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COMPARISON OF THE FREQUENCY OF MICRONUCLEUS IN CYTOKINESIS BLOCKED BINUCLEATE LYMPHOCYTES OF OCCUPATIONALLY EXPOSED PERSONNEL IN RADIOGRAPHY AND NUCLEAR MEDICINE DEPARTMENTS

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Background: Radiology technologists are exposed to low dose protracted radiation continuously below dose limit every day. However, the levels of harmful effects of radiation on these individuals are under-estimated and ignored. In this study we compared cytogenetic damage induced in lymphocytes of occupationally exposed radiology (RT) and nuclear medicine technologists (NMT).

Methods: Aged matched male and female control unexposed individuals (n=20), RT (n=30) and NMT (n= 30) were enrolled in this study. Heparinaized whole blood cultures were initiated for ever individual in complete RPMI-60 medium, lymphocytes were stimulated with phytoheamaglutinin and incubated at 37 C for 44 hours. Cytochalasin B was then added to cultures to arrest binucleate cells at cytokinesis. After 72 hours cells were harvested and slides were made. 1000 binuclei lymphocytes stained in 5% Giemsa were scored under a light microscope with magnification of x1000 for presence or absence of micronuclei. Statistical analysis was done on obtained data.

Results: Results showed no statistical difference of age between study groups ($p>0.05$). A year of exposure of RT was 10 + 0.81 and NMT was 8+0.8. Mean frequency of MN observed for unexposed individuals was 8.05 +0.49 while for RT was 17.8+0.95 and NMT 20.56 +1.02. Statistical analysis showed a significant difference between the frequency of MN observed for unexposed individuals and radiation workers ($p<0.01$). Frequency of MN was also significantly different between RT and NMT ($p<0.05$).

Conclusion: Results indicates cytogenetic damages induced in lymphocytes of radiation workers are considerably higher than non-exposed individuals. Moreover, despite lower exposure duration of NMT compared to RT, frequency of MN was higher in lymphocytes of NMT. These observations might indicate higher exposure of NMT compared to RT and also more appropriate protective measures should be considered for radiation workers in these departments.

Keywords: Occupational exposure, cytogenetic damage, radiation technologists

MAGNETIC NANOPARTICLES FUNCTIONALIZED WITH FOLIC ACID-LIGAND FOR EFFICIENTLY INTRACELLULAR TEMOZOLOMIDE DELIVERY TRIGGERING C6 GLIOMA CELL DEATH

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Abstract:

In order to conduct an effective chemotherapy session as a treatment modality for glioblastoma tumors, a nanocarrier platform is required for the drug to cross the blood brain barrier (BBB) successfully, and properly target glioma cells. Dual-targeting Temozolomide (TMZ) loaded triblock polymer coated magnetic nanoparticles were synthetized with SPION core and by conjugating surface with folic acid (FA), which were shown effective passing of the BBB and targeting tumor cells, respectively. Two principal methods, Dynamic Light Scattering (DLS) and Transmission Electron Microscopy (TEM), were employed for characterization of the synthesized nanoparticles. TMZ-loaded MNP-FA nanoparticles presented with a size of 58.61 nm, a zeta potential of -29.85 ± 0.47 mV, and a drug loading content of 6.85 ± 0.46%. The anti-cancer effect of the dual-targeting MNPs-FA was also indicated by the increased survival time (>100%, $p < 0.001$) and decreased tumor volume ($p < 0.001$). In conclusion, the dual-targeting TMZ-loaded MNPs-FA are able to improve the therapeutic efficiency of brain glioma in rats.

Keywords: Dual-targeting; Folate; Magnetic targeting; Glioblastoma; Blood brain barrier

EVALUATION OF AUDITORY BRAIN STEM RESPONSES (ABRS) IN PATIENTS WITH HEAD AND NECK CANCER WHO RECEIVED RADIATION THERAPY

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Abstract

Background: The side effects of radiotherapy (RT) on hearing loss risk related to auditory brainstem function in patients treated with RT is unknown. In current study, we evaluated auditory brainstem radiation responses (ABRs) in eighth-nerve among patients with head and neck cancer (HNC) treated RT.

Methods: This case-control study was conducted on 100 individuals (50 patients with HNC and 50 healthy people as a control group). Patients were selected from radiotherapy centers of Firoozgar and Pars Hospitals (Tehran, Iran) during 2017-2019. Patients in case group treated with RT (1.8–2 Gy/fraction in five consecutive days per week.). The RT was done by 3D-computer based treatment planning system, using CT scan. The ABR test was used to evaluate association between brainstem dose and latency time of waves.

Results: The *paired* sample *t-test* shown the latency time of waves (I, III, V, I-III and III-V) in both right and left ears was significantly more in the case group compared to control group, ($P < 0.001$). However, there was no significant correlation between the brain stem dose and latency time of waves. The simple regression tests demonstrated a significant correlation showed between age and latency time of wave I in right ear ($p=0.005$) and left ear ($p=0.02$).

Conclusion: In general, findings of this study suggested RT in patients with HNC lead to increases risk of hearing impairments related to auditory brainstem function (neural hearing). In this context, early diagnosis of hearing impairments and determining the appropriate dose and timing of RT is important.

Keywords: auditory brainstem responses, head and neck cancer, radiotherapy

THE PROTECTIVE EFFECT OF OLEUROPEIN AGAINST RADIATION- DAMAGE IN CULTURED HUMAN LYMPHOCYTES

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Purpose: Oleuropein is one of the most abundant and important phenolic compounds in fruits and olive leaves. In this research, the radioprotective effect of oleuropein was investigated versus 2 Gy of gamma radiation on human peripheral blood mononuclear cells.

Materials and Method: Human mononuclear cells were treated with oleuropein at the concentration of 100 µM (optimum concentration), incubated for 24 hours, and then exposed to 2Gy gamma rays. The anti-radiation effect of oleuropein was assessed by MTT assay, flow cytometry, comet assay, and micronucleus (MN) assay.

Results: The results showed that 24 hours after radiation, a reduction occurred in the cell viability percent of lymphocytes that did not receive oleuropein compared to the control group, indicating the cytotoxic effects of gamma rays. It was found that pre-treatment with oleuropein(25, 50, 75, 100, 200, 400, and 800 nM –1, 5, 10, 15, 20, 25, 30, 40, 50, 75, 100, 125, 150, 175, 200µM)significantly increased the percentage of cell viability compared to the irradiated group ($p<0.001$).Moreover, oleuropein treatment with the above concentrations defined without γ-ray did not show any cytotoxicity effect in human mononuclear cells.$LD_{50\,/\,24h}$ was calculated according to the radiation curve.The$LD_{50/24h}$dose was calculated as2.9 Gy, whereas by 200,150,50, and 100 µM oleuropein prior to radiation(1, 2,and 4 Gy),radiation $LD_{50/24h}$increased to 3.36, 3.54,3.81, and greater than 4 Gy, in that order. A very noticeable dose-modifying factor (DMF) of 1.16, 1.23, 1.31, and 1.72 was observed for 200, 150, 50, and 100µM, in order. Therefore, 100 µM of oleuropein was selected as the desirable dose for radio-protection trial, and 2 Gy gamma rays were used for further research. Human mononuclear cells treatment with oleuropein (100 µM) prior to 2Gy gamma rays significantly decreased apoptosis, genomic damage, and MN occurrence in human mononuclear caused by γ-radiation($p<0.001$).Furthermore, treatment with oleuropein (100 µM) without radiation did not lead to apoptosis, genotoxicity, or clastogenic effects caused by oleuropein in human mononuclear cells. Radiation of lymphocytes that had not received oleuropein increased apoptosis, DNA damage, and the frequency of MN in comparison with the control group, which showed apoptosis, genotoxic, and clastogenic gamma rays, respectively.

Conclusion: The results revealed that oleuropein is able to significantly reduce cytotoxicity, apoptosis, genotoxic, and clastogenic gamma rays. Therefore, oleuropein is an herbal extract with a strong radioprotective effect in MTT, flow cytometry, comet, and micronucleus assay studies. However, due to its nature, it has no cytotoxic effects. As a result, the use of oleuropein can reduce the side-effects of radiation therapy.

INTRINSIC RADIOSENSITIVITY-BASED RADIATION THERAPY TO PREDICT RESPONSE IN BREAST CANCER PATIENTS

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Background: Despite the fact that dose delivery techniques have been greatly improved in radiation therapy (RT), however, some patients encounter abnormal responses in normal tissues. A high risk for development of severe side effects after RT may be correlated with high cellular radiosensitivity. The aim of present study was to identify the mechanism of DNA repair kinetics and intrinsic apoptosis pathway on radiosensitivity and normal tissue complications caused by the RT and also assess the application of radiosensitivity index (RSI) to personalize RT.

Methods: Radiation-induced DSBs, DNA repair kinetics and apoptosis in peripheral blood mononuclear cells derived from 60 breast cancer patients was analyzed by flow cytometric method of phosphorylation of histone H2A (γ-H2AX-assay) and the relative quantitative RT-PCR. All the patients received similar tangential irradiation of the whole breast and conventional fractionation and acute normal tissue reactions were assessed by RTOG score.

Result: The notable result was a significant correlation between dose-response curve slope of the apoptosis and acute skin toxicity score. Also, repair kinetic of DSBs after 3 and 24 hours were strongly correlated with the clinical RSI. This issue could be subject for treatment adjustment.

Conclusion*:* These data suggest that Bax/Bcl-2 ratio and measurement of DSB by performing γ-H2AX flow cytometric analysis has the potential to be developed into a clinically useful predictive assay for distinguishing the overreactors among breast cancer patients prior to the start of radiotherapy. A RSI-based strategy will allow personalizing RT dose prescription to individual tumor biology and improve outcomes.

Keywords: personalized medicine, Breast cancer, Radiotherapy, Radiation sensitivity

DOSE DISTRIBUTION IN RADIOSENSITIVE ORGANS IN INTENSITY MODULATED RADIOTHERAPY (IMRT) VS 3D-CONFORMAL RADIOTHERAPY (3D-CRT) IN PROSTATE CANCER

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Abstract

Introduction: The dose distribution outside the treatment field can be clinically important as it related to normal tissue irradiation, as the aim of the radiation therapy is decrease normal tissue complications (NTCP) while increasing tumor control probability (TCP). Now days improvements in delivery techniques causes increasing patients' overall survival rates, while secondary cancers in normal tissues outside the target organs, specifically in radiosensitive organs, have been developed with a high latency period after radiotherapy.

Materials and Methods:

The calculations of dose distribution in peripheral organ At Risk by commercial treatment planning systems have poor accuracy, because TPSs are not generally commissioned for the out-of-field area.

Actually assessment of induction of carcinogenic effects, such as secondary cancers, require a knowledge of dose distribution outside the target volume, especially in the beam-bordering regions. Accuracy of Dose calculation outside the treatment field can be important for several reasons, including to estimate the risk of stochastic effects, and the severity of deterministic effects. In addition, such knowledge of dose distribution inthe low dose area can be used in the treatment of pregnant patients or patients with implanted electronic devices which high cumulative doses from leakage and scatter can also induce harmful effects. Based on the studies the calculation of dose contributions by the TPSs were poor in out-of-field area. As the distance from the field edge, increase the scatter and leakage radiation increase in IMRT and 3DCRT. As the field size increase , because more volume of tissue is irradiated produce more patient scatter, near the field edge where the dominant source of radiation is patient scatter radiation, therefore it can be cause more inaccuracy of the dose calculation by TPS in 3DCRT. The increase time delivery and higher number of monitor units (MU), rising OARs dose outside the fields which can lead to increases potentially risk of secondary cancers after treatment in IMRT. This increase in collimator scatter radiation and head or MLC leakage might result an increase in the carcinogenic Risk linearity.

Results:

It is clinically important to quantify the accuracy of dose calculation in sensitive normal tissues outside the treatment field. In conclusion to regard as many documents the average underestimation in dose calculation outside the field could be various with type of treatment techniques and type of TPSs. The study carried out by Howell et al., accuracy of out-of-field dose calculations by AAA algorithm of the Eclipse for a simple field was 38% to 126% at 3.75 to 11.25 cm respectively.

Conclusion:

Knowledge of dose distributions outside the field, resulting from IMRT delivery technique in prostate cancer, specifically in radiosensitive organs like rectum, is critical and clinical interest because Physician must be able to estimate the OAR dose to estimate the risk of stochastic effects, and the severity of deterministic effects. Dialo et al. demonstrated that 40% underestimation of the dose by TPS in normal tissues outside the treatment field could lead to a 40% underestimation in risk.

Based on studies higher photon energy should be related to higher dose outside the field, due to an increase in leakage radiation and neutron production at energies above 10 MV. More studies is recommended to quantify these dose accuracy calculation in higher photon energy linac in the out of field regions.

Keywords: IMRT, Radiosensitive Organs, Secondary Cancer, 3DCRT

WHOLE BODY HYPERTHERMIA AS AN RADIOSENSITIZER AND A POTENT ENHANCER OF SYNERGIST AFFECT WITH RADIATION THERAPY

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Abstract:

Background: Treatment tumors through heating which has been used since the time of the ancient Egyptians. Based on the temperature, Whole body hyperthermia classify in 3 type, including, mild, fever range and extreme. In Mild hyperthermia, the temperature is from 37.5 up to 38.5 degree Celsius, in fever range hyperthermia, 38.5 up to 40 degree Celsius, and extreme hyperthermia, the temperature above 40 degree Celsius.

Materials & Methods:

It is now appreciated that heating tumors in situ can activate vascular, metabolic, and immunologic parameters of the tumor microenvironment which may play an additional role in radiochemosensitization beyond hyperthermia induced cell killing of tumor cells. HT is known to cause direct cytotoxicity and also acts as a radiosensitizer. The mechanisms of action of HT appear to be complementary to the effects of RT with regard to inhibition of potentially lethal damage and sub lethal damage repair, cell cycle sensitivity, and effects of hypoxia and nutrient deprivation. To regard as many Studies that have demonstrated immunological effects of fever range whole-body hyperthermia (FR-WBH) , The most important role of elevation temperature in fever range is immmunologucal effects.

Nonetheless, there are a lot of randomized trials of HT in human cancer patients ,the majority of which demonstrate a local tumor control and/or survival advantage with the addition of HT to standard therapy, providing strong impetus for continuing work in this field. The DNA repair process itself is heat sensitive and this may be one of the mechanisms that lead to heat-induced radiosensitization. The extent of the interaction of heat and radiation can be expressed in terms of the thermal enhancement ratio (TER), defined as the ratio of doses of x-rays required to produce a given level of biologic damage with and without the application of heat. TER have been estimated to bein range of 1.5 for several human tumor type. Jones and colleagues reported that mild hyperthermia (41° and 41.5° C at 90% of the measured points for 1 hour) significantly increased the p O2 in hypoxic. Such increases in tumor oxygenation could significantly improve tumor response to radiotherapy and is likely to be the primary important effect of local/regional or whole body forms of clinical hyperthermia.

Results: In summarize some of the Molecular effectors of hyperthermia include Impairment of RNA/DNA synthesis Inhibition of repair enzymes Induction of HSP-synthesis. 'thermal radiosensitization' results in a reduction of the shoulder of the dose–effect curve. It appears most pronounced in S-phase cells that are usually resistant to radiation alone. Long-term whole body fever range hyperthermia is suitable to induce significant tumour growth delay due to apoptosis.

Conclusion: In conclusion, large number of studies have documented clinical effectiveness of hyperthermia in combination with RT or CT in vivo and/or in vitro condition. Hyperthermia aims improving the results of the conventional treatment strategies within the framework of multimodal treatment concepts.

Keywords: Whole Body Hyperthermia, Radiosensitizer, Radiation Therapy, Cancer

EXPRESSION OF BAX AND BCL2 IN PERIPHERAL BLOOD LYMPHOCYTES (PBLS) OF PATIENTS WITH DIFFERENTIATED THYROID CANCER

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Abstract:

Background: Thyroid cancer is the most common endocrine malignancy worldwide. Iodine-131 is used in the treatment of thyroid cancer with high dose of 100 mCi. In the medical applications of ionizing radiation besides the advantages such as diagnosis and treatment of diseases, the risks arising from exposure should be considered as well. Ionizing radiation has been known as causing oxidative stress by generating active oxygen types and free radicals in the tissues and irradiated cells. The present study aimed to evaluate the changes in expression levels of apoptotic Bax and Bcl-2 and the ratio of Bax/Bcl-2, in the peripheral blood lymphocytes (PBLs) of patients with differentiated thyroid cancer.

Methods: This study was conducted on 50 thyroid cancer patients who had undergone surgery and were under treatment with 100 and 150 mCi doses. Blood samples were taken from the patients, one before iodine treatment and another 48 hours after therapy. Bax and Bcl-2 expression levels were measured using real-time reverse transcriptase polymerase chain reaction (RT^2qPCR). The data were analyzed using one-way analysis of variance (ANOVA) followed by samples T-Test and independent samples T-Test.

Results: Significant changes were observed in the percentage of apoptotic cells, in groups, after radioiodine therapy compared with before treatment. The ratio of Bax/Bcl-2 in both groups showed a significant increase ($P<0.001$). The relative expression level of Bax gene showed a significant increase in comparison with the control group.

Conclusions: Iodine therapy reduced expression of Bcl-2 and a significant expression of Bax and finally increased the ratio of Bax/Bcl-2. Iodine therapy led to apoptosis in the peripheral blood lymphocytes (PBLs) of patients with differentiated thyroid cancer.

Key-words: PBLs; Differentiated thyroid cancer; Bax**;** Bcl2; Gene expression

PARAMETERS ESTIMATION OF NORMAL TISSUE COMPLICATION PROBABILITY MODELS FOR ACUTE ESOPHAGITIS FOLLOWING RADIATION THERAPY

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Background: The aim of this study was to estimate models' parameters for probability of acute radiation esophagitis (AE) caused by the treatment of head/neck and thoracic tumors.

Methods: one hundred patients with nasopharynx, larynx, Hodgkin's lymphoma, spinal metastases, oral cavity and lung tumors were treated with three-dimensional conformal radiotherapy (3D-CRT). Radiobiological models of Logit, Logistic, mean dose (MD), Lyman-Kutcher-Burman (LKB), and Niemieriko were used. AE follow up was performed up to 90 days after treatment initiation according to National Cancer Institute Common Toxicity Criteria (NCI-CTC) scale. Akaike information criterion (AICc) and Maximum likelihood analysis (MLA) were employed to ranking the models and estimate the model parameters respectively.

Results: Volume effect values were n = 0.2. TD_{50} of Logit, Logistic, MD, LKB and Niemieriko models, were 14.95, 17.03, 66.81, 44.95 and 44.91 and the slope of the dose response curves were 2.26, 0.56, 0.923, 0.23 and 1.98, respectively. The AICc values were also 149.18, 134.51, 126.73, 167.33, and 197.16, respectively.

Conclusions: According to AICc, MD model exhibited the most agreement with clinical results.

Keywords: NTCP, Acute esophagitis, radiation therapy

GOLD NANOPARTICLES CAN CHANGE THE CELL CYCLE DISTRIBUTION AND RADIO-SENSITIZATION OF COLON CANCER CELLS IRRADIATED BY HIGH ENERGY PHOTONS

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Background: Despite the prediction of calculational studies that reported gold nanoparticles (GNPs) can't radio-sensitize cells at high energies, the experiments show a significant cell death at the energies. Some studies have proven the biological mechanisms like changes in cell cycle distribution due to GNPs are involved in the radio-sensitization process of the cells. The aim of the study was the investigation of the changes in the cell cycle distribution as well as the potential enhancement in radio-sensitivity of HT-29 cancer cells due to treatment by GNPs.
Methods: After synthesizing of GNPs, they were characterized. To evaluate the cytotoxicity of the GNPs on HT-29 cells, MTT colorimetry assay was used. In addition, the uptake of GNPs into the cell was measured by atomic absorption spectrophotometry (AAS). Afterward, the cells were irradiated at 18 MV energy and the survival curves were achieved for both control and GNPs-treated groups. The cells distribution in each cell cycle phase was examined by the flow cytometry method before and after irradiation.
Results: TEM images demonstrated spherical GNPs mean size of about 25 nm. The synthesized GNPs showed no significant cytotoxicity for concentrations below 250 µM. AAS results exhibited a time-dependent manner for the uptake of GNPs into the cells so that it was maximum for 12 h of incubation time. A significant increase in the frequency of cells in G2/M phases was observed after treatment by GNPs as well after irradiation of the cells. Additionally, the colony formation assay results proved that the GNPs can sensitize HT-29 cells up to 25% at 18 MV energy.
Conclusion: It seems the GNPs have a great potential to sensitize the cells even at higher energies. Moreover, the radio-sensitization of the GNP treated-cells can originate from the accumulation of the cells treated by GNPs into the more sensitive phases like G2/M.

Keywords: Gold nanoparticles, Radio-sensitizing, Clonogenic assay, Radiotherapy

A-966492, A NOVEL PARP INHIBITOR DRUG RADIOSENSITIZED GLIOBLASTOMA SPHEROIDS

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Abstract

Radiotherapy is one of the modalities in the treatment of glioblastoma patients, but glioma tumors are resistant to radiation and also chemotherapy drugs. Thus, researchers are investigating drugs which have radiosensitization capabilities in order to improve radiotherapy. PARP enzymes and topoisomerase I enzymes have a critical role in repairing DNA damage in tumor cells. Thus, inhibiting activity of these enzymes helps stop DNA damage repair and increase DSB lethal damages. In the current study, we investigated the combination of TPT as a topoisomerase I inhibitor, and A-966492 as a novel PARP inhibitor for further radiosensitization. U87MG cells (a human glioblastoma cell line) were cultured in Poly-Hema coated flasks to reach 300µm-diameter spheroids. Treatments were accomplished by using non-toxic concentrations of A-966492 and Topotecan. The surviving fraction of treated cells was determined by clonogenic assay after treatment with drugs and 6MV X-ray. The γ-H2AX expression was measured by an immunofluorescence staining method to examine the influence of A-966492, TPT and radiation on the induction of double stranded DNA breaks. Treatments using the A-966492 drug were conducted in concentration of 1µM. Combining A-966492 and TPT with radiation yielded enhanced cell killing, as demonstrated by a sensitizer enhancement ratio at 50% survival (SER_{50}) 1.39 and 1.16 respectively. Radio- and chemo-sensitization was further enhanced when A-966492 was combined with both X-ray and TPT, with SER_{50} of 1.53. Also γ-H2AX expression was higher in the group treated with a combination of drugs and radiation.

A-966492 is an effective PARP inhibitor and has significant radio-sensitivity on U87MG spheroids. By accumulating cells in the S phase and by inhibiting the DNA damage repair, TPT enhanced radio-sensitivity**.** A-966492 combined with TPT as a topoisomerase I inhibitor had additive radio-sensitizing effects. As a result, applying PARP and topoisomerase I inhibitors can be a suitable strategy for improving radiotherapy in clinics.

Key word: Glioblastoma, PARP inhibitor, Topoisomerase I inhibitor, Topotecan, Radiosensitivity

FUNCTIONALIZED DRUG-LOADED MAGNETITE NANOPARTICLES COMBINING RADIOFREQUENCY HYPERTHERMIA TO IMPROVE THE THERAPEUTIC EFFICACY

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Abstract

Background: Hyperthermia is a promising adjuvant therapy for cancer treatment. The anti-tumor effect of hyperthermia can be occurred at 42-45˚C. Magnetite nanoparticles (MNPs) through Radiofrequency hyperthermia leads to localized heat induction and can reduce side effects. In the present study, Temozolomide-loaded magnetite nanoparticles were used for localized chemo-hyperthermia treatment of C6 glioblastoma cancer cells.

Methods: Magnetite nanoparticles were characterized for diameter, morphology, and magnetic thermal properties. Moreover, RF-triggered release of TMZ from nanoparticles was assessed. The C6 cells were treated with MNPs and subjected to RF-hyperthermia, then the apoptotic cells were evaluated through flow cytometry analysis.

Results: The in vitro release profiles showed that the drug release from TMZ-loaded MNPs was noticeably increased after 10 min exposure with RF irradiation (57.1±1.5%). Whereas, the release rate was minimal at the same time without RF irradiation. The saturation magnetization value of MNP and TMZ-MNP were equal to 39.14 and 30.5 emu/g, respectively.

The results of flow cytometry analysis exhibited that the combining of RF- hyperthermia with TMZ-loaded MNPs noticeably enhanced the percentage of apoptotic cells.

Conclusion: Magnetite nanoparticles could transduce radiofrequency energy to heat in cancer cells. Drug release from TMZ-loaded MNPs could be well-controlled by RF irradiation. So, RF hyperthermia in the presence of TMZ-loaded MNPs could be introduced as a new therapy method in the treatment of glioblastoma cancer cells.

Keywords: Magnetite nanoparticle, Radiofrequency hyperthermia, Glioblastoma, Combining therapy

ASSESSMENT OF THE RADIOPROTECTIVE EFFECT OF ARBUTIN: STUDY ON HUMAN LYMPHOCYTE CELLS USING MICRONUCLEUS ASSAY

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Abstract

Introduction: X-irradiations induce damages to the hematopoietic system by reducing the production of blood cells in bone marrow. In this study, the radioprotective effect of arbutin was investigated in megavoltage x-irradiated mice by measuring changes in lymphocyte cells with micronucleus assay.

Material and methods:

Whole blood samples from healthy donors were exposed to various doses of x-rays(2 and 4 Gy in one fraction with a 6 MV x-ray accelerator unit). Lymphocytes in cultures were treated with arbutin at different concentrations (50, 100, and 200 µg/ml) 2 hours before x radiation . Standard procedure for the cytokinesis-block micronucleus (CBMN) assay was used to assess the effect of arbutin on radiation induced micronucleus in binucleate lymphocytes**.**The frequency of micronuclei in 1000 cells were measured for each sample were analyzed. The data were statistically evaluated using one-way ANOVA, and Tukey HSD test.

Results: there was no side effects after injection arbutin 50, 100, and 200 µg/ml ($P > 0.05$), but a significant increasing was observed for the incidence of micronuclei in irradiated group (2 and 4 Gy) compared to the control group ($P < 0.001$).

The frequency of micronuclei found in the “2 and 4 Gy x irradiation + distilled water” groups was significantly higher than the “2 and 4 Gy irradiation + 50 µg/ml arbutin”, “2 and 4 Gy irradiation + 100 µg/ml arbutin”, and “2 and 4 Gy irradiation + 200 µg/ml arbutin” groups ($P < 0.001$).

The comparison into the groups indicated that the frequency of micronuclei in the “2 Gy irradiation + 50 µg/ml arbutin” group was considerably lower than the “2 Gy irradiation + 100 µg/ml arbutin”, and “2 Gy irradiation + 200 µg/ml arbutin” groups, but there were not any differences between the “2 Gy irradiation + 100 µg/ml arbutin”, and “2 Gy irradiation + 200 µg/ml arbutin” groups. No significant differences were observed among the “4 Gy irradiation + 50 µg/ml arbutin”, “4 Gy irradiation + 100 µg/ml arbutin”, and “4 Gy irradiation + 200 µg/ml arbutin” groups.

Conclusion: The present investigation showed that arbutin is a strong radioprotector. There were not any significant differences between the various concentrations of arbutin, however, the concentration of 50 µg/ml showed higher radioprotective effect.

Keywords: Radiation, Arbutin, Radioprotector, Lymphocyte, Micronucleus tests

CORRELATION OF DIFFERENT RADIOBIOLOGICAL ENDPOINTS FOR RADIOSENSITIVITY PREDICTION COMPARED WITH CLONOGENIC SURVIVAL

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Background: The Detection of predictive assay for radiosensitivity has been an important issue in radiation biology. The purpose of this study was to evaluate the capability and relationship of various endpoints including GammaH2AX, micronuclei, and apoptosis in determining the human tumor cell lines radiosensitivity compared with clonogenic survival.

Methods: Two different human carcinoma cell lines of HN5 and Hela with distinct radiosensitivities were selected. The response of the tumor cell lines to the 2 Gy of 6 MV photon beam was investigated via various assays and enhancement ratios were calculated quantitatively. The correlation between endpoints was evaluated using Spearman correlation and its coefficient was determined.

Results: Survival fraction at 2 Gy (SF2) of Hela and HN5 was indicated as 0.42 ± 0.06 and 0.5 ± 0.03 respectively, proposing more radioresistance of HN5. The "2 Gy clonogenic cell death enhancement ratio" of Hela and HN5 was 2.36 and 1.98, respectively. This finding was confirmed with "2 Gy apoptosis enhancement ratio" which was 1.77 and 1.42 in Hela and HN5. The remarkable level of DNA DSBs elevation was observed after irradiation; eye-catching in Hela with enhancement rate of 19.24. Micronuclei formation followed an ascending trend post irradiation but with the least difference between two cells. Although, the relationship between micronuclei and clonogenic survival was moderate (R^2 = 0.35), a good correlation was observed between the apoptosis and clonogenic survival (R^2 = 0.71).

Conclusion: The results of studied endpoints agreed with the SF2, highlighting their capabilities in radiosensitivity prediction. According to the enhancement ratio, gammaH2AX foci scoring could be a valid indicator of radiosensitivity but not the exact surrogate marker of survival based on not observing the correlation. Moreover, considering the chief determents comprising lack of time and money, the apoptotic induction might be an appropriate indicator with the best correlation coefficient.

Keywords: Radiosensitivity, GammaH2AX, Micronuclei, Apoptosis, Clonogenic survival.

VALUE OF LONG NON CODING RNAS IN LOW DOSE RADIATION BIOLOGICAL DOSIMETRY

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Background: Biological dosimetry is important in estimation of dose received by individuals in a nuclear or radiological events as well as low dose occupational exposure. Various bioindicators were introduced to date, but there are limitations in using even with the most well known dicentric assay. By advent and advancement of molecular biology and genetics techniques, investigation of molecular bioindicators with the use of high throughput systems received much interest. Circulating or functional RNAs, including Long non-coding RNA (lnc-RNA) and their targets such as microRNAs (miRNAs) are potential valuable candidates as biomarkers of radiation response. This systematic review summarizes the current knowledge related to the value of long non coding RNAs for low dose radiation biological dosimetry.

Methods: Eligible studies were identified by extensive searches of the online databases such as Pubmed, Google scholar, Scopus, etc. from 1990 to 2019. Original publications related to radiation-induced changes in the levels of lnc-RNAs were evaluated.

Results: LncRNAs are regulated by radiation and their expression is affected by radiation dose. LncRNA targets of tumor protein 53 (p53), Dino, Pvt1, Trp53cor1 and Tug1, and upstream regulator of p53, Meg3 were changed in response to radiation. Tmevpg1 and Gm14005 (Morrbid) were regulated by radiation across all time points and doses. In addition, lncRNA MALAT1 and SOX2OT expression is a part of the complex stress response operating in radiation-treated cells and this response depends on functional p53. It was shown the expression of 115 lncRNAs was elevated in a dose-dependent manner after X- irradiation.

Conclusion: Because radiation induces both DNA damage and an associated systemic immune response, and lncRNAs are being identified to play key roles in these processes, it is logical to propose a lncRNA profile changes as potential low dose radiation biodosimetry markers.

Keywords: Long non-coding RNA, p53, ionizing radiation, low dose biological dosimetry.

THE EXPRESSION CHANGES OF THE INVOLVED METASTASIS GENES IN BREAST CANCER PATIENTS PRE-POST SURGERY, CHEMOTHERAPY AND RADIOTHERAPY

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Introduction: Breast cancer is the most common cancer among women (29%). The development and use of diagnostic and prognostic techniques and prognosis of metastasis in this group of patients is very important for early diagnosis. Meanwhile, the effects of gene expression in predicting survival of patients and being metastatic in the future can be very effective.
Materials and Methods: For evaluation of the genes that involved in metastasis, the expression of PDCD4, HOXD10, and HMGA2 genes in thirty breast cancer patients (before and after surgical, chemo and radiotherapy) were evaluated by Real-time PCR reactions. Data were analyzed by SPSS software using T-test.
Results: The results showed that HOXD10 expression in both groups was significantly lower than those in the control group (P = 0.06662). With the advancement of the disease, the expression of the HOXD10 gene decreased, so that the difference in the stage 3 was significantly more than stage 2 (P = 0.0001). The expression of PDCD4 gene were decreased in both groups, (in stage 2 patients with P = 0.0008, stage 3 with P = 0.0001). The results showed that with the advancement of the disease, the expression of the PDCD4 gene declines, so that the difference in expression in stage 3 and stage 2 was not significantly different (P = 0.1949). The expression level of HMGA2 gene increased in both groups of patients compared to control group. This increase was not significant in all groups. The results of the measurements showed that with the progression of the disease, the expression of the HMGA2 gene increased, but this increase in the expression of the gene in the patients with stage 3 was not significantly different from that of the second stage (P = 0.7219)
Conclusion: The expression of genes such as PDCD4 and HOXD10 decreases in the development of malignancy and metastasis in breast cancer. The rate of HMGA2 expression increases when breast cancer develops in malignancy and metastasis. None of the treatment modalities makes any significant changes in the level of expression of these genes in patients with breast cancer.

Keywords: Breast Cancer, PDCD, HMGA2, HOXD10, Metastasis, Surgery, Chemo Therapy, Radiation Therapy

DISCOVERY AND VALIDATION OF NOVEL RADIOIMMUNOTHERAPY TARGETS FOR TARGETED RADIOTHERAPY OF CANCER

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Background: Radioimmunotherapy (RIT), as a targeted radiotherapy, has attracted considerable attention in recent years. Since the target selection is the first critical step in radiolabeled-antibody development, the systematic discovery of radioimmunotherapeutic targets per tumor type is of high interest. The purpose of this study was to systematically identify and prioritize candidate radioimmunotherapeutic targets across 20 common cancer types by mining the Human Protein Atlas (HPA).

Methods: To perform a multi-step screening process, XML and TSV files including immunohistochemistry (IHC) expression data for different normal tissues and tumors were downloaded from the HPA (www.proteinatlas.org). For genes without the high protein expression across critical normal tissues, a quasi H-score (range, 0-300) was computed per tumor type. All genes with a score ≥150 for at least one tumor type were extracted. Among these, genes with surface localization were selected and included in an extensive validation process.

Results: Among 19670 genes that encode proteins, 5520 membrane protein-coding genes were included in our study. During a multi-step data mining procedure, 332 potential targets were identified based on the level of protein expression across 20 tumor types and 13 critical normal tissues. After the validation process, a total of 23 cell surface proteins were identified as candidate targets of which two have interestingly been approved by the FDA for use in human, one has recently been granted for the priority review, and five have currently been entered in clinical trials.

Conclusions: We identified and prioritized several candidate targets with translational potential, which may yield new clinically effective and safe radioimmunotherapeutics in the near future. This large-scale antibody-based proteomic study allows us to go beyond the RNA-seq studies, facilitates bench-to-clinic research of targeted anticancer therapeutics, and offers valuable insights into the targeted radiotherapy.

Keywords: Radioimmunotherapy, cancer, systematic discovery, targeted therapy, proteomics

MEASUREMENT OF OXIDATIVE STRESS INDEX BEFORE AND AFTER ADMINISTRATION OF MELATONIN IN RECTAL CANCER PATIENTS

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Background

Free radicals such as hydroxyl are produced by the reaction of ionizing radiation with water molecules in cells, which cause oxidative stress and DNA, lipids and proteins damages. Melatonin is a well-known antioxidant that activates antioxidant enzymes and sweeps free radicals to protect cells from their damage. Because of the antioxidant properties of melatonin and its low toxicity in the body, various studies have suggested melatonin as an adjunctive therapy. In this study, we aimed to measure oxidative stress index by FRAP and TBARS assay before and after administration of melatonin in patients with rectum cancer undergoing radiotherapy.

Methods

This the double-blind placebo-controlled study conducted on 60 rectal cancer patients and an equal number of patients were randomly assigned as a control group which received a placebo. Study group received 20 mg melatonin a day as an intervention. The melatonin administered twice a day for five days a week until 28 days. Blood samples were taken before melatonin receiving at day 1 and also day 28 and FRAP and TBARS assays were done on samples.

Results

Our findings show that, the obtained values of the FRAP assay for the melatonin group were significantly higher than that of the placebo group ($p<0.001$). The values obtained from TBARS assay in the melatonin group were much lower than the placebo group ($p<0.02$).

Conclusion

The FRAP assay is a novel way of measuring the antioxidant power of the serum, our results indicate that total antioxidant levels of patients who received melatonin were much more than the placebo group. Using TBARS assay to measure serum malondialdehyde concentration and oxidant status shows that melatonin can partly prevent lipid peroxidation. The results of our study are indicating that melatonin could prevent or minimize the unfavorable effects of radiotherapy on normal cells by attenuating the adverse influence of radiation.

Keywords: Radiotherapy; Rectal Cancer; Melatonin

STUDY OF CIRCULAR RNA 000284 EXPRESSION IN BREAST CANCER PATIENTS PRE AND POST CHEMOTHERAPY

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Abstract

INTRODUCTION: Breast cancer (BC) is the most common cancer in women worldwide. Non-coding RNAs (NcRNAs) included miRNA, lncRNA, and circRNA formed 95% of total transcribed eukaryotic RNAs mainly regulate gene expression. Recent studies have shown that circRNAs are potential biomarkers in various cancers. Hsa-circ-000284 is a circRNA which can sponge specific miRNAs that are regulators of some important oncogenes or tumor suppressor genes in different cancer.

OBJECTIVE: The circRNA-000284 expression was assessed in breast cancer patients pre and post chemotherapy in comparison to normal control group in order to find possible cancer related candidate marker.

METHODS: Total RNAs were extracted from the peripheral blood of patients and control followed by cDNA synthesis. The circRNA-000284 expression was assessed by SYBR Green Real-Time RT- PCR normalized with beta actin as internal control.

RESULT: The circRNA-000284 expression was up-regulated (1.84 fold) in peripheral blood of breast cancer patients compared with normal control. The expression of circRNA-000284 was associated with higher cancer stages and lymph node involvement. The rate of expression of this circRNA in patients with breast cancer after a chemotherapy period was decreased about 50% ($p < 0.0001$).

CONCLUSION: These data indicated that circRNA-000284 expression could be proposed as a possible marker which could be associated with malignancy and also may considered as a possible indicator of chemotherapy responses.

Keywords: Breast cancer, circular RNA, chemotherapy, biomarker, early detection

AUGMENTATION EFFECT OF OF MELATONIN AND FAMOTIDINE ON RADIATION INDUCED CHROMATID BREAKS IN G2 LYMPHOCYTES OF BREAST CANCER PATIENTS.

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Purpose: Using antioxidants are introduced for reduction of radiation induced damages as radioprotectors. The aim of this study was to study the effects of antioxidants melatonin and famotidine on chromatid type aberrations induced in G2-irradiated lymphocytes of breast cancer (BC) patients.

Methods: Based on DPPH assay appropriate doses of melatonin and famotidine was chosen for treatment of lymphocytes. Lymphocyte cultures were initiated in RPMI-1640 medium supplemented with fetal bovine serum and antibiotics. Phytohemaglutinin (PHA) was added to the culture for proliferation induction of lymphocytes. Culture vessels were treated with either agent for two hours. Following antioxidant treatment cells were exposed to 1 Gy gamma-rays generated from Co-60 source at a dose rate of 0.85 Gy four hours before harvesting. Slide preparation and staining was done. 100 well spread metaphases was scored for Frequency of chromatid breaks under a light microscope with X1000 magnification.

Results: Results showed induction of high frequency of chromatid breaks following radiation alone in lymphocytes of breast cancer patients significantly higher than normal individuals. Famotidine and melatonin induced very low frequency of aberrations by their own not significantly different from control. However, when combined with radiation led to increased frequency of aberrations in lymphocytes of BC patients. No significant difference was seen for the frequency of chromatid breaks in lymphocytes of normal individuals after irradiation alone or in combination of agents.

Conclusion: The results imply that the studied agents may not be potent radioprotective agents when used at G2 phase of the cell cycle of lymphocytes of normal individuals. Moreover, these agents act as radiosensitizers when used in G2- lymphocytes of BC patients. This study may indicate that these agents may not potentially reduce genotoxicity of ionizing radiation in cells with geneome instability.

Keywords: Breast cancer, Lymphocytes, G2 assay, Melatonin, famotidine, radiosensitization.

RADIO-SENSITIZING EFFECTS OF SAFFRON ON RADIATION INDUCED CHROMOSOMAL ABERRATIONS IN G2-LYMPHOCYTES OF NORMAL INDIVIDUALS AND BREAST CANCER PATIENTS

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Purpose: Adverse reaction of normal tissues during radiotherapy of cancer patients is well known phenomena. Natural, herbal and chemical agents are introduced to combat radiation adverse effects; however, no suitable agent or compound is introduced for clinical use yet. The aim of this study was to study the effects of saffron on chromatid type aberrations induced in G2-irradiated lymphocytes of breast cancer (BC) patients.
Methods: Based on DPPH assay appropriate dose of saffron was chosen for treatment of lymphocytes. Lymphocyte cultures were initiated in RPMI-1640 medium supplemented with fetal bovine serum and antibiotics. Phytohemaglutinin (PHA) was added to the cultures for proliferation induction of lymphocytes. Culture vessels were treated with saffron for two hours. Then cells were exposed to 2 and 4 Gy X-rays generated from a clinical Linac at a dose rate of 1 Gy/min four hours before harvesting. Slide preparation and staining was done. 100 well spread metaphases was scored for Frequency of chromatid breaks under a light microscope with X1000 magnification.
Results: Results showed induction of high frequency of chromatid breaks following radiation alone in lymphocytes of breast cancer patients significantly higher than normal individuals. Saffron alone induced low frequency of aberrations not significantly different from control ($p>0.05$). However, when combined with different doses of radiation led to a considerable increase in frequency of aberrations in lymphocytes of both normal individuals and BC patients ($p<0.01$).
Conclusion: Despite antioxidant property of saffron, it may not act as a radioprotective agent when used at G2 phase of the cell cycle of lymphocytes of normal individuals and BC patients. It is apparent that this agent acts as a radiosensitizer when used in G2- lymphocytes of normal and BC patients. This study may indicate that saffron may intervene in homologous repair pathway which is active in G2 phase of the cell cycle after sensing DNA damage.

Keywords: Breast cancer, lymphocytes, G2 assay, saffron, radiosensitization.

DIFFERENTIAL RADIOSENSITIZATION EFFECTS OF ZNO AND GADOLINIUM-DOPED ZNO NANOPARTICLES AGAINST LUNG CANCER CELLS

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Background: Zinc oxide nanoparticles (ZnO NPs) have been shown to be promising inherent differential anticancer agents. This effect was significantly enhanced under UV irradiation. However, UV light has limited penetration into the body. In order to be used in high energy ionizing radiation fields common in treating deep-seated tumors, the high atomic number (Z) element of gadolinium (Gd) can be doped into the ZnO NPs structure (designed as Gd-doped ZnO NPS). The purpose of this study was to investigate the differential radiosensitization effect of ZnO and Gd-doped ZnO NPs in combination with high-energy X-rays against lung cancer cells.

Methods: ZnO and Gd-doped ZnO NPs were synthesized and characterized. SKLC-6 lung cancer and MRC-5 lung normal cells were selected as cancer and normal cell models respectively. The following tests were performed: inductively coupled plasma mass spectrometry (ICP-MS) for NPs cellular uptake, MTT assay for cytotoxicity and radiosensitization assessment, and flow cytometry for cell cycle progression evaluation.

Results: High purity crystalline ZnO and Gd-doped ZnO NPs were synthesized. Both NPs were taken up by cancer cells at higher rates than normal cells. Both NPs showed dose-dependent toxicity with a maximum non-toxic concentration of 10 µg/ml in cancer cells while less toxicity against normal cells. ZnO and Gd-doped ZnO NPs showed significant enhancement ratios of 1.19 and 1.35 in cancer cells respectively while did not in normal cells (enhancement ratios of 1.02 and 1.07). A combination of ZnO and Gd-doped ZnO NPs with high-energy radiation blocked both cancer and normal cells in the G1 phase that was accompanied by apoptosis induction in cancer cells but not in normal cells.

Conclusion: Both NPs induced differential radiosensitization effects on cancer cells with a higher effect in the case of Gd-doped ZnO NPs. This favored feature can promote the therapeutic efficacy of lung cancer radiotherapy.

Keywords: ZnO NPs, Gd-doped ZnO NPs, Radiosensitization, High-energy X-ray

Abstract of Radiobiology

(Lectures)

The Fourth International Clinical Oncology Congress

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ESTRO

GENOTOXIC EFFECTS OF 131-I IN THE CLINIC

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Background: During the last decades, radioiodine therapy has been considered to be a safe and effective treatment for patients with hyperthyroidism and differentiated thyroid carcinoma. Radioiodine therapy is usually carried out with high doses of 131-I and despite its advantages, it has some potential side effects because 131-I in blood and other tissues as well as gamma ray emitted from the thyroid gland also contribute to the exposure of the rest of the body. Hence, special concern persists regarding to its potential hazards. In this paper, the genotoxic effects of diagnostic and therapeutic exposure to 131-I have been reviewed.
Methods: The Published articles in Pubmed, Google scholar and Science direct were searched and investigated.
Results: Many studies demonstrated genotoxic effects of exposure to 131-I in clinic. The cytogenetic damage induced by a low dose of 131I is minimal and reversible. For high dose, the radiation -induced cytogenetic effects persisted for many years after treatment.
Conclusion: Persistence of genotoxic damage after 131I administration can be used for estimation of whole-body dose and biological dosimetry in internal contamination scenarios.

Keywords: Radioiodine Therapy, 131-I, Genotoxic effects.

PREDICTIVE GENOMIC BIOMARKERS FOR RADIOTHERAPY

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Ionizing radiation (IR) damage both normal and tumor cells. The toxicity reactions of normal tissues to IR are a major limitation in efficiency of radiotherapy. Unfortunately, Predictive biomarkers allowing selection of treatments for individual patients are not clinically in use yet to prevent these side effects. Therefore, biomarkers that predict tumor control probability and normal tissue complication probability would advance the care of individual patients. IR kills cells through induction of various types of DNA damages, with DNA double-strand breaks (DSB) being the most important lesion. DNA damages are repaired by cells efficiently but if left unrepaired will cause genome instability, chromosomal aberrations and cell death. Markers of DSB repair defects including altered expression of genes involved in DNA repair pathways, might serve as ideal predictive biomarkers. The predictive power of assays that measure classic aspects of radiobiology for example, G_0 or G_2 chromosomal aberration test, comet assay, RILA assay and gamma-H2AX for assessment of unrepaired DNA double strand breaks also warrants further exploration. These methods, with their limitations are not being implemented in routine clinical use because of technical limitation to achieve tumor tissue from radiotherapy patients. Liquid biopsies as an attractive approach allow analysis of circulating tumor DNA and circulating tumor cells. Moreover, noninvasive genotyping of tumors being treated with radiation therapy for which no or minimal tissue is available. Development of high throughputs technologies in molecular biology and genetics led to achievement of big data from single nucleotide polymorphism (SNPs) to show patient specific variability in gene or protein function related to radiation damage. Several other techniques such as microarray and genome wide association (GWAS) have been used to achieve this goal. Predictive biomarkers help the clinical management of patients treated with radiation therapy. However, any predictive biomarker discovers should be validated in independent cohort studies.

Keywords: Radiotheray, Predictive assays, biomarkers, liquid biopsy.

ADVERSE EFFECTS OF IMMUNOTHERAPY

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Immunotherapy is an essential component of cancer care and expands the treatment possibilities for patients. Immune checkpoint inhibitors are among the most promising drugs but are associated with toxicities. The most frequently occurring ones affect skin, colon, endocrine organs, liver and lungs. Others are very infrequent but may be very serious, even lethal, such as neurological disorders and myocarditis.

In general, irAEs occur quite early, mostly within weeks to 3 months after initiation of immune checkpoint blockers. However, the first onset of irAEs has been documented as long as1 year after discontinuation of treatment.

Despite the identification of promising and validated biomarkers the response to immunotherapy can be unexpected or variable, including rapid regression (complete or partial) of the tumor mass, stability, progression, pseudo progression or hyper tumor progression . Immunotherapy, in general, is less toxic than chemotherapy for patients with cancer. However, the side effects [adverse events (AE)] linked to these new treatments [treatment-related adverse events (trAEs)] are often described and have variable severity. Stimulation of an immune response by checkpoint inhibitors can lead, in particular, to side effects of immunological origin [immune-related adverse events (irAEs)], which are variable depending on the series, the therapeutic molecule, the pathology, the tumor and the patient . These irAEs cause the formation of lesions in one or different organs according to the patient with very variable consequences . While immunotherapy and most of the AEs are relatively well tolerated the irAEs are sometimes very severe running a risk of death of the patient, leading rapid and adapted therapeutic care.

we need time to describe all of side effects of immunotherapy.

RADIOGENOMICS IN HEAD AND NECK CANCER: FINDINGS FROM UMCS-HANS GWA STUDY

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Objective: We aimed to find genetic variants associated with radiation-induced late Xerostomia in head and neck cancer (HNC) patients population treated with definitive or postoperative radiotherapy (RT).
Methods: We included 1,061 HNC patients treated with definitive or postoperative RT with or without chemotherapy from a prospective cohort study. All baseline patient- tumor- and treatment characteristics and acute and late toxicity was prospectively scored. Patients were followed up to 5 years after treatment. Patient phenotype data were imputed to correct for missingness of samples. Patients were genotyped on Illumina human hap 550k v.3.0 (n=607) or Illumina global screening array (n=464). Genotypes were imputed on Haplotype Reference Consortium reference panel version R1.1. Principal component analysis (PCA) was performed to identify population substructures among samples. Eventually, 957 patients and 6,334,277 SNPs passed quality control which were included in the final analysis. Xerostomia was defined as moderate to severe xerostomia at 6 months (XER6M). We fitted first a phenotype model (model I) to identify the significant non-genetic clinical and bassline factors associated with XER6M by using imputed samples. Next logistic regression was used to estimate the association of the additive effect of genetic variants with XER6M while adjusting for other predictors from the model I and the top four eigenvectors obtained from PCA analysis. A p-value<0.05 for clinical co-variable, and a genome-wide p-value<5.0×10^{-8} for genetic variants was considered statistically significant.
Results: Full data were available in 763 patients, of whom 280 (36.7%) had XERM6. These cases were compared to 483 patients without XERM6. Clinical factors including N stage (OR=0.29; 95%CI 0.12 to 0.68; p=0.004), volume surrogate (5.97; 3.11 to 11.46; $p=7.16\times10^{-8}$), definitive radiotherapy (0.22; 0.15 to 0.32; $p=1.61\times10^{-15}$) and baseline xerostomia (2.60; 2.00 to 33.36; $p=5.48\times10^{-13}$) were significantly associated with XER6M. In total, 26 variants across eight genomic regions showed a suggestive association at (5.0×10^{-8}<p<5.0×10^{-6})to XER6M, including one variant on chr1.q41 at $p=7.8\times10^{-7}$ with an OR of 2.5 (95%CI 1.74 to 3.61).
Conclusion: We found suggestive genetic variants associated to in XERM6, independent of clinical predictors of XERM6. Further replication is required in independent cohorts while also adjusting for dose distributions in related organs at risk. Identification of genetic variants associated with radiation-induced XER6M may eventually improve predictive models for radio-toxicity in HNC patients.

BREAST CANCER, RADIATION TOXICITY AND THE CORRESPONDING BIOMARKERS

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As an indispensable part of different adjuvant treatment modalities, radiotherapy reduces the risk of recurrence and mortality in majority of breast cancer patients. Nevertheless, minority of the treated patients somehow suffer from the negative consequences of radiation due to less-effective impact on malignant cells as well as toxicity induction to the normal tissues. It is estimated that 80% of the genomic variations in clinical response might be caused by patients-related factors. Identification of these molecular factors might help predict breast cancer patients with high risk of developing adverse reaction to radiotherapy. Work in radiogenomics has greatly led to identify several genetic variations as the cause or consequence of radiation toxicity on the malignant and normal tissues. Some of these molecular mechanisms and genetic factors have currently been suggested as predictive/prognostic biomarkers in different malignancies including breast cancer. In this presentation we will briefly overview some potential biomarkers to predict sensitivity or follow up prognosis of breast cancer patients, against radiotherapy.

Keywords: Radiogenomics, Toxicity, Biomarker, Breast Cancer

RECENT APPROACHES IN MANAGEMENT OF LOCAL RADIATION INJURIES

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local radiation injuries consist an inflammatory reaction of the skin with a particular cytokcoine profile, observed after radiation exposure. Following exposure to high doses it is not only the skin which is involved, but also the subcutaneous tissue, and even muscles and bones.
No standardized therapeutical protocols exist. Preceding approaches include conservative (pain management, reduction of inflammatory reaction, healing acceleration, wound cleaning and prevention of infection and improvement of local microcirculation) and surgical treatment (opening overstretching blisters and vesicles, reconstructive and plastic surgery and amputation in final steps).
Two challenging problems for physicians are determining the extent of the damage and deciding which tissue will inevitably become necrotic and choosing the most suitable moment to perform surgery. Dosimetry guided surgery is a new approach, which represent the extent and whenever irreversible alterations appear. The dose absorbed at the skin lesion centre is very high but dropped rapidly due to the combined effect of distance and tissue attenuation. Dose reconstruction is performed using the numerical method taking into account the anatomical characteristics of the patient morphology in order to improve the accuracy of the surgical excision and rapid surgical intervention before the occurrence of the radionecrosis.
Mesenchymal stem cell therapy is a new emerging therapeutical strategy based on stem cell injection. The injected cells have the capacity to both acquire the morphology and function of the deficient cells after tissue damage and to release growth factors and cytokines known to favour wound healing and tissue regeneration. These cells are multipotent cells that can give rise to cartilage cells, bone cells, muscle cells and other cell types. These stem cells have furthermore a high proliferative capacity rendering possible to obtain them at a very high number in the laboratory.
The radiological accident in Chile; with iridium-192 source; 3.3 $\times$ 1012 Bq activity, made local injury to left hand and buttock of a worker. By the use of these two new approaches, the hand lesions were successfully treated, the necrosis process in buttock level has stopped and the tissue repair mechanism was in a good way.
In conclusion, regarding the previous cases of Georgian or Peruvian patients, we conclude that the stem cell therapy approach combined with early surgical therapy is a very efficient approach for irradiation burn treatment that could be, however, further confirmed.

Keywords: Local radiation injuries, Mesenchymal stem cell therapy, Dose reconstruction

REIRRADIATION IN RECURRENT TUMOR

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It may be necessary to consider treatment to a tumor located in any area of the body that had previously been irradiated. Surgery may be compromised if the tissues involved had been previously irradiated to a high dose. One thing is clear, namely, that if the radiation tolerance of a given organ or tissue has been exceeded by the initial treatment, to the extent that function is lost or is in the process of being lost, then subsequent retreatment cannot be contemplated with safety.

When considering retreatment with radiation, whether it is intended to be either curative or palliative, several factors must be taken into account:

1. The dose and volume treated during the initial radiotherapy and the extent to which the retreatment fields overlap with the initial fields
2. Whether chemotherapy was added to the initial radiotherapy
3. The time interval that has elapsed since the initial radiotherapy
4. The tissues and organs involved because they differ markedly in their ability to recover
5. Highly conformal techniques, such as stereotactic radiosurgery, stereotactic body radiotherapy (SBRT), or brachytherapy, are most appropriate.
6. Whether there are alternative options to radiation that could be considered

If the radiation tolerance of a given organ or tissue was exceeded by the initial treatment to the extent that function is lost, or is in process of being lost, then retreatment cannot be contemplated safely and if the normal tissue tolerance was not exceeded by the initial treatment, some reirradiation at a later date is safe, varying very much with the tissue or organ involved and depending on other factors. Most clinical studies involve small numbers of patients, variable doses, and various time intervals between the initial treatment and reirradiation. Reirradiation is possible in various sites with reduced doses and with a high price in terms of morbidity.

The spinal cord is a major dose-limiting organ in the treatment of primary tumors of the spinal cord or of neoplastic disease in the direct vicinity of the cord. There are no animal data available on the reirradiation tolerance of the brain. It might be thought that information derived from studies of the spinal cord could be transferred to the brain, Despite significant improvements in outcome for head and neck squamous cell carcinoma treated aggressively by modern techniques, the major pattern of failure continues to be locoregional recurrence. The addition of preoperative or postoperative chemotherapy and or radiotherapy to radical surgery for rectal carcinoma has reduced the incidence of local recurrence to approximately 10% to 15%, but this group of patients presents a substantial problem. Bone metastases are a frequent cause of morbidity in patients with malignant disease, occurring most often in patients with breast, lung, prostate, thyroid, and renal cancers, and those with multiple myeloma. Reirradiation after recurrence of breast cancer is a major problem. Local recurrence of lung cancer after initial external beam radiotherapy poses substantial problems for the subsequent management of the patient. A report from China concluded that reirradiation for late recurrence in the vagina after previous radiotherapy for cervical cancer is valuable in selected cases.

Conclusion: Reirradiation is a new "R" in modern radiotherapy and can be useful in some cases.

THE ROLE OF PHYSICO-CHEMICAL PROPERTIES OF NANOPARTICLES IN RADIOSENSITIZATION

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There are various parameters to evaluate when constructing new nanoparticles such as the material they should be developed from, their shape and size, the surface coating, and the net charge on the nanoparticle. All of these criteria impress cellular uptake and the biological response of cells as well as their interaction with radiation.

The size of nanoparticles determines how they interact with the biological system and with the radiation. The size of the nanoparticles affects the biological distribution and elimination pathway from the body. As a result of interaction between positive charge on the surface of nanoparticles and negative charged of lipid membrane, the nanoparticles can penetrate into the cells. Positively charged nanoparticles could also selectively target cancer cells. The concentration of nanoparticles in tumour tissue plays an important role in the radiosensitisation effects, and it has since been reported that the concentration of AuNPs plays a larger role in radiation dose enhancement than their size.

From the very basic knowledge of photoelectric and its associated effects it can be easily deduced, that there are clearly benefits in combining AuNPs with radiotherapy. Here likewise much work is still necessary in order to optimise not only the multi-parameter properties mentioned above, but also to predict the most efficient way in secondaries production. It has already been shown that the surface changes, which increase the cellular uptake and enable passive or active targeting, may place the secondary electrons in the close proximity to the nanoparticle, thus preventing an efficient radiosensitisation.

CLINICAL CORRELATION BETWEEN HYPERTHERMIA AND TUMOR ALPHA/BETA RATIO

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It has been shown that hyperthermia inhibits the repair mechanism of DNA damage after irradiation and, therefore, it can change the α/β values of tumours. Hereby, the results of recent study will be presented in order to show that how we can estimate the clinical α/β_{HTRT} values from clinical trials of thermoradiotherapy (HTRT) vs radiotherapy (RT).
In this study clinical α/β_{HTRT} was obtained from data of recurrent breast (RcBC), head and neck (III/IV) (LAHNC) and cervix cancers (IIB-IVA) (LACC). Tumor biological effective dose (BED) for each study with RT (BED_{RT}) was computed assuming an α/β_{RT} of 10 Gy. As outcomes were favorable with HTRT, thermo-radiobiological BED (BED_{HTRT}) was calculated as a product of BED_{RT} and $\%CR_{HTRT}/\%CR_{RT}$. The α/β_{HTRT} was estimated as $Dd/(BED_{HTRT} - D)$. Thermoradiobiological effects on the repair of RT induced DNA damage results in reduction in α/β values of tumours.

Fractionation in Radiotherapy from radiation biology point of view
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Radiation Biology in known as an inter-disciplinary study deals with the effects of radiation on living things. This overview, concentrates on the effects of radiation doses and dose rate deliveries applied in radiation therapy.
Recent development in radiotherapy applies different treatment regimen with arrange of very low to very high dose rates. In addition, different scenarios of treatment are recently applied for treatment. This issues have been reviewed from radiation biology point of view. The impact of four Rs on the target dose response and management of treatment is discussed.

Keywords: Radiation Biology, Fractionation, Dose rate effect

THE CHALLENGES OF J-SHAPED DOSE RESPONSE MODELS FOR IONIZING AND NON-IONIZING RADIATIONS: THE ROOTS OF CONTROVERSY

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An accumulating body of evidence indicates that living organisms exposed to specific windows of doses/dose rates of both ionizing and non-ionizing radiation demonstrate J-shaped dose response curves. Evaluation of these dose-response curves is of great importance in radiation biology as well as radiation protection. Studies conducted by my colleagues and I show that the general patterns of induction of phenomena such as adaptive response are similar for ionizing and non-ionizing radiations. Given this consideration, we have previously reported that the so called “dose window theory” that is well discussed for adaptive responses induced by ionizing radiation, is valid for non-ionizing radiation. Recently, after reviewing the current literature, we provided data indicating that in a similar pattern with ionizing radiation, the carcinogenesis of non-ionizing radiofrequency electromagnetic fields (RF-EMF) may have a nonlinear dose-response relationship. In particular, we introduced data that support the validity of a J-shaped dose-response relationship. Considering the pattern of J-shaped dose response models, ignoring the key issue of the exposure level (low levels vs. high-level exposures) can be introduced as a main root of current controversial reports regarding the carcinogenesis of RF-EMF. In this light, some studies show an association between mobile phone use and brain tumors, especially in people who used their mobile phones for long durations (e.g. ≥10 years). In summary, better understanding of the J-shaped dose response models for both ionizing and non-ionizing radiations can shed some light on the dark corners of current controversies about the adverse health effects of low-level exposures.

RADIOBIOLOGCAL PRINCIPLES OF TREATMENT PLANNING IN RADIOTHERAPY

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The combination of physics and biology makes radiotherapy as an attractive/challenging area of science. Modern Radiotherapy has changed very rapidly in recent years, but, still achieving uncomplicated local regional control of cancer remains as a final goal and needs to combine the art and science of radiation oncology. Radiobiologicaly point of view in radiotherapy treatment planning is a very important concept and has advantages/limitations which are addressed in this topic.

Abstract of Radiobiology

(Posters)

The Fourth International Clinical Oncology Congress

The 14th Iranian Annual Clinical Oncology Congress
The Fourth International Clinical Oncology Nursing Congress
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ESTRO

CORRELATION OF LOW DOSE EXPOSURE ASSESSES BY TLD DOSIMETRY WITH CYTOGENETIC DAMAGE IN LYMPHOCYTES OF OCCUPATIONALLY EXPOSED PERSONNEL IN RADIOLOGY DEPARTMENTS

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Background: Radiation workers in radiology departments are exposed to low dose radiation continuously below annual dose limit. However, biological effects of low dose irradiation are not taken into account seriously both by radiation workers and health system administrators. In this study we compared annual dose received by RW and compared with cytogenetic damage induced in their lymphocytes expressed as micronucleus.

Methods: Thermoluminscent dosimeters (TLD) were provided to 30 RW (15 radiology technologists RT and 15 nuclear medicine technologists (NMT) for 4 mounths. Then, annual dose equivalent for RW was calculated Heparinaized whole blood cultures were initiated for every RW in complete RPMI-60 medium; lymphocytes were stimulated with phytoheamaglutinin and incubated at 37°C for 44 hours. Cytochalasin B was then added to cultures to arrest binucleate cells at cytokinesis. After 72 hours cells were harvested and slides were made. 1000 binuclei lymphocytes stained in 5% Giemsa were scored under a light microscope with magnification of x1000 for presence or absence of micronuclei. Statistical analysis was done on obtained data.

Results: Results showed no statistical difference of age between study groups ($p>0.05$). Calculated annual exposure of RT was 2.16 mSv and for NMT was 5.4 mSv. Mean frequency of MN observed for RT was 17.8+0.95 and NMT 20.56 +1.02. Mean annual dose calculated for NMT was statistically significant compared to RT. Similarly, frequency of MN was significantly different between RT and NMT ($p<0.05$).

Conclusion: Results indicates annual dose received by radiation workers in both radiology and nuclear medicine departments is lower than dose limit set at 20 mSv. However, the dose received by NMT was more than RT. Cytogenetic alterations seen as micronuclei can be considered as an appropriate biomarker for low dose biomonitoring.

Keywords: Occupational exposure, physical dosimetry, cytogenetic damage, radiation workers.

CARDIAC AND PULMONARY COMPLICATION PROBABILITIES IN HYPOFRACTIONATED FORWARD INTENSITY MODULATED RADIOTHERAPY OF BREAST CANCER

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Introduction: Hypofractionation regimen (40 Gy/ 16 fractions) of radiotherapy is conducted to delivery of larger dose of radiation per treatment fraction thereby completing the treatment over shorter duration compared to conventional fractionation (50 Gy/ 25 fractions). The main radiobiological advantage of breast tissue is a relatively low α/β ratio of 4.

With the advent of the multileaf collimators (MLCs) and model based algorithms of treatment planning, technique of segmented fields, called forward intensity modulated radiotherapy (IMRT), has been introduced to improve the homogeneity of the isodose distribution.

This study aims to compare the radiobiologic model prediction of Tumor Control Probability (TCP) of the hypofractionated FIMRT technique plan compared with rectangular two tangential wedged fields (2FW) in the treatment of breast cancer. Furthermore, reduction of the heart and lung dose in the FIMRT was studied using radiobiologic model prediction of Normal Tissue Complication Probability (NTCP) for breast cancer patients planned with both techniques.

Materials and Methods: 25 left-sided breast cancer patients were selected. All patients were scanned on a CT simulator in spiral mode with slice thickness of 0.5 cm. Radiation oncologists contour planning target volume (PTV), planning target volume for evaluation (PTV-5) (5 mm below the skin), and organs at risk (heart ad ipsilateral lung). The tangential technique of treatment planning consists of two optimized wedged beam without blocks (2FW) were compared to FIMRT plans for same patients.

The FIMRT plans were done by optimizing the isodose distribution on the standard tangential plan. To this end, the dose distribution via the beam's-eye view was observed. Then, the primary tangential fields were copied as open fields and the areas of the breast receiving high doses (105%, 107%, and 110% of the prescription dose) were shielded using the MLCs.

The weight of additional subfields was approximately 6–10% of the total dose. FIMRT and 2FW was planned for hypofractionated delivery of 40 Gy dose to the target (≥ 0.97% volume coverage) for 16 fractions of 2.5 Gy.

All beams used in the study were 6 MV photon beams from an Elekta Synergy platform linear accelerator equipped with a 40-leaf-pair multileaf collimators (MLCs).

For radiobiologic evaluation, TCP was calculated via the Linear- quadratic model. NTCPs for radiation pneumonitis and late heart mortality were calculated with the Lyman model for organs at risk, using Kutcher-Burman dose- volume histogram data (DVH).

Paired samples t-test was used for statistical analysis and $p < 0.05$ was considered as significant level.

Results:

TCP was greater for hypofractionated FIMRT plans (79.1%) than for 2FW ones (76.8%).

The NTCP for radiation pneumonitis was (0.5%±0.1%) and (0.8%±0.3%) for the FIMRT and 2FW techniques, respectively. The NTCP for late heart was (7.5%±1.8%) for the 2FW technique. However, it was reduced to (4.3%±1.1%) in the FIMRT technique. Differences of the NTCP values were statistically significant for both lung and heart ($p < 0.05$).

Conclusion: The results of the present study showed that for all organs, mean NTCP were lower for hypofractionated FIMRT technique of treatment planning for breast cancer than for the 2FW plans. In addition, the FIMRT technique delivered more homogenous dose to the target while maintaining or increasing the TCP.

To conclude, the hypofractionated FIMRT FIMRT technique can be used as a straightforward and fast technique in clinics that have not inverse IMRT.

Keywords: Radiobiologic modeling, Hypofractionated radiotherapy, Intensity modulated radiation therapy, Breast cancer, Conformal radiotherapy, Dosimetry, Heart dose, Lung dose, Dose-volume Histogram

اندازه گیری حداکثر دوز پوستی (PSD)ناحیه CHEST با محاسبه فاکتور تصحیح دوز در بیماران تحت درمان آزمون ابلیشن با استفاده از فانتوم ANTHROPOMORPHIC WATER AND WHOLE BODY PHANTOM (PBU-60, KYOTO)

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چکیده

زمینه وهدف : استفاده طولانی مدت از فلوروسکوپی در اعمال مداخله ای قلبی دوز تابشی بیماران را بالا برده که بدنبال آن واکنش های شدید پوستی گزارش شده است و نگرانی روبه افزایش از این اقدام ایجاد می شود(۱). مطالعه حاضر با هدف بدست آوردن حداکثر دوز پوستی بیمار جهت تخمین ریسک ناشی از تشعشع با بررسی دوز تابشی واریتمای ناشی از تشعشع وبررسی اثر پرتو در مطالعات الکتروفیزیولوژی انجام شده است.

روش ها:در این مطالعه۳۰ بیمار الکتروفیزیولوژی با عمل درمانی ابلیشن و حائز شرایط مطالعه مراجعه کننده به بیمارستان شهید فقیهی شیراز بعد از تکمیل فرم رضایت ،انتخاب شد. مقدار دوز جذبی در ناحیه مورد نظر توسط دزیمتر TLD اندازه گیری شده ومدت زمان تحویل دوز ودوز جذب شده توسط دستگاه وفاکتورDAPاندازه گیری شده با DAP meter دستگاه برای هر مریض ثبت گردید.ازدو هفته بعد از عمل تا دوماه بعد از عمل ، مشاهده تغییرات پوستی پیگیری شد. نتایج مطالعه جهت تخمین حداکثردوز پوستی بیماران وارتباط دوز اندازه گیری شده توسط دزیمتر با عوامل تحت مطالعه ،بررسی شد.

نتایج: نتایج مطالعه نشان داد با دوز دریافتی بیماردر آزمون ابلیشن هیچ گونه اریتمای پوستی مشاهده نگردید.ارتباط معنادار آماری بین زمان فلوروسکوپی استفاده شده ودوزTLD بیماران بدست آمد (p-value<0.05). میانگین دوز تصحیح شده بیماران ۹.۰۰mGy می باشد که به دوز آستانه اریتمای پوستی نمی رسد.

نتیجه گیری : با محدوده تکنیکی مورد استفاده در آزمون ابلیشن درمدت فلوروسکوپی استفاده شده، دوز دریافتی بیماردر آزمون ابلیشن درآستانه دوز لازم جهت ایجاد اریتمای تابشی نبود وهیچ گونه اریتمای پوستی مشاهده نگردید.در سال ۱۹۹۴ سازمان غذا ودارو توصیه کرد دوز تابشی در گزارش پزشکی بیمار برای همه اقدامات تحت فلوروسکوپی که احتمال می رود دوز پوستی بیمار به قدر کافی جهت ایجاد آسیب پوستی باشد،ثبت گردد.اندازه گیری دوز پوستی حداکثر قابل اعتماد ترین روش برای تخمین زدن ریسک وخطر ایجاد آسیب پوستی می باشد. در این مطالعه به منظور تخمین حداکثر دوز پوستی بیماران واندازه گیری ضریب تصحیح دوز ، مقادیر دوز اندازه گیری شده در یک دقیقه در بیماران وفانتوم مقایسه شد دوز تصحیح شده بیمار با فانتوم جهت تخمین صحیح تر حداکثر دوز پوستی بیماروریسک ناشی از آن با تأثیر ضریب تصحیح بدست آمده محاسبه گردید. میانگین دوز تصحیح شده بیماران ۹.۰۰mGy می باشد که به دوز آستانه اریتمای پوستی نمی رسد

کلمات کلیدی :اریتمای تشعشعی – الکتروفیزیولوژی– ابلیشن– حداکثر دوز پوستی(PSD)

EFFECT GLUTAMINE IN PREVENTION OF RADIATION-INDUCED ORAL MUCOSITIS IN PATIENTS WITH HEAD AND NECK CANCER: A SYSTEMATIC REVIEW OF CLINICAL TRIALS

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Abstract

Radiotherapy is one of the main methods in the treatment of head and neck cancer (HNC). However, radiation-induced oral mucositis is a major dose-limiting toxicity in patients with HNC. It is a normal tissue injury caused by radiotherapy, which has marked adverse effects on the quality of life of the patients. It is a challenge for radiation oncologists since it leads to several problems, including pain, nutritional problems as a result of inability to eat, and increased risk of infection due to open sores in the mucosa. Therefore, finding an approach for management of radiation-induced oral mucositis is important. The systematic review aimed to evaluate effect glutamine in prevent of radiation-induced oral mucositis. Search in published articles shows, four RCTs (Two RCTs for oral glutamine and two RCTs parenteral glutamine) suggested that glutamine administration to be effective for the prevention of oral mucositis in the patients undergoing hematopoietic stem cell transplantation[1-4]. Also, a RCT showed that parenteral glutamine may prevent of oral mucositis in patients undergoing chemotherapy[5]. Three RCTs showed that glutamine administration to be effective for the prevention radiation-induced oral mucositis. The results of a pilot RCT indicated oral glutamine may significantly reduce the duration and severity of oral mucositis during radiotherapy in patients with HNC[6]. In the other RCT, 10 g of oral glutamine given 2 h before RT, delays oral mucositis and reduces the frequency and duration of grade 3 and grade 4 mucositis in the patients with HNC[7]. Also, a RCT reported that glutamine (dose of 10 g 3 times a day) significantly decreased the maximal mucositis grade and pain score. Glutamine significantly decreased mucositis severity in the oral cavity, pharynx and larynx induced by chemoradiotherapy in patients with HNC[8]. The systematic review suggested glutamine can be useful for the management of oral mucositis in patients with HNC.

Keywords: Glutamine, Head and neck cancer, Radiotherapy, Oral mucositis

VALIDITY OF COMPLETE BLOOD COUNT (CBC) TESTS IN EVALUATION OF RADIATION EFFECTS IN OCCUPATIONAL EXPOSURES: A SYSTEMATIC REVIEW

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Background: Exposure to high levels of ionizing radiation can lead to hematopoietic, gastrointestinal and cerebrovascular syndromes. However, there are not consistent reports about the detrimental effects of low dose radiation (LDR). Given this consideration, LDR (doses < 100 mSv) is not expected to cause a significant effect on blood count. Although lymphocytes are among the most sensitive cells to radiation, their count does not show any significant change as long as the radiation level is less than a few hundreds of mSv. In spite of this, in Iran radiation workers, even those who work in diagnostic radiology departments, are regularly examined for blood count changes. The aim of this systematic review was to answer this question whether complete blood count (CBC) tests are valid markers of radiation effects in occupational exposures?
Methods: 650 articles was found after a detailed search in PubMed, ISI, Scopus, SID and Google Scholar. 12 out of them matched our criteria. A final review report of these 12 reports was prepared.
Results: The results showed that occupational exposures to ionizing radiation that lie in the low dose range could not have a significant effect on the blood parameters and hence CBC test has a very low efficiency in evaluation of the adverse health effects of ionizing radiation in radiation workers.
Conclusion: Highly given this consideration, evaluation of chromosome aberrations or micronuclei by fast automated scoring systems can be a good alternative for current CBC tests. Developing low-cost methods can remove current barriers in widespread use of these methods.

Keywords: Radiation Workers, Complete Blood Count (CBC), Safety, Risk

ارزیابی نفروپاتی پرتویی بعد از رادیوتراپی سرطان‌های ناحیه شکم از طریق بررسی پارامترهای بالینی

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چکیده

سابقه و هدف: نفروپاتی پرتویی بعد از پرتودرمانی بدخیمی‌های ناحیه شکم به علت پرتوگیری کلیه‌ها در طول درمان، ایجاد می‌شود. آسیب‌های کلیوی بر اساس مقدار دز رسیده به کلیه‌ها و بررسی تمام فاکتورهای موثر در بیان میزان آسیب کلیوی به صورت حاد و مزمن رتبه‌بندی می شوند.در این مطالعه رابطه دز-پاسخ کلیوی و رتبه‌بندی میزان آسیب‌ها مورد بررسی قرار می‌گیرد.

روش بررسی: آسیب کلیوی ۶ الی ۱۲ ماه بعد از رادیوتراپی در۵۰ بیمار مبتلا به سرطان‌های ناحیه شکم (معده، پانکراس، متاستاز، سارکومای شکمی) از طریق ارزیابی‌های بالینی تعریف شده در سیستم نمره‌دهی CTCAE ومیزان دز رسیده به کلیه‌ها در طول درمان رادیوتراپی با بررسی طرح درمانی آن‌ها، مورد تجزیه و تحلیل قرار گرفت.

یافته‌ها: در این مطالعه با توجه به رتبه‌بندی سیستم نمره‌دهی CTCEA، ۲۱نفر(۴۲درصد)؛ شامل ۱۱مرد(۵۲درصد) و ۱۰زن(۴۷درصد) در گرید۱ و ۲۹ نفر (۵۸درصد)؛ شامل ۲۱مرد(۷۲ درصد) و ۸زن(۲۷درصد) در گرید ۲ رتبه بندی، قرار گرفتند.

آسیب کلیوی در گرید ۲ به بالا(eGFR≤ 30-59ml/min/1.73m2) به عنوان اثر نهایی در نظر گرفته شده است، گرید ۳ و ۴ آسیب کلیوی در گروه ما مشاهده نشد. رابطه دز-پاسخ آسیب کلیوی با اطلاعات حجمی (DVH) بدست آمده از طرح درمان بیماران دارای آسیب گرید۲؛ نشان دهنده دریافت 15Gy در توسط 252 Cm^3 از حجم کلیه است که به طور میانگین در فیلد درمانی می‌باشد. رابطه معناداری میان میزان آسیب ایجاد شده با دز دریافتی و حجم تحت تابش کلیه وجود دارد و نشان داده شد با تعدیل اثر سن و جنس به ازای افزایش ۱واحد دز دریافتی کلیه؛ ۲ واحد eGFR و به ازای افزایش هر Cm^3 از حجم کلیه؛ ۰/۰۰۵واحد eGFR کاهش می‌یابد.

نتیجه‌گیری: نفروپاتی ناشی از تابش نیازمند بررسی طولانی مدت اختلالات عملکرد کلیه می‌باشد و به مقدار زیادی به دز کل و دز در هر جلسه وابسته است. با وجود دقت و پیشرفت سیستم‌های طراحی درمان در کانتور و شیلدینگ کلیه‌ها، طراحی درمان همچنان نیازمند پیشرفت و استفاده بیشتر تکنیک‌های نوین درمانی در جهت حفظ هرچه بیشتر ارگان های حساس در معرض خطر می‌باشد.در تحقیقات نیز باید اثر تجمعی تمامی عواملی که در کاهش عملکرد کلیوی دخیل هستند لحاظ گردد.

واژگان کلیدی: رادیوتراپی-سرطان‌های ناحیه شکم-کلیه- نفروپاتی

IN VIVO MECHANISMS OF RADIOADAPTIVE RESPONSE

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Abstract

Background: Radioadaptive response (RAR) describes a phenomenon in which small priming doses of ionizing radiation (IR) reduce detrimental effects of subsequent higher doses. Since IR-induced carcinogenesis is a main concern in the low-dose radiation risk assessmen, the aim of this study was to investigate the RAR with the end points of carcinogenesis and the related genomic damages and evaluation of the effective in-vivo mechanisms in this phenomenon.

Material & Methods: The present review article was performed by using the research and review articles indexed in Pubmed, Google scholar, Science direct. In this review article, some resent studies related to RAR with end points of carcinogenesis in different species of mice and human lymphocytes has been investigated. Additionally, in the present review article, the role of important in vivo mechanisms involved in adaptive response, namely DNA repair, bystander effect and endocrine system hormones such as glucocorticoids has been investigated.

Results: These studies, often revealed efficient induction of RAR by chronic or repeated low-dose priming irradiation.

Conclusion: Current radiation protection regulations do not include RAR because of the large variability in expression among individuals and uncertainties of the mechanism. However, in the future, RAR should be regarded as an indispensable factor for estimation and control of individual IR sensitivity.

Keywords: Adaptive response, Low-dose Radiation, Ionizing Radiation, DNA Repair, Bystander effect, Cancer

THE EVALUATION OF RADIO-SENSITIVITY OF 20(S)-GINSENOSIDE RG3 AND CURCUMIN ON MDA-MB-231 CANCER CELL LINE

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Background : Breast cancer is the second most commen cancer in women all over the world. There are currently few therapeutic options for patients with breast cancer. These types of cancers most of time resist common treatments . Thus , Drug development for the protection of normal tissue and increase the radio-sensitivity effect of tumoral tissue is very important. Rg3, one of the active material extracted from Ginseng , has demonstrated to have various pharmacological effects and anti proliferation activity in cancer cell line. In this study we investigated if Ginsenoside Rg3 and Curcumin could increase radiosensitivity of MDA-MB-231 cell line.

Methods : Different concentrations of Rg3 and Curcumin plus radiation were used to study growth inhibitory effect with MTT assay. Flow cytometry was applied to measure the effect of Rg3 and Curcumin on radiation-induced apoptosis .

Results: The results of MTT assay showed that Rg3 and Curcumin had an inhibitory effect on MDA-MB-231 cell line in a concentration dependent manner. Rg3 and Curcumin inhibit tumor cellular development and proliferation at concentrations of 80 µmol/l and 30 µg/ml respectivly, with a viability of 50% at 48 hours incubation time .

Conclusion: This study showed Rg3 and Curcumin inhibit MDA-MB-231 cell growth in a Dose and time dependent manner and increase the radiosensitivity. Therefore those could be combined with radiation for cancer therapy .

Keywords: Breast Cancer, Curcumin, Ginseoside, Radiation

OPTICAL CHARACTERISTICS CHANGES OF MCF-7 CELLS AFTER COMBINATION OF RADIOTHERAPY AND RADIOFREQUENCY HYPERTHERMIA IN THE PRESENCE OF GOLD COATED IRON OXIDE NANOPARTICLES

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Abstract:

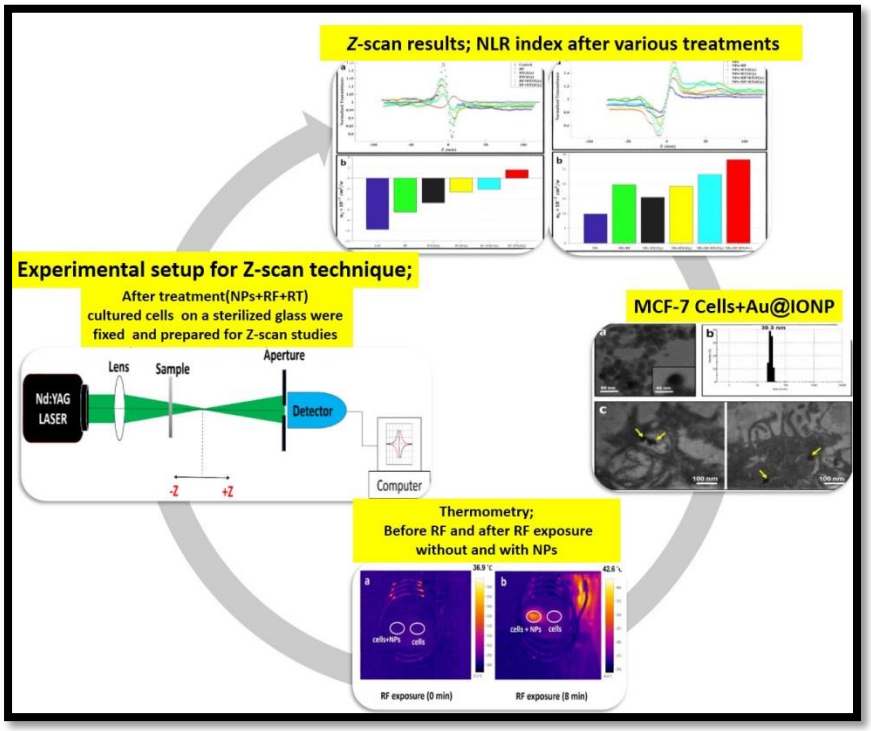
Recently, thermo-radio therapy in the presence of nanoparticles (NPs) has been considered in cancer treatment.

In this study, the human breast adenocarcinoma cells (MCF-7) with and without gold coated iron oxide nanoparticles (Au@IONPs) were exposed to radiofrequency (RF) waves and radiotherapy (RT) at interval of one hour. Then, the amount of cellular damage was evaluated based on physical changes caused by apoptosis in cells. The Z-scan as a simple, inexpensive and convenient technique, was used to evaluate the physical changes based on optical nonlinear refractive index (NLR).

The Z-scan results showed that the NLR in all cell groups with NPs was positive and the highest NLR was observed in combination groups containing NPs.

Consistency of the results of this study as a physical method with other biological damage assessment methods confirmed that Au@IONPs nanocomplex with thermo-radio sensitivity, can be enhance the effects of combined RF hyperthermia and RT in damage to the cancer cells, effectively.

Keywords: Cancer, Nanoparticles, Radio frequency hyperthermia, Radiotherapy, Z-scan



PREDICT OF ACUTE ESOPHAGITIS USING SURVIVAL ANALYSIS METHOD FOLLOWING RADIATION THERAPY OF HEAD/NECK AND THORAX TUMORS

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Background: The aim of this study was to predict of incidence acute radiation esophagitis induced by radiation therapy of head / neck and thoracic tumors using survival analysis method.
Methods: In this study, AE follow up was performed up to 90 days after treatment initiation according to National Cancer Institute Common Toxicity Criteria (NCI-CTC) scale. In addition, one hundred patients with nasopharynx, larynx, Hodgkin's lymphoma, spinal metastases, oral cavity and lung tumors were treated with three-dimensional conformal radiotherapy (3D-CRT). SPSS software ver.23 and Cox analysis were employed to prediction of AE basis time of beginning treatment.
Results: In univariate cox analysis, the variables of concurrent chemo radiation therapy (with hazard ratio (HR) = 1.92) and the maximum esophageal dose (with HR = 1.03) with p-value less than 0.05 were the most important predictor variables for acute esophagitis grade ≥2. Nevertheless, in multivariate Cox analysis, the concurrent chemo radiation therapy variable was not statistically significant when adding the mean dose effect and using multivariate Cox analysis.
Conclusions: Patients treated with concurrent chemo radiation therapy and dose higher than mean of maximum esophageal dose had a significant association with the incidence of acute esophagitis grade ≥2.

Keywords: Acute esophagitis, Survival analysis, radiotherapy

EVALUATION OF NORMAL TISSUE COMPLICATION PROBABILITY OF ESOPHAGUS FOLLOWING RADIATION THERAPY OF TUMORS BASIS LKB MODEL

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Background: The aim of this study was to evaluation of occurrence acute radiation esophagitis (AE) caused by the treatment of head/neck and thoracic tumors using Lyman-Kutcher-Burman (LKB) model.
Methods: In this study, patients were treated with three-dimensional conformal radiotherapy (3D-CRT). One hundred patients with nasopharynx, larynx, Hodgkin's lymphoma, spinal metastases, oral cavity and lung tumors were treated. Bioplan software version 1.3.3 was employed to prediction of AE. The parameters of TD50 = 51 Gy, m=0.32, and n=0.44 were used.
Results: Equivalent uniform dose (EUD) for Hodgkin's lymphoma, spinal metastases, nasopharynx, oral cavity, larynx and lung tumor were 30.94±4.65, 28.72±11.19, 19.54±7.73, 25.36±6.52, 25.23±8.3 and 41.22±10.86. Normal tissue complication probability (NTCP) for Hodgkin's lymphoma, spinal metastases, nasopharynx, oral cavity, larynx and lung tumor were 11.85±6.99, 12.31±10.03, 3.82±4.26, 7.04±7.90, 7.85±7.50 and 30.42±18.39.
Conclusions: According to the NTCP values obtained in the treatment of all tumors, most acute esophagitis was related to the treatment of lung tumors.

Keywords: NTCP, Acute esophagitis, radiotherapy, LKB, EUD

UNIVARIATE BINARY LOGISTIC REGRESSION METHOD FOR PREDICTION OF ACUTE ESOPHAGITIS FOLLOWING RADIATION THERAPY

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Background: The aim of this study was to predict the probability of acute radiation esophagitis (AE) caused by the treatment of head/neck and thoracic tumors using univariate binary logistic regression method.
Methods: In this study, 100 patients with nasopharynx, larynx, Hodgkin's lymphoma, spinal metastases, oral cavity and lung tumors were treated with three-dimensional conformal radiotherapy (3D-CRT). Univariate binary logistic regression method were used for prediction AE and ROC curve were employed for best agreement of dosimetric data with clinical follow-up results. Follow up of patients for AE was performed up to 90 days after treatment initiation according to National Cancer Institute Common Toxicity Criteria (NCI-CTC) scale. SPSS software ver.23 were employed to predict of AE basis physical and clinical data.
Results: Parameters of weight loss percentages, L5-50 and V5-50, mean and maximal dose received by esophagus, esophageal length and volume in radiation field, concurrent chemo radiotherapy and upper esophageal were significantly correlated with acute esophagitis (P-value < 0.05). Nevertheless, the variables L55-60 and V55-60, minimum dose, age and sex of patients, smoking and karnofsky performance status (KPS) and clinical stage of tumors had no significant relationship with the occurrence of AE. Regarding the ROC curve, V_{40} was the most important predictor of acute esophagitis (AUC = 0.915).
Conclusions: Parameters L_{40} and V_{40} were the most important predictors of AE grade ≥ 2.

Keywords: Acute esophagitis, logistic regression, radiation therapy

RADIOPROTECTIVE EFFECTS OF SELENIUM NANOPARTICLES AND ROSEMARY IN CHINESE HAMSTER OVARY (CHO) CELLS

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Background: Radiotherapy has a profound impact on the ovarian function, leading to depletion of the primordial follicle reserve, premature amenorrhea, and loss of fertility during or shortly after completion of irradiation. The radioprotectors are compounds that have the ability to reduce the effects of ionizing radiation (IR). Stabilized selenium nanoparticles and some extracts including Rosemary demonstrated high antioxidant activity. The aim of this study is evaluation of Rosemary extract and selenium nanoparticles ability to scavenge free radicals.

Methods: At first water extract from Rosemary was prepared، then selenium nanoparticles with Rosemary was synthesized. Chinese Hamster Ovary (CHO) cells was cultured in-vitro and randomly divided into 6 groups: control (without nanoparticle and Rosemary) ،case1(nanoparticle conjugated with Rosemary), case 2(Rosemary only), case 3(IR only), case 4(IR with nanoparticle conjugated with Rosemary) ،case 5(IR and Rosemary only). Case 3, case 4 and case 5 was irradiated with 2, 4 and 6 Gy then MTT and colony assay was used to determine the percent of cell survival.

Results: It is expected that mitosis death be lower in radiation with Rosemary or nanoparticle conjugated with Rosemary groups than another groups.

Conclusion: Probably Rosemary cause protection against radiation in CHO but using targeting therapy, may lead to get better results. Also evaluation of Rosemary extract in *in-vivo* experiments is suggested.

Keywords: Radiotherapy, Radiation Protection, Rosemary, Selenium Nanoparticles, Ovary

ACHILLES HEEL OF THE $25M NTP STUDY: THE MAJOR LIMITATIONS THAT SIGNIFICANTLY LIMITED THE SCIENTIFIC IMPACT OF THIS STUDY

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After more than 10 years of research, the US government's National Toxicology Program (NTP) has released its final report about the effects of radiofrequency radiation (RFR) on mice and rats exposed throughout their whole life (2 years). In this $25M study, rodents were exposed to CDMA or GSM-modulated RFR. Findings of the NTP study, the largest of its kind, showed that exposure to high levels of RFR can cause some cancers in these animals. NTP study is based on RFR frequencies used by 2G and 3G mobile phone systems. However, today most of the countries use 4G and in particular, there is a growing demand for high-frequency 5G that broadcasts at frequencies up to 86 GHz, transferring at least 1000Mbps. Interestingly, NTP study was unable to show any increased malignancies in female rats. Although, this gender-based difference can be due to sex hormone variations in male and female rodents, other possibilities such as the effect of number of cells exposed to RFR in male and female rats should also be carefully investigated. In the NTP study, whole-body animal exposure levels had specific absorption rates (SAR) of 1.5, 3.0, and 6.0 W/kg. While the exposure limit to RFR for the general population in the US is 0.08 W/kg averaged over the whole body and the localized exposure limit is only 1.6 W/kg. Thus, the levels of exposure to RFR in the NTP study were much higher than what people experience with even the highest level of cell phone use. In addition, RFR exposures were conducted over a period of approximately 18 hours/day using a continuous cycle of 10 minutes RFR on and 10 minutes off. Therefore, the total daily exposure time was about 9 hours, 7days/week. No doubt, the exposure pattern in the NTP study may not be typical for most or all cell phone users. In summary, due to some limitations, the findings of this animal study cannot be extrapolated for human risk assessment without caution.

PROTECTION EFFECT OF CERIUM OXIDE NANOPARTICLES AGAINST RADIATION-INDUCED ACUTE LUNG INJURIES IN RATS

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Abstract

Introduction: Radiation therapy is one of the most common tools for treating cancer. The aim is to deliver adequate doses of radiation to kill cancer cells and the most challenging part during this procedure is to protect normal cells from radiation. One strategy is to use a radioprotector to spare normal tissues from ionizing radiation effects. Researchers have pursued cerium oxide nanoparticles as therapeutic agent, due to its diverse characteristics, which include antioxidant properties, making it a potential radioprotector.

Materials and methods: One hundred rats were divided into five groups of A) control group, intraperitoneal (IP) saline injection was done twice a week; B) bi-weekly IP injection of 14.5 nM (0.00001 mg/kg) CNP for two weeks; C) a single whole thorax radiation dose of 18 Gy; D) a single whole thorax radiation dose of 18 Gy + bi-weekly injection of 14.5 nM CNP for two weeks after radiation; E) bi-weekly IP injection of 14.5 nM CNP for two weeks prior to radiation + a single whole thorax radiation dose of 18 Gy. Thirty days after irradiation, 7 rats from each group were anesthetized and their lungs extracted for histopathological examination.

Results: Statistical analyses revealed that CNP significantly decreased the incidence of tissue collapse and neutrophile aggregation in rats, receiving CNP before radiation in comparison with radiation group.

Conclusion: The results suggested the possibility of using CNP as a future radioprotector due to its ability in protecting normal cells against radiation-induced damage.

INVESTIGATING THE THERAPEUTIC EFFECTS OF ALGINATE NANOGEL CO-LOADED WITH GOLD NANOPARTICLES AND CISPLATIN ON U87-MG HUMAN GLIOBLASTOMA CELLS

Abstract

Background and purpose: It has been well-known both gold nanoparticles (AuNPs) and cisplatin are potential radiosensitizers for radiotherapy of cancer. In this in vitro study, we investigated the chemo-radiotherapeutics effects of alginate nanogel co-loaded with AuNPs and cisplatin (ACA) on U87-MG human glioblastoma cells.

Methods: Based on the accomplished pilot studies, U87-MG cells were incubated with ACA and cisplatin at 10% inhibitory concentration (IC10) for 4 h. Then, the cells were irradiated to different doses of 6MV X-rays (2 and 10 Gy). MTT assay were performed to evaluate the cell survival rate. Apoptosis was determined by flow cytometry using an annexinV–fluorescein isothiocyanate/propidium iodide apoptosis detection kit.

Results: The results showed that ACA at the concentration of 4 µg/ml (per cisplatin) and free cisplatin at concentration of 15 µg/ml have the same effects on U87-MG cells (survival rate: 90%). The combination of ACA with radiation resulted in a significant decrease in cell viability (survival rate: 30%). The flow cytometry assay also showed that such a combination therapy induces more apoptosis than necrosis.

Conclusion: It may be concluded that co-delivery of AuNPs and cisplatin with a single nanoplatform like ACA nanocomplex enhances the therapeutic ratio of human glioblastoma radiation therapy.

Keywords: Chemotherapy; Radiotherapy; Cisplatin; Gold nanoparticles; Apoptosis.

EVALUATION AND SYNTHESIS OF CYSTEINE CONJUGATED GOLD NANOSHELL FOR THERAPEUTIC EFFECT OF PHOTOTHERMAL THERAPY ON MELANOMA CANCER CELL LINE A375

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Abstract

Gold nanoshells functionalized with a small amino acid as a targeting agent were designed and synthesized for photothermal therapy of melanoma cell (A375).This study was aimed to synthesis the Cysteine (Cys)-conjugated with silica @gold core-shell nanoparticles (Cys-SiO_2@AuNPs) for improving the treatment of melanoma cancer cells. The characterization data showed that the Cys-SiO_2@AuNPs is spherical in shape and its size is approximately equal to 49.4 nm. The intra-cellular uptake of Cys-SiO_2@AuNPs into melanoma cells was measured through inductively coupled plasma, (~50%). The cytotoxicity of nanoparticles was investigated on A375 and HDF (Human dermal fibroblast) cell lines. Cytotoxicity results indicated that there is not any significant cytotoxicity in HDF cell lines treated with nanoparticles. MTT results showed that viability of A375 cells treated by SiO_2@Au and Cys-SiO_2@AuNps was decreased significantly to about 78.98% and 55.20% respectively. The higher toxicity of cancer cells were obtained for the cells exposed to 808nm near infrared (NIR) laser after incubation with Cys-SiO_2@AuNPs rather than the non-targeted SiO_2@AuNPs (about 22% and 42% respectively). Furthermore, about 80% more cell death was observed for A375 cells using both photo thermal therapy and treatment with Cys-SiO_2@AuNPs compared to photo thermal therapy alone. Additionally, the majority of the cell deaths was related to apoptosis process, not necrosis. It can be concluded that, Cys-SiO_2@AuNps was an effective targeting agent for photo thermal therapy in the treatment of melanoma.

Keywords: Au shell, Cysteine, Hyperthermia, Melanoma cancer, Nanoparticle,

QUANTITATIVE EVALUATION OF CK18, CK19 EXPRESSION AS BIOMARKER IN BLOOD SAMPLES OF PEOPLE WITH COLORECTAL CANCER

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Introduction: Colorectal cancer is the third general cancer and the third cause of cancer death in American. CK18 and CK19 are two protein biomarkers, which has the potential to detect colorectal cancer early. In this study, the potential of gene expression as molecular biomarkers in the diagnosis of colorectal cancer in blood samples of patients using technique Real Time PCR was examined, to do more research on the mechanism and how these genes work, as a suitable target for the treatment of colorectal cancer used.

Materials and Methods: Blood sample of 42 patients with colorectal cancer and 42 healthy individuals were collected as a control group then RNA was extracted from peripheral blood centrifuged serum. The cDNA molecule was synthesized using RT enzyme. Then appropriate and specific primers for the genes under study were designed and synthesized then, using Real Time PCR technique, tumor expression of CK18 and CK19 markers was evaluated. The information were analyzed by SPSS software.

Results: Relative expression of CK19 gene was not significantly different between control and patient group. (P=0.816). Relative expression of CK18 gene was not significantly different between control and patient group. (P=0.502)

Correlation between the expression of CK18 and CK19 genes in the control group. (P= 0.684). Correlation between the expression of CK18 and CK19 genes in the patient group (P<0.001).

Keywords: Colorectal cancer, CK18 and CK19 biomarkers, Real Time PCR, Metastasis.

ASSESSMENT THE RADIOPROTECTIVE EFFECTS OF VITAMIN A AGAINST GAMMA RADIATION IN MOUSE BONE MARROW CELLS

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Abstract

Background: Radioprotectors by neutralizing the effects of free radicals, reduce the destructive effects of radiation. In this study, the radioprotectory effect of Vitamin A in mouse bone marrow cells irradiated by gamma radiation was evaluated using Real-Time PCR.

Methods: Vitamin A was injected intraperitoneally at 100, 200 and 400 mg/kg two hours before 2 Gray (Gy) of gamma radiation. Animals were sacrificed after 24 hours, and then the expression of NOX4 was evaluated by Real-Time PCR.

Results: There was a significant difference between the mean of gene expression in groups with different doses of Vitamin A compared to irradiated group ($p<0.05$).

Conclusion: The results of the study showed that Vitamin A, possibly with an antioxidant mechanism, eliminates the effects of free radicals from ionizing radiation on bone marrow cells and reduces genetic damage.

Keywords: Radioprotectors**,** Vitamin A**,** Real-Time PCR**,** Gamma radiation**.**

EVALUATION OF THE RADIOPROTECTIVE EFFECTS OF VITAMIN A AND MAGNESIUM SULFATE AGAINST GAMMA RADIATION IN MOUSE BONE MARROW CELLS

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Abstract

Background: Radioprotectors by scavenging free radicals induced by ionization radiation, reduce the harmful effects of radiation. The aim of this study was to evaluate the radioprotectory effect of the combination of Vitamin A and magnesium sulfate in mouse bone marrow cells irradiated by gamma radiation by Real-Time PCR.

Methods: A mixture of Vitamin A and Magnesium Sulfate with three different doses was injected intraperitoneally into mice two hours before 2 Gray (Gy) of gamma radiation. Animals were sacrificed after 24 hours, and then the expression of NOX4 was evaluated by Real-Time PCR.

Results: There was a significant difference between the mean gene expression in groups with different doses of Vitamin A and magnesium sulfate and irradiated group ($p<0.05$).

Conclusion: The results of the study showed that the mixture of Vitamin A and magnesium sulfate, possibly with an antioxidant mechanism, reduces the effects of free radicals generated by radiation on bone marrow cells.

Keywords: Radioprotectors**,** Vitamin A, Magnesium Sulfate, Real-Time PCR**,** Gamma radiation**.**

EVALUATION OF THE RADIOSENSITIZING EFFECT OF METFORMIN IN COMBINATION WITH DISULFIRAM ON GBM CELLS

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Abstract

Purpose: Glioblastoma is one of the devastating types of primary brain tumors with negligible response to standard therapy. Repurposing drugs, such as Disulfiram and Metformin that can penetrate the Blood Brain Barrier with low side effects and low toxic profiles, have shown antitumoral properties in different cell lines. In the present study, the effect of combining Met with DSF-Cu on the induction of apoptosis in U87-MG cells at 6 MV X-ray was investigated. Materials and Methods: MTT assay was performed to evaluate the cytotoxicity of drugs. After irradiation, the apoptotic population was assessed using Flowcytometry and RT-qPCR to determine the expression level of apoptotic genes.

Results: The combination of Met with DSF-Cu and 2Gy of irradiation had cytotoxic effect on cells, and decreased proliferation and also a large increase was observed in the rate of apoptosis ($p< 0.05$), upregulation of family of genes, *BAX, P53, CASPASE3*, and downregulation of BCL_2.

Conclusions: Our data showed that a combination of Met and DSF-Cu with 2Gy of 6 MV X-ray, have the potential of killing U87-MG cells. This may trigger apoptosis from the intrinsic pathway, and these repurposing drugs combination can be used as a radiosensitizer and efficient candidate to improve the overall survival of glioblastoma patients.

Keywords: Glioblastoma, Disulfiram, Metformin, Apoptosis

عنوان خلاصه مقاله: جینسینگ بعنوان یک ماده طبیعی و اثرات محافظ پرتویی

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چکیده

زمینه و هدف: با توجه به افزایش روزافزون استفاده از تابش یونیزان در تصویربرداری پزشکی و درمان بیماران سرطانی در رادیوتراپی و پزشکی هسته ای، توسعه و استفاده بیشتر از محافظ پرتوها به منظور تعدیل آسیب بافت های نرمال ضروری به نظر می رسد. سمیت ذاتی عوامل محافظ پرتویی مصنوعی، گرایش محققین را به سمت محافظ پرتوهایی طبیعی با سمیت کمتر بیشتر کرده است. جینسینگ گیاهی است که عمدتا در چین، کره و آمریکا می روید. به دلیل خواص درمانی متفاوت (ضد سرطان، ضد خستگی، ضد استرس، افزایش انرژی، افزایش تمرکز و ...) از سال ها قبل مورد استفاده قدیمیان بوده است. خاصیت آنتی اکسیدانی جینسینگ باعث شده است به عنوان محافظ پرتو نیز مورد آزمایش های بسیار قرار گیرد. سمیت کمتر این گیاه نسبت به مواد سنتزشده ی مصنوعی و قابلیت تجویز خوراکی آن باعث شده است که بتوان آن را به عنوان محافظ پرتو مناسب به بیماران رادیوتراپی، پرتوکاران و عموم جامعه پیشنهاد داد. در این مقاله خلاصه ای از مطالعات محققین بر روی خاصیت محافظ پرتویی جینسینگ ارائه می گردد.

مواد و روش کار: مطالعه مروری حاضر با انتخاب کلیدواژه های مناسب و جستجوی مطالعات مرتبط که درپایگاه های Google ،Science direct scholarو PubMed نمایه شده، به انجام رسید. در این مقاله مهمترین مقالات مرتبط با آثار محافظ پرتوی جنسینگ گرداوری شده است و از بین مقالات موجود، خلاصه برداری و جمع آوری صورت گرفته است.

یافته ها: تاریخچه استفاده از جینسینگ نشان می دهد از دیرباز از این گیاه برای درمان بسیاری از بیماری ها استفاده شده است. تحقیقات گسترده ای بر روی انواع خواص درمانی این گیاه انجام شده است. با توجه به بررسی مطالعات انجام شده بر روی اثر محافظ پرتویی جینسینگ می توان گفت این گیاه می تواند تا حد خیلی زیادی اثرات مخرب ناشی از تابش را در رادیوتراپی و سوانح هسته ای کاهش می دهد. با توجه به این که یک ماده محافظ پرتو ایده آل علاوه بر تعدیل اثرات مخرب بر روی بافت نرمال، نباید هیچ گونه اثر محافظتی بر روی سلول های توموری داشته باشد و حتی سلول های توموری را نسبت به تابش حساس کند.

نتیجه گیری: از همین رو تایید قطعی اثر محافظ پرتویی جینسینگ به پژوهش های خیلی بیشتری نیاز دارد. در صورتی که مطالعات آینده اثر محافظتی این گیاه را تایید کنند می توان از آن در رادیوتراپی و سوانح هسته ای استفاده کرد.

کلید واژه: جینسینگ ، محافظت پرتویی، تابش یونیزان، آنتی اکسیدان

GINSENG AS A NATURAL SUBSTANCE AND PROTECTIVE EFFECTS OF RADIATION

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Background: Due to the increasing use of ionizing radiation in medical imaging and the treatment of cancer patients in radiotherapy and nuclear medicine, further development and use of radioprotectors to modulate normal tissue damage seems necessary. The inherent toxicity of artificial radioprotector agents has increased the researchers' tendency to natural radioprotectors with less toxicity. Ginseng is a plant mainly found in China, Korea and the United States. It has been used for many years due to its various therapeutic properties (anticancer, anti-fatigue, anti-stress, energy gain, increased concentration, etc.). The antioxidant property of ginseng has also been tested as a radioprotector. The lower toxicity of this plant than synthetic substances and its ability to be administered orally has made it suitable for protection to radiation patients, radiologists and the general public. This paper presents a summary of the researchers' studies on the ginseng radioprotector property.
Methods: This review study was conducted by selecting appropriate keywords and searching for related studies indexed in Science direct, Google scholar and PubMed databases. In this article the most important articles related to the radioprotective effects of ginseng have been compiled and summarized and collected from existing articles.
Results: History of ginseng use indicates that this plant has long been used to treat many diseases. Extensive research has been done on a variety of therapeutic properties of this plant. According to studies of the radioprotective effect of ginseng, it can be said to greatly reduce the radiation-induced effects on radiotherapy and nuclear accidents. Given that an ideal beam shielding agent, in addition to modifying the deleterious effects on normal tissue, should not have any protective effect on tumor cells and, even if possible, make tumor cells sensitive to radiation.
Conclusion: Therefore, definitive confirmation of the radioprotective effect of ginseng requires much more research. Future studies can confirm that the plant's protective effect can be used in radiotherapy, nuclear accidents and occupational exposures.

Keywords: Ginseng, radioprotector, Ionizing Radiation, Antioxidant

THEORETICAL CALCULATION BY LINEAR QUADRATIC MODEL AND EXPERIMENTAL INVESTIGATIONS OF HIGH DOSE BYTANDER RESPONSE IN HYPOFRACTIONATION TECHNIQUE OF GRID

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Background: The Linear Quadratic (LQ) equation as the most common formula in radiotherapy has a debatable accuracy in modeling high-dose effects. The purpose of this study was to demonstrate bystander response of Grid treatment in SCC cell line, based on both theoretical calculations and experimental investigations.
Methods: The linear quadratic model was used to calculate the equivalent uniform dose (EUD) of a Grid-field with the maximum dose of 10 Gy. According to the EUD definition, the identical tumor survival fraction (SF) was expected to obtain from both Grid and an open-field single fraction. After observing the difference between the theoretical calculations and experimental results, the clonogenic and apoptosis assays were exerted to investigate bystander response in a Grid-field via medium transfer strategy which was performed from 10Gy-irradiated donors to 1.5Gy-irradiated recipients based on the Grid peak-to-valley dose profile.

Results: The EUD was equal to 4 Gy and the SF of 4 Gy EUD and 10 Gy Grid-field were 0.1 ± 0.02 and 0.051 ± 0.008, respectively. These findings contradicted the theoretical expectations of their survivals equality. From the bystander standpoint, the clonogenic cell death enhanced approximately by 2.91 times; highlighting the bystander response role defined as statistically significant survival decrease ($P<0.05$) in bystander groups comparing to directly-irradiated cells. The apoptotic findings illustrated that the bystander cells experienced an approximately 10% increase and the apoptotic rate confirmed the clonogenic survival result which was less in the EUD than the Grid-field.
Conclusion: Since the SF of the Grid-field was less than the EUD, it revealed the Grid therapeutic advantages based on the bystander response manifestation; that was ignored in the LQ model and may not be demonstrated by sheer theoretical calculations of the Grid inhomogeneous dose distribution. Consequently, more precise parameters should be needed to express bystander response of modulated high-dose Grid.

Keywords: Linear Quadratic, Grid, Bystander, Clonogenic survival, Apoptosis.

ROLE OF SILYMARIN AS AN HERBAL RADIOPROTECTOR ON SPERM AND IN VITRO FERTILIZATION IN MICE IRRADIATED WITH Γ-RAYS

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Abstract

Background and purpose: Ionizing radiation effects on cells and produces directly or indirectly free radicals, oxidative stress, and reactive oxygen species. In radiotherapy, radiation can damage intra/extra cellular signaling, induces DNA damages, mutation, and cancer in normal cells around the tumor. Silymarin (SM), a flavanolignan compound, has wide variety of phytotherapeutic applications as an anti-oxidant drug. Purpose of the present study was to evaluate radioprotective effect of SM on the in vitro fertilization (IVF) parameters of mice exposed to γ-rays.

Methods and materials: The experiment was carried out on 50 adult male mice; which were randomly and equally divided in five groups. The control group neither treated with SM nor irradiated by γ-rays. The second group only irradiated with 2 Gy of γ-rays. In third group mice were treated with 100 mg/kg SM. The fourth and the fifth groups were firstly treated with 100 and 200 mg/kg of SM, respectively; and then 24 hrs later were irradiated by 2 Gy of γ-rays. After, sperm parameters were evaluated using Eosin-Nigrosin and Aniline blue staining and a neobar slide. After collecting sperm and oocyte and performing IVF, the number of 2-cell, blastocyst, and dead mice was counted using a stereomicroscope.

Results: Results: The results showed that irradiation of γ-rays significantly reduced the number of sperm compared to the control group. The results also showed that Silymarin has a significant effect on the increase in the number of sperm in mice exposed to γ-rays. Furthermore, in the group receiving SM, the number of motile sperm was increased. The results show that high doses of silymarin not only increase the number of progressive sperms in healthy mice, but also improve the number in irradiated mice. The results showed that in group 2, the number of two-cell embryos and blastocyst embryos decreased and the number of dead embryos increased. In the group with high doses of silymarin, there was a significant increase in the number of two-cell embryos and blastocyst embryos.

Conclusion: The study reveals that the use of silymarin compound improves the vital parameters of sperm and increases the percentage of two-cell and blastocyst embryos in the culture medium. Thus can be a cost-effective solution with high efficiency and can be used as an herbal radioprotector against testis damage induced by γ-rays but clinical studies are necessary to explain the molecular mechanism of SM.

Keywords: Silymarin, in vitro fertilization, Radiotherapy, Infertility, Medical herb.

CLASTOGENIC EFFECTS OF COMBINED SAFFRON AND VITAMIN C ON FREQUENCY OF CHROMATID BREAKS IN G2-IRADIATED MALE FETAL AMNIOCYTES.

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Purpose: Saffron as an herbal antioxidant and vitamin C were considered as capable of reducing clastogenic effects of radiation on G2-amniocytes. Amniocytes are essentially radiosensitive cells. The aim of this study was to study the effects of combined treatment of saffron and vitamin C on radiation induced chromatid type aberrations induced in amniocytes of male fetus at G2 phase of the cell cycle.

Methods: Amniocytes were cultured in amniomax culture medium and maintained with the use of trypsin – EDTA for preparing different cultures for treatments. DPPH assay was done to find appropriate dose of saffron and vitamin C with appropriate antioxidant properties. Cells were treated with saffron, vitamin C alone or in combination 2 hour prior to irradiation. Irradiation was done with a 6-MV linear accelerator at a dose of 2 Gy with a dose rate of 1 Gy/min. Following irradiation cells were incubated at 37°C for 4 hours. 1 hour before harvesting cells was exposed to colcemid to inhibit cells at mitosis. After harvesting and slide preparation, cells were stained in Giemsa. Fifty – 100 well spread mitoses were scored for chromatid type aberrations under a light microscope with X1000 magnification.

Results: Results showed a induction of very high frequency of chromatid breaks in amniocytes following radiation alone. However, Saffron when combined with radiation, the frequency of chromatid breaks in all samples increased significantly in a synergistic manner ($P<0.01$). Vitamin C had no protective effects on irradiated cells but could reduce the effect of saffron when used in combination.

Conclusion: The results imply that saffron in combination with radiation potentiate radiation effects and acts as a radiosentiziser. Moreover, Vitamin C exhibited no protective effect for amniocytes. Therefore these agents might not be considered as radioprotective agents at least for fetal cells.

Keywords: Male fetal cells, G2 assay, chromatid breaks, Saffron, Vitamin C, radioprotection.

MODULATING EFFECTS OF COMBINED TREATMENT OF MELATONIN AND FAMOTIDINE ON RADIATION INDUCED APOPTOSIS IN G0- LEUKOCYTES OF BREAST CANCER PATIENTS ASSAYED BY THE COMET ASSAY

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Purpose: Using antioxidants are introduced for reduction of radiation induced damages as radioprotectors. The aim of this study was to study the effects of antioxidants melatonin and famotidine on radiation induced apoptosis in leukocytes of breast cancer (BC) patients.
Methods: Based on DPPH assay appropriate doses of melatonin and famotidine were chosen for treatment of lymphocytes. Lymphocyte cultures were initiated in RPMI-1640 medium supplemented with fetal bovine serum and antibiotics. Culture vessels were treated with either agent for two hours. Following antioxidant treatment cells were exposed to 4 Gy gamma-rays generated from Co-60 source at a dose rate of 0.85 Gy four hours before harvesting. Slide preparation was done and neutral comet assay was performed for all slides. 500 cells stained with ethidium bromide were scored for frequency of apoptosis under a fluorescent microscope with X400 magnification.
Results: Results showed induction of high frequency of apoptosis following radiation alone in leukocytes of breast cancer patients significantly higher than normal individuals ($p<0.01$). Famotidine and melatonin induced very low frequency of apoptosis by their own not significantly different from control ($p>0.05$). However, when combined with radiation led to decreased frequency of apoptosis in leukocytes of both normal and BC patients ($p<0.05$). The effect of famotidine was more pronounced than melatonin.
Conclusion: The results imply that the famotidine may be potent radioprotective agent for radiation induced apoptosis, but melatonin because was not so potent to reduce apoptosis. This effect may be due to apoptosis inducing effect of melatonin by itself. This study may indicate that these agents may potentially reduce genotoxicity of ionizing radiation both in normal cells and those with geneome instability.

Keywords: Leukocytes, comet assay, apoptosis, Melatonin, famotidine, radioprotection.

THE EFFECT OF RESVERATROL ON THE BREAST CANCER CELLS DUE TO INCREASING RADIOSENSITIVITY OF 5-FU

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Abstract

Breast cancer is the commonest diagnosed disease and the most typical invasive cancer among women around the world. Chemotherapeutic agents have been used as the main therapy for treating the disease. One such agent for treating breast cancer is 5-fluorouracil (5-FU). It has effect on metabolic analog of thymine in DNA synthesis or uracil in RNA synthesis and replacement of this analog prevents DNA synthesis in cells that divide actively. The purpose of the present study was to analyze the efficiency of Resveratrol (Res) on radiosensitivity of 5-FU in the spheroid culture of MCF-7 breast cancer cell line using comet assay. Resveratrol is a natural polyphenolic compound and a strong antioxidant, can be found in different food sources, such as peanuts, red wine, and grapes. Spheroids with 300µm diameters were treated with 20 µM Res and/or 1 µM 5-FU for 42 hours and then exposed with 2 Gy gamma radiation (^{60}Co) in six groups. Then the viability and comet tails of the cells were respectively obtained by blue dye exclusion and comet assay. The population doubling time in the monolayer culture and the volume doubling time (VDT) of spheroid culture was 21.75± 0.14 hours and 43± 0.56 hours respectively. Neither the drugs nor their combination could affect the cells viability. The combination treatment of 5-FU + Res + radiation caused more damages in the DNA of spheroid cells in comparison with each treatment alone. The results of our study represented that Resveratrol and 5-FU in combination with gamma-rays can remarkably increase DNA damages. Therefore, Resveratrol as a hypoxia-inducible factor-1-alpha inhibitor increased the radiosensitization of 5-FU in breast cancer cells. In other words, Res is the main cause of increasing the destructive effect of 5-FU on genome which leads to the death of more cells and consequently increases the treatment efficiency.

KEYWORDS: 5-Fluorouracil, Breast cancer, Radiation, Radiosensitivity, Resveratrol, Spheroid

CYOME ASSAY STUDY OF THE EFFECTS OF SAFFRON AND MELATONIN ON LYMPHOCYTES OF LUMINAL A AND LUMINAL B BREAST CANCER PATIENTS IRRADIATED *IN VITRO*

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Purpose: Despite intensive search for a suitable radioprotective agent, no appropriate radioprotective agent is introduced for clinical use or for use in radiological event yet. In this study effects of 2 known antioxidants were tested for their radioprotective property with the use of cytokinesis blocked micronucleus assay in peripheral blood lymphocytes of luminal A and luminal B breast cancer patients.
Methods: Based on DPPH assay appropriate doses of saffron and melatonin was chosen for treatment of lymphocytes. Lymphocyte cultures were initiated in RPMI-1640 medium supplemented with fetal bovine serum and antibiotics. Phytohemaglutinin (PHA) was added to the culture for proliferation induction of lymphocytes. Culture vessels were treated with either agent for two hours. Following antioxidant treatment cells were exposed to 3 Gy gamma-rays generated from Co-60 source at a dose rate of 0.85 Gy. Cell were treated with cytochalasin B, then harvested at 72 hours post culture initiation. Frequency of micronuclei was scored in at least 1000 binucleate lymphocyte under a light microscope with X1000 magnification.
Results: Results showed induction of high frequency of micronucleus following radiation alone in lymphocytes of both breast cancer types significantly higher than normal individuals. Saffron and melatonin induced very low frequency of micronuclei by their own not significantly different from control. However, when combined with radiation all agents reduced the frequency of micronuclei slightly but the reduction was more significant for melatonin treated samples. There was no difference in response of lymphocytes of both breast cancer types to radiation alone or in combination with antioxidants.
Conclusion: The results imply that the studied agents exert low radioprotective potential. However, the reducing effect of melatonin was more pronounced compared to saffron. This study may indicate these agents may not potentially reduce genotoxicity of ionizing radiation in cells with geneome instability.

Keywords: Breast cancer lymphocytes, cytome assay, antioxidants, radioprotection.

ارزیابی آهنگ دز معادل پرتو ایکس در بخش رادیولوژی مراکز دولتی و نیمه دولتی استان سیستان و بلوچستان(۱۳۹۷)

زینب یزدی ستوده[۱] ،سحرآذری مفرد[۲] ،اسما ریگی[۳] ،ریحانه عباسی مقدم[۳]

۱. هیئت علمی گروه تکنولوژی برتوشناسی ،دانشکده پیراپزشکی ،دانشگاه علوم پزشکی زاهدان ،زاهدان ،ایران
۲. دانشجوی کارشناسی رادیولوژی ،عضو کمیته تحقیقات دانشجویی ،دانشگاه علوم پزشکی زاهدان ،زاهدان ،ایران
۳. دانشجوی کارشناسی رادیولوژی ،دانشگاه علوم پزشکی زاهدان ،زاهدان ،ایران

چکیده

سابقه و هدف: پرتوگیری ناشی از پرتوهای طبیعی مانند پرتوهای کیهانی و مصنو عی از ، جمله رادیو گرافی می توانـد آثـار مضری برسلا مت انسان و سایر موجودات زنده دا شته با شد.این مطالعه به منظور سنجـش توزیع نسبی آهنگ دزمعادل پرتـوایکس در سالن انتظار بخش رادیولوژی مراکز دولتی و نیمه دولتی استان سیستان و بلوچستان(۱۳۹۷) انجام شد.

مواد و روش ها: این مطالعه توصیفی–تحلیلی بر روی سالن های انتظار ۲۰ تا از بخش هایرادیوگرافی و CTscan مراکز دولتی و نیمه دولتی اسـتان در سال ۱۳۹۷ انجام گرفت. نمونه های انتخابی از نوع آسان و در دسترس بود. مطالعه با دزیمتر گایگر مولر مدل LND712 محصول شرکت آمریکا که یک سیستم اندازه گیری تشخیصی آلفا، بتا، گاما و اشعه ایکس بوده، دزیمتری صورت گرفته است. آهنگ دز در محدوده ۰.۰۰۰۱ تا ۱۱۰۰ میکروسیورت برساعت و با دقت به صورت معمولی ۱۰٪± و حداکثر ۱۵٪± و میزان دز معادل برحسب میلی سیورت mSv صورت گرفت. دوزیمتری در نقاط مختلف سالن انتظار مراکز پرتونگاری با درنظرگرفتن متغییرهایی ازجمله بالاترین شرایط تابش روتین(Lat Lumbar) ، نقطه دزیمتر، زمان شروع و پایـان ثبـت دز، میزان فاصله از اتاق انتظار و گرافی و کنترل انجام شد. داده ها با استفاده از نرم افزار آماری SPSS و آزمون کروسکال والیس انجام پذیرفت.

یافته ها : سالن انتظار بیمارستان امام خمینی خاش با دز معادل ۳.۲۷۵ میکروسیورت برساعت، دزی بالاتر از حد استاندارد و بیمارستان علی اصـغر بـا دزی معادل ۰.۰۱۹ میکروسیورت برساعت کمترین آهنگ دز را دارا بود.(P<0.001) همچنین میانگین آهنگ دز نشـتی پشـت درب اتـاق انتظـار اتـاق CTscan ۱.۹۳۵ میکروسیورت برساعت بود. (P<0.018) در فاصله یک متری از اتاق کنترل و سالن انتظار همه ی بخش های تصـویربرداری مـورد مطالعه میزان دز نشتی در حد تابش زمینه بود.

نتیجه گیری : میانگین آهنگ دز نشتی پشت درب اتاق های انتظار رادیوگرافی نسبت به CTscan در استان با اختلاف کمی بدست آمده اسـت. ایـن اختلاف معنا دار آهنگ دز به عواملی چون عمرکاری دستگاه های تصویربرداری، زمان ساخت اتـاق هـای تصـویربرداری وضـخامت کـاربردی وجـنس مصالح بکاربرده شده دردیوارهای اتاق های تصویربرداری مرتبط میباشد.

کلید واژه ها : دستگاه های رادیوگرافی ، دز معادل ، سالن انتظار رادیولوژی . حفاظ گذاری

RADIO-PROTECTIVE EFFECTS OF CURCUMIN AND LYCOPENE ON HUMAN LYMPHOCYTES WITH 2 GY IRRADIATION

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Background: In recent years, the use of ionizing radiation to diagnose and treatment of diseases has increased. Since the use of radiation in addition to its useful uses leads to harmful biological effects, so scientists are looking for materials that can protect human cells against biological effects.
The Aim of this study was to evaluated the radio-protective effects of simultaneously use of Lycopene and Curcumin in 2 Gy of radiation on human lymphocyte cells by MN assay technique.
Methods: In this study, 5µg/ml Lycopene (21st-century healthcare, INC., USA) and Curcumin (Sigma) were prepared in RPMI 1640(1x) (SBSA) and dimethyl sulphoxide (DMSO) (Sigma-Aldrich). Blood samples from three healthy donors were collected and then cultured in RPMI 1640 (1x), FBS, Pen-strep and phytohaemagglutinin (PHA). After 1-hour drugs were added to samples and were irradiated with 2 Gy X-ray radiation using linear accelerator (Stockholm, Sweden).
44 hours post-irradiation, 100 µl Cytochalasin-B (Lot. #42F650K, SIGMA) was added to samples, then cells were incubated for another 22 hours. After that, the cells were harvested and stained with Giemsa. The Bi-Nucleated Cells (BNCs) were counted based on the Countryman and Heddle criteria.
Results: As can be seen in Figure 1-B, co-treatment of lycopene and curcumin can significantly decrease the number of MNs in lymphocytes from 9.00 to 1.33 (equal as the control group) (P-Value < 0.001).
Conclusion: In conclusion, these results suggest that it is possible to use the combination of lycopene and curcumin in 2 Gy as a radio-protector

Keywords: Lycopene, Curcumin, Radiation, MN assay

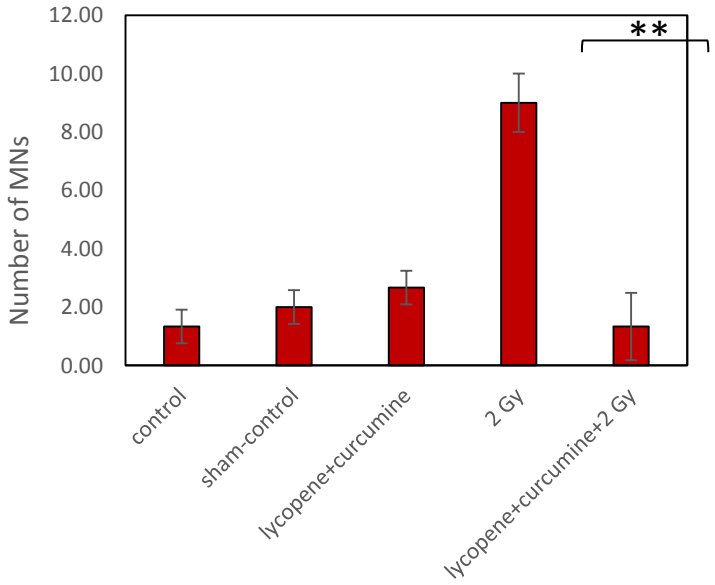

Fig 1: Effects of co-treatment with curcumin and lycopene pretreatment on MN numbers in lymphocyte cells prior to irradiation (** P<0.001). Data are presented as the mean ± SD. P<0.05 were considered as significant.

STUDY OF CARCINOGENIC GENES INDUCED BY ELECTROMAGNETIC RADIATION(SINGLE AND FRACTION) IN THE BRAIN

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Abstract:

Backgrounds: The increasing use of mobile phones has raised concerns about their possible RF (radio frequency) radiation side effects on the health of general public.

Materials and Method: 24 male BALB/c mice were randomly divided into three groups (n=8 each). Animals in the one experimental groups were respectively exposed for two hours to electromagnetic waves radiated twice a day at the frequencies for a period of 30 consecutive days. One of experimental group was radiated for 4 hours once a day, while the control group remains constant during the experiment. The hippocampal expression of Bax,bcl2,P21and P53 mRNAs were evaluated using Real-Time PCR.

Results: There were not differences between the mean expression level of Carcinogenic Genes of the exposure groups compared to those of the control group (P>0.05).

The ratio expression of genes was increased to greater than one in all experimental groups compared to controls, except for the group with 2 hours twice a day exposure. However, there was not significant differences between the expression level of Carcinogenic genes among the experimental groups using paired t test (p>0.05).

Conclusion: In fact, radio frequencies of mobile phones damage brain cells depending on the duration of the conversation (the duration of radiation). While further investigation is recommended, our results revealed that the mobile phone radiation had no effect on the hippocampus expression of Carcinogenic genes in the mice.

Keywords: single and fraction Electromagnetic radiation, Mice, Apoptosis, Carcinogenic Genes, Hippocampus

NECESSARY EVALUATION OF TECHNICAL, PROTECTIVE AND TECHNOLOGICAL OPERATION

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Abstract

Background: Radiation protection is an important safety issue for radiographers and patients who depend on the performance of the radiologist. Therefore, the present paper aimed Evaluation of Technical, Protective and Technological Operation whit Interventional Radiologists.

Methods: In this descriptive-analytical study, all the 60 radiolographers working in the radiology wards of Zahedan University hospitals. In order to collect data about their performance, a checklist whose reliability and validity had been approved was provided. For the radiography staff 17 technical and 12 protective items during three work shifts were checked and recorded. The obtained data was statistically analyzed by means of SPSS.

Results: A total of 60 personnel in the study were 27 male (45%), 33 female (65%) Their performance score was assessed.The results of the seven factors of radiology staff including gender, employment status, age, work experience, Number of shifts, Work Shift and Education evaluated That Number of shift factor was significant.

Conclusions: The radiographers' awareness of technical and protective principles was at medium level. but, both quality academic training and in-service education seem necessary.

Keywords: Radiographs; radiation protection; radiography techniques

ASSESSMENT OF THREE-DIMENSIONAL SET-UP ERRORS IN CONVENTIONAL HEAD AND NECK RADIOTHERAPY USING ELECTRONIC PORTAL IMAGING DEVICE

Vida Rezaei, Mohsen Bakhshande,Najme Ghatei

Abstract

Background: Set-up errors are an inherent part of radiation treatment process. Coverage of target volume is a direct function of set-up margins, which should be optimized to prevent inadvertent irradiation of adjacent normal tissues. The aim of this study was to evaluate three-dimensional (3D) set-up errors and propose optimum margins for target volume coverage in head and neck radiotherapy.

Methods: Thirty-three patients were included in the study. The total number of portal images studied was 560. Population systematic (Σ) and random (σ) errors for the patients with head and neck cancer were evaluated based on the portal images in the longitudinal and left-right lateral (LR) direction measured in the anterior-posterior (AP) field. The values for the clinical-to-planning target volume (CTV-PTV) margins were calculated using ICRU Report 62 recommendations, along with van Herk's formulae (M=√([2.7]^2*Σ^2+[1.6]^2*σ^2)-.28cm).

Results: Population systematic (Σ) and random errors (σ) were 0.09, .1 and 0.1 cm and 0.49, 0.66 and 0.58 cm in AP, ML and SI direction respectively. Using van Herk's formula, the clinical target volume to planning target volume margins were 0.55, 0.82 and 0.69 cm in AP, ML and SI direction respectively.

Conclusion: The present study report compares well with published set-up error data relevant to head and neck radiotherapy practice. The set-up margins were <9 mm in all directions. Caution is warranted against adopting generic margin recipes as different margin generating recipes lead to a different probability of target volume coverage.

THE EFFECT OF GOLD AND FE3O4 NANOPARTICLES DISPERSED ON TISSUE-EQUIVALENT BOLUS ON THE ABSORBED DOSE DISTRIBUTION OF THE SKIN SURFACE IN RADIATION THERAPY FOR BREAST CANCER PATIENTS USING MONTE CARLO SIMULATION AND PHANTOM DOSIMETRY.

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Abstract Aim: The aim of this study was to determine the entrance skin dose for breast cancer patients who undergo radiotherapy in the presence and absence of bolus with gold and Fe_3O_4 nanoparticles to evaluate and compare the changes in dose distribution. Gold and Fe3O4 nanoparticles lead to more photoelectric and pair production absorption of x-ray photons.
Materials and methods: To calculate the skin dose in the presence of the bolus, nanoparticles were simulated in the bolus, over the skin of a breast phantom, using MCNPX Monte Carlo code. The skin dose was also measured experimentally, using a bolus containing homogeneously distributed Fe3O4 nanoparticles on the surface of a slab phantom and advanced Markus chamber.
Results: A significant skin dose enhancement was obtained for the case that 25 nm gold and Fe3O4 nanoparticles with 3% concentration were uniformly distributed in the bolus. However, increased concentration of nanoparticles in the bolus will increase the skin dose.
Conclusion: It is concluded that using nanoparticles in the bolus leads to a significant skin dose enhancement for 6 MV x-ray photons. Furthermore this study suggested that, less thick blouses may provide the same dose distribution.

CYTOTOXIC EFFECTS OF HYPERTHERMIA, CHEMOTHERAPY (NAVELBINE) AND RADIATION ON GLIOMA SPHEROIDS

Seied Rabi Mahdavi 1, Rasoul Yahyapour 2*, AlirezaNikoofar 3

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Background: Glioblastoma multiform (GBM) is the most common malignant primary brain tumor in humans. Current conventional treatment could not effectively increase the survival rate of patients who suffered from GBM. The aim of this study was to determine the cytotoxicity caused by Navelbine, hyperthermia and radiation on glioma spheroids.

Methods: The spheroid cells were separately or simultaneously treated with the doses of 7.5 µg/ml Navelbine for 50.3h irradiated with 2Gy and incubated at 43 °C for 1h. Comet and colony formation assays were applied to assess the DNA damages and survival rate of the cells.

Results: In both comet and colony formation assays, cell damage in all treated groups was significantly higher in comparison with control group ($P \leq 0.05$). Moreover, the synergistic effect of combined groups such as: hyperthermia and radiotherapy, Navelbine and radiotherapy and combination of Navelbine-hyperthermia-radiotherapy was observed.

Conclusions: Combined agents with low concentration can cause a synergistic effect on treatment procedure and increased damages in multicellular spheroids.

Keywords: Glioblastoma, Spheroid, Irradiation, Navelbine, Hyperthermia.

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Keywords: Glioblastoma, Spheroid, Irradiation, Navelbine, Hyperthermia.

From Radiogenomics to Personalised Medicine

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Radiogenomics is the study of the genetic variation in relation to response to radiation, and in particular a risk of developing toxicity following radiation therapy in cancer patients. Radiogenomics has potential in three areas. First, in personalized medicine, to drive clinical practice towards a patient-centered management of radiotherapy. This prognostic goal requires establishing patient cohorts using detailed clinical protocols to: integrate genomic and clinical data, build validated genetic based advanced multivariate Normal Tissue Complication Probability (mNTCP) models, to implement the models in clinical management. Expectedly, this route leads to overcome the radiation-induced toxicities in patients. Second, in diagnosis, to link imaging omics-sub-phenotypes to tumor genetic profiles. This adds genetic values to predictive values of radiomics features through complex integrative modeling of genome-radiomics data. Third, in pathology, to increase understanding of the underlying mechanisms involved in inter-individual differences in tissue sensitivity to radiation and the pathogenesis of radiation- induced toxicities. This mechanistic concept customs the integration of genomics data into genomics, proteomics, quantitative biomarkers, and clinical endpoints. Aggregated analyses of multi-omics data in the context of a systems biological approach. In our view, such aggregation will enable a correct stratification of each patient to receive the minimum needed radiation, to minimize the risk for radiation side effect, to improve diagnostic value radiomics features, and to unearth the mechanism of radiation sensivity. This lecture outlines briefly the concept of radiogenomics, summarizes

recent advances in radiogenomics, and highlights upcoming research plans within the international radiogenomics consortium.

Abstract of Medical (Radiotherapy) Physics

The Fourth International Clinical Oncology Congress

The 14th Iranian Annual Clinical Oncology Congress
The Fourth International Clinical Oncology Nursing Congress
Annual Radiotherapy Technologists' Congress &
Medical (Radiotherapy) Physics Congress
Clinical Radiobiology Congress

All the accepted abstracts of The Fourth International Clinical Oncology Congress are accessible online at the website of the official journal of Iranian Society of Clinical Oncology:
Reports of Radiotherapy & Oncology
http://radioncology.com/en/index.html

ISRO Iranian Society of Radiation Oncology

ESTRO

MEASUREMENT OF RADIATION SKYSHINE FROM ELECTA LINAC

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Background and Objectives: Protecting against ionizing radiations in radiotherapy centers is important, and the lack of attention to this issue can cause irreparable damage to the radiation workers and whole community. Sky shine is referred to the radiations that pass through the ceiling in the vertical direction, scatter at the atmosphere above the roof, back to the Earth's surface and transmit radiation doses to the area outside the radiotherapy room. These radiations collide with the upper air molecules and deflect in many directions; as a result, the scattered photons reach the treatment room's surroundings and increase the exposure dose of radiation workers or members of the public. The aim of this study was to determine sky shine radiation dose rates**.**

Material and Methods: This study was performed using a 6mv-photon-beam linear accelerator *(Elekta, Compact*™), installed at the Babolsar Oncology Center in 2013. The treatment room had 166 and 174 cm thickness of concrete in the walls and ceiling, respectively. This linear accelerator system had physical parameters including the dose rate of 50, 100, 200 and 300 CGy/MU, which could be adjusted in three Static, Wedge and ARC therapeutic conditions.Dosimetry was performed using an ionization chamber PTW LS01 at thirteen distances (25, 50, 100, 150, 300, 400, 600, 800, 1000, 1200, 1400, 1600 and 1800 cm) from isocenter point. Conversion factors were also used to calculate the dose and Sky shine.

Results: The results of the evaluation that recorded by ion chamber in 13 different distances from the isocenter axis of the linear accelerator ELEKTA, with 6MV energy, at a height of 2.10 m above the ground by the Younes chamber dosimeter PTW LS01 was registered at the Babolsar oncology center. The maximum dose at 25 cm and 10 m distance from the external wall of the treatment room was measured at 1.017 mSv/ h.

Conclusions: The values recorded by the ion chamber indicate that in the Babolsar oncology Center, the radiation induced by the Sky shine radiation does not increases the staff and normal people outside the range, and the center is well protected.

Keywords: shielding; Ionizing Radiation; sky shine; medical accelerator

INVESTIGATING EFFECT OF GOLD NANOPARTICLES ON MEGAVOLTAGE RADIATIONS' ABSORBED DOSE ENHANCEMENT IN MR BASED POLYMER GEL DOSIMETRY

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Background and Objectives: Radiotherapy is a medical technique which utilizes ionizing radiation in the Treatment of malignant cells. Such ionizing radiations originate typically from high energy photons, which are potentially deadly to all cells at high dosage. Developments in the field of nanotechnology have potentially provided an Alternative to conventional radiotherapy techniques through the application of nanomaterials. Embedded nanoparticle in polymer gel dosimeter poses the first step to assess dose enhancement capability in nanoparticles.This study aims at determining dose enhancement capability of gold nanoparticles in a MAGICA gel dosimeter under external radiation with 6 MV x-rays.

Material and Methods: Gold nanopowder (28 nm) was mixed with a concentration of 0.1mM in a MAGICA gel dosimeter. To measure the absorbance dose in the presence of nanoparticles, 6 vials containing gel were filled with gold nanoparticle and a zero dose vial was considered as the control group. Irradiation was performed for all vials under the same conditions using an accelerator 6MV, and MRI (1/5 tesla) images were used to measure the Spin-spin relaxation rate. Absorbed dose enhancement was calculated as the ratio of absorbed dose in the presence of nanoparticles and without them.

Results: The response of MAGICA polymer gel was linear throughout the entire dose range of 2-10 Gy. The mean enhanced absorption dose factor in the presence of gold nanoparticles into the MAGICA polymer gel was %9.88±0.50.

Conclusions: The results of current study indicated the combination of MAGICA polymer gel with nanoparticles a good tool for radiation increase measurement.

Keywords: gold nanoparticles, dose enhancement, gel dosimetry, external radiotherapy

HELICAL TOMOTHERAPY DOSE CALIBRATION: DIFFERENCE WITH CONVENTIONAL LINACS.

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Helical tomotherapy units require a calibration of their dose output in the different manner but same accuracy as performed for conventional Linacs.

The helical tomotherapy physical limitations do not permit a 100×10 cm field size at 100 cm SSD. However, a 5 cm0*10 cm field size can be set at 85 cm SSD on the tomotherapy machine.
This does not allow for an accurate measurement of the photon component percent depth dose at a 10 cm depth for 100 cm SSD since there would not be sufficient phantom material for appropriate backscatter. In addition, since the helical tomotherapy unit does not have a flattening filter, depth dose data are slightly different from the depth dose data for similar nominal photon energies that have passed through a flattening filter. So In this report we are discussing about differences of Dose calibration method of Helical Tomotherapy and C-arm-Gantry –based Therapeutic accelerators based on TG148.

QA PROCEDURE OF HELICAL TOMOTHERAPY IN PARS HOSPITAL CENTER BASED ON TG148

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Helical tomotherapy is a new modality with integrated treatment planning and delivery hardware for radiation therapy treatments. Pars Tomotherapy unit is the first installed unit in IRAN in 2019. In This report, we are discussing about installation and QA procedure of our newly installed Tomotherapy units based on TG148.

COMPARISON OF PATIENT RADIOTHERAPY PLAN VERIFICATION WITH OCTAVIUS 4D PHANTOM, IN ZERO AND REAL FIELD ANGLES, USING GAMMA INDEX

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Abstract

Purpose: The advent of advanced treatment techniques in the radiotherapy of cancer patients has established the need for a comprehensive Quality Assurance program to confirm each patient's specific dose delivery. A key component to success in clinical implementation of the treatment plan is the development of a dosimetric confirmation process that ensures that the delivered dose and calculated dose for each patient are in agreement. OCTAVIUS 4D phantom was used to confirm the validity of treatment plan.

Methods: Dose parameters calculated by treatment planning system and dose parameters measured by OCTAVIUS 4D phantom were compared and evaluated by using Verisoft software. In this study, treatment plans of 4 patients in Head and Neck area, 4 patients in Thoracic and Abdominal area and 4 patients in Pelvic area were evaluated. All treatment plans were evaluated in two conditions. In the first condition, all treatment fields of the treatment plans were irradiated at zero angle and then the dose distribution of the treatment plans were evaluated. In the second condition, all treatment fields were irradiated at real angles related to the treatment plans and then dose distributions were studied.

Results: The relevant criterion was considered to be 3% for the dose difference and 3 mm for the distance to agreement with the 10% maximum dose threshold. The mean percentage values of points passing the 3D gamma criterion for verification at zero angle, was 96.5% and for verification at real angles, this value was 95.2%.

Conclusion: The angular dependence analysis for the OCTAVIUS 4D phantom indicated that if the mean percentage values of points passing the 3D gamma index is considered for the evaluation of treatment plans, this phantom has a few angle dependence in the treatment plan verification analysis.

Keywords: Treatment Plan Verification, OCTAVIUS 4D Phantom, Gamma Index, Calculated Dose, Measured Dose

PROTON BEAM THERAPY IN IRAN: WHERE HAVE WE STOOD?

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Abstract

Proton beam therapy (PBT) is a modern radiotherapy technique utilizing high-energy proton beams to treat a wide range of cancers. Superior dose distribution and inferior surface dose are two key advantages of PBT over conventional radiotherapy techniques. In this research, a comprehensive survey was conducted to highlight the present status of PBT in Iran as a low-income country. For this purpose, cancer statistics, supply radiotherapy machines, key role players in the field of interest were reviewed in brief. Then, SWOT analysis, as a strategic study, was performed through collecting radiotherapy expert staff viewpoints about PBT. Furthermore, the status of PBT research in Iran was identified by a bibliographic study considering both Scopus- and ISC-indexed Iranian publications. Based on the results, there are 110 supply MV machines distributed over Iran in 2015. The Iran national ion therapy center (IRNitc) is then introduced as the specialized PBT clinic in the near future. Based upon the SWOT matrix, availability of trained radiotherapy staff and a strong background in electron accelerator design and development are two key strengths of PBT in Iran. Nuclear Science and Technology Institute is a leading contributor to the field of interest by publishing the highest number of both Scopus- and ISC-indexed publications. Also, Italy is the main foreign partner in Iranian publications. Ten IAEA recommendations for low- to middle-income countries (for example, Iran) were finally presented. In addition, launching the IRNitc will provide PBT clinical experiments by benefiting from an 800 MeV proton synchrotron. Considering recent improvements in medical accelerators design and development in Iran, a promising future is waiting for PBT.

Keywords: Proton beam therapy, Iran, Bibliography, SWOT analysis**,** Research and development

RADIATION-INDUCED HYPOTHYROIDISM FOLLOWING BREAST CANCER RADIOTHERAPY: SHORT-TERM OUTCOMES

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Abstract

Background: Radiotherapy-induced hypothyroidism seems to be more frequent in breast cancer patient receiving radiotherapy to the supraclavicular field because a part of the thyroid gland includes in the field. Thus, the aim of this study is to evaluate radiation-induced hypothyroidism in patients with breast cancer by assessing thyroid function before and 6 months after radiotherapy.

Methods: In total, 27 patients undergoing three-dimensional conformal radiotherapy for breast cancer were enrolled. Thyroid-stimulating hormone (TSH), thyroxine (T4), and triiodothyronine (T3), as well as parathyroid hormone (PTH) were measured before, last day of radiotherapy and 6 months after radiotherapy. Also, dose-volume parameters of thyroid gland including volume of thyroid gland receiving 20 Gy (V20), 30 Gy, 40 Gy, and 50 Gy, as well as mean dose to the thyroid were derived from dose-volume histograms.

Results: A statistically significant difference between thyroid and parathyroid function tests before and 6 months after completion of radiotherapy was not found ($P > 0.05$). Only, there is a significant difference between T3 level before and last day of radiotherapy ($P = 0.027$). Mean (standard deviation (SD)) thyroid dose was 15.0 Gy (6.8), and Mean (SD) value of V20-30-40-50 were 30.3% (14.8), 24.9% (14.8), 18.9% (14.2), 7.5% (10.7), respectively.

Conclusion: We found that thyroid and parathyroid hormone levels did not significantly change before and 6 months after breast cancer radiotherapy.

Keywords: Hypothyroidism; Breast cancer; Radiotherapy; Thyroid disorder

TITLE: PRE-TREATMENT AND DELTA-RADIOMIC BASED SIGNATURES INTEGRATED WITH CLINICAL PARAMETERS FOR NCRT RESPONSE PREDICTION IN RECTAL CANCER PATIENTS.

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Abstract:

Objectives: The aim of this study was to investigate the ability of T2-weighted (T2W) MRI based features with and without 3D wavelet transform (WT) based pre-processing and also delta-radiomic features integrated with clinical parameters for response prediction in locally advanced rectal cancer (LARC) patients.

Materials and methods: This retrospective study included 36 patients (17 men; age range, 45-78 years; 19 women; mean age, age range, 55- 66 years) with LARC treated from May 2017 to September 2018. T2W MR Images were acquired for all patients 2 week before and 4 week after neoadjuvant chemoradiation therapy (nCRT). 106 features from shape and texture feature sets were extracted from MR images. nCRT response was scored based on American Joint Committee on Cancer and College of American Pathologists (AJCC/CAP) pathologic grading. Logistic regression classifier was used for response prediction. In univariate analysis, Pretreatment, 3D WT based and delta-radiomic based features predictive performance was evaluated using the area under the receiver operator characteristic (ROC) curve (AUC). In multivariate analysis, predictive performance of extracted features were investigated in combination with patient's clinical parameters.

Results: Patients' nCRT responses included 8 patients with Grade 0, 7 with Grade 1, 9 with Grade 2, and 12 with Grade 3 according to AJCC/CAP pathologic grading. In pretreatment features analysis, the best result was for multivariate analysis using Dependence Non Uniformity feature and clinical parameters (AUC, 0.91). In 3D WT based univariate analysis, the highest predictive performance was found for Gray Level Non Uniformity (with LHLWT) and Large Area High Gray Level Emphasis (with LLH WT) features (AUC, 0.84). Finally, combining delta-radiomics of Coarseness with clinical parameters showed the highest predictive performance of our study (AUC, 0.94).

Conclusion: combining delta-radiomic features and clinical data have the highest predictive performance in LARC patients. Also multiscale 3D WT based feature extraction can be promising technique for response prediction improvement.

Keywords: MRI; delta-Radiomics; rectal cancer; 3D wavelet transform

MACHINE LEARNING RADIOMICS TO PREDICT IMRT RESPONSE IN PROSTATE CANCER PATIENTS.

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Abstract

In the present study, thirty-three prostate cancer patients were included. All patients underwent pre- and post-IMRT T2-weighted (T2 W) and apparent diffusing coefficient (ADC) MRI. IMRT response was calculated in terms of changes in the ADC value, and patients were divided as responders and non-responders. A wide range of radiomic features from different feature sets were extracted from all T2 W and ADC images. Univariate radiomic analysis was performed to find highly correlated radiomic features with IMRT response, and a paired t test was used to find significant features between responders and non-responders. To find high predictive radiomic models, tenfold cross-validation as the criterion for feature selection and classification was applied on the pre-, post- and delta IMRT radiomic features, and area under the curve (AUC) of receiver operating characteristics was calculated as model performance value. Our results showed that, of 33 patients, 15 patients (45%) were found as responders. Univariate analysis showed 20 highly correlated radiomic features with IMRT response (20 ADC and 20 T2). Two and fifteen T2 and ADC radiomic features were found as significant (P-value ≤ 0.05) features between responders and non-responders, respectively. Several cross-combined predictive radiomic models were obtained, and post-T2 radiomic models were found as high predictive models (AUC 0.632) followed by pre-ADC (AUC 0.626) and pre-T2 (AUC 0.61). For GS prediction, T2 W radiomic models were found as more predictive (mean AUC 0.739) rather than ADC models (mean AUC 0.70), while for stage prediction, ADC models had higher prediction performance (mean AUC 0.675). We concluded that, radiomic models developed by MR image features and machine learning approaches are noninvasive and easy methods for personalized prostate cancer diagnosis and therapy.

QUANTIFICATION OF SKIN DOSE INCREASE AND PHOTON BEAM ATTENUATION FOR A COMMERCIAL COUCH TOP AND BREAST BOARD USING DOSIMETRIC AND MONTE CARLO METHODS

Faezeh Arianfard

Introduction

Many radiotherapy (RT) techniques use photon beams passing through patient support structures (treatment couch and/or patient immobilization devices). They include traditional treatment methods as well as modern ones (e.g., rotational and non-rotational intensity modulated radiation therapy). Couchtop and patient immobilization devices attenuate a beam passing through them. If this attenuation is ignored in treatment planning, it can result in target underdosage. Moreover, the passage of a megavoltage photon beam through patient support structures reduces the dose buildup effect, thereby diminishing skin sparing and compromising one of the main advantages of using megavoltage photon beams (1).

The couchtop must be rigid without producing imaging artifacts. It must also be as translucent as possible to the photon beams used on the treatment unit, i.e., create minimal beam attenuation and dose buildup. In the past few decades, compact foam sandwiched between carbon fibre layers has been used due to the rigidity and higher transmission it offers compared to other materials; however, beam attenuation is still considerable and must be quantified(2).

Similarly, the need for patient immobilization structures such as head rests, baseplates for thermoplastic meshes and other fixation devices, breast boards, knee and ankle supports, etc. is well established. Information on the attenuation effects of these devices is also necessary.

Determining the dosimetric influences of couch and immobilization devices on megavoltage beams has been studied at many centres, as it is necessary to characterize the effects of each combination of patient support structures and treatment unit photon beam energy (1). The reported magnitude and trend of the effect has been shown to be non-universal. There are differences in the attenuation for normal incidence, as well as how it varies with field size and gantry angle (GA), including the angle at which it is maximal. For example, McCormak et al. measured a 2% attenuation by a *SinMed* couch at normal incidence at 6 MV that reached 9% at 110° GA (3). Poppe et al. measured 2.7% and 6.4% 6 MV attenuations for the *RM2* couch and the couch-combiboard combination (4). Njeh et al. measured 4.9% and 2.5% (5×5 cm^2) and 3.4% and 1.6 % (10×10 cm^2) 6 MV attenuations for the *Brainlab* couch and its head rest, respectively; the highest attenuation was observed at the 110° and 120° GAs (5). Seppala et al. recorded the highest 6 MV attenuation at the 110° gantry angle with the field size of 10×10 cm^2 (2).

Some papers have reported the effect on surface dose and/or percentage depth dose (PDD) near the surface. Meydanci et al. reported that a carbon fibre couch (Reuther Medizin Technik, Mülheim- Kärlich, Germany) increased surface dose from 7.5% to 63% in small 6 MV fields; Moreover, fivefold and twofold attenuation increases were observed at 10×10 cm^2 and 40×40 cm^2 field sizes, respectively (6). Ghasemi et al. quoted 16.56% and 5.27% increases in skin dose by a non-carbon-fibre baseplate at 6 MV and 15 MV, respectively (7). Gul et al. measured a 29% increase in Co-60 beam attenuation and 6% increase in skin dose caused by a couch nylon mesh (8).

To the best of knowledge, no paper has been published on the *iBEAM Standard* couchtop (Medical Intelligence (Elekta), Schwabmuenchen, Germany) regarding such effects. After an extensive search of the literature, the only reported study we found was by Wieslander et al in a conference proceedings, which included beam attenuation but not the effects of the couchtop on skin dose or the buildup region (9). There are many RT centres worldwide equipped with this couchtop as part of an *Elekta Compact* linear accelerator unit. Although within the acceptance range, the specified penetrative quality of the 6 MV beam of this accelerator is slightly less than that stated in the *British Journal of Radiology* Supplement 25; PDD of a 10×10 cm^2 field at 10 cm depth in water being 67.0% compared to 67.5% (with probable increased effects of patient support structures). Quantifying these effects is, therefore, considered necessary. The aforementioned points constitute the novel aspects of this work.

In this study, beam attenuation as a function of GA for the combination of this accelerator's 6 MV beam and the *iBEAM* couchtop was studied to provide the necessary information for use in treatment planning. Attenuation factors of this couchtop extension and a breast board were also measured. As for skin dose, instead of measuring dose at a specific depth to estimate skin dose in the presence of couchtop at a particular depth in tissue (as reported in some studies), we measured and also Monte Carlo (MC) simulated several depths in the buildup region to provide more data and insight regarding this effect. MC simulation was a particularly useful tool in this study as it provided PDD data at very shallow depths (<0.4 mm), relevant to the various depths of the skin basal cell layer (BCL) throughout the body, where measurement was not practicable. A secondary purpose of this work was to provide a direct comparison of doses to skin and subcutaneous tissue resulting from the combination of this carbon fibre couchtop and 6 MV accelerator with those from traditional treatments on a Co-60 unit (Theratron Phoenix, Best Theratronics, Canada) equipped with a 'tennis racket' couchtop insert (nylon mesh without a Mylar sheet). This aimed to provide a link and perspective with respect to experiences of skin effects observed historically.

Methods and materials

Overview

Attenuation factors of the *iBEAM Standard* couchtop, its contoured *Head & Neck extension* and the *BreastSTEP* boards from the same manufacturer (Elekta, Scwabmünchen, Germany) were measured in the 6 MV accelerator beam. Then, focusing on the couchtop itself, central-axis PDD curves in the buildup depths (starting from 0.4 mm) were measured for both the accelerator and Co-60 combinations. The geometry of the accelerator and iBEAM couchtop was MC simulated and the results of the experimental measurements were used for additional validation of the model. Then, the MC model was used to provide PDD data at all buildup depths including those less than 0.4 mm. The 6 MV and Co-60 PDDs for their respective couches were then compared directly in a clinically relevant scenario.

Unless otherwise stated, accelerator beams passing through the couchtop, the extension and the breast board were measured at180° GA. For measurements without the couchtop in the accelerator beam path, measurements were made at 0° GA for practical reasons. The small differences in accelerator output (including any effects on measurements arising from gantry sag) were measured in air at 0°, 125°, 135°, 150°, 165° and 180° GAs and applied in the calculations accordingly. The 180º GA was considered as reference and the other angles were corrected relative to that. All measurements in the Co-60 beam were at 0° GA, made possible by its removable couch insert.

Attenuation measurements

Figure 1 shows the experimental setup for couchtop attenuation measurements schematically. Impact of the couchtop on beam attenuation at 125°, 135°, 150°, 165° and 180° Gas was studied for 5×5 cm^2, 8×8 cm^2, 10×10 cm^2, 15×8 cm^2, and 20×8 cm^2 field sizes.

Measurements were made with a *Semiflex* ionisation chamber (connected to a *UNIDOS* electrometer) (PTW Freiburg, Germany) placed at the isocentre at the centre of a water-equivalent plastic, cylindrical phantom of 1.03 g/cm^3 density, 25 cm diameter and 12.5 cm length. Potential variations in temperature and pressure were monitored throughout but no corrections were found to be necessary. For comparison with MC simulations, in order to have a set of measurements without the large influence of attenuation in the phantom itself, couch attenuation measurements were repeated in air with the same ion chamber and a 6 MV Perspex buildup cap (PTW Freiburg, Germany) for 5×5 cm^2 and 10×10 cm^2 field sizes.

As the cross-section of the couchtop is tapered at the two sides (Figure 1), the path through the couch does not always increase with increasing beam obliquity. In order to characterize this effect with an increasing trend as a function of path length through the couchtop, beam path length for every GA was measured accurately by using the *AutoCAD* software and then, by considering the density of the materials in the couchtop, air and phantom, a total water equivalent thickness (WET) for each GA was calculated.

EVALUATION AND CORRECTION OF SYSTEM RELATED GEOMETRIC DISTORTION FOR MAGNETIC RESONANCE IMAGES BY A NEW LARGE FIELD OF VIEW PHANTOM FOR MRI BASED RADIOTHERAPY TREATMENT PLANNING

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Abstract

Introduction: superior soft tissue contrast, imaging protocol variety, possibility of functional imaging of magnetic resonance imaging (MRI) and new combined radiotherapy systems of MR-Linac and MR-Co have been the main impetus upon the application of MR imaging in the radiotherapy treatment planning. The first limitation of MR-based radiotherapy is the geometric distortion of MR images that can generate errors in contouring and dosimetry stages of radiotherapy. The aim of this study is to evaluate and correct geometric distortion for radiotherapy applications.

Materials and method: A new large field of view (FOV) phantom is developed using Perspex sheets and 325 plastic pipes containing water as the signal producer. The evaluation, quantification and correction of the system related geometric distortion of MR images is conducted for HASTE protocol by MATLAB and 3D slicer software. The effect of geometric distortion on the dosimetry stage of radiotherapy is assessed in the pelvic region.

Results: In radial distances of < 13 cm (or FOVs < 25 cm), the amount of distortion is under 2 mm, but at larger radial distances, distortion may increase up to about 3.5 cm in radial distances exceeding 25 cm. The geometric distortion of MR image can generate 1.05% error in the dosimetry stage with a radiation of 15 MV.

Conclusion: Geometric precision of MR images in large FOVs is not sufficient for MRI only treatment planning of radiotherapy and further corrections are required. B-spline deformable registration method can correct the MR geometric distortion until an acceptable range of 2 mm for radiotherapy applications is achieved.

Keywords: Magnetic resonance imaging, Computed tomography, Geometric distortion, 3D slicer, B-spline deformable registration, Scatter transform

COMPARISON THREE DIFFERENT METHODS OF PSEUDO CT CONSTRUCTION FOR MRI BASED RADIOTHERAPY TREATMENT PLANNING IN PELVIC REGION

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Abstract

Introduction: Duo to the advantages of Magnetic resonance imaging (MRI) , the problems of using two modalities of imaging, and clinical usage of radiotherapy instruments of MR-linac and MR-cobalt, several studies have evaluated the possibility of using only MR images for radiotherapy treatment planning in recent years by expressions of MR-based or MR only radiotherapy. The aim of this study is the dosimetry evaluation of three different pseudo CT for MRI based radiotherapy treatment planning in pelvic region.

Methods and materials: The optimization of MR protocols was done by a natural bone phantom and MR images of two HASTE and HASTETIRM protocols from 10 pelvic patients are used for pseudo CT construction. The segmentation of fat, bone and soft tissues are done and suitable CT numbers are used for bulk CT construction. In voxel based method, the relation of MR pixel values with CT numbers are delineated by multiple ROIs in tissues. By collected data, three pseudo CTs of homogenous (water equivalent), bulk with 3 kinds of tissue, and voxel based are investigated for dosimetry calculation in comparison with CT volume. The similarity of DRRs from CT and pseudo CT are delineated by dice similarity index.

Results: The planning target volume doses (D95%) in the three pseudo CTs of homogenous (water equivalent), bulk with 3 kinds of tissue, and voxel based were within 1.97%, 1.04% and 0.41% compared to CT images. Average dose difference of 1.43% was observed in relation to skin contours differences in CT and pseudo CT images. The dice similarity index of 0.85 and 0.82 was achieved for superior-inferior and lateral DRRs.

Conclusion: In this study indicates that it is possible to construct high quality pseudo- images by converting the intensity of a single MR series (HASTE protocol) in to CT numbers in pelvic region.

Keywords: Radiotherapy treatment planning, Magnetic resonance imaging, Computed tomography, Pseudo CT, Dice similarity index

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DOSIMETRIC AND RADIOBIOLOGIC ASSESSMENT OF WHOLE PELVIC RADIOTHERAPY (WPRT) AND LOCAL RADIOTHERAPY (LRT) FOR THE TREATMENT OF PATIENTS WITH PROSTATE CANCER

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Abstract

Purpose: comparing whole pelvic radiotherapy (WPRT) and local radiotherapy (LRT) procedures for the treatment of prostate cancer patients based on the assessment of various dosimetric parameters and Lyman-Kutcher-Burman (LKB) radiobiologic model.

Materials and Methods: This study was carried out on two groups of prostate patients including 32 patients. For a group of 16 patients the WPRT procedure was carried, composed of two consecutive IMRT phases (IMRT+IMRT).However, for these patients two other different radiotherapy procedures were also made including one 3DCRT phase followed by a IMRT phase (3DCRT+IMRT) and two consecutive 3DCRT phases (3DCRT+3DCRT).for another groups of 16 patients the LRT procedure was made. Which included just an IMRT procedure. By the way, for these patients an alternative 3DCRT procedure was also studied. The WPRT treatment plans were compared with the LRT plans with respect to normal tissue complication Probability (NTCP), tumor control probability (TCP) and dosimetric parameters. TCP was calculated for both of the WPRT and LRT plans using Poisson statistics model and NTCP was estimated by using the LKB radiobiologic model.

Results and Conclusions: dosimetric and radiobiologic parameters of Bladder, rectum and femoral heads were improved significantly with the LRT (IMRT) compared to all the WPRT procedures. The Bladder and the femoral heads received the lowest and the highest doses from LRT (IMRT) and WPRT (3DCRT+3DCRT) procedures, respectively. But, while the rectum received the lowest dose from LRT (IMRT), it received the highest dose from the LRT (3DCRT). In LRT procedure, the LRT (IMRT) plans delivered smaller mean dose to the bladder (9.36 Gy), rectum (25.31 Gy), right Femur head (11.24 Gy) and left Femur head (11. 6 Gy). For bladder, rectum and femoral heads the LRT (IMRT) procedure was the best one among all the studied plans regarding the volume receiving the dose meeting the relevant dose constraining as well as their mean dose. The TCP and EUD were the highest in the LRT (IMRT) modality with the minimum variation (±0.8%). the NTCP and EUD for bladder and femoral heads were the lowest and the highest in WPRT (3DCRT+3DCRT) and LRT (IMRT), respectively. But, the lowest and the highest of the NTCP and EUD for rectum were in LRT (3DCRT) and WPRT (IMRT+IMRT), respectively. No significant difference found regarding with TCP and EUD achieved for the prostate and NTCP and EUD achieved for the bladder and femoral heads in LRT procedure. There was a significant difference between the IMRT and 3DCRT from LRT procedure for the NTCP and EUD achieved for rectum.

Keywords: WPRT, LRT, Dosimetric Evaluation, Radiobiologic Evaluation.

DOSIMETRIC COMPARISON OF LEVEL II LYMPH NODES BETWEEN MONO-ISOCENTRIC AND DUAL-ISOCENTRIC APPROACHES IN 3D-CRT AND IMRT TECHNIQUES IN BREAST RADIOTHERAPY OF MASTECTOMY PATIENTS

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Aim: To evaluate the dosimetric parameters of level II lymph nodes in chest wall three-dimensional conformal radiotherapy (3D-CRT) and intensity-modulated radiotherapy (IMRT) of mastectomy patients using dual-isocentric (DIT) and mono-isocentric techniques (MIT).

Materials and methods: Computed tomography (CT) images of 20 mastectomy patients undergoing chest wall external radiotherapy were used as the input data for the abovementioned techniques. Selected dosimetric parameters were calculated for the axillary level I–III lymph nodes, chest wall, heart and lung. Paired t-test statistical analysis was used for comparing the results of MIT and DIT in both 3D-CRT and IMRT methods.

Results: There were significant differences in D_{min} (minimum dose), D_{max} (maximum dose) and maximum–minimum dose between MIT and DIT techniques (13, −8·6, −52·2% differences for D_{min}, D_{max} and maximum–minimum, respectively) in IMRT. There were also significant differences for D_{mean} (mean dose), D_{max} and maximum–minimum dose (7·8, −11·4, −44·6% differences in D_{mean}, D_{max} and maximum–minimum, respectively) in 3D-CRT ($p < 0·05$). In addition, there were not any differences in the dosimetric parameters for heart, lung and level I and III lymph nodes.

Conclusion: In both 3D-CRT and IMRT methods, level II lymph node dose distribution in MIT was closer to the prescribed dose compared with DIT due to the position of these nodes in the field junction area. To achieve a better dose homogeneity, it could be recommended to use MIT instead of DIT in 3D-CRT and IMRT for mastectomy patients.

Keywords: 3D-CRT, IMRT, Breast cancer, Lymph nodes, Mono-isocentric technique

VERIFICATION OF COLLAPSED CONE CONVOLUTION ALGORITHM USED IN MONACO TREATMENT PLANNING SYSTEM IN PREDICTION OF CARDIAC AND PULMONARY COMPLICATIONS IN BREAST CANCER RADIOTHERAPY USING MONTE CARLO

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ABSTRACT:

Background: The purpose of this work is to verification a treatment planning system (TPS) using Monte Carlo for the treatment of breast cancer.

Materials and Methods: The 3D dose distributions of 21 treatment plans at breast cancer patients, produced using CCC algorithm, were recalculated using Monte Carlo for each patient; Normal tissue complication probability (NTCP) was calculated for organs at risk in the treatment of breast cancer including heart and lung. NTCP is calculated using radiobiological mathematical models extracted from previous studies and selection of model parameters from the published studies. Since Monte Carlo is an accurate method of dose calculation and is also a valuable tool for verification a treatment planning system, Monte Carlo calculated dose distributions are considered as benchmarks in the comparison. The paired Student t-test was used for statistical comparison of the Monte Carlo and the CC algorithm calculated dose.

Results: In the mentioned plans, NTCP for the heart and lung were calculated with the two radiological models of LKB and RS models, and comparing the two models, it can be stated that the LKB model was more accurate in estimating the probability of normal tissue complication than the RS model. T-test indicated a strong correlation for all dosimetric data. Consistently, CC predicted significantly higher NTCP values than MC.

Conclusions: This study emphasize that more appropriate radiobiological parameters should be accreted with more recent dose calculation methods to achieve dependable prediction of pneumonitis toxicity and cardiac injury and avoid over/under estimating of NTCP. The NTCP is strongly depends on the wide-ranging values of radiobiological parameters.

A MONTE CARLO EVALUATION OF THE DOSIMETRIC CHARACTERISTICS OF THE ^{60}CO HDR BRACHYTHERAPY SOURCE

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Abstract

Introduction: In this study, we attempted to obtain full dosimetric data for a $^{60}\mathrm{Co}$ (model of BEBIG) brachytherapy source developed for use in high-dose-rate after-loading systems. Due to the differences in source design and manufacturing process from one new source to the next, their dosimetric parameters should be determined according to the AAPM TG-43 guidelines. The present work is based on Monte Carlo simulations with MCNP code for the transport of subatomic particles in matter. This code incorporates a number of physical processes, presenting many important characteristics for medical applications, due to its precision in the treatment of geometries, materials, particle trajectories inside the volumes, particle fields, energy range, visualization of events, etc.

Materials and Methods: In this research, the Co-60 (Model BEBIG) brachytherapy source was simulated in water phantom using MCNP4C Monte Carlo code. *F8 tally was used to obtain the dose in a fine cubical lattice. Then the TG-43 dosimetry parameters of the brachytherapy source such as radial dose function ($\mathrm{g(r)}$), geometry function ($\mathrm{G_L(r,\theta)}$), anisotropy function ($\mathrm{F(r,\theta)}$) and dose rate constant were obtained in water phantom.

Results: The results of this evaluation indicate the value of dose rate constant of 1.0771 ± 0.0314 $\mathrm{cGy\ h^{-1}U^{-1}}$ in liquid water, which is in good agreement with 1.087 ± 0.011 $\mathrm{cGy\ h^{-1}U^{-1}}$ reported by Granero, 2007. The radial dose function of the Co-60 source was simulated in water at distances ranging from 0.25 to 20 cm. Results shows a good agreement between the simulated $\mathrm{g(r)}$ and the measured data by Granero et al. (2007). Anisotropy Functions of the Co-60 source were calculated in Water phantom using Monte Carlo simulation method.

Conclusion: Dosimetric data are provided for the Co-60 brachytherapy source. These data are meant to be used commercially in after-loading system. The results of the simulations have shown that dose calculation in water phantom would introduce errors in the dose calculation around brachytherapy sources. Therefore, it is suggested that the correction factors of different tissues be applied after dose calculation in water phantoms, in order to decrease the errors of brachytherapy treatment planning.

EFFECT OF 153SM ON BONE PAIN PALLIATION IN BONE METASTATIC PATIENTS (PROSTATE AND BREAST CANCER)

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Abstract:

Introduction: Bone metastatic pain resulted from different cancers have symptoms that will affect the patients' quality of life. Systemic therapy by radiopharmaceutical instead of radiotherapy and sedative drugs has different advantages like decreasing pain, cost and side effects, increasing survival rate, augury and life quality. The main purpose of 153Sm, which has beta and gamma radiation ability, is to increase the absorbed dose to bone lesions and decrease the absorbed dose to bone marrow in order to eventually decrease the pain.

Materials and Methods: This descriptive epidemiological study was conducted on 30 patients with generalized bone cancer (with prostate and breast cancer origin), who did not respond to conventional treatments and had a full body scan with sufficient bone marrow function. 1 mci/kg Samarium was given to all patients via Intravenous injection: before radiotherapy and then one month after samarium injection. Pain reduction and quality of life were assessed by a questionnaire based on the Quality of Life Questionnaire for Cancer Patients, visual analogue pain scale and Karnofsky index. The availability of information about the bone density of patients, their BMD, and the number of metastatic foci involved in pre- and post-treatment patients will be studied.

Results: According to various diagnostic, therapeutic studies and physical properties of 153Sm, we expect to completely relieve the pain in at least more than half of the samples 2 to 7 days after receiving 153Sm and this result may be continued for several months after injection.

Conclusion: Our expectations of 153Sm injection in bone metastatic patients include decreasing the pain level from 60% to 92%, increased life quality, decreasing mortality and higher life expectancy.

Keywords: 153Sm-EDTMP, Bone metastases, Pain palliation, Radionuclides

COMPARISON OF RADIOBIOLOGICAL EFFECT IN DETERMINING PATIENT SETUP ERRORS DURING WHOLE BREAST IRRADIATION IN CONVENTIONAL AND FIELD-IN-FIELD TECHNIQUES

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Abstract:

Introduction & Objective: Breast cancer is the most common cancer in women worldwide, which treated with radiotherapy after mastectomy. In conventional radiotherapy, two tangential techniques, and FIF techniques are used. Although a breast-conserving therapy has beneficial, but it increased the delivery of doses. Patient setup error occurs due to differences in patient position between treatment plan and treatment implementation. Since breast tissue is close to important organ at risk, so, breast cancer needs to evaluate the radiobiological effects of errors at the PTV and organ at risks during whole breast irradiation. Towards to achieve the ultimate goal of radiotherapy, the present study aimed to evaluate patient setup errors during whole breast radiation using radiobiological indicators in conventional and FIF techniques.

Materials & Methods: This retrospective study was performed at Guilan Oncology Center using CorePlan Seoul C&J Inc, (Korea) treatment planning system. The treatment plan of 30 patients with left breast malignancy was selected for evaluation. Sixteen new plans were adjusted for each treatment technique, including shifting the isocenter 0.5 centimeter in all directions (RL, SI, or AP) and the gantry angle 2.5–10 ° in clockwise and counterclockwise. Radiobiological indicators (tumor control probability (TCP), normal tissue complication probability (NTCP)) were evaluated and compared. The results were analyzed using SPSS software version 13.

Results: The isocenter shifting in all direction (RL, SI and AP) for TCP and NTCP decreased by approximately 40% and 30%, respectively, for both techniques. By increasing the gantry angel in the clockwise and counterclockwise of the both techniques, the TCP decreased by approximately 23% and 14% and, respectively. The NTCP of the heart showed a little change at clockwise and counterclockwise; however, the NTCPs of the lungs decreased in the clockwise by approximately 10% and increased in the counterclockwise by approximately 27%, for both techniques. The changes of FIF were similar to conventional techniques. In addition, FIF technique was more sensitive than conventional technique to the isocenter and the gantry angel changes, but significant differences were not observed between the two techniques ($P>0.05$).

Conclusion: The results showed that the radiobiological indicators are capable to detected dosimetric errors. So, it could be used as a method for patient quality assurance.

Keywords: whole breast irradiation, setup error, radiobiological indices, Field in field

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BEAM-MATCHING ANALYSIS OF TWO SIMILAR LINEAR ACCELERATORS

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Abstract

Goal: The process of simulating/or matching output and dosimeteric characteristics of two different linear accelerators define as beam-matching. Radiotherapy centers equipped with beam-matched Linacs are capable to exchange patients between machines, without needing/having re-plans, at emergency times or whenever one machines is broken. Given that in our center there are two Siemens Primus Linacs, the aim of the study is estimated as evaluating level of beam-matching characteristic of these two machines. In order to having good comparison/analyses between two machines the gamma index (γ-index) analysis was used. The gamma index quantifies the difference between measured and/or calculated dose profiles on two scanners in terms of both dose and distance to agreement (DTA) difference.

Method: Dose profiles of nominal energy 6 MV was acquired with an ionization chamber (PTW 31010 Semiflex, Germany), a TBA Tandem electrometer (PTW 011299, Germany) and MEPHYSTO Navigator software (Version 3.3) in a water phantom (PTW MP3-M water phantom system) on two Siemens Primus linear accelerator. Dose profiles were measured at constant source-to-surface distance (SSD = 90 cm), for field sizes of: 5 cm × 5 cm, 8 cm × 8 cm, 10 cm × 10 cm, 15 cm × 15 cm, 35 cm × 35 cm from the surface of the water to the depth of the 30 cm. MATLAB code was developed for γ-index calculation. γ-index calculated for distance to agreement (DTA) of 3 mm and percent dose difference (% DD) of 3 %. For all calculation γ-index acceptance criteria Was considered below 1.

Results: All of the dose profiles were entirely beam-matched according to gamma analysis except filed size 35 cm × 35 cm. The γ-index in the build-up region of filed size 35 cm × 35 cm was slightly higher than 1. All of the other points on dose profiles were in on acceptable level of beam-matching (γ-index < 1).

Conclusion: Our results indicates that our machines are beam-matched in terms of dose profiles. Further investigations are necessary to conclude two machines are entirely beam-matched. Our work is continuing to test other available photon and electron energies and test beam profiles to ensure our machines are beam-matched or not.

Keywords: Medical Linear accelerator, Beam-Matching, Gamma Index

RADIATION DOSE TO CONTRA LATERAL BREAST DURING RADIOTHERAPY OF BREAST CANCER

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Abstract:

Introduction: Many researches have been conducted on Breast cancer and its treatment strategies aimed to find new treatments and improve the quality of previously known therapeutic methods. This study aimed to estimate the dose of the *contralateral breast* tissue for patients who treated by 3D treatment planning which referred to radiotherapy department of Shahid Rajaei oncology Hospital in Babolsar.

Materials and Methods: 50 patients referred for breast radiotherapy with a 3D treatment plan were participated in this study. Patients who had bilateral breast cancer or less than one-quarter of their opposite breast was presented in CT scan were excluded. The opposite breast was contoured based on the RTOG contouring protocol. DVH of opposite breast was planned and mean dose was obtained from DVH. The obtained dose was recorded according to different treatment conditions including presence or absence of mastectomy in the involved breast, presence or absence of wedge, treatment shield and complementary fields such as supraclavicular and axillary fields. The mean and SD of dose for patients participated in the study were reported.

Results: The mean dose of opposite breast in 50 patients was 78.3±11.9 cGy based on the contouring protocol and dose-volume histogram. It is expected that the risk of secondary cancer to be directly related to the radiation dose and inversely related to the patient's age.

Conclusion: Due to the sensitivity of the breast tissue to radiation, it is recommended to consider the opposite breast as organ at risk in Radiation Therapy Treatment Planning and pay special attention to it.

Keywords: Breast malignancy, Contralateral breast, Radiation risk

PHOTON BEAM TRANSMISSION AND DOSE BUILDUP FOR AN ELEKTA 6 MV LINEAR ACCELERATOR, COUCHTOP AND BREAST BOARD

Faezeh Arianfard

Introduction

Many radiotherapy (RT) techniques use photon beams passing through patient support structures (treatment couch and/or patient immobilization devices). They include traditional treatment methods as well as modern ones (e.g., rotational and non-rotational intensity modulated radiation therapy). Couchtop and patient immobilization devices attenuate a beam passing through them. If this attenuation is ignored in treatment planning, it can result in target underdosage. Moreover, the passage of a megavoltage photon beam through patient support structures reduces the dose buildup effect, thereby diminishing skin sparing and compromising one of the main advantages of using megavoltage photon beams (1).

The couchtop must be rigid without producing imaging artifacts. It must also be as translucent as possible to the photon beams used on the treatment unit, i.e., create minimal beam attenuation and dose buildup. In the past few decades, compact foam sandwiched between carbon fibre layers has been used due to the rigidity and higher transmission it offers compared to other materials; however, beam attenuation is still considerable and must be quantified(2).

Similarly, the need for patient immobilization structures such as head rests, baseplates for thermoplastic meshes and other fixation devices, breast boards, knee and ankle supports, etc. is well established. Information on the attenuation effects of these devices is also necessary.

Determining the dosimetric influences of couch and immobilization devices on megavoltage beams has been studied at many centres, as it is necessary to characterize the effects of each combination of patient support structures and treatment unit photon beam energy (1). The reported magnitude and trend of the effect has been shown to be non-universal. There are differences in the attenuation for normal incidence, as well as how it varies with field size and gantry angle (GA), including the angle at which it is maximal. For example, McCormak et al. measured a 2% attenuation by a *SinMed* couch at normal incidence at 6 MV that reached 9% at 110° GA (3). Poppe et al. measured 2.7% and 6.4% 6 MV attenuations for the *RM2* couch and the couch-combiboard combination (4). Njeh et al. measured 4.9% and 2.5% (5×5 cm^2) and 3.4% and 1.6 % (10×10 cm^2) 6 MV attenuations for the *Brainlab* couch and its head rest, respectively; the highest attenuation was observed at the 110° and 120° GAs (5). Seppala et al. recorded the highest 6 MV attenuation at the 110° gantry angle with the field size of 10×10 cm^2 (2).

Some papers have reported the effect on surface dose and/or percentage depth dose (PDD) near the surface. Meydanci et al. reported that a carbon fibre couch (Reuther Medizin Technik, Mülheim- Kärlich, Germany) increased surface dose from 7.5% to 63% in small 6 MV fields; Moreover, fivefold and twofold attenuation increases were observed at 10×10 cm^2 and 40×40 cm^2 field sizes, respectively (6). Ghasemi et al. quoted 16.56% and 5.27% increases in skin dose by a non-carbon-fibre baseplate at 6 MV and 15 MV, respectively (7). Gul et al. measured a 29% increase in Co-60 beam attenuation and 6% increase in skin dose caused by a couch nylon mesh (8).

To the best of knowledge, no paper has been published on the *iBEAM Standard* couchtop (Medical Intelligence (Elekta), Schwabmuenchen, Germany) regarding such effects. After an extensive search of the literature, the only reported study we found was by Wieslander et al in a conference proceedings, which included beam attenuation but not the effects of the couchtop on skin dose or the buildup region (9). There are many RT centres worldwide equipped with this couchtop as part of an *Elekta Compact* linear accelerator unit. Although within the acceptance range, the specified penetrative quality of the 6 MV beam of this accelerator is slightly less than that stated in the *British Journal of Radiology* Supplement 25; PDD of a 10×10 cm^2 field at 10 cm depth in water being 67.0% compared to 67.5% (with probable increased effects of patient support structures). Quantifying these effects is, therefore, considered necessary. The aforementioned points constitute the novel aspects of this work.

In this study, beam attenuation as a function of GA for the combination of this accelerator's 6 MV beam and the *iBEAM* couchtop was studied to provide the necessary information for use in treatment planning. Attenuation factors of this couchtop extension and a breast board were also measured. As for skin dose, instead of measuring dose at a specific depth to estimate skin dose in the presence of couchtop at a particular depth in tissue (as reported in some studies), we measured and also Monte Carlo (MC) simulated several depths in the buildup region to provide more data and insight regarding this effect. MC simulation was a particularly useful tool in this study as it provided PDD data at very shallow depths (<0.4 mm), relevant to the various depths of the skin basal cell layer (BCL) throughout the body, where measurement was not practicable. A secondary purpose of this work was to provide a direct comparison of doses to skin and subcutaneous tissue resulting from the combination of this carbon fibre couchtop and 6 MV accelerator with those from traditional treatments on a Co-60 unit (Theratron Phoenix, Best Theratronics, Canada) equipped with a 'tennis racket' couchtop insert (nylon mesh without a Mylar sheet). This aimed to provide a link and perspective with respect to experiences of skin effects observed historically.

Methods and materials

Overview

Attenuation factors of the *iBEAM Standard* couchtop, its contoured *Head & Neck extension* and the *BreastSTEP* boards from the same manufacturer (Elekta, Scwabmünchen, Germany) were measured in the 6 MV accelerator beam. Then, focusing on the couchtop itself, central-axis PDD curves in the buildup depths (starting from 0.4 mm) were measured for both the accelerator and Co-60 combinations. The geometry of the accelerator and iBEAM couchtop was MC simulated and the results of the experimental measurements were used for additional validation of the model. Then, the MC model was used to provide PDD data at all buildup depths including those less than 0.4 mm. The 6 MV and Co-60 PDDs for their respective couches were then compared directly in a clinically relevant scenario.

Unless otherwise stated, accelerator beams passing through the couchtop, the extension and the breast board were measured at180° GA. For measurements without the couchtop in the accelerator beam path, measurements were made at 0° GA for practical reasons. The small differences in accelerator output (including any effects on measurements arising from gantry sag) were measured in air at 0°, 125°, 135°, 150°, 165° and 180° GAs and applied in the calculations accordingly. The 180º GA was considered as reference and the other angles were corrected relative to that. All measurements in the Co-60 beam were at 0° GA, made possible by its removable couch insert.

Attenuation measurements

Figure 1 shows the experimental setup for couchtop attenuation measurements schematically. Impact of the couchtop on beam attenuation at 125°, 135°, 150°, 165° and 180° Gas was studied for 5×5 cm^2, 8×8 cm^2, 10×10 cm^2, 15×8 cm^2, and 20×8 cm^2 field sizes.

Measurements were made with a *Semiflex* ionisation chamber (connected to a *UNIDOS* electrometer) (PTW Freiburg, Germany) placed at the isocentre at the centre of a water-equivalent plastic, cylindrical phantom of 1.03 g/cm^3 density, 25 cm diameter and 12.5 cm length. Potential variations in temperature and pressure were monitored throughout but no corrections were found to be necessary. For comparison with MC simulations, in order to have a set of measurements without the large influence of attenuation in the phantom itself, couch attenuation measurements were repeated in air with the same ion chamber and a 6 MV Perspex buildup cap (PTW Freiburg, Germany) for 5×5 cm^2 and 10×10 cm^2 field sizes.

As the cross-section of the couchtop is tapered at the two sides (Figure 1), the path through the couch does not always increase with increasing beam obliquity. In order to characterize this effect with an increasing trend as a function of path length through the couchtop, beam path length for every GA was measured accurately by using the *AutoCAD* software and then, by considering the density of the materials in the couchtop, air and phantom, a total water equivalent thickness (WET) for each GA was calculated.

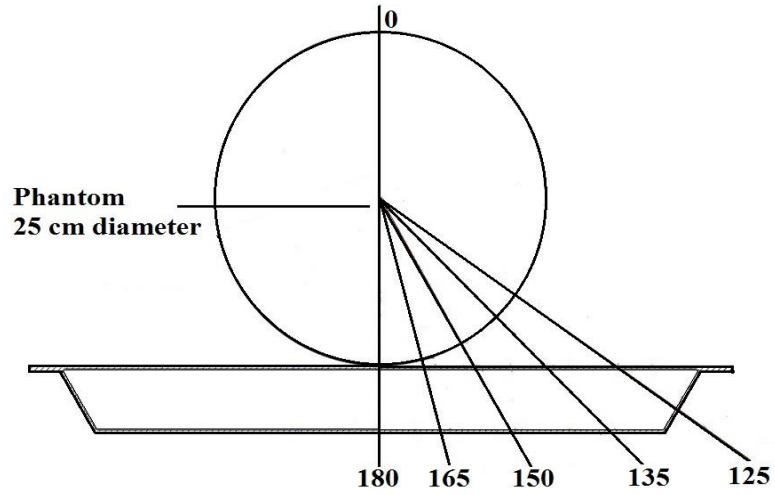

Figure 1 Schematic of the 6 MV beam attenuation measurement setup

The attenuation factors of the extension board, and the couchtop-breast board combination, were measured in an 8×8 cm^2 field. The extension board has a similar carbon fibre foam sandwich structure to the couchtop but has thinner layers of carbon fibre and foam. The breast board has a horizontal carbon fibre baseplate and a variable-angle inclined one, which together form a wedge shape. The horizontal one is contoured such that relevant vertical and tangential beams do not pass through any solid structures. For each of the four board angles (*A, B, C* and *D*) with the horizontal baseplate of the breast board, attenuation was measured in air for a representative field size (8×8 cm^2) such that the distance between the baseplate and dosimeter was at least 20 cm, to reduce any effects of electron contamination on the readings. The results were compared with the situation that the couch and breast board were not in the beam path, at the chamber position corresponding to board angle *A*, because at that level, the influence of backscattered electrons from the baseplate was at its lowest.

Measurements in buildup region

To determine the influence of the couch on the dose in the buildup region up to a very shallow depth, depth-doses were measured using an electron field diode (*EFD*; Scanditronix/IBA, Uppsala, Sweden). The EFD is a p-type silicon diode, the effective point of measurement of which is 0.4 mm below the surface of its entrance window. This depth of detector sensitive volume was the lowest among the dosimeters available to us.

Figure 2 schematically shows the measurement setup for studying the effect of the couch on PDD. Measurements were made with and without the couch in the beam path for 5×5 cm^2, 10×10 cm^2 and 20×20 cm^2 field sizes. The diode was embedded in a purpose-made Perspex slab with its entrance window at the surface and facing the beam. A 9 cm thickness of Perspex slabs made up the rest of the phantom. The slab containing the diode was then sequentially placed at different depths until the depth of maximum dose (d_{max}) was reached. A source-to-surface distance (SSD) of 100 cm was maintained throughout. At least three readings were taken at each depth. The readings were normalized to that at d_{max}.

INTRAOPERATIVE RADIOTHERAPY (IORT) WITH NANOPARTICLES: AN EFFICACY STUDY

Gilnaz Omyan, Somayeh Gholami

Purpose: The delivery of a sufficient amount of radiation dose required for tumor control while minimizing toxicities to healthy tissues is one of the major research aims in radiotherapy. Thus, the present study aimed to investigate the efficacy of cancer treatment using IORT in combination with nanoparticles (NPs).
Methods: The Geant4 Monte Carlo (MC) toolkit was used to simulate ZEISS INTRABEAM 50 keV IORT machine (ZEISS Medical Technology, Germany) and its 1.5 and 5 cm applicator diameters. Further simulation was done to obtain the dose enhancement effects (DEFs) of spherical NPs including Silver (Ag), Gold (Au), Bismuth (Bi), Copper (Cu) and Iron (Fe) of varying concentrations (5, 10, 15 and 20 mg/g) located on the surfaces of the applicators. Analytical calculations of the DEF were done for a modelled tumor vascular endothelial cells of dimension 20×10×10 µm as a slab of tumor cell, with its results compared to that from simulation for validation.
Results: Simulation results showed an increase in DEF up to 20% for IORT combined with NPs. Furthermore, comparison with analytical calculations indicated good agreement (±2%).
Conclusion: Our results have shown that this technique is promising. This will pave way for future in vitro and in vivo studies, which could possibly lead to clinical trials with new insights into this technique. This could go a long way in improving cancer therapy via efficient dose delivery as well as safety and timely treatment.

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CHARGE COLLECTION EFFICIENCY MEASUREMENT FOR A FARMER TYPE ION CHAMBER USING DIFFERENT RECOMMENDED PROTOCOLS

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Introduction: Incomplete charge collection efficiency of employed ion chamber for high-energy photon and electron dosimetry, due to both initial and general ion recombination within the active volume of ion chamber, is one of the main concerns, which should be compensated following the recommended protocols for ion chamber response correction. In this regard, a correction factor, known as recombination correction factor (denoted as K_{sat} or P_{ion}), has been introduced by different dosimetry protocols which is inversely equal to the charge collection efficiency of employed ion chamber dosimeter. The aim of this study is to measure and compare the obtained K_{sat} values by different recommended protocols for a Farmer type ion chamber at different chamber operating voltages.

Materials and Methods: A Farmer type ion chamber (TM30013, PTW), a cylindrical chamber with a sensitive volume of 0.6 cm^3, was considered in this study. Different recommended protocols including IAEA-TRS-398, AAPM-TG-51, DIN 6800-2 and multiple voltage analysis (MVA) through Jaffe plots were employed for K_{sat} evaluation at various operating voltages of 200 V, 300 V and 400 V. K_{sat} values at different chamber voltages were obtained at the 6 MV photon field of an ELEKTA-Compact Clinac. The SSD-setup was employed for irradiation. The radiation field size at the surface was 10×10 cm^2 and the chamber reference pointed had been located at the reference depth of 10 cm inside the water phantom. The LINAC dose rate during the measurements was adjusted to 200 MU/min.

Results: Obtained K_{sat} values following the different protocols demonstrated that the obtained K_{sat} data through different recommended methods would not differ from 0.1% at all studied chamber voltages. The maximum K_{sat} values were related to those obtained from the recommendation of DIN 6800-2 dosimetry protocol which ranges from 1.0032 to 1.0016 at different chamber voltages. On the other hand, the minimum K_{sat} values were observed in the case of IAEA-TRS-398 protocol which varied between 1.0021 and 1.0010 at different chamber voltages. The results showed that the K_{sat} value is a function of chamber voltage, such that it would be decreased by the factor of about 0.2% with increasing the operating voltage from 200 V to 400 V for all considered protocols in the current study. Therefore, the charge collection efficiency increases with the increment of chamber voltage which is likely attributed to the increased electric field strength within the chamber sensitive volume at higher voltages which caucus the larger number of ion pairs would be collected before the ion recombination would occur.

Conclusion: From the obtained results, it can be concluded that the different recommended protocols for charge collection efficiency (ion recombination correction) determination would result in analogous data and no significant difference would be observed between the measured K_{sat} factors by the various recommended protocols.

Keywords: Charge collection efficiency, Recombination correction factor, Farmer type ion chamber, Different dosimetry protocols

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DEPENDENCE OF PLAN QUALITY INDICES ON MODULATION RESTRICTION IN MIN/MAX BASED INVERSE OPTIMIZED HDR BRACHYTHERAPY OF CERVICAL CANCER

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ABSTRACT

Purpose: Restricting the gradients of dwell times between adjacent dwell positions can potentially be beneficial in reducing the probability of unwanted hot/cold spots occurring if the planned applicators/anatomy relative positions change before or during treatment. This constraint, however, may degrade plan quality. This study, for the first time, aims to quantify the impact of modulation restriction (MR) on plan quality indices in inverse optimization for cervix high dose rate (HDR) brachytherapy using the BEBIG SagiPlan treatment planning system.

Material and Methods: Ten cervical cancer patient plans were optimized for treatment with a BEBIG SagiNova cobalt-60 HDR afterloader using the Min/max inverse planning method with the dwell time homogeneity error weight values of 0 to 10 (as the MR parameter). Dwell time homogeneity and gradients as well as various plan quality indices were analyzed.

Results: For MR = 0, Min/max-based optimization yielded higher HR-CTVD90 values than the Variance-based option ($P<0.001$) and was therefore selected for this study. Averaging over all patients, selecting non-zero MRs resulted in a general increase in dwell time homogeneity and decrease in mean and maximum adjacent dwell time gradients, especially between MRs of 0 and 1. For MR>1, increasing this parameter did not always result in more homogeneous dwell times or reduced gradients in individual patients. Increasing the MR value caused a statistically significant decrease in dwell time inhomogeneity ($P<0.001$, $r = -0.982$), absolute adjacent maximum dwell times gradients ($P<0.001$, $r = -0.945$) and absolute adjacent mean dwell times gradients ($P<0.001$, $r = -1.000$) averaged over all patients. There was a negative correlation between MR and both HR-CTVD90 and V100 ($P<0.001$, $r = -0.91$). Increasing MR also negatively affected conformity index ($P<0.001$, $r = -0.99$). Changes in rectum and sigmoid colon D_{2cc} were insignificant. There was a strong positive relationship between bladder D_{2cc} and MR ($P<0.001$, $r = 0.99$).

Conclusions: Averaged over a group of patients, selecting a non-zero value of the MR parameter results in a general increase in dwell time homogeneity and decrease in mean and maximum adjacent dwell time gradients, especially between the unconstrained situation (MR = 0) and MR = 1. Assuming a static geometry, statistically significant plan quality degradation can result from restricting the dwell time homogeneity in Min/max-based optimization of cervix HDR brachytherapy plans using SagiPlan. Therefore, setting MR to zero is indicated for the type of patient plans considered in this study.

Keywords: High dose rate brachytherapy, cervical cancer, Dwell time homogeneity error weight, Modulation restriction, Min/max based optimization.

EVALUATION OF HEART RECEIVED DOSE IN RADIATION THERAPY OF BREAST CANCER PATIENTS WITH AND WITHOUT ELECTRON FIELD

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Purpose: To evaluate the impact of adding an electron field to the radiation therapy treatment plan of left breast cancer patients for decreasing the heart received dose

Methods and Materials: 21 patients with left breast cancer were selected in this study. The heart received dose was measured under virtual simulation with Isogray treatment planning system. At First, all patients were planned with Forward IMRT breast radiation therapy treatment plan with tangential photon fields by field in field technique. Then an electron field was added to these treatment plans in the heart area and heart was shielded in the tangential photon fields. We did these for treatment plans of all patients and compared heart received dose with Quantec criteria. We did our comparisons with three criteria. Heart mean dose<26Gy, V_{46}<30 and V_{33}<60.

Results: Under the two techniques for treatment plan of 21 patients, by average, heart mean dose without electron field was 9.18Gy and with electron field was 7.34Gy. 30% of heart volume without electron field received 2.91Gy and with electron field received 2.63Gy. 60% of heart volume without electron field received 4.42Gy and with electron field received 4.05Gy.

Conclusions: We concluded that by adding an electron field to the breast cancer radiation therapy treatment plans, heart received mean dose and volumetric dose decreased by average in all treatment plans. Therefore, it is necessary to consider this method as an alternative for left breast radiation therapy treatment plans.

Keywords: Radiation Therapy, Breast Cancer, Treatment Planning, Heart Received Dose.

DOSIMETRIC COMPARISON OF DIFFERENT TANGENTIAL FIELDS ARRANGEMENTS IN THE LEFT-SIDE WHOLE BREAST RADIATION THERAPY

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Introduction: 3-dimensional conformal radiation therapy (3D-CRT) is a supplementary treatment modality after breast conservation surgery (BCS). Considering the supraclavicular fields during the radiotherapy, the mono-isocentric technique is the best one in the patient setup during the treatment. Arrangement of tangential fields in left breast radiation therapy may play a critical role in the received dose to organs at risks (OARs) such as heart and lung as well as the dose uniformity and conformity within the planning target volume (PTV). In this study, a dosimetric comparison was performed between three different tangential fields arrangements employed in 3D-CRT of left breast radiation therapy.

Materials & Methods: In this study, CT images of 15 patients with left breast cancer were randomly selected. They had previously undergone breast conservation surgery. All OARs and target volumes contouring was performed by a radiation oncologist. Three different treatment planning procedures through various tangential fields arrangements were performed by a medical physicist and then checked and confirmed by the second one. All dosimetric data of each plan for both PTV and OARs were extracted from obtained DVH data for each filed arrangement. Furthermore, some geometrical data such as central lung distance (CLD), maximal lung distance (MLD), and maximal heart distance (MHD) and their correlation with OAR's dosimatric data were determined. The one-way ANOVA and Pearson correlation were used as statistical tests in this study.

Results: There was no statistical difference between dosimetric parameters (D95, V95, Dmax, and Dmean, HI, CI) of the target volume in all studied field arrangements through separate treatment plans. No meaningful difference was also observed between dosimetric parameters of OARs such as contralateral breast, ipsilateral lung, and heart. Furthermore, no significant level was found between geometrical data in three types of tangential fields arrangements. On the other hand, a remarkable correlation was observed between MHD, MLD, CLD and some dosimetric parameter of heart and lung such as V5 and V10.

Conclusion: The tangential fields arrangement during the left breast radiotherapy treatment planning is an important issue viewpoint to the clinical radiation oncology. In this study, three different tangential field arrangements were studied for left breast treatment planning in 15 BCS patients. No significant difference was found in the dosimetric parameters of both target and OARs by changing the arrangement of the employed tangential fields. The results of this study showed that V5 and V10 of heart and lung can have a rational correlation with corresponding OARs geometric data. As a result, these dosimetric data can also be considered as suitable dose constraints in the left breast treatment planning evaluation.

CONFORMAL BRACHYTHERAPY IN SUPERFICIAL SKIN CANCER

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Introduction: Nonmelanoma skin cancer (NMSC) is the most commonly diagnosed malignancy in humans. The first treatment of choice for NMSC is surgery. However, surgical removal of skin lesions may be contraindicated because of the cosmetic complications following surgery. In such cases, radiation therapy can be used as an effective alternative. The main purpose of radiation therapy is the delivery of the prescribed radiation dose to the tumor while keeping the dose received by adjacent normal tissue to the minimum. In this study, we simulated a new brachytherapy applicator for use in the treatment of thin skin lesions. The main feature of this applicator is its capability to minimize unwanted exposure to healthy tissue surrounding the skin lesion while treatment is delivered.

Materials and Methods: The novel skin brachytherapy applicator simulated in the current study is a 3D-printed cuboid containing a 9×7 array of 2mm×2mm×1mm wells. The wells can be filled with a radioactive gel which is a mixture of a gel and a beta-emitting isotope. For our study. the radioisotope of choice was yttrium-90 (Y-90), a pure betta-emitting source with a half-life of 64 hours. The beta particles of this isotope can penetrate up to ~ 10 mm in tissue. To do dosimetry study of the applicator, EGS C++ Monte Carlo particle transport code was used. The wells of the applicator were filled in the desired pattern to simulate the corresponding dose profile, assessing the capability of the applicator to conform the radiation dose. Additionally, the amount of the activity of some of the wells was doubled to assess how the intensity of the resultant dose profile changes.

Results: Results of the simulation study of this applicator showed that shaping the dose distribution is readily possible by adding the radioactive gel to specific wells of the applicator. In addition, there is a possibility to modulate the intensity of the radiation by changing the amount of the activity added to the wells. Based on the percent depth dose calculated for this applicator, the dose drops to almost zero beyond a depth of 7 mm in skin tissue.

Conclusion: The multiwell applicator simulated in this study is capable of conforming the radiation dose to the tumor 2D shape on the skin surface. It is also possible to modulate the radiation dose where it is needed. These features of the multiwell applicator, together with the sharp dose falloff of the beta radiation used to load it, can be advantageous in radiation therapy of skin tumor located right on top of the bony structures or very close to critical organs such as the eye.

FEASIBILITY STUDY OF MR-GUIDED CARBON-ION RADIOTHERAPY: ASSESSMENT OF THE IMPACT OF MAGNETIC FIELD ON DOSE DISTRIBUTION

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Abstract

Purpose: Magnetic resonance imaging (MRI) plays an effective role in image guidance for modern radiotherapy. One of the prominent challenges in the feasible idea of coupling a carbon therapy gantry with an MRI system involves magnetic field-induced dose effects in patients. Accordingly, this paper aims to evaluate the effect of the magnetic field on dose distribution of therapeutic carbon Gaussian beams inside homogeneous and inhomogeneous phantoms.

Methods: FLUKA Monte Carlo (MC) code was used to transport the therapeutic carbon Gaussian beams in a homogeneous water phantom and a multilayer tissue phantom. First, the effect of a 1.5 Tesla (T) magnetic field on the depth dose distribution of therapeutic carbon Gaussian beams inside the homogeneous phantom was evaluated. Second, the amount of dose profile deflection induced by 0.5, 1.5 and 3 T magnetic fields was calculated at various depths at 100, 220 and 310 MeV/nucleon (MeV/n) energies. Finally, the depth dose distribution of a 220 MeV/n carbon beam inside the inhomogeneous media affected by a 1.5 T magnetic field was obtained.

Results: In the homogeneous phantom affected by a 1.5 T magnetic field, by increasing the carbon-ion (C-ion) energy, the variation in the Bragg curve increased, and the Bragg depth decreased (maximum 0.34 % at 310 MeV/n energy). Moreover, for a specific energy, the changes in the Bragg curves before reaching the Bragg peaks was less than that after the Bragg peak. Maximum deflections at 100, 220 and 310 MeV/n energies were 0.4, 3.95 and 10.5 mm, respectively. Furthermore, the Bragg depth decreased by approximately 8.80 % in the inhomogeneous phantom in comparison to the homogeneous water phantom. Dose profile displacement inside the heterogeneous phantom was 1.7 mm. In both phantoms studied, maximum variations in the Bragg curve were higher in the fragmentation tail than before the Bragg peak.

Conclusions: Dose perturbations were negligible for intermediate initial energies and median magnetic fields. Since MR-guided particle therapy is a topic of interest in the medical physics community, this paper could be helpful for evaluating feasible MR-guided C-ion radiotherapy (MRgCIRT) and for finding solutions to its dosimetric challenges. While the results of this research provide valuable data for validating existing analytical models, they also open the door for practical implementation of MRgCIRT. This study indicates that MRgCIRT could be feasible. However, its future challenges should be solved as soon as possible.

A Quality control test for scatter dose computing by ISO GRAY treatment planning system

The accuracy is an important factor in radiotherapy due to organs at risk, which are sensitive to the radiation. And to reduce the therapeutic margin around the cancer cells and less irritate healthy cells.

This study was carried out using “Iso-Gray” treatment planning system, which is made in France. And aims to evaluate Iso-Gray TPS in computing scatter dose around the target volume.

In this study, we used Thermoluminescent GR-200A chips and two special Rando Alderson alike phantom, one uniform and another with uniformity.

First, the phantom was put in a supine position on the CT simulator bed; second, the phantom was fixed by tape to avoid of shifting or moving markers showing the position during the phantom shifting or locating TLDs chips. Next, three radiopaque markers were centered in isocentre, one at anterior and two in sides, by external lasers. Images with the thickness of 5mm were sent to TPS and external contour was delineated with the consideration of isocentre.

Then The treatment planning was carried out for the phantoms as same as five patients and dose of scattered radiation, which delivered into the eyes, was computed.

TLD chips were located in eyes lens position at the depth of 5mm. Two chips next together were used to increase the accuracy of dosimetry and calibration and also the average of reading was considered as s total dose to cause results to be more valid.
After irradiating and reading the TLT chips gross:
For Uniform phantom radiation There was the error rate in computing scatter dose less than 7% and for the Non-uniform phantom The average of error rate was 11%.
And result for all three dose computing protocol was very similar.
Therefore, TPS has more errors in computing dose for un-uniform phantom than uniform one, and it is necessary to do more experiment.

Keywords: scatter dose, organ at risk, treatment planning system

ULTRASOUND EVALUATION OF RADIATION INDUCED MORPHOLOGICAL AND STRUCTURAL ALTERATION OF PAROTID GLAND DURING RADIOTHERAPY OF HEAD AND NECK CANCER

Hossein Abbassian

Objective: Radiation induced morphological and structural changes of parotid gland were evaluated, during radiotherapy of head and neck cancer, and in relation to dose-volume distribution by ultrasonography (US) imaging.

Methods: 30 patients (17 Male and 13 female) with head and neck malignancies who had been referred for radiotherapy, were selected. Dimensions, echogenicity, echotexture and margins of parotid glands of each patient were evaluated before (stage I), during (stage II), and immediately after radiotherapy (stage III) using US. Also, Doppler US parameters such as peak systolic velocity (PSV), end diastolic velocity (EDV), resistive index (RI) and pulsality index (PI) were evaluated simultaneously. The relationship between parotid volumes receiving 30 and 40 Gy (V_{30} and V_{40}) and change in the US parameters between stages was assessed as well.

Results: The maximum/minimum change for length, width, depth (height), and volume from stage I to II were 1.8/2.8 mm, 7.1/7.98 mm, 10.0/1.49 mm, 4.2/0.72 mm^3 and from stage II to III were 0.5/2.1 mm, 6.9/3.91 mm, 1.1/1.59 mm, 0.2/0.7 mm^3 respectively. No significant difference was observed for PSV and EDV between stages. However, change in echotexture, echogenicity and gland margin from stage I to III was significant (P=0. 000). The change in length in stage II and stage III relative to stage I, were significantly correlated with V_{30} (r =0.365, P=0.020) and V_{40} (r = 0.478, P= 0.025) respectively. Also change in RI in stage II relative to stage I had significant correlation with V_{40} (r =0.427, P=0.021).

Conclusion: Ultrasonography can be used in adaptive radiotherapy by monitoring alteration in position of parotid during treatment and for predicting radiation induced xerostomia by monitoring acute morphological alteration of parotid during radiotherapy of head and neck cancer.

Keywords: xerostomia, ultrasonography, parotid gland, head and neck cancer, Radiotherapy

ARGON PLASMA COAGULATION THERAPY FOR A HEMORRHAGIC RADIATION PROCTITIS IN A PATIENT WITH METASTATIC PROSTATIC CANCER, A CASE REPORT AND LITERATURE REVIEW

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Abstract

Background: Radiation injury to the bowel may result from treatment of cancers in the pelvic area. Radiation proctitis is a serious complication of radiation therapy for cancers which is challenging to manage by clinician. The common presentation is rectal bleeding. Different strategies of treatment have been described for this complication but there is no definite standard treatment for this condition. The argon plasma therapy (APC) is an option for its treatment.

Case presentation: In this article, we reported a good experience of the efficacy of APC on a hemorrhagic radiation proctitis in a 67-year-old man with metastatic prostatic cancer. The patient had fresh rectal bleeding and severe anemia. He was pale and his hemoglobin level was 6 mg/dl at first visit. The colonoscopic examination revealed edematous and fragile mucosa with multiple telangiectasias and oozing in the whole rectum. This patient was treated as severe hemorrhagic proctitis induced by radiotherapy for prostatic cancer. After two interval sessions of endoscopic treatment using APC, his anemia and rectal bleeding associated with hemorrhagic radiation proctitis improved.

Conclusion: Endoscopic therapy - APC appears to be as an effective and safe treatment for radiation proctitis. For treatment of extending mucosal injury followed by radiation maybe need to do multiple sessions of APC.The best results of treatment have been reported in patients with mild to moderate radiation proctitis.

Keywords: Argon plasma coagulation (APC), radiation proctitis, pelvic radiation, endoscopic treatment, complications.

FEASIBILITY AND EFFICACY OF HYPOFRACTIONATED SIMULTANEOUS INTEGRATED BOOST (SIB) IMRT METHOD USING THREE-LAYERED PTV FOR MALIGNANT GLIOMAS.

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Purpose: The aim of this study was to assess the feasibility and efficacy of hypofractionated simultaneous integrated boost-IMRT using three-layered PTV for malignant glioma.

Material and methods: From May 2019 until now patients with newly diagnosed and histologically confirmed GBM in our institute received hypofractionated SIB-IMRT. Three-layered CTVs were contoured, high risk CTV as the area of surgical bed including residual gross tumor with a 0.5 cm margin called CTV64, moderate risk CTV as the area surrounding the high risk CTV with 1.5 cm margin including edema called CTV 60 and low risk CTV as the area surrounding the moderate risk CTV with 1cm margin called CTV54 and 3mm setup margin was used for CTV to PTV structure. Dose layers were chosen according to our physician's recommendation and our institute facilities. The number of fractions was 27, PO algorithm of Eclips TPS was used for IMRT.

Results: SIB-IMRT has become known as a treatment method to provide dosimetric benefits for protecting adjacent normal tissues. By this method overall treatment time will be short, and by hypofractionation a biologically effective dose (BED) can be escalated, these are important for overcoming radioresistance tissues, because the majority of tumors recur or progress at the primary lesions. This technique controls organ at risks near the CTV by escalating dose in GTV and reducing dose in low risk CTV.

Conclusion: An escalated dose of hypofractionated SIB-IMRT using three layered CTVs can be safely performed in patients with malignant glioma, and might contribute to better tumor control and survival.

Keywords: IMRT, simultaneous integrated boost, hypofractionation, GBM, SIB.

PROPOSINNG A MODEL FOR CERVICAL CANCER BRACHYTHERAPY TREATMENT PLANNING CORRECTION BASED ON ANATOMICAL VARIATION

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Purpose: Main aims of this study were: (1) To analyse the optimum organ filling point for organs at risk (OARs) dose in cervical cancer HDR intracavitary brachytherapy. (2) To investigate the concurrent effects of tandem length and bladder volume on dose to OARs in HDR this treatment. (3) To demonstrate the utility of '3D Slicer' for easy treatment verification by comparing DVHs calculated on pre- and post-treatment images. (4) To introduce a fast and independent technique to estimate OARs dose due to intra-fractional variations. (5) To propose a model to correct the treatment planning of GYN patients based on their anatomical variations.

Materials and Methods: (1) In a retrospective study, 32 locally advanced cervical cancer patients (97 insertions) who were treated with 3D conformal EBRT and concurrent chemotherapy. Rotterdam HDR tandem-ovoid applicators were used and CT scanning was performed after each insertion. The OARs delineation and GEC-ESTRO-based CTVs contouring was followed by 3D forward planning. Then, dose volume histogram (DVH) parameters of organs were recorded and patients were classified based on their OARs volumes as well as their inserted tandem length. (2) Twenty patients with the same inclusion criteria were selected. The patients were CT scanned twice with empty and full bladder. Two treatment plans were prepared on each of the image sets. Patients were categorized into two groups; those treated with a tandem length of 4 cm or smaller ($T \leq 4$ cm) and those with tandem length larger than 4 cm ($T > 4$ cm). DVHs of OARs were calculated and compared. (3) Thirty cervical cancer patients were CT scanned twice; first for treatment planning and a second time after the dose delivery. The initial plan was manually duplicated on the post-treatment image set in the treatment planning system (TPS) and DVH parameters were calculated. Pre- and post-treatment images, organ structures and plan data were exported from the TPS to 3D Slicer to validate DVH parameter calculation with 3D Slicer. The gamma analysis was used to compare Flexiplan® and 3D Slicer DVHs. Post-treatment images were rigidly fused on the initial CT to automatically transfer the data of the pre-treatment plan onto the post-treatment images. DVH parameters were calculated in 3D Slicer for both image sets and their relative variations were compared. (4) Images and structures of each pre- and post-treatment plan of previous cases were exported in DICOM format to an in-house MATLAB written code. MLP and RBF artificial neural network (ANN) were developed to predict the OARs dose variations. ANNs input data were based on the changes of OAR wall distance-to-dwell positions along the applicators that were extracted from two images series of each case. ANNs testing was performed by comparing the intra-fractional OARs dose variations obtained from TPS calculated DVH and that obtained from ANN-based computing. The performances of the ANNs were analyzed by mean square error (MSE). (5) A series of MATLAB codes were written as a model to propose a new planning data (dwell times) based on the second image sets of each patients. Another ANN was developed to estimate the new DVH parameters of OARs and CTVs after each new proposed treatment planning. MLP and RBF networks were tested.

Results: (1) The absorbed dose to point A ranged between 6.5–7.5 Gy. $D_{0.1cm^3}$ and D_{2cm^3} of the bladder significantly increased with the bladder volume enlargement. By increasing the bladder volume up to about 140 cm^3, the rectum dose was also increased. For the cases with bladder volumes higher than 140 cm^3, the rectum dose decreased. For bladder volumes lower than 75 cm3, the sigmoid dose decreased; however, for bladder volumes higher than 75 cm^3, the sigmoid dose increased. The D_{2cm^3} of the bladder and rectum were higher for longer tandems than for shorter ones, respectively. Divergence of the obtained results for different tandem lengths became wider by the extension of the bladder volume. The rectum and sigmoid volume had a direct impact on increasing their $D_{0.1cm^3}$ and D_{2cm^3} as well as decreasing their D_{10}, D_{30}, and D_{50}. (2) Bladder dose was significantly affected by both bladder volume and tandem physical length for $T \leq 4$ cm. This was reflected on the values obtained for D_{2cm^3} and $D_{0.1cm^3}$ for both empty and full bladder cases. When $T > 4$ cm no correlation could be established between variations in bladder dose and bladder volume. Rectum dose was generally lower when the bladder was empty and $T > 4$ cm. Dose to sigmoid was increased when $T > 4$ cm; this

increase was larger when the bladder was full. (3) In calculating DVH parameter variations no significant differences were observed between Flexiplan® and 3D Slicer. Where the registration accuracy was better than 0.03, they returned similar results for D_{2cm^3} of bladder, rectum and sigmoid. Mean and standard deviation of DVH parameters were calculated on pre- and post-treatment images for several organs; both the *manually duplicated plan* and the *automatically registered* plan in SlicerRT returned comparable relative variations of these parameters. For 88% of the organs more than 95% of the DVH dose bins passed the gamma analysis. (4) The best results were obtained by RBF networks with spread of 100, 50, 150, 200, and 150 for bladder, rectum, sigmoid, CTV_{IR}, and CTV_{HR}, respectively. MPE of the final networks were also 6%, 5%, 8%, 7%, and 10%, respectively. (5) RBF networks predicted more accurately in this step, too. Their MPE were 5%, 6%, 6%, 9%, and 11% for bladder, rectum, sigmoid, CTV_{IR}, and CTV_{HR}, respectively.

Conclusions: (1) There is a relationship between the volumes of OARs and their received doses. Selecting a bladder with a volume of about 70 cm^3 or less proved to be better with regards to the dose to the bladder, rectum, and sigmoid. (2) Our results suggest that for tandems longer than 4 cm, keeping the bladder empty may reduce the dose to rectum and sigmoid. This is contrary to cases where a shorter than 4 cm tandem is used in which a full bladder (about 50-120 cm^3) tends to result in a lower dose to rectum and sigmoid. Attention should be given to doses to sigmoid with long tandem lengths as a larger tandem generally results in a larger dose to sigmoid. (3) We tested an automated DVH assessment method with an imaging freeware, 3D Slicer, for use in IGABT. SlicerRT is a viable verification tool to report and detect DVH variations between different contoured images series. (4) An ANN-based model was introduced which can give a fast prediction of OARs intra-fractional dose variations during cervical cancer intracavitary brachytherapy independent from TPS based dose calculations. This can serve as a basis for online verification tools in brachytherapy dose delivery. (5) A RBF ANN model was introduced to predict the organs DVH parameters by having access to the relative organs-applicators geometrical data and source dwell times during the applicators.

THE EFFECT OF CT CONTRAST AGENTS ON TREATMENT PLANNING AND DOSE CALCULATION IN RADIATION THERAPY OF PELVIS CANCERS

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ABSTRACT

Introduction: Using contrast medium in diagnosis and identifying of an organ from its surrounding tissue is very useful. These contrast mediums alter radiation absorption of studied organs. The aim of this study is to identify the influences of contrast media in treatment planning system of the pelvis.

Materials and Methods: Seven patients with pelvis area cancer with two sets of CT image, one with contrast medium and another without it, have been used and influences of contrast medium in treatment planning system for these patients were studied.

Results: After using contrast medium 2.63% increase in MU for RL field and 0.79%, 1.05%, 1.42% decrease in MU for AP, PA, RL fields have been obtained in rectum, respectively. For Bladder cancer, 0.34% decrease in MU of AP filed and 1.57%, 0.46%, 0.39% increase in MU for PA, RL and LL fields have been calculated, respectively. For cervix cancer, 1.1% decrease for AP field and 0.68% increase for PA field have been obtained.

Conclusion: According to the DVHs and calculated MUs, the results showed that the dose differences between the plans for the CT images with and without contrast medium were less than about 2% and was clinically tolerable.

Keywords: Contrast medium Treatment Planning –System, CT Simulator, Radiotherapy , Pelvis Cancer

EVALUATION THE EFFECTS OF BOLUS-SURFACE AIR GAPS ON PDD IN ELECTRON BEAM

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Introduction: Megavoltage electron beam is an important treatment modality in the radiotherapy and provide a unique choice in the treatment of superficial lesions. For superficial tumors, the practical range maybe too large to provide sufficient healthy tissue sparing beyond the tumor depth. To fix this problem, a tissue equivalent bolus put on the surface of the patient. Other uses of bolus include flattening out irregular surfaces and reducing the electron beam penetration in some parts of the treatment field. Given the natural contours of the human body, it is difficult for a bolus to achieve perfect contact with the patient and air gaps are often present between the applied bolus and the patient's surface. This study investigates the effect of air gap under 0.5 cm bolus on the depth dose distribution of central axis in the electron beam.

Methods and Material: In this study the PDD data taken with 0.5 cm bolus using 3D water phantom. Bolus was place on the end-of-treatment cone and the results recorded. The electron beams had nominal energies of 7, 8 and 10 MeV and circular and square fields were 5 and 10 cm^2, respectively. Depth dose measurements performed in the 3D water phantom with a Roos electron chamber. Depth dose measurements performed with a Roos electron chamber and reference chamber was semiflex. The results for without and with gap measurements normalized to the maximum dose of each one.

Results: Using 5×5 and 10×10 cm^2 cone sizes, we noted a decrease in mean electron energy at the phantom surface ($\bar{E}_0$) with the 1.5 cm air-gap. Our results showed that 1.5 cm air-gap between 0.5 cm bolus and surface can increase the skin dose and reduce Rp, R50 and d max in different electron energies. Furthermore, the R90 decreases after the 1.5 air-gap compare to perfect contact of bolus and skin.

Conclusion: The present study shows, a bolus-surface air gap can decrease mean electron energy at the phantom surface, R90, Rp, R50 and d max and finally can increase the skin dose in different electron energies. Therefore, an air-gap between bolus and surface causes the increased skin dose and treatment area could not receive adequate doses.

Keywords: Electron energy, Skin dose, Bolus, Air-gap

بررسی انرژی اسمی شتابدهنده اختصاصی LIAC در IOERT به روش شبیه سازی مونت کارلو با استفاده از کد GATE

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مقدمه: کاربرد شبیه سازی مونت کارلو در حل مسائل رادیوتراپی و دزیمتری، به ویژه در مواردی که اندازه گیری دز در ناحیه مورد نظر امکان پذیر نبوده و یا همراه با عدم قطعیت باشد، از سال ۱۹۷۰ مورد توجه قرار گرفته است. در دو دهه اخیر تکنیک پرتودرمانی حین عمل با استفاده از پرتوهای الکترونی (IOERT)، که در طی آن دز ۱۰-۲۰ Gy حین جراحی به تومور و بستر تومور در یک جلسه انتقال می یابد، مورد توجه قرار گرفته است. با توجه به محدودیت های موجود در IOERT مانند عدم دسترسی به تصاویر CT بیمار در حین عمل و سیستم طراحی درمان، به کارگیری شبیه سازی مونت کارلو در بررسی توزیع دز جذبی، ضرورت می یابد. یکی از مهمترین مراحل در شبیه سازی مونت کارلو به کارگیری پارامترهای دقیق سر شتابدهنده و باریکه الکترون می باشد. اگر چه پارامترهای هندسی و فیزیکی دستگاه توسط شرکت سازنده ارائه گردیده، اما انرژی باریکه الکترونی یکی از مهمترین پارامترهای موثر در نتایج شبیه سازی می باشد که توسط شرکت سازنده به صورت انرژی اسمی، اعلام می گردد. لذا انتخاب دقیق انرژی باریکه الکترونی در اعتبارسنجی، نتایج شبیه سازی و نتایج دزیمتری شتابدهنده LIAC اهمیت فراوانی دارد و یکی از مهمترین مراحل در اعتبار سنجی شبیه سازی شتابدهنده LIAC می باشد. در مقاله پیش رو به بررسی انرژی اسمی و دستیابی به مقدار واقعی انرژی باریکه الکترونی در شبیه سازی شتابدهنده LIAC پرداخته شده است.

مواد و روش ها: سر شتابدهنده اختصاصی LIAC و فانتوم آب، طبق پارامترهای اعلام شده از طرف شرکت سازنده و با استفاده از روش مونت کارلو و کد Gate شبیه سازی شد. به منظور دستیابی به مقدار دقیق انرژی باریکه الکترونی، منحنی های درصد دز عمقی در راستای محور مرکزی و دز پروفایل در فانتوم آب رسم گردید. همچنین لازم به ذکر است نتایج شبیه سازی و اعتبارسنجی آن، با نتایج اندازه گیری عملی مقایسه شده است. جهت تعیین دقیق انرژی باریکه الکترونی برای هر انرژی اسمی با گام های ۰/۱ MeV در محدوده MeV ±1 شبیه سازی انجام شد. در نهایت برای هر شبیه سازی، منحنی PDD رسم شده با منحنی PDD حاصل از نتایج دزیمتری عملی، با استفاده از شاخص گاما به کمک نرم افزار Mephysto مقایسه شد.

نتایج: منحنیهای PDD حاصل از اندازه گیری عملی و شبیه سازی مونت کارلو برای تمامی انرژی های اسمی رسم و مقایسه گردید. برخی پارامترهای دزیمتریک از جمله بیشینه دز جذبی در داخل فانتوم آب (D_m)، عمق بیشینه دز (d_m)، عمق دز ۵۰٪ (R_{50}) و برد عملی (R_p) از منحنی های درصد دز عمقی و پروفایل دز استخراج و با مقادیر حاصل از اندازه گیری عملی با استفاده از اتاقک یونش Advanced Markus مقایسه شد و شاخص گاما به کمک نرم افزار Mephysto verisoft بدست آمد.

بحث: شاخص گاما در ۹۵٪ منحنی های PDD برای مقادیر تعیین شده در هر انرژی اسمی کمتر از یک بدست آمده است، که نشان دهنده صحت شبیه سازی می باشد. علت اختلاف مشاهده شده در ۵٪ منحنی ها را می توان به دلایلی از جمله خطای اندازه گیری عملی، بالاتر بودن رزولوشن محاسبات دزیمتری در شبیه سازی (در اندازه گیری عملی، رزولوشن مکانی ۲ میلی متر و در شبیه سازی، ۱ میلی متر) نسبت داد. همچنین لازم به ذکر است، خطای مشاهده شده مربوط به انتهای منحنی درصد دز عمقی بوده است که چون دز جذبی در آن ناحیه نزدیک به صفر می باشد، از لحاظ کلینیکی دارای اهمیت نمی باشد. در نهایت نتایج بیان شده و خطای بسیار کم شبیه سازی مونت کارلو (۲٪ در انتهای منحنی PDD) نشان دهنده این امر است که می توان از کد Gate به منظور ارزیابی و تعیین مقادیر دقیق انرژی اسمی بهره مند شد.

کلید واژگان: پرتودرمانی حین عمل با استفاده از پرتوهای الکترونی، شتابدهنده LIAC، انرژی اسمی، کد مونت کارلو Gate

THERMAL ENHANCEMENT EFFECT ON CHEMO-RADIATION OF GLIOBLASTOMA MULTIFORM

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Background: Hyperthermia plays a significant role in the chemo-radiotherapy effect in different malignancies. In this research, we treated Glioblastoma multiform (GBM) patients with hyperthermia (HT) along with the chemoradiation, in order to evaluate HT efficacy in terms of tumor volume changes, survival time, and probability.

Patients and Methodology: Thirty-eight GBM patients were distributed into two groups identified as chemoradiation (CRT), and also CRT plus HT (CRHT). The Karnofsky Performance Status Scale (KPS) was done before, immediately and three months after treatments. Capacitive hyperthermia device was used at frequency of 13.56 MHz (Celsius 42+ GmbH, Germany) for HT one hour before the radiotherapy for 10-12 sessions. Patients in both groups underwent MR imaging (1.5 Tesla) before, 3 and 6 months after the treatments. Thermal enhancement factors (TEF) were attained in terms of clinical target volume changes, *TEF(CTV)*, and survival probability *(SP)* or *TEF(SP)*.

Results: Age ranges were from 27-73 years (Mean=50) and 27-65 years (Mean=50) for CRT and CRHT groups, respectively. For 53% and 47% of cases biopsy and partial resection were accomplished in both groups, respectively. Means and standard deviations of tumor volumes were ۱۳۵.۴۲±۹۲.۵ and ۱۰۴.۱±۵۸.۴ cm^3 before treatment in CRT and CRHT groups, respectively, with no significant difference (P= 0.2). *TEF(CTV)* value was attained to be as 1.54 and 1.70 for three and six months after treatments, respectively, *TEF(SP)* was also equal to the 1.90.

Conclusion: HT enhanced the chemoradiation effects throughout the patient survival probability and KPS. TEF may reflect the hyperthermia efficacy for a given radiation dose.

Keywords: Hyperthermia, GBM, Chemoradiotherapy, Thermal enhancement factor

REAL-TIME DOSIMETRY THROUGH FIBRE OPTIC DOSIMETRY

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Real-time dosimetry, including the monitoring of the variation of radiation dose rate and measurement of absorbed dose to the region of interest during the dose delivery is a challenging issue. Ionization chambers, semiconductor dosimetric systems like diodes are used to monitor the dose, but due the reliability of the measurement, size and other technical issues such as detector effective size, water equivalency, energy dependency, etc. none of them were found to be the perfect tool. The current work investigates the capability of the use of real-time dose of organic plastic detectors accompanying crystals such as Carbon-doped Aluminium Oxide (Al_2O_3:C). Due to the small size of the detector used, the reliable signal, reproducibility, dose linearity, and dose rate response were checked. It has been shown that the plastic detectors are known as near water equivalent material. However, “stem effect” is observed as one major disadvantage of this type of detector. However, the major disadvantage of Al_2O_3:C crystal is not water equivalency.

Dose linearity of the response in a range of 0.05 Gy to 20 Gy dose was found reliable with R^2 = 0.995 through optically stimulated luminescence (OSL) assessment. Dose rate dependency for each pulse was also investigated and the dose rate of machine can be recognized perfectly through Radio-luminescence (RL).

The investigation shows that RL based dosimetry can be addressed as one of the potential ways for real-time dosimetry. In contrast, OSL is known as a suitable option for accumulated dose measurement.

Keywords: Optically Stimulated Luminescence, Radio-Luminescence, Dosimetry, Fibre Optic Dosimetry

OPTIMIZATION OF TOTAL BODY IRRADIATION FROM DOSIMETRIC POINT OF VIEW

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Total Body Irradiation (TBI) is a conditional Radiation Therapeutic regimen applied for treatment of several diseases including multiple myeloma, leukaemia, lymphomas, several solid tumours and body immune system suppression prior bone marrow transplant. TBI is reported to be an effective method when traditional chemo-therapy is not able to be applied. Based on American Association of Physicists in Medicine (AAPM) report, the lowest available dose rate should be used within a ± 10% whole-dose inhomogeneity to reduce the risk of complication.

The study investigates the most available potential TBI technique among reported ones so far based on current situation in Iran. Parameters such as human's experience, machines, insurance cover and support, cost effectiveness, simplicity of the delivery etc. has been taken into account to introduce a platform for Iranian radiation oncology societies.

Due to development of current treatment planning systems for isocentric treatment at 100 cm distance from the source, planning of TBI through the TPSs are not reliable and re-commissioning for TBI is compulsory. In addition, *in-vivo* dosimetry for all TBI cases is strongly recommended.

The reports demonstrates that the investigation of proposed TBI method for 47 patients with a ranges of prescribed doses will be able to deliver the dose requested with uncertainty of 2.062 +/- 0.093 Gy.

Keywords: Total Body Irradiation, Dosimetry, radiotherapy

REAL-TIME DOSIMETRY THROUGH FIBRE OPTIC DOSIMETRY

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Real-time dosimetry, including the monitoring of the variation of radiation dose rate and measurement of absorbed dose to the region of interest during the dose delivery is a challenging issue. Ionization chambers, semiconductor dosimetric systems like diodes are used to monitor the dose, but due the reliability of the measurement, size and other technical issues such as detector effective size, water equivalency, energy dependency, etc. none of them were found to be the perfect tool. The current work investigates the capability of the use of real-time dose of organic plastic detectors accompanying crystals such as Carbon-doped Aluminium Oxide (Al_2O_3:C). Due to the small size of the detector used, the reliable signal, reproducibility, dose linearity, and dose rate response were checked. It has been shown that the plastic detectors are known as near water equivalent material. However, “stem effect” is observed as one major disadvantage of this type of detector. However, the major disadvantage of Al_2O_3:C crystal is not water equivalency.

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IN-VIVO DOSIMETRY: RADIOCHROMIC FILMS VERSUS THERMO-LUMINESCENT DOSIMETERS

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Radio-graphic and recently Radio-chromic films are extensively applied as a powerful two-dimensional dosimeters for radiotherapy purposes including *in-vivo* dosimetry, treatment verification, and quality assurance tasks. In contrast to old-fashion radio-graphic films, radio-chromic ones have introduced more convenience and comfort for use. However, the structure of the products is essentially the same. Beside of films, a wide range of materials, mostly Lithium Fluoride, are used for Thermo-Luminescent Dosimetry tasks. Radiation dose, mostly surface radiation dose including entrance and exit radiation doses can directly be measured using TLDs. The measurement uncertainty using TLD and films are reported to be within 5%.
This study is a comparative effort to compare the radiochromic films versus TLDs used for different types of treatment as *in-vivo* dosimetry.

Results show that TLDs and film results are in agreement with the delivered dose and the average inconsistency was found to be 3.64 % and 2.77% respectively. However, TLD results depends on personal skill and the dosimetric tasks is known as a time intensive tasks. In contrast radio-chromic films were found more convenient and more flexible for the use. However, films should be scanned and the scanning is suffering from lateral response artefact (LRA). In order to manage the artefact, different strategies are applied to correct optical density for radio-chromic films.

Keywords: Radiochromic film, Radiographic film, Thermo-Luminescent Dosimetry

ASSESSMENT OF CENTRAL AXIS DEPTH DOSE WITH DIFFERENT BOLUS MATERIALS: AN ELECTRON RADIATION THERAPY STUDY

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Introduction: In radiotherapy boluses are often used on the skin for the following purposes: Increase the surface dose, flatten out irregular surfaces. As a compensator for missing tissue, reduce the electron beam penetration in some parts of the treatment field. Some physical characteristics of good bolus are non-toxic, non-sticky, good visibility, inexpensive, flexible, and tissue equivalent. The purpose of this study was to compare the central axis depth dose of distribution different bolus materials which are used in electron beam therapy to investigate the possibility of using different materials bolus in radiotherapy.

Method and Material: Super Flab, a towel dipped in water, wet gauze Vaseline and thermoplastic bolus were performed to dose measurements. The thickness of each sample was 0.5±0.1 cm. The percent depth dose was measured for the electron beams (7, 8 and 10 MeV) in a water phantom and for cone size 10×10 cm^2 with and without bolus. Measurements were made with ionization chamber accomplished at a source surface distance (SSD) of 95 cm.

Results: Based on our results, seems that towel dipped in water provides the highest surface dose, the maximum dose depth is closer to the surface and these values were very close to the surface dose values and the maximum dose depth obtained for the standard bolus. When bolus material is wet towel, the max dose is related to depths of 8.02, 10.2 and 16.96 mm for energies of 7, 8 and 10 Mev, respectively. While for Super Flab, wet gauze Vaseline and thermoplastic bolus maximum dose depth was more than the wet towel.

Conclusion: The towel dipped in water can be a good alternative to boluses in cases where access to the bolus is not standard or to maintain hygiene and prevent joint use.

Keywords: bolus materials, electron therapy, surface dose, dose distribution

APPLICATION OF FAILURE MODE AND EFFECTS ANALYSIS (FMEA) TO PRETREATMENT PHASE IN IMRT TREATMENTS.

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Objective: The overall goal of an FMEA in radiation therapy is to identify potential points of weakness in the process then set up procedures like FTA (fault tree analysis) to prevent failures from negatively affecting the patients. Design QA programs based on procedures and resources that are specific of the individual institutions.

Material and methods: An FMEA is conducted by a multi-disciplinary panel of personnel experienced in the process to be evaluated, starting with a detailed outline of the processes commonly in the form of a process map. The panel then identifies every failure mode possible for each step of each process and each of these failure modes is assigned three scores: The probability of occurrence (O), probability of failure to detect (D), the severity of the consequences (S). Each of these scores ranks from 1 (smallest risk) to 10 (largest risk). The product of the three scores for each failure mode results in the Risk Probability Number (RPN), which is then used to rank the failure modes in order of their potential impact on the patient and the clinic. The RPN for each failure mode is calculated as RPN = O × S × D. FMEA proved to be a powerful and flexible tool to develop and implement a quality management QM framework.

Result: Performing an FMEA of a process is beneficial to the entire process team as they developed a better understanding of the process components, their interactions, and the potential risks. This analysis clearly results in improvements to the overall treatment process and therefore reduced risk. By risk management reduce the RPN, Re-design the product or Improve Processes in order to: Remove the failure mode, Increase the detectability of the failure mode, or reduce the severity by changing the effect.

Conclusion: FMEA proved to be a powerful and flexible tool to develop and implement a quality management (QM) framework for IMRT technique. The QM checks are a starting point, for consideration and incorporation into the QM program defined by each institute.

Keywords: FMEA, Quality management, QA, IMRT, Risk Probability Number

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DOSIMETRIC COMPARISON OF FOUR DIFFERENT TECHNIQUES FOR SUPRACLAVICULAR IRRADIATION IN 3D-CONFORMAL RADIOTHERAPY OF BREAST CANCER

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Abstract

This study aimed to compare and evaluated the dosimetric characteristics of esophagus, spinal cord, carotid artery, lungs, and brachial plexus in patients with breast cancer undergoing four various techniques of supraclavicular irradiation. By keeping unchanged the breast tangential radiotherapy fields, four different treatment field arrangements were created to irradiate the supraclavicular region as follows: (1) four field (4F; 1 anterior-posterior and 1 posterior-anterior), (2) six field (6F; 2 anterior-posterior and 2 posterior-anterior), (3) five field-1 (5F-1; 2 anterior-posterior and 1 posterior-anterior), and (4) five field-2 (5F-2; 1 anterior-posterior and 2 posterior-anterior). Then, the dosimetric parameters for the above-mentioned organs were evaluated. The mean dose (Dmean) of the esophagus had significant difference between 6F and 5F-2 techniques. For the spinal cord, the Dmean dosimetric parameter demonstrated significant difference between the 4F and 6F techniques, and between the 4F and 5F-1 techniques, with lower values for the 4F technique. There was no significant difference between the different irradiation techniques in all the dosimetric parameters for the carotid artery. The Dmean of the left lung significantly differed between the 4F and 5F-2 techniques, with lower values for the 5F-2 technique. Furthermore, the V20Gy dosimetric parameter had significant difference between the 4F and 6F, and also 4F and 5F-2, techniques with lower values for 5F-2. The maximum dose (Dmax) of the brachial plexus showed significant difference between the two techniques of 5F. The V45Gy dosimetric parameter of the brachial plexus revealed significant difference between the 4F and 6F techniques, and also between the 4F and 5F-1 techniques, with lower values for 5F-1. In general, these techniques had similar dosimetric results, with little differences. The dosimetric parameters for the esophagus and lung showed better results with the 5F-2 technique in comparison with other techniques. Dosimetric results for the brachial plexus and spinal cord improved with the 5F-1 and 4F techniques, respectively, against other techniques. Dose distribution for the carotid artery did not differ in the four irradiation techniques.

Keywords: accelerators, medical; cancer; dose; radiation therapy

INTRA-FRACTION MOTIONS INDUCED SET-UP ERROR DURING THE RADIOTHERAPY PATIENT'S SET-UP AND POST- EPID IMAGING PROCESS TIME INTERVAL

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Introduction: Electronic Portal Imaging Device (EPID), as a detector with faster performance than radiographic film, without post imaging processing measures is an ionizing convertor to the electronic signals. It is currently used as a pre-treatment radiation delivery verification tool to ensure the therapy staff that the target organ position has not changed significantly before radiation delivering. In the case of shift detection, the patient can be repositioned before the treatment takes place. We aimed at compare the radiaotherapy patient's position pre and post EPID imaging process for Intra-fraction motion detection.

Materials and methods: The patient's translational position characteristics during the time interval of the patient's set-up process (reference position) was compared to the post-EPID imaging process for 6 patients. Rotational position characteristics were limited by the patient's body surface laser line-marker protraction in pre-treatment patient's set-up process. Department action level for EPID imaging software was purposed 3 (mm) in all directions. In this study the patient's deviation from reference points was measured and checked using laser line-marker impression coincidence before and after the imaging process.

Results: Four patients were automatically repositioned (by EPID automatic table alignment) by an average of 6.98, 3.2 and 4 mm in X, Y, Z axes, respectively and the rotation was zero. Two other patients did not go beyond the adjusted action level and remained intact. Mean deviation of 5.5, 2 and 3 (mm) were measured (in 3 axes of X, Y, Z respectively) based on sagittal, axial and coronal laser line-marker for two intact patients position after entering the treatment room. It showed that patient's intra-fractional movements between pre and post imaging time intervals could affect the patient's treatment accuracy in all the next fractions and induced a systematic errors.

Conclusion: The technique of along the laser lines with the marker (on the patients surface body) and comparing their (laser&marker) coincidence before and after EPID Imaging (before the treatment starting) and shorten imaging time seems to be a helpful, easy and practical method to consider these important movements and avoid any misalignment. Especially for patients using any immobilization devices. Therefore, accurate drawing of treatment points (and laser lines) before imaging, in first session, is necessary to avoid any possible errors. More patients, also EPID imaging-based deviation measurements calls for more evaluation in future studies.

EVALUATION OF MLC LEAF POSITIONING ACCURACY: A GAFCHROMIC FILM STUDY

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Introduction: Accurate multileaf collimator (MLC) positioning plays a vital role in the patient dose. In three Dimensional Conformal Radiotherapy Technique (3D-CRT), the accuracy and precision of MLC position affects the dose near the border of the treatment field. In this paper we examine the accuracy of static MLC position.
Materials and methods: This study was aimed to evaluate the accuracy of static MLC positions using radio chromic film . The measurements accomplished in this study were carried out on accelerator Elekta (6 MV) which is assembled by 51 pairs MLC. The pattern was created using mlc shaper software to identify a point of known distance from the radiation center, two interleaf- leakage lines ,the horizontal-line and the vertical-lined field were created. By this means a narrow vertical line was utilized as a reference line for the determination of the leaf tip locations, which the horizontal line was a guide to recognize the leaf numbers along the film. the film was scanned using Microtek ScanWizard Pro with 16-bit grayscale images at a spatial resolution of 72 dpi and was analyzed using PTW Mephysto mc^2 which determined leaf edge of MLC using profile.
Results: The measurement showed that the average error value of the best precision which obtained at leaf number16 (bank B) was 0.01 mm than expected place and the worst at leaf number 2 (bank B) was 0.98 mm than expected place. the results also showed that the precision in positioning of the bank A was better than bank B which the average errors were o.27 mm and 0.36 mm respectively.
MLC leaves positioning errors using profiles in MEPHYSTO were not within tolerance in leaves numbers 1,2,7,9,11 and 13 in bank A and leaves numbers 1,4,21,23 and 25 in bank B so the MLC calibration was recommended.

Keywords: Radiotherapy; multileaf collimator; Gafchromic film;

IT WAS FOUND THAT THE RADIOCHROMIC FILM CAN DETECT SYSTEMATIC ERRORS ON THE ORDER OF 2 MM OR ABOVE. THE EFFECT OF A COUCH ON THE DEPTH DOSE ON MEGAVOLTAGE PHOTON BEAM ATTENUATION

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Introduction: The most common material used in couch is Carbon-fiber. Carbon-fiber couch are an important tool as it causes less beam attenuation than other materials. Physical properties of carbon fiber couch are high strength, low density, translucence, are more desirable for radiotherapy treatment. This study was conducted to investigate the photon-beam attenuation by a Carbon-fiber couch for 6 and 15 MV photons.

Method and material: For 6 and 15 MV energies the attenuation of the treatment couch was measured in a solid water phantom for 0° and 180° gantry angles and collimator angles fixed at 0° for a square field size (10 × 10 cm^2, SSD (source to surface distance) 100 cm). Dose measurements were taken using a parallel plate ionization chamber.

Results: The depth dose maximum (Dmax) for 6 MV and 15 MV photon energies were 1.5 cm and 2.6 cm, respectively and the Dmax for beams passing through treatment couch were 1.1cm and 2 cm, respectively. Maximum attenuation was measured for 6MV. The couch created a maximum attenuation of 2.4% and a surface dose increased from 47% to 97 % for 6 MV and 30% to 82% for 15 MV, respectively.

Conclusion: *Attenuation* is *greatest* at low photon energies and least at high photon energies. The *surface dose* values of low photon energies were higher than the high photon energies. Therefore, low photon energies delivered through treatment couch lead to damage of skin and causing skin burns.

Keywords: Attenuation, treatment couch, parallel plate ionization chamber, surface dose

DESIGN AND MANUFACTURE OF RESPIRATORY CONTROL BELT USING LOAD CELL SENSOR

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Abstract: The purpose of this study was design and manufacture a respiratory gating belt using a load cell sensor in order to record the patient respiratory signals.

Material and Methods: The respiratory signals were acquired from the load cell sensor (with milivolts (mV) unit). A special main board was designed to convert an analog data to a digital data (A-to-D). In addition, different parts such as pre-amplifier, micro-controller and Bluetooth were considered in the main board. The MATLAB Program was used to analyze the transferred data from the belt to the computer.

The Validation of the accuracy of this respiratory belt was performed according to a comparison between our data with the results from available commercial SOMNO device in terms of shape and amplitude for a clinical test.

Result: The accuracy of the manufactured respiratory belt was in good agreement (with a coefficient factor of 0.6) compared to the SOMNO device.

Conclusion: This respiratory control belt can be used for both imaging and radiotherapy purposes, especially for estimating a tumor movement located in abdominal and thoracic region.

INTEGRATING FMRI DATA INTO 3D CONFORMAL RADIATION TREATMENT PLANNING OF BRAIN TUMORS

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The main purpose of this investigation was to evaluate the effects and benefits of fMRI data into radiation treatment planning of brain tumors in order to selectively preserve brain's functionally considerable regions from radiation damage. In this study, the fMRI data from 3 low grade glioma patients were obtained using an fMRI block-designed paradigm and incorporated into the radiation treatment planning. These patient-specific fMRI data were attained based on tumor location, *patient's general* status, and the importance of functional area. The fMRI data were analyzed (processed) using the SPM software and the active areas of each patient were determined. The resulting activation volumes were fused with the anatomical MR images and the simulation computed tomography (CT) scan. The functional and anatomical organs at risk and the tumor were contoured for the radiation treatment planning. Finally, the radiation treatment planning with and without functional information was obtained and compared.

Results: On average, we attained respectively 51.21% (P = 0.003) and 34.76% (P = 0.003) decrease in the mean and maximum doses to the functional regions without compromising the dose coverage to the planning tumor volume or the dose-volume restrictions to anatomical organs at risk.

Conclusion: In this study, we demonstrated the feasibility of using fMRI data into radiation treatment planning in order to maximally preserve the functional cortex of the brain from radiation. We also observed a significant reduction in the mean and maximum doses reached to these neurologically relevant brain regions. The decrease in dose would diminish the neuro-cognitive complications and increase the patient's quality of life. The results of this study can provide the ground for future clinical follow-up studies in order to more accurately investigate the neurological-cognitive effects of this dose reduction on patients.

Keywords: Cancer, Brain Tumor, Functional Cortex, Radiation Treatment Planning, Radiation Therapy

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INVESTIGATING THE NEUTRON SPECTRUM BY THE HIGH-ENERGY SIEMENS ONCOR LINEAR ACCELERATOR USING THE MCNPX CODE

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Abstract

Purpose: Considering the high dependency of neutron measurement on the neutron energy, this study investigates the neutron energy spectrum in different points of the patient's plane, photon beam energy, and field size for the Siemens Oncor linac.

Methods and materials: In this study, the Monte Carlo code, MCNPX (version 2.7.0), was used to simulate a Siemens Oncor linac model. The neutron energy spectrum and average energy of neutron in the central axis and at 30 cm inferior were calculated for 7 × 7 and 20 × 20 field sizes and energies of 15 and 18 MV.

Results: The neutron spectrum covers a wide of neutron energy from thermal neutrons to fast neutrons. With decreasing distance from the central axis and increasing photon beam energy, the fraction of the fast neutrons in the neutron spectrum increases, resulting in an increase in the average neutron energy. With increasing the distance from the central axis and decreasing the photon beam energy, the maximum neutron energy in the neutron spectrum shifts toward lower energies and the total neutron fluence decreases. Generally, the average neutron energy, the maximum neutron energy, and the total neutron fluence were increased by increasing field size. Studying the shape of the neutron spectrum, it should be noted that the change in photon beam energy and field size does not affect the shape of the neutron spectrum and the peak of the neutron spectrum is within the range of thermal neutrons.

Conclusion: The neutron spectrum and derived factors vary under different conditions (e.g., photon energy beam, site, and field size). Therefore, it is necessary to explore their changes during the neutron measurements.

Keywords: neutron spectrum; neutron average energy; neutron flux; linear accelerator; high energy photon; MCNPX.

THE COMPARISON OF EFFECT GOLD NANOPARTICLES ON THE DOSE DISTRIBUTION AT COMBINED (EXTERNAL & INTERNAL) AND EXTERNAL RADIOTHERAPY OF THE PROSTATE IN A PELVIC PHANTOM USING THE GEL DOSIMETRY AND MONTE CARLO METHOD

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Abstract:

Background : Recently, for the treatment of advanced prostate cancer with radiotherapy, the total dose of 18 MV energy given to the pelvis. Afterwards according to the actual size of the tumor, the proportionate dose will be transferred to the patient with brachytherapy method. In this study, by using of the MAGIC-f gel and Monte Carlo method, the values and the dose distributions due to combine the high dose rate Ir-192 sources with 18MV photon beams were assessed and compare for the prostate external and combined radiotherapy, with or without the presence of gold nanoparticles (GNPs).

Materials and Methods: At Plexiglas phantom had been made the presenting human pelvis, hollow tubes made of Plexiglas were located in the anatomical location of prostate and bladder inside the phantom. Afterwards, the MAGIC-f polymer gel dosimeter was synthesized. It was fabricated to pour in the tubes located in the prostate (with and without the presence of GNPs) and the bladder regions. To calibrate the gel dosimeter, the tubes containing the gel were irradiated by using a Varian 2100 linear accelerator. The phantom pelvic was irradiated at external and combined radiotherapy methods. In the combined radiotherapy, the phantom was irradiated once to the 18 MV linac energy and thereafter to the high dose rate Ir-192 sources. The gel dosimeters were read using a Siemens 1.5 Tesla Magnetic Resonance Imaging (MRI) scanner 24 hours after the irradiation. The R2 maps were extracted from multiple images of the tubes and phantom. The values of the absolute dose and isodose curves resulted from experimental measurements of the reference points with the values of the computational Monte Carlo simulation with the MCNPX code at the same points were compared for both of the external (only) and combined radiotherapy techniques.

Results: The mean absorbed dose values measured with the gel in the presence of the GNPs in prostate region were 9% and 14 % higher than the corresponding values without the GNPs in the external and combined radiation therapy. The Monte Carlo simulations also indicated a dose increase of 8 % and 13 % practice respectively, due to presence of the GNPs, for the same irradiation conditions read in the experimental measurements.

Conclusion: The use of gel dosimetry could be determine to dose distribution and DEF(Dose Enhancement Factor) in presence GNPs. In the combined of radiotherapy (radiotherapy combined with brachytherapy), the effective dose to the target volume has been higher and the dose value to normal tissues surrounding of the prostate is much smaller than the external radiotherapy.

Keywords: Gold nanoparticles, Polymer gel dosimetry, Prostate, radiotherapy, combined radiotherapy, Monte Carlo simulation.

DOSIMETRIC EVALUATION OF BREAST HYPOFRACTIONATED RADIOTHERAPY USING FORWARD INTENSITY MODULATED RADIOTHERAPY TECHNIQUE

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Introduction: Hypofractionation is a radiotherapy dose regimen which involve the delivery of radiation therapy with a dose per fraction > 2.0 Gy.
Radiation therapy (RT) is the most common part in local management of early breast cancer. The execution of homogeneous dose distribution inside the target volume is the major difficulty with tangential field breast irradiation. With the advent of the multileaf collimators (MLCs) and model based algorithms of treatment planning, technique of segmented fields, called forward intensity modulated radiotherapy (FIMRT), has been introduced to improve the isodose distribution. This study was conducted to dosimeteric evaluation and quantification of the hypofractionated FIMRT versus two tangential wedged fields (2FW) technique for the treatment of breast cancer.
Materials and Methods: 25 left-sided breast cancer patients were selected for our study. All patients were were scanned on a CT simulator in spiral mode with slice thickness of 0.5 cm. Radiation oncologists contour planning target volume (PTV), planning target volume for evaluation (PTV-5) (5 mm below the skin), and organs at risk (heart ad ipsilateral lung). The tangential technique of treatment planning consists of two optimized wedged beam without blocks (2FW) were compared to FIMRT plans for same patients. The FIMRT plans were done by optimizing the isodose distribution on the standard tangential plan. To this end, the dose distribution via the beam's-eye view was observed. Then, the primary tangential fields were copied as open fields and the areas of the breast receiving high doses (105%, 107%, and 110% of the prescription dose) were shielded using the MLCs. The weight of additional subfields was approximately 6–10% of the total dose. FIMRT and 2FW was planned for hypofractionated delivery of 40 Gy dose to the target (≥ 0.97% volume coverage) for 16 fractions of 2.5 Gy. The minimum dose, maximum dose, mean dose and homogeneity index (HI) of the dose for the PTV_5 were obtained for both techniques. Moreover, maximum and mean dose for the lung and heart tissues were obtained. The monitor unit counts required for treatment and the percentage doses which encompass 97% of the PTV_5 were recorded for both techniques. Paired samples t-test was used for statistical analysis and $p < 0.05$ was considered as significant level. All beams used in the study were 6 MV photon beams from an Elekta Synergy platform linear accelerator equipped with a 40-leaf-pair multileaf collimators (MLCs).
Results: The evaluation of the DVHs showed that the homogeneity index between the two techniques was significant ($p > 0.05$), HI= 1.12 vs 1.07 for 2FW and FIMRT, respectively. Mean dose to the breast PTV as mean± standard deviation (SD) value was 41.8±0.7 Gy for FIMRT vs. 42.1±1.1 Gy for 2FW plans.
The percentages of the PTV receiving a 97% of the prescribed dose of 40 Gy in 16 fractions was 96.1%± 1.2%, and 95.3%± 1.9 for the FIMRT and 2FW treatment techniques, respectively. The treatment monitor units (MUs) of the 2FW plans and FIMRT plans were 218.3 ± 15.1 and 182 ± 9.1 MUs, respectively. With the hypofractionated FIMRT technique, the mean dose of the heart and the lung was (1.7 Gy vs. 0.9 Gy) and (10.4 Gy vs. 5.8 Gy) respectively, compared with the 2FW technique. In addition, the maximum doses in the heart and lung were decreased significantly from (2.9 Gy to 1.4 Gy) and (14.1 Gy to 8.7 Gy) in favor of the FIMRT plans.
Conclusion: The FIMRT technique improves the dose homogeneity in the target. Furthermore, the treatment MUs were significantly reduced by the FIMRT-RT technique ($p < 0.05$). To conclude, the hypofractionated FIMRT technique can be suggested in hypofractionation of breast for sparing of lungs and heart as well as more homogenous dose to the breast.

Keywords: Intensity modulated radiation therapy, Breast cancer, Hypofractionated radiotherapy, Conformal radiotherapy, Dosimetry, Heart dose, Lung dose, Dose-volume Histogram

A NEW BONE EQUIVALENT MATERIAL AN ORDER TO ELECTRON DENSITY

Radiation has described as particles and electromagnetic wave and carried energy; in addition, it leads depositing energy in the human tissue.
Phantoms help radiation scientists compute precisely doses delivered into organs of human body that the radiological characteristics of the phantom is important. Materials used in phantoms should maintain characteristics of the mechanical integrity, change in different shapes easily since they are formed a shape such as all of human body or part of it and also have densities the equal of tissue while to have the same electrons number per gram.
this technical study is about making bone equivalent material for phantoms building and dosimetry.
according to ICRU 44 (ICRU,1989) the bone equivalent material (elements) have been chosen in this order: in each 120 grams contain 75 grams of Epoxy resin, 25 grams of calcium carbonate, $CaCo_3$, 10 grams of sodium hexametaphosphate, $Na_6P_6O_{18}$, 5 grams of magnesium carbonate, $MgCo_3$. $Mg(OH)_2.\ 5H_2O$ and 5 g (Calcium hydroxide) $Ca(OH)_2$.
Electron density in terms of electron per cubic centimeters (cm^3) is calculated by following formula: Multiplying N (Avogadro number) in the atomic number (Z), then diving it into mass number (A) are done as followed to calculate the number of electrons in grams (e/gr):
e/gr = N * Z /A

then by Multiplying in atom density the result will be Electron density
e/gr * gr/cm^3 = e/cm^3
After that, the electron density obtained for each element was multiplied by the number of that element in the material and then, in the percentage of the material used in the ultimate composition, in this way, the electron density of each component of matter was obtained that by obtaining the average density, the mean electron density of the whole bone equivalent material is calculated.
Therefore, electron density is obtained about $5.535*10^{23}$ for bone equivalences. Since the electron density of bone is $5.264*10^{23}$, there is difference about 4.9 percent between them that is acceptable in accordance with therapeutic range, which Campton is dominant

Keywords: bone equivalent material, electron density,

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INITIAL EXPERIENCE IN ^{18}F-FDG TUMOUR IMAGING WITH EASYPET-3D SCANNER

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Abstract:

Introduction: Nowadays, to satisfy the requirements of preclinical cancer research programs, dedicated small animal positron emission tomography (PET) scanners have been developed to image tumour animal models at the molecular level. The feasibility of mouse solid tumour imaging, using a dedicated preclinical PET scanner with [F-18]-fluoro-2-deoxy-d-glucose (^{18}F-FDG), was evaluated. The easyPET technology (a patented axial microPET system) allows achieving good sensitivity and state of the art spatial resolution across the whole field of view. Since glucose has a high uptake in certain organs and in tumours, ^{18}F-FDG is one of the most used radiotracers for cancer imaging. In this context, the main application in oncology is to determine if the subject is a candidate for the study and to assess therapeutic response in tumoural models.

Materials and Methods: In total, 35 BALB/c-nu/nu mice were used: 21 males were inoculated with 3×10^6 WiDr cells (human colon cancer); and 14 females with 6×10^6 MCF-7 cells (human breast cancer + estradiol injection 1-wk post-inoculation). Tumoural cells were inoculated subcutaneously in the right flank in both models. Typically WiDr tumours started to be visible and measurable 2-3-wks post-inoculation, whereas MCF-7 tumours only 4-7-wks post-inoculation. ^{18}F-FDG (8-26 MBq/0.2-0.5 mL) was intraperitoneally (i.p.) administered. 40 min later, the animals were anaesthetized (i.p.) with a mixture of ketamine/chlorpromazine (3:1) diluted 1:1 in saline. A scan with 10^6 counts was performed approximately 60 min after ^{18}F-FDG injection. PET images were reconstructed with the 3D MLEM-OSEM algorithm and processed in AMIDE software. The studies were performed according to the 2010/63/EU Directive on the protection of animals used for scientific purposes, and according to the Annex IV of the national law no 113/2013, regarding the severity of the experimental animal procedures.

Results: The easyPET-3D images allowed to decide if the subject was a candidate for the study or not, based on the development or not of a tumour due to the injected cell lines, respectively. Regardless of the type of tumour, three distinct cases were evaluated. In the first one, the subject already presented a considerably large tumour (externally visible and measurable: 11×9 mm), easily detected and imaged by the easyPET-3D system; in the second and third cases, it was impossible to tell if the mice had a tumour without any imaging technique, since there was no externally visible lump. Once easyPET-3D imaging was performed, it was clear that one mouse had a metabolically active tumour and the other did not. Hence, easyPET-3D was able to detect and characterize tumours at a very early stage (1-1.5 mm), as well as to monitor their growth along time, with anatomopathology confirmed by histological studies.

Conclusion: By inoculating two cell lines of human cancer cells in two sets of BALB/c-nu/nu mice, easyPET-3D images were acquired to evaluate the potential of this equipment for ^{18}F-FDG solid tumour imaging in mice. The results suggest that the easyPET-3D technology has a great potential for applications in oncology. EasyPET-3D scans provided an efficient fast detection of tumours, originated either by human colon and breast cancer cells - all confirmed by histology - thus enabling an early diagnosis and a precocious start of therapy. Furthermore, easyPET-3D allows a direct molecular assessment of treatment effects by follow-up imaging.

Keywords: PET, Tumour imaging, Oncology

THE INVESTIGATION OF NANOPARTICLES FEATURES ON DOSE ENHANCEMENT: A SIMULATION STUDY

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The radiotherapy aimed to increase the dose in the tumor while reducing the dose of normal tissues. To achieve this goal, several efforts have been done. Nanoparticles are introduced as a radiosensitizer agent in radiotherapy for decades. Selecting the appropriate concentration and material in the case of optimum dose enhancer is important. Monte Carlo code provides an appropriate tool to investigate the characteristics of nanoparticle without any toxic effect. In the current study using the Geant4 toolkit, a realistic geometry of the cell simulated and nanoparticles with different concentration placed around the nucleus. The results show that there was a direct relationship between the concentration of nanoparticles and dose enhancement factor. Hence, the highest increase occurred at concentration of 30 mg/g. Moreover, the DEF of each material like gold, silver, gadolinium, and platinum picked at certain energy that is close to their K-edge . This study gives an overview to indicate optimal energy and concentration for a better choice of nanoparticles in clinical trials.

A NEW METHOD FOR THE CALCULATION OF EQUIVALENT PATH LENGTH USING DIGITALLY RECONSTRUCTED RADIOGRAPH FOR TWO-DIMENSIONAL EMPIRICAL REAL TIME TRANSIT EPID DOSIMETRY

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Background: In-vivo dosimetry (IVD) is one of the major challenges in radiotherapy. The increase in complexity of radiotherapy treatments requires more and more accurate and efficient strategies to verify the dose delivered to patients. The current study introduces a rapid empirical transmission dosimetry through an Electronic Portal Imaging Device (EPID), to achieve a two-dimension dose distribution by calculating the equivalent path length (EPL) matrix obtained from Digitally Reconstructed Radiographs (DRR) for heterogeneous environments.
Method: First, the relationship DRRs' pixel values obtained via Plastimatch software with the thickness of homogenous slab phantoms was determined. Second for the Alderson phantom the corresponding DRR was obtained at the midplane, and then it was converted into an EPL matrix using the equation obtained at the first step. The EPID image was converted into portal dose image using the calibration curve, which has already been obtained. The scattering contribution was applied to obtain the primary dose. Furthermore, by means of a verified back-projection algorithm, EPL matrix and the necessary scatter corrections, a 2D dose distribution at the midplane was obtained.
Results: According to the results, the method developed to obtain the EPL matrix using DRR is able accurately calculate the dose at any depth of interest. The results of 2D dose distribution for a homogenous slab phantom and a prostate case as an inhomogeneous medium were compared with the dose distribution obtained from treatment planning system using gamma function at the midplane with criteria the distance to agreement of 3 mm and dose difference of 3%.
Conclusion: The results showed an acceptable consistency. Therefore, the method proposed can be used in real time EPID dosimetry because it does not require time-consuming calculations.

Keywords: Real-Time EPID Dosimetry, Digitally Reconstructed Radiograph, Equivalent Path Length, Radiotherapy

پیاده‌سازی تکنیک تابش‌دهی فوتونی کل بدن روی فانتوم شبه انسان در بیمارستان امام خمینی تهران

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چکیده

مقدمه: تابش تمام بدن (TBI) یک تکنیک رادیوتراپی است که طی آن کل بدن با پرتوهای فوتونی مگاولتاژ تابش‌دهی می‌شود. هدف از این مطالعه پیاده‌سازی تکنیک TBI روی فانتوم شبه انسان در بیمارستان امام خمینی تهران می‌باشد.

مواد و روش‌ها: در این مطالعه فانتوم شبه انسان در هندسه مخالف و موازی دوجانبه تحت تابش TBI با فوتون‌های ۱۸MV و ۶MV قرار گرفت. از کیسه‌های پارچه ای پر شده با برنج خام به عنوان جبرانگر استفاده شد. به منظور دزیمتری در نقاط مختلف بدن فانتوم طی تابش‌دهی از فیلم‌های گاف‌کرومیک EBT_3 استفاده شد.

نتایج: مقدار یکنواختی دز در انرژی ۱۸MV در اکثر نقاط در محدوده قابل‌قبول ٪۱۰± قرار گرفت در حالی که در انرژی ۶MV در سه نقطه از بدن غیر یکنواختی توزیع در بیش از مقدار قابل قبول بود. مقادیر دز دریافتی ریه در شش فرکشن برای انرژی ۶MV و ۱۸MV به ترتیب برابر با ۱۰/۱۶ و ۱۰/۰۱ گری می‌باشد. مقادیر عدم قطعیت در صحت تحویل دز برای هر دو انررژی نیز کمتر از ٪۵ به دست آمد.

بحث و نتیجه‌گیری: مقدار یکنواختی توزیع دز با افزایش انرژی دسته پرتو بهبود یافت. کیسه‌های برنج جبرانگرهای مناسبی هستند. با توجه به نتایج به دست آمده اکنون آمادگی لازم برای راه‌اندازه تکنیک TBI در بیمارستان امام خمینی وجود دارد.

کلمات کلیدی : تابش تمام بدن، هندسه دوجانبه، یکنواختی دز، جبرانگر

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MODELING THE RELATIONSHIP BETWEEN THE PROTON ENERGY, RANGE AND LATERAL SCATTERING IN THE WATER PHANTOM FOR PROTON THERAPEUTIC ENERGY USING GEANT4 TOOLKIT

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Introduction: Proton therapy as a new treatment method, reduces side effects of radiotherapy[1]. The quality of treatment in radiotherapy depends on the dose calculation algorithm[2]. The pencil beam method is currently used to calculate the dose in proton therapy [3]. Studies have shown that pencil beam algorithm method can lead to a 30% uncertainty in radiation therapy dose measurement[4, 5].
There are two methods for correcting the dose calculation algorithm in proton therapy. In the first method, the equipment is used to accurately calculate the Range of the radiation. These include IGPT[6] and Gated proton therapy[7]. In another method, modeling the exact location of the proton range as function of input parameter[8, 9] help to reduce current uncertainty in dose measurements. In the present study, it was attempted estimate at a precise formula between the proton range and lateral scattering and the input parameter (energy).
Material and Methods: The 30×30×50 cubic water phantom was simulated and exposed to proton beams in the Geant4 toolkit. Proton beam energy was in the range of 5-250 MeV (therapeutic therapy). For each energy, the amount of energy stored per millimeter of depth of phantom was calculated and the depth dose chart was plotted. Modeled phantom was in good agreement with Zarifi.et al[10] calculations. A table was made up of the energies used as independent value, proton range and lateral scattering as dependent value. Finally graph of proton range versus proton energy and the graph of proton lateral scattering versus proton energy was plotted. In order to find mathematical modeling of proton range and proton lateral scattering versus energy, pervious graph was fitted using fitting techniques in MATLAB 2015 software.
Results: Results showed that, exact location of the proton range can be modeled using the following formula:

$$Range = a \times Energy^{b}$$

a=0.00206and b=1.78421,
And the lateral scattering of proton can be modeled by:

$$Lateral\ Scattering = a1 + b1 * x + c1 * x^{2}$$

$a1 = -0.08689$ And $b1 = 0.00568$ and$c1 = 3.8E - 5$.
Conclusion: Performed calculations showed that, it is possible to establish the exact formula to calculate range of proton beam as function of proton energy. This formula was modeled in homogeneous medium. For inhomogeneous medium more calculation needs and this formula must be modified.

Keywords: Proton range, Geant4, proton therapy, mathematical modeling, lateral scattering

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INVESTIGATING RADIATION SHIELDING FOR A TREATMENT ROOM OF A 6 MV LINAC USING THE NCRP REPORT 151 RECOMMENDATIONS

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Abstract

Purpose: Comparison of lead, iron, and ordinary concrete to shield a treatment room for a 6 MV linac

Methods and materials: A treatment room at Isfahan Omid Hospital was considered for shielding under the following conditions: the walls were made of ordinary 2.35 g/cm^3 concrete, there was a 6 MV linac at the center of the treatment room, 100 patients were treated every working day (16h), work load was w=1250 Gy/wk, without IMRT condition, and the limit dose was 0.02 mSv/wk for the general public and radiation workers' places. The thickness of concrete and the equivalent thicknesses of lead and Iron required for shielding the walls were calculated according to the NCRP Report 151 recommendations.

Results: In a 6 MV linac treatment room, the ratios of thicknesses of shields walls were 2/10, 3/10, and 3/2 for lead/concrete, steel/concrete, and steel/lead, respectively. Also, concrete shields increased the dose rate in front of the maze door up to three times more than lead and iron shields.

Conclusion: In shielding the walls of treatment room for a 6 MV linac, iron and lead can be dosimetrically more useful than concrete.

Keywords: Concrete; Lead; Steel; NCRP-151; 6MV linac; bunker.

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EVALUATION OF OAR DOSE CALCULATION ALGORITHM BY COMMERCIAL TREATMENT PLANNING SYSTEMS IN SLIDING WINDOW IMRT AND 3DCRT

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Abstract

Introduction: The out-of-filed dose can be clinically important as it is related to normal tissue irradiation as the aim of the radiation therapy is decrease normal tissue complications (NTCP) while increasing tumor control probability (TCP).Actually radiotherapy treatment planning systems are not commissioned for out-of-field dose calculations. Although it is clinically important to quantify the accuracy of calculated organ-at-risk doses. Now days, using modern radiotherapy techniques such as IMRT is more common. On the other hand this techniques include increased monitor units intensity modulated radiation treatment (MUs) for dose delivery in comparison with conformal radiotherapy, and these higher number of MUs result to increased peripheral dose which generally is known as low dose region. This increased peripheral dose distribution can lead to increase the risk of secondary cancer after IMRT. The objective of this study is evaluation and quantify the accuracy of out-of-field dose calculation accuracy of ISOgray and Eclipse treatment planning systems (TPSs), through in-phantom dosimetry for these TPSs.

Materials & Methods: In the current study, Nine field IMRT plans for prostate cancer were generated for ten patients, being treated with sliding window IMRT technique. The commercial TPS Eclipse Version 13.0.26 (Varian Medical Systems, Palo Alto, Ca, USA) with the anisotropic analytic algorithm (AAA) dose calculation algorithm and a dose grid of 2.5 mm, and ESOgray TPS with the collapsed cone convolution (CCC) dose calculation algorithm were evaluated in this study. At first for evaluation of the accuracy of dose calculation algorithm in outside the field area by ISOgray and Eclipse treatment planning systems, dose measurements were performed in three different depths (10, 15 and 20 cm) and in three different field sizes (10 × 10, 20 × 20 and 30 × 30 cm^2) at 1-8 cm distances far from the field edge with 1 cm intervals. The corresponding data in the same condition were measured by a water phantom and Farmer ion chamber based on the TRS 398 protocol. At second step TPS dose calculation at various out-of-field anatomical locations of the radiosensitive OARs by Delta $^{4+}$ Phantom according to the report of American Association of Physicist in Medicine (AAPM) Task Group (TG) 218 in 2018, gamma passing rate (3%,3mm) were verified.

Results: In this study, the treatment planning system Eclipse underestimated the out-of-field dose for all 10 IMRT plans, and the underestimation increased as a function of distance from the field edge For the ISOgray treatment planning system the results show dose overestimations in the 1-8 cm distance from the field edge in the water phantom.. In the 10 cm depth and 10 × 10 cm^2 field size the discrepancies were significant (p<0.05). An average underestimation of 38.80% was observed in the calculation of Eclipse treatment planning system (p<0.05).

Conclusion: Based on the results of the current study, the accuracy of dose calculations of the evaluated treatment planning systems is poor in calculation of dose in out-of field regions. In clinical practice, AAA algorithm's significant underestimation of the out-of-field dose could be used to estimate the risk of secondary cancer. The underestimation of TPSs increases with increase of distance from the field edge. In IMRT technique the TPSs underestimated the dose for the OARs including rectum, bladder and femoral head.

Keywords: Treatment planning system, IMRT, OAR, Dosimetry, prostate cancer

تعیین دوز رسیده به جنین در اسکن VENTILATION/PERFUSION ریه با استفاده از شبیه‌سازی مونت‌کارلو

چکیده

مقدمه: آمبولی ریوی PE (Pulmonary Embolism) یک انسداد در یکی از رگ های ریه است. اسکن V/Q (Ventilation/Perfusion scan) به عنوان مرسوم ترین روش تشخیصی PE در زنان باردار به کار می رود که بررسی دوز رسیده به جنین و مقایسه آن با مقادیر توصیه شده است. هدف این مطالعه تعیین دوز رسیده به جنین در اسکن V/Q با استفاده از شبیه‌سازی مونت‌کارلو می‌باشد.

روش‌ها: از یک فانتوم زن باردار بزرگسال و تمام اندام‌های جابجاشده بدن او برای انجام شبیه‌سازی استفاده شد. ارگان های چشمه برای هر یک از رادیوداروهای مورد استفاده در دو اسکن تهویه و پرفیوژن ریه شامل: ریه و مثانه برای رادیوداروهای ^{133}Xe (Xenon) ، ^{81m}Kr (Krypton) و آئروسل ^{99m}Tc-DTPA (Technetium diethylene-triamine-pentaacetate aerosol) برای اسکن تهویه ریوی؛ ریه، مثانه و کبد برای رادیوداروی ^{99m}Tc-MAA (Technetium Macroaggregated Albumin) برای اسکن پرفیوژن ریه، می‌باشد.

یافته‌ها: برای ^{99m}Tc-MAA در دوز تجویزی ۲۰۰ مگابکرل مقدار دوز رسیده به جنین ۱/۰۱ میلی‌گری و بیشینه دوز ۱/۹۷ میلی‌گری می‌باشد که هر دو بیشتر از حد مجاز (۱ میلی‌گری) توصیه شده در ICRP هستند. برای ^{99m}Tc-DTPA مقدار دوز و بیشینه دوز رسیده به جنین زیر ۱ میلی‌گری می‌باشد. برای ^{133}Xe و ^{81m}Kr مقدار دوز رسیده به جنین ناچیز بود.

بحث و نتیجه‌گیری: با توجه به بالاتر بودن مقدار دوز رسیده به جنین برای ^{99m}Tc-MAA ، باید به زن باردار در صورت لزوم اسکن، آگاهی لازم داده شود.

واژگان کلیدی: آمبولی ریوی، دوز جنین، اسکن V/Q، شبیه سازی مونت کارلو

INVESTIGATION OF FETAL DOSE IN V/Q SCAN USING MONTE CARLO SIMULATION

Abstract

Introduction: Pulmonary embolism (PE) is a blockage in one of the pulmonary arteries. Ventilation/Perfusion (V/Q) scan is the most common diagnostic method of PE in pregnant women. It is necessary to investigate fetal dose and compare it with recommended values. The aim of this study is to investigation of fetal dose in V/Q scan using Monte Carlo simulation.

Methods: An adult pregnant woman phantom and all her displaced organs were used for simulation. Source organs were defined for each of the radiopharmaceuticals used in two lung ventilation and perfusion scans, including: lung and bladder for ^{133}Xe, ^{81m}Kr and ^{99m}Tc-DTPA -aerosol for lung ventilation scan; lung, bladder and liver for ^{99m}Tc-MAA for lung perfusion scan. Fetal dose was determined and evaluated by the simulation output after calculations.

Finding: For ^{99m}Tc-MAA at prescription dose of 200 MBq, fetal dose is 1.01 mGy and maximum fetal dose is 1.97 mGy that both of them are more than ICRP recommended limit. For ^{99m}Tc-DTPA, fetal and maximum dose are below 1 mGy. For ^{133}Xe and ^{81m}Kr fetal dose is negligible.

Discussion: It is concluded that the higher dose to the fetus (200 MBq of ^{99m}Tc-MAA), if the pregnant woman scan is needed, her awareness must be done.

Keywords: Pulmonary embolism, Fetal dose, V/Q Scan, Monte Carlo Simulation

مقدمه

آمبولی ریوی PE (Pulmonary Embolism) یک انسداد در یکی از رگ های ریوی در ریه هاست (۱). PE یکی از علل اصلی مرگ و میر مادران در جهان توسعه‌یافته است (۲). احتمال ابتلا به PE در زنان باردار در دوران بارداری ۵ برابر می‌شود که این به خاطر سیستم انعقاد و فاکتور های مکانیکی مثل فشار وریدی می‌باشد. بیش از ۵۰ درصد موارد در ۲۰ هفته اول بارداری اتفاق می‌افتد (۳). اسکن V/Q ریه یکی از روش‌های مرسوم تشخیص PE در زنان باردار است (۴).

جنین در حال رشد درون رحم در تمام طول دوره قبل از تولد نسبت به تابش‌های یونیزان حساس است (۵). مراحل اصلی رشد انسان قبل از تولد شامل: تکثیر سلولی، تفکیک و حرکت آن می‌شود، پرتو یونیزه کننده می‌تواند در هر سه فرآیند دخالت کند، اما حساسیت به پرتوهای مذکور و اثرات بیولوژیکی ناشی از آن در هر یک از این مراحل متفاوت است (۶). به طور کلی دوره‌ی رشد پیش از تولد به سه مرحله تقسیم می‌شود: دوره پیش از لانه‌گزینی، که از لقاح تا جای‌گیری جنین در دیواره رحم است، دوره اندام‌سازی که در این دوره اندام‌های بدن شکل می‌گیرد و دوره جنینی که در طول آن رشد ساختارهایی که قبل از آن شکل گرفته، اتفاق می‌افتد (۷). نطفه در دوره اندام‌سازی در آسیب‌پذیرترین حالت خود قرار دارد به همین دلیل پرتوگیری نطفه در این دوره، سلامت آن را بیشتر از هر زمانی تهدید می‌کند (۸). این در حالی است که در بیشتر مواقع، زنان در این مرحله، از بارداری خود مطلع نیستند (۹).

هرویتز و همکاران (Hurwitz et al) دوز جنین در حالت پرفیوژن (^{99m}Tc-MAA ۷۴ MBq) را ۰/۲۱ تا ۰/۳ میلی گری برای دوره ابتدایی بارداری، و در حالت تهویه ۳۷۰ مگابکرل ^{133}Xe، دوز جنین را ۰/۱۵ میلی گری در دوره ابتدایی بارداری به دست آوردند (۱۰). راسل و همکاران (Russel et al) دوز جنین در حالت پرفیوژن (^{99m}Tc-MAA ۲۰۰ MBq) را در سه‌ماهه اول بارداری۰/۶ میلی گری و در حالت تهویه (^{99m}Tc-MAA ۴۰ MBq) دوز جنین را ۰/۱۷ میلی گری در سه ماهه اول به دست آوردند (۱۱). کوک و کایریو (Cook and Kyriou) دوز رسیده به جنین برای پرفیوژن با دوز کم (^{99m}Tc-MAA ۵۰MBq) را ۰/۱۲ میلی گری گزارش کردند (۱۲).

پس بررسی دوز رسیده به جنین و مقایسه آن با مقادیر توصیه شده، امری ضروری است (۱۳). یکی از روش‌های دقیق دوزیمتری داخلی در پزشکی هسته ای روش شبیه‌سازی مونت کارلو است (۱۴, ۱۵). هدف این مطالعه تعیین دوز رسیده به جنین در اسکن V/Q با استفاده از شبیه‌سازی مونت‌کارلو می‌باشد.

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PALLIATION OF METASTATIC BONE PAIN: COMBINED RADIOTHERAPY AND HYPERTHERMIA ON THE TREATMENT RESPONSE OF PATIENTS WITH PAINFUL BONY METASTASES - A PHASE 2 CLINICAL TRIAL

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Abstract

Introduction: Since the survival time of patients with bony metastases has noticeably improved in recent years, these patients are at a high risk of complications associated with this metastasis. Hence, the appropriate choice of treatment modality or combination of therapeutic approaches can lead to increasing bone pain relief, improving quality of life, etc. This study aimed to evaluate the effectiveness of combined radiotherapy and hyperthermia on the treatment response of patients with painful bony metastases.

Patients and methods: In a single-arm clinical trial, 23 eligible patients, 14 females and 9 males with the median age of 67 years old and with bony metastases were enrolled in the study. Two hours after radiotherapy, the patients underwent hyperthermia for 1 hour in supine position. All the patients completed the Brief Pain Inventory (BPI) assessment tool and quality of life questionnaire (QLQ-C30) from the European Organization for Research and Treatment of Cancer (EORTC) at the baseline, end of the treatment and 1, 2 and 3 months thereafter. The response to the treatment was assessed as the zero score (complete response) or two or more than two-point drop of the worst pain within the preceding 24 hours (partial response) during the 3-month posttreatment.

Results: All the pain intensity and interference scores except the pain interference with the enjoyment of life score significantly decreased. A total of 18 out of the 23 patients (78%) achieved complete or partial response. The number of patients using pain relief medications decreased from 74% (n=17) at the baseline to 48% (n=11) 3 months later. Moreover, except for nausea and vomiting, appetite loss, diarrhea and financial impact problems, and patients' quality of life improved significantly in all the functional scale and symptom within 3 months.

Conclusion: This study showed that using hyperthermia in combination with radiotherapy significantly ameliorated bone pain in cancerous patients with painful bony metastases.

Keywords: Radiotherapy; Hyperthermia; Bony Metastases; Treatment Response; Bone Pain Relief; Quality of Life

DEVELOPING A MOBILE PHONE APPLICATION FOR RADIOTHERAPY TECHNOLOGISTS AND STUDENTS

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Abstract:

Introduction: Radiotherapy has proved to be one of the most effective methods for cancer treatment. The effectiveness of this method, however, is, to a large extent, dependent on the accuracy and precision in preparing the patient before treatment, in delivering the radiation and in the quality of treatment plan, needless to say, all these must be done by well-trained oncologists, physicists and radiotherapy technicians. The motivation behind this study was two-fold. For one thing, to the best of the author's knowledge, there is no comprehensive source for radiotherapy techniques in Farsi for Iranian technicians and students. Furthermore, mobile phone applications have shown to be precious tools to help individuals learn whatever they wish, wherever and whenever they want. So the purpose of this study was to develop a mobile phone application in Farsi to teach the radiotherapy techniques to radiotherapy students and technicians.

Materials and Methods: The content of the items in the application has been extracted from the book "Principles and Practice of Radiation Oncology", seventh edition. The application was developed under Android operating system using Java programming language.

Results: The application can be installed on devices with Android version 4 or higher. For easier access, the techniques in this application were categorized based on body parts and types of cancer. Different categories in the application include Head and Neck, Lung, Gastrointestinal Tract, Gynecologicl, Breast, Genitalurinary System, Hodgkin's Lymphoma, Soft Tissue Sarcoma, Central Nervous System, Retinoblastoma, Wilms' Tumor, Neuroblastoma, Skin, HIV/AIDS-related Cancers and Ewing Tumor. The application is distributed under the name "Radiotherapy Techniques" and is downloadable from local app stores.

Conclusion: The Application "Radiotherapy Techniques", which is the only case in this field can be useful for all Iranian students, professors and radiotherapists.

Keywords: Radiotherapy Techniques; Radiation Therapy; Radiotherapy; Radiation Oncology; Android Application

ENHANCEMENT OF RADIATION EFFECTS BY BISMUTH-GOLD NANOPARTICLES FOR SUPERFICIAL RADIATION THERAPY

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INTRODUCTION

Radiation therapy is a non-invasive procedure to destroy cancer cells and can result in toxicity for surrounding tissues . Its purpose is to eliminate tumors and protecting normal tissues near it.[1]. To solve this problem we can use high-atomic materials, such as gold and bismuth [2]. Herein In this Project we explain the use bismuth and Au nanoparticles to have a tumor targeting (folic acid) and enhanced X-ray interaction.

METHOD AND MATERIAL: Bi_2S_3-BSA was prepared with BSA in the presence of (Bi $(NO_3)_3$) with the aid of NaOH. Bimetallic Bi_2S_3-Au heterodimers was formed by the *in-situ* growth of Au nanoparticles onto the surface of Bi_2S_3-BSA. In the other hand the BSA-FA was synthesized by applying the EDC and NHS, carboxylic acid activators. Also, a simple mixing method was applied to preparation of Bi_2S_3-Au-BSA-FA hybrids.

Subsequently for characterization to confirm success synthesis used Fourier-transform infrared spectroscopy (FTIR), transmission electron microscope (TEM) , UV/Vis, and dynamic light scattering (DLS) techniques. . BALB/c mice bearing with 4T1 tumor were randomly divided into 4 groups when the tumor volume reached around 200 mm3: control group, radiation only group, nanoparticles no radiation group, nanoparticles with radiation group. Each group included five mice. The dose of radiation was 4 Gy and all treatments were given only once. The change of tumor volume and the body weight of each mouse were monitored on every other day.

RESULTS: TEM image showed that bismuth nanoparticles uniform spheres. and the core-shell structure could be seen clearly. the XRD pattern of the bismuth and Au nanoparticles matched well with their XRD standard card [3, 4]. DLS results confirmed hydrodynamic diameter of Bi_2S_3-BSA, Bi_2S_3-Au heterodimers and Bi_2S_3-Au-BSA-FA hybrids are about 66.70 nm, 89.09 nm and 182.7 nm, respectively. These results demonstrated that Bi2S3-Au nanoparticles had been modified with BSA-FA membranes.

CONCLUTION: As a result, the surviving ratio of groups including control group, radiation alone group and nanoparticles no radiation group the tumors grew. Combination of Bi_2S_3 semiconductor with Au nanoparticles caused improved radiation therapy. Moreover, the *in vivo* therapeutic efficacy result confirmed the radiosensitizing power of designed and further prepared hybrids.

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AN ALGORITHMIC APPROACH FOR SELECTING APPROPRIATE PROSTATE IMRT TECHNIQUE BASED ON PATIENTS' ANATOMICAL PARAMETERS AND IMPORTANCE OF DOSE LIMITATIONS

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Running title: An algorithmic approach for selecting prostate IMRT technique

AN ALGORITHMIC APPROACH FOR SELECTING APPROPRIATE PROSTATE IMRT TECHNIQUE BASED ON PATIENTS' ANATOMICAL PARAMETERS AND IMPORTANCE OF DOSE LIMITATIONS

Abstract

Purpose: Proposing an algorithmic approach for selecting appropriate IMRT technique to treat prostate cancer based on patients' anatomical parameters and dose limitation priorities.

Methods: CT scans of 100 prostate cancer patients were used for planning with four common IMRT techniques (9, 7, 5 fields, and automatic). The patients' anatomical parameters having strong/very strong Pearson correlations with radiobiological parameters were selected and divided into 3 ranges. The IMRT techniques were compared over these ranges based on radiobiological parameters. An IMRT technique selection algorithmic approach was developed based on the radiobiological outcomes from various IMRT techniques at different anatomical parameter and impact of changing dose limitation priorities on target tissue dose homogeneity and organs at risk (OARs) sparing. The algorithm written in MATLAB (ver.2017b) was then tested on 5 new prostate cancer patients.

Results: Just two anatomical parameters showed high correlation with calculated radiobiological parameters including percent joint volume and center-to-center distances between the OARs and target. The algorithmic approach proposed the fields' number based on the patients' anatomical parameters at the first step, and determined the dose limitation priority values based on the user-defined importance of target or OARs, at the second step. The results of the tested algorithm on 5 new prostate cancer patients, showed that the proposed IMRT technique has better or similar radiobiological results compared to other techniques.

Conclusion: The algorithmic approach developed for automatic selection of appropriate prostate IMRT technique based on the patient's anatomical parameters and dose limitation priorities was proved to be reliable.

Keywords: Prostate Cancer; Intensity-Modulated Radiotherapy; Radiobiology; Anatomical Parameters; Algorithmic approach

THE EFFECT OF GOLD AND FE3O4 NANOPARTICLES DISPERSED ON TISSUE-EQUIVALENT BOLUS ON THE ABSORBED DOSE DISTRIBUTION OF THE SKIN SURFACE IN RADIATION THERAPY FOR BREAST CANCER PATIENTS USING MONTE CARLO SIMULATION AND PHANTOM DOSIMETRY.

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Abstract

Aim: The aim of this study was to determine the entrance skin dose for breast cancer patients who undergo radiotherapy in the presence and absence of bolus with gold and Fe3O4 nanoparticles to evaluate and compare the changes in dose distribution. Gold and Fe3O4 nanoparticles lead to more photoelectric and pair production absorption of x-ray photons.

Materials and methods: To calculate the skin dose in the presence of the bolus, nanoparticles were simulated in the bolus, over the skin of a breast phantom, using MCNPX Monte Carlo code. The skin dose was also measured experimentally, using a bolus containing homogeneously distributed Fe3O4 nanoparticles on the surface of a slab phantom and advanced Markus chamber.

Results: A significant skin dose enhancement was obtained for the case that 25 nm gold and Fe3O4 nanoparticles with 3% concentration were uniformly distributed in the bolus. However, increased concentration of nanoparticles in the bolus will increase the skin dose.

Conclusion: It is concluded that using nanoparticles in the bolus leads to a significant skin dose enhancement for 6 MV x-ray photons. Furthermore this study suggested that, less thick blouses may provide the same dose distribution.

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UNCERTAINTIES IN BRACHYTHERAPY: COMMON GUIDELINES OF ESTRO AND AAPM

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Abstract

Reduction of uncertainties in brachytherapy can improve the clinical outcome, local control of tumor and reduces side effects to organs at risk. Different types of uncertainties in brachytherapy are presented and quantified. The identification of the uncertainties and their relative contribution in overall uncertainty is based on a detailed literature review. Some uncertainties, including source strength and afterloader timer, are independent of the location of clinical disease and the prescribed dose. The influence of medium composition on dose calculation is important for low energy sources, while it has minor importance for high-energy sources. The amounts of uncertainties due to other factors such as target volume, organ at risk, applicator, source movement depend on fractionation and the level of the adaptive treatment. There are differences between variations, uncertainties, and errors or mistakes. Recommendations for uniform uncertainty reporting in clinical brachytherapy are provided. The recommendations can help to identify the brachytherapy treatment processes that require improvement. It is recommended that the clinical brachytherapy data be presented in terms of evaluated parameters including distance shifts, volume changes, source or applicator position, etc. It is suggested also that, the impact of such parameters on dosimetric parameters (such as D_{90} or doses to organs at risk), a statement of total dose uncertainty in the entire treatment sessions, the fractionation schedule and level of image guidance for adaptation be reported.

Keywords: Brachytherapy, dosimetry, uncertainties, treatment planning

THE ACCURACY OF FULL SCATTER CONVOLUTION ALGORITHM IN SMALL FIELD SIZES AND BEYOND HETEROGENEITY OF PHOTON BEAM USING RADIOCHROMIC EBT2 FILM STACK

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Abstract

Introduction: The presence of inhomogeneities, such as air-filled cavities, in the head and neck treatment fields region, may result in potential dosimetric disagreement, this must be due to the lack of charged electron equilibrium. Inaccurate dose estimation by treatment planning system (TPS) beyond the heterogeneous regions has been a great challenge in radiotherapy especially when small field sizes are used. Better understanding of this inaccuracy that depends on dosimetry methods is very crucial. Recently, film stack dosimeter has been purposed for 3D comprehensive dosimetry.

Material & methods: The dose distribution and dose profile of rectangular heterogeneous nasopharynx (RHN) phantom with two air cavities and bone equivalent were measured with a 3D stack film dosimeter containing 9 GAFchromic-EBT2 films positioned beyond the heterogeneity regions. The evaluation of TPS inaccuracy in small field sizes (3×3, 4×4, 5×5 cm2) was determined by comparing reconstructed 3D dose distribution of stack film dosimeter with TPS based on full scatter convolution (FSC) using in-house Matlab code.

Result: The 3D-dose distribution of 9 GAFchromic films sandwiched in RHN phantom and TPS in heterogeneous regions were created using in-house Matlab through interpolated 2D-planar dose distribution. Then, the enclosed volume between the 9 interpolated isodoses lines was compared with volume obtained through the dose volume histogram's (DVH) histogram of TiGRT-TPS. The results showed a large discrepancy between stack films measurements and TPS calculations in volumes enclosed high iso-doses, so that the biggest difference occurred in 3×3 cm^2 field size (relative mean difference = 1.72 ± 0.24, 1.5 ± 0.16 and P-value = 0.002 and 0.001 for V95 and V90 respectively) and it decreased in 5×5 cm^2 field size (relative mean difference = 0.46 ± 0.05, 0.35 ± 0.04 and P-value = 0.001 and 0.002 for V95 and V90 respectively).

Conclusion: The results suggested that 3D stack film dosimetry can be successfully used as a reliable dosimeter for QA procedure of heterogeneous region in small field sizes and also the results demonstrated some uncertainties in dose delivery calculations especially in heterogeneous regions and small field sizes. The TPS based FSC algorithm doesn't have acceptable performance in heterogeneous areas and small fields. This TPS overestimated dose at some areas like air cavity or interface of air/tissue. Therefore; it seems heterogeneity corrections should be considered for nasopharynx treatment.

Key Word: Heterogeneity, 3D dosimetry, Film, nasopharynx, quality assurance

QUALITY ASSURANCE IN RADIATION THERAPY

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Quality assurance in medical care has become very important in recent years. The process of radiotherapy plays a critical role in cancer treatment and involves many steps including, simulation, treatment planning, and treatment delivery. Each step needs quality control and quality assurance (QA) to prevent errors and to give high confidence that patients will receive the planned treatment correctly.

Quality assurance programs in radiation therapy include machine‐related QA procedures that measure the physical parameters of the radiation generators and regular patient‐related procedures that contains the verification of pre-treatment and treatment patients' factors which called patient-specific quality assurance.

Patient-specific treatment quality assurance (PSQA) tests are performed routinely for accuracy of delivered dose and tumor control, especially in advanced ration therapy techniques. Many cancer patients have marked anatomic change during radiotherapy including tumor shrinkage and weight loss. The use of a sharp dose gradient between tumor and normal tissue increases the sensitivities of these techniques to anatomical changes.

Various methods have been studied for treatment verification. Among these methods, the use of electronic portal imaging device (EPID) is highly considered. The electronic portal imaging devices in addition to the possibility of portal dosimetry allow predicting the dose changes caused by the patient's anatomical modification due to weight loss or tumor shrinkage during the treatment course.

Keywords: quality assurance – radiation therapy

CT RADIOMICS ANALYSIS OF IRRADIATED BREAST TISSUE IN BREAST CANCER PATIENTS AFTER INTRAOPERATIVE RADIOTHERAPY AS BOOST DOSE COMPARED TO THE CONTRALATERAL BREAST.

Abstract:

Background: in this study, we used CT texture and other radiomics features analysis of irradiated breast compared to contralateral breast after 12Gy boost radiation dose in IORT to achieve radiation-sensitive indicators (parameters) to introduce parameters which can be used as the biological markers or even the biological dosimeter in the Future.

Materials and Methods: in this study, 36 chest CT scans of unilateral Breast Cancer patients diagnosed with DCIS, undergoing breast IORT with boost dose were used. A total of 259 radiomics features including first order features, textural features, gradient features and autoregressive model based features were extracted using Mazda software. Using the hybrid feature selection method, first the features that were significantly different in the two breasts were selected, and then, according to the level of significant differences, a score was assigned to each of the features and ultimately features with the highest scores were characterized.

Result: Conclusively, most of the investigated radiomics features were changed by receiving radiation dose (AUC = 0.9) compared to the non-irradiated contralateral breast (p value <0.05). Among these features the features of Teta1, S (0,3) Correlat, S (1,0) Correlat, Vertl_RLNonUni, S (1,0) Contrast, S (1,0) DifVarnc and S (0,3) DifVarnc had the highest score and difference compared to the other features .

Discussion: CT Texture analysis showed that dose radiation significantly changes the radiomic features of the breast tissue, which may in the future by more researches we can fit the extent of these changes directly with received dose radiation and achieve a biological dosimeter in order to detect low dose radiations.

Keywords: Radiomics, CT texture analysis, Breast cancer, IORT

EVALUATION OF DOSE-PAINTING IN THE DOMINANT INTRAPROSTATIC LESIONS BY RADIOBIOLOGICAL PARAMETERS USING ^{68}GA- PSMA PET/CT

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Abstract

Aim: The study aimed to evaluate the dose-painting approach in the case of boosting the dominant intraprostatic lesions (DILs) by radiobiological parameters, tumor control probability (TCP), and normal tissue complication probability (NTCP) via PET/CT images traced by ^{68}Ga-PSMA.

Materials and methods: In this study, ^{68}Ga-PSMA PET/CT images were obtained from 14 patients with at least one DIL that were delineated using the Fuzzy c-mean (FCM) algorithm and thresholding methods. The protocol of therapy included two phases; at the first phase (ph1), a total dose of 72 Gy in 36 fractions were delivered to the planning target volume 1 (PTV1); the seconds phase consisted of the application of variable doses including 10, 14, 20, 24, 28, 32, and 36 Gy, delivered to the PTV2. Moreover, two concepts were also considered to calculate the TCP using the Zaider-Minerbo model, including high clone density and ordinary clone density DILs.

Results: The lowest volume in DILs belonged to the DIL1 extracted by the FCM method. According to dose-volume parameters of the rectum and bladder, by the increase in the PTV dose higher than 92 Gy, the amounts of rectum and bladder doses are increased. There was no difference between the TCPs of DILs at doses higher than 84 Gy and 96 Gy for ordinary and high clone density, respectively.

Conclusion: Consequently, our dose-painting approach for DILs, extracted by the FCM method via PET/CT images, can reduce the total dose for prostate radiation with 100% tumor control and less normal tissue complications.

Keywords: Dose-painting; PET/CT; DIL; TCP; NTCP

DESIGNING OF AN COMPREHENSIVE AUDIT BRACHYTHERAPY METHOD

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Abstract

Independent dosimetry audits improve quality and insure safety of radiation therapy. There is no agreement or consensus method for audit in HDR brachytherapy. In this study an end to end audit test was designed and evaluated for brachytherapy. A solid water phantom designed for reading the ionization of ^{60}Co high dose rate source and for verification of the dose calculated by the treatment planning system, geometric accuracy of medical imaging and delivery of treatment in HDR Brachytherapy. The audit conducted as onsite test using a Plexiglas phantom in an end-to-end test. The routine process of a clinical treatment was applied. Relative dose point measurements were performed with Farmer-type ionization chambers and they were compared with relative dose points from Treatment Planning System (TPS). Audit results were evaluated as $\pm 5\%$ action level. Measuring values in 80% was in pass level, $\leq 5\%$ and 20% points were out of tolerances.

This study showed that this design for dosimetry audit test and this phantom design is an appropriate way for identify fundamental systematic errors that affect entire process of brachytherapy treatments.

QUALITY ASSURANCE IN BREAST INTRAOPERATIVE RADIOTHERAPY

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Introduction: The lack of a robust image-based treatment planning system for breast intraoperative electron radiotherapy (IOERT) as well as the single fraction dose delivery approach in this treatment method reveal the necessity of implementing a quality assurance program in order to verify both treatment setup and treatment delivery during the breast IOERT. In this regard, a novel method was introduced for treatment setup qualification and the accuracy of treatment dose delivery was also evaluated through in-vivo dosimetry.
Materials and methods: Twenty-five patients with different types of breast cancer including invasive ductal carcinoma (IDC) and invasive lobular carcinoma (ILC) were considered in the current study. The accuracy of hard-docking based irradiation setup was assessed through online imaging inside the operating room using a C-arm imaging system. delivered dose to the enrolled patients was also evaluated through Gafchromic EBT2 film dosimetry at the surface and distal end of irradiated target. The significance level of difference between obtained dosimetry results and predicted ones was evaluated by the statistical tests.
Results: The acquired C-arm images in two different oblique views can effectively reveal any misalignment between the IOERT applicator and shielding disk. The mean difference between the measured surface dose and expected one was 1.8% ± 1.2 ($p=0.983$) while a great disagreement, 11.1% ± 1.5 ($p < 0.001$), was observed between the measured distal end dose and corresponding expected one. This discrepancy is mainly correlated to the backscattering effect from the shielding disk. Target depth non-uniformities and film response uncertainties can also contribute to this remarkable difference.
Conclusion: Employing the intraoperative imaging for IOERT setup verification can considerably improve the treatment quality viewpoint to the reduction of received dose by surrounding and underlying healthy tissue as well as the favorable accordance between the target area and treatment field size. Therefore, it is suggested to implement this imaging procedure as a part of treatment quality assurance. Favorable agreement between the predicted and measured surface doses demonstrates the applicability of EBT2 film for dose delivery verification. The results of in-vivo dosimetry showed that the electron backscattering from employed shielding disk can affect the received dose by the distal end of tumor bed which should be considered during the manual treatment planning and MU calculation.

Keywords: Quality assurance, Breast cancer, IORT, Electron

THE ROLE OF BIOLOGICAL MODELS IN RADIOTHERAPY TREATMENT PLANNING

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Introduction: during the previous decades, the main development in radiation therapy was movement from classical rectangular beams to fully conformal and intensity modulated dose delivery. During the last 10 years, using of biological models in radiotherapy is taken into consideration as Biologically Guided Radiation Therapy (BGRT). The aim of biological models is to predict the radiation response of biological systems. While early approaches focused on modeling the radiation response for different fractionation schemes, newer developments attempt to model effect probabilities (TCP and NTCP) and their volume dependence. the purpose of this study was evaluation of limitations and uncertainties of these models, Terms of use and potential dosimetric differences between biologically model based and dose-volume based treatment plan optimization and evaluation.
Materials and Methods: Nowadays, furthermore dose-volume (DV)-based parameters, most of treatment planning systems (TPSs) use from biological models in their procedures such as optimization and evaluation. We evaluated the effects of these models in treatment planning procedures.
Results: our results showed that using of biological models in treatment planning led to different results compared with dose-volume based planning. However, the uncertainty of the models always should be considered and be used with caution.
Conclusion: regarding to Individual differences between patients, using of biological models can to have important role in individualized radiotherapy. The main advantage of biological models in treatment planning is more sparing of normal tissues.

Keywords: BGRT**,** individualized radiotherapy**,** TCP, NTCP.

اخلاق حرفه ای در رادیوتراپی

دکتر فتح الله بوذرجمهری، استاد بازنشسته دانشگاه علوم پزشکی شهید صدوقی یزد

موفقیت درهر کاری علاوه برتسلط علمی و فنی، اشراف برمبانی و اصول اخلاق حرفه ای ضروری است، بخصوص در اموری حساس مثـل پرتودرمـانی که با جان بیماران ارتباط مستقیم دارد.

یکی از نکات برجسته و تاثیر گذاردر اخلاق حرفه‌ای پرتودرمانی، باورو ایمان قلبی برحضور و اراده خداوند کریم در ممات و حیـات آدمـی اسـت. اگرچـه معمولا عمر بیماران مبتلا به سرطان محدود است، اما قطعا میزان محدودیت برای همه یکسان نیست و احتمالات پزشکی همواره حاوی خطاهـای کـم زیاد بوده است. ازآنجا که پذیرش قطعی کوتاهی طول عمربیماران می تواند تاثیرمخربی در فرایند درمان آنها داشته باشد، لـذا توصـیه مـی‌گـردد بـدون درنظر گرفتن این محدودیت، حداکثر تلاش دردرمان بیماران سرطانی انجام شود.

پرتودرمانی کاری جمعی است وخطای هریک از اعضای تیم درمان اثر هم افزایی دارد، بنابراین خطای هرچند ناچیز تکنولوژیسـت، فیزیسـت ، مهنـدس مقیم و پزشک در مجموع مقدار زیادی خواهد شد که می تواند نتیجه درمان را تغییر دهد.

بروز سرطان در هر انسانی با تالمات روحی شدیدی همراه است این مساله وظیفه اعضای تیم درمان را دوچندان می کند. برای تاثیر مضاعف پرتودرمانی باید از هرطریق ممکن در تقویت روحیه و افزایش امید به زندگی در بیماران کوشید و خدای ناکرده رفتارتیم درمان سبب تضعیف روحیه آنان نگردد.

کار با بیماران سرطانی ممکن است درنشاط و شادابی شما به عنوان اعضای تیم درمان اثرات سوء داشته باشد، ولی ایمان و باور بر اجر و پاداش خداونـد کریم بر کمترین عمل خیرهر مسلمان، سبب صفا و جلای روح و جان شما می‌شود.

در این مقاله برای تاثیر بیشترکلام از حکایات مصلح شیراز، سعدی بزرگوار استفاده و متناسب با موضوع شاهد گرفته شده است.

IMRT TREATMENT PLANNING TECHNIQUES: PAST, PRESENT, AND FUTURE

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Intensity modulated radiotherapy (IMRT) is capable of producing dose distributions that conform to the planning treatment volume and deliver a reduced dose to the organs at risk (OARs).
Historically, the basic concepts and developments of IMRT treatment planning is from inverse planning using an optimization algorithm according to the Dose-volume constraints.
Today, managing uncertainty related to patient's geometry is a major challenge in clinical practice of IMRT treatment planning. In recent years, vendors have introduced a robust optimization framework to implement a method for considering uncertainties in dose volume histogram (DVH) calculations. In this framework, a DVH estimation model is created on the basis of the information extracted from training plans to generate estimate-based optimization objectives in optimization.
In the era of big data, development and implementation of the voxel-based method for evaluation of the radiotherapy treatment plan is desired to consider effects of different radiobiological and imaging parameters.
In summary, the future of artificial intelligence in IMRT treatment planning is bright. The planning process is expected to be fully automated, from contouring to plan creation, with the human experts supervising and evaluating on the given results.

QA PROCEDURE OF HELICAL TOMOTHERAPY

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Helical tomotherapy is a new modality with integrated treatment planning and delivery hardware for radiation therapy treatments. Pars Tomotherapy unit is the first installed unit in IRAN in 2019. In This report we are discussing about installation and QA procedure

OUTCOME MODELLING IN RADIATION ONCOLOGY

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Abstract

The field of radiation oncology has been updated in various fields including clinical, imaging, dosimetric, and genomic data. On the other hand, advances in statistics, machine learning, radiomics, and big data processing is lead to development new outcome models by more accuracy, sensitivity and specificity. This talk presents main aspects of outcome modelling in radiation oncology in terms of model's data, top-down/bottom-up modelling, existing and emerging applications of outcome modeling ranging from the treatment planning, adaptive therapy, and particle therapy to clinical trials. In addition, in this talk we provide an overview on the applications of artificial intelligence, radiomics and Radiogenomics to develop new generations of radiation oncology models.

EVALUATION OF THE EFFECTIVENESS OF RADIATION PROTECTION TRAINING IN INCREASING PHYSICIAN RADIATION INFORMATION: A PILOT STUDY

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Objective: All physicians need to have some knowledge on ionizing and non-ionizing radiation safety. The aims of this study were to determine the level of awareness on radiation safety among physicians at Qazvin province and to evaluate the effectiveness of a one-day radiation protection training program provided by the Qazvin University of Medical Sciences in 2018, to increase the radiation knowledge of physicians.

Method and materials: A total of 12 physicians (6 general doctors and 6 specialists) attending a training program on radiation safety were asked to complete a questionnaire. A self-administered questionnaire consists of 22 items and were categorized into three main areas; demographic information, performance and general radiation knowledge and safety. Survey data were collected before and after the training and were analyzed using descriptive statistics and paired sample t-test. Respondents were scored out of a total of 18 marks.

Results: The findings showed that the range of total scores obtained by the physicians before and after the training were 3-11 (mean score of 7± 2.56) and 8-15 marks (mean score of 11.92± 2.31), respectively. Results showed that the radiation information of physicians significantly increased (p-value <0.05). But no significant relationship was found between age, sex, field of study, work experience and number of correct answers.

Conclusion: Findings revealed that the knowledge and awareness on radiation safety among the physicians are at the low level. Based on the findings of the study, it can be also concluded that the radiation protection training course has been effective in increasing the radiation information of physicians and the training can be implemented in a larger community of physicians.

Keywords: physician, training effectiveness, radiation protection

HELICAL TOMOTHERAPY DOSE CALIBRATION: DIFFERENCE WITH CONVENTIONAL LINACS.

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Helical tomotherapy units require a calibration of their dose output in the different manner but same accuracy as performed for conventional Linacs.

The helical tomotherapy physical limitations do not permit a 100*10 cm^2 field size at 100 cm SSD. However, a 5 cm0*10 cm field size can be set at 85 cm SSD on the tomotherapy machine .
This does not allow for an accurate measurement of the photon component percent depth dose at a 10 cm depth for 100 cm SSD since there would not be sufficient phantom material for appropriate backscatter. In addition, since the helical tomotherapy unit does not have a flattening filter, depth dose data are slightly different than the depth dose data for similar nominal photon energies that have passed through a flattening filter. So In this report we are discusing about differences of Dose calibration method of Helical Tomotherapy and C-arm-Gantry –based Therapeutic accelerators based on TG148.

QA IN RADIATION THERAPY." HOW GOOD IS GOOD ENOUGH"?

Ali Shabestani Monfared*

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Quality assurance in radiotherapy is all procedures that ensure consistency of the medical prescription, and safe fulfillment of that radiotherapy related prescription. Potential failure to control the tumor and risk to normal tissue are twofold risk for the patient in radiothrapy process. The concept of a quality system in radiotherapy is broader than technical maintenance and quality control of equipment and treatment delivery and needs to implement a comprehensive quality system. How good is good enough in radiotherapy quality assurance? This is an important question and this lecture addresses various aspects as well as the major challenges of quality assurance in radiation therapy.

IMPACT OF BIOLOGICAL RESPONSE OF TUMOR CELLS TO RADIATION ON HOMOGENOUS DOSE DELIVERY DURING RADIOTHERAPY

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The aim of radiotherapy is to impart energy on tumor cells while maintain the normal tissue spared. However, this aim is not achievable in many cases and many cancers because of their biological nature and behaviors after receiving first radiation. Tumors are generally irradiated with 2Gy dose per fraction delivered daily to a more or less homogeneous field over a 6 week time period to a specified total dose. It has been shown that various biological responses such as reoxygenation, redistribution, reassortment, repair and inherent radiosensitivity, the classical 5R are key players in the outcome of radiotherapy. These events except repair and inherent radiosensitivity are not seen in normal tissue. Therefore, for appropriate dose planning taking these factors and their subsequent associated biological response is of importance. The classical 5R mechanisms act on every solid tumor following irradiation There are radiobiological mechanisms that impact the response to a fractionated course of radiation therapy. However, Radiobiological parameters derived from clinical altered fractionation protocols such as hyperfractionation, accelerated fractionation and hypofractionation schedules may not follow these mechanisms. Nearly most of biological events are initiated in tumor cells following radiation induced DNA damage. DNA damages are repaired by cells efficiently but if left unrepaired will cause genome instability leading to survival of genetically damaged cell which will become a malignant cell later. Genome instability may express as single gene defect, epigenetic alterations or chromosomal damages that can initiate other biological processes such as intrinsic radiosensitivity, radioadaptation and bystander effect; leading to an altered therapeutic gain factor. Therefore, having information regarding intrinsic radiosensitivity of patients by using predictive cytogenetic and genetic assays is of importance before making decision for radiotherapy regimen of patients.

Keywords: Radiotheray, fractionation, tumor biology, biological response.

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MEASUREMENT OF DOSE UNCERTAINTY USING MONTE CARLO METHODIN 60 MEV PROTON THERAPY OF LUNG CANCER

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Introduction : Proton therapy is an evolving treatment modality that affords many advantages due to its special dose distributions[1]. Proton can theoretically produce a superior dose distribution to the target using the sharp distal falloff of the Bragg peaks produced by these techniques compared with that produced by photon irradiation[2, 3]. The pencil beam method is currently used to calculate the dose in proton therapy[4]. In the pencil beam method, to compute dose, the position of Bragg-peaks within the target, with appropriate range/energy relation has to be determined. For this, the stopping power of the patient is required. Hounsfield Units (HU) provided by CT scan, converted to a relative stopping power from to water phantom[5]. Because of this, Studies have shown that pencil beam algorithm method can lead to a 30% uncertainty in radiation therapy dose measurement[6, 7] in an inhomogeneous tissue. In the present study, the lung medium as an inhomogeneous tissue was modeled and proton deep dose was compared with water phantom as a homogenous tissue.

Materials and methods: To investigate the dose uncertainty in the treatment of lung tumors with 60 MV protons, a 30 × 30 × 30 cm water phantom modeled in Monte Carlo MCNPX2.6 code[8] and was irradiated with a proton source. The result of this study was in good agreement with the study was done by Zarifi et.al [9]. Then; a lung phantom with dimensions determined by MIRD phantom [10]was inserted into box phantom, and a tumor with 1cm diameter was placed in the lung wall and re-radiated with the previous condition. The depth dose graphs in both situations were plotted and the result was compared.

Result: According to the results, in the proton therapy of lung tumors, due to the heterogeneity in the tissue, the proton range of 3.4 cm in water change to 5.3 cm. Also, the location of the Bragg peak reaches 4.6 cm in the non-uniform water phantom, compared to 3.1 cm in the uniform water phantom. Bragg peak height also decreased by 63.57 percent (below figure).

Conclusions: Tissue non-uniformity in the treatment of lung tumor cancers is with uncertainty as high as 55% in the proton range and 48% in the Bragg peak location. The results also showed a 63.5% drop in Bragg peak height. This result showed that the treatment of lung tumor cancers using proton therapy with the current algorithm is with large error and the pencil beam algorithm must be correct in non-uniform treatment planning.

Keywords: Proton therapy, lung cancer, uncertainty, MCNPX

COMPARISON OF EPID-BASED DOSIMETRY WITH OTHER 2D AND 3D DOSE VERIFICATION TECHNIQUES IN RADIATION THERAPY.

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The success of a radiotherapeutic treatment is dependent on the accuracy of the planning and delivery of the 3D dose distribution to a target volume and the surrounding critical organs in a specific patient. 3D dosimetry therefore plays a vital role in radiation therapy.
In this study the advantages and limitations of different 2D and 3D dosimetry techniques used in radiation therapy will be summarized, and compare these features relative to EPID-based techniques. We will review the use of EPIDs for pre-treatment and *in vivo* dosimetry applications either forward- or backward-projection methods. We will then review the various types of 3D dosimetry systems to which EPID-based back-projection approaches belong, and full-3D systems. All methods can be used for pre-treatment 3D dose verification; the choice of a specific system depends on the aim of the measurement and the properties of the specific hard- and software. At this moment EPIDs are the only tools available for 3D *in vivo* dosimetry. We will conclude with revealing some trends and future developments in 3D pre-treatment and *in vivo* dosimetry.

Keywords: EPID, Dose Verification, Radiotherapy

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EVALUATION OF THE METAL ARTIFACT REDUCTION SOFTWARE FILTER FOR CT SIMULATION IN RADIOTHERAPY OF HEAD AND NECK TUMORS

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Abstract

Objective: Radiotherapy should be performed based on a careful treatment plan to ensure that the tumor receives adequate treatment dose and to minimize the damages to the normal tissues. Imaging systems are used to optimize the treatment planning. Computed tomography is an essential factor in Modern radiotherapy. Using diagnostic CT images as input data, delineating the anatomy and computing the optimized radiotherapy plans would be possible. Image quality may be affected and degraded by metal artifacts from dental fillings and other devices and the detection and evaluation of lesions in the oral cavity and oropharynx by CT could be compromised. Therefore, this study aimed to evaluate the effects of metal artifacts caused by metal implants at the jaw and nasopharyngeal areas CT in the treatment planning and also to evaluate the dose received by critical organs such as spinal cord and eyes using the regeneration algorithm of metal artifact removal.

Materials and Methods: In this study, 30 patients (suffering from cancer in the jaw and nasopharyngeal areas) with metal dental implants referred to perform the neck and nasopharynx CT scan have participated. The device used in this study was a Philips' two-slice CT scan Neusoft (neuViz dual MX8000, China). First, CT scans were performed based on the standard procedure without any filters. In the next step, the METAL filter (Body Standard C) was applied to each of those standard images. Then both groups of images (standard and filtered) were entered into the treatment plan system. Both images (with and without filter) were sent to the radiotherapy center. The radiotherapy planning was separately performed on each group of images. After completing the appropriate treatment plan approved by an oncologist and physicist, treatment plans were compared by the maximum, and minimum dose in the target organ and at-risk organs (eyes and spinal cord) using treatment plan software.

Results: Images can be acquired using metal artifact reduction software, despite metal implants. The improvement in the image quality using Metal Artifact Reduction Software Filter and reduce image noise were expected.

Conclusion: As predicted, the entire radiation treatment planning process for the head and neck areas can be improved by metal artifact reduction software. After CT scans and using metal artifact reduction software, it is recommended to provide the output to an oncologist in order to better delineate the sensitive target organs for radiotherapy treatment.

Keywords: Computed tomography, Reconstruction, Metal artifacts, Medical image artifacts

GUIDELINES FOR EDUCATION AND TRAINING OF MEDICAL PHYSICISTS IN RADIOTHERAPY: WHERE ARE WE NOW IN IRAN?

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Medical physicists fulfil an essential role in modern medicine, most commonly in the field of treatment of cancer. Medical physicists working in the field of radiation oncology are generally called “qualified medical physicists in radiotherapy” or “radiation oncology medical physicists” dependent upon the country in which they work. They are part of an interdisciplinary team in the radiation oncology department dedicated to providing safe and effective treatment of cancer.

A guideline curriculum covering theoretical and practical aspects of education and training for medical physicists in radiotherapy required. For instance, in 2004 a joint ESTRO/EFOMP European guideline curriculum was a first step to harmonise specialist training of medical physicists in radiotherapy within Europe or IAEA in 2009, published TCS 37 entitled "Clinical Training of Medical Physicists Specializing in Radiation Oncology" for developing countries.

In Iran, a member of AFOMP, still there is in no resident medical physics program to train medical physicists specializing in radiation oncology. In 2016 in order to ensure that the a clinically qualified medical physicist (CQMP) with the level of expertise enter to a radiotherapy department, a joint criteria has been signed between the Iran association of medical physics (IAMP) and Iran atomic energy organization (IAEO) and CQMP needs to be certified by an appropriate professional certification board selected by IAMP.

In this study, I will present some guidelines for education of medical physicist in radiotherapy and the current criteria in Iran to provide a guideline curriculum covering theoretical and practical aspects of education and training for radiotherapy medical physicists in Iran.

Keywords: Education, Medical Physicist, Radiotherapy

RESIDENCY PROGRAM FOR RADIATION ONCOLOGY MEDICAL PHYSICIST

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It is clear the academic based education is not able to cope with the technical and scientific aspects of clinical duties delivered to Medical Physicist. In the other words, the careers of Medical Physicists as Radiation Oncology and Diagnostic Imaging Medical Physicists need to be reconsidered. Nowadays, several programs and plans such as Commission on Accreditation of Medical Physics Education Program (CAMPEP), Training Education and Assessment program (TEAP), European-wide organization to accredit Medical Physics Education and Training, Clinical Training of Medical Physicists Specializing in Radiation Oncology IAEA, IOMP academic programme guidelines have been proposed.

Based on the available and potential resources and requirements, a local plan is required for Iranian Medical Physics training program. The objective of the local residency program is to train ROMPs elected for a professional training and education. The plan can be created in three levels including training and working under supervision, working independently and interpreting the situations and ultimately, creating and managing a plan to train other staff. The plan support and approval is required by the relevant association, health and medical institutions.

Keywords: Medical Physics, Residency program, Radiation Oncology, Education and Training

PALLIATION OF METASTATIC BONE PAIN: COMBINED RADIOTHERAPY AND HYPERTHERMIA ON THE TREATMENT RESPONSE OF PATIENTS WITH PAINFUL BONY METASTASES - A PHASE 2 CLINICAL TRIAL

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Abstract

Introduction: Since the survival time of patients with bony metastases has noticeably improved in recent years, these patients are at a high risk of complications associated with this metastasis. Hence, the appropriate choice of treatment modality or combination of therapeutic approaches can lead to increasing bone pain relief, improving quality of life, etc. This study aimed to evaluate the effectiveness of combined radiotherapy and hyperthermia on the treatment response of patients with painful bony metastases.

Patients and methods: In a single-arm clinical trial, 23 eligible patients, 14 females and 9 males with the median age of 67 years old and with bony metastases were enrolled in the study. Two hours after radiotherapy, the patients underwent hyperthermia for 1 hour in supine position. All the patients completed the Brief Pain Inventory (BPI) assessment tool and quality of life questionnaire (QLQ-C30) from the European Organization for Research and Treatment of Cancer (EORTC) at the baseline, end of the treatment and 1, 2 and 3 months thereafter. The response to the treatment was assessed as the zero score (complete response) or two or more than two-point drop of the worst pain within the preceding 24 hours (partial response) during the 3-month posttreatment.

Results: All the pain intensity and interference scores except the pain interference with the enjoyment of life score significantly decreased. A total of 18 out of the 23 patients (78%) achieved complete or partial response. The number of patients using pain relief medications decreased from 74% (n=17) at the baseline to 48% (n=11) 3 months later. Moreover, except for nausea and vomiting, appetite loss, diarrhea and financial impact problems, and patients' quality of life improved significantly in all the functional scale and symptom within 3 months.

Conclusion: This study showed that using hyperthermia in combination with radiotherapy significantly ameliorated bone pain in cancerous patients with painful bony metastases.

Keywords: Radiotherapy; Hyperthermia; Bony Metastases; Treatment Response; Bone Pain Relief; Quality of Life

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ESTRO

STUDY OF THE NEEDS FOR EMPOWERING FAMILIES OF CHILDREN WITH LEUKEMIA: A QUALITATIVE STUDY

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Purpose: Families of children with leukemia suffer many challenges and have many requirements in the long-term treatment path of the patient. A lack of recognition of the needs of these families can compromise their physical and mental health and will deprive the patients of proper family care.
Despite the importance of this, few studies have been conducted in this area. Accordingly, this study conducted aimed to determine the needs for empowering families of children with leukemia.
Materials and methods: This is a descriptive exploratory qualitative research study. It was conducted using qualitative content analysis in order to understand experiences of families of children with acute lymphoblastic leukemia. All participants in this study were recruited from the largest specialized hospitals providing children's oncology services in the Isfahan province. Purposeful sampling by means of maximum variation was used to recruit 18 therapy team members to ensure diversity related to relationship, roles and positions, demographics, and work experiences. The researcher justified all the participants who had accepted the invitation to participate in the goals and process of the study and received informed consent for participation in the interviews. 20 semi-structured in-depth interviews were conducted individually with the 18 participants. 18 interviews were repeated once and 2 interviews were repeated twice. To elicit contributors' ideas and insights on empowerment needs in a focused, facilitated and non-threatened environment, two group interviews were also conducted. All interviews began with open-ended questions. For each interview, more specific questions were designed and asked based on the participants' responses to the main questions. The duration of the individual interviews lasted between 25 – 60 minutes with an average of 40 minutes, and the focus group sessions lasted between 75 – 110 minutes; all interviews were recorded on MP3 players. Data collection continued until saturation of data was achieved, which can be defined as a point where uncertainty around the concept can be resolved or no new information emerges and understandings are comprehensive, .The Graneheim and Lundman method was the basic qualitative content analysis, through which the data was categorized and labeled. In this study, Denzin and Lincoln's aspects of trustworthiness were used. Factors including prolonged interaction with the participants, member-check and peer-check resulted in credibility of research. Data collection took place from July 2016 to May 2017
Results: the main themes of the present study is the need for social empowerment needs from the participants' perspectives in five main categories: the need for communication and social interaction with relatives, peer groups and families, treatment teams, networking, and social supportive organization as some of their needs with many positive effects.
Conclusion: Families are considered as components of the healthcare team. The health system is unable to meet all the needs of patients with chronic diseases in the absence of family support. Nevertheless, all focus on the patient care and meeting the needs of families is not considered. Therefore, identification of the family needs in order to design empowerment programs is necessary. The results of this study can be widely used in understanding, evaluating and recognizing the needs of empowerment of families of children with leukemia.

Keywords: Needs, empowering, family, children, leukemia, qualitative study

باورها، رفتارها و درمان های خانگی سیستانی های ساکن یکی از روستای های استان گلستان در باره سرطان: یک مطالعه خرده اتنوگرافی پزشکی

Javad Lakzaei, Zahra Abbasi

چکیده

زمینه و هدف: باورها و اعتقادات و رفتارهای مرتبط با سلامتی و درمان های خانگی بخشی از فرهنگ مردم است. استان گلستان دارای موقعیتی ویژه از نظر تنوع قومیتی؛ ترکمن، قزاق، کرمانج، سیستانی، بلوچ، ... است. هدف از این مطالعه بررسی طب عامیانه مردم سیستانی روستا نشین استان گلستان برای سرطان بوده است.

روش کار: در این مطالعه (۱۳۹۵) با رویکرد اتنوگرافی برای جمع آوری اطلاعات از یادداشت برداری در عرصه و مشاهده و مستندات و مصاحبه نیمه ساختار با افراد کلیدی؛ درمانگران محلی و سالمندان با تجربه سیستانی ساکن روستای شهرک شهید بهشتی شهر گنبد استان گلستان استفاده شد. باورها و عقاید و رفتارهای مرتبط با درمان سرطان جمع اوری شد. مصاحبه ها دست نویس و کدگذاری و طبقه بندی شدند.

یافته ها: درمانگران محلی بر این باور بودند سرطان همانند یک موریانه وجود فرد مبتلا را می خورد و کم کم او را ذوب می کند و دردی بدون درمان است. مردم سیستانی معتقد بودند علت سرطان آلودگی مواد غذایی به سموم است و زندگی آرام و توکل به خدا می تواند مانع پیشرفت سرطان شود. درمان های خانگی مخصوصی برای سرطان نداشتند اما از درمان های علامتی استفاده می شد. استفاده از گیاهان دارویی، جوشانده تلخی، کلپوره، استفاده از خاکستر نی سبز روی محل درد و زخم، قرار دادن بیمار در پوست گوسفند و داغ کردن محل زخم سرطان با قاشق داغ از جمله طب عامیانه مردم سیستانی برای مشکلات جسمی ناشی از سرطان بوده است.

نتیجه گیری: مردم سیستانی بر این باورند که سرطان بیماری لاعلاج و مترداف با مرگ است. طب عامیانه این گروه از ساکنین استان گلستان شامل رفتارهای بهداشتی سالم، خنثی و مضر است که با فرهنگ سازی می توان موارد قوت آن را حمایت نمود.

کلمات کلیدی: سرطان، مردم سیستانی، طب عامیانه ، اتنوگرافی پزشکی، ایران

CANCER STIGMA: THE EDUCATIONAL NEEDS OF PEOPLE AFFECTED BY CANCER AND RELATED CARE PLAN

Fatemeh Hasan Shiri [*1], Jamileh Mohtashami[2], Houman Manoochehri[3], Camelia Rohani[4], Malihe Nasiri[5].

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Introduction: Diagnosis of cancer is a critical crisis for the patient and the family. Cancer is considered as an untreatable and deadly disease. On the other hand, insufficient knowledge of the disease, the presence of stigma and misconceptions has negative and adverse effects on the individual, family and social life of the patients and their families. Thus, people affected by cancer at the time of diagnosis and after the treatment process need care, support and training to be able to go through the long and difficult process of treatment and to overcome the erosive consequences of illness, treatment and stigma. This study focuses on the educational needs of patients and their families about cancer and provide a care plan to reduce stigma in this group.

Materials and Methods: This study was conducted in a qualitative, quantitative, and then reviewed the articles about reducing stigma in different diseases, including cancer. The various needs of the affected individuals and families were extracted from face-to-face interviews. Then a comprehensive care plan designed to reduce the stigma associated with the disease that can be used in cancer care centers.

Results: The results showed that people with cancer and their families have little knowledge about the disease, process of treatment, complications and even their needs; which is especially important at the beginning of the diagnosis and treatment which causes anxiety, uncertainty and feelings of stigma. Based on these results, the main part of the care plan focuses on teaching patient knowledge in 14 measures, including enhancing information about the disease, treatment, possible complications, and preventing misinformation from non-specialists person and reducing confusion.

Conclusion: Professional caregivers should pay attention to the different needs of people with cancer and their families and apply different methods, including teaching patient knowledge, to reduce confusion, anxiety, and feelings of stigma and help to improve the quality of life of patients and their families.

Keywords: Cancer, Educational Needs, Stigma, Care Plan.

ACCESS TO SUPPORTIVE RESOURCES: A FACILITATOR FOR COPING WITH BODY IMAGE ALTERED IN IRANIAN WOMEN WITH BREAST CANCER

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Abstract

Background: Coping with the body image altered is one of the most challenges breast cancer treatments. Identify the facilitators is essential for integrative care planning for improve coping with body image. This study aimed to explore facilitators for coping with body image altered in Iranian women with breast cancer.

Method: This study has been done with qualitative approach during March 2016 till October 2017. Participants (36 Iranian women with breast cancer) were selected using purposeful sampling and maximum variation from healthcare centers in Alborz province, Iran. The method of data collection was semi-structured interview and analyzed by conventional content-analysis approach defined by Graneheim and Lundman.

Results. The present study showed that “access to supportive resources” was the facilitating factor in coping with body image altered in women with breast cancer. Access to supportive resources extracted from the four subcategories of "receive / understand spouse support", "perceived support for the family", real / online peer group support" and "support from NGOs**".**

Conclusion: This study showed that access to supportive resources and receiving emotional, informational, esteem and instrumental support was the main facilitating factor in coping with altered body image in Iranian women with breast cancer.This finding can be used in designing supportive care guideline and planning context based integrated care.

Keywords: Breast Cancer, Body Image, Facilitators, Support, Conventional Content Analysis.

PREVENTION AND CONTROL OF BREAST CANCER IN MOVING TOWARDS SUSTAINABLE DEVELOPMENT GOALS

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Introduction: Among the Noncommunicable Diseases (NCDs), cancer is the leading cause of death and the single main obstacle to increase life expectancy of people in the 21st century. During the last decades, incidence rates of breast cancer have been increasing in most countries in the world. This study aimed to show a clear picture of the pattern of morbidity and mortality of breast cancer in women in the world and in Iran, and to discuss the main current tasks of healthcare providers to prevent and control the disease in Iranian women towards the Sustainable Development Goals (SDGs) by 2030.

Materials and Methods: This is a review study which was conducted by an extensive review of five years old studies in databases; PubMed, Web of Science, Google Scholar, SID, Magiran, Iranmedex, and existing data on specific valid organization websites; World Health Organization (WHO), CDC, American Cancer Society and Mayo Clinic. The results of epidemiological studies were used together with seven years author's research and education experience in community health centers following a major clinical study on Iranian women with breast cancer at Karolinska Institute in 2012. The data were integrated and a qualitative report was produced.

Results: Based on the estimation of the GLOBOCAN 2018, there are about 2.1 million newly diagnosed cases of breast cancer in the world, almost 1 in 4 cancer cases among women. Breast cancer is the most common diagnosed cancer in the majority of countries (154 countries of 185 countries). It is also the leading cause of cancer mortality in over 100 countries. The trend of the morbidity and mortality of breast cancer can reflect a grouping of demographic and geographic factors together with economic and social features which are influencing breast cancer in women. Also, a perspective on the history of the United Nations shows that the Sustainable Development Goals (SDGs) are the blueprint to get a better and more sustainable future for all. Thus, moving towards new action plans is necessary for educational intervention and screening of the women in the community.

Conclusions: Moving towards SDGs, involves new national and local action plans for education of the women by focusing on self-care and empowerment in our context. Screening of breast cancer in women according to risk stratification, as well as producing screening guidelines are key issues in our context.

Keywords: Breast cancer, Prevention, Sustainable development goals, Women

CANCER STIGMA: THE EDUCATIONAL NEEDS OF PEOPLE AFFECTED BY CANCER AND RELATED CARE PLAN

Fatemeh Hasan Shiri [*1], Jamileh Mohtashami[2], Houman Manoochehri[3], Camelia Rohani[4], Malihe Nasiri[5].

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Conclusion: Professional caregivers should pay attention to the different needs of people with cancer and their families and apply different methods, including teaching patient knowledge, to reduce confusion, anxiety, and feelings of stigma and help to improve the quality of life of patients and their families.

Keywords: Cancer, Educational Needs, Stigma, Care Plan.

COMPREHENSIVE ASSESSMENT IN SUPPORTIVE& PALLIATIVE CARE

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Introduction: Palliative care is an approach that improves the quality of life of people and their families facing the problems associated with life-limiting illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual. The palliative care approach aims to promote physical, psychological, social and spiritual well-being. Patients with life limiting conditions frequently have multiple symptoms and all health care professionals who working with them are involved in providing supportive& palliative care, so should be acquire core skills and knowledge regarding care. Palliative care principles and practices can be integrated into any health care setting, delivered by all clinicians and supported by palliative care specialists who are part of an interdisciplinary team with the professional qualifications, education, training to deliver optimal patient and family-centered care.

Supportive& palliative care begins with a comprehensive assessment and emphasizes patient and family engagement, communication, care coordination, and continuity of care across healthcare settings. An interdisciplinary comprehensive assessment of the patient and family forms the basis for the development of an individualized patient and family supportive& palliative care plan. All clinicians need expertise in the assessment of patient symptom burden, functional status, and quality of life, and in the development of a palliative treatment plan that is consistent with patient and family needs and preferences. It is extremely important to perform a comprehensive and multidimensional assessment in all patients with advanced illness with multiple symptoms. The multidimensional assessment should help in the recognition of the contribution of the different dimensions to the patient's symptom expression, and thereby assist in the planning of care. Good symptom assessment precedes effective symptom treatment.

Discussion: Recognizing patients' distressing symptoms as multidimensional complexes and using appropriate and validated assessment tools help physicians manage these symptoms to improve patients' quality of life and decrease caregiver burden.

CORRELATION OF SPIRITUAL HEALTH AND HOPE IN FAMILY CAREGIVERS OF CANCER PATIENTS

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Background and Aim: Cancer as one of the most common diseases worldwide is considered a crisis for both the patient and the family. Studies have shown that family caregivers of chronic patients use hope to adapt to stressors. On the other hand, in the studies on the amount of effect of variables related to hope, spiritual health had the greatest effect. Understanding the correlation between spiritual health and hope in these families can be effective in establishing a support system to reduce the negative effects of illness on families. Therefore, this study aimed to determine the relationship between spiritual health and hope in family caregivers of cancer patients.

Methods: In this descriptive-correlational cross-sectional study, 150 family caregivers of patients with cancer referred to Ayatollah Taleghani, Shohada Tajrish, Masih Daneshvari and Imam Hossein Hospitals of Tehran from August to November 2016 were selected by convenience sampling method. Data collection tools were Herth Hope Questionnaire and Paloutzian & Ellison Spiritual Health Questionnaire. Data were analyzed by descriptive and inferential statistics using SPSS 24 software at the significant level of 0.05.

Results: The mean and standard deviation of spiritual health score and hope of family caregivers were 90.36 ± 17.70 and 31.74 ± 4.36, respectively. The caregivers participating in this study had high spiritual health and hope. There was also a significant relationship between spiritual health and hope (r = 0/421 and p> 0/000).

Conclusion: Family caregivers of cancer patients during patient care, while experiencing many challenges, always have high levels of hope that associated with their spiritual health. Therefore, considering holistic view of nursing, it is important to consider family and its health in different aspects including spiritual health.

Keywords: Spiritual Health, Hope, Family Caregivers, Cancer Patients

EFFECT OF DEEP BREATHING TECHNIQUE ON ANXIETY, PAIN AND VITAL SIGNS IN PATIENTS UNDERGOING BONE MARROW ASPIRATION- A RANDOMIZED CLINICAL TRIAL

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Purpose: Bone Marrow Aspiration (BMA) is one of the approaches for diagnosis and treatment of various diseases that nowadays it is widely used in regenerative medicine. Although this Procedure in adults is usually performed by using local anesthesia, it is associated with anxiety and pain. The purpose of the present study is to conduct research into the effect of Deep Breathing Technique (DBT) on patients who have undergone BMA for appeasement of pain and reduction of anxiety.
Method: This study was a parallel randomized clinical trial. 60 patients who underwent BMA were randomly divided into two groups. The intervention group received DBT training but control group did not take any training program. To measure the scope of anxiety and severity of pain, Spielberger State Anxiety Inventory (SAI) and Visual Analogue Scale (VAS) were used respectively. The pre-anxiety and post pain of BMA were evaluated in two groups.
Result: Comparison of anxiety and pain variables in study groups revealed that the mean score of anxiety and VAS average in the intervention group have been lower than that of the control group and this difference was significant ($P = 0.018$ and $P < 0.001$ respectively). Comparison of vital signs prior and post DBT showed the reduction of the vital signs after the intervention. However, no significant change was observed in control group.
Conclusion: DBT is an effective technique to reduce anxiety and relieve pain in BMA candidate. Nurses need to be aware of anxiety and pain procedures during BMA.

Keywords: breathing exercises; anxiety; pain; Visual Analog Scale.

EFFECTIVENESS OF MEDITATION ON NAUSEA AND VOMITING OF PATIENTS WITH BREAST CANCER UNDER CHEMOTHERAPY

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Introduction: Nausea and vomiting are known as the most common complication experienced by 70% of patients belong antiemetic medications. The aim of this study was to determine the effect of Meditation on Twin Hearts on Nausea and Vomiting in breast cancer patients under chemotherapy.

Method: This is a clinical trial study. 120 women with breast cancer referred to chemotherapy Khonsari hospital sampling were recruited through random allocation to two groups. Research Tools: patients before the intervention completed demographic questionnaire, Visual scale for nausea and vomiting severity checklist. In the study, patients in the experimental group training Meditation on Twin Hearts with it for half an hour was given by a co-worker and patients had at least 3 times a week for two week to do their meditation. After the intervention, nausea and vomiting severity in both groups was completed. Data analysis was done with SPSS version 20 and α =0.05 was considered.

Results: Before intervention, there was no significant difference among the means of nausea and vomiting severity in two groups. However, after intervention, a significant difference was seen among the means in two groups. The average severity of nausea in the experimental group (21/5) to (12/7) and vomiting of (13/5) to (7/3) reached. In addition, the average severity of nausea and vomiting before and after the intervention, there was no significant difference ($P \leq 0.001$). In the control group the mean nausea of (21/9) to (22/2) and vomiting of (12/6) to (12/9) reached. Between severity of nausea and vomiting before and after the intervention, there was no significant difference.

Conclusion: Meditation on Twin Hearts to reduce nausea and vomiting in patients with breast cancer and was undergoing chemotherapy.

Keywords: Meditation on Twin Hearts, breast cancer, Nausea, Vomiting

HYPNOSIS- BASED INTERVENTIONS TO IMPROVE SPIRITUAL AND MENTAL HEALTH IN MOTHERS OF CHILDREN WITH CANCER.

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Introduction: Cancer has many negative psychological and spiritual effects on families of affected children. As a part of a comprehensive project to improve health in mothers of children with cancer, we used some hypnosis-based interventions for this group to influence on their positive health related consequences.
Methods: In this presentation, we will introduce the method of designing the intervention program and report some results from a pilot study.
Results: As a preliminary study, we found that the majority of mothers have a moderate to severe level of psychological and spiritual distress assessing standard tools. The interventions are designed by a team of experts in different fields of psychotherapy, psychoanalysis and psychiatric nursing. A variety of methods are using based on the history of mother.
Conclusion: Hypnosis based interventions are cost effective to be used in clinical settings and they can modify based on the context and situation. The modifications of routine hypnosis interventions to be adopted for a Muslim group will be discussed.

APPLYING MIXED-METHODS METHODOLOGY IN DEVELOPING CARE PLAN FOR ADOLESCENTS WITH CANCER

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Introduction: The purpose of this study was to identify the unique needs of adolescents and to design a professional care plan based on their needs to improve the quality of life and reduce psychological-social injuries.

Methods: This study was conducted between 2014 and 2016 with a consecutive (qualitative-quantitative) approach. In order to identify the needs of adolescents with cancer, a qualitative descriptive-exploratory study was conducted in the first step. For this purpose, semi-structured in-depth interviews were conducted with 33 participants (adolescents with cancer, parents, and care team members) and data were analyzed using constant comparative analysis. A modified Delphi technique was used to prioritize the extracted needs. In the first round, a questionnaire containing the needs extracted from the qualitative study was provided to 43 experienced individuals (adolescents with cancer, parents, and care and treatment team members) who were asked about their importance and voluntarism, to specify. In the second round, the important and priority needs of the experts were confirmed. In the second stage, the researcher designed a care plan using the planning model. Then, in the third phase, in a two-group clinical trial study with pre- and post-test, part of the care program was administered to a group of adolescents with cancer and the variables of quality of life (EORTC QLQ-C30.V.3) and uncertainty Questionnaire of uncertainty of children (before and after intervention, immediately after and one month after intervention) was evaluated in two groups.

Results: The data were analyzed by qualitative study data of 4 main categories: information-communication needs, psychological-psychological needs, supportive needs and physical needs. The care plan was designed to meet the most pressing needs of adolescents with cancer and to review texts and expert opinions. Then part of the care plan was implemented based on the available facilities. Comparison of quality of life between the two groups showed that overall health increased in the intervention group and decreased in the control group over time. There was no significant difference in functional status and symptoms over time between the two groups. Analysis of uncertainty in the two groups showed that mean ambiguity, uncertainty, and uncertainty in the intervention group were significantly lower than the control group. Uncertainty in adolescents with cancer decreased after the intervention, which was statistically significant.

Conclusion: The results showed that the use of a part of need-based care program could change the variables of quality of life and uncertainty in adolescents with cancer in a positive direction, thus, more interaction and collaboration of care and treatment team members as well as policy. It is recommended that managers in the field of health care be implemented and evaluated.

Keywords: adolescent, cancer, care plan, combination study, quality of life, uncertainty

THE MOST IMPORTANT INFORMATION NEEDS OF NEWLY DIAGNOSED WOMEN WITH BREAST CANCER AFTER SURGERY

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Introduction: Information support is a critical and multidimensional requirement for Women with Breast Cancer. These patients have different information needs at different stages of the disease and treatment. Surgical treatment is usually performed shortly after diagnosing the disease, which is of great concern and anxiety. Information support for these patients should be consider based on their needs and priorities. The information needs of women with breast cancer after the surgery were investigated in this study.

Materials & Methods: This cross-sectional study was conducted from September 2018 to February 2019. The research population was women diagnosed with breast cancer and informed about their disease who referred to surgery wards at hospitals of Mashhad. Sample size of this study were estimated 81. Finally, 83 patients were studied.

The instruments used in this study included two questionnaires of demographic information and Patient Learning Needs Scale (PLNS).

Results: The average age of the women in the study was 43.06 ±10.83 years. About half of the women (49.4%) were illiterate; the majority were housewives (75.9%) and married (85.5%). The results of this study showed that the information needs of these patients were related to all aspects of PLNS and The most important information needs of these patients at this stage of treatment were "enhancing the quality of life", "treatments and complications", and "medications". And the most important topic was who to see at fallow up. Other important topics were those related to disease management and pain management.

Conclusion:

This study highlights that Iranian breast cancer patients in surgical stage, have many information needs in all domains of PLNS, especially in enhancing quality of life, treatment and complications, and medications domains, Therefore a good, well-organized plan to provide these patients with information as one of their undeniable rights is necessary.

THE EFFECT OF A PSYCHOLOGICAL TRAINING PROGRAM ON THE QUALITY OF SLEEP OF LEUKEMIA PATIENTS REFERRED TO THE SELECTED HOSPITAL OF ISFAHAN UNIVERSITY OF MEDICAL SCIENCES IN 2018

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Introduction: Insomnia is one of the most prominent concerns of cancer patients. The psychological training program can improve the quality of sleep in patients. Therefore, the purpose of this study was to investigate the effect of a psychological training program on the quality of sleep in leukemia patients who were referred for treatment to the selected hospital in Isfahan University of Medical Sciences in 2018.

Methods: The present research is a clinical trial study conducted in 2018. The research population included patients with all types of leukemia who were referred for treatment to Seyyed-Al-Shohada Hospital of Isfahan University of Medical Sciences. 60 participants were divided into two groups of control and intervention. Entrance and exit criteria were controlled and The Pittsburgh Sleep Quality Index (PSQI) was used to survey the different dimensions of sleep. In the intervention group, the training program was conducted in 6 sessions and in groups of 8 to 12 persons. In addition, participants in the control group, after taking a face-to-face training session concerning the generalities of cancer, they received educational pamphlets for more education. Finally, the data were analyzed by SPSS software version 22 and Chi-square and t-tests.

Results: In this study, 46.67 percent of the participants were male and 53.33 percent were female. According to statistical tests, there was no significant difference between any of the demographic characteristics in the intervention and control groups. In addition, there was no significant differences between the mean sleep quality score in the control group before and after the intervention with an average of 11.8 and 10.46, respectively (p-value = 0.06, t= 1.93). This difference was meaningful in the intervention group with an average of 11 and 6.9, respectively (p-value = 0.00, t= 6.53).

Conclusion: The findings of this study confirmed the desired effect of a psychological training program on the quality of sleep in patients with leukemia. More research might be needed to study this question from various perspectives.

THE EFFECT OF EDUCATION ON SELF-CARE BEHAVIORS OF GASTROINTESTINAL SIDE EFFECTS ON PATIENTS UNDERGOING CHEMOTHERAPY

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Background and Objectives: Cancer is a deadly disease of humanity. One of the main curative options is the use of chemotherapy treatments. From 40 to 80 percent of chemotherapy treatment can cause complications such as nausea and vomiting, mouth sores and disorders of the bowel. The aim of this study was to evaluate the effect of education on self-care behaviors on gastrointestinal side effects in patients undergoing chemotherapy.

Methodology: This study is a randomized clinical trial of 60 women with breast cancer undergoing chemotherapy who were referred to Chamran hospital chemotherapy center. Prior to chemotherapy and after obtaining the consent for the random sampling method, patients were divided into two groups, intervention and controls. Patients in the intervention group received routine treatment to improve the side effects of chemotherapy, in the form of self-care training received from the researcher. Data was collected by a demographic questionnaire, a questionnaire on side effects of chemotherapy questionnaire and Morrow standard questionnaires were collected. Data using descriptive and inferential statistics were analyzed by SPSS (v21) software.

Results: The results showed that the use of self-care education to reduce mouth sores was statistically significant ($p < 0.05$). Self-care training also leads to a reduction in frequency and severity of nausea and vomiting in patients. This reduction was statistically significant ($p < 0.05$).

Conclusion: Findings of the study showed that the use of self-care training alongside drug regimen reduces the side effects of chemotherapy in patients. Therefore, it is recommended that nurses use this technique as a complementary method to reduce side effects of chemotherapy.

Keywords: self-care, side effects of chemotherapy, chemotherapy, nurses

THE PSYCHOSOCIAL IMPACT OF CANCER ON MOTHERS OF CHILDREN WITH CANCER

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Background and Objectives: Diagnosis and treatment of malignant diseases affect the lives of patients, family, relatives and friends in many ways. In the meantime, the psychosocial impact of child cancer on parents is particularly significant, especially on mothers who take care of almost all affected children. Understanding the different aspects of the psychosocial impact of childhood cancer from the perspective and expression of mothers of affected children can have a significant impact on the different consequences of the disease on the family. Consider the perspective of mothers of affected children.

Methods: This is a qualitative study. In this study, 28 mothers of children with acute lymphoblastic leukemia under 15 admitted to pediatric cancer wards of Syed-al-Shohada Hospital in Isfahan were enrolled after expressing their intentions and obtaining informed consent. In this study, data were collected from 30 semi-structured in-depth individual interviews with mothers of affected children, two of which were repeated for the second time, as well as 2 focus group interviews with 14 mothers of children with acute lymphoblastic leukemia. Interviews were conducted in the special room of nursing professors at Seyed al-Shohada Hospital. The interview lasted between 25 and 45 minutes with an average of 35 minutes. Interviews were recorded with the informed consent of the participating mothers and were transcribed verbatim immediately after completion of the interview after listening several times. The transcripts of the interviews were read several times and analyzed using the qualitative content analysis method by the conventional Granheim method. The interview continued until saturation and until the new interviews had no new consequences for the researcher.

Study Findings: The data obtained was divided into five main categories, and then subdivided into fifteen subcategories. The first reaction of mothers to receiving news of a child being shocked was cancer, and many mothers said, "When I was told that my child had cancer it was as if I had been electrocuted. I could not say anything for a while. I was not the world. "Many mothers could not believe that their child had the disease, and many mothers said, "This was impossible. This cannot be my child. There must have been a mistake in the tests." Denial was one of the most common mothers' reactions to receiving news of a child's cancer. Many mothers said, "No, this can't be right. My baby was okay. My baby's diagnosis is wrong." The coping behaviors of mothers of children with family members, relatives, treatment team members and friends are a social psychological response to dealing with the child's illness, and in fact, mothers try to combat and fight the illness by adopting these behaviors. Many mothers said, "I had been arguing for a long time with anyone who told me my baby had cancer and I didn't even want to admit that my baby had the disease." Many mothers had severe nightmares related to the child's type of illness, and with this nightmare fear of loss, social stigma, and social isolation contributed to the mother's rejection of the disease. Many mothers said in this connection, "When I thought my baby was getting cancer, my eyes were stuck in front of me and I couldn't think of anything other than death. I was always thinking now about people and everyone and everyone understand what they are thinking and it will hurt me so much. "There are various findings in this connection that will be discussed further in this article.

Conclusion: Consequences of childhood cancer have a great impact on the psychological, social, and daily lives of mothers. Mothers of affected children may rarely report the problems and outcomes, therefore, the

healthcare professionals should have the required competencies to diagnose, treat, assist, and support these mothers.

Keywords: Psychosocial, Impact, mother, children, leukemia, qualitative study

WHAT DO WOMEN WITH BREAST CANCER WANT AT THE BEGINNING OF (ONCOLOGIC) TREATMENT? A QUALITATIVE STUDY OF INFORMATION NEEDS

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Introduction: Breast cancer is the most common malignancy and the second leading cause of cancer death among women worldwide. Especially when they are aware of cancer diagnosis, necessity of understanding and recognition of the information needs of patients is very important; considering the events that occur to an individual during encounter the diagnosis, including awareness of the diagnosis, the need for diagnostic procedures, and the initiation of treatment through surgery or chemotherapy. In this study, the information needs of women with breast cancer were examined at this stage of the disease.

Materials and Methods: The present study was conducted using the qualitative approach and through the conventional content analysis method. Participants in this study were 10 women with breast cancer referred to cancer treatment centers in Mashhad city (together with 4 service providers) and 5 healthcare provider (3 physician and 2 nurses). The sampling began as purpose-based and continued until data saturation. Semi-structured interviews were used to collect data. All interviews were recorded and then transcribed verbatim.

Results: From the 368 initial codes obtained by data analysis, four categories were achieved including “the need to trust the physician”, “the need to overcome fear”, “the need to understand the threat”, and “the need for support to make the right choice”.

Conclusion: The findings of the study showed that women with breast cancer have many needs and concerns after facing with diagnosis and direction of initiation and continuation of treatment; therefore it is of high importance by nurses and the other clinical staff to recognize these needs and concerns and to support these patients in meeting those needs and accepting the disease.

WHO IS RESPONSIBLE FOR SPIRITUAL CARE OF CANCER PATIENTS IN HOSPITAL? EVIDENCE-BASED RECOMMENDATIONS

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Introduction: Training a healthcare provider to provide spiritual care for cancer patients is one of the vital part of the holistic care. Spiritual self-awareness, communication skills, cultural competence, spiritual sensitivity, adherence to professional and ethical boundaries, and professional development are among the characteristics of spiritual care providers. The ability to communicate with the patient and build a trust in this relationship is the foundation of spiritual care delivery (Hardman-Smith 2011). In Spiritual Therapy protocol, one of the important techniques of spiritual therapy is therapeutic communication. Spiritual therapists should be kind, and patient (Waziri et al., 1986).The secondary analysis was done to answer to this question "What are the characteristics of a spiritual care provider"?

Methods: This study is a secondary analysis on some parts of the results of a multi-method study design with a qualitative and systematic review parts.

Results: The human workforce in the healthcare system after passing preliminary and advanced courses of spiritual care should be able to identify and assess the spiritual needs of patients and design a care program for solving the problems of patients

Recommendation: The necessary qualifications of a spiritual care provider

1. Spiritual self-awareness

1.1. Spiritual self-awareness, self-reflection, identification of the spiritual and religious status of the self should be trained to the members of the spiritual care team (Based on the clinical guideline of the patient and practitioner relationship; level of evidence: I; strong degree A).

2. Communication skills

2.1. The most important characteristic of a spiritual care provider is the ability and art of establishing therapeutic communication (Based on the qualitative research of researcher, level of evidence: IV; weak degree C).

2.2. All individuals who work even as nongovernmental and voluntary groups in the oncology ward should possess high communication and moral skills (Based on the clinical guideline of supportive and palliative care of patients with cancer; level of evidence: I; strong degree A).

2.3. Spiritual care team members should be trained for communication skills. These skills include the ability of collecting information (open questions, leading questions, facilitating communication and speaking, abstracting), the ability of discovering the views of patients such as finding the worries of the patient, giving suitable information, examining the patient understanding, the ability of developing sympathy, responding to the patients emotions, and providing support (Based on the clinical guideline of the patient and practitioner relationship; level of evidence: I; strong degree A; Based on systematic review).

2.4. Healthcare provider should be patient in his/her communication with patients. Introduce yourself to the patient. Begin the communication with simple language. Establish eye contact with the patient. Talk slowly and friendly with them. Use common points, strong points of the patient, and showing willingness to help (Based on the clinical guideline of the patient and practitioner relationship; level of evidence: I; strong degree A).

2.5. Practice active listening (Based on randomized clinical trial; level of evidence: I; strong degree A).

2.6. Don't interrupt the patient's crying (Based on randomized clinical trial; level of evidence: I; strong degree A).

2.7. Through sympathizing with the patient during daily activities and typical care, show your understanding about their pain and suffering (Based on systematic review; level of evidence: I; strong degree A).
2.8. The healthcare provider should be conscious of obstacles and confounders of communication such as frowning, negligence, discrimination between patients, and indifference to states of the patient, anger, and not giving timely response (Based on the qualitative research of researcher, level of evidence: IV; weak degree C).

3. Cultural qualifications

3.1. The ability of establishing communication and approving patients with different cultures, religions, and values (Based on the clinical guideline of the patient and practitioner relationship; level of evidence: I; strong degree A).

4. Collaboration

4.1. Spiritual care is a team care which is presented with the all-round participation and collaboration of all healthcare team members. The team should keep its dynamics by mutual developing respect and trust, as well as evaluating different opinions and encouraging constructive discussions. Discussion on the problems of patients, recording and documenting the available information, and participation of the patient in the care process are among the duties of the team?. The healthcare provider's organization should support the spiritual care team (Based on the qualitative research of researcher, level of evidence: IV; weak degree C).
4.2. The spiritual care team needs a suitable conductor and coordinator to conduct the care program. The person in charge of coordination of the spiritual care team is the nurse employed in the oncology ward or the oncology specialist nurse; in addition to close communication with the patient, they also interact with the physician and clergy (Based on descriptive research; level of evidence: IV; weak degree C).

5. Spiritual sensitivity

5.1. The members of the spiritual care team in addition to qualification regarding the mentioned characteristics in the previous stage, should be able to identify the spiritual needs, take history, and screen. They should also be able to plan for the problems of patients in the spiritual aspect. While keeping the patient’s information confidential, if necessary, they should provide the ground for referring them to the relevant specialist (Based on clinical guideline of supportive and palliative care of patients with cancer; level of evidence: I; strong degree A).
2.5. The spiritual care team members should be able to identify the existential as well as religious spiritual needs, approved the value and culture of patients and their families and even their colleagues for timely decision-making and intervention (Based on clinical guideline of supportive and palliative care of patients with cancer; level of evidence: I; strong degree A).

6. Adhering to ethical-professional boundaries

6.1. The members of the spiritual care team should be careful about the professional boundaries. For example, as a trained clergy cannot give opinion on physical, diagnostic, therapeutic, and other similar issues instead of physicians and nurses and giving recommendation to the patient, the nurse and other healthcare members cannot give comment on religious and philosophical issues. (Based on descriptive research; level of evidence: IV; weak degree C).
6.2. The spiritual healthcare provider should be a theologian (Based on descriptive research; level of evidence: IV; weak degree C).
6.3. The spiritual healthcare provider should be cordial, conscientious, kind, responsible, responsive, and patient, and possess a strong spirituality (Based on descriptive research; level of evidence: IV; weak degree C).

7. Professional development

7.1. The nurse employed in the oncology ward, the specialist, psychologist, and other members of the healthcare team should have been trained in ontology, ethics and communication skills with patients to provide spiritual care (Based on the clinical guideline of promoting spiritual and religious care; level of evidence: I; strong degree A).
7.2. The members of the spiritual care team should be holistic and individual based, in providing care to the patients (Based on a study through systematic review; level of evidence: I; strong degree A).
7.3. The specialist and trained clergy in the area of ontology, philosophy, ethics, and communication skills should receive training regarding medical and disease issues as well as the symptoms and treatments. The clergy is in charge of addressing the complex problems of patients in spiritual aspect as well as training the newcomers of the team (Based on the clinical guideline of promotion of spiritual and religious care; level of evidence: I; strong degree A).

7.4. The specialist clergy in the spiritual care team should update their skills annually in order to enhance their ability in solving the complex problems of patients. Further, they should be in contact with the available people and resources in the society to facilitate and improve the teamwork (Based on the clinical guideline of promotion of spiritual and religious care; level of evidence: I; strong degree A).

WORKSHOP: NURSING MANAGEMENT OF TWO COMMON CHEMOTHERAPY INDUCED COMPLICATIONS (MUCOSITIS, NEUTROPENIA) IN CANCER PATIENTS UNDERGOING CHEMOTHERAPY

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Introduction: The side effects of chemotherapy are very wide in cancer patients. All of these effects have a significant impact on the quality of life of cancer patients. Therefore, effective management of these symptoms is very important.

Aim: Understanding Nursing Care in the Management of Mucositis and Neutropenia in Patients Undergoing Chemotherapy

Target group: the oncology nurses caring cancer patients

Abstract: In this workshop, two symptoms of mucositis, neutropenia due to cancer treatment, are discussed and the nursing management of these four complications is described in detail.

Cancer therapy induced mucositis:

Oral mucositis is a common side effect in cancer patients and has a significant negative impact on the patient's quality of life and interferes with the patient's ability to eat, making oral hygiene more difficult, and may lead to reduced adherence to treatment.

Cancer therapy induced febrile neutropenia

Febrile neutropenia is a common and serious complication of chemotherapy, a decrease in the number of neutrophils in patients receiving chemotherapy.

ADAPTATION OF CLINICAL GUIDELINE FOR PREPARATION AND ADMINISTRATION OF INJECTABLE CHEMOTHERAPY DRUGS AND PRESCRIPTION CARE IN ADULT CANCER PATIENTS FOR NURSES WORKING IN IRANIAN ONCOLOGY CENTERS

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Introduction: Intravenous (IV) catheterizations are frequently applied in cancer therapy for drug administration. Oncology nurses are responsible for the safe administration of IV treatments to the patients through peripheral and central venous catheter (CVC) and management of any possible complication. Therefore, nurses should follow evidence-based recommendations and clinical guidelines. The aim of this study was to adaptation the clinical guideline for preparation and administration of injectable chemotherapy drugs and prescription care in adult cancer patients for nurses working in Iranian oncology centers.

Methods: This research was conducted based on guideline adaptation method. After searching through authoritative databases and institutions publishing clinical guidelines, the articles published within the period of 2007 to August 2018 with selected keywords were reviewed and the clinical guidelines were evaluated independently by 5 experts using AGREE II tool based on the inclusion and exclusion criteria. In the next step, according to the recommendations available in selected guidelines, the draft of clinical guideline prepared was evaluated and revised in terms of usefulness, clarity, relevance and applicability by experts group in two stages. Finally, the clinical guideline to preparation and administration of injectable chemotherapy drugs was provided and final assessment was made by experts.

Results: After assessing the quality of selected clinical guidelines, five baseline guidelines and thirteen complementary guidelines were selected. According to the recommendations of selected clinical Guidelines, the views of the experts and conditions and facilities of the Iranian oncology centers. The clinical guideline for preparation and administration of injectable chemotherapy drugs and prescription care in adult cancer patients for nurses working in Iranian oncology centers was developed in seven chapters and confirmed by experts.

Conclusion: The results of present study showed that based on the opinion of the expert panel, the present clinical guideline is useful in terms of usefulness, clarity, relevance and some of its recommendations are not satisfactory in terms of performance. Since their application in practice has the need to provide some equipment, facilities and training of nurses in oncology centers; therefore, managers and authorities of oncology centers are required to provide the necessary equipment and training of nurses.

Keywords: Clinical guideline, preparation, administration, chemotherapy, cancer

UNDERSTANDING THE BARRIERS TO EFFECTIVE CHEMOTHERAPY FROM THE PERSPECTIVES OF ONCOLOGISTS, NURSES, PATIENTS AND THEIR FAMILIES

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Introduction: One of the treatments for cancer patients is chemotherapy. These patients require managed care, and for some reasons chemotherapy fails in some patients. This study aimed to explain the barriers of chemotherapy.

Method: This study was conducted using qualitative research approach and conventional qualitative content analysis. Purposeful sampling was done with oncologists, nurses, patients and their families. Sampling was completed in 12 samples with data saturation. Semi-structured interviews and data analysis were conducted using content analysis approach. In this study, four measures of trustworthiness; reliability, transferability, dependability and confirmability were used as recommended by Guba and Lincoln.

Results: The analysis of the interviews yielded 300 codes and three main categories which were structural components of the experience as follows: Barriers related to the patient and family (chemotherapy induced complications, financial barriers, cultural barriers, emotional/psychological status, intra family issues), Barriers related to the health professional (communication and educational barriers, lack of skills, lack of educating to staff, forced working in oncology ward for some staff), Barriers to the treatment system(Lack of physical, cultural and caring infrastructure to provide services, Lack of support in the continuum of the disease from diagnosis to rehabilitation, Lack of a multi-disciplinary team, Lack of expert staff in the healthcare team to provide quality care).

Conclusion: The comprehensive care of these patients and the removal of these barriers are important in routine care. The most important barriers to attention in the Iranian health care system were educational, communication, psychological, financial, and treatment barriers.

Keywords: barriers, chemotherapy

HOME CARE NEEDS OF CANCER PATIENTS: A QUALITATIVE STUDY

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Introduction: In recent years, with the increasing number of people victim to cancer, the need to provide care through different care systems has been increased. Since patients spend a lot of time at home either in the treatment phase or in the terminal phase. So the need for a home care system has become increasingly important for these patients, which has been shown an effective intervention in improving patients' quality of life in the different studies.

Methods: This is a qualitative descriptive study with conventional content analysis. Participants include patients and families referred to Entekhab Cancer Control Center in 1396. The sampling was continued until data saturation was achieved and consisting of 6 individual interviews with patients, one interview with two patients simultaneously, three interviews with caregivers, and two interviews with staff. The interview was semi-structured. All interviews were recorded and analyzed using content analysis.

Results & Discussion: Data from 12 interviews with participants indicated that the needs of patients receiving home care were divided into five main categories, including spiritual needs, psychological needs, socioeconomic needs, educational needs, and physical needs. The results of this study showed that there is need for a holistic approach to patients' needs in caring for cancer patients and it is important to meet the psychological and spiritual needs of these patients.

Keywords: cancer, home care, qualitative study, Iran

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ESTRO

RADIOTHERAPY IN RECTAL CANCER, COMPARING EARLY SIDE EFFECTS IN A PROSPECTIVE STUDY

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Abstract

Background: Different neoadjuvant treatments for rectal cancer lead to acute complications. The aim of this study was to evaluate and compare the acute complications of short-term (SC) and long-term (LC) radiotherapy.

Methods: one-hundred patients with rectal cancer who were referred to Namazi Hospital radiotherapy and oncology center before surgery were entered into this cross-sectional study. Patients in terms of type of treatment were divided into two categories: SC (25 grays radiotherapy at 5 fractions in 5 days) and LC (chemo-radiotherapy with a dose of 45-50.4 grays in 25- 28 fraction in 5-6 weeks with Co-administration of Capecitabine at 825 mg / m2 twice daily and five days a week). Then, the patients were evaluated for acute complications in the SC group for 10-14 days after the end of treatment and in the LC group at intervals of treatment, end of treatment and 2 weeks after treatment.

Results: In the LC group compared to the SC group, the percentage of patients with grade 1 diarrhea, grade 2 colitis and grade 1 cystitis at the end of treatment was statistically different ($P < 0.001$, $P = 0\text{-}046$, $P = 0.036$). In addition, the total number of patients with grade 1 and 2 dermatitis was higher in the LC group than in the SC group ($P = 0.046$). There was no significant difference between the two groups in the severe acute complications ($P > 0.05$).

Conclusion: The results of this study showed that some acute complications only had a significant difference between the two treatment groups in grade 1 and 2, and there was no significant difference between the two treatment groups in grade 3 and 4 acute complications.

STUDY OF CLINICAL AND PATHOLOGICAL FEATURES OF PATIENTS WITH MALIGNANT SALIVARY GLAND TUMOR OF HEAD AND NECK AND THEIR TREATMENT OUTCOME IN ALL PT CAME TO RADIOTHERAPY AND ONCOLOGY CENTER OF NAMAZI HOSPITAL SINCE 2005 2015

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Introduction: Head and neck cancers are a serious and growing problem worldwide. Salivary gland tumors are not common tumors that comprise 3 to 4% of head and neck neoplasms. We want to share our experience in our center with colleuges.
Method: This study is a retrospective descriptive study in which the records of all patients with salivary gland cancer referred to the Radiation and Oncology Center of Namazi Hospital during 2005-2015 were reviewed. Data were analyzed using descriptive statistics including frequency and percentage and inferential statistics including chi-square test or Fisher's exact test and survival analysis.
Results: 158 patients were included in this study with a mean age of 55.37 years. 49.37% of the subjects were men. Adenoid cystic carcinoma was the most common histologic type of tumor (30.57%) and adenocarcinoma with the lowest prevalence of 1.91%. 65.19% of the salivary gland neoplasms in this study had parotid gland involvement and the sub lingual type had the least prevalence (3.8%). Survival analysis results also showed that with increasing tumor size, tumor grade, tumor stage, lymph node involvement and metastasis and recurrence, survival rate significantly decreased, with negative gender and Complete Resection and surgical margin. Neoadjuvant therapy and chemotherapy were associated with increased relative survival.
Conclusion: Overall, the authors concluded that clinical, pathological, and therapeutic factors were significantly associated with their survival in patients with malignant salivary gland neoplasms. In tumor histology, larger tumors and higher lymph node involvement as well as distant metastases such as bones and lungs have a higher mortality risk.

REPORTING A RARE CASE WITH OROPHARYNGEL EXTRAMEDULLARY PLASMACYTOMA

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Introduction: plasma cell neoplasms are a wide range odf disease that may be asymptomatic or may present with a leukemic feature.solitary extramedulary plasmacytomas are a category of plasma cell tumors with specific feature ant treatment. extramedullary plasmacytoma that occurs ibn soft tissue is less common than bone plasmacytoma. In head and neck, nasopharynx is the most common site for this tumor. We report a case of ortopharyngeal plsamacytoma and its treatment.
Case Presentation: The patient was a 57 year-old man with 2 months history of dysphagia with a foreign body sensation. Total tumor resection was done and he received 40 Gy radiation. After 24 months of follow up, the patient was well and disease free.
Conclusion: according to the presented case, a plasmacytoma should be considered in patients with dysphagia and oropharyngeal lesion. These masses can be treated with surgical excision and radiotherapy.

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PREVALENCE OF ABNORMAL FINDINGS IN THE UPPER GASTROINTESTINAL TRACT OF REFERRED PATIENTS UNDER PATRONAGE OF A LOCAL RELIEF FOUNDATION IN GUILAN PROVINCE

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Abstract

Background: Precancerous lesions of upper gastrointestinal (UGI) tract are multifactorial diseases resulting from persistent cellular damage caused by long-term exposure to various carcinogens.

Methods: In a cross-sectional study, three hundred patients under the patronage of a local relief foundation aged more than 40 years were enrolled. All patients underwent endoscopy and checked for *Helicobacter pylori* infection**.**

Results: Grade A mucosal breaking (58.7%) in the esophagus, erosions (57.0%) in the stomach and ulcers (6.3%) in the bulb were the most frequent lesions. The prevalence of *H. pylori* infection was 59% and male patients and smokers were more infected (P=0.018 and P=0.045, respectively). Esophageal lesions were higher in the age more than 60 years (P=0.036). Smokers and patients with familial history of cancers in the 2nd and 3rd grade of relatives had more lesions in the bulb (P=0.005 and P=0.010, respectively). Totally, 6 male patients aged more than 60 years had gastric masses in endoscopic evaluation (4 fundic polyps and 2 hyperplastic polyps) mainly in fundus and body (66.6%) which half of them were lesser than 5 mm and others had the size of 5-10 mm. These were mostly seen in BMI > 30 kg/m^2 and significantly associated with exposure to harmful industries and having a familial history of cancers in the first grade of relatives. Totally, 54 patients had intestinal metaplasia (IM) and three patients had adenocarcinoma. In addition, there was a positive association between gastric atrophy and age (P=0.009). The Significant positive association between consumption of fish meat and occurrence of IM was detected (P=0.010).

Conclusions: Male sex, higher age, and smoking for IM and male sex, higher BMI and smoking for *H. pylori* infection were the predictive risk factors. It seems early diagnosis of precancerous lesions help to prevent cancers and to increase the survival rate.

Keywords: Intestines, Metaplasia, Atrophic Gastritis, Helicobacter pylori, Endoscopy

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KNOWLEDGE EVALUATION OF GASTROINTESTINAL CANCERS IN PATIENTS REFERRED FOR ENDOSCOPY AND COLONOSCOPY DURING A SCREENING PROGRAM IN NORTH OF IRAN

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Abstract

Introduction: We evaluated knowledge of gastrointestinal (GI) cancers in patients referred for endoscopy and colonoscopy screening which can play an important role in the correct direction of health plans in order to control and prevent the disease at the community level.

Materials and Methods: This study was conducted in the Gastrointestinal and Liver Disease Research Center (GLDRC), Rasht, north of Iran, between May 2017 and April 2018 among 461 participants who were screened by endoscopy and colonoscopy. Sociodemographic characteristics were collected using a questionnaire for both groups. Gastric (29 items) and colon (23 items) cancer knowledge questionaires were used in order to assess the knowledge of participants about GI cancers in five domains before the screening.

Results: Overall, 300 and 161 individuals were in the gastric and colon cancer knowledge group, respectively. The level of knowledge in various areas of gastric and colon cancer was desirable. In general, the average of different domains in gastric and colon cancer knowledge questions were 20.2 ± 6.6 and 19.2 ± 4.9, with a knowledge level of 174 (58%) and 108 (67.1%) higher than the mean. The mean score of knowledge of GI cancers in terms of risk factor indicated a significant relationship between BMI and alcohol consumption. Meanwhile, a significant relationship between symptoms and BMI with knowledge was declared. About domains of colon cancer, there was a significant relationship between younger age and knowledge in the risk factor.

Conclusions: We suggest to formulate strategies to achieve goals, especially in the field of education, prevention, and control of the disease by raising knowledge for the general public and educating people who are responsible for providing and delivering health services.

Keywords: Knowledge, Gastrointestinal, Screening Cancer

EVALUATION OF BREAST CANCER SCREENING AND MAMOGRAPHY FINDINGS IN WOMEN UNDER PATRONAGE OF A LOCAL RELIEF FOUNDATION IN GUILAN PROVINCE IN 2016-2017

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Abstract:

Background: Breast cancer is one of the most common and important disease in women and the second leading cause of death is these patients, in which Prevention and screening will reduce the risk of death.

Aim: The purpose of this study was to determine the screening of breast cancer and imaging findings in women under patronage of a local relief foundation in Guilan province in the years 2016-2017.

Methods: This descriptive cross-sectional study was conducted in which 300 women under patronage of a local relief foundation who were willing to participate in the study were enrolled. Data were collected using a researcher-made questionnaire, height and weight measurements to determine BMI and mammography for samples. Data were analyzed using descriptive and analytical statistics, using chi-square and t-test with SPSS ver16 software.

Results: The results of the study showed that the prevalence of breast cancer in the population of Guilan province was estimated to be 1.7%, with a 95% confidence interval for the community, equal to 0.6% -3.6%, of which more than one in 60 people had cancer.

Conclusion: The implementation of screening programs in women should be considered and breast screening using mammography is a valuable method for early diagnosis of breast lesions. Early diagnosis is associated with better cancer prognosis.

Keywords: Screening,Breast cancer, Mamography findings

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PREVALENCE OF PRE-CANCEROUS COLON LESIONS IN REFERRED PATIENTS UNDER PATRONAGE OF A LOCAL RELIEF FOUNDATION IN GUILAN PROVINCE

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Abstract

Introduction: Colon cancer is the most commonly diagnosed gastrointestinal cancers in developed countries and its epidemiological features such as the incidence and the onset age of disease varied worldwide.

Methods: In a cross-sectional study from March 2016 to March 2017, 161 participants who were under patronage of a local relief foundation with age more than 50 years or more than 40 years with history of colorectal cancer in their first-degree family were enrolled. Demographic information was collected. Colonoscopy was performed and histopathological evaluation of observed lesions and polyps was done.

Results: Most of participants were female (113 individuals, 70.2%) and aged 50-60 years (83 ones, 51.6 %). Seventy-four ones (46%) had certain lesions. Most of colonoscopy findings were observed in the ascending colon in which depressed polyps and diverticulum were most frequent. However, rectum showed the most histological findings. All polyps of descending and ascending colons were neoplastic, while most of the rectal polyps were non-neoplastic. Male patients, who aged more than 60 years and smokers had a significant higher percentage of both lesions and polyps in their colon ($P<0.05$). Moreover, the significant positive association was detected between exposure to harmful industries and having polyps ($P=0.01$). No significant association detected between dietary habitations with neither lesions nor polyps. Regression model study revealed that just male sex, higher age for colonoscopy lesions and male sex, higher age and exposure to harmful industries for polyps were the predictive risk factors.

Conclusion: We found male gender, higher age, smoking, and exposure to harmful industries as important risk factors for having colorectal lesions, which must be confirmed in further studies.

Keywords: pre-cancerous, colon lesions, histopathology

POPULATION-BASED SCREENING OF PROSTATE CANCER: A CROSS-SECTIONAL STUDY IN NORTH OF IRAN

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Abstract

Background: It seems that screening of asymptomatic males through measurement of prostate specific antigen (PSA) levels and digital rectal exam (DRE) leads early detection and treatment which prevents prostate cancer (PC).

Objective: This study was aimed to screen PC among a certain male group in north of Iran.

Method: A total of 300 males were included to this cross-sectional study which was conducted between 2016 to 2017 with the collaboration of the Gastrointestinal and Liver Diseases Research Center (GLDRC) and the Razi Urology Research Center (RURC), Guilan province, Iran. A questionnaire included demographic data, risk factors and clinical symptoms were recorded in GLDRC. Then subjects were referred to an urologist for DRE. Also, PSA evaluation was performed by Razi Hospital Laboratory. The data were analyzed using one-way ANOVA and Chi square test. Also, $p< 0.05$ was considered statistically significant.

Results: The mean age of study population was 63.7 ± 8.8 (mean ± SD). Forty-five males (15%) had PSA>3. Overall, 162 males (54%) had abnormal DRE. Older males had significant abnormal PSA levels. Furthermore, the relationship between abnormal PSA levels and history of PC in first grade relatives was statistically significant ($P <0.05$). In this study, the most common symptom was hematuria while pain or cramping in the lower trunk, pelvis, and upper extremities were found as the lowest signs.

Conclusion: According to the higher PSA levels among elderly subjects, this marker can be used in future local PC screenings. Also, it seems that it is essential to increase the awareness of men about PC by investing budgets in training programs.

Keywords: Prostate cancer, Screening program, Prostate-specific antigen, Iran

EFFECT DEEP BREATHING TECHNIQUE ON ANXIETY, PAIN AND VITAL SIGNS IN PATIENTS UNDERGOING BONE MARROW ASPIRATION- A RANDOMIZED CLINICAL TRIAL

Abstract

purpose: Bone Marrow Aspiration (BMA), widely used in regenerative medicine, is one of the approaches for diagnosis and treatment of various diseases nowadays. Although this Procedure in adults is usually performed by using local anesthesia, it is associated with anxiety and pain. The purpose of the present study is to lunch research into the effect of Deep Breathing Technique (DBT) on patients who have undergone BMA for appeasement of pain and reduction of anxiety.

Method: This study was a parallel randomized clinical trial. 60 patients who underwent BMA were randomly categorized into two groups. The intervention group received DBT training, but control group did not take any DBT training program. To measure the scope of anxiety and severity of pain, Spielberger State Anxiety Inventory (SAI) and Visual Analogue Scale (VAS) were recruited respectively. The pre-anxiety and post pain of BMA were evaluated in two groups.

Result: Comparison of anxiety and pain variables in study groups revealed that the mean score of anxiety and VAS average in the intervention group have been lower than that of the control group and this difference was significant ($P = 0.018$ and $P < 0.001$ respectively). Comparison of vital signs before and after DBT showed the reduction of them after the intervention. However, no significant change was detected in control group.

Conclusion: DBT is an effective technique which is applied to reduce anxiety and relieve pain in BMA candidate. Nurses need to be aware of anxiety and pain during performance of this procedure BMA.

Keywords: breathing exercises; anxiety; pain; Visual Analog Scale; stem cell therapy

COMPARING THE EFFICACY AND SIDE EFFECTS OF PDLASTA® (PEG-FILGRASTIM) WITH PDGRASTIM® (FILGRASTIM) IN BREAST CANCER PATIENTS; A NON-INFERIORITY RRANDOMIZED CLINICAL TRIAL

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Introduction: G-CSF is the main cytokine in the control of neutrophil production, which is used clinically for the treatment of chemotherapy-induced neutropenia. It may be prescribed in single dose (Peg-Filgrastim) or repeated six daily injections (Filgrastim) during chemotherapy courses. The objective of this study was to compare the efficacy and side effects of to evaluate the efficacy and safety of Peg-Filgrastim product of Pooyesh Darou Biopharmaceuticals Company with Filgrastim in breast cancer patients in a non-inferiority clinical trial.

Methods: In this randomized clinical trial, 80 patients recruited and allocated randomly in two arms of study, equally. In first group, a single subcutaneous dose of 6 mg of Peg-Filgrastim was injected the day after receiving chemotherapy regimen in each cycle. The second arm received subcutaneous injection of 300 micrograms per day for six consecutive days in each course of treatment. Hematologic parameters were measured at first day and 7th and 15th days of each cycle of chemotherapy. All probable side effects were recorded during the eight courses of treatment in two groups of study. Side effects of GCF treatment and its effect on blood parameters were compared in each cycle and during 8 courses of chemotherapy.

Result: hematologic parameters showed no significant difference in each course of treatment between two groups of study. The comparison of the WBC (p=0.527), Hgb (p=0.075), Platelet (p=0.819), Neutrophil (p=0.575), Lymphocyte (p=705) and ANC (p=0.675) changes during eight courses of treatment identified no statistically significant difference between two study groups, too. Side effects including headache, injection site reaction and muscle pain had lower frequency in patients receiving Peg-Filgrastim drug.

Conclusion: Regarding to our results. Peg-Filgrastim is completely non- inferior in efficacy and less toxic compared to Filgrastim. Prescribing in single dose and lower expenses of Peg-Filgrastim, introduces it as a cost-effective drug in treatment of chemotherapy induced neutropenia.

Keywords: Peg-Filgrastim, Filgrastim, chemotherapy, breast cancer, Iran

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DESIGNING AND CONSTRUCTION OF AN APPLICATOR GUIDING SYSTEM IN INTRA-OPERATIVE ELECTRON RADIOTHERAPY

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ABSTRACT

Breast Intraoperative Electron Radiotherapy (IOERT) is a multidisciplinary procedure, which performed in combinations with cancer surgery and radiotherapy. During this approach, a high-level of radiation dose (i.e. between 12 to 21 Gy) is delivered to the tumor bed for an anesthetised patient and after tumor resection. In this method, organs at risk such as pectoral muscles, heart, and lungs may be exposed to unwanted radiation. Therefore, a radioprotective disk is commonly used to protect the underlying healthy tissues behind the surgical flap.

Being sure about the precise position of the radioprotective disc relative to the applicator wall and also the complete contact of the applicator end with the tumor surface (any air gap between tumor surface and the end of the applicator) is of particular importance in protecting healthy tissues and delivering a proper dose distribution to the tumor bed. As a high dose per pulse linear accelerator IOERT can exposes a target to about 20 Gy in one minute.

This study addresses the potential of previously mentioned disk displacement problem, which has been happened in experimental IOERT setups, routinely. The first idea was about constructing a tool that could serves as a mechanical navigator to make a physical adaption between the end of applicator and the protective disk. Therefore, a guiding applicator system was designed using SOLID WORKS (2019, SP3.0 Full Premium) software. Then, employing a 3D printing machine (Jahan3D JP4), the corresponding guiding applicator system was constructed with poly-lactic acid (PLA) material. The applicability of this guiding applicator system was tested in IOERT operation rooms. This tools in not mounted during the beam pass way and so do not have any perturbation effects on the radiation beam. After passing the first confirmation tests it has been employed during IOERT of about 20 breast cancer cases. Currently, this tool has been used in Khatamol Anbia hospital, an IOERT center in Iran.

PROTECTION EFFECT OF CERIUM OXIDE NANOPARTICLES AGAINST RADIATION-INDUCED ACUTE LUNG INJURIES IN RATS

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Abstract

Introduction: Radiation therapy is one of the most common tools for treating cancer. The aim is to deliver adequate doses of radiation to kill cancer cells and the most challenging part during this procedure is to protect normal cells from radiation. One strategy is to use a radioprotector to spare normal tissues from ionizing radiation effects. Researchers have pursued cerium oxide nanoparticles as therapeutic agent, due to its diverse characteristics, which include antioxidant properties, making it a potential radioprotector.

Materials and methods: One hundred rats were divided into five groups of A) control group, intraperitoneal (IP) saline injection was done twice a week; B) bi-weekly IP injection of 14.5 nM (0.00001 mg/kg) CNP for two weeks; C) a single whole thorax radiation dose of 18 Gy; D) a single whole thorax radiation dose of 18 Gy + bi-weekly injection of 14.5 nM CNP for two weeks after radiation; E) bi-weekly IP injection of 14.5 nM CNP for two weeks prior to radiation + a single whole thorax radiation dose of 18 Gy. Thirty days after irradiation, 7 rats from each group were anesthetized and their lungs extracted for histopathological examination.

Results: Statistical analyses revealed that CNP significantly decreased the incidence of tissue collapse and neutrophil aggregation in rats, receiving CNP before radiation in comparison with radiation group.

Conclusion: The results suggested the possibility of using CNP as a future radioprotector due to its ability in protecting normal cells against radiation-induced damage.

EVALUATION OF HUMAN SERUM FATTY ACID BINDING PROTEIN AS A PROGNOSTIC FACTOR IN NON-METASTATIC BREAST CANCER PATIENTS

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Abstract

Introduction: Breast cancer is the most common malignancy in women worldwide. It would be of great value to have reliable prognostic factors which could help to find patients most at risk of recurrence. Fatty acid binding protein (A-FABP) is recognized to affect insulin sensitivity, lipid metabolism, and an inflammatory response associated with atherosclerosis, and circulating A-FABP could be involved in the pathogenesis of breast cancer. In this study, we analyzed serum A-FABP levels in breast carcinoma patients to evaluate its function as a prognostic factor in breast cancer.

Method: Seventy-nine breast cancer patients who fulfilled inclusion and exclusion criteria enrolled in study. Before any adjuvant chemotherapy or surgery, peripheral blood samples were collected and serum level of A-FABP was determined by using ELISA kit. The usual breast cancer clinical and pathological variables were also collected. All patients follow up for 5 years particularly regarding cancer recurrence and patients' survival.

Results: Forty-two percent of the patients experienced no recurrence after five years. Cumulative risk of recurrence 5 years after the beginning of the study was 0.86. There was no significant correlation between serum level of A-FABP and recurrence rate in 5 years (p=0.925).

Conclusion: According to the results, the serum levels of serum levels protein A-FABP had no roles in prognosis in breast cancer.

Keywords: A-FABP, prognostic factor, breast cancer

RADIOPROTECTIVE EFFECT OF SULINDAC SULFIDE TO PREVENT DNA DAMAGE INDUCED BY IONIZING RADIATION ON HUMAN LYMPHOCYTES

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Abstract: The expose of the normal cell to ionizing radiation (IR), causes damage of DNA leading to cell dysfunction or even cell death. However, the identification of new radio protectives is necessary to protect normal cells. Sulindac sulfide (SS) as a metabolite of sulindac (a non-steroidal anti-inflammatory drug) is a cyclooxygenase inhibitor. IR generates free radicals and reactive oxygen species as well as induces inflammation process is affected in DNA damage.

Purpose: In this experiment, the radioprotective effect of SS was researched against genotoxicity and lipid peroxidation induced by ionizing radiation in human blood lymphocytes.

Methods: In this study, human blood samples were pretreated with SS at different concentrations (10, 25, 50, 100 and 250 µM) and then were exposed to IR at dose 1.5 Gy The radioprotective effects of SS were assessed by the micronucleus (MN) assay, as well as the malondialdehyde (MDA) levels (a biomarker of oxidative stress) were evaluated in every treated group.

Results: It was found that SS decreased the percentage of MN induced by IR in lymphocytes. The maximum reduced in frequency of MN was observed at 250 µM of SS (87% reduction), providing the most protection against ionizing radiation. On the other hand, pretreatment with SS (250 µM) inhibited IR-induced oxidative stress which afterward led to decreasing of the micronuclei (MN) frequencies in human lymphocytes.

Conclusion: This data demonstrates that SS is a good radioprotective agent that can protect human normal cells against the lipid peroxidation and genetic damage induced by ionizing irradiation.

Keywords: Sulindac sulfide, DNA damage, MN, Radioprotective, Genotoxicity, lipid peroxidation

LncRNA CCAT1 (Colon-cancer associated transcript-1) up-regulation in Iranian breast cancer patients

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Introduction : Long non-coding RNAs (LncRNAs) are a group of non-protein-coding RNAs, with more than 200 nucleotides in length, which consider as a new layer of biological regulation. Recent studies have shown that LncRNAs play key roles including proliferation, differentiation, migration and invasion in different cellular processes. CCAT1 (colon cancer–associated transcript-1) is a cellular LncRNA which shown in different types of malignancy such as gastric cancer, colorectal cancer and hepatocellular carcinoma.

Materials and Methods : In this study, blood specimens were collected from 30 normal healthy women and 30 breast cancer patients. LncRNA CCAT1 expression level was evaluated and quantified by Real-Time PCR.

Results: LncRNA CCAT1expression is significantly up-regulated in blood of patients with breast cancer comparing with normal blood specimens.

Conclusion: Up-regulation of LncRNA CCAT1 is shown in Iranian breast cancer patients that could correlate with aggressive disease progression and poor prognosis of breast cancer patients. LncRNA CCAT1 up-regulation might be involved in breast cancer carcinogenesis and become a potential future prognostic biomarker for breast cancer patients.

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ELECTROCARDIOGRAPHIC AND ECHOCARDIOGRAPHIC CHANGES AFTER RADIOTHERAPY IN PATIENTS WITH BREAST CANCER

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Background: About 18.1 million new cases of cancer and 9.6 million deaths due to cancer were reported by the Global cancer statistics (GLOBOCAN) in 2018. Among these, breast cancer is the most common cancer in women worldwide. Radiotherapy (RT) as a standard treatment for breast cancer is usually used in combination with surgery or chemotherapy. However, radiation dose received by heart in breast cancer RT can cause cardiovascular (CV) side effects in these patients. Heart diseases due to RT including pericardial diseases, cardiomyopathy, coronary artery diseases (CADs), arrhythmias, myocardial ischemia, valvular diseases, and conduction system diseases have been reported in these patients. Left breast cancer patients mostly are exposed to RT-related heart disease relative to right breast cancer patients. It has been reported that left anterior descending coronary artery (LAD) in these patients receives higher radiation doses. Screening methods including electrocardiogram (ECG) and echocardiography (ECHO) can be used to diagnose these heart problems.

Materials & Methods: In this article, we reviewed the more recently published works in the field of cardiovascular side effects due to breast cancer radiation therapy using ECG and ECHO. The papers were searched in PubMed, Scopus and Sciencedirect databases with the relevant keywords including Breast cancer, Radiotherapy, Cardiovascular diseases, Heart dose, Electrocardiography and Echocardiography.

Results : Based on the former studies, RT-induced ECG changes have been observed in 13 to 37% of women with breast cancer. It has been proved that radiation doses (>30 Gy) to the whole heart leads to CV damage; and also if the V_{25}<10% *of the hear*, the probability of long-term cardiac death will be less than 1٪. However, the mean heart dose has dropped to less than 5 Gy nowadays due to developments in dose delivery techniques. Also based on the former studies, the pericardium layer damage including pericarditis and pericardial effusion are more likely in breast cancer RT, because this layer is the most superficial layer. Pericarditis occurred when $V_{30} < 46\%$ .T-wave and ST segment changes (as an early ECG changes) are most common in breast cancer RT. It has been proved that T-wave and ST segment abnormality and decrease in QRS voltage are significantly related to pericarditis. Although, it is not yet known that ECG changes are only due to RT; other factors such as chemotherapy drugs also have been reported for these changes. Heart problems caused by breast cancer RT are usually associated with ECHO parameters such as decrease in left ventricular ejection fraction and myocardial longitudinal shortening (using global longitudinal strain parameter that is related to left ventricular systolic dysfunction).

Conclusion: Ionizing radiation-related heart problems can be occur in patients with left-breast cancer after RT, which can significantly decrease the quality of life of these patients. The higher dose to heart results in a higher probability of causing side effects. However, the ECG and ECHO methods can be used to diagnose the heart problems after RT; but cardiac side effects should be considered during treatment planning in left-breast cancer patients based on the recently-approved NTCP models in relevant and reliable clinical-radiobiological studies. Recent advancements in radiotherapy techniques such as proton therapy and other techniques such as deep inspiration breath-hold (DIBH) as well as proper positioning of the patients are the factors that can reduce the heart radiation dose; and consequently decreases the occurrence of the cardiac side effects.

Keywords: Breast cancer, Radiotherapy, Cardiovascular diseases, Heart dose, Electrocardiography, Echocardiography

DOWN-REGULATION OF LNCRNA GROWTH ARREST-SPECIFIC TRANSCRIPT 5 (GAS5) IN IRANIAN BREAST CANCER PATIENTS

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Introduction: Breast cancer (BC) is the most common malignancy and cause of cancer-related mortality among women, in Iran. Studies have suggested that the dysfunction of long non-coding RNAs (LncRNAs) is correlated with breast cancer. In this study, we aimed to investigate the role of LncRNA growth arrest-specific transcript 5 (GAS5) in breast cancer.

Materials and Methods: In this research, blood samples collected from 30 breast cancer patients and 30 healthy women (controls). RNA was extracted from the whole blood and cDNAs were then synthesized. Quantitative reverse transcription-polymerase chain reaction (qRT-PCR) was performed to detect expression of LncRNA GAS5 by Real-time PCR.

Results: LncRNA GAS5 expression level was decreased significantly in patients with breast cancer when compared to normal controls.

Conclusion: dysregulation of LncRNA expression level is a major component in carcinogenesis. Down-regulation of GAS5 LncRNA has previously been reported in several types of cancers.

In our study, GAS5 LncRNA was down-regulated in Iranian breast cancer patients compared to normal controls. In conclusion, GAS5 LncRNA could consider as a prognostic biomarker for breast cancer patients.

THE ROLE OF SOCIAL MEDIA IN KNOWLEDGE ACQUISITION IN CANCER PATIENTS

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Introduction: Cancer is one of the most common health problems worldwide. As in other countries in the world, the incidence of cancer has increased in Iran. A large group of patients spend the majority of their lives with cancer, so they require long-term follow-up, and this is an area for loss of control over life. One of the biggest challenges in this regard is the acquisition of caring knowledge from different sources. One of the sources of information is the use of social media.

Method: This qualitative study was conducted with a phenomenological approach. The method of selecting participants was purposive sampling. Participants were selected from a referral center for cancer patients in the northwest of IRAN. The main tool for data collection was unstructured interviews.

Results: Data analysis showed that knowledge enhancement via social media is one of the strategies for increasing caring knowledge. Health professionals and staff also acknowledge that using the internet and virtual networks is a good way to learn some health care issues.

Participant 6 stated that:

"I had learned from the internet that I should use masks and I shouldn't be in crowded places. I learned about nutrition in cancer via social media ."

Conclusion: The results of this study can be used by family caregivers. It will also provide a framework for team-based guidance to routine hospital training. Social media can be used as a basis for empowering patients and their family caregivers.

Keywords: Cancer, Caring Knowledge, Social Media

THE ROLE OF RADIOBIOLOGICAL PARAMETERS ON TUMOR CONTROL PROBABILITY (TCP) IN PROSTATE CANCER

Introduction: The aim of this study was to evaluation radiobiological modeling parameters on tumor control probability (TCP) for prostate cancer in three different models. These parameters included α⁄β ratios and cell surviving fraction at 2 Gy (SF2).

Materials and Methods: the Poisson, equivalent uniform dose (EUD) and linear quadratic (LQ) models was used as the radiobiological models. TCP was calculated in 10 prostate cancer patients as a function of α⁄β ratios (1.5-20) for all radiobiological models and SF2 (0.3-0.7) for LQ model . For each patient, 3D-CRT and IMRT plans were designed to deliver, on average 76 Gy and 82 Gy to planning target volume, respectively.

Results: The TCPs calculated by Poisson model were dependent on α/β, results demonstrated that dose escalation from 76 Gy in 3D-CRT to 82 Gy for IMRT caused 5% improvement in TCP for prostate cancer considering the α/β of 10 and higher TCP for IMRT relative to 3D-CRT was seen for α/β higher than 5. According to our results For EUD model the TCPs were independent on α/β. In the LQ model with increase in α/β in specific SF2 , TCP will not change remarkable. but with the change of SF2 from 0.7 to 0.3, TCP values change from 0 to 100 % at the prescribed doses in both treatment planning's.

Conclusion: Different mathematical models provided different quantitative outcome for TCP of prostate cancer plans. The IMRT plans were significantly advantageous over the 3DCRT plans with some small variations in each patient. More studies are needed for the optimization of radiobiological models for the prediction of the treatment outcomes in radiation therapy.

Keywords: Prostate cancer, 3D-CRT, Intensity Modulated Radiotherapy, Radiobiology, Tumor control probability

THE ROLE OF THERAPEUTIC TOUCH IN REDUCING THE DEATH ANXIETY IN PATIENTS WITH BREAST CANCER: A REVIEW STUDY

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Introduction:
Breast cancer with an annual prevalence of 10-30 thousands persons is the commonest cancer among women. Most of the existing treatments have serious physical and mental complications. Awareness of this disease can end in deep emotional problems in the patients. One of the most common psychological experiences of patients is death anxiety, which can affect the acceptance of the disease and its treatment regimen. Some studies have mentioned the role of massage and therapeutic touch in establishing a sense of relaxation and improving the mental health of the patients. Hence, the study was conducted to determine the role of therapeutic touch in death anxiety of breast cancer patients.
Materials and methods:
The review study was conducted by search in SID, Google Scholar, Pubmed, and Science Direct databases using the keywords therapeutic touch, death anxiety, breast cancer, non-pharmacological interventions based on Mesh from 2008 to 2019. Moreover, 98 papers were found and after removal of the repetitious, unrelated cases and lack of access to the full text, 36 papers were finalized.
Results:
The results from different studies showed that therapeutic touch interventions increase the psychological health of patients and bring about relaxation among the patients. Moreover, it was seen that therapeutic touch reduced anxiety, worry and rumination about death in patients. Therapeutic touch increases cortisol and life quality bringing more comfort and responsiveness to the patients with cancer, and reduces the anxiety of death in breast cancer patients.
Discussion and conclusion:
As the death anxiety in breast cancer patients can affect the life quality of patients, and non-pharmacological interventions based on energy therapy, like the therapeutic touch, can affect adaptive coping processes and the effective acceptance and response of the therapeutic treatment of these patients. It also helps them get more coherence in their sense of relaxation through the restoration of mental relaxation and reducing their death anxiety. Hence, conducting interventions based on therapeutic touch, education in this regard, and special attention to it in patients with breast cancer is suggested.

Keywords: Death anxiety, breast cancer, therapeutic touch

EVALUATION OF EXIT SKIN DOSE FOR INTRA-CAVITARY BRACHYTHERAPY TREATMENTS BY THE BEBIG ^{60}CO MACHINE USING THERMO-LUMINESCENT DOSIMETERS

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Abstract

Purpose: This study aims to evaluate the application of the exit skin dose (ESD) in verifying the accuracy of intra-cavitary brachytherapy treatments performed by the BEBIG ^{60}Co machine using TLD dosimeters.

Material and methods: Eleven patients who were treated for gynecological malignancy by HDR brachytherapy machine have been considered in this study. A combination of tandem, cylinder, and interstitial needles was applied for 8 patients while tandem ovoid applicators were used for the rest (3 patients). In order to measure ESD, TLD dosimetry was performed for each patient. TLDs were placed precisely on the patient's skin along her symphysis pubis bone (anterior) and left (L)/right(R) sides of her pelvic. Positioning of the dosimeter was accurately determined using fiducial markers in CT-scan imaging, prior to the treatment. Finally, a comparison was made between calculated the dose from the treatment planning system and the dose measured by TLDs.

Results: About 90% of all cases showed a good agreement (while considering TLD uncertainty ~ 5.5%) between TPS dose calculations and TLD measurements. The measured mean values of ESD received to anterior, left and right positions were 56.72 cGy, 12.18 cGy and 12.82 cGy, respectively. For three patients differences up to 11.9 % were detected**.**

Conclusion: To conclude, ESD measurement method can be a suitable practical approach for verifying the accuracy of GYN HDR treatment delivery.

A 10-YEAR-OLD BOY WITH CHOROIDAL HEMANGIOMA: REPORT OF A CASE

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Abstract

Introduction: Choroidal hemangioma is a rare type of hemangioma. Here we report this uncommon tumor in a young boy.

Case presentation: A 10 year old boy referred to ophthalmologist due to decrease visual acuity. The patient had large hemangioma that involved almost all parts of face .With ophthalmologic examination, ultrasound and MRI, choroidal hemangioma of right eye was diagnosed.

Conclusion: We report a rare case of choroidal hemangioma and review literature.

Keywords: hemangioma, choroidal hemangioma, childhood.

SUCCESSFUL TREATMENT OF REFRACTORY ACNE KELOIDALIS NUCHAE (AKN) WITH EXTERNAL IRRADIATION

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Abstract

Acne Keloidalis nuchae (AKN) is a chronic inflammatory condition that leads to fibrotic plaques, papules and alopecia on the occiput and/or nape of the neck. Although it involves both genders, it is much more prevalent in young African American men. As the exact etiology of AKN is unclear the condition is therefore difficult to treat, and the clinical response is usually poor. Numerous modalities have been used, but currently there is no standard treatment. In this study, we present a case of a 29-year-old man with AKN who was found to be resistant to topical treatments, cryotherapy, antibiotics and surgery. As an alternative treatment, the patient underwent radiotherapy in our department, with good response.

PRIMARY HIGH GRADE PAPILLARY SEROUS CARCINOMA OF CERVIX: A CASE REPORT

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Abstract

Introduction: Adenocarcinoma amounts to less than 20% of cervical carcinomas. A very rare type of cervical adenocarcinoma is papillary serous carcinoma (PSCC).

Case report: The patient is a 65-year-old female that presented with vaginal spotting and underwent TAH-BSO because of abnormal pop smear.

On gross examination, an oval shape mass measuring 1.2 × 0.7 × 0.7 cm was detected in the middle part of endocervix. Microscopic examination of the cervical mass revealed papillary structures that were linked buy highly atypical cells with large nuclei and prominent nucleus. So PSCC was diagnosed. The stage of disease was I_b. Because lymph node dissection was not performed, we offered the patient external irradiation and brachytherapy. She refused chemotherapy.

Conclusion: PSCC of cervix is an extremely rare disease with a poor prognosis in advanced stages. Current treatment is in accordance with cervical S.C.C. Herein we report a case of PSCC and review the literature.

LONG TERM SURVIVAL IN A MAN WITH METASTATIC GASTRIC ADENOCARCINOMA: A CASE REPORT

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Introduction: Locally advanced and metastatic gastric carcinomas are not curable conditions. The goals of treatment in these patients are improve quality of life, symptom palliation and prolong survival. Here we report a case with long-term survival.

Case presentation: A 56-year-old man presented with abdominal pain 8 years ago. Endoscopy showed mass in cardia and biopsy was well-differentiated adenocarcinoma. He underwent operation but because of adhesion of mass to aorta and celiac trunk, Para-aortic LAP and liver metastasis, only biopsy was taken. He received chemotherapy (EOX) with good response. After 6 years, he has developed mass in para-aortic area with involvement of L3 that was unresectable. Biopsy was metastatic adenocarcinoma. He was offered external irradiation and chemotherapy for six courses and then refused more treatment. Now the patient is still alive with good performance status.

Conclusion: Here we report an advanced metastatic adenocarcinoma of stomach responding to systemic chemotherapy and review the literature.

Keywords: Gastric Carcinoma, Chemotherapy, metastasis.

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COMPARING OUTCOME OF BOOST DOSE OF INTRAOPERATIVE RADIOTHERAPY WITH ELECTRON (IOERT) AND LOW-KV X-RAY (IOERT) AND EXTERNAL BEAM RADIOTHERAPY (EBRT) IN BREAST CANCER AFTER NEOADJUVANT CHEMOTHERAPY

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Abstract

Background: In the large breast tumors or locally advanced breast cancers, breast conserving surgery (BCS) after neoadjuvant chemotherapy (NACT) had an acceptable local control, but greater risk of recurrence. Adding boost dose radiation to whole breast radiotherapy is involved with a reduced risk of recurrence. Boost radiotherapy can be delivered in 3 methods, including 1) External beam radiotherapy (EBRT), 2) Intraoperative radiotherapy with electron (IOERT), and 3) Intraoperative radiotherapy with low-kV x-ray (IOXRT). This study compared the outcomes of these 3 methods with each other.

Methods: Within 60 months, 217 unselected breast cancer patients in Cancer Research Center of Shahid Beheshti were under treatment with BCS after NACT. They received boost dose radiation in 3 groups; 115 patients in EBRT group, 39 patients IOXRT group, and 63 patients in IOERT group. All of them received WBRT after surgery.

Results: Patients had large tumors or stage 3 breast cancer. Local recurrences were 1 (2.5%) in IOXRT, 2 (3.2%) in IOERT, and 1 (0.9%) in EBRT groups. Systemic recurrences were 4 (10.3%) in IOXRT, 10 (15.9%) in IOERT, and 16 (13.9%) in EBRT groups. Deaths were 3 (7.7%) in IOXRT, 2 (3.2%) in IOERT, and 10 (6.9%) in EBRT groups. Patients with any events were 4 (10.3%) in IOXRT, 11 (17.5%) in EBRT, and 33 (15.2%) in EBRT group. Death due to distant metastases was lower in IOERT group, but it was not significant. No significant difference was observed in disease-free survival (DFS) among 3 groups. IOXRT group had non-significant, lower events, and better DFS. Especially, in non-PCR (non-pathologic complete response) patients, multivariate COX analysis showed better outcome (DFS) in IOXRT group (HR = 0.50), although it was not significant (P = 0.53).

Conclusions: Intraoperative radiotherapy (IORT or IOXRT) as tumor bed boost during BCS after NACT had at least non-inferiority compared with EBRT. In non-PCR patient, IOXRT group had non-significant better outcomes (DFS).

Keywords: Intraoperative radiotherapy; IORT; IOERT; IOXRT; Neoadjuvant chemotherapy; DFS

EVALUATION OF BREAST CANCER PREVALENCE IN RADIOTHERAPY DEPARTMENT OF SHAHREKORD

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Introduction: Breast cancer is the most commonly occurring cancer in women in both developed and developing countries. Information on the incidence of breast cancer is essential for planning health measures. The aim of the present study is to investigate the incidence of Breast cancers in Chaharmahal and Bakhtiari province according to patients referred to the hospital.

Methods: In this retrospective descriptive study, cases with breast cancer were obtained from hospital registry system to determine the number of the patients who were treated in Shahrekord Parsian Hospital in 2016 and 2017. Furthermore, the correlation between the age, sex, clinical pathologic type and surgical treatment of breast cancer (Mastectomy and breast conserving) were considered.

Result : In 2016 and 2017, 1348 cases of cancer registered in this hospital. Breast cancer is the most common cancer in females (49.5%), 1.1% (4 patients) and 98.8% (355 patients) in men and women, respectively. Age ranged between 26-81 with an average of 48 years. According to the pathological type, the most common cancer was Invasive ductal carcinoma (77.2 %), 8.9% tubular invasive, 7.2% ductal in situ and 6.7% lobular in situ. Mastectomy was performed in 44.8% (161) of patients while BCS in 55.2% (198).

Conclusion: Our study shows that breast cancer is most common cancer in Chaharmahal and Bakhtiari female. Therefore, health education programs are needed to inform women about the symptoms, risk factors and screening to facilitate early diagnosis.

Keywords: Breast cancer, Prevalence, Chaharmahal and Bakhtiari

THERAPEUTIC APPROACH OF CRISPR/CAS9 GENE EDITING SYSTEM IN CANCER CELLS: WHAT IS GOING ON?

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Background: Cancer is a disease defined by multiple genetic and epigenetic abnormalities in which healthy cells are transformed into malignancy in an uncontrolled manner and invading the surrounding normal tissues. As such, a new promising approach is needed to manipulate the genomes of malignant cells and normal cells for devising disease model and studying different types of responsible genes. In recent years, CRISPR–Cas9 (clustered regularly interspaced short palindromic repeats–CRISPR-associated 9), a gene editing technology, has attracted extensive attention in editing the genome of interest cells and being investigated as a tool for cancer therapy. CRISPR/Cas9 system is armed with single-guide RNA (sgRNA) which directs the Cas9 protein to cleave DNA at desired sites, permitting DNA editing via a defined method. The primary goal of this paper is to shed light on the statue and the impact of CRISPR/Cas9 system in cancer treatment.
Methods: The PubMed was searched and related papers were selected based on relevant abstracts and following keywords "CRISPR/Cas9", "Cancer treatment", "Gene editing", and "Targeted therapy". Results: CRISPR/Cas9 has been exploited in different prominent purposes which are as follows: being used to replace large MHC alleles of MHC mismatches in cellular transplantation; high-throughput CRISPR screens to uncover genes mediating numerous biological phenotypes; recognizing DNA sequences and overexpressing/over-activated genes precisely; knocking-out target oncogenes which are mutated; repairing tumor-suppressor genes; editing drug-resistance genes to improve the sensitivity of malignant tumor cells to chemotherapeutics agents; playing an important role in screening of drug targets; detecting miRNAs; capable of detecting allele frequency and mutation rate; manipulating the tumor immune system via knocking out PD1; generating chromosomal rearrangements, and acts as an effective tool in manufacturing of allogeneic universal CAR T cells.
Conclusion: This technology despite of being in its preliminary stage of development has achieved remarkable success; however, further in vivo and clinical experimental investigations are required to be determined on the aspect of CRISPR/Cas9 applicability in cancer cells.

Keywords: CRISPR/Cas9; Targeted therapy; Cancer treatment; Gene editing

EFFECTIVENESS OF STRESS COPING TRAINING ON IMMUNE SYSTEM AND PAIN LEVEL IN PATIENTS WITH BREAST CANCER

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Background: Cancer causes many physical, psychological and social problems, including pain tolerance and quality of life.
Objectives: The aim of this study was to determine the effectiveness of teaching stress coping skills on the pain, quality of life of patients with breast cancer in Dezful.
Method: This is a semi-experimental study with a pretest-posttest design with a follow-up control group. For this purpose, 34 patients with study conditions were enrolled in the informal invitations. The patients were randomly divided into two groups of 17 controls and controls. The experimental group was trained in 8-week, 1.5-hour stress-coping skills (Lazarus and Folkman, 1984), and the control group received a normal program until the end of their normal program. Both groups completed the pain intensity questionnaire before and after the program, and were evaluated in two stages in terms of the activity of natural lethal cells.
Results: Descriptive results indicated a better status of the experimental group at the level of natural killer cells and reduced the pain and its dimensions compared to the control group. The results of multivariate covariance analysis with the control of the effect of pre-test showed that teaching stress coping skills improves the function of natural lethal cells in patients with breast cancer. The program also reduces the severity of pain and reduces pain interference in the daily functioning of these patients.

Keywords: coping with stress, immune system, Natural Killer Cells, pain, breast cancer

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EFFECT OF TOPICAL APPLICATION OF SESAME OIL ON THE SEVERITY OF PHLEBITIS CAUSED BY CHEMOTHERAPY

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Introduction: Cancer is one of the major health challenges. Various methods such as chemotherapy for cancer treatment is used mostly used intravenously. The most common complication of catheter-related phlebitis, which affects more than half of patients and as a potential risk for infectious complications is a killer.

Methods: 60 patients with colorectal cancer were identified according to the criteria of selection on 06.01.1391 until 11.30.1392 and randomly assigned to the intervention group (A) and control (B). In (A), sesame oil, 10 drops twice a day, and each time it is used on local phlebitis with data and then was dressing. Patient follow-up period was one week. Pain early physical examination as the first, the third, fifth & seven investigated.

Results: The results of the chi-square test showed that the distribution of the subjects in the two groups in terms of age, gender, location, education, marital status, occupation, race, injection site pain was similar to the first day there was a statistically significant difference (p> 0/05). T-test results proved that the pain in the third, fifth and seventh intervention and control groups were significantly different from each other (p <0/05).Patients in the intervention and control groups in terms of age, sex, place of residence, marital status, education, occupation, race, site of injection, were the same. Although the incidence and severity of phlebitis factors such as age and gender are effective. The mean pain score in the third, fifth and seventh patient and control groups there was a significant difference.

Conclusion: The use of local sesame oil has a significant impact on reducing the severity of pain on the third, fifth and seventh compared to patients who did not use topical sesame oil in these days, and sesame oil was able to accelerate the process of healing and recovery use a topical sesame oil reduces the pain caused by trauma to the body.

Keywords: Colorectal Cancer, Phlebitis, sesame oil

COMPARISON OF TWO 3D CONFORMAL PLANNING TECHNIQUES FOR BREAST RADIOTHERAPY WITH INTERNAL MAMMARY NODES INCLUSION: A DOSIMETRIC ANALYSIS

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Introduction: Internal mammary lymph nodes (IMNs) are a potential site of metastasis for breast cancer. Targeting IMNs as a part of comprehensive regional nodal irradiation is accompanied by higher unwanted dose to important nearby organs at risk. Thus, the efficacy and safety of different radiotherapy techniques to cover this area has been remained elusive. Herein, we did a dosimetric comparison between partially wide tangents (PWT) and direct photon/electron (P/E) portals in terms of target volume coverage and normal tissue sparing.
Materials and Methods: Patients with left-sided breast cancer referred to our clinic for post-lumpectomy or post-mastectomy radiotherapyunderwent computed tomography (CT) simulation. The left breast and IMNs, heart, lung, right breast, and the esophagus were contoured. Dosimetric comparisons were based on dose–volume histograms (DVHs) generated for all of the aforementioned organs. A subgroup analysis was also performed based on patients' type of surgical treatment.
Results: A total of 30 patients (10 with breast conserving surgery and 20 with modified radical mastectomy) were included. The P/E plan provided higher coverage of the left breast and IMNs though a less volume of the heart and lungs were irradiated. These advantages came at the cost of a higher dose to the esophagus, a greater dose to the right breast, and morehotspots compared to the PWT technique. In addition, when comparing the results across mastectomy and lumpectomy patients, the P/E technique retained many of its advantages of target coverage and toxicity regardless of the type of surgery.
Conclusion: Based on the results of this study, overally, the P/E plan is superior to PWT for the radiotherapy of breast cancer when the internal mammary node inclusion is required. However, the appropriate treatment plan should be decided on a case-by-case basis.

Keywords: breast cancer, internal mammary lymph nodes, radiotherapy, partially wide tangents, photon /electron mix

EVALUATION OF DEPTH-DOSE PARAMETERS OF PROTON PENCIL BEAMS WITHIN THERAPEUTIC ENERGY RANGE: A MONTE CARLO STUDY

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Introduction: In proton radiation therapy, minute characterization of the dosimetric properties of an incident beam is a crucial aspect for treatment planning and quality assurance. An important point in the calculation of dose distribution with ion beams is the Bragg peak (BP) range uncertainty. Knowing the exact range of a proton beam is crucial and one of the main challenges in proton therapy. Much efforts have been recently made to improve the accuracy of calculations for proton therapy. In this regard, the Monte Carlo methods achieve the highest degree of accuracy.

Materials & Methods: In this study, in order to improve the simulation efficiency, we use the pencil beam geometry instead of parallel broad field geometry. Depth dose distributions for beam energies from 5 to 250 MeV in a water phantom were obtained. This study used parameters named Rpeak, R90, R80, R73, R50, full width at half maximum (FWHM), width of 80-20% distal fall-off (W(80-20)), and peak-to-entrance ratio to represent Bragg Peak characteristics. The obtained energy-range relationships were fitted into third order polynomial formulae.

Results: The study results reveal deeper penetration, broader FWHM and distal fall-off and decreased peak-to-entrance dose ratio with increasing beam energy. Study results for monoenergetic proton beams show that R73 can be a good indicator to characterize range of incident beams. They also suggest FWHM is more sensitive than the W(80-20) distal fall-off in finding initial energy spread.

Conclusion: Detail depth dose characteristics for monoenergetic proton beams within therapeutic energy ranges were reported. These results can serve as a good reference for clinical practitioners in their daily practice.

A DOUBLE BLIND RANDOMIZED TRIAL ON THE EFFECTIVENESS OF MOMETASONE 0.1% CREAM AND HYDROCORTISONE 1% CREAM ON THE PREVENTION OF ACUTE RADIATION DERMATITIS

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Abstract

Background: Acute radiation dermatitis (ARD) is very common in breast radiation treatment, but data about how to prevent it is conflicting.

Aims: We investigated whether the use of topical corticosteroids or moisturizing cream can reduce ARD.

Methods: 120 patients who underwent breast conservative surgery (BCS) for breast cancer randomly assigned to use mometasone 0.1% cream or hydrocortisone 1% cream or moisturizing base cream from the first day of radiotherapy. CTCAE v. 4 was used to score the grade of ARD. Outcomes were analysed by relevant statistical methods.

Results: The groups were not different in incidence of maximum ARD grade. In addition, the timing of maximum ARD was not significantly different between groups.

Limitations: The limitation of this study is that we did not evaluate patient's quality of life. **Conclusions:** This study demonstrated that application of corticosteroid creams (hydrocortisone 1% or mometasone 0.1%) from the first day of breast radiotherapy does not result in a significant difference in ARD occurrence when compared with daily skin care and use of emollient.

Key-words: breast cancer, acute radiation dermatitis, topical corticosteroids

THYMIC CARCINOMA PRESENTED WITH GYNECOMASTIA

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Background: Gynecomastia is overdevelopment of the male breast in response to high estrogen level or low testosterone level. In adult males, gynecomastia is usually caused by another condition, such as liver or lung cancer, cirrhosis of the liver, overactive thyroid, or by hormone problems, such as cancer of the pituitary gland, adrenal glands, or testicles. Alcohol, marijuana, methamphetamine, and heroin use also may cause gynecomastia. 1% of breast cancers occur in men, with higher frequency rates in those with a positive family history of breast cancer or history of prior chest radiation. After an extensive literature review, we found only a case of gynecomastia associated with malignant thymoma. Here we report a 73 y/o male with thymic carcinoma presented with gynecomastia.

Case Report: A 73 years/old male was admitted with anorexia and weight loss. He complained from right sided painful gynecomastia since 6 months ago. In addition, he had pleuritic chest pain, dry cough and severe bone pain. Physical exam showed pallor and loss of breathing sounds in the base of right. Further work up revealed microcytic anemia, elevated ESR, right sided pleural effusion and a few pulmonary nodules in right lung and a mass in anterior mediastinum and multiple metastatic bone lesions in ribs and right pelvic bone. Mammography was reported normal. Cytology of pleural fluid and pleural biopsy were negative for malignancy but biopsy of anterior mediastinal mass and IHC study confirmed the diagnosis of thymic carcinoma.
Result: This case of thymic carcinoma was presented with unilateral gynecomastia.
Conclusion: Gynecomastia was a paraneoplastic syndrome for thymic carcinoma in this case. Gynecomastia is a paraneoplastic syndrome and we should search for underlying malignancy in males with gynecomastia.

Keywords: Thymic carcinoma, Gynecomastia, Mediastinal mass

ASSOCIATION ANALYSIS OF AN EXONIC G894T VARIANT OF ENDOTHELIAL NITRIC OXIDE SYNTHASE GENE WITH PROSTATE CANCER RISK

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ABSTRACT

Background*:* The endothelial form of nitric oxide synthases (eNOS) seems to have an important role in angiogenesis, tumor growth, invasion, and metastasis in human prostate cancer (PCa).The purpose of this study was to investigate the association between 894G>Tpolymorphism of the eNOS gene and prostate cancer risk.

Methods*:* In a case-control study, 50 prostate cancer patients and 50 healthy controlsubjects referring toShahidBehesti hospital were enrolled. The 894G>T polymorphism of the eNOS gene was genotyped by polymerase chain reaction and restriction fragment length polymorphism**.**

Results*:* Our results suggested that 894G>T polymorphism is not associated with PCa risk under heterozygote codominant model (GT vs. GG; OR= 1.81, 95%CI= 0.75 – 4.37, p= 0.187) while there are significant associations under dominant (TT vs. GG;OR= 9.69, 95%CI= 1.12 -83.64, p= 0.039)and allelic (T vs. G; OR= 2.54, 95%CI= 1.27-5.09, p= 0.008) models.

Conclusions*:* These results suggest that the 894G>T polymorphism of the endothelial nitric oxide synthase gene is associated with prostate cancer in our population. Further studies in larger samples are needed to confirm our results and characterize the molecular mechanisms by which eNOS is involved in the susceptibility to prostate cancer.

Keywords: eNOS, Polymorphism, Prostate cancer, PCR-RFLP

LIQUID BIOPSY EPIGENETIC EVALUATION AS BIOMARKERS IN BREAST CANCER DIAGNOSIS

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Introduction: Breast cancer (BC) metastasis might be latent or occur several years after primary tumor removal. Solid tumor genetic profiling may fail to show intra-tumoral heterogeneity and genetic modification which occur during tumor evolution. Therefore, it is essential to discover new non-invasive biomarkers to improve anticipation of recurrence risk in BC patients.

Material and Methods: The plasma levels of miR-129, miR-203a and methylation of *DAPK1*, *CAVIN3* gene promoters were evaluated to investigate their diagnostic potential in BC and BC metastasis. Invasive Ductal Carcinoma blood samples were divided into 3 groups of 30 patients based on their stages as: I, II/III, IV. Thirty normal individuals were also recruited as control group. Real-Time PCR and MethySYBR assays were conducted to evaluate miR-129, miR-203a expression levels and *DAPK1*, *CAVIN3* promoter methylation frequencies.

Results: MiR-129 and miR-203a expression levels were significantly downregulated in BC. However, only mir-129 decreased expression level differentiated significantly between metastatic and non-metastatic groups. Methylation of CAVIN3 gene indicated it could differentiate significantly between metastatic and non-metastatic groups, and differentiate between various progression stages of the condition. DAPK1 methylation level demonstrated increase in BC cases compared to normal, though not significantly.
Conclusions: miR-129 and miR-203a may both act as tumor suppressor miRNAs and potentially diagnostic biomarkers in BC. MiR-129 may be used as a potential diagnostic biomarker in BC metastasis. Promoter hypermethylation of *DAPK1* and *CAVIN3* genes in plasma can be potential BC diagnostic biomarkers. This suggests the potential usage of *DAPK1* promoter methylation as a non-invasive strategy for metastatic BC diagnosis.

EVALUATION OF SPECIFICITY, SENSITIVITY AND PREDICTIVE VALUE OF HIGH CEA CARCINOEMBRYONIC ANTIGEN FOR DIAGNOSIS OF COLORECTAL CANCER.

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Abstract

Colon cancer is the third most common cancer worldwide and in Iran. Carcinoembryonic antigen (CEA) is a glycoprotein which increase in colon cancer and can be used as a tumor marker. This antigen increases in fetal blood and in patients with colon cancer. Limited studies have been conducted in this field in Iran, and to our best knowledge, this is the first one in Quazvin.

Material and method: In this cross sectional study, we evaluate all of the patients who had CEA test in Velayat hospital between 1396 and 1398 and all colon cancer pathology reports.

Results: We evaluated 1047 cases who had CEA test and 14.8% of cases had pathologic report of colon cancer. There were a significant association between presence of colon cancer and serum levels of CEA. Sensitivity of test was 61%, specificity was 56.9 %, positive predictive value was 20.8 and negative predictive value was 90.3% .

Conclusion: Results of study showed that Serum CEA level has significant association with patient ages, no association with patient gender and has a significant association with presence of colon cancer. CEA is a tumor marker with intermediate sensitivity (61%)and specificity (56.9 %). Positive predictive value is very low (20/8)then elevated levels are not necessarily representative of cancer and negative predictive value was 90/3 % then it is a marker which is appropriate ruling out of colon cancer.

Keywords: Carcinoembryonic antigen, Predictive value, specificity, sensitivity

SIGNIFICANCE OF POST-CHEMORADIATION BIOPSY IN PREDICTING PATHOLOGIC COMPLETE RESPONSE IN THE SURGICAL SPECIMEN

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Objective: The standard method for assessing the response to preoperative chemoradiotherapy in patients with esophageal cancers has not been defined. Previously introduced methods including endoscopic biopsy, endoscopic ultrasonography and FDG-PET scan have been associated with different results. Considering the tolerability of esophagectomy and its mortality and morbidity, which can be potentially avoided in case of proven complete pathologic response before the surgery, this study aimed to determine the predictive value of endoscopic biopsy after chemoradiotherapy in evaluating the complete pathologic response in esophageal cancer patients.

Methods & Materials: This descriptive correlational study was carried out prospectively in the radiotherapy department of Imam Reza Hospital and Omid Hospital, both affiliated to Mashhad University of Medical Sciences during the years 2016-2018. Patients with pathologic proven esophageal cancer were enrolled. During the initial endoscopy, the tumor was carefully identified for future interventions using anatomical criteria. Patients staged using CT scan of the thoracic and abdomen and the patients without distant metastasis entered in the study. Initially, patients underwent neoadjuvant chemoradiation using carboplatin (dose: AUC 2) and Paclitaxel (dose: 50 mg / m2) on a weekly schedule for five weeks, along with 28 fraction of radiotherapy with a total dose of 5040 cGy (180 cGy per Fraction). After 4-6 weeks of chemoradiotherapy, endoscopy was performed and biopsy was performed from tumoral bed. The patient was then referred for esophagectomy. Finally, pathologic response from endoscopic sampling and the pathologic response from esophagectomy was compared.

Results: Of 69 patients, 32 patients underwent esophagectomy and their data was used to assess the predictive value of post chemoradiation biopsy (PCEB) in predicting residual cancer in post-treatment esophagectomy specimens. The median age was 65.5 years old and most of patients were male (17 out of 32). The tumor was mostly located at distal of esophagus (17 out of 32). Sensitivity, specificity, positive predictive value and negative predictive value of the endoscopic evaluation were 94.7%, 23%, 64.2% and 75%, respectively. Sensitivity, specificity, positive predictive value and negative predictive value of preoperative biopsy were 30.7%, 64.8%, 40%, and 59%, respectively.

Conclusion: Negative predictive value for endoscopic observations as well as post-chemoradiation biopsy is about 60% to 70%, and the positive predictive value of these two tools is about 40% to 60%, and therefore they are not considered as an appropriate tools for evaluating the complete pathologic response after treatment.

Keywords: esophageal cancer, neoadjuvant chemoradiotherapy, endoscopic response

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THE ASSOCIATION OF A GENETIC VARIANT IN MULTI-DRUG RESISTANCE GENE AND COLORECTAL CANCER SUSCEPTIBILITY

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Disclosures: The authors have no conflicts of interest to declare.

Abstract:

The transmembrane protein MDR1 (Multi-Drug Resistance Gene) interferes with the removal of endogenous and exogenous toxins from cells. This protein was initially identified for its importance in the development of drug resistance in cancer cells, but several studies have shown that a MDR1 polymorphism affects the susceptibility in various cancers. Here we examined the relationship between a single nucleotide polymorphism (SNP) in the MDR1 gene (rs1128503) and risk of colorectal cancer in 334 individuals with, or without CRC. DNA was extracted, and genotyped using a Taq-Man based PCR method. TheMDR1polymorphism was found to be associated with an increased risk of developing CRC (using a recessive model: OR=3.76, CI= 2.18-6.51, p<0.001).In aggregate our findings demonstrated the association of the genetic variant in MDR1gene with susceptibility with CRC, indicating further investigations to show the value of emerging markers as a risk stratification marker in CRC patients.

Keywords: Colorectal cancer, MDR1 gene, Polymorphism

AMP-KINASE INHIBITOR DORSOMORPHIN REDUCES THE PROLIFERATION AND MIGRATION BEHAVIOR OF COLORECTAL CANCER CELLS BY TARGETING THE AKT/MTOR PATHWAY

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Abstract

Colorectal cancer (CRC) is among the leading causes of cancer-related mortality, despite extensive efforts in the identification of new treatment options. Hence, there is a need for the development of novel agents with therapeutic potential in treatment of CRC. Dorsomorphin has demonstrated anti-proliferative activity against different malignancies. Here we have investigated the pharmaceutical potential of dorsomorphin in two-dimensional and three-dimensional cell-culture models of CRC. The anti-proliferative, anti-migratory, apoptotic activity and effect of this agent on cell cycle was evaluated by MTT assay, wound healing assay and Flow cytometry, respectively, while the expression of genes involved in Wnt/Pi3K pathways was assessed at mRNA and/or proteins by RT-PCR or Western blot. Dorsomorphin inhibited CRC cell growth by modulating the cyclinD1, surviving and p-Akt. This agent was able to reduce the migratory behaviors of CRC cells, compared to control cells, through perturbation of E-cadherin. Also our data showed that dorsomorphin enhanced the percentage of the cells in sub-G1 and induced apoptosis in both late/early stages, as detected by annexin V. Also the regulatory effect of dorsomorphin on oxidant/antioxidant balance was assessed by cellular reactive oxygen species (ROS) generation. In particular, this data showed that dorsomorphin markedly increased the ROS production in CRC cells. Our finding demonstrated that dorsomorphin antagonizes cell growth and migration, through perturbation of Akt/mTOR/Wnt pathways in CRC, supporting further-studies on the therapeutic potential of this novel anticancer agent in treatment of colorectal cancer.

Keywords: Colorectal cancer, Dorsomorphin, Wnt/PI3K/Akt -pathway,

EFFICACY OF INTRAOPERATIVE RADIOTHERAPY TARGETED TO ANGIOGENESIS FACTORS IN PATIENTS WITH BREAST CANCER

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Introduction and aim: The standard of breast cancer treatment is based on breast conserving surgery with administration of adjuvant whole breast radiotherapy. It is shown that in-breast relapse is most likely to occur in the tumor bed, i.e. around the scar. The wound healing process after surgery alters the area surrounding the original tumor and around the scar, and the modified microenvironment is more favorable for tumor recurrence. Intraoperative radiotherapy (IORT) is one of the novel strategies in breast cancer treatment. Irradiation during surgery has effects on the tumor microenvironment, abrogating the proliferative cascade induced by surgical wound healing. The aim of the present study was to determine the effect of IORT on angiogenesis factors, recurrence and overall survival of patients with breast cancer. **Methods:** We collected serum and surgical wound fluids from 400 patients who underwent IORT and from patients after breast-conserving surgery alone. Finally, TGF-β, EGF, FGF, DLL4 and VEGF were measured using ELISA.
Results: Our results demonstrated that IORT effect on angiogenesis factors especially DLL4 and improved recurrence-free and overall survival. It seems that TGF-β and EGF can predict late stages in patients before surgery.
Conclusion: Delivery of IORT to the tumor bed alters the molecular composition and biological activity of surgical WF. This novel antitumoral effect could, at least partially, explain the very low recurrence rates. We suggest that inhibition of angiogenesis factors directly after surgery can increase survival and postpone recurrences.

Keywords: IORT, Angiogenesis, Survival, TGF-β, EGF, FGF, DLL4, VEGF

THE TIME TREND OF COLORECTAL CANCER IN IRAN AND COMPARE IT WITH THE WORLD

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Abstract

Background and purposes; Colorectal cancer is one of the most common cancer in the world and in Iran, with both preventive and curative therapies available. This review is part of a time trend analysis proposal on data from the National Cancer Registry. The aim of the study was to compare the time trend of this cancer in Iran and compare it with the world.

Materials and Methods: This study is a non-systematic review. Keywords including colon, rectum, colorectal, cancer, incidence, Iran, Trend, and World, were searched in databases of Pubmed, Science Direct, Google Scholar, Scopus, Web of Science. The most important articles of the last few years have been extracted and reviewed. In addition, GLOBOCAN data from 2008 to 2018 were used.

Results: If colon and rectal cancers were considered together, 9864 new cases of cancer were diagnosed in 2018 in Iran. This cancer was ranked third after breast and stomach cancers in both sex. Of them, 5630 were in males (third place after stomach and prostate cancers) and 4234 were in females (Second place after breast cancer). The incidence of this cancer has been increasing in recent years. Age standardized incidence rate (per 100,000 Iranian people) at years 2008, 2012, and 2018 was 7.6, 11.1, and 12.9 respectively. It is still lower than the global incidence of colorectal cancer in 2018 (19.7 per 100,000). This increase was occurred in both colon and rectal cancer and in all ages including young people. The general trend in the developed countries is stabilizing or decreasing but increasing in young people (particularly rectal cancer).

Conclusion; Increased incidence of colorectal cancers in Iran, especially in young people, and as a result of increasing prevalence and increasing number of survivors, makes the country's health system ready for treatment and screening programs and early detection.

EPIDEMIOLOGIC AND DEMOGRAPHIC ASPECTS OF HEAD AND NECK SARCOMA IN ISFAHAN PROVINCE IN A 5 YEARS PERIOD (2015-2019)

Nadia Najafizadeh MD, Neda Mohammadi MD

Introduction:
Head & neck sarcomas are rare and have very aggressive behaviour.as they 5 years survival has been reported about 60%.their prognosis is very poor. The best management of them remain unclear, particularly because of their various pathological subtypes. epidemiologic studies include large population may reveal valuable information about the prevalence & clinicopathological characteristics of them.in this study we evaluate the demographic features of head & neck sarcomas in patients who have treated in Omid hospital from 2015 to 2019 in Isfahan province.

Materials & Methods: This study is a cross sectional study on patients who had head & neck sarcomas from 2015 to 2019 and have treated in Omid hospital in Isfahan province. Our demographic data were collected from patients' files census that were archived in Omid hospital and included age, gender, pathological subtype, origin of sarcoma and kinds of their treatment. After that, we phoned and asked about their actual conditions and if some of them were died, we would demand details of the time and reason of their death. We analyzed our information by SPSS software version 25 and used Kaplan-mayer, log rank and cox regression tests.

Results: A total of 21 sarcoma patients were assessed from 2015 to 2019.their median age were 39.47 ± 21.64. 17 patients (81%) were male and 4 patients(19%) were female. The most common pathological subtype were rhabdomyosarcoma(6 patients) and the most common tumor location were paranasal sinuses(7 patients),versus the lowest prevalence in nasopharynx(1 patient) & nasal cavity(1patient). Based of treatment approaches, 7 patients (33.3%) received all three types of surgery, chemotherapy and radiotherapy. Six cases (28.6%) treated by surgery and radiotherapy and 5 patients(23.8%) treated by chemotherapy and radiotherapy.one patient did not treat any more, one patient just underwent surgery and one case treat by surgery and chemotherapy. Six patients were died that in 5 patients (83.3 %) lung metastasis and in 1 case (16.7%) brain metastasis was the reason of death. The median time to death in these patients were 19.24 ±10 months, the longest one was 40 month and the shortest was 4 months. The median 5 year survival rate in this study were 22.99 ±2.69 month(95% CI:17.73-28.26).according to gender, the median survival for men & women was 25.88 ±2.95 and 12.25 ±2.96,respectively.this difference was significant in favour of men(p=0.005).female gender, pathological subtype and kinds of therapy did not effect the survival rate.

EFFECT OF CURCUMIN ON QUALITY OF LIFE AND REDUCTION OF INFLAMMATORY FACTORS IN COLORECTAL CANCER PATIENTS UNDERGOING CHEMOTHERAPY

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Background: Colorectal cancer is a common and lethal disease. The risk of developing CRC is influenced by both environmental and genetic factors(1). Inflammatory biomarkers are useful predictors of disease outcome and treatment response over several treatment lines in mCRC patients(2).
Curcuminoids are among the most extensively studied natural products in modern science, and comprise 3 phenolic compounds i.e., curcumin, demethoxycurcumin and bisdemethoxycurcumin. Curcuminoids are the active principles and the yellowish pigments of the famous spice, turmeric. These phytochemicals have been used for centuries in the Indian, Chinese and Iranian traditional medicines, to treat various ailments. Over the past 30 years, numerous studies have shown the promise of curcuminoids to elicit a variety of pharmacological activities including anti-tumor, chemopreventive, anti-inflammatory, antioxidant, immunomodulatory, cardioprotective, neuroprotective, hepatoprotective, nephroprotective, mood-stabilizing, anti-diabetic, anti-viral and anti-amyloid properties (3-12).
Method: A double-blinded, randomized, clinical trial phase 3 was designed, in which 72 patients with diagnosis of colorectal cancer, who met the inclusion criteria and confirmed the informed consent, were involved.
All the patients had undergone the surgery in the way of colorectal cancer treatment, and were at stage 3 (based on TNM system) of disease.
All patients received standard chemotherapy regimen (FOLFOX). They were randomly assigned to interventional group (Curcumin Capsule 500mg once daily) and control group (Placebo), contemporary, both groups were assigned for 8 weeks. Both physician and patients were blind about the type of intervention.
Demographic information - past medical history, *quality of life (QOL) C30 EORTC* questionnaire, CBC with diff, ESR, CRP, IL 2,6,8,10 and TNF-α level at the baseline and 8 weeks later - at the end of study were recorded in designed checklist.
Data analyses, including parametric and nonparametric tests were done using SPSS software. P-value < 0.05 was regarded as statistically significant (Ethics committee code was taken).
Results: 67 patients were completed the study. Mean age and sex had no significant difference at the baseline between the groups.
In interventional group, which received curcumin capsule, showed a significant decrease in ESR and CRP level and *QOL C30 EORTC* questionnaire, comparing results of each subject before and after the treatment ($p<0.05$).
By comparing pre- and post-treatments values among the curcumin group, IL6, IL8, IL10 level showed non-significant decrease($p>0.05$). Also, a non-significant increase was seen in IL2 and TNF-α, by comparing pre- and post-treatment values in curcumin group.
Conclusion: These findings suggest that curcumin has a desire effect on quality of life of patients with colorectal cancer; also, it can decrease the inflammatory biomarkers in these patients. The non-significance decreasing of IL6, IL8, IL10 level maybe is because of the short time of the curcumin administration at this study.

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EVALUATION OF CLINICAL EFFICACY AND OUTCOME OF VARIOUS IMRT TECHNIQUES FOR TREATING PATIENTS WITH NASOPHARYNGEAL CARCINOMA

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Abstract

Aim: The purpose of this study was to evaluate the clinical efficacy and outcome of various IMRT techniques used for the treatment of patients with nasopharyngeal carcinoma (NPC).

Materials and Methods: Our study was conducted on 30 patients with NPC who were referred for IMRT treatment. A planning target volume (PTV) dose of 70 Gy was administered for the patients' IMRT plans by using the Eclipse treatment planning system (TPS). Standard IMRT treatment plans were constructed using the volume and dose constraints for the target and organs at risk (OARs) based on the Radiation Therapy Oncology Group (RTOG) 0615 protocol. In addition to the routine IMRT protocol used for treating the patients, 11 different protocols were carried out for every patient and their outcomes were investigated. The homogeneity index (HI) and conformation number (CN) were calculated for all the IMRT plans. The Poisson model was utilized for estimation of the tumor control probability (TCP). The normal tissue complication probability (NTCP) of the brain steam, spinal cord, optic chiasm, optic nerves and parotid glands were also calculated based on the relative seriality radiobiological model.

Results: The mean of HI ,CN and TCP values showed no statically significant difference due to the various of collimator angle and non-coplanar field, but the effect such parameters was statistically significant on the mean of maximum dose (D_{max}) for some of the OAR_s. The mean of D_{max} for optic chiasm, spinal cord, right optic nerve and right parotid gland were 29.16 (P=0.01), 42.18 (P=0.001), 29.69 (P=0.001) and 30.22 (P=0.042), respectively. On the other hand, there were not statistically significant difference among the calculated mean of $NTCP_s$ for all the protocols.

Conclusions: Our finding indicates that using appropriate IMRT protocols for the treatment of NPC could potentially reduce the OARs doses and consequently the probability of secondary cancer in the NPC patients.

Keywords: nasopharyngeal carcinoma, IMRT, angle of collimator, non-coplanar field.

THE ROLE OF CLINICAL USED OF HYPERTHERMIA AS IMMUNOTHERAPY IN CANCER TREATMENT

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Abstract

Introduction: Generally the term 'hyperthermia' means elevation temperature of tumor to a super physiological level (39 up to 43 Degree Celsius). Hyperthermia in clinical used refers to elevation tumor temperature from 38 up to 42 degree Celsius. Hyperthermia therapy refers to treatment tumors through heating which has been used since the time of the ancient Egyptians .hyperthermia can be used alone or in combination with other modalities such as radiation therapy or chemotherapy Typically there are three categories for Hyperthermia, including local , regional and whole body. Local hyperthermia is used to solid, localized and superficial tumors while regional is generally used for deeper diseases, and whole body hyperthermia typically used for metastatic cancers. Local Hyperthermia is used to solid, localized and superficial tumors while regional is generally used for deeper diseases, and whole body Hyperthermia typically used for metastatic cancers. Whole body hyperthermia devices uses water-filtered infrared radiation (wIRA) emitters by four wIRA emitters to the upper zone , and two WIRc emitters for warming the lower limb of patients.

Materials & Methods: Certainly clinical effects of Hyperthermia is more Based on it 's combination with other modalities ,and it is more important, it can sensitize tumor cells to other forms of therapy, including RT (Radiation Therapy) and chemotherapy (CT).(van et ol 2012) Hyperthermia in combination with RT can be used as a systemic anti-tumor immune response. It can induce local control tumor apoptosis and HSP-70 synthesis. (Yuk-Wah Tsang et al 2015). Hyperthermia as an adjunctive method for palliative effect with RT, due thermally enhance immune effectors cells (Mau-Shin Chi,et al 2017). A randomized clinical trial carried out by Jones et al Has reported CR rates of 23.5% for radiotherapy alone versus 68.2% for Hyperthermia plus Radiotherapy.

Conclusion: In conclusion, hyperthermia aims at improving the results of the conventional treatment strategies within the framework of multimodal treatment concepts. Actually a large number of studies document clinical effectiveness of hyperthermia in combination with RT or CT in vivo and/or in vitro condition

Keywords: Hyperthermia, Immunotherapy-Radiotherapy-Cancer

EVALUATING VIABILITY OFHUMAN ESOPHAGEAL CARCINOMA CELLS UPON UROLITHIN TREATMENT AND HEAT SHOCK INDUCTION

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Background and objective: Esophageal squamous cell carcinoma (ESCC) is a lethal cancer that arises from malignant transformation of cells lining the esophagus. Urolithins are ellagic acid metabolites with wide pharmacological properties such as chemopreventive, anticancer and anti-inflammatory activities. The goal of this study was to investigate whether pretreatment of esophageal carcinoma cells with urolithins could affect heat shock response.

Methods: Urolithin A, methylated urolithin A and urilithin B (UA, mUA and UB, respectively) were synthesized by a reaction between 2-bromo-5-methoxybenzoic acid and resorcinol. KYSE30 cells, an ESCC cell line, were pretreated with 20 µM of UA, mUA and UB for 48 h. For heat shock induction, cells were incubated at 51 °C for 30 min, followed by 24 h recovery. To note, cells treated with 0.2% DMSO + heat shock were considered as control treatment. Then, viability of cells was determined by resazurin as a colorimetric assay, and mechanism of cell death was elucidated using annexin V-PI flowed by flow cytometry analysis.

Results: Our findings indicated that 48 h after treatment of cells with 20 µM UA and heat shock induction, 57% of cells were alive. However, percentage of viable cells were calculated as 62% and 69% upon 48 h pretreatment with 20 µM mUA and 20 µM UB followed by heat shock induction, respectively. Detection of cell death by flow cytometry confirmed viability assessment, as considerable increase in the percentage of early and late apoptotic cells was observed upon 20 µM UA + heat shock treatment.

Conclusion: Due observed activities of UA in present research, this agent has the potential to be used in future studies on other ESCC cell lines and/or in combination with more therapeutic modalities such as radiotherapy.

Keywords: Esophageal carcinoma, Urolithin A, Heat shock, Viability assessment, Apoptosis detection.

PRE-CHEMOTHERAPY DELAY IN LOCALLY ADVANCE BREAST CANCER CANDIDATE FOR NEOADJUVANT CHEMOTHERAPY

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Purpose: There is no distinct threshold time between clinical presentation of disease and starting chemotherapy which can affect outcome in neoadjvant chemotherapy treatment of locally advance breast cancer.
Delay in treatment, theoretically, except progression can cause worse prognosis.
This study was performed to determine the median time interval from presentation to diagnosis by biopsy in locally advance non metastatic breast cancer candidate for neoadjvant chemotherapy and its treatment outcome.
Method: Retrospectively, between 2011 to 2017 in Shohada Tajrish Hospital, Patients with non-metastatic locally advance breast cancer who received neoadjvant chemotherapy where asked about median time interval between diagnosis and presentation of disease, and the pathologic response also were include and observed.
Result: 210 patients included in this study, the median time was 3.9 month with 2 to 36 month range. 44 patients delay were 2 till 3 month, 37 patients delay were 3 till 4 month, and other were more than 4 month.
Pathologic complete response in patients with delay less than 3 month were 33% in comparison with more than 3 month 37%, this difference was not statistically significant.
Conclusion: Also the best time threshold in one study is one month, none of our patient diagnosed in this time, this indicate that increasing in general population knowledge can affect patient's prognosis.

Key word: Breast cancer, Delay

MESENCHYMAL STEM CELLS ACT AS A POTENTIAL STRATEGY OF REGENERATIVE MEDICINE IN THE CLINICAL ONCOLOGY TREATMENT

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Abstract

The process of activating, replacing, engineering or regenerating human cells, tissues or organs to restore or establish normal function refers to regenerative medicine. Cancer immunotherapy activates, replaces, engineers or regenerates the immune system in order to fight cancer. In fact, it is the most frequently used and marketed form of regenerative medicine. Another form of cancer fighting method in terms of regenerative medicine is cell therapy. Mesenchymal stem cells (MSCs) potentially possess the ability of therapy, as they have long been used as therapeutic agents in disease affecting various organ systems. However, MSCs are fast emerging as promising anticancer agents which have the potential to treat a number of different cancer types, including glioblastoma and metastatic breast, ovarian and hepatic carcinoma. In fact, the ability of MSC to migrate directly into the tumor microenvironment and to produce IFN-α and -β makes this possible.

Furthermore, MSCs carry great potential for the treatment of cancer as well as many other diseases. This is supported by clinical trials that have been conducted to date using MSC in the treatment of myocardial damage, graft versus host disease (GVHD), generating surrogate β-cells for insulin-dependent diabetic patients and replacing damaged tissues. Panoramically, MSCs are revolutionizing anti-tumorigenic therapy by challenging the resiliently elusive nature of cancer at the cellular level. The ability of MSCs to exhibit innate tropism for tumors and to interact with an array of tissues renders them an important tool, representing palpable vehicles for trailblazing cancer therapy. In addition, almost all animal studies that have employed genetically modified MSCs for the treatment of tumors or GVHDs have demonstrated therapeutic effects without significant side effect. However, the possibility that MSCs may themselves undergo malignant transformation or transform into tumor-associated fibroblasts to promote tumor progression cannot be ignored. It is hoped that future research can overcome these limitations and facilitate the use of MSC clinically.

Keywords: Regenerative medicine, Clinical oncology, Mesenchymal stem cells, Cell therapy

EVALUATION OF SLEEP DISTURBANCE AND MOOD DISORDER IN BREAST CANCER PATIENTS DURING RADIOTHERAPY

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Abstract

Background: Breast cancer is the most commonly diagnosed cancer and the leading cause of cancer deaths among women. Radiation therapy plays a significant role in the treatment of patients with breast cancer as it reduces the relative risk of recurrence. Sleep and mood disorder has been widely reported in female patients during the Treatment. The purpose of this research is to evaluate Patients' mood and its relation to their sleep quality during radiation therapy.

Methods: The analysis was carried out on 100 female patients with breast cancer undergoing radiation therapy and the control group consisted of 100 women attending medical imaging in Tehran. Participants' mood situation was evaluated by POMS questionnaire and their sleep status was checked through standard questionnaires specified for analyzing sleepiness, sleep quality, and insomnia severity.

Results: Study results demonstrated greater overall score for mood and sleeping when compared to healthy people (which means worse mood and sleeping disturbance) and there is a significant correlation between some mood subcategories such as vigor, fatigue with sleeping quality and insomnia severity. There was also a significant difference between case and control group (P: 0.008).

Conclusions: Mood and sleep disorder are common problems in women with breast cancer and paying attention to their mental health as well as routine cancer treatments may significantly improve quality of life and mood and sleep status.

Keywords: radiation therapy, breast cancer, mood disorder, sleep disorder

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EFFECT GLUTAMINE IN PREVENTION OF RADIATION-INDUCED ORAL MUCOSITIS IN PATIENTS WITH HEAD AND NECK CANCER: A SYSTEMATIC REVIEW OF CLINICAL TRIALS

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Abstract

Radiotherapy is one of the main methods in the treatment of head and neck cancer (HNC). However, radiation-induced oral mucositis is a major dose-limiting toxicity in patients with HNC. It is a normal tissue injury caused by radiotherapy, which has marked adverse effects on the quality of life of the patients. It is a challenge for radiation oncologists since it leads to several problems, including pain, nutritional problems as a result of inability to eat, and increased risk of infection due to open sores in the mucosa. Therefore, finding an approach for management of radiation-induced oral mucositis is important. The systematic review aimed to evaluate effect glutamine in prevent of radiation-induced oral mucositis. Search in published articles shows, four RCTs (Two RCTs for oral glutamine and two RCTs parenteral glutamine) suggested that glutamine administration to be effective for the prevention of oral mucositis in the patients undergoing hematopoietic stem cell transplantation[1-4]. In addition, a RCT showed that parenteral glutamine may prevent of oral mucositis in patients undergoing chemotherapy[5]. Three RCTs showed that glutamine administration to be effective for the prevention radiation-induced oral mucositis. The results of a pilot RCT indicated oral glutamine might significantly reduce the duration and severity of oral mucositis during radiotherapy in patients with HNC[6]. In the other RCT, 10 g of oral glutamine given 2 h before RT, delays oral mucositis and reduces the frequency and duration of grade 3 and grade 4 mucositis in the patients with HNC[7]. In addition, a RCT reported that glutamine (dose of 10 g 3 times a day) significantly decreased the maximal mucositis grade and pain score. Glutamine significantly decreased mucositis severity in the oral cavity, pharynx and larynx induced by chemoradiotherapy in patients with HNC[8]. The systematic review suggested glutamine could be useful for the management of oral mucositis in patients with HNC.

Keywords: Glutamine, Head and neck cancer, Radiotherapy, Oral mucositis

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EVALUATION OF AUDITORY BRAIN STEM RESPONSES (ABRS) IN PATIENTS WITH HEAD AND NECK CANCER WHO RECEIVED RADIATION THERAPY

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Abstract

Background: The side effects of radiotherapy (RT) on hearing loss risk related to auditory brainstem function in patients treated with RT is unknown. In current study, we evaluated auditory brainstem radiation responses (ABRs) in eighth-nerve among patients with head and neck cancer (HNC) treated RT.

Methods: This case-control study was conducted on 100 individuals (50 patients with HNC and 50 healthy people as a control group). Patients were selected from radiotherapy centers of Firoozgar and Pars Hospitals (Tehran, Iran) during 2017-2019. Patients in case group treated with RT (1.8–2 Gy/fraction in five consecutive days per week.). The RT was done by 3D-computer based treatment planning system, using CT scan. The ABR test was used to evaluate association between brainstem dose and latency time of waves.

Results: The *paired* sample *t-test* shown the latency time of waves (I, III, V, I-III and III-V) in both right and left ears was significantly more in the case group compared to control group, ($P < 0.001$). However, there was no significant correlation between the brain stem dose and latency time of waves. The simple regression tests demonstrated a significant correlation showed between age and latency time of wave I in right ear ($p=0.005$) and left ear ($p=0.02$).

Conclusion: In general, findings of this study suggested RT in patients with HNC lead to increases risk of hearing impairments related to auditory brainstem function (neural hearing). In this context, early diagnosis of hearing impairments and determining the appropriate dose and timing of RT is important.

Keywords: auditory brainstem responses, head and neck cancer, radiotherapy

ASSOCIATION ANALYSIS OF AN EXONIC G894T VARIANT OF ENDOTHELIAL NITRIC OXIDE SYNTHASE GENE WITH PROSTATE CANCER RISK

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Background: The endothelial form of nitric oxide synthases (eNOS) seems to have an important role in angiogenesis, tumor growth, invasion, and metastasis in human prostate cancer (PCa). The purpose of this study was to investigate the association between 894G>T polymorphism of the eNOS gene and prostate cancer risk.

Methods: In a case-control study, 50 prostate cancer patients and 50 healthy control subjects referring to Shahid Beheshti hospital were enrolled. The 894G>T polymorphism of the eNOS gene was genotyped by polymerase chain reaction and restriction fragment length polymorphism**.**

Results*:* Our results suggested that 894G>T polymorphism is not associated with PCa risk under heterozygote codominant model (GT vs. GG; OR= 1.81, 95%CI= 0.75 – 4.37, p= 0.187) while there are significant associations under dominant (TT vs. GG; OR= 9.69, 95%CI= 1.12 -83.64, p= 0.039) and allelic (T vs. G; OR= 2.54, 95%CI= 1.27- 5.09, p= 0.008) models.

Conclusions: These results suggest that the 894G>T polymorphism of the endothelial nitric oxide synthase gene is associated with prostate cancer in our population. Further studies in larger samples are needed to confirm our results and characterize the molecular mechanisms by which eNOS is involved in the susceptibility to prostate cancer.

Keywords: eNOS, Polymorphism, Prostate cancer, PCR-RFLP

بررسی اثر دما در موفقیت درمان با کلاه سرد کننده در بیماران تحت شیمی درمانی

هدف: ریزش مو یکی از شایعترین و ناراحت کننده ترین عوارض ناشی از شیمی درمانی می باشد. استفاده از کلاه سرد کننده در حین شیمی درمانی، تنها راه جلوگیری از آلوپسی ناشی از شیمی درمانی می باشد. هدف از این مطالعه بررسی این روش حمایتی بر روی ۳۰ بیمار زن مبتلا به سرطان پستان غیر متاستاتیک می باشد.

روش کار: این مطالعه بر روی ۳۰ بیمار زن مبتلا به سرطان پستان غیر متاستاتیک با میانگین سنی ۴۷/۶ سال که طی سالهای ۹۶ و ۹۷ به بیمارستان هاشمی نژاد مشهد مراجعه کردند انجام شد. بیماران با Her_2^- تحت شیمی درمانی با رژیم AC-T (آدریامایسین $60\ mg/m^2$، سیکلوفسفماید $600\ mg/m^2$ و پکلی تکسول $175\ mg/m^2$) به فاصله ۲ یا ۳ هفتگی درمان شدند. در بیماران با Her_2^+ ، شیمی درمانی با اضافه شدن هرسپتین همراه با پکلی تکسل (هرسپتین $4\ mg/kg$ دوز اولیه و سپس $2\ mg/kg$ هفتگی همراه با پکلی تکسول $8\ mg/m^2$ تا ۱۲ هفته) ادامه پیدا کرد بطوریکه بیماران با Her_2^+ مجموعاً ۱۶ جلسه و با Her_2^- مجموعاً ۸ جلسه شیمی درمانی دریافت کردند.

نمونه کلاه و یونیت سرد کننده ایرانی، ۳۰ دقیقه پیش از شیمی درمانی، در حین شیمی درمانی و بنا به رژیم درمانی ۲ تا ۳ ساعت پس از اتمام شیمی درمانی، در بیمارانی که تمایل به استفاده از کلاه داشتند استفاده شد. در این دستگاه برای تمامی بیماران، دمای پوست سر در محدوده فرونتال که معمولاً گرمتر از سایر نقاط اسکالپ می باشد توسط سنسور پوستی تماسی، اندازه گیری و فیدبک گردید و در محدوده ۱۴ تا ۱۶ درجه در طی درمان ثابت نگه داشته شد.

نتایج: تمامی بیماران پس از پایان یا خروج از درمان از لحاظ ریزش مو بر اساس گریدینگ WHO مورد بررسی قرار گرفتند. در ۱۰ بیمار ریزش مو بدنبال ۲ جلسه شیمی درمانی رخ داد. تعداد ۵ بیمار نیز بدلیل عدم تحمل سرما یا سردرد از مطالعه خارج شدند. ۱۰ بیمار نیز بدلیل زمان طولانی درمان و یا سایر عوامل غیر مرتبط با عوارض کلاه از مطالعه خارج شدند. در ۵ بیمار نیز موها بر اساس گریدینگ حفظ گردید.

بحث و نتیجه گیری: مقایسه درصد موفقیت استفاده از کلاه در این مطالعه با میانگین موفقیت گزارش شده در مقالات با جامعه آماری بزرگ (حدود ۵۰٪) نشان می دهد آستانه تاثیر روش سرد سازی پوست موی سر که در رفرنسهای اصلی (همانند Devita) ۱۸ تا ۲۴ درجه سانتیگراد اشاره شده است نمی تواند منجر به نتایج قابل قبول گردد. در مطالعات بعدی انتظار می رود ضمن حفظ متغیرهای کلیدی مطالعه از جمله جنسیت، میانگین سنی، نوع سرطان و در نهایت شکل کلاه و روش و ابزار اندازه گیری دما، با کاهش دمای متوسط پوست سر تا ۳ درجه سانتیگراد که در دستگاههای جدیدتر از جمله Dignicap مبنای درمان قرار گرفته است، موفقیت درمان، افزایش یابد. البته بررسی میزان تحمل بیماران در دماهای پایینتر تا نزدیک صفر درجه سانتیگراد نیز حائز اهمیت خواهد بود.

Abstract of Selected Articles

The Fourth International Clinical Oncology Congress

The 14th Iranian Annual Clinical Oncology Congress
The Fourth International Clinical Oncology Nursing Congress
Annual Radiotherapy Technologists' Congress &
Medical (Radiotherapy) Physics Congress
Clinical Radiobiology Congress

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Vida Rezaee

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