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▸ **AIMS AND SCOPE**

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Original articles in basic and applied research
Case studies
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ABSTRACTS

■Dosimetric Comparison of 3D Conformal Radiotherapy, IMRT and Tomotherapy Plans in Nasopharyngeal Cancer

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Abstract

Introduction: Nasopharyngeal Cancer (NPC) is one of the most common head and neck cancers. Approximately 68% of NPC patients suffer from locally advanced disease at the time of diagnosis. The purpose of this study is to compare and evaluate the dosimetric parameters of Three - Dimensional Conformal Radiotherapy (3D - CRT), step - and - shoot Intensity Modulated Radiation Therapy (SaS - IMRT) and Helical Tomotherapy (HT) in advanced NPC to help choose the optimal technique for nasopharyngeal patients.

Methods: A retrospective study was conducted involving 10 patients with advanced NPC who were re - planned using HT, SaS - IMRT and 3D - CRT techniques. All three techniques were optimized to deliver 70 Gy in 33 fractions simultaneously to the primary tumor and metastatic lymph nodes, and 59.4 Gy in 33 fractions to the high - risk regions. The dosimetric parameters of the Planning Target Volumes (PTVs) and Organs at Risks (OARs), along with treatment time, were evaluated and compared using the paired - samples t - test.

Results: HT significantly possessed better target homogeneity, conformity and better mean dose compared to 3D - CRT and SaS - IMRT. Also, reduced the dose delivered to OARs compared with 3D - CRT. Although in compared with SaS - IMRT and HT, 3D - CRT reduced the treatment delivery time by 51.5% and 44.05% respectively, but worse in tumor coverage and dosimetric accuracy and protection of some OAR compared with SaS - IMRT and HT.

Conclusions: Despite the HT achieving optimal conformity, homogeneity for PTV coverage, and optimal OARs sparing, shorter treatment times for 3D - CRT reduce the probability of patient movement and discomfort. The findings of this study can offer guidance for selecting suitable radiation technologies for treating patients with advanced NPC.

Keywords: 3D - CRT; Nasopharyngeal Cancer; Helical Tomotherapy; Step - and - Shoot IMRT

■Introducing a Clinical Case of Lymphoma with a Large Ulcer in the Chest

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Introduction: Introducing a clinical case of lymphoma with a large ulcer in the chest Diagnosis based on biopsy and sent to pathology: High Grade B cell Lymphoma

Methods: Descriptive methods Introducing a clinical case of lymphoma with a large ulcer in the chest Diagnosis based on biopsy and sent to pathology: High Grade B cell Lymphoma Clinical manifestations on arrival: A very large wound on the chest wall Severe edema of the hands Increased creatinine during hospitalization Pulmonary pleural effusion in chest radiograph Pulmonary involvement in lung CT The patient underwent chemotherapy, and after one week, the patient was discharged with a good general condition and reduced wound size.

Results: The patient underwent chemotherapy, and after one week, the patient was discharged with a good general condition and reduced wound size.

Conclusions: Scientific and professional nursing care can lead to effective results

Keywords: Lymphoma Wound Nursing Care

■Beam Quality and the Mystery Behind the Lower Percentage Depth Dose in Grid Therapy

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Introduction: Grid therapy recently has been picking momentum due to favorable outcomes in bulky tumors. This is being termed as Spatially Fractionated Radiation Therapy (SFRT) and lattice therapy. SFRT can be performed with specially designed blocks made with brass or cerrobend with repeated holes or using multi - leaf collimators. Aim: The main challenge is the mystery behind the lower PDD (percentage depth dose) in grid fields. The knowledge about the beam quality, indexed by TPR20/10

(Tissue Phantom Ratio), is also necessary for absolute dosimetry of grid fields. Since the grid may change the quality of the primary photons, a new k_ (q,q_0)should be requested for absolute dosimetry of grid fields. The present Monte Carlo (MC) study was devoted to resolving the questions.

Methods: In this study, the main components of a typical medical linac in 6 MV mode were considered to be simulated using MCNPX® code. Additionally, a commercial grid therapy device was used to simulate the grid fields. After validation of the MC model, output factor, depth of maximum dose, PDDs, dose profiles, TPR20/10, electron and photon spectra were compared between open and grid fields.

Results: The results demonstrated that output factors for grid fields are 0.2 ± 0.05 lower than in open fields. The dmax is the same for open and grid fields. The difference in TPR20/10 of open and grid fields is observable (~5%).

Conclusions: TPR20/10 is still a good index for the beam quality in grid fields and consequently choose the correct k (q, q_0) in measurements. The lower depth dose (~10%) in grid therapy is due to lower depth fluence with scatter radiation but it does not impact the dosimetry as the calibration parameters are insensitive to the effective beam energies. Standard dosimetry in open beam based on international protocol could be used.

Keywords: Grid Therapy; Small Field Dosimetry; Spectrometry; Monte Carlo; Linac

■Hippocampus Sparing in Whole Brain Radiotherapy: Dosimetric Study Between 3D - conformal, IMRT and VMAT

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Introduction: Whole Brain Radiotherapy (WBRT) is one of the methods used alone or in combination with other treatments for adults with multiple brain metastases. In WBRT receiving dose by organs at risk (OARs) as well as hippocampus is inevitable. Sparing of OARs such as cochleaes, parotid glands, orbits, lenses, ear canals, scalp can cause to reduction of toxicities for patients treated with WBRT.it is evident that radiation damage to hippocampus can cause to neurocognitive deficits, so it is recommended that the hippocampus in WBRT be considered as an OAR. The aim of this study is comparison dosimetrically between 3Dconformal, intensity-modulated radiotherapy (IMRT) and volumetric-modulated arc therapy (VMAT) in good coverage of planning target volume (PTV) and sparing of organs at risk (OARs) and hippocampus.

Methods: Ten patients previously treated with 3D-conformal WBRT with Elektra Versa_HD linac by using parallel opposed lateral beams were retrospectively re-planned using IMRT (seven beams) and VMAT (two arcs) techniques with OARs and hippocampal sparing. Prescription dose was 30Gy in 10 fractions for all patients. For each technique Dose–volume histogram (DVH), conformity index (CI) and homogeneity index (HI) of PTV, hippocampus D100% and mean and maximum dose and other OARs were calculated and compared.

Results: As expected the hippocampus is not spared in 3d_ conformal radiotherapy. According to the RTOG 0933 protocol the constraints were used for hippocampi sparing in IMRT and VMAT plans including mean and maximum dose and the dose to hippocampi of 100% of the volume (D100% 9Gy). The mean dose of the hippocampus was 14.3 ± 0.4 Gy and 15.6 ± 0.6 Gy in VMAT and IMRT respectively. The maximum hippocampus dose was 15.2 ± 0.5 Gy and 17.1 ± 0.4 Gy in VMAT and IMRT respectively. The D100% of the hippocampus was 8.45 ± 0.3 Gy and 8.81 ± 0.4 Gy in VMAT and IMRT respectively

Conclusions: VMAT resulted in the lowest maximum, mean and D100% values for the hippocampus and in overal showed the best PTV coverage and sparing of OARs in WBRT. Hippocamus sparing with VMAT can cause reduction in cognitive decline.

Keywords: Hippocampus Sparing; Whole Brain Radiotherapy; 3D-Conformal, IMRT, VMAT

■Dosimetric Impact of Collimator Rotation on Volumetric Modulated Arc Therapy and Intensity Modulated Radiotherapy for Rectal Cancer Patients

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Introduction: Intensity Modulated Radiotherapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT) are primary techniques for rectal cancer treatment. In radiotherapy planning, collimator rotation is a crucial parameter, and its adjustments can lead to dosimetric variations. This study examined the influence of collimator rotation on dosimetric outcomes for different IMRT and VMAT plans for rectal cancer.

Methods: CT images from 20 male rectal cancer patients were used for IMRT and VMAT treatment planning with varying collimator angles. Nine IMRT techniques (5, 7, and 9 coplanar fields with collimator angles of 0°, 45°, and 90°) and six VMAT techniques (1 and 2 full coplanar arcs with collimator angles of 0°, 45°, and 90°) were

planned for each patient. Dosimetric results for target tissue (conformity index [CI] and homogeneity index [HI]) and sparing of organs at risk (OARs) (parameters from OARs dose - volume histograms [DVH]) were analyzed and compared, along with radiobiological findings.

Results: The 7-fields IMRT technique showed lower bladder doses (V40Gy, V45Gy) unaffected by collimator rotation. The 9 - fields IMRT and 2 - arcs VMAT (excluding the 90 - degree collimator) exhibited the lowest V35Gy and V45Gy. A 90 - degree collimator rotation in 2 - arcs VMAT significantly increased small bowel and bladder V45Gy, femoral head doses, and HI values. Radiobiologically, the 90 - degree rotation adversely affected small bowel NTCP (normal tissue complication probability). No superiority was observed for a 45 - degree collimator rotation over 0 or 30 degrees in VMAT techniques.

Conclusions: Collimator rotation minimally impacted dosimetric parameters in IMRT planning but significantly affected VMAT techniques. A 90 - degree rotation in VMAT, especially in a 2 - full arc technique, negatively impacted PTV homogeneity index, bladder dose, and small bowel NTCP. Other evaluated collimator angles did not significantly affect VMAT dosimetrical or radiobiological outcomes.

Keywords: Rectal Cancer; Intensity - Modulated Radiotherapy; Volumetric Modulated Arc Therapy; Collimator; Radiobiologic Parameters; Dosimetric Parameters

■ Zap - X: Advances in next - Generation Radiosurgery for Brain Tumors and Benign Brain Conditions

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Introduction: This article provides an overview of the Zap - X device, an advanced radiosurgery system used for the treatment of brain tumors and benign brain conditions. The Zap - X device is a non - invasive and painless treatment option that utilizes advanced technology for precise and effective brain radiation therapy with exceptional accuracy and minimal damage to surrounding healthy tissues. With various factors such as low radiation energy, the ability to use a 4 - millimeter collimator, and isocentric planning capability, Zap - X offers an interesting platform for functional radiation therapies.

Methods: By utilizing scientific sources and reputable libraries such as PubMed, this article provides a general overview of the Zap - X device, which is a next - generation radiosurgery device for the treatment of brain tumors and benign brain conditions.

Results: The Zap - X device utilizes X-ray imaging to visualize the skull structure and tumor location with high precision. Using these images, the device delivers hundreds

of radiation beams with sub - millimeter spatial accuracy to the target site in the brain. This notable precision enables healthcare professionals to eradicate tumors or treat benign conditions while minimizing radiation dosage to adjacent healthy tissues. ZAP - X is a "self - shielded" device as almost all radiation remains within the device, eliminating the need for expensive radiation therapy bunkers and regular maintenance, safety measures, and replacement of live radioactive isotopes. Under standard working conditions, the maximum expected equivalent dose rate at a distance of 1 meter from the device is less than 1 mSv/year, which corresponds to the limit for public exposure. A typical radiosurgery treatment with Zap - X takes approximately 30 minutes, and the radiation dose administered is equivalent to what is typically given over the course of a month through conventional radiation therapy. The inherent risk of an incorrect treatment is delivering dangerous doses to the brainstem, which can have serious potential neurological consequences.

Conclusions: The Zap - X device fulfills safety requirements, precision, and performance widely accepted in the field of radiation oncology and radiosurgical surgery and features advanced characteristics such as image - guided systems, beam delivery design, and precise radiation targeting and control. It is an advanced and powerful radiosurgery solution in the field of neurosurgery and provides a highly accurate and effective treatment approach for patients with brain tumors and benign brain conditions.

Keywords: Zap - X; Radiosurgery; Radiation Therapy; Intracranial; Tumor

■ Individual Dosimetry in Radionuclide Therapy with Actinium-225, Thorium-227, and Radium-223 by the Utilization of Cherenkov Radiations

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Introduction: Targeted Alpha Therapy (TAT), employing alpha - emitting radionuclides, has emerged as a promising strategy for localized and systemic cancer treatment. Due to the short-range and high - energy deposition characteristics exhibited by alpha particles, obtaining accurate information regarding the dose distribution is imperative for optimizing the efficacy of this therapeutic approach. Currently, using existing methods for individual dosimetry, such as SPECT (Single - Photon Emission Computerized Tomography) image - based and PET (Positron Emission Tomography) image - based dosimetry in the TAT, faces numerous challenges and, in some cases, may be impractical. Therefore, it is necessary to consider developing new radiopharmaceuticals or exploring alternative dosimetry methods such as Cher-

enkov luminescence image - based dosimetry. Objective: This work investigated the possibility of using Cherenkov radiations to determine radiation dose during radionuclide therapy with actinium - 225, thorium-227, and radium-223.

Methods: Utilizing the GEANT4 simulation toolkit, we modeled the Cherenkov radiation emanating from radionuclides 225 - Ac, 227 - Th, and 223 - Ra within a bone tumor with a diameter of 5 cm. The Cherenkov photons emitted were assessed for their correlation with the dose distribution induced by these radionuclides. Furthermore, the relative yields of Cherenkov photons from each radionuclide were quantified.

Results: Our study results demonstrate that the distribution of Cherenkov radiation within the tumor closely corresponds to the absorbed dose distribution within the tumor. Moreover, our study results revealed a markedly increased generation of Cherenkov radiation by 223 - Ra compared to 225 - Ac and 227 - Th.

Conclusions: Our findings indicate the potential utility of Cherenkov emission for individual dosimetry in TAT. Although Cherenkov luminescence image - based dosimetry has been extensively studied in external radiotherapy, its adaptation to internal radiotherapy requires additional investigation, encompassing diagnostic accuracy, resolution, and clinical implementation considerations.

Keywords: Targeted Alpha Therapy; Dosimetry; Cherenkov Radiation; Simulation

■An Innovative Approach to Individual Dosimetry in Yttrium-90 Transarterial Radioembolization Utilizing Cherenkov Luminescence Imaging

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Introduction: Accurate post-treatment dosimetry is essential for evaluating the effectiveness of the Yttrium-90 Transarterial Radioembolization (TARE) treatment. Y-90 Positron Emission Tomography (PET) imaging is acknowledged as the premier modality for post-TARE dosimetry. The low positron yield of Y-90 is a significant challenge for Y-90 PET image - based dosimetry. Recently, Cherenkov Luminescence Imaging (CLI) has been used as a new technique for Y - 90 imaging. CLI is simple and resolves some limitations with the Y-90 PET imaging. Objective: This work aimed to improve personalized dosimetry in TARE using Cherenkov Luminescence Imaging.

Methods: The Monte Carlo codes GATE (version 9.2) were employed to simulate post - TARE PET imaging and CLI in the MOBY mouse phantom. The liver tumor with a 5 mm diameter was modeled in the phantom, and Y-90 was distributed uniformly within the tumor. The quality of PET and Cherenkov luminescence images was evaluated by calculating contrast and Coefficient of Variance (CV). The personalized dosimetry accuracy was estimated as Root Mean Square Errors (RMSEs) in the acquired image-based Dose Volume Histograms (DVHs) and the reference DVHs.

Results: The findings indicated that the Cherenkov luminescence image exhibited approximately 39% higher contrast and 44% lower Coefficient of Variation (CV) values than the PET image. The RMSE in Cherenkov luminescence image-based dosimetry, in comparison to PET image - based dosimetry, demonstrated a significant reduction of 51.4%

Conclusions: Our research offers compelling evidence supporting the superior precision of personalized dosimetry using CLI over PET imaging in the TARE. Our approach is readily applicable in preclinical studies and is characterized by its simplicity and effectiveness.

Keywords: Transarterial Radioembolization; Dosimetry; PET; CLI

■Five-Year Survival and Mental Outcomes of Combined Crocin and Adjuvant Chemotherapy for Breast Cancer; Does Crocin Demonstrate its Multifaceted Effects in Clinic?

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Introduction: Crocin is a flavonoid that is extracted from saffron (Crocus sativus L.). It has mood - regulatory and antioxidant properties. Studies have confirmed its anti - cancer effects on different types of cancer cells in vitro and in vivo. However, no clinical trials have been conducted yet. In this study, we have investigated the 5 - year follow - up of patients who participated in our previous double - blind, randomized clinical trial on crocin administration during breast cancer chemotherapy.

Methods: All patients initially enrolled in the study were newly diagnosed non - metastatic breast cancer patients referring to three main referral cancer clinics, with a pathologically confirmed diagnosis of Her2 enriched or triple - negative invasive breast carcinoma. Patients were randomly assigned to receive either 30 mg/day of crocin (15 mg film - coated tablets, 2 tablets daily) or a placebo (containing cellulose) during chemotherapy. Crocin and placebo tablets were made in exactly the same shape, color, and size and placed in a dark pill box with a random code. The patients, oncologists, and the psychiatrist who assessed the anxiety, depression, and general

function status were blinded to the study groups, and a person out of the research team assigned A or B codes to the pill containers. At this stage of patient follow - up, the first endpoint is the study of disease - free survival (DFS) and overall survival (OS) of patients, which are the time interval between the first pathologic diagnosis and the first evidence of (distant or regional) recurrence, and the time interval between the first pathologic diagnosis and death/last visit, respectively. DFS and OS were both reported in months. For surviving patients, Beck's Depression and Anxiety Inventories (BDI and BAI) are used to determine levels of depression and anxiety respectively. Higher scores indicate higher levels of anxiety and depression (31). Considering that crocin affected neurological complications and blood counts in patients in the initial evaluation, the reexamination included an assessment of chronic neurological complications (headache and neuropathy), and the blood counts were repeatedly checked for possible changes. Moreover, a psychiatric interview is performed for each surviving patient to perform a Mental Status Examination (MSE). All the participants are interviewed by the same blinded psychiatrist in order to decrease heterogeneity and risk of bias.

Results: Out of 72 patients, 63 survived after 5 years. Median follow - up for surviving patients was 4.42 years, ranging from 3.1 to 5.75 years. No significant differences were found between the crocin and placebo group in terms of neurological side effects, depression and anxiety scores, blood count disturbances, events, DFS, and OS. However, overall mental health status evaluated via MSE showed a significant difference (P - value: 0.02).

Conclusions: This study shows that administering crocin alongside chemotherapy to breast cancer patients has a long - term positive effect on their mental health, even after 5 years. However, it did not show any survival benefits. To draw more definitive conclusions, further clinical studies with larger sample sizes and other formulations of the drug are required.

Keywords: Crocin, Flavonoids; Breast Neoplasms; Survival; Depression; Anxiety

■ Palliative Care Strategies of Iranian Nurses for Children Dying from Cancer: A Qualitative Study

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Introduction: Children with cancer, who are at the end-of-life and facing death, need access to palliative care services, and nurses play an important role in providing these services.Aim this stud was explore the palliative care strategies of Iranian nurses for children dying from cancer.

Methods: This was a qualitative study with conventional content analysis. Participants were 8 nurses, 1 social worker, 1 psychologist, 2 children, and 4 mothers from the Paediatric Oncology Unit in Semnan, Islamic Republic of Iran, who had experience in palliative care for children with cancer. Data were collected from individuals using in - depth, unstructured and semi - structured interviews and analysed using the Graneheim and Lundman approach. Data rigour increased with credibility, dependability, transferability, and confirmability criteria

Results: Data analysis led to the emergence of the concept of "perceived compassion". This theme was derived from the 2 main categories of "feeling the shadow of death on the child" and "comforting accompaniment". Feeling the shadow of death on the child included the subcategories of "pre - death arrangements" and "an opportunity to continue interactions". Comforting accompaniment was derived from 3 subcategories: "preparing to announce the child's death", "extra - role sympathy" and " post - death interactions".

Conclusions: Perceived compassion was the main strategy used by Iranian nurses to provide palliative care to children dying from cancer.

Keywords: Islamic Republic of Iran; Nursing; Cancer; Compassion; Death; Paediatric; Palliative Care; Sympathy

■ Sensitivity Analysis of Field Width on Quality and Treatment Time for Brain Hypo - Fractional Treatment

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Introduction: This study evaluates the effect of Fixed and Dynamic Field Width (FW) on treatment time and plan quality for the patient with brain metastasis with HT radiotherapy. It achieves an optimized plan parameter with proper treatment time

Methods: he treatment plan for 20 patients with brain metastases was prepared, and the delivery time, HI, and CI were evaluated with plan parameters of a pitch of 0.303, and the MF 3, Fixed jaw width of 1, 2.5, and 5cm, and dynamic jaw width of 2.5 and 5cm

Results: No significant changes in the dose distribution of PTV were found with Fixed and Dynamic FW 5 cm. The irradiation time showed a linear relationship with the FW and decreased by increasing FW. The Max irradiation

time was 2443.1s when the Fixed FW was 1cm

Conclusions: Plans with fixed and Dynamic FW 2.5 cm were found as optimized plans; however, the latter was chosen for treatment due to the delivery time.

Keywords: Brain Tumor, Hypo Fraction, Tomo Therapy, Field Width

■Disease Control Outcomes of Stereotactic Body Radiation Therapy or Moderate Hypo - Fractionation for Prostate Cancer: Real - World Experience at Two Canadian Centers

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Introduction: Advantages of using stereotactic body radiation therapy to treat prostate cancer include short treatment times, decreased costs, and limited toxicity. Randomized trial outcomes comparing 5 - fraction stereotactic body radiation therapy to conventionally fractionated radiotherapy or hypo - fractionated radiation therapy are pending.

Methods: Patients with low - or intermediate - risk prostate cancer treated with stereotactic body radiation therapy alone (35 - 40 Gy in 5 fractions) or hypo - fractionated radiation therapy alone (60 - 62 Gy in 20 fractions) in the period of July 2010 and June 2020. The biochemical relapse - free survival, PSA nadir, interval time to PSA nadir, time to biochemical recurrence (2 ng/ml above PSA nadir) and overall survival were reviewed. Outcomes between treatment groups were compared after propensity - matching by patient baseline characteristics. Kaplan - Meier curves were used to assess biochemical relapse - free survival and overall survival

Results: We identified 205 and 513 patients with low or intermediate - risk prostate cancer who were treated with stereotactic body radiation therapy or hypo - fractionation, respectively. Intermediate - risk category composed 81% and 95% of the stereotactic body radiation therapy and hypo - fractionated radiation therapy cohorts, respectively. After a median follow up of 58.6 months for the stereotactic body radiation therapy cohort and 45.0 months for the hypo - fractionated cohort, biochemical relapse - free survival and overall survival were not significantly different between treatment groups. The 5 - year biochemical relapse - free survival rates were 92.1% and 93.6% and overall survival rates were 96.4% and 95.0% for the stereotactic body radiation therapy and hypo - fractionated cohorts, respectively, after propensity - matching. Stereotactic body radiation therapy resulted in a significantly lower PSA nadir (0.18 ng/ml) compared to hypo - fractionated radiation therapy (0.48 ng/ml) in patients

with low - risk prostate cancer. Mean time to biochemical recurrence was not different between treatment groups.

Conclusions: Stereotactic body radiation therapy is an effective treatment option for low and intermediate - risk prostate cancer with encouraging biochemical relapse - free survival and overall survival rates comparable with hypo - fractionated radiation therapy.

Keywords: PSA Nadir; SBRT; Biochemical Failure; Hypo-fractionated Radiotherapy

■Ionometric scaling factors measurement inside a new water - equivalent plastic phantom for electron dosimetry purposes

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Introduction: Water is the reference medium for electron beam calibration and quality assurance purposes. Nevertheless, chamber - positioning uncertainties in near surface regions, employing non - waterproof dosimeters, etc. may impose some limitations on employing water phantoms in certain conditions. Here, it is allowed to use water - equivalent plastic phantoms instead of water, provided that specific scaling factors (depth scaling (cpl) and fluence scaling (hpl)) be carefully measured for intended solid phantom. cpl and hpl for a new solid phantom, know as RW3, have been measured for different clinical electron energies in the current study.

Methods: RW3 solid phantom was irradiated by nominal electron energies of 4, 6, 9, 12, and 16 MeV produced by a Varian Trilogy clinic. The same irradiations were also repeated in water to determine cpl and hpl values at corresponding electron energies following the recommendations of TRS - 398 dosimetry protocol. The validity of measured scaling factors were evaluated through comparing the in - water and in - plastic measured PDD curves. Advanced Markus ionization chamber was used for ionometric measurements.

Results: Cpl values at 4, 6, 9, 12, and 16 MeV electron energies were respectively found as 0.915, 0.927, 0.934, 0.937, and 0.937. hpl values were dependent on electron energy and measurement depth. Measured PDD curves inside the water were in accordance with those indirectly acquired inside the plastic phantom, so that the observed deviations among corresponding PDD curves at different electron energies was less than 1.2%.

Conclusions: cpl and hpl scaling factors were practically determined for a new solid phantom at different clinical electron energies. The validity of reported scaling factors was confirmed regarding the favorable accordance of in - water and in - plastic measured PDD curves.

Therefore, these scaling factors can be reliably applied to mimic the water dosimetry results through indirect electron measurement inside the RW3 plastic phantom.

Keywords: RW3 Plastic Phantom, Scaling Factors, Ionometric Measurement, Electron Beam Dosimetry

■ Effect of Group Therapy on Anxiety, Depression and Stress of Women with Breast Cancer; A Systematic Review

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Introduction: Breast cancer is a global challenge and one of the most prevalent cancers among women. Breast cancer as a critical condition can endanger the patient's mental health but group therapy provides conditions for people to get a more realistic picture of their conditions. This study aims to investigate the effect of group therapy on anxiety, depression and stress of women with breast cancer has been done.

Methods: The current study is a systematic review that examines 17 articles that met the inclusion criteria and was searched in Google Scholar and Elmnet search engines and SID, Magiran, PubMed, Elsevier, Science Direct databases with medical subject headings as Keywords psychotherapy, Group, anxiety, depression, stress, Breast Neoplasms, meaning therapy, reality therapy, optimism and their Persian equivalents were published in the time range of 2000 to 2023 There have been. Two researchers separated the data separately and the third one supervised the process of data extraction.

Results: According to the reviewed articles, cognitive - behavioral group counseling by challenging and changing beliefs plays a significant role in reducing patients' depression and anxiety. Also, group positivity psychotherapy has significantly reduced depression, anxiety and stress in patients. According to the researches, the spiritual therapy group is effective in reducing depression in patients, and the existential therapy group based on meaning has been effective in reducing depression and perceived stress. According to the conducted studies, group therapy increases patients' awareness about themselves, improves social skills, adapts to the environment and creates social support for group members, which is an important factor in reducing depression based on previous researches. Also, patients can easily express their thoughts and concerns in a therapeutic team and actively adapt to stress with each other's help.

Conclusions: Based on the results of psychological treatments, group therapy can be useful as an effective way to deal with psychological effects of breast cancer in patients. It is important that psychiatrists and oncologists cooperate together to determine psychotherapy and group therapy as a useful intervention.

Keywords: Psychotherapy; Group; Anxiety; Depression; Stress; Breast Neoplasms

■ Evaluation of IMRT Plan Robustness in Patients with Localized Prostate Cancer Using Different Setup Uncertainty Scenarios

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Introduction: Robustness evaluation is increasingly used in radiotherapy planning to assess the degree of resiliency of the required dose distribution to the radiotherapy uncertainties. This study aimed to assess the impact of systematic setup uncertainty on intensity modulated radiation therapy (IMRT) plans in patients with localized prostate cancer using a plan robustness evaluation method.

Methods: Ten prostate patients previously treated with IMRT were selected for this study. Clinical target volume (CTV) to planned target volume (PTV) margins of 7 mm in all directions, except 4 mm posteriorly, were used. The original plans were normalized to PTV V98%>98%. Seven uncertainty plans were recalculated based on the 5 times setup errors acquired from electronic portal imaging device (EPID) and two worst - case scenarios. CTV, PTV, rectum, bladder, femoral heads, and penile bulb dose metrics were analyzed between the 10 O - plans 70 and U - plans. The dose differences of the O - plans and U - plans corresponded to the plan robustness for each structure.

Results: The mean dose differences of D2cc, D95%, D98%, V95%, and V100% (ΔD2cc, ΔD95% and ΔD98%, ΔV95% and ΔV100%,) of CTV were respectively 1.3 Gy, 3 Gy, 4.6 Gy, 4.2%, and 9.7%. The mean (SD) of worst - case for CTV V95% and CTV V100% were 97.4% (4.0%) and 90.3% (6.7%). The ΔDmax, ΔD95% , and ΔD98% of PTV were 1.2 Gy, 12.1 Gy, and 17.4 Gy, respectively. CTV exhibited more strong robustness than PTV. In rectum, ΔV60Gy and ΔV70Gy were 20.9% and 15.1%. The mean (SD) of worst - case rectum for V60 and V70 were 24.2% (8.7%) and 16.0% (6.1%). Both ΔV60Gy and ΔV65Gy were 14.6% for bladder. The mean (SD) of worst - case bladder for V60 and V65 were 24.2% (5.4%) and 24.6% (6.3%). ΔD1% and ΔD90% were 6.5 Gy and 20.3 Gy for femoral heads and penile bulb. In OARs, the rectum and penile bulb exhibited weak robustness due to their location.

Conclusions: IMRT plans had a strong sensitivity to

setup uncertainty beyond 4 mm, with increasing risk of underdose of tumor and overdose of OARs. Therefore, IMRT plans for localized prostate patients can be considered robust if setup uncertainties kept at or below 4 mm for prostate patients

Keywords: IMRT; Plan Robustness; Prostate Cancer; Setup Uncertainty

■ Exploring the Beam Modeling Algorithm in Patient-Specific IMRT Quality Assurance

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Introduction: The main objective of this study is to assess the dosimetric accuracy in the delivery of intensity - modulated radiation therapy (IMRT) and its impact on patient - specific quality assurance (QA). Specifically, the focus is on the verification of treatment plans in a phantom geometry, known as pretreatment patient - specific QA, for small fields. Small fields present challenges in accurately modeling their dosimetric characteristics in treatment planning systems (TPS) and transferring them to treatment delivery. This study aims to investigate how imprecise beam modeling of small fields in TPSs affects patient - specific IMRT QA. Two different dose calculation algorithms used in commercial TPSs are evaluated, and the impact of imprecise extrapolation of small field parameters on IMRT QA is studied.

Methods: Experimental measurements were conducted using a Siemens Artiste linear accelerator with different field sizes. The behaviors of two different dose calculation algorithms were analyzed using a 2D diode array, specifically the MapCHECK2 system from Sun Nuclear Corporation. Planar dose comparison between the TPSs and the 2D array was performed for fields involving small segments, and the percentage of points that passed the acceptable gamma criteria was calculated. The gamma criteria used were a 3% dose difference and a 3mm distance - to - agreement (DTA) with a 10% dose threshold

Results: The study demonstrated that the collapsed cone convolution/superposition algorithm (CCCS) used in the Prowess TPS accurately models the small nonequilibrium IMRT segments compared to the full scatter convolution (FSC) algorithm used in the TiGRT TPS. Gamma analysis of the calculated and measured dose distributions showed that the gamma index pass rate for small segments designed by Prowess was good. However, the results obtained by TiGRT showed a significant difference in average segment size below 3×3 cm2, indicating imprecise beam modeling of small fields by FSC.

Conclusions: Based on the conducted studies, it can be concluded that there is a direct relationship between the dose calculation algorithm, beam modeling of small fields, and patient - specific QA. The choice of dose calculation algorithm and accurate beam modeling for small fields are crucial factors in ensuring dosimetric accuracy in IMRT treatment delivery.

Keywords: IMRT Quality Assurance, Small IMRT Segment, Dose Calculation Algorithm

■ Randomized, Double - Blind, Placebo - Controlled Clinical Trial of Concurrent use of Crocin During Chemoradiation for Esophageal Squamous Cell Carcinoma

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Introduction: Esophageal cancer is considered as one of the most prevalent malignancies all over the world. Despite new chemotherapy and targeted treatments and radiotherapy methods, the prognosis of patients with esophageal cancer is dismal. There is growing evidence pointing to the role of crocin, the main active compound in saffron (Crocus sativus L.); in improving the survival in patients with cancer and ameliorating the psychological effects of suffering from these disorders. Therefore, the current study aimed to assess the effects of concurrent use of crocin during chemoradiation of esophageal squamous cell carcinoma on pathologic response following definitive surgery.

Methods: In this double - blind, placebo - controlled, parallel - group trial, newly diagnosed non - metastatic patients with esophageal squamous cell carcinoma were randomly assigned to either the intervention (30 mg/day of crocin) or placebo groups. The interventions were prescribed during the neoadjuvant radiotherapy (50.4 Gy in 25 fractions/5 weeks) and concurrent chemotherapy (paclitaxel 50 mg m - 2/carboplatin AUC 2). The primary outcomes were pathologic response and toxicity, and the secondary outcomes were levels of depression and anxiety and survival analysis. In all analyses, $P < 0.05$ was considered significant.

Results: A total of 63 patients were recruited to participate in this study. Of these, 4 patients were excluded because of recurrence and death before the start of the study. The remaining 59 patients were enrolled in the study, of whom 13 patients were lost to follow - up and 46 patients completed the study. The pathologic responses were similar between the groups. with a median follow - up of 8 months, the mean overall survival (OS) was 11.75 months in the crocin group and 10.6 months in the placebo group (p - value = 0.456). Also, the mean disease - free

survival (DFS) was 10.82 months in the crocin group and 10.30 months in the placebo group (p - value = 0.323). The mortality and recurrence rates were 17.4% and 30.43% in the crocin group and 13% and 21.73% in the placebo group, respectively (p - value ≥ 0.46). Moreover, toxicities were similar in both groups. The mean depression score in the crocin group is 19.1 ± 1.8 before treatment and 12.06 ± 0.93 after treatment (p - value = 0.001), and the mean depression score in the placebo group is 18.03 ± 0.9 before treatment and 16.02 ± 0.89 after treatment (p - value = 0.08). The mean difference of depression score after the intervention was - 6.43 ± 1.66 in crocin group and - 1.9 ± 0.65 in placebo group (p - value = 0.017). The mean anxiety score in crocin group before treatment was 1.31 ± 17 and this score after treatment was 12.39 ± 1.35 (p - value = 0.001). In the placebo group, the mean anxiety score was 17.86 ± 1.39 before treatment and 16.69 ± 1.38 after treatment (p - value = 0.098). The mean difference of anxiety score after the intervention was - 4.67 ± 0.67 in crocin group and - 0.86 ± 0.58 in placebo group (p - value = 0.0001).

Conclusions: The results of present study showed that crocin can increase neither the rate of pathologic complete response rates nor the survival rates in patients with operable esophageal cancer. However, it can ameliorate the psychological adverse effects of suffering from cancer and its treatment.

Keywords: Esophageal Squamous Cell Carcinoma; Chemotherapy; Radiotherapy; Crocin; Carotenoids; Anxiety; Depression

■Electronic Medical Prescription and its Relationship with Medical Errors; A Narrative Review Focusing on Oncology

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Introduction: Medical errors are one of the leading causes of death around the world. One of the prevalent and preventable subcategories is medication errors including the mistakes that occur in prescribing medicine. Cytotoxic medication errors are reported to be associated with more significant adverse events as one - third of identified oncologic prescribing errors are categorized as serious or even life - threatening

Methods: In this review, we investigated the significance of medication errors around the world and in Iran, the history of implementing electronic prescription (eP), and the relationship between eP and medication error, with a focus on clinical oncology, searching for keywords such as E - Electronic Prescription, Oncology, Chemotherapy, Patient Safety, Medical Error, Medication Errors, and prescription from 2000 to November 2023 in PubMed, Scopus, SID, and search engines like google. We further discussed the various aspects in which eP can benefit clinical oncology.

Results: According to the available data, medical errors including both omission and commission errors represent more than half of the overall preventable harm in healthcare globally, injure one million patients, and result in 44,000 deaths yearly in the US, with an estimated annual cost of €4.5–21.8 billion in Europe and over $21 billion in the United States. Regarding clinical oncology, estimates of medication errors in ambulatory chemotherapy range from 7.1% to 18.8%, oral cytotoxic medications are at the highest risk, and incomplete prescriptions are a significant cause of prescription errors. In Iran, the rate of Medical Errors is estimated at 0.35% and the error rates during the medication process were 31%, 27%, and 35%, respectively; However, there were no specific reports on oncology. Several countries began implementing eP systems in the early 2000s, which were further accelerated by the COVID19 pandemic in recent years. EP can also improve oncology by optimizing medicine dispensing, dose adjustment, speed and repetition patterns, drug preparation orders, error reporting, documentation, and research

Conclusions: Oncology is one of the branches of medicine that benefits most from advances in eP as it requires maximum interventions to prevent the fatal consequences of cytotoxic therapy with a narrow therapeutic range, and a delicately calculated prescription

Keywords: Electronic Prescription; Oncology; Prescription; Medical Errors

■Cardiac Safety of Trastuzumab in Breast Cancer Patients with Left Ventricular Dysfunction

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Introduction: Trastuzumab is one of the most effective treatments in HER - 2 positive breast cancer patients. One of the important side effects of trastuzumab is cardiotoxicity, which usually occurs as a reduction in the left ventricular ejection fraction (LVEF). Discontinuing the treatment due to cardiotoxicity may lead to cancer progression and worsen prognosis.The aim of the cur-

rent study was to evaluate the cardiac function in HER - 2 positive breast cancer patients who were candidates for trastuzumab therapy but had already left ventricular dysfunction prior to initiation of the treatment.

Methods: HER - 2 positive breast cancer patients with asymptomatic LV dysfunction with LVEF 40 - 53% who were candidates for receiving trastuzumab (after initial chemotherapy) included in this study. Patients were visited in the Cardio - Oncology clinic before initiating the treatment and then before every two cycles of trastuzumab. They also received the standard treatment for heart failure including a beta - blocker (carvedilol) and ACE - I (Lisinopril), up to the maximum tolerated dose, if there were no contraindications. Patients were followed up 6 months after the end of treatment. Myocardial infarction (MI), cardiac arrhythmia, heart failure(HF) symptoms and any death that occurred due to Cardiovascular diseases were recorded as cardiac events. If the LVEF decreased below 40%, the treatment was temporarily interrupted for one or two cycles, and spironolactone was added to the patient's treatment. but If the LVEF improved(≥40%), trastuzumab was rechallenged.

Results: Thirty - six patients were included in the study. LVEF reduction of more than 10% occurred in 16.7% of the patients, and a GLS reduction of more than 15% was detected in 11.1% of the patients. There was a significant association between a ≥10% reduction in LVEF and baseline systolic blood pressure (P - value: 0.04). LVEF reduction below 40% was observed in 3 patients, that trastuzumab was interrupted in them. All of these three patients had obesity and uncontrolled HTN, and one of them had symptoms of heart failure (NYHA class II), for whom the trastuzumab treatment was discontinued. In the two other patients, after the temporary interruption of trastuzumab, LVEF improved to above 40%, and the treatment was restarted with close cardiac monitoring; therefore, they could complete the entire one - year treatment period.

Conclusions: Continuing the treatment with trastuzumab seems to be safe in patients with reduced LVEF (LVEF = 40 - 53%), but they should be strictly monitored and controlled for cardiovascular risk factors, especially HTN.

Keywords: Trastuzumab, Left Ventricular Dysfunction, Cardiotoxicity, Targeted Therapy

■Investigating Factors Related to Advanced Care Planning in the Elderly in a Cross - Sectional Study in Iran

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Introduction: Elderly is a phenomenon in the 21st century in developed and developing countries, which is considered as a silent revolution. Studies show that the end - of - life care needs of elderly patients are not well taken into account, considering that palliative care is done with the aim of improving the quality of life of patients with life - threatening diseases and their families, one of the most important priorities in palliative care includes discussion And the discussion is about patients' desire to receive palliative care and their preferences regarding end - of - life issues, which is called advanced care planning. Therefore, the aim of this study is to investigate the factors related to advanced care planning

Methods: This cross - sectional descriptive study was conducted in 2021 - 2022 in four hospitals in Tehran and with 390 eligible elderly people using available sampling method. The instrument used was the Persian version of the Advanced Care Planning Questionnaire and related factors It was determined by advanced care planning with multivariate linear regression test.

Results: The results show that the availability of advanced care planning services, discussions about it with others, patients' attitudes about advanced care planning and disease experience are 35% predictors of patients' feelings towards advanced care planning. There is a significant relationship between demographic variables such as income, marital status, gender and education of patients with advanced care planning

Conclusions: Considering that the factors related to advanced care planning can be different from one person to another and affected by different conditions, therefore with proper training of the treatment team and the knowledge and attitude that patients can acquire about advanced care planning.it is possible to achieve specialized care at the end of life and respect the dignity of patients.

Keywords: Advanced Care Planning; Elderly; End of Life Care

■Evaluation of Resveratrol - Loaded Polymeric Based Nanocapsule Mitigation Effect on Radiation - Induced Hematopoietic System and Intestine Injury After Whole Body Exposure to X-ray Radiation in Mice

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Introduction: Radiation - induced damage to the hematopoietic and gastrointestinal system especially intestine is a major concern for individuals exposed to ionizing radiation. Resveratrol has shown potential in mitigating radiation - induced toxicity, but its efficacy may be limited by its low bioavailability. In this study, we aimed to evaluate the effectiveness of resveratrol - loaded polymeric - based nanocapsules in mitigating radiation - induced injury to the hematopoietic system and intestine after whole - body exposure to X-ray radiation in NMRI mice.

Methods: Sixty male NMRI mice were randomly divided into four groups: control, radiation, resveratrol only, and resveratrol+radiation. Mice were exposed to a single dose of 7.2 Gy of X-ray radiation. Resveratrol - loaded polymeric - based nanocapsules were administered to the mice in the sham and resveratrol treatment groups through gavage. Mice were sacrificed on day 7 post - irradiation, and blood and tissue samples were collected for CBC, histopathological and biochemical evaluation.

Results: The study found that resveratrol - loaded polymeric - based nanocapsules effectively (significantly) mitigated radiation - induced injury to the hematopoietic system and intestine. The histopathological evaluation showed a slight decrease (non - significant) in goblet cell injury, villi shortening, inflammation, and mucous layer thickness in the resveratrol treatment group compared to the radiation group. Biochemical evaluation showed a significant increase in GPx and SOD activities in the resveratrol treatment group compared to the radiation group. Resveratrol treatment group showed a significant improvement in some of blood parameters compared to the radiation group.

Conclusions: The findings suggest that resveratrol - loaded polymeric - based nanocapsules can be an effective approach to mitigate radiation - induced damage to the hematopoietic system and intestine after whole - body exposure to X-ray radiation in mice. Further research is needed to explore the optimal dose and timing of resveratrol administration and to investigate the potential for clinical translation of this approach.

Keywords: Mitigation, Radiation; Oxidative Stress; Nano Drug Delivery; Nanoparticles Chitosan; Resveratrol

■Assessment of Radiation Therapy Dose Distribution Using Digitally

Reconstructed Radiograph

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Introduction: The DRR has typically been employed for verifying the geometry in radiotherapy treatment, and there have been no documented instances of its use for dosimetric purposes. This research aims to introduce a new methodology, allowing us to generate a two - dimensional dose distribution within a treatment plan using the DRR for the first time.

Methods: First, the study will investigate the relationship between the pixel values of the DRR and water - equivalent thickness (WET). Next, it aims to establish a link between depth and absorbed dose. By combining these relationships, a new equation will be developed to connect the pixel values of the DRR to the absorbed dose. This method will be utilized to calculate the dose distribution in the isocentric plane for both homogeneous and heterogeneous phantoms. To verify the accuracy of this approach, the results will be compared with the two - dimensional dose distribution from the treatment planning system (TPS).

Results: At the isocenter, the point dose comparison indicates a variance of around 1% for the homogeneous phantom and 1.2% for the heterogeneous phantom. A gamma analysis (3% - 3mm criteria) was conducted to compare the region - based dose distribution. The pass rate achieved was 98.44% for the homogeneous phantom and 96.6% for the heterogeneous phantom

Conclusions: Confirming the dose distribution derived from this method with TPS introduces a novel use of DRR for assessing dose distribution in perpendicular planes to the treatment field's central axis. This serves as a means for verifying treatment planning and a fresh approach to quality control in radiotherapy.

Keywords: Radiotherapy; Digitally Reconstructed Radiograph; Dosimetry Verification; Water Equivalent Thickness

■Comparison of Computed Tomography and Magnetic Resonance Imaging in Cervical Cancer Brachytherapy with dosimetric and Clinical Parameters

ABSTRACTS

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Introduction: The aim of this study was to evaluate the relative deviation of dose - volume(DVH) parameters for the high - risk clinical target volume(HRCTV) and organ at risk (OARs) using computed tomography (CT) versus magnetic resonance imaging (MRI) in cervical cancer brachytherapy.

Methods: In this study, we analyzed 24 patients with pathologically confirmed cervical carcinoma using CT and MR images. The HRCTV and OARs, including the rectum, bladder and sigmoid, were outlined on both images. We calculated the dice coefficient of similarity (DSC) score, and the volume, height, width, and dose parameters including D90, D98, D100 for HRCTV, and dose - volume parameters of OARs including D0.1cc, D1cc, and D2cc. Additionally, we examined the relationship between body mass index (BMI) and the dose parameters.

Results: There was strong correlation between CT and MR images for the bladder ($r > = 0,72$) and rectum ($r > = 0.83$) except for the D0.1cc of the bladder. However, there was a poor correlation between the doses of HRCTV for CT and MRI plans for DVH parameters such as D90,D98, and D100.The mean DSC range was between 75.13% for the bladder, 64.13% for the rectum,56.71% for the sigmoid, and 66.54% for HRCTV.

Conclusions: MRI is currently considered the gold standard for tumor delineation. However, CT with clinical information can also provide comparable results, which merit further investigation. When planning treatment, it may be necessary to consider both MRI and CT in order to make an informed decision.

Keywords: CT, MRI, Dose - Volume Histogram, Cervical Cancer, Brachytherapy

■Mirafos®: A Combination of Natural and Chemical Antioxidants Capable of Radiosensitizing Tumor Cells and Radioprotector of Normal Tissue

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Introduction: Ionizing radiation used for radiotherapy of cancer pose side effects on normal tissue that intervene in the process of radiotherapy. Short term effects such as leukopenia and thrombocytopenia lead to immunodeficiency. Long term effects such as infertility, secondary cancers and transgenerational genetic diseases are other side effects of radiotherapy. Despite long time efforts toward introducing a chemical or natural radioprotector to combat side effects of radiotherapy, little success was achieved so far. Moreover, radiation oncologists are reluctant to use chemical radioprotectors for cancer patients because they think it might intervene with the effect of ionizing radiation on tumor.

Methods: Mirafos®, an orally administrable drug with patented ingredient is a mixture of chemical and natural antioxidative agents that was tested for genotoxicity and cytotoxicity on various tissue types in vivo and in vitro. The end points used in the preclinical study of this drug were of DNA damage, micronucleus assay, chromosomal aberration assay, MTT and cell survival assay alone or in the form of mixed agents. Results were analyzed with appropriate statistical tests for significances.

Results: Results of cytome assay, cell survival, MTT assay, DNA damage and micronucleus assay indicated that some ingredients when administered in combination act as a powerful radioprotector on normal tissues and cells, while some of them induce radiosensitivity when using cells with genome instability such as lymphocytes of breast cancer patients. These agents have no protective effect on normal cells against radiation.

Conclusions: Mirafos®, was found a dual action drug with different ingredients that act as both radioprotector of normal tissue and a radiosensitizer of tumor tissue. When administered, accumulation of Mirafos® lead to higher efficacy of radiation on tumor cells and on the other side protecting the normal tissue from side effects of ionizing radiation. This differential effect may lead to higher therapeutic gain factor. Other important features of Mirafos® are oral administration route, stability in ambient condition, and low cost. It may also lower the risk of secondary cancer due to radiotherapy by protection of normal tissues.

Keywords: Radioprotection; Radiosensitizer; Genotoxicity; Tumor Radiotherapy; Mirafos®

■Evaluation of Relationship Between the Complexity of Intensity Modulated Radiation Therapy of Head and Neck Plans and Results: of Quality Assurance with the Help of Phantom Measurements and Determination of Complexity Threshold Values

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Introduction: Intensity modulated radiation therapy is an effective technique for treatment of all types of tumors, especially in the head and neck region. Complexity score is a tool for predicting the delivery and accuracy of treatment plans, which are determined in the range of 0 - 1. Gamma passing criterion is used to evaluate the dose values measured and calculated by the treatment planning system. Determining the range of the complexity factor in treatment plans can help to predict the results of quality assurance and prevent creating complex plans. Thus, the aim of the present study is to investigate head and neck treatment plans with intensity modulated radiation therapy (IMRT) and to perform quality assurance for each of them in order to determine the range of acceptable complexity.

Methods: The initial treatment plans of 30 head and neck cancer patients who were treated with IMRT using the Step and Shoot method by the Ray Station treatment planning system were examined. Then MCS and PMU complexity indicators were coded and added to the treatment planning system. Then three treatment plans include; A simple, standard and complex treatment plan were created for patients. Quality assurance of the plans is done with Octavius 4D phantom, the implementation and the relationship of complexity and quality assurance results were compared with each other using gamma criteria of 3%/3mm

Results: The results of the study showed that complex treatment plans had lower MCS and higher total MU and PMU than other treatment plans. With the increase of MU and the number of segments, the amount of complexity increases. There is a statistically significant relationship between the amount of MCS and PMU with the number of segments (p = 0.000). Mean gamma pass rate in all treatment plans were more than 99% and Its values were the highest in simple treatment plans and the lowest in complex treatment plans. A statistically significant relationship was not observed between the gamma pass and complexity parameters.

Conclusions: MCS is a very sensitive metric to distinguish between complex, standard and simple treatment plans. This criterion can be incorporated into process of plan evaluation

Keywords: Quality assurance of patient treatment plans, complexity of treatment plans, complexity index, complexity threshold value, IMRT

■ A Multicenter, Randomized, Open- Label, Controlled trial to Compare Recurrence Pattern of Reduced Margins vs RTOG Protocol in Adjuvant Chemoradiation of High - Grade Glioma

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Introduction: The current standard treatment for high - grade glioma (HGG) Typically includes maximal
surgical resection and adjuvant radiotherapy, with or without concurrent chemotherapy,
followed by adjuvant chemotherapy. There is still some debate about the target delineation of
HGG, and it continues to be a subject of investigation. This study aimed to assess the feasibility,
safety, and efficacy of using a smaller margin of radiotherapy than what is recommended in the
latest ESTRO/ACROP guideline for HGG.

Methods: In this multicenter, randomized, open - label, controlled trial, patients aged 18 to 75 years with
grade 3 and 4 gliomas were enrolled following surgery. Eligible patients were randomly
assigned to either the standard group, based on RTOG guidelines, or the intervention group,
which utilized a smaller margin of 1 cm. They received a total dose of 60 Gy in two phases
according to the RTOG protocol. After chemoradiation, patients underwent brain MRI every
three months during follow - up. The recurrence pattern was determined by the 95% isodose line
on the CT scan used for treatment planning at the time of imaging progression.

Results: A total of 258 patients were randomly assigned to two groups. Both groups were similar in
terms of age, gender, radiotherapy technique, IDH mutation status, type of surgery, surgery -
radiotherapy interval, duration of adjuvant chemotherapy, GTV60 volume, and the volume of
GTV46. Grade 4 tumors were more prevalent in the control group (31.3% vs. 18.8%, p = 0.02).
There was no significant difference in the in - field recurrence rates between the two groups
(intervention: 84% vs. control: 83.8%, p = 0.829).

Conclusions: Adjuvant radiotherapy of HGG with smaller margins does not compromise the recurrence
pattern of the tumor. Therefore, it is safe to recommend a smaller margin in order to spare
more normal brain tissue.

Keywords: High Grade Glioma; Adjuvant Radiotherapy; Margin; Target Delineation

■ Accurate Prediction: Deep Learning Approach for Dose Prediction Integrating Field Shape and Patient Anatomy in Breast Cancer Patients'

ABSTRACTS

Radiation Therapy

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Introduction: Geometrical information, particularly field shape, plays a pivotal role in accurate dose calculation for radiation therapy. Recent advancements in dose prediction utilizing deep learning focus predominantly on CT images and patient contouring. This study aims developing a deep learning method that incorporates not only CT and contouring images but also leverages field shape for three - dimensional dose prediction in breast cancer radiotherapy.

Methods: In this study, a dataset comprising 150 breast cancer patients treated with the 3D CRT technique was utilized to train and test a proposed deep learning model. The model incorporated CT images, patientsand#39; contouring, and field shape as inputs. The network output was the corresponding the patients' dose distribution. Dosimetric parameters extracted from dose volume histograms for planned and predicted distributions were compared. Parameters included D mean for the planning target volume and organs at risk, as well as D 95% , D 50% , V 47.5Gy for the planning target volume, and V 30Gy , V 25Gy for the heart, and V 20Gy for the left lung.

Results: The average absolute difference of the D mean relative to the prescribed dose for the PTV, heart, left lung, right lung and spinal cord were 1.37%, 2.02%, 2.12%, 0.37% and 0.41%, respectively.

The 3D gamma pass rate with 3mm/3% criteria for planning target volume, heart, left lung, right lung, spinal cord and body were 89.49%, 91.39%, 92.84%, 98.71%, 99.46% and 96.29%respectively.

Conclusions: This study presents promising results indicating no significant differences between predicted and planned dose distributions using a novel deep learning model for 3D dose prediction in breast cancer radiotherapy. The model exhibits rapid real - time prediction capabilities, providing accurate results within seconds. Further studies with more patients and on other cancer sites are essential to fully validate the proposed method.

Keywords: Deep Learning; Dose Distribution Prediction; Field Shape; Breast Cancer

■Exploring the Impact of Delayed Postoperative Radiotherapy on Relapse and Metastasis in Female Breast Cancer Patients: Insights from Penalized Cox Regression

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Introduction: The correlation between the timing of radiotherapy commencement following breast surgery and the disease - free status of patients remains a topic of debate. In this study, we investigated the association between the delay in adjuvant radiotherapy post - surgery and the survival free from relapse or metastasis in women with breast cancer, considering the substantial presence of censored data

Methods: Conducted as a historical cohort investigation, this study involved 284 individuals diagnosed with breast cancer who underwent surgical procedures between 2001 and 2007 and were subsequently monitored until March 2017. The research delved into the relationship between the interval separating radiotherapy and surgery, along with various demographic and clinical factors, and the incidence of local relapse or metastasis in breast cancer. This analysis was carried out using penalized Cox regression modeling, and the acquired data were subjected to analysis using R 3.6.3.

Results: A total of 284 women, with a mean age of 47.2 ± 11.3 years, fulfilled the inclusion criteria for this study. The maximum follow - up period extended to 11.1 years, with the duration between surgery and radiotherapy averaging 168 ± 84.3 days. Approximately 10% of the patients encountered local relapse, and 19% experienced metastasis. In a comprehensive analysis of factors influencing disease - free survival, the disease stage emerged as a significant factor, while the interval between surgery and radiotherapy (≤180 days vs. >180 days) did not exhibit any significant impact on the hazard of failure. Furthermore, the analysis of delays in radiation therapy lasting 3, 4, or 5 months did not reveal any significant effects.

Conclusions: In the studied patients, the delay in radiotherapy initiation after surgery did not lead into outcomes of local relapse or metastasis.

Keywords: Breast Neoplasm, Radiotherapy Delay, Local Relapse, Metastasis, Penalized Cox Regression

■Quality of Life Assessment Among Older Adult Patients with Chronic Wounds

ABSTRACTS

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Introduction: Patients with chronic wounds experience various biopsychosocial problems which severely affects their quality of life (QOL). Thus, a Persian instrument to assess the QoL of these patients is required. This study aimed to determine the psychometric properties of the Persian version of the wound - QOL questionnaire.

Methods: This methodological study was performed on Iranian patients during 2021 - 2022. The translation was carried out via forward - backward method. Face validity was addressed with 10 patients and content validity with 12 wound specialists. Construct validity was also assessed by performing exploratory factor analysis (EFA) (n = 100) and convergent validation with EQ - 5D - 3L plus Pain VAS Score and known - groups validity. The reliability was assessed by internal consistency using Cronbach's alpha coefficient and test - retest.

Results: A total of 100 patients with chronic wounds were included in the study. Two factors with cumulative variance of 65.39% were extracted during EFA. The results revealed a significant and high correlation between the total scores of wound - QOL questionnaire, the Persian version of EQ - 5D - 3L (P = 0.000, r = 0.502), and Pain score (0 - 10; P = 0.000, r = 0.627). The Cronbach's alpha was 0.743 and stability of the questionnaire (? = 0.872) was confirmed. In confirming the known - groups validity, the results showed that this tool can differentiate the QOL of patients with different wounds

Conclusions: The Persian version of the wound - QOL questionnaire is a valid and reliable questionnaire which can measure the QoL of patients with chronic wounds. This instrument can be used in clinical evaluation as well as research purposes across the Iranian population

Keywords: EQ - 5D - 3L; Iran; Persian; Chronic Wound; Quality of Life; Reliability; Validation; Wound - QOL Questionnaire

■ Sexual Experience of Iranian Women with Cancer: A Qualitative Content Analysis

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Introduction: Cancer diagnosis and treatments cause sexual dysfunction in patients. Sexual function is one of the most important aspects of quality of life. However, in previous studies, qualitative methods have been less accentuated to explore in to the sexual experiences and feelings of cancer patients. The aim of the present study was to investigate the experiences of Iranian women affected with cancer about their sexual quality of life

Methods: A qualitative descriptive study with a conventional content analysis approach was performed on a targeted sample of 28 Iranian women with cancer from October 2018 to February 2020. Data were collected through face to face and in depth semi structured interviews until data saturation was attained.

Results: Data analysis revealed four themes and 11 categories. The emerged themes were entitled: "Changing sexual capacity", "physical consequences", "sexual self - sacrifice" and "Changing woman's identity"

Conclusions: Women with cancer experience many sexual problems such as reduced orgasm, lack of pleasure, and pain during sex. Due to the taboo of sexual issues, especially for women, many of them are embarrassed to ask their questions to the medical staff and for this reason, their problems will remain unresolved. The support of their spouses and the social can play an important role in facilitating coping. Health care providers have an important role in assessing and improving patients' quality of life. It is recommended to adopt strategies for appropriate interventions, education and counseling to improve sexual quality of life in cancer patients.

Keywords: Sexuality; Qualitative Research; Neoplasms; Iran; Women

■ Patient - Specific Geometrical Distortion Corrections of MRI Images Improve Dosimetric Planning Accuracy of Vestibular Schwannoma Treated with Gamma Knife Stereotactic Radiosurgery

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Introduction: To investigate the impact of MRI patient - specific geometrical distortion (PSD) on the quality of Gamma Knife stereotactic radiosurgery (GK - SRS) plans of the vestibular schwannoma (VS) tumors.

Methods: Three open access datasets including the MPI-Leipzig Mind - Brain - Body (318 patients), the slow event

- related fMRI designs dataset (62 patients), and the VS dataset (242 patients) were used. We used first two datasets to train a 3D convolution network to predict the distortion map of third dataset that were then used to calculate and correct the PSD. GK - SRS plans of VS dataset were used to evaluate dose distribution of PSD - corrected MRI images. GK - SRS prescription dose of VS cases was 12 Gy. Geometric and dosimetric discrepancies were assessed between the dose distributions and contours before and after the PSD corrections. Geometry indices were center of the contours, Dice coefficient (DC), Hausdorff distance (HD), and dosimetric indices were Dμ, Dmax, Dmin, and D95% doses, target coverage (TC), Paddick's conformity index (PCI), Paddick's gradient index (GI), and homogeneity index (HI).

Results: Geometric distortions of about 1.2 mm were observed at the air - tissue interfaces at the air canal and nasal cavity borders.Average center of the targets was significantly distorted along the frequency encoding direction after the PSDcorrection. Average DC and HD metrics were 0.90 and 2.13 mm. Average Dμ, D95%, and Dmin in Gy significantly increased after PSD correction from 16.85 to 17.25, 12.30 to 12.77, and from 8.98 to 9.92. Dmax did not significantly change after the correction. Average TC and PCI significantly increased from 0.97 to 0.98,and 0.94 to 0.96.Average GI decreased significantly from 2.24 to 2.15 after PSD correction. However, HI did not significantly change after the correction.

Conclusions: The proposed method could predict and correct the PSD that indicates the importance of PSD correction before GK - SRS plans of the VS patients.

Keywords: Deep Learning; Field Mapping; Image Quality; Precision Radiation Therapy; Susceptibility Variations

■ Exploration of the Strategies of Iranian Nurses in Providing Palliative Care to Children with Cancer: A Qualitative Study

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Introduction: Due to the prevalence of cancer in children and the decrease in their quality of life, attention to palliative care has become one of the main concerns of the Iranian health system. Given that nurses are the key members of pediatric palliative care, explaining their strategies can help to identify existing limitations in addition to recognizing ongoing care. So this study aimed to explain the strategies of Iranian nurses in providing palliative care to children with cancer.

Methods: This study is a qualitative research with an approach to the conventional content analysis. The main participants were nine nurses working in ward pediatric oncology. Also based on data analysis, five parents of children, two children, one social worker, one physician, one psychologist, and one nutritionist were also included. Data were collected through semi - structured interviews and observation and were analyzed by the Elo and Kyngäs approach. Lincoln and Guba criteria were used for the trustworthiness of data analysis.

Results: Three conceptual categories were developed with qualitative analysis: "prevention and relief of pain and physical symptoms", "spontaneous compassion", and "strengthen parental resilience"; that were derived from the main categories: "attention to precautionary considerations," "friendly relationship of nurses with parents of children, create enjoyable moments, spontaneous assistance," "facilitate coping with current situation, perceived confrontation with child death."

Conclusions: In this study, the results showed that nurses' strategies in providing palliative care to children with cancer were a combination of professional and spontaneous strategies.

Keywords: Children with Cancer; Iran; Nurses' Strategies; Palliative Care; Qualitative Study

■ The knowledge - based Organ at Risk Dose Estimation in 3D Conformal Radiation Therapy of Breast Cancer

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Introduction: An optimal dose distribution in radiotherapy requires balancing the radiation dose in the target and the organs at risk (OARs). However, current optimization methods can be time - consuming and dependent on the user's expertise, hindering the development of streamlined and automated techniques. To address this issue, we evaluated the performance of several regression models in estimating OARs doses in left breast radiotherapy treatment planning. Our study results have the potential to pave the way for the development of more streamlined and automated techniques to generate optimal dose distributions.

Methods: We analyzed 70 3D - conformal radiotherapy treatment plans for left breast cancer and extracted geo-

metrical and dosimetric features, including field size, CLD, MLD, MHD, tangential fields angle, wedge angle, Vx, and Dx of the target and OARs. The OARs in the plans were the left lung and heart. We applied various regression models and optimized their hyperparameters. We selected the best model for each specific dosimetric parameter based on mean absolute error scores. We also performed feature selection to identify the most effective parameters for each OAR and model.

Results: The KNN_regression model was the best for mean dose of the heart, lung, and V20 of the lung. The SVR model was the best for the V10 and V5 of the lung. The AdaBoost model was the best for V30 of the heart, and MLP_regression model was the best for V5 of the heart. We identified the most important features for all models and OARs, which can be considered for accurate dose estimation.

Conclusions: Our study demonstrates the feasibility of using regression models to determine OARs dose in left breast radiotherapy treatment planning without relying on dose calculation algorithms. Our proposed method can potentially reduce the time required for plan optimization in 3D - CRT. We believe that our findings can lead to the development of more efficient and automated techniques for generating optimal dose distributions.

Keywords: Machine Learning, Breast Cancer, Radiotherapy, Dosimetry, Organs at Risk

■ Recent Insight into the Adaptive Response Effect Induced by the Stimulation of DNA Double - Strand Break Repair

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Introduction: Adaptive response (AR) is a major biological effect caused by priming low - dose ionizing

radiation (LD). The incidence of AR in radiotherapy and its influence on cancer treatment

efficacy highlights the importance of AR. In this study, we aimed to investigate AR induction in

human lung tumor cells versus normal cells; also, we have addressed this effect by evaluating

the role of the DNA double - strand breaks (DSBs) repair process in response to LD.

Methods: The AR effect was examined by measuring cell survival and proliferation ability of the normal

lung fibroblast cells (MRC - 5) and cancer lung cells (QU - DB) using the MTT and clonogenic assay.

To acquire new insight into the unknown underlying mechanisms of the AR induction, flow

cytometric analysis of γ - H2AX was used to reveal the rate of DNA DSBs induction, repair, and

residual damages.

Results: The MTT viability and clonogenic assay showed that AR has occurred in normal lung fibroblast

cells but not in cancer lung cells; the γ - H2AX level at 0.5h, 3h, and 24h after exposure showed

that the primary low dose affects the induction of DSBs repair in normal cells but not in cancer

cells. Our results demonstrated that the AR mechanism in normal cells influenced the potential

of DNA DSBs repair.

Conclusions: Finally, we outlined the potential role of the DNA repair mechanism in AR induction. Therefore, it may reduce radiation's side effects in clinical radiotherapy applications. Our findings suggest that LD stimulates DNA DSBs repair; thus, this pathway likely contributes to the distinctive AR in normal cells and cancer cells.

Keywords: Ionizing Radiation; Adaptive Response; DNA Double - Strand Breaks; DNA Repair; γ - H2AX

■ The Effect of Cobalt Chloride (CoCl2) - Induced Hypoxia on Radioresistance and Hypoxia - Related Genes Pattern in Human Glioblastoma Cell Line

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Introduction: Glioblastoma (GBM) is the most malignant and invasive type of astrocytoma, which accounts for 15% of all central nervous system (CNS) tumors and about 56.1% of all gliomas with a poor prognosis. Estimates of relative survival for glioblastoma are so low that 5.5% of patients survived five years after diagnosis. Multiple hypoxic regions are present in this tumor that are associated with GBM aggressiveness and treatment resistance. So, we herein aimed to evaluate the effects of CoCl2 (as a hypoxia simulator (on radioresistance and change of downstream genes related to hypoxia in the U87 cell line.

Methods: Following the treatments with different concentrations of CoCl2 for 24 hours, 3 - (4,5 - Dimethylthiazol - 2 - yl) - 2,5 - diphenyltetrazolium bromide (MTT) assay was used to investigate the cytotoxicity of CoCl2 on U87 cells. To evaluate the effect of radiation on the hypoxia - mimicking model, the U87 cells were treated with 100μM CoCl2 for 24 h and then exposed to 6 MV radiation. Then, a colony formation assay was performed to determine the radiosensitivity of treated and non - treated cells. Additionally, Reactive oxygen species (ROS) production level was measured by 2',7'–dichlorofluorescein diacetate (DCFDA) probe staining. Also, Real - time PCR was used to evaluate the expression of hypoxia - associated genes, including HIF - 1α, HIF - 2α, and their target genes (GLUT - 1).

Results: The results of the MTT assay showed that the viability of CoCl2 - treated cells was decreased in a concentration - dependent manner and CoCl2 did not cause any toxicity even up to 100 μM after treatment for 24 hours. Colony formation assay showed that at all doses of ionizing radiation, pretreatment with CoCl2 induced radioresistance of tumor cells. Also, in the irradiated group, pretreatment with CoCl2 significantly decreased ROS levels. The qRT - PCR results showed a significant up - regulation in HIF - 1α and GLUT - 1 gene expression under hypoxia simulation and/or radiation exposure. HIF - 2α mRNA upregulated significantly only under hypoxia with radiation exposure.

Conclusions: Our results showed that CoCl2 as a chemical inducer of hypoxia can increase intracellular ROS production. Although radiation induces ROS level, CoCl2 attenuates this effect and induces radioresistance of U87 cancer cells and it protects cells against radiation damage by reducing ROS level. Also, it effectively upregulates some hypoxia - related genes like HIF - 1α and GLUT - 1 genes but has no effect on HIF - 2α gene expression.

Keywords: Hypoxia; Glioblastoma; Radioresistance; CoCl2

■Enhancement of 161Tb Radionuclide Production by Irradiation of Nano Gd Target

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Introduction: 161Tb (T1/2 = 7days, E_ (β^ -) = 154keV), as an alternative to 177Lu due to similar decay properties, is a promising radionuclide for targeted radionuclide therapy of cancer, such as breast and prostate cancer. The radiopharmaceuticals labeled with terbium - 161 bind to the tumor receptors and then emit a considerable number of low energy conversion and Auger electrons destroy the site of the tumor.

Methods: Irradiation of two forms of natural and enriched Gd and GdNPs in Tehran Research Reactor was evaluated for production of 161Tb through 160Gd (n,γ) 161Gd →161Tb nuclear reaction. FT - IR, TEM, and EDX analyses were used to characterize the gadolinium nanoparticles. Activity values of 161Tb and other impurities obtained by irradiating bulk and nano - scale Gd targets have been compared theoretically and experimentally.

Results: The obtained results showed the activity values obtained from irradiation of nanoparticles of Gadolinium (size of ≤4nm) are about 3 times more than bulk ones.

Conclusions: This work has highlighted 161Tb production through irradiation of bulk and Nano - scale Gadolinium targets theoretically and experimentally. It has been observed using Nano targets of natural and enriched Gd, the obtained activity has increased in comparison to bulk targets. Noteworthy, the incorporation of irradiation of Nano targets may economically be efficient in nuclear medicine.

Keywords: Terbium - 161; Nano Particles; Irradiation; Radionuclide Production

■Cytotoxic and Cytostatic Study of the Effects of Antioxidants on Lymphocytes of Luminal A and Luminal B Breast Cancer Patients Irradiated in Vitro

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Introduction: Breast cancer (BC) is one of the most common malignant tumors in women and Luminal A and B are defined as its molecular subtypes. Due to high radiation - sensitivity of BC patients, use of radioprotectors including antioxidant nutrients to ameliorate the deleterious effects of radiation could be a priority. The cytokinesis block micronucleus cytome assay in peripheral blood lymphocytes with capability of examining the nuclear division index (NDI), apoptosis and necrosis could measure cytostasis, and cytotoxicity of ionizing radiation. The current work aimed to evaluate the reducing effects of saffron and melatonin on ionizing radiation - induced damages in lymphocytes of luminal A and B BC patients using cytome assay.

Methods: Whole blood samples were collected from 15 Luminal - A and 15 Luminal - B, BC patients, and also 10 healthy individuals. Irradiation was applied in G0 lymphocytes 1 hour before cell culture using the Varian

2100C linear accelerator of 6 MV photon beam, at dose of 3 Gy. Melatonin and/or saffron treatment of irradiated cells were exerted simultaneously with cell culture. The cell harvesting and cytome assay was applied and 1000 cells were scored per sample for frequency of apoptosis, NDI and necrosis. Data were statistically analyzed using ANOVA and p value < 0.05 was considered as significant difference.

Results: The frequency of background NDI was not significantly differed for both types of BC before and after various treatments. However, the frequency of apoptosis was increased after irradiation of lymphocytes and antioxidants reduced the effects of radiation in both groups. However, conjointly administration of saffron and melatonin was compatible with the melatonin results. Noteworthy to mention that the melatonin utilization reduces the apoptosis value significantly compared to the irradiation alone or with the antioxidant treatment.

Conclusions: Current study provides evidence for capability of cytome assay to demonstrate the impacts of two natural antioxidant compounds in reducing cytotoxic and cytostatic effects of radiation in lymphocytes of BC patients. Furthermore, obtained results elucidated more pronounced role of melatonin in decreasing necrosis and apoptosis frequencies post irradiation.

Keywords: Breast Cancer; Lymphocytes; Antioxidants; Ionizing Radiation; Cytotoxicity

■ The Effect of Spiritual Care on Posttraumatic Growth in Mothers of Children with Cancer: A Mixed Method Study

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Introduction: Parents of children with cancer suffer a lot of stress and tension. It is important for parents to use spiritual strategies to cope with these situations. One of the most common methods is spiritual care. Spirituality plays an important role in parental adaptation and has many benefits. Objective: This study was conducted to design and evaluate the effectiveness of spiritual care program on post - traumatic growth of mothers of children with cancer.

Materials: The present study was performed using a mixed method in three stages. In the first stage, in a qualitative study of contractual content analysis, the spiritual needs of mothers of children with cancer were determined. At this stage, 15 semi - structured individual interviews were conducted with 12 mothers and 3 nurses. In the second stage, a spiritual care program was de-

signed. The third stage of the study was an interventional study with a four - group design by Solmon method. The target population was 127 mothers of children with cancer admitted to hospitals in Bushehr province. Participants were selected by convenience method and based on inclusion criteria, and then randomly assigned to four experimental groups 1 and 2 and control 1 and 2. The spiritual care program was implemented for one month through the WhatsApp social network for the experimental groups. post - traumatic growth of mothers before, immediately and three months after the implementation of spiritual care program were measured using Tedeschi and Calhoun questionnaire.

Results: From the analysis of initial qualitative data, 22 sub - sub - themes, 7 sub - themes and 3 main themes were obtained. The main theme was communication with God (including sub - themes of direct and indirect communication with God), existential well - being (including sub - themes of hope and multifaceted connection) and growth and excellence (including sub - themes of meaning, submission and contentment and transcendence). The results show that the mean score of post - traumatic growth from pre - test to post - test in experimental group 1 increased and decreased in control group 1, and this difference between the two groups was statistically significant ($p < 0.001$).

Conclusions: Findings of this study showed the effect of spiritual care program on post - traumatic growth of mothers of children with cancer in the form of an educational intervention.

Keywords: Spiritual Care, Post - traumatic Growth, Cancer, Mixed Study

■ The Role of TiO2 Nanoparticles in the Individual Dosimetry of Yttrium - 90 Transarterial Radioembolization Using Cherenkov Luminescence Imaging

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Introduction: Individual dosimetry makes Yttrium - 90(90Y) Transarterial Radioembolization (TARE) safer and more effective. Cherenkov Luminescence Imaging (CLI) has been employed as a novel approach for 90Y imaging. While this technique is straightforward and effectively tackles specific limitations in current nuclear medicine systems, its broad application is hindered by its constrained penetration range and low light yield. The predominant wavelength of Cherenkov radiation falls within the ultraviolet spectrum. As a result, it is strongly absorbed by the medium. The intensity of generated Cherenkov radiation is directly dependent on the refractive

index of the medium. Introducing nanoparticles (NPs) with a high refractive index into the medium makes it possible to increase the penetration depth and the number of Cherenkov radiation. Objective: This study aimed to overcome limitations in CLI by utilizing TiO2 NPs during the 90Y TARE.

Materials: The simulation of CLI was performed using the Monte Carlo codes GATE (version 9) and GEANT4 (version 10.6). TiO2 NPs (with a diameter of 100 nm) were modeled to be randomly distributed within 90Y - loaded glass microspheres at concentrations of 0, 1.2 mol/L, 2.4 mol/L, and 4.8 mol/L. The Cerenkov radiation spectra emitted from the glass microsphere were computed using GEANT4. The obtained spectra were uniformly distributed within the liver tumor of the MOBY mouse phantom. Subsequently, Cherenkov luminescence images of the tumor were captured using GATE. The dosimetry accuracy was assessed by determining the Root Mean Square Errors (RMSEs) in Cherenkov luminescence image - based Dose Volume Histograms (DVHs) and the reference DVHs.

Results: The in - silico results showed that RMSE values decreased significantly as the TiO2 NP concentration increased in the glass microspheres. The maximum RMSE reduction was observed at the TiO2 NP concentration of 4.8 M (17%).

Conclusions: Our investigation has provided evidence that integrating TiO2 NPs into the glass microspheres enhances the precision of individual dosimetry in Y - 90 - TARE.

Keywords: Transarterial Radioembolization; Dosimetry; Nanoparticle; CLI

■ Comparative Between Two Nanoparticles, Biosynthesizing Selenium Nanoparticles by Gum Arabic and Poly Anionic Cellulose against Radiation on Chinese Hamster Ovary (CHO) Cell

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Introduction: In premenopausal ladies, abdomino-pelvic radiotherapy may have a coordinated and significant impact on ovarian work. Indeed, radiation of moo measurements to the ovaries may lead to exhaustion of the primordial follicle save, untimely amenorrhea, and misfortune of richness amid or without further ado after completion of light. Avoidance of radiation - initiated castration can be accomplished by lessening ovarian radiosensitivity. Radioprotectors are compounds that can decrease the unfavorable impacts of ionizing radiation (IR). Stabilized selenium nanoparticles (NPs) and a few common materials have been illustrated to have a tall antioxidant movement. In this manner, this think about was done to compare the capacity for biosynthesis of selenium NPs by Gum Arabic (Se - GA) and polyanionic cellulose (Se - PAC) in the security of Chinese hamster ovary (CHO) cells against radiation harms.

Materials: For this reason, to begin with, selenium nanoparticles (SeNPs) were synthesized within the nearness of GA and PAC. At that point, CHO cells were refined in vitro and were haphazardly divided into 6 bunches in several concentrations of Se - GA and Se - PAC to the degree of biocompatibility of NPs. At long last, cells were treated with NPs and radiation (6MV, 2Gy), and the rate of cell survival was decided by MTT measure. Characterization comes about appearing rod - shaped morphology for both NPs with a normal measure of 20 - 30 nm and assimilation top at approximately 300 nm utilizing ultraviolet - visible (UV–Vis) spectroscopy.

Results: Concurring with our comes about, Se - GA concentration higher than 0.865 ppm altogether expanded the radioprotective impact on CHO cells compared to the control bunch (P > 0.05).

Conclusions: which can be due to the antioxidant impact of GA and SeNPs. However, this impact did not appear a critical contrast with Se - PAC.

Keywords: Radiotherapy; Radiation Protection; Gum Arabic; Polyanionic Cellulose; Ovary

■ Enhancing Precision Oncology for Advanced Uterine Cancer through Genomic Profiling and Biomarker - Directed Treatments

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Introduction: Uterine cancer remains a significant public health concern worldwide, with an estimated 66,000 new cases and 12,500 deaths projected annually in the United States alone. While early - stage disease is

often managed effectively with surgery and/or radiation, recurrent and advanced - stage uterine cancer portends a less favorable prognosis due to limited therapeutic options and a propensity for widespread metastasis. However, evolving insights into tumor biology have revealed uterine cancer to be a heterogeneous disease comprised of distinct molecular subtypes. This molecular characterization has opened avenues for a precision, or personalized, oncology approach leveraging genomic profiling to better understand a given patient's unique cancer. Personalized medicine aims to individualize cancer treatment based on the molecular profiling of unique tumor biomarkers. Comprehensive genomic characterization plays a crucial role in identifying clinically actionable alterations to guide selection of targeted therapeutic strategies. This systematic review seeks to evaluate the emerging application of personalized medicine strategies in the management of advanced uterine cancer through comprehensive genomic profiling and selection of targeted therapeutic approaches guided by molecular characterizations of individual patient tumors.

Materials: A systematic literature review was conducted to evaluate personalized medicine approaches for advanced uterine cancer, including multi - omics analysis, radiopharmaceutical therapies directed at molecular characteristics, advanced diagnostic technologies leveraging digital pathology with omics data, next - generation sequencing techniques, and artificial intelligence applications.

Results: Genomic profiling determined molecular aberrations in the majority of patients with advanced uterine cancer. Radiotherapeutics targeting identified genomic alterations demonstrated preliminary efficacy. Integrated analysis of digital pathology and multi - omics data enhanced precision prediction of tumor aggressiveness. Next - generation sequencing underscored the significance of advanced molecular diagnostic techniques. Artificial intelligence showed promise in personalized oncology applications.

Conclusions: Personalized medicine holds potential for optimizing the management of advanced uterine cancer by focusing on genomic profiling, targeted treatment selection, and advanced diagnostics. Incorporating these approaches into clinical decision - making presents an opportunity to improve treatment strategies and patient outcomes. Personalized medicine represents an emerging paradigm shift with genomic characterization enabling individualized care based on tumor biology.

Keywords: Precision Oncology; Uterine Cancer; Targeted Therapy; Biomarkers

■Analysis and Effectiveness of Music Therapy on Stress, Anxiety, and Depression in Cancer Patients at Vasei Hospital in 1401

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Introduction: Cancer is one of the most common and increasing diseases that consumes a significant amount of efforts from healthcare systems. Despite considerable advancements in medical science, cancer still remains one of the most important diseases and second cause of death after heart disease. It is characterized by the abnormal transformation of cells and loss of cell differentiation. Currently, more than 7 million people worldwide lose their lives annually due to cancer. It is predicted that the number of new cases will reach 15 million by 2025. Stress, anxiety, and depression are major problems for cancer patients.

Materials: Therefore, this research was conducted to investigate the effectiveness of music therapy on stress, anxiety, and depression in cancer patients. The research method was semi - experimental with pre - test and post - test design, along with a control group. The study population consisted of all cancer patients who were hospitalized for treatment at Vasaei Sabzevar Hospital. Out of this population, 50 individuals (25 men and 25 women) were selected through convenience sampling and randomly assigned to the experimental and control groups. Pre - test was conducted for both groups. Then, the experimental group received music intervention during treatment (for 15 days, 35 minutes per day), and both groups underwent post - test. The measurement tools were a questionnaire and the DASS psychological stress and pressure questionnaire. The data were measured and analyzed using SAS software.

Results: The results showed that music therapy is effective in reducing stress, anxiety, and depression in cancer patients.

Conclusions: It is suggested that non - pharmacological methods such as music therapy or playing Quranic recitations should be considered in the medical staff training program and used as part of treatment in hospital departments, especially in specialized units.

Keywords: Cancer; Stress; Anxiety; Depression; Music Therapy

■A Randomized, Controlled, Parallel - Group, Trial on the Long - term Effects of Melatonin on Fatigue Associated with Breast Cancer and Its Adjuvant Treatments

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Introduction: Cancer related fatigue is a distressing condition and correlated with decrease in quality of life of patients with malignant conditions. In continuation of our previous research, we assessed long term anti - fatigue effects of melatonin in patients with the breast cancer.

Materials: In this clinical trial, 92 breast cancer patients were randomly assigned to receive either melatonin (18 mg/day) or placebo from 1 week before the adjuvant treatments until 2 years after their completion. The levels of fatigue were assessed before and after intervention using Brief Fatigue Inventory (BFI) and were compared at a significance level of $P \leq .05$.

Results: The BFI scores were similar between the 2 groups at the baseline (placebo group: 5.56 ± 1.59 and melatonin group: 5.72 ± 1.68, $P = .67$). After the intervention, not only the mean fatigue score was significantly lower in melatonin group (2.93 ± 1.04 vs 1.99 ± 1.02, $P < .001$, $P \leq .05$), but also a greater reduction in fatigue score in intervention group was evident over time ($P \leq .001$).

Conclusions: Long - term usage of melatonin even after completion of adjuvant therapies in women with breast cancer decreased the levels of fatigue associated with the malignant condition and its treatments.

Keywords: Adjuvant Treatment; Breast Cancer; Fatigue; Melatonin

■Evaluating the Psychometric Properties of the Persian Version of the Healthy Lifestyle Instrument for Breast Cancer Survivors (HLI - BCS)

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Introduction: Precise examination of breast cancer survivors' lifestyles can lead to improved planning and implementation of care and counseling interventions to increase their survival rate and improve their quality of life. Therefore, a valid and reliable instrument needs to be developed. Therefore, the present study aimed to determine the psychometric properties of the Persian version of the Healthy Lifestyle Instrument for Breast Cancer Survivors (HLI - BCS).

Materials: This methodological study was conducted on 420 Iranian breast cancer survivors between May and November 2022. Participants were selected using convenience sampling. The face, content, construct validity, convergent, and reliability of the Persian version of the HLI - BCS were assessed.

Results: After assessing face, content, and construct validity, the Persian version of the HLI - BCS with five factors and 20 items was provided. The total Cronbach's alpha and intra - class correlation coefficient (ICC) were calculated as 0.86 and 0.79, respectively, which were at acceptable levels. A healthy lifestyle in breast cancer survivors was observed to have strong and significant relationships with quality of life in general ($P < 0.001$, $r = 0.832$), physical health ($r = 0.786$), and mental health ($r = 0.809$).

Conclusions: The Persian version of the HLI - BCS has favorable properties, is consistent with the conditions of breast cancer survivors, and is valid and reliable. This version of the scale can provide adequate and precise information on the lifestyles of these patients.

Keywords: Lifestyle; Breast Cancer; Survivors; Psychometrics

■Health - Promoting Lifestyle Among the Survivors of Colorectal Cancer: An Integrative Review

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Introduction: Health - promoting lifestyle (HPL) among the survivors of colorectal cancer (CRC) is essential to reduce CRC complications, prevent its recurrence, and improve survival. Nonetheless, there is no comprehensive definition for the concept of HPL in CRC survivors. This study aimed to define the concept of HPL among CRC survivors based on the existing literature.

Materials: This integrative review was conducted in 2021 using Whittemore and Knafl's method. The national and international databases of SID, Magiran, ProQuest, Medline, ScienceDirect, Web of Science, and Scopus were searched. Quality appraisal was performed using the Mixed Methods Appraisal Tool (MMAT) and the data were analyzed using the four - step approach proposed by Whittemore and Knafl.

Results: After data evaluation, 167 documents were included in the final analysis. 1863 codes were generated and categorized into eighteen main categories and three main themes of antecedents, attributes, and consequences. Accordingly, HPL among CRC survivors was defined as "a set of behaviors in the areas of health responsibility, physical activity, nutrition, spiritual growth, psychological management, and interpersonal relations which are

affected by sociodemographic characteristics, clinical characteristics, psychological status, physical conditions, time and place limitations, and patient education, and lead to better disease prognosis, better general health status, better bio - psycho - social status, and better quality of life".

Conclusions: The definition of HPL among CRC survivors provided in the present study can be used in counseling, educational, supportive, and care programs for CRC survivors to improve their quality of life and survival.

Keywords: Health Promotion; Lifestyle; Colorectal Cancer; Survivors; Integrative Review

■Development and Psychometric Properties of Health - Promoting Lifestyle Scale in Colorectal Cancer Survivors (HPLS - CRCS): A Mixed - Method Study

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Introduction: Detecting a health - promoting lifestyle in colorectal cancer (CRC) survivors is of paramount importance to manage disease complications, prevent their recurrence, and enhance survival; however, no specialized tool has yet been provided to measure the lifestyle of these patients. Accordingly, this study aimed to develop and determine the psychometric properties of the Health - Promoting Lifestyle Scale in CRC Survivors (HPLS - CRCS).

Methods: This study was a mixed study with an exploratory sequential design in two phases. Concept analysis was performed in the first phase according to Schwartz - Barcott and Kim's (2000) hybrid model to explain the concept, identify dimensions, and generate items. In the second phase, psychometrics including validity (face, content, and construct) and reliability (internal consistency and stability) were determined. Responsiveness, interpretability, ease of use, item weighting, and scale scoring were also determined.

Results: After explaining the concept, an initial scale encompassing 211 items was developed, content and item analyses were conducted, and the items decreased to 89 items after the face validity assessment. For construct validity, confirmatory factor analysis (CFA) was conducted with a sample size of 500 survivors, and convergent validity was performed for the Persian version of the Health - Promoting Lifestyle Profile II (HPLP - II). Accordingly, 80

items were classified into six factors: activity and rest, spiritual growth, health responsibility, nutrition, interpersonal relationships, and psychological management, with RMSEA = 0.055, $\chi 2/df$ = 2.484, and $\chi 2$ = 6816.516. The reliability of the scale was confirmed, Cronbach's alpha was between 0.865 and 0.928, and the intraclass correlation coefficient (ICC), the standard error of measurement (SEM), the minimal important change (MIC), and the smallest detectable change (SDC) were 0.896, 3.36, 13.86, and 19.87, respectively.

Conclusions: The HPLS - CRCS consists of 80 items in six dimensions and is a valid and reliable scale for evaluating the health - promoting lifestyle in CRC survivors. Using this scale to evaluate the healthy lifestyle of these survivors can lead healthcare providers to detect deficiencies and plan the lifestyle of CRC survivors during the post - treatment period.

Keywords: Lifestyle, Health Promotion; Colorectal Cancer; Survivors; Scale; Psychometrics

■Evaluation of Perceived Barriers and Benefits of Breast Cancer Screening in Women Participated in the PERSIAN Guilan Cohort Study (PGCS)

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Introduction: Breast examination and mammography help in the early detection of breast cancer, leads to improving survival by reducing mortality. In this study, we aimed to investigate perceived barriers and benefits of breast cancer screening in women participated in the PERSIAN Guilan Cohort Study (PGCS) population.

Materials: This cross - sectional study was conducted on 476 women aged 35 to 70 among the PGCS population. The demographic and clinical data of participants were collected through a questionnaire. Also, the Champion Health Belief Model, including the perceived benefits of breast self - examination (6 phrases), perceived barriers to breast self - examination (9 phrases), perceived benefits of mammography (6 phrases), perceived barriers mammography (9 items), was used to collect the knowledge data. The variables of the questionnaire were assessed using the Likert scale. Data was analyzed using

SPSS version 20 by significant level <0.05.

Results: Results showed that 64.9% of the participants had not done mammography so far and only 6.5% had regular breast self or clinical - examination. Of those with prior mammography, 55.1% did it without a specified reason and only on the recommendation of others. Older people, farmers and ranchers with no insurance, illiteracy, no breast problems or discomfort, no history of breast cancer in first - degree relatives and those with no history of mammography significantly underestimated the benefits of breast self - examination and mammography, but married and pregnant women and those with no history of infertility and stillbirths perceived more benefits of mammography and breast self - examination, respectively. People over 65 years of age, farmers, ranchers, and housekeeping jobs, less education, no insurance, no problems or discomfort in the breast, and no history of mammography were significantly related with less understanding the barriers of breast self - examination and mammography.

Conclusions: Therefore, according to the barriers and benefits identified in this study, it is possible to plan for breast cancer screening. It is recommended to focus more on attracting older women to perform screening programs. It is also necessary to encourage doctors to refer women for mammography and support insurance organizations to provide screening services at a lower cost.

Keywords: Breast Cancer; Screening; Mammography; Breast Self - Examination; Cohort Study; Barrier

■Challenges and Educational Needs of Clinical Oncology and Surgical Oncology Residents in Tumor Board Meetings, a Qualitative Study

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Introduction: Tumor board meetings where different specialists and students convene to discuss to make decisions about complex cases of cancer. These meetings have a high educational aspect in terms of specific type of synergy and future clinical experience for clinical oncology and surgical oncology residents, and in order to educational standards, it is necessary to carefully assess the student educational needs. This research was conducted with the aim of assessing the student educational needs in tumor board meetings at Omid Oncology Hospital in Mashhad in the northeastern part of Iran, which is a Specialist Cancer Center.

Methods: Data were collected through educational needs assessment through semi - structured interviews in focus groups with students and then through semi - structured interviews with professors (6 face - to - face interviews) in October 2023. The interview questions were formulated based on the steps of the ADDIE model in educational design. Then the interviews were recorded and noted, and qualitative data analysis Contented Analysis with MAXQDA 20.

Results: The participants included 20 students in Clinical Oncology and oncosurgery and 6 professors (Clinical oncology, oncosurgery and radiology) who participated in the tumor board meetings of Omid Hospital in Mashhad. 2 main themes were identified: structural barriers and management barriers. And 5 sub - themes were extracted: (environmental barriers which was among structural barriers and the four management obstacles, included educational obstacles, learning obstacles, performance obstacles and psychological obstacles as the main barrier).

Conclusions: Considering Higher number and variety of multidisciplinary tumor board meetings and complex cases in Tumor board meetings, it is important to solve the structural and management challenges of the meetings as Priority areas for action in education, also, management was the most important factor to guide and supervise students also give perceived feedback, in order to remove educational, learning, executive and psychological obstacles and improve their motivation.

Keywords: Tumor Board; Educational Needs; Qualitative Study

■Preparation of MnO2@poly (DMAEMA co IA) conjugated methotrexate nano complex for MRI and radiotherapy of breast cancer application

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Introduction: A novel efcient pH - sensitive targeted magnetic resonance imaging (MRI) contrast agent and innovative radiosensitizing system were synthesized based on MnO2 NPs coated with biocompatible poly - dimethyl - amino - ethyl methacrylateCo - itaconic acid, (DMAEMA - Co - IA) and targeted with methotrexate (MTX).

ABSTRACTS

Materials: the as - established NPs were fully characterized and evaluated for MRI signal enhancement, relaxivity, in vitro cell targeting, cell toxicity, blood compatibility, and radiotherapy (RT) efcacy.

Results: the targeted NPs MnO2@Poly (DMAEMA - Co - IA) and MTX - loaded NPs inhibited MCF - 7 cell viability more efectively than free MTX after 24 and 48 h, respectively, with no noticeable toxicity. Additionally, the insignifcant hemolytic activity demonstrated their proper hemo - compatibility. T1 - weighted magnetic resonance imaging was used to distinguish the diferential uptake of the produced MnO2@Poly (DMAEMA - Co - IA) - MTX NPs in malignant cells compared to normal ones in the presence of high and low MTX receptor cells (MCF - 7 and MCF - 10A, respectively). In MRI, the produced theranostic NPs displayed pH - responsive contrast enhancement. As shown by in vitro assays, treatment of cells with MnO2@ Poly (DMAEMA - Co - IA) - MTX NPs prior to radiotherapy in hypoxic conditions signifcantly enhanced therapeutic efcacy.

Conclusions: We draw the conclusion that using MnO2@Poly (DMAEMA - Co - IA) - MTX NPs in MR imaging and combination radiotherapy may be a successful method for imaging and radiation therapy of hypoxia cells.

Keywords: Nanoparticle; Manganese Dioxide; Magnetic Resonance Imaging; Radiation Therapy

■ A Phase III Randomized Clinical Trial Study of Chemoradiation using Lovastatin/Cisplatin in Patients with Head and Neck Squamous Cell Carcinoma

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Introduction: Target therapy of apoptosis signaling has been previously shown to have a therapeutic role in the treatment of head and neck squamous cell carcinoma (HNSCC). The present study aimed to investigate the safety and maximum dose of Lovastatin (80 mg/day) in additional standard therapy with cisplatin.

Materials: The current study is a phase III randomized clinical trial, conducted to determine the effect of Lovastatin on HNSCC. To eliminate the interference effect of previous treatments and surgeries, newly - diagnosed HNSCC patients were included. A total of 45 patients from May 2017 to February 2018 were enrolled. The intervention group received Lovastatin/cisplatin chemoradiotherapy and the control group received only cisplatin. All the subjects were evaluated on a weekly basis during the treatment and three and six weeks after that for related adverse events (AEs). The response rate to the treatment was assessed eight weeks following the treatment.

Results: No significant differences were found between the two groups concerning the objective response (OR) rate (95.8% vs. 95.2%, P = 1, 95% confidence interval). In the intervention group, tumors were entirely removed in 70.8% of the subjects and partial response was seen in 25% of them. No patient was excluded due to the AEs. The gastrointestinal AE (31.1%) was the most frequent one.

Conclusions: In the present study, comparing the intervention and control groups, no significant differences were observed concerning OR, but unlike previous investigations, the related cardiac AEs were not seen. This observation confirmed the hypothesis that there is a possible association of Lovastatin use with better OR compared with standard chemoradiation (cisplatin) in the initial point of the treatment. However, further research is needed to investigate different doses of Lovastatin with longer follow - ups and new diagnoses of HNSCC patients.

Keywords: Carcinoma; Squamous Cell; Chemoradiation; Cisplatin; Lovastatin

■ Therapeutic and Prophylactic Effects of Radiation Therapy in the Management of Recurrent Granulation Tissue Induced Tracheal Stenosis: A Review on the Role of Endobronchial Brachytherapy and External Beam Radiation Therapy

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Introduction: Granulation tissue - induced tracheal stenosis (mainly secondary to intubation or lung transplantation) is one of the most common etiologies of benign airway obstructions. Recurrence rates after standard treatment options (surgical resection and/or endobronchial interventions) can inadvertently worsen the stricture through the stimulation of more granulation tissue generation (via increased fibroblast activity and roliferation). Low - dose radiotherapy could be a promising tool to prevent granulation tissue formation after surgery and/or endobronchial interventions regarding its established role in the treatment of keloids or hypertrophic scars, two benign diseases with similar a pathophysiology to tracheal stenosis. This study reviews case reports and small series that used endobronchial brachytherapy (EBBT) or external beam radiotherapy (EBRT) for the management of refractory granulation tissue - in-

duced tracheal stenosis after surgery and/or endobronchial interventions.

Materials: Case reports and series (published up to October 2022) that reported outcomes of patients with recurrent granulation tissue - induced tracheal stenosis (after surgery and/or endobronchial interventions) treated by EBBT or EBRT (in definitive or prophylactic settings) were eligible.

Results: Sixteen studies (EBBT: nine studies including 69 patients, EBRT: seven studies including 32 patients) were reviewed. The pooled success rate across all studies was 74% and 97% for EBBT and EBRT, respectively.

Conclusions: Radiation therapy appears to be effective in the management of selected patients with recurrent/refractory tracheal stenosis. Response to this treatment is usually good, but further studies with a larger number of patients and long - term followup are necessary to determine the optimal technique, dose, and timing of radiation therapy, late complications, the durability of response, and criteria for patient selection.

Keywords: Radiation Therapy; Brachytherapy; Benign Airway Obstruction; Tracheal Stenosis; Endoscopic Intervention

■Magnetic Nanoparticles in Hyperthermia

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Introduction: Among all the available therapeutic modalities for cancer treatment, hyperthermia uses moderate heat to kill tumor cells. Nanoparticle - based platforms have the potential to deposit heat locally and selectively with the simultaneous utilization of nanoparticles as heat transducers. During the past few decades, magnetic nanoparticles (MNPs) have been widely investigated in the field of biomedicine. Magnetic hyperthermia therapy (MHT) is a promising therapeutic approach in cancer treatment that utilize the magnetic nanoparticles with selectively target cancer.

Methods: Magnetic - hyperthermia technique involves utilizing magnetic nanoparticles in cancerous tissues, that can be delivered systemically or intratumorally, by direct injection or with a non - invasive, non - toxic alternating magnetic field. After delivering MNGs into the cancerous tissues, the target tissues will be heated by external source of heating for increasing temperature in the tumor. MNGs can absorb the thermal energy from heating source.

Results: Magnetic nanoparticles can be activated by an external magnetic field, which generates heat within the tumor area, causing local heat destruction of cancerous cells. In fact, MNGs play the primary role of heat source and reverse the direction of heat gradient (from inside to outside). For example, in hyperthermia, nanoparticles concentrate the energy of an external source on the tumor to cause local heat destruction, while minimizing undesirable effects on surrounding tissues.

Conclusions: Using MNGs, that have ability to selectively target cancer cells, in hyperthermia preventing damage to healthy tissues via generation heat within the tumor tissues. This technique is safe for living organisms as biological tissues are "transparent" to the magnetic fields, with no significant energy deposition. The tunable physical and chemical properties of MNGs enhance their heating efficiency, making them a promising technique for treating cancer compared to other heating methods.

Keywords: Hyperthermia; Magnetic Nanoparticles; Cancer Treatment

■Prostate Cancer Diagnosis with Transrectal Ultrasound - Guided Biopsy: Results: of Screening in Patients Supported by Relief Foundation in Guilan Province

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Introduction: Considering the high prevalence of prostate cancer and its related death in Iran, screening methods for early diagnosis, for prompt follow - up and treatment are very important. This study aimed to investigating prostate malignancy with transrectal ultrasound - guided prostate biopsy in people with high PSA through a screening study in patients supported by relief foundation in Guilan.

Materials: The present study was a cross - sectional study that was conducted on 300 patients supported by Relief foundation, referred to the urology clinics of Razi Hospital, Rasht, Guilan. After the initial examination, the patients underwent a rectal examination (DRE) and PSA measurement. The presence of high PSA in reassessing after the treatment of urinary symptoms, leaded to prostate biopsy (14 samples) under the guidance of ultra-

sound and pathology examination. Data was analyzed using SPSS version 20 by significant level <0.05.

Results: In the initial study, 45 of 300 patients had PSA ≥ 3. After treatment of symptomatic individuals and re - measurement of PSA, 25 patients with PSA ≥ 3 underwent ultrasound guided prostate biopsy. Pathology results showed that 9 patients had prostate cancer, 14 patients had benign prostate hyperplasia, and 2 patients had normal biopsy results. Among those with PSA ≥ 3, 37 (82%) patients were over 60 years old. There was a statistically significant relationship between old age and high PSA. Also, there was no significant relationship between having a family history of prostate cancer (both first and second degree), smoking, opium consumption, and body mass index (BMI) and increased risk of prostate cancer in our study.

Conclusions: The results of this study emphasized on age is a major risk factor for prostate cancer. Given the note that increased PSA and prostate cancer may not have any symptoms, the above results suggest the need for screening, especially with increasing age.

Keywords: Prostate Cancer; Prostate Biopsy; Screening; Transrectal Ultrasound - Guided Biopsy

■ Dosimetric Effect of Isocenter Displacement Simulation on 3D and IMRT Plans in Brain Tumor Patients

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Introduction: Knowing uncertainty in the control of the position of the patient during radiotherapy can impact accurate delivery of dose to either tumor or the surrounding organs at risk, nevertheless it seems to be inevitable. Hence, our study aimed to quantify the variation in delivered dose owing to setup errors.

Methods: An isocenter displacement of 3.0 mm was implemented for treatment plans of 20 cases, randomly, with brain tumor. This direction shift was carried out for their 3D - CRT and IMRT plans. Dose delivered to 8 organs at risk including eyes, lens, optic nerves, brain stem, and chiasm were determined, then compared with ones in the original plans on maximum dose (Dmax) or 0.03 cc.

Results: DVH of the main plane was compared with each direction. Then using the statistical t - test, the average Dmax of the main plan was compared with the average Dmax in each direction and finally the P - values of each organ in all 6 directions were obtained. According to the P - values, it was found that for 3D plans, the 3.0mm isocenter displacement in four cases and for the organs of the chiasm, right and left optic nerve (2 cases) and in

the - z, - y, +x directions has an effect on the dose distribution. Also, in IMRT plans, this isocenter displacement has affected on the dose distribution of 7 organs in 4 directions (± y, +z, - x). These organs included chiasm (2 cases), left eye, right lens, left lens (2 cases) and right optic nerve. Also in 3D plans isocenter displacement in 2 (y and z) directions has an effect on the dose distribution of 95% and 98% PTV but in IMRT plans in all directions, isocenter displacement has an effect on the dose distribution of 95% and 98% PTV.

Conclusions: In this study, we reported the isocenter displacement for 20 patients with brain tumor. Based on the results, the most effective isocenter displacement has been in the longitudinal direction and in IMRT plans in comparison with 3D plans.

Keywords: Brain Tumor; Isocenter Displacement Simulation

■ Enhancing Cancer Therapy Through Nanomaterial - Based Radiosensitizers in Combined Photothermal and Radiotherapy

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Introduction: This review aims to comprehensively assess the collective findings in the realm of cancer therapy, focusing on the integration of nanomaterial - based radiosensitizers in combined photothermal and radiotherapy. The study delves into the potential of high atomic number (Z) nanomaterials, including gold, platinum, titanium, and hafnium nanoparticles, to enhance treatment outcomes through a synergistic approach.

Methods: A literature review was conducted to identify relevant studies investigating the use of high - Z nanomaterials in combined cancer therapy. Emphasis was placed on studies reporting on the efficacy of these sensitizers in overcoming radiotherapy challenges, with a particular focus on radioresistance of hypoxic tumor cells. Data extraction included in vitro and in vivo outcomes, such as cell viability, reactive oxygen species production, double - strand breaks, apoptosis, and tumor growth inhibition. Biocompatibility and potential clinical applications of high - Z nanomaterials were also assessed.

Results: Studies reveal a consistent and substantial decrease in cell viability in in vitro studies employing high - Z nanomaterials in combination therapy, surpassing the effects of standalone radiotherapy or photothermal therapy. Noteworthy increases in reactive oxygen species production, induction of double - strand breaks, and apoptosis further underscore the radiosensitizing potential of these materials. In vivo studies consistently demonstrate superior inhibitory effects on tumor growth with combi-

nation therapy, establishing its superiority over individual modalities. Additionally, the results of studies confirm the excellent biocompatibility of high - Z nanomaterials, supporting their potential for clinical translation.

Conclusions: This review provides compelling evidence for the integration of nanomaterial radiosensitizers into combined cancer photothermal therapy and radiotherapy. The precision offered by targeted hyperthermia and radiation sensitization holds significant promise for improving treatment outcomes while minimizing side effects. The synthesized data strongly advocate for the continued exploration of high - Z nanomaterials in clinical settings, emphasizing their potential to revolutionize cancer treatment strategies.

Keywords: Nanomaterial Radiosensitizers; Photothermal Therapy; Radiotherapy; Cancer Treatment; Synergistic Combination; Tumor Targeting; Hyperthermia; Radiation Sensitization

■The Impact of Acupressure on P6 and K - K9 Points on Nausea and Vomiting in Chemotherapy Patients: A Review Study

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Introduction: Chemotherapy is a primary treatment for cancer. Considering the adverse effects of chemotherapy on individuals' quality of life and treatment protocol adherence, the exploration of non - pharmacological methods to mitigate these side effects is imperative. Among these methods, acupressure stands out as a safe, economic, and easily applicable approach. This study aims to review the impact of acupressure on the P6 and K - K9 points on nausea and vomiting in chemotherapy patients.

Methods: This narrative review systematically searched international databases, including Pubmed, Scopus, Proquest, ISI, Web of Science, and CINAHL, as well as Persian - language databases MagIran, IranDoc, ISC, and SID, using keywords such as "nausea," "vomiting," "chemotherapy," "acupressure," "P6," and "K - K9 without time limitations (up to December 2023). After excluding irrelevant studies, a total of 26 studies were initially identified, with eleven studies finally selected for review.

Results: Among the reviewed studies, seven indicated a significantly positive impact of acupressure on the P6 point on the severity of nausea and vomiting in chemotherapy patients. However, three studies suggested that this point does not have a significant effect on the severity of nausea. Furthermore, six studies acknowledged a reduction in the frequency of nausea and vomiting in

these patients. Regarding the impact of the K - K9 point on nausea and vomiting in chemotherapy patients, only one comparative study was found, revealing the superiority of the P6 point over the K - K9 point in alleviating chemotherapy - induced nausea and vomiting.

Conclusions: There are contradictory results regarding the impact of the P6 point on nausea and vomiting in chemotherapy patients. In most conducted studies, this point demonstrated significantly positive results on the "severity" of nausea and vomiting. However, studies on the K - K9 point are limited. Larger population studies are recommended for both points to obtain more precise results.

Keywords: Nausea, vomiting, Chemotherapy, Acupressure

■Comparison of Received Dose from Three Iodine Radionuclides (I123, I125 and I131) in Thyroid Cell Model Using Gate Monte Carlo simulation

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Introduction: Radioactive iodine finds widespread application in both diagnostic and therapeutic contexts. I - 123 and I - 125 serve diagnostic purposes, whereas I - 125 and I - 131 are employed for treating conditions such as hyperthyroidism and thyroid tumors, either through targeted radionuclide therapy or brachytherapy. The deterministic impact of the dose received by cells, especially within the cell nucleus, plays a crucial role in predicting radiation complications. This study aims to compare the received dose in cellular human thyroid models resulting from exposure to I - 123, I - 125, and I - 131 radionuclides.

Methods: The Gate Monte Carlo software (version 9.3) was used for simulation and dosimetric calculations. The energies of electrons resulting from decay were chosen based on the corresponding decay spectrum of each radionuclide, as provided by MIRD (medical internal radiation dose). The cells were simulated considering cubic geometries with the dimensions of 6, 10, and 17.5 micrometers, and the nucleus was modeled as a spherical shape with diameters of 5, 7, and 9 micrometers. The s - value (dose per decay) values were calculated for different source - target configurations, including nucleus (as source) - nucleus (as target volume), cell membrane - nucleus, and cytoplasm - nucleus. In all cases, the S - values in the extracellular medium, were also calculated.

Results: Across all scenarios, the highest S - value was

related to the nuclear self - absorption (nucleus - nucleus configuration). I131 had the highest S - value in the nucleus - nucleus situation and the lowest value was for I123. In the case of cytoplasm - nucleus and cellmembrane - nucleus, the highest S value was related to I131. In all cases, the contribution of internal radiation electrons in S - value was higher than Auger and beta electrons. S - value decreased with the increase of cell size and nucleus. This difference was greater in the cytoplasm - nucleus and cell - nucleus membrane than in the nucleus - nucleus situation. It is worth mentioning that I123 delivered a lower dose to the extracellular environment compared to other radionuclides.

Conclusions: Distinct radiations of radioactive iodine demonstrated significant differences in their contributions to S - values. The dimensions of the cell exerted a more substantial effect than the source - nucleus location on the delivered dose to the cell nucleus. I123, notably, resulted in a lower dose to the cell nucleus and the extracellular environment, suggesting potentially reduced damage to the thyroid cell DNA.

Keywords: Cellular Dosimetry; Thyroid; Monte Carlo Simulation; Gate

■ Preparation and Quality Control of [113mIn] - In - PSMA: A Novel SPECT Agent for Prostate Cancer Imaging

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Introduction: Prostate - specific membrane antigen (PSMA) is vastly used for diagnosis and therapy of the PSMA - overexpressing tumors. DKFZ - PSMA - 617 is a new emerging peptide which shows interesting results in labeling with different radionuclides. Due to suitable physical characteristics of Indium - 113m and its availability in the form of 113Sn/113mIn generator, this radionuclide is useful for developing new single photon emission computed tomography (SPECT) agents. This study amied to develop [113mIn] - In - PSMA - 617 radiolabeled compound for SPECT imaging of patients with prostate cancers.

Materials: Indium - 113m chloride was prepared using an in - house 113Sn/113mIn generator. The chemical and radiochemical purities were investigated using inductively coupled plasma mass spectrometry (ICP - MS) and radio thin - layer chromatography (RTLC) method, respectively. The radionuclidic purity was assessed using an high purity germanium (HPGe) detector. DKFZ - PSMA - 617 was

labeled with indium - 113m at optimized conditions. The radiochemical purity of the radiolabeled compound was evaluated by an high performance liquid chromatography (HPLC). The stability of the final complex was studied in PBS buffer and human serum by RTLC method.

Results: Indium - 113m chloride with the radionuclidic purity > 99.999% was used for labeling purposes. [113mIn] - In - PSMA - 617 radiolabeled compound was prepared with radiochemical purity of greater than 99%. The optimized condition of the radiolabeling was as follows: The reaction pH = 3, reaction time = 15 min, and reaction temperature = 95°C. The radiolabeled compound was stable in PBS buffer (4°C) and human serum (37°C) at least for 3 h post incubation.

Conclusions: This study showed that [113mIn] - In - PSMA - 617 radiolabeled compound can be prepared as a new SPECT imaging agent using an in - house generator.

Keywords: 113mIn, PSMA, Prostate Cancer

■ Deep - Learned Classification of Bone Lesions in Proximal Femur/Pelvis X-ray Radiographs

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Introduction: It is difficult to distinguish between malignant and benign bone lesions mainly due to similar imaging appearance, particularly in the early stages. It is well - known that bone cancer (or sarcoma) most commonly affects the pelvis and/or the long bones such as the tibia, femur, and upper arm. This study aims to classify bone tissue into 3 - class (normal, benign, and malignant) based on X-ray radiographs of the proximal femur/pelvis.

Materials: A total of 507 proximal femur/pelvis X-ray radiographs of both men and women were acquired and collected. The dataset includes 167, 148, and 192 malignant, benign, and healthy bone scans, respectively. The dataset was pre - processed to reduce the imaging noise, resampling, and also thresholding. A multiclass deep convolutional neural network (CNN) model was exploited and trained to classify the bone radiographs. The performance of the CNN architecture was also compared with that of the two expert radiologists.

Results: The confusion matrix shows an encouraging performance of the proposed deep neural network. Compared with two expert radiologists, the CNN architecture results in superior performance in terms of average sensitivity (0.822 vs 0.751) and specificity (0.912 vs 0.889). The area under the receiver operating characteristic curve (ROC AUC) is 0.853 indicating promising diagnostic accuracy of the proposed network.

Conclusions: The findings confirm that the proposed

deep CNN model accurately classifies the bone tissue in proximal femur/pelvis X-ray radiographs and therefore can be the method of choice for early and accurate diagnosis of bone cancer.

Keywords: Bone Cancer; X-ray Imaging; Classification; Deep Neural Network; Proximal Femur/Pelvis

■Advancing Cancer Therapy: The Role of Diet - Derived Compounds in Radiotherapy

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Introduction: The quest for more effective cancer therapies continually drives research in radiobiology. This abstract amalgamates insights from two innovative studies, each exploring how certain dietary compounds can augment radiotherapy's effectiveness against breast cancer and glioblastoma.

Materials: In the first study, MCF - 7 cell lines were the subjects of an investigation into the effects of EGCG and ATO, both independently and combined with 2 Gy gamma radiation, focusing on apoptotic pathways and gene expressions. The second study took a different approach, utilizing U87MG glioblastoma cells to explore the interplay between Genistein and varying doses of gamma radiation, with particular attention to survival rates assessed through colony formation and MTT assays.

Results: The research unveiled that EGCG and ATO, when used alongside gamma radiation, substantially boost apoptosis in breast cancer cells, a phenomenon underscored by increased expression of genes associated with cell death. The glioblastoma study painted a similar picture, where Genistein, coupled with low - dose radiation, significantly enhanced the cells' vulnerability to the treatment.

Conclusions: These studies reveal the promise of dietary and natural components to optimize cancer treatment. Capitalizing on this knowledge pioneers personalized medicine, innovations in precision radiotherapy, modulation of radiobiological effects through nutrition/genomics, and elucidating factors impacting radiotherapy efficacy to inform personalized care regimens. This advances radio - genomics and precision oncology.

Keywords: Cancer Therapy Innovation; Dietary Elements; EGCG; ATO; Genistein; Radiotherapy; Glioblastoma; Breast Cancer; Apoptotic Pathways

■Effect of Remote Training and Support on Sleep Quality and Insomnia Severity of Cancer Patients Undergoing Chemotherapy

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Introduction: Sleep disturbances are very common among cancer patients, and they need more support in this regard. More access to technology has provided opportunities to use virtual teaching methods to train and support cancer patients. This study aimed to investigate the effect of supportive - educational intervention (SEI) through virtual social networks (VSNs) on the sleep quality and the severity of insomnia of cancer patients.

Materials: The study was conducted on 66 patients with cancer, intervention (n = 33) and control (n = 33) groups (CONSORT). Intervention group received supportive - educational intervention on sleep for two months through virtual social networks (VSNs). All participants completed the Pittsburgh Sleep Quality Index and insomnia severity index (ISI) before, and after the intervention.

Results: The mean scores of sleep quality (P = .001) and insomnia severity (P = .001) in the intervention group had a statistical significant decrease. Moreover, quality, latency, duration, efficiency, disturbances of sleep, and daytime dysfunction showed significant improvement in the intervention group, every two times after the intervention (P < .05). However, the participants' sleep quality deteriorated progressively in the control group (P = .001).

Conclusions: Supportive - Educational Intervention (SEI) through VSNs can be an effective method to improve the sleep quality and decrease insomnia severity of patients with cancer.

Keywords: Sleep Quality; Cancer; Virtual Training; Supportive Care

■Investigating the Effects of Radiation Dose on Brain Tumor Treatment Efficacy using Monte Carlo Modeling

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Introduction: Brain tumors pose a significant challenge in the field of oncology, and radiation therapy plays a crucial role in their treatment. Accurate modeling of radiation dose distribution is essential for optimizing treatment plans and improving patient outcomes. In this

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study, we utilized the Monte Carlo N - Particle (MCNP) code to investigate the effect of radiation dose on the treatment of brain tumors.

Methods: We developed a comprehensive MCNP model to simulate the interaction of radiation with brain tissue. The model incorporated anatomical details, such as tissue heterogeneity and tumor characteristics, to accurately represent the complex tumor microenvironment. We employed various radiation sources, including photon and electron beams, to deliver therapeutic doses to the tumor region. The treatment plans were optimized based on prescribed dose, tumor size, and critical organ constraints.

Results: The MCNP simulations provided detailed information on the radiation dose distribution within the brain tumor and surrounding healthy tissues. We analyzed the impact of different radiation doses on tumor control probability (TCP) and normal tissue complication probability (NTCP). Our results demonstrated a dose - dependent relationship between radiation dose and tumor control, with higher doses resulting in increased TCP. However, escalating the radiation dose beyond a certain threshold led to a higher risk of normal tissue complications.

Conclusions: The findings of this study highlight the importance of accurate radiation dose planning in brain tumor treatment. The utilization of MCNP code allowed for precise modeling of radiation interactions and provided insights into the dose - response relationship. Optimizing treatment plans to maximize tumor control while minimizing normal tissue toxicity is crucial for improving patient outcomes. Further investigations should focus on refining treatment protocols and exploring advanced radiation delivery techniques to enhance therapeutic efficacy.

Keywords: Brain Tumors; Radiation Therapy; Monte Carlo N - Particle (MCNP); Radiation Dose; Treatment Planning; Tumor Control Probability; Normal Tissue Complication Probability; Radiation Modeling

■ A Survey on Quality - of - life Indicators During the Last Months of Terminally ill Cancer Patients in Iran; A Cross - Sectional Study in a Home - Based Palliative Care Center

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Introduction: Responsiveness to the needs of patients with advanced cancer should always be in line with maintaining the quality of life of patients and families. Frequent referring to hospitals and recurrent and long - term hospitalizations are the factors reducing the quality - of - life of patients during the palliative phase. Therefore, this study aimed to determine quality - of - life indicators during the last months of terminally ill cancer patients.

Methods: This retrospective cross - sectional study was performed on 371 patients with advanced end - stage cancer referring to the MACSA Home Care Center from March 21, 2018 to September 22, 2018 for receiving palliative care and support. The information was gathered from the patients' files by a checklist. Two indicators were considered to evaluate the patients' quality of last months of life. All data were analyzed using Minitab software version 19 using descriptive and inferential statistics.

Results: In the place of death, most patients (70.8%) who did not receive chemotherapy during hospitalization died at home, and the majority (62.5%) of the patients who received at least one round of chemotherapy during hospitalization died in the hospital. The quality index of end - of - life months based on the mean hospitalization length during the last months of life was 9.3% for the patients who had received at - home care at least once and 33.8% for those who died in the hospital. The end - life quality index was 12.4% for the patients who had received at - home care at least once and were hospitalized more than once during the last months of life and 41.8% for those who died in the hospital. The life quality index of the mean number of inpatient nights was higher in those who died in the hospital (10.1) compared to that of the total sample population (2.8). Also, the life quality index of the episodes of hospitalization during the last months of life was higher in people who died in the hospital (41.8%) compared to that of the total sample population (12.4%).

Conclusions: It seems necessary to provide at - home palliative care infrastructure in order to improve the quality - of - life indicators of patients with advanced cancer during the last months of their lives.

Keywords: Palliative Care; Quality - of - life Indicators; Advanced Cancer; Terminally Ill; Home Health Care

■ Description of Disease Progression in Pathologic Complete Response Patients Following Rectal Cancer Surgery: A Long - Term Study

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ABSTRACTS

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Introduction: About 15% - 27% of rectal cancer patients exhibit a pathologic complete response (pCR) which is associated with improved oncologic outcomes. Limited long - term data exists about the postoperative complications, disease - free survival, and mortality rates after rectal surgery in pathologic complete response patients. We aimed to describe our experiences on recurrence, survival, and surgical complication rates in pCR and near pCR rectal cancer patients in east Iran.

Methods: This is a multicenter retrospective study of rectal cancer patients who achieved pCR or near pCR after neoadjuvant chemo - radiation therapy and surgical resection (July 2011 - September 2022). pCR was defined as no evidence of tumor or lymph nodes (ypT0N0) by final pathology. Single cells/rare small groups of cancer cells in the resected specimen were considered as near pCR.

Results: Of 696 rectal cancer patients who underwent curative surgery after neoadjuvant chemoradiation, 149 (21.4%) achieved a pCR/near pCR. During the follow - up period with a median (IQR) duration time of 64(70.5) months, 4 (2.7%) patients with local recurrence, 18 (12.1%) patients with distant metastases, and 2 (1.3%) cases with both kinds of recurrence were identified. The three - year recurrence - free survival (RFS) and overall survival (OS) rates were 91% and 92%, respectively. Moreover, the five - year RFS and OS were 83% and 87%, respectively. However, no differences were observed in recurrence frequency between near pCR and pCR group patients (P = 0.141). In addition, death status was not associated with near or complete status of pathologic response (P = 1.000). The percentage of these patients who live without stoma was over 50%.

Conclusions: Our study indicated that patients achieving pCR / near pCR have a favorable prognosis, with distant metastases predominating (83.3% of all recurrences). Although near pCR/pCR are associated with long - term survival, local recurrence and distant metastasis (even late recurrence) remain possible. Hence, regular follow - up is warranted in these patients.

Keywords: Rectal Cancer; Recurrence; Survival; Pathologic Complete Response

■Prediction of Attention Decline Toxicity after Radiotherapy for Brain Metastasis Patients in Velayat Zahedan Radiotherapy Center

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Introduction: Attention decline toxicity is a common effect following radiation therapy (RT) for Brain Metastases. Purpose of the present work is to Statistical analysis and multivariate modelling approaches for prediction of acute radio - induced attention decline toxicity after whole - brain radiotherapy (WBRT).

Materials: The study includes 37 brain Metastases patients evaluated for acute attention decline toxicity after 3D conformal radiotherapy. Median age was 49 years (range 31 - 67). All patients received a total dose of 30 Gy to the whole brain with daily fractions of 3 Gy. The acute radio - induced attention decline complications were classified according to the RTOG/EORTC scoring system. Dose - volume histograms were extracted and clinical and non - clinical variables were recorded, Multivariate logistic regression NTCP models was used to fit the Clinical and non - clinical data. The overall performance, discriminative ability, and calibration were evaluated using the scaled Brier score, area under the receiver operator curve (AUC), and Hosmer–Lemeshow test, respectively.

Results: At follow - up of 2 months, 40.54% (15/37) of patients experienced grade 1 acute attention decline events while 16.21% (6/37) of patients developed grade 2 acute attention decline events. In regression analysis, D100 and Vtotal bilateral hippocampi were associated with acute attention decline toxicity (odd ratios = 1.02 and 1.00, respectively), and bilateral hippocampi Dmax also showed the greatest association with problems (odd ratio = 1.96). The multivariate logistic regression models achieved a better discriminative ability performance than the overall, and calibration.

Conclusions: In this study, we compared its performance with that of a data - driven multivariate model. The multivariate model confirmed a higher predictive power as showed by the AUC values, Further study with larger and external datasets is warranted to verify our NTCP models before clinical implementation.

Keywords: Acute Attention decline, Brain Metastases, Logistic regression, NTCP

■Current Insights into FLASH Radiotherapy Progress

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Introduction: In the field of oncological treatments, FLASH Radiotherapy stands as a significant breakthrough. It is characterized by its rapid dose delivery, which shows promise in diminishing the typical negative side effects

of radiation, yet still remains potent in tumor treatment. This review delves into current research to highlight the biological benefits, confront the technical complexities, and unravel the essential mechanisms that position FLASH - RT at the forefront of cancer therapy.

Materials: FLASH Radiotherapy research evaluates various irradiation methods, including electron, photon, and proton beams, and their specific delivery techniques, like magnet switching in proton therapy. The exploration extends from cellular studies to animal models and initial human patient applications, showcasing FLASH - RT's versatility. We investigate its impact on tissue oxygenation, reactive oxygen species dynamics, DNA integrity, and immune system interactions to understand its nuanced effects on living tissues. This is augmented by examining theoretical models, particularly focusing on peroxyl radical recombination, to decode the FLASH effect's mechanisms. The review also contrasts FLASH - RT with conventional radiotherapy, noting differences in how normal and tumor tissues respond, and the role of redox biology.

Results: Studies demonstrated FLASH - RT's capacity to spare normal tissues from late radiation - induced toxicity, an effect partly attributed to peroxyl radical recombination and the kinetics of reactive oxygen species. Clinical applications in various models, including canine cancer patients, showed promising outcomes. Technical challenges, particularly in proton therapy, were addressed, highlighting the necessity for specific dose rate requirements and delivery systems. A comprehensive model of reaction kinetics supported peroxyl radical recombination as a primary determinant of the FLASH effect, challenging the transient oxygen depletion hypothesis.

Conclusions: FLASH - RT emerges as a paradigm - changing technology in radiation therapy, offering significant normal tissue sparing without compromising tumor control. Future developments and clinical translations of FLASH - RT are anticipated to revolutionize therapeutic approaches in oncology, necessitating further research into optimized delivery systems and a deeper understanding of its underlying mechanisms.

Keywords: FLASH Radiotherapy; Cancer Treatment, Radiation Therapy; Tumor Control; Radical Recombination

■ Comparison of Dosimetry of the Left and Right Parotid for the Treatment of Nasopharyngeal Cancer Using Two Methods: of Helical Tomotherapy and Three - Dimensional Conformal Radiation Therapy

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Introduction: Nasopharyngeal cancer is one of the most common head and neck cancers, and the main treatment for this type of cancer is radiotherapy. After radiotherapy, diseases such as periodontal occur due to decreased saliva secretion and damage to the salivary glands (sublingual, parotid, and submandibular), which causes tooth decay and loss. The purpose of this study is to investigate and compare the dose of organs at risk in two adaptive three - dimensional (3D - CRT) methods and helical tomotherapy (HT) in patients with head and neck cancer.

Methods: The present study is a retrospective study of a cross - sectional experimental type, and to conduct this study, CT scan images (CT scan or computed tomography) of 16 patients were collected. The at - risk patients and their target volume were contoured by the doctor, and the treatment plan Patients were designed for HT and 3D - CRT methods. In the end, by using histogram - dose (DVH, or Volume - Dose histogram), dosimetric variables of organs at risk and target volume were extracted and compared with each other.

Results: Compared to 3D - CRT, the HT method improved the homogeneity index and the concordance index (P = 0.002, P = 0.009, respectively). Also, in the HT method, the maximum dose reached to the right and left parotid glands is 27.2 ± 2.6 and 26.24 ± 5.3, respectively; in the 3D - CRT method, the dose reached is 47.08 ± 0.18 and 0.8, respectively. It is 30.72 ± 2 Gy (P = 0.006, P = 0, respectively) that the HT method has significantly reduced the dose of these organs compared to 3D - CRT.

Conclusions: The HT method is preferable to the 3D - CRT method for the treatment of nasopharyngeal cancer patients who are candidates for radiotherapy due to better coverage of the target volume and also better performance in preserving the parotid glands.

Keywords: Nasopharyngeal Cancer; Radiotherapy; Dosimetry; Adaptive Radiation Therapy; Tomotherapy

■ Iron Oxide Nanoparticles Coated with Polydopamine as a Potential Nano - photothermal Agent for Treatment of Melanoma Cancer

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Introduction: Melanoma is a metastatic cancer resistant to a wide range of therapies, including standard chemotherapy and radiation therapy, and cannot be treated with existing treatments owing to its intrinsic drug resis-

tance. In terms of convenience and cheap cost of fabrication, one of the novel treatments is using polydopamine - coated iron oxide nanoparticles (IONs@PDA). One of the newest and most practical coatings is polydopamine, which can be used in diagnostic imaging and treatment in the form of PTT and hyperthermia. Polydopamine - coated iron oxide nanoparticles were identified due to their simplicity of surface modification and unique biocompatibility, as well as their properties in medical application. Coating NPs (Fe, Au, Cu, Ag) using polydopamine as an effective biopolymer material has the potential to be used as a therapeutic agent for heat treatment and chemotherapy PTT. Coated MNPs such as IONs@PDA indicated lower cytotoxicity for the following reasons: their coating was biocompatible that resulted in the reduced toxicity, and due to the coating, the adsorption sites for proteins, ions, and other environmental components were decreased.

Methods: Fe_3O_4 nanoparticles were synthesized according to a previously published work [17]. In brief, 3.2 g of NaOH (POCH, Korea), 3.2 g of $FeCl_3$, and 2.78 g of $FeSO_4 \cdot 7H_2O$ (Merck) were added to 100 ml distilled water in three diferent glass containers. Then, to obtain constant solutions, $FeCl_3$ and $FeSO_4 \cdot 7H_2O$ were shaken using a magnetic rotor; however, NaOH solution was rotated and heated. All solutions were washed five times with distilled water. Then, 80 mg of synthesized Fe_3O_4 NPs was added to 80 mg of dopamine hydrochloride (Sigma, Aldrich) and 40 ml Tris base bufer (pH = 8.5) and continued shaking overnight. Finally, the NPs were washed several times with distilled water and ethanol. Biophysical properties of the synthesized SPIONs were reported in a previous study. The morphology and size distribution of the synthesized nanoparticles were obtained by transmission electron microscopy (TEM). The accuracy coating of PDA to iron oxide was measured by Fourier transform infrared (FTIR) spectroscopy. Thirty male C57/BL6 mice (age: 8 weeks, weight range: 25–30 g) were divided into six groups of 5 as follows: (1) intratumoral injection saline without laser ablation; (2) intratumoral injection saline with laser ablation; (3) intratumoral injection of SPIONs (0.5 mg Fe/kg), without laser ablation; (4) intratumoral injection of SPIONs (0.5 mg Fe/kg) with laser ablation; (5) intratumoral injection of IONs@PDA (0.5 mg Fe/kg) without laser ablation; and (6) intratumoral injection of IONs@PDA (0.5 mg Fe/kg) with laser ablation. The studied mice were treated four times in a period of 2 weeks. The duration time of laser ablation was varied due to diferent sizes of tumors. Before and after each treatment, the size of tumors was measured. Finally, to perform pathological evaluation, the mice were sacrifced. Livers, tumors, and skins of mice were removed, placed in formalin, and then swabbed. Mice survival was examined each week.

Results: Iron oxide nanoparticles (IONs) were synthesized (7.36 nm) and coated with polydopamine (15–20 nm). To examine the efect of photothermal ablation in melanoma cells (B16 - F10), a Q - switched ruby laser (λ = 694 nm, spot size = 4 mm, out - put power = 5 J/s) was used. The prepared nanoprobe was applied to mice, and their survival after treatment was evaluated. Then histopathological studies were done on the livers and skins of the treated mice. The nanoparticles absorb the laser, raising the temperature and initiating photothermal treatment, with signifcant apoptosis (74%) after the 4th time of treat - ment. Photothermal therapy (PTT) by using IONs@PDA proved to be efective in the treatment of melanoma cells (tumor size of<2 mm) without side efects. The lifespan of mice was signifcantly increased in a group of mice post - administered. IONs@PDA and laser ablation. The fabricated nanoprobe (IONs@PDA) enhanced the melanoma cell apoptosis in the mice model, and it has promise for the treatment of melanoma (B16 - F10) cells using photothermal therapy. Comparison of mean for the size of the tumor through diferent period times (time1treatment; time 2: 2nd treatment; time 3: 3rd treatment; and time 4: 4th treatment) individually for each experi - mental group (control, IONs@PDA, SPIONs, SPIONs with laser, IONs@PDA with laser, and laser). In each experimental group, the size of the tumor did not difer statistically signifcan at times when they had at least one common English letter (using the Friedman test, post hoc was conducted by the Wilcoxon signed rank test. ns, non - signifcant; $**P$ - value<0.01

Conclusions: In summary, this study successfully showed the ability of IONs@PDA as a PTT nanoagent to treat melanoma (B16 - F10) cancer cells (tumor size, 2 mm) by laser (Q - switched ruby laser (λ = 694 nm, spot size = 4 mm, output power = 5 J/s). We have shown a 74% reduction of melanoma after the 4th time of treatment with IONs@PDA without side effects. The lifespan of mice was significantly increased in a group of mice post - administered IONs@PDA aftertreatment. Therefore, the fabricated IONs@PDA has the potential as an ideal PTT nanoagent for cancer treatment.

Keywords: Melanoma Cancer; PDA, IONs@PDA, Laser, Photothermal Therapy (PTT)

■ How Can We Communication at Terminal Stage of Cancer to Patient?

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Introduction: One of the challenges faced by healthcare professionals is communicating the progression of cancer, especially during the end stages of the disease. This review study aims to gather important communication points during these stages.

Methods: For this research, information was extracted from databases such as PubMed, Google Scholar, and Science Direct from the years January 2000 to November

2023 using keywords like cancer terminal stage, communication therapy, communication in cancer.

Results: Research has shown that therapeutic communication in end‑of‑life stages requires empathy, sensitivity, transparency, and compassion. It is important to consider factors such as having necessary knowledge about the patient's history and advance notice, acknowledging potential emotional reactions of the patient, creating a calm and non‑threatening environment for conversation, using plain language and avoiding medical jargon, asking the patient about their desired level of information regarding the disease progression, providing a supportive environment for comfortable questioning by the patient and their family, helping them express their emotions and identifying them in a timely manner, introducing a supportive and palliative care team, and ensuring active participation of all members of the healthcare team in communication. These are important considerations, especially when it comes to communication in the end stages of the disease.

Conclusions: Patients and their families may have different needs and preferences when it comes to discussing the end stages of cancer. It is important for the healthcare team to adjust their approach according to the individual circumstances and provide ongoing support throughout this journey.

Keywords: Cancer Terminal Stage; Communication Therapy; Communication in Cancer

▪Personalized Cancer Care Journey, at Home

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Introduction: The concept of hospital‑at‑home is an innovative approach to providing healthcare that involves interventions at the hospital level but takes place in the patient's home, offering an alternative to traditional hospitalization. The aim of this review was to identify the concept of hospital‑at‑home in cancer patients.

Methods: A search was conducted on various databases, including PubMed, Scopus, ProQuest, Web of Science, Embase, Cochrane, and Google Scholar, using keywords. The search was not restricted by time and was conducted until September 21, 2023. The results were collected in the X8.1 EndNote reference management software, duplicates were removed, and two researchers screened them based on the research question. The full text of 20 articles was reviewed, and for summarizing and reporting the results, a qualitative content analysis method based on Graneheim and Lundman's approach was used. It is worth mentioning that the ARKSY and O'Malley protocols were used in the systematic review.

Results: The search results were categorized into three main themes: (1) monitoring the entry of eligible patients into the care journey (identification of eligible patients, screening, comprehensive initial assessment), (2) designing the care journey (personalized care plan, customized care plan, planned care route design, unplanned care route design, and rapid response, designing a nature‑connected care plan), (3) providing care during the care journey (providing in‑person care, remote care provision, in‑person clinical monitoring, remote clinical monitoring, a care team ready to provide timely care, maintaining quality in care provision).

Conclusions: This study demonstrated that home‑based care in cancer patients can provide the experience of a care journey for eligible individuals.

Keywords: Hospital At Home; Cancer Care; Personalized Care

▪Family Caregiver Experiences of Terminal Cancer Caregiving Trajectory: A Qualitative Study in Palliative Care Setting

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Introduction: Caring for a family member with cancer in the final stages of life is a life‑threatening and exhausting experience that is associated with high levels of emotional and psychological problems. In this way, reaching a comprehensive and deep understanding of care problems and difficulties can be a step towards solving the problems faced by family caregivers of these patients. Objective: The present study was conducted with the aim of investigating the challenges and problems of care that family caregivers of patients with end‑stage cancer face.

Materials: The present study was based on qualitative content analysis. In this method, an in‑depth semi‑structured interview was conducted with 13 family caregivers of terminally ill cancer patients. Participants were selected purposefully and the interviews continued until data saturation. All the interviews were recorded, transcribed and analyzed through conventional content analysis and the results were reported in the form of themes, subcategories and primary categories.

Results: Most of the participants of the present study were women who were in the age group of 35 to 75 years. The theme of the fence of care, which was extracted from the subcategories of "physical and psychological collapse", "stuck in the bottlenecks of care", "caregiver absent from attention" and "mental rumination of the death of a family member", explains the care problems and challenges of family caregivers.

Conclusions: This study provided insights into the

caregiving challenges of Iranian family caregivers caring for their patients with advanced cancer. Such an understanding can help in establishing and designing appropriate interventions for caregivers to reduce the caregiving burden and prepare them to accept the loss.

Keywords: Family Caregiver; Caring Experiences; Palliative Care; Cancer

■Preparation of 89Zr - DFO - Cetuximab for Imaging of EGFR - Expressing Tumors

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Introduction: Nowadays, radioimmunoscintigraphy (RIS) utilizing the monoclonal antibodies (MAbs) based radiopharmaaceuticals is recognized as a particular and accurate approach for the detection of cancers. Cetuximab is an EGFR - targeted chimeric human/mouse IgG1monoclonal antibody labelled with different diagnostic and therapeutic radionuclides. This study was aimed to develop 89Zr - DFO - Cetuximab for the first time in the country.

Materials: 89Zr was produced by proton bombardment of 89Y2O3 pellet target using 30 MeV cyclotron. The cetuximab mAb was purified using an Amicon filter. Conjugation of DFO with cetuximab was performed at 37°C and pH = 9.0 while the chelator/mAb ratio was considered as 10:1. Several experiments were performed to determine the best conditions for radiolabeling varying the ligand concentration, pH, temperature and time. The stability of the final radioimmunoconjugate in PBS buffer (4°C) and in human serum (37°C) was checked up to 48 h using the RTLC method. The biodistribution of the complex was studied in tumor - bearing nude mice up to 120 h.

Results: In the best conditions, 1 mg of DFO - cetuximab was added to the vial containing 185 MBq of 89Zr while the pH was adjusted between 6.8 to 7.2 and the reaction product was heated up to 37°C for 50 min. The RCP was determined to be higher than 99%. The radiolabeled complex was stable both in PBS buffer (4°C) and freshly prepared human serum (37°C) at least for 48 h. considerable uptake was observed in tumor compared to the other non - target organs which increases up to 72 h after injection.

Conclusions: 89Zr - DFO - Cetuximab can be produced with high radiochemical purity and can be considered as an appropriate PET imaging agent of EGFR - expressing tumours at 72 to 120 h after injection.

Keywords: 89Zr; Cetuximab; EGFR - Expressing Tumors

■Development of 89Zr - DFO -

Bevacizumab for PET Imaging of VEGF+ Tumors

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Introduction: The vascular endothelial growth factor - A (VEGF - A) is a potent angiogenic factor which is overexpressed in different types of cancers including colorectal carcinomas, breast tumors, pancreatic cancer and lung cancer. Bevacizumab (Avastin) is an anti - VEGF monoclonal antibody that binds to all VEGF isoforms. 89Zr - Bevacizumab has recently indicated significant potential for detection of VEGF - expressing primary breast cancers. This study was aimed to develop 89Zr - DFO - bevacizumab for the first time in the country.

Methods: 89Zr was produced by proton bombardment of 89Y2O3 pellet target using 30 MeV cyclotron. The radionuclidic purity was investigated using an HPGe detector. The chemical and radiochemical purity of 89Zr was studied by the inductively coupled plasma mass spectrometry (ICP - MS) and radio thin - layer chromatography (RTLC) method. Conjugation of DFO with bevacizumab was carried out at the chelator/mAb ratio of 10: 1. While several experiments were performed to determine the best conditions for radiolabeling, the radiochemical purity was checked using RTLC method. Finally, the stability of the final radioimmunoconjugate in PBS buffer (4°C) and in human serum (37°C) was checked up to 48 h.

Results: Two major photons originating from 89Zr (511 and 908.97 keV) were observed in the gamma spectrum. The total amount of the metal ions in the final solution was less than 0.1 ppm. The best conditions for radiolabelling was achived as follows: 1 mg of conjugated bevacizumab was added to the vial containing 74 MBq of 89Zr. The pH was adjusted to 7 and the reaction product was heated up to 37°C for 60 min. ITLC chromatograms of 89Zr - DFO - bevacizumab showed the radiochemical purity of higher than 98%. The radiolabeled complex was stable both in PBS buffer (4°C) and freshly prepared human serum (37°C) at least for 48 h.

Conclusions: 89Zr - DFO - Bevacizumab can be prepared with high radiochemical purity and be used for PET imaging of patients with VEGF - expressing tumors in the country, however, more biological studies are still needed.

Keywords: 89Zr, Bevacizumab, VEGF - expressing tumors

■The Role of Cu - Cy NPs, Cisplatin, and Radiation in Promoting Apoptosis and Preventing Migration in Cervical Cancer Cells

ABSTRACTS

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Introduction: Copper - Cysteamine nanoparticles have emerged as a promising tool in the field of nanotechnology for various approaches. One notable application is their usage as radiation sensitizers in cancer therapies. This study aims to enhance the efficacy of chemoradiation therapy for cervical cancer by investigating the combined therapeutic effect of Cu - Cy NPs and Cisplatin using a clinical linear accelerator.

Methods: After the successful synthesis of Cu - Cy NPs, the cytotoxicity effect of these nanoparticles and Cisplatin in various concentrations was evaluated on HeLa cancer cells, individually and in combination. Moreover, the radiobiological effects of these substances were analyzed under a 6MV linear accelerator. Cell viability was quantitatively detected by MTT assay. Apoptosis was evaluated using Annexin - V/PI staining followed by flow cytometry analysis. Cell migration was evaluated through a wound healing assay.

Results: The concentration of 25 mg/L of Cu - Cy NPs exhibited no significant toxicity on HeLa cancer cells. However, in the presence of 2Gy X-ray at the same concentration, the nanoparticles demonstrated a potent radio - sensitizing effect. Moreover, the cell viability and migration rate in the combination group (Cu - Cy NPs+ Cisplatin+ radiation) significantly decreased compared to the radiation alone group. Furthermore, there was a notable increase in the rate of apoptosis in the combination group in compare with the radiation alone group.

Conclusions: Cu - Cy NPs in combination with Cisplatin under X-ray exposure showed a significant synergistic radiation enhancement effect in a dose - dependent manner, and may provide a promising approach to improve the therapeutic effect of conventional radiation therapy.

Keywords: Copper - Cysteamine Nanoparticles; Cisplatin; Cervical Cancer; Radiosensitizer; Chemoradiation Therapy

■Design and Development of 166Dy/166Ho Generator to Produce Carrier - Free 166Ho for use in Nuclear Medicine

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Introduction: 166Ho is one of the most effective radionuclides in cancer radio - immunotherapy (RIT). It has been well applied in nuclear medicine because of its good nuclear characteristics such as short half - life (26.8 hours), emission of beta particles with an average energy of 665.7 keV, emission of gamma particles with suitable energy (80.6%, 80 keV) for imaging and the high production possibility using a nuclear reactor. 166Ho can be produced through direct (165Ho (n,γ)166Ho) and indirect (164Dy(2n,γ)166Dy(β -)166Ho) methods. In this study, the production of carrier - free 166Ho (166Ho - CF) using a 166Dy/166Ho generator based on the indirect method was performed.

Methods: In this research, the first 166Dy produced by 164Dy (n,γ)165Dy(n,γ)166Dy reaction through irradiation of the enriched Dy - 164 target with thermal neutrons in the Tehran research reactor. Then, the extraction chromatography method based on Ln resin was used to separate the daughter radionuclide from the parent. The effective parameters on the radio - chemical separation, such as eluent concentration, temperature, and flow rate have been optimized.

Results: Under the optimized conditions (HNo3 1.5 M, temperature 50°C, and flow rate 1.5 mL/min) average separation yield of 83% was achieved. 166Ho was milked from the column in the three - step process. The milking time of the 166Dy/166Ho generator is 2.5 days. The radionuclide purity of 166Ho - CF was determined using the HPGe gamma - spectrometry method. The radionuclide purity of Ho - 166 obtained by this method was ≥99%.

Conclusions: The obtained results showed that the final product of 166Ho - CF, with radionuclide purity above 99%, activity 40.95 mCi, and specific activity of 100 Ci/mg can be achieved from the 166Dy/166Ho generator. Dy leakage in the final production is insignificant (less than 0.2 μCi per mCi of 166Ho).

Keywords: Ho - 166, Carrier - Free; 166Dy; Generator; EXC

■Patient radiation biological risk in dual - energy computed tomography procedure

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Introduction: Dual - energy computed tomography (DECT), a strong diagnostic tool, delivers higher radiation doses than most imaging modalities. As DECT use has increased rapidly, the induction of diseases such as cancer due to high radiation exposure of patients are become a concerns. The head and neck DECT has been thoroughly investigated in recent years, primarily focusing on oncologic and vascular imaging. So, this survey was conducted to evaluate the cancer risk of head and neck DECT examination.

Methods: The scan parameters and patient gender and age were collected for a total 100 patients undergoing DECT scans of the head and neck. The organ doses for each patient were computed using the tissue weighting factors from Report 103 by the International Commission on Radiation Protection (ICRP). The cancer risk values were quantified by the Xrayrisk.com web - based software that is based on BEIR VII (Biological Effects of Ionizing Radiation VII) - Phase 2 report.

Results: The highest organ dose were observed in thyroid. The overall mean effective dose in the females was higher than that in the males (1.78 vs. 1.36 mSv). Male patients had a mean cancer risk of 0.01%, whereas female patients had a mean cancer risk of 0.02%. The younger females had much higher cancer risk values. The cancer risk decreased with the increasing age of patients in both genders.

Conclusions: According to the results of this study, head and neck DECT scans are associated with an increased potential risk of cancer. Therefore, this study will help the referring physicians to weigh medical benefits of DECT examination in clinical practice against possible risks to justify each DECT decision in order to reduce unnecessary examinations or use alternative imaging modalities with low risk.

Keywords: Dual - Energy Computed Tomography; Biological Risk; Cancer Risk; Head And Neck

■ Prevalence of Depression and Related Factors in Patients with Colorectal Cancer in Mashhad, Iran, 2022 - 2023

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Introduction: Colorectal cancer is the most common malignancy of gastrointestinal tract and considered as one of the major causes of cancer - related deaths. This disease has severe impact on psychological and social status of patients, their families and consequently society. Depression negatively influences patients' physical performance, quality of life, time - length of hospitalization and treatment results. Hence, treating depression in patients with cancer is of great importance. Depression is a dangerous consequent of cancer that can reduce the survival rate and it is known as an important reason for disapproval of treatment in patients. The purpose of this study is to identify and determine the prevalence of depression and related factors in patients with colorectal cancer referred to Imam Reza and Omid hospitals of Mashhad from 2022 to 2023.

Methods: This is a cross - sectional study in which 100 patients with colorectal cancer referred to Imam Reza hospital and Omid hospital in Mashhad from 2022 to 2023 were sampled and analyzed. We used Beck Depression Inventory (BDI) as a screening test to determine the prevalence of depression based on age, sex, marital status, education, job, history of colostomy, duration of disease, comorbidity, awareness of the disease, location of tumor, stage of disease, chemotherapy, chemotherapy regimen, radiotherapy, surgery and patients' condition in their last appointment.

Results: The findings of this study suggest that the prevalence of depression in patients with colorectal cancer referred to Imam Reza and Omid hospitals of Mashhad from 2022 to 2023 was %32 and depression had a significant correlation with age, marital status, education, job, awareness of disease, duration of disease, location of tumor, stage of disease, chemotherapy, chemotherapy regimen, radiotherapy, surgery and patient's condition at the last appointment (P <0.05). Correlation with sex and history of colostomy and comorbidity was not statically significant (p>0.05).

Conclusions: Prevalence of depression in patients with colorectal cancer is relatively high. Hence, effective interventions are recommended during the processes of clinical diagnosis and treatment to identify different aspects of depression and improve quality of life in these patients.

Keywords: Depression; Cancer; Malignancy; Tumor; Colorectal; Gastrointestinal

■ Risk of Relapse and Death from Colorectal Cancer and its Related Factors Using Non-Markovian Multi-State Model

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Introduction: The objective of this investigation was to employ multi - state models for the purpose of modeling the likelihood of local relapse and mortality following the initial treatment for colorectal cancer, along with its associated determinants. In the realm of cancer research, the modeling of disease progression with respect to various events experienced by patients holds significant significance. Multi - state models, designed to account for

intermediate events while treating death as the ultimate endpoint, have been advanced for this purpose.

Methods: Conducted as a historical cohort study, this research focused on 235 individuals diagnosed with colorectal cancer, who sought medical attention at Omid Hospital in Mashhad between 2006 and 2011. The participants were monitored continuously until 2017. Transition probabilities to death resulting from metastasis, both with and without the occurrence of local relapse, along with pertinent variables, were ascertained using a non - Markovian multi - state model. The study delineated three distinct states of disease, encompassing local relapse and death.

Results: The likelihood of not encountering any events, experiencing only relapse, or facing death within the initial 5 years were 0.45, 0.09, and 0.46, respectively. In cases where patients remained event - free during the first year of treatment, the probabilities of relapse and death before the fifth year were 0.04 and 0.33, respectively. Conversely, if relapse occurred during this period, the probability of death by the fifth year escalated to 0.62. The cancer stage exhibited associations with both relapse and death, while factors such as ethnicity and a history of addiction were linked to death without relapse. Additionally, BMI demonstrated a significant correlation with death following relapse ($p < 0.05$).

Conclusions: Risk of death in patients with colorectal cancer depends on local relapse and the time between them.

Keywords: Colorectal cancer; Local relapse; Death, Non-Markovian Multi-State Model

■Uncovering the Intangible Heterogeneity of Gene Effects in the Survival Time of Cancer Patients

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Introduction: Colorectal cancer (CRC), the third most common cancer worldwide, is a group of diseases characterized by genetic and epigenetic changes. Irregular gene - methylation alteration causes and advances CRC tumor growth. Detecting differentially methylated genes (DMGs) in CRC and patient survival time paves the way to early cancer detection and prognosis. However, CRC data including survival times are heterogeneous. Almost all studies tend to ignore the heterogeneity of DMG effects on survival.

Materials: We employed a four-step data analysis process. Using the 6 CRC and 6 healthy male tissue samples, the DNA methylation read counts and read - depth for each CpG site captured by SureSelectXT Human Methyl - Seq. Approximately, 68\% of the CpGs had missing data in at least one sample. Then The DMCHMM pipeline was utilized for identifying differentially methylated cytosines (DMCs) in CRC vs. normal samples; results were aligned with the reference genome (hg19) to obtain a list of DMGs. Candidate methylation profiles were extracted from GEO for the validation step, showcasing consistent hypo/hyper-methylation across different populations and platforms. Afterward a PPI network analysis was performed. Densely connected substructure modules were determined using the MCODE algorithm. Then, hub genes were selected as the DMGs with the highest correlation in the modules using cytoHubba. Finally, the effects of DMGs and hub genes on the survival of patients were uncovered using the FMAFTR model to address sparsity and gene effects heterogeneity.

Results: We identified 3,406 DMGs. Analysis of overlapped DMGs with several Gene Expression Omnibus datasets led to 917 hypo-and 654 hyper - methylated DMGs. CRC pathways were revealed via gene ontology enrichment. Hub genes were selected based on Protein - Protein - Interaction network including SEMA7A, GATA4, LHX2, SOST, and CTLA4, regulating the Wnt signaling pathway. The relationship between identified DMGs/hub genes and patient survival time uncovered a two - component mixture of AFT regression model. The genes NMNAT2, ZFP42, NPAS2, MYLK3, NUDT13, KIRREL3, and FKBP6 and hub genes SOST, NFATC1, and TLE4 were associated with survival time in the most aggressive form of the disease that can serve as potential diagnostic targets for early CRC detection.

Conclusions: Our findings can provide insights into the development of potential therapeutic strategies for CRC.

Keywords: Colorectal Cancer; Human Genome; Cancer Epigenetics; Bisulfite Sequencing; DNA Methylation

■A Review of Patients' and Treatment Team's Viewpoints About Home Chemotherapy

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Introduction: This study was a qualitative research which was conducted in Shiraz Amir Hospital of Oncology. Interviews were conducted during the sessions of 30 - 60 minutes in the form of deep and semi - structured questions about their views, the disadvantages and advantages of this method from their point of view and the

facilities needed to assure patients of home chemotherapy. The sample consisted of 32 patients, 7 nurses and 10 doctors.

Methods: Interviews 5 were extracted from the main source. Concerns related to chemotherapy, concerns related to facilities, awareness, emotions and costs. Concerned about the complications of chemotherapy in the two categories of concern(Infection, platelet and white blood cell counts,….) Other classes included access to equipment, access to team therapy, team awareness, team awareness, home comfort, home comfort, team cost, equipment costs, and drug costs.

Results: A 39 - year - old man with leukemia expressed his concern about the lack of availability of ambulances and other emergency services: "Look, went to the hotel, got sick." has a record at Namazieh Hospital, when my platelet fell, got a call from the lab and the man said, "Sir, you should use your own car and come here The family may be exposed with chemo."Another nurse with five years of work - experience mentioned her concern about the inability of the family to carry out the plan and the lack of compliance with the sterilization injections and said: "Because of the environmental pollution that is caused for the caretaker or her children or someone may take care of the patient who has no literacy or is not able to help which may cause an error to occur and may lead to infection.

Conclusions: It is clear that the arrangements for this work and all positive and negative aspects of it should be reviewed by experts With regard to chemotherapy at home, ethical issues, the cost and safety of patient and his family are the priorities of the plan.

Keywords: Chemotherapy; Oncology; Infusion Pump; Phlebitis; Radiotherapy; Mental Illness; Neutropenia

■How Applicator Diameter Can Influence the Radiobiological Characteristics of Low-Energy IORT X-Rays?

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Introduction: One of candidate modalities for tumor bed irradiation after breast conserving surgery in intraoperative radiotherapy (IORT) by low - energy X-rays. For this purpose, dedicated spherical applicator are applied for tumor bed (a spherical shell with 1 cm thickness as PTV) irradiation. Based on the size of lumpectomy cavity, various applicator diameters are used for IORT. On the other hand, these different applicators sizes can induce distinct X-ray filtration. Hence, the X ray effective energy and relevant radiobiological characteristics may vary with changing the applicator diameter. Current study aims to evaluate the RBE value for emerging low - energy

IORT X-rays form different spherical applicator diameters through a hybrid Monte Carlo (MC) simulation approach.

Methods: INTRABEAM, a dedicated low - kV IORT facility, along with different applicator diameters were fully modeled by GEANT4 MC Toolkit. Then, the secondary electrons following X-rays interactions inside the water were scored at different depths from the applicator surface. Ultimately, the scored secondary electron energy spectra for various applicator diameters were imported to MCDS MC code to estimate the strand break yields and corresponding DNA - damage RBE values.

Results: Presence of spherical applicator can increase the RBE value up to 22.3% respect to the obtained value for the bare probe. Furthermore, changing the applicator diameter can also affect the RBE value by about 3.2%. Changing the depth affects the RBE value by about 10% inside the PTV.

Conclusions: From the results, it can be concluded that the size of spherical applicator can change the RBE| value of low - energy X-rays employed for IORT purposes. On the other hand, these RBE variations may be of concern, due to single fraction nature of IORT technique and its consequent impacts on patient prescribed dose.

Keywords: Breast Cancer; Low-kV IORT; RBE; Applicator Diameter; Hybrid Monte Carlo Simulation

■Changes in Radiation Dose Distribution by a Medical Mask Used During COVID-19 Pandemic

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Introduction: The medical mask was considered as an effective equipment to protect the respiratory system against COVID - 19 virus transmission. During pandemic, due to the wide use of medical masks on the faces of patients undergoing radiotherapy treatment, this study was conducted in order to investigate the effect of the presence of the medical masks in the treatment field or close to it.

Methods: The dose distribution was calculated in a PMMA phantom, and then measured in a water phantom under medical mask, for photon energies of 6, 10, 18 MV, and electron energies of 6, 8, 10, 12, and 15 MeV emitted from a Versa HD linac.

Results: In photon radiation, the difference in the dose distribution created in the field under the mask and outside the mask was seen only up to a depth of 5 mm, and in other depths it was insignificant. In electron radiation, this difference was seen up to a depth of 10 mm. In the photon radiation in the field around the mask at a depth

of more than 40 mm, a difference in the depth dose was observed, which decreased with the increase of photon energy.

Conclusions: The medical masks changed the dose distribution of the photon and electron radiation especially at surface, which is suggested to keep the patient's medical masks out of radiated field.

Keywords: Medical Mask; Photon; Electron; Radiation Dose; COVID - 19

■Advancements in Breast Cancer Risk Prediction Using Artificial Intelligence: A Systematic Review

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Introduction: Breast cancer (BC) is a global concern affecting 1 in 8 women with 2.3 million new cases and 685,000 deaths in 2020. Risk prediction and early detection are crucial for BC management. Risk prediction models mainly consider factors like lifestyle, genetics, age, body mass index, menopausal situation, family history, microcalcifications, breast masses, and mammographic density. Radiomic features, especially mammographic density, hold promise among these features. Artificial intelligence (AI) models, particularly convolutional neural networks (CNNs) using radiomics, enhances BC risk assessment, outperforming traditional methods. This study aims to review the role of AI models in improving BC risk prediction.

Methods: PubMed, Science Direct, Web of Science, and Google Scholar databases were explored up to May 2023, using different combinations of the keywords: "Breast Cancer", "Deep - Learning", "Mammographic Density", "Convolutional Neural Networks", "Artificial Intelligence", "Predictive Models" and "Risk Assessment". Eight more recent and relevant records were included in the study.

Results: The findings from the reviewed studies on BC risk prediction have demonstrated diverse accomplishments. BC risk prediction models based on CNN architecture for extracting mammographic radiomics achieved a pooled accuracy of about 70% through pixel - wise matching and consideration of breast density. Notably, an Inception ResNet - v2 deep learning (DL) model surpassed density - based models in predicting 5 - year BC risk, particularly in cases involving aggressive tumors. Additionally, unsupervised DL model of convolutional sparse autoencoder (CSAE) network, exhibiting promising results in BC risk prediction (AUC = 0.59). However, some stud-

ies have shown the accuracy up to about 86% for hybrid models that benefit from logistic regression, CNN-based models derived radiomics and other BC risk factors.

Conclusions: Deep learning, despite being a black box, provides superior accuracy, aiding radiologists in screenings. Locally validated networks aim to create a specific screening tool for targeted risk assessment, reducing unnecessary mammography and identifying high - risk patients. The reviewed records collectively highlight the potential of AI models in improving BC risk prediction. While results vary among different studies, the integration of clinical factors with radiomics extracted from advanced imaging modalities using DL models, holds promise for personalized BC risk assessment and improved prediction accuracy.

Keywords: Breast Cancer; Deep-Learning; Convolutional Neural Networks; Artificial Intelligence; Breast Cancer Risk Assessment.

■Stereotactic Radiosurgery in Brain Metastasis; Single or Combined Therapy?

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Introduction: Brain metastases (BMs) are the most common intracranial tumors which occur in 24–45% of adult patients with systemic cancers each year. Although various primary extracranial tumors pose a risk for BMs, melanoma, lung, breast, colon, non - small cell lung cancers, and kidney malignancies are more likely to spread intracranially. BMs are a major contributor to morbidity and mortality in patients with systemic cancers. Currently, the management of BMs has become a great healthcare concern worldwide.

Methods: A network meta-analysis (NMA) of randomized controlled trials (RCTs) and a direct comparison of cohort studies were performed. Relevant literature regarding the effectiveness of SRS alone and in combination with wholebrain radiotherapy (WBRT) and surgery was retrieved using systematic database searches up to April 2019. The patterns of overall survival (OS), one-year OS, progression - free survival (PFS), one-year local brain control (LBC), one-year distant brain control (DBC), neurological death (ND), and complication rate were ana-

lyzed. A total of 18 RCTs and 37 cohorts were included in the meta - analysis.

Results: Our data revealed that SRS carried a better OS than SRS+WBRT (P = 0.048) and WBRT (p = 0.041). Also, SRS+WBRT demonstrated a significantly improved PFS, LBC, and DBC compared to WBRT alone and SRS alone. Finally, SRS achieved the same LBC as high as surgery, but intracranial relapse occurred considerably more frequently in the absence of WBRT. However, there were not any significant differences in ND and toxicities between SRS and other groups.

Conclusions: Therefore, SRS alone may be a better alternative since increased patient survival may outweigh the increased risk of brain tumor recurrence associated with it.

Keywords: Stereotactic Radiosurgery; Brain Metastases; Meta-Analysis

■18F-DCFPyL (PSMA) PET as a Radiotherapy Response Assessment Tool in Metastatic Prostate Cancer

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Introduction: Prostate Specific Membrane Antigen (PSMA) - positron emission tomography (PET) guides metastasis - directed radiotherapy (MDRT) in prostate cancer (PrCa). However, its value as a treatment response assessment tool after MDRT remains unclear. Importantly, there is limited understanding of the potential of radiotherapy (RT) to alter PSMA gene (folate hydrolase 1; FOLH1) expression.

Methods: We reviewed a series of 11 men with oligo - metastatic PrCa (25 metastasis sites) treated with MDRT before re - staging with 18F - DCFPyL (PSMA) PET upon secondary recurrence. Acute effects of RT on PSMA protein and mRNA levels were examined with qPCR and immunoblotting in human wild - type androgen - sensitive (LN-Cap), castrate - resistant (22RV1) and castrate - resistant neuroendocrine (PC3 and DU145) PrCa cell lines. Xenograft tumors were analyzed with immunohistochemistry. Further, we examined PSMA expression in untreated and irradiated radio - resistant (RR) 22RV1 (22RV1 - RR) and DU145 (DU145 - RR) cells and xenografts selected for survival after high - dose R

Results: The majority of MDRT - treated lesions showed lack of PSMA - PET/CT avidity, suggesting treatment response even after low biological effective dose (BED) MDRT. We observed similar high degree of heterogeneity of PSMA expression in both human specimens and in xenograft tumors. PSMA was highly expressed in LNCap and 22RV1 cells and tumors but not in the neuroendocrine PC3

and DU145 models. Single fraction RT caused detectable reduction in PSMA protein but not in mRNA levels in LN-Cap cells and did not significantly alter PSMA protein or mRNA levels in tissue culture or xenografts of the other cell lines. However, radio - resistant 22RV1 - RR cells and tumors demonstrated marked decrease of PSMA transcript and protein expression over their parental counterparts.

Conclusions: PSMA - PET may be a promising tool to assess RT response in oligo - metastatic PrCa. However, future systematic investigation of this concept should recognize the high degree of heterogeneity of PSMA expression within prostate tumors and the risk for loss of PSMA expression in tumor surviving curative courses of RT.

Keywords: DT, Androgen Deprivation Therapy; AMACR, Alpha-Methylacyl-CoA Racemase; ARAT, Androgen Receptor Axis-Targeted; BED, Biological Effective Dose; CRPC, Castration Resistant Prostate Cancer

■Introducing a simple and cost-effective phantom for fast and simple stereotactic radiosurgery end to end testing

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Introduction: The aim of this project is to design a cost-effective end-to-end (E2E) phantom for quantitative and qualitative (SRS - QAQ) the geometric and accuracy of frameless stereotactic radiosurgery (SRS) technique.

Methods: In order to evaluate the accuracy of different organs' contouring in TPS (Ray plan), a simple phantom consisting of 9 semi - cylindrical - semi - conical chambers with a volume of 0.4 cc, which is filled with various materials such as water, air, bone (powder), MRI and CT contrast agent were used. According to the different window levels as lung, soft tissue and vertebra in the TPS, 9 objects on two MRI sequences and two CT reconstructions, were contoured. In order to evaluate the subjective error, contouring was done by different physicists and physicians. It is worth mentioning that image fusion was not used in the contouring of the structures.

Results: The 144 VOI obtained from the contouring of 9 objects in 4 window levels, 2 different CT reconstructions and 2 different MRI sequences per people. Agreement of volume between MRI and CT (quantitative) and verification of electronic density of different materials, were evaluated.

Conclusions: Structure volumes and borders possess slight differences in different modalities (such as CT scan and MRI). In our review, we did not find any significant

differences between VOIs in terms of volume.

Keywords: SRS; End to End Test; Phantom; CT; MRI

■Assessing the Compliance of Educational Curricula of Selected Disciplines with the Content Standards of Cancer Related Palliative Care

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Introduction: Management of cancer complications requires the provision of palliative care as a comprehensive care by the main and trained members of this method of care. The aim of the present study was to assess the compliance of educational curricula of selected disciplines with the content standards of cancer related palliative care.

Methods: In this descriptive–comparative study, the content standards of palliative care for nurses, physicians, and social workers were identified based on the World Health Organization guideline and Oxford Textbook of Palliative Nursing. For this purpose, a separate checklist was prepared for the disciplines with different dimensions. Then the face and content validity of the checklists were checked. Finally, we examined the coordination between selected curricula available on the website of Education Deputy of the Ministry of Health, Treatment and Medical Education with the dimensions of the checklists.

Results: All three curricula in most domains were relevant with the content standards, but there was the biggest education need in the areas related to the dimensions of "planning and educational," educating physician in palliative care," and "considering patient preferences" in these disciplines.

Conclusions: To meet the educational needs, it is suggested to change some course topics, hold training courses, or joint workshops.

Keywords: Content Standards; Curriculum; Medical; Neoplasms; Nursing; Palliative Care; Social Work

■The Relationship between Uncertainty in Illness and Social Support Among Elderly with Prostate Cancer

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Introduction: People with prostate cancer, from the time of diagnosis and the initiation of treatment, often experience high levels of psychological stress, including uncertainty in illness, significantly impacting their quality of life and coping abilities. Social support, as a significant coping factor, plays a crucial role in reducing stress, enhancing adaptability, and improving patient's health status. Given the increasing number of elderly diagnosed with prostate cancer in Iran, this research aims to determine the relationship between uncertainty in illness and social support among elderly with prostate cancer.

Methods: This descriptive correlational study was conducted on 219 elderly men with prostate cancer who were admitted to two educational hospitals in Tehran in 2022. Based on the inclusion criteria, participants were selected by convenience sampling method. Data were collected using demographic information forms, the Mishel Uncertainty in Illness Scale (MUIS), and the Perceived Social Support Scale (MSPSS). Statistical analysis was performed using descriptive statistics, Pearson correlation coefficient, T - test, and ANOVA, with a 0.05 significance level.

Results: The mean score of uncertainty in illness was 98.52 ± 9.26, and the mean score of social support was 46.08 ± 8.60, both indicating high levels. A significant inverse correlation was found between uncertainty in illness and social support ($P < 0.001$, $r = -0.535$). Additionally, a significant relationship was observed between uncertainty in illness, social support, and marital status of patients ($P < 0.05$), but no significant correlations were found between age, education, and employment status.

Conclusions: Uncertainty in illness is a significant dimension of the cancer experience among the elderly with prostate cancer. Sufficient social support from family and healthcare providers can reduce uncertainty, enhance coping abilities, and consequently improve treatment outcomes.

Keywords: Uncertainty in Illness, Social Support, Elderly, Prostate Cancer

■Survival Rate Prediction in Glioblastoma Patients Using Radiomics Extracted from Post-Contrast Magnetic Resonance Images: Comparison of Multiple Machine Learning Models

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Introduction: Glioblastoma multiforme (GBM) is one of the most aggressive primary malignant brain tumors. The standard treatment for GBM combines surgery, chemotherapy, and radiotherapy. Magnetic resonance imaging (MRI) serves as the primary imaging modality for GBM tumors, accurately depicting the tumor's center and margins. MR sequences including T1, T2, T2FLAIR, diffusion - weighted imaging (DWI), and post - contrast T1, are mainly used for GBM studies. In addition to subjective visual analysis of the images by radiologists, radiomics (shape, first, second, or higher - order statistics, and texture features) extracted from images, can also be applied to evaluate GBM patients' treatment outcomes. These extracted radiomics can serve as input data for machine learning (ML) models, contributing to predicting GBM patients' survival rates. This study aims to review various ML algorithms utilized for predicting GBM patients' survival rates.

Methods: PubMed, Science Direct, Web of Science, and Google Scholar databases were explored up to November 2023, using different combinations of the keywords: "Glioblastoma multiforme ", "GBM", "survival prediction", "Magnetic resonance imaging", "radiomics", "artificial intelligence", "machine learning" and "deep learning". Finally, seven more recent and relevant records were included in the study.

Results: Based on the results of the reviewed records, SVM (support vector machine), RF (random forest), LASSO (least absolute shrinkage and selection operator), XGBOOST, CATBOOST, LIGHTGBM, Nearest neighbor, Neural network, Multilayer perceptron (MLP), and Naïve Bayes models have been applied for GBM patients' survival rate prediction. The highest reported AUC (area under the curve) value was related to a Nearest neighbor - based model. The reported average AUC values for SVM and RF models were equal to 0.793 and 0.889, respectively. Furthermore, the RFE - SVM combined model presented the highest level of accuracy. The LASSO model also showed an appropriate performance in predicting GBM patients' survival rates. Moreover, Haralick features were the most significant applied radiomics with ML models.

Conclusions: The high AUC and accuracy values in different studies for ML models predicting GBM patients' survival rates and treatment outcomes indicate the potential efficacy of such models as supportive tools for clinicians. These ML - based approaches using MRI - based extracted quantitative features, precisely predict GBM patient survival.

Keywords: Glioblastoma Multiforme (GBM); Survival Rate Prediction; Magnetic Resonance Imaging; Radiomics; Artificial Intelligence; Machine Learning

■ Prostate-Specific Membrane Antigen

(PSMA) Expression Predicts Need for Early Treatment in Prostate Cancer Patients Managed with Active Surveillance

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Introduction: Metabolic dysregulation is an early event in carcinogenesis. Here, we examined the expression of enzymes involved in de novo lipogenesis (ATP - citrate lyase: ACLY), glucose uptake (Glucose Transporter 1: GLUT1), and folate - glutamate metabolism (Prostate - Specific Membrane Antigen: PSMA) as potential biomarkers of risk for early prostate cancer progression

Methods: Patients who were managed initially on active surveillance with a Gleason score of 6 or a low - volume Gleason score of 7 (3 + 4) were accrued from a prostate cancer diagnostic assessment program. Patients were asked to donate their baseline diagnostic biopsy tissues and permit access to their clinical data. PSMA, GLUT1, and ACLY expression were examined with immunohistochemistry (IHC) in baseline biopsies, quantitated by Histologic Score for expression in benign and malignant glands, and compared with patient time remaining on active surveillance (time - on - AS).

Results: All three markers showed trends for elevated expression in malignant compared to benign glands, which was statistically significant for ACLY. On univariate analysis, increased PSMA and GLUT1 expression in malignant glands was associated with shorter time - on - AS (HR: 5.06, [CI 95%: 1.83 - 13.94] and HR: 2.44, [CI 95%: 1.10 - 5.44], respectively). Malignant ACLY and benign gland PSMA and GLUT1 expression showed non - significant trends for such association. On multivariate analysis, overexpression of PSMA in malignant glands was an independent predictor of early PC progression (p = 0.006)

Conclusions: This work suggests that the expression of metabolic enzymes determined by IHC on baseline diagnostic prostate biopsies may have value as biomarkers of risk for rapid PC progression. PSMA may be an independent predictor of risk for progression and should be investigated further in systematic studies

Keywords: ACLY; GLUT1; PSMA; Active Surveillance; Progression; Prostate Cancer

■ Novel Chemo-Photothermal Therapy in Breast Cancer

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Introduction: Combined therapeutics dependent on the synergistic effect between photothermal therapy (PTT) and chemotherapy have been anticipated to be the next generation of cancer treatment.

Methods: For this purpose, a novel gold hydrosol was synthesized by a one - pot approach using poly (2 - (dimethylamino) ethyl methacrylate - co - N - isopropylacrylamide - co - 2 - vinylpyridine) P(DMAEMA - co - NIPAAM - co - VP) terpolymers as a reducing and stabilizing agent. The synthesized gold hydrosol was recoated by a novel carboxylic acid rich poly (N - isopropyl acrylamide - co - maleic anhydride - graft - citric acid) (PNIPAAm - co - PMA - g - CA) copolymer. Then the gold nanoparticles conjugated with Doxorubicin (DOX) and served as a smart photo synthesizer for chemo/ photothermal therapy of MCF - 7 breast cancer cells. The synthesized nanoparticles had mono - dispersed spherical morphology with a diameter below 30 nm.

Results: Our results from cellular uptake indicated that around 100% of the particles were uptake by MCF - 7 cells in the first 3 h of exposure time. The temperature of nanocomposites considerably went up to 45 °C with 10 min exposure to near - infrared irradiation. As a striking result, a single round of PTT combined with a sub - therapeutic dose of DOX revealed a synergistic effect with an ability of robust anti - tumor response up to 99.99% (sum of the population of apoptotic and necrotic cells) demonstrated by Annexin - V, cell cycle and DAPI staining techniques.

Conclusions: In conclusion, Near - infrared - mediated photothermal conversion exhibited high effectiveness of a combinational chemo - thermotherapy to treat cancer cells.

Keywords: Photothermal Effect; Smart Gold Hydrosol; Doxorubicin; Combination Therapy; Apoptosis

■Altering Tumor Microenvironment of Colon Cancer by Intra-Tumor Injection of Serum Originating from EAE Animals; an In-vivo Study

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Introduction: Despite recent advancements in colon cancer therapies, finding an effective approach to reduce tumor resistance to treatments remains a challenging issue. Numerous studies demonstrated that tumor immunosuppressive microenvironment plays a crucial role in tumor progression and treatment failure. Based on the inflammatory status of autoimmune diseases, we hypothesized that incompatible serum originated from EAE mice (EAE - serum), as experimental animal model of multiple sclerosis could induce anti - tumor response and reverse immune tolerance at the tumor loci of colon cancer.

Methods: Female C57BL/6 and BALB/C mice were used to induce EAE and non - orthotopic CT26 colon cancer models, respectively. The colon cancer mice were treated by intra - tumor injection of EAE - serum in three doses every other day while the control group was treated with normal saline. Using a caliper, the tumor size was measured and the longitudinal data of the two groups were compared. After euthanizing both groups, using real - time PCR and IHC methods the VEGF - A/CD31, HIFα, MMP2and9, and IL10/CD38 were investigated as representatives of angiogenesis, hypoxia, tumor invasion capacity, and immunosuppressive tumor microenvironment, respectively.

Results: Tumor size measurement during the experiment showed that EAE - serum could significantly inhibit colon cancer growth in mice. Furthermore, the molecular investigation of the study showed decreased levels of HIFα, VEGF - A, and CD31 in the treatment group demonstrating suppression of hypoxia and angiogenesis at the tumor site. Likewise, MMP2 and MMP9, as representatives of tumor invasion and metastasis, were decreased after treatment. Also, regulatory markers of immune cells (IL10 and CD38) were decreased in the treatment group compared with the control group.

Conclusions: Our results suggest that this approach is promising and could potentially affect the tumor microenvironment in BALB/C colon cancer. More experiments should be performed to get a better understanding of the mechanism and side effects of this method.

Keywords: Colon Cancer; Tumor Microenvironment; Experimental Autoimmune Encephalomyelitis (EAE); Immunotherapy; Inflammation

■Sono-sensitivity and radio - sensitivity of methylene blue with apigenin - coated gold nanoparticles on MCF7 cells

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Introduction: Sonodynamic therapy and nanoparticles with green compounds reduce complications and improve the treatment of cancer along with radiotherapy. The aim of the study is to investigate the synergistic efficacy of low dose radiotherapy and sonodynamic therapy in the presence of apigenin - coated gold nanopar-

ticles and methylene blue sonosensitizer on the breast cancer cell.

Methods: The synthesized apigenin - coated gold nanoparticles have been confirmed by UV - Visible, HR - TEM, DLS, Zeta - potential and FTIR. The toxicity of the nanoparticles and methylene blue were measured. Ultrasound parameters were extracted in the acoustic cavitation threshold by mechanical index modeling. The concentration of Api@AuNPs nanoparticles and methylene blue was obtained and then irradiated by ultrasound and 2 Gy X-ray radiation. The toxicity of the nanoparticles and methylene blue, cell viability and survival were measured by MTT. The percentage of apoptotic and necrotic cells was estimated by flow cytometry.

Results: The MTT assay indicated that sonodymic therapy combined with radiation therapy with theconcentration of 8 μg/ml nanoparticles and 0.4 μmol methylene blue caused a synergistic effect on cell death 0.27 ± 0.03. Necrosis and apoptosis increased in presence of apigenin - coated nanoparticles in radiation therapy and ultrasound alone and together.

Conclusions: Using sonodynamic therapy as a non - invasive and non - ionizing treatment with novel sensitizers based on optimum physical parameters can lead to increase cell death in low dose radiation therapy. Also, The study uses green nanoparticle versus chemical sensitizers in order to gain insights into eliminate the side effects of cancer treatment.

Keywords: Sonodynamic Therapy, Radiation Therapy, Apigenin-Coated Gold Nanoparticles, Methylene Blue

■Evaluation of Monaco Treatment Planning System by Use of American Association of Physicists in Medicine Task Group-119 Test Cases

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Introduction: This study aimed to evaluate the overall accuracy of the beam commissioning criteria of Monaco treatment planning system (TPS) based on the American Association of Physicists in Medicine (AAPM) Task Group Report 119 (TG-119).

Methods: The work was performed using 6 MV energy LINAC with a variable dose rate of 600 MU/min. The AAPM TG-119 intensity-modulated radiation therapy (IMRT) commissioning tests are composed of two preliminary tests and four clinical test cases. The clinical tests consisted of mock prostate, mock head and neck, C-shaped target, and multitarget. Matrixx phantom was used for evaluating the IMRT plans. The dose prescription for each fraction was 200 cGy in mock prostate, mock head and

neck, C-shaped target, and multitarget. Dose distributions were analyzed using gamma criteria of 3% and 2% dose difference (DD) and 3 and 2 distance to agreement.

Results: In all test cases, the gamma criteria for 2%/2mm and 3%/3mm were found to be 94% and 98%, respectively. Results showed that the average gamma criteria result was in the range of 98% to 96% (3%/3, 2%/2) overall test cases, for getting better results, we did post modeling evaluation and tune some geometrical value of TPS with this method our results improve with range of 99% to 98% (3%/3, 2%/2).

Conclusions: Findings were favorable and in some tests were comparable with the other studies. The dose point values were within the mean values of the range reported by TG-119. Overall, the Monaco TPS is needed to apply IMRT technique in radiation therapy centers.

Keywords: American Association of Physicists in Medicine Task Group Report 119; Intensity Modulated Radiation Therapy; Radiation Therapy; Monaco; Treatment Planning System

■The Effects of Medical Linear Accelerator X-rays on Human Peripheral Blood Lymphocytes in the Presence of Glucosamine

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Introduction: Glucosamine is widely prescribed as a dietary supplement used to treat arthritis. In this study, the radioprotective ability of glucosamine was evaluated against radiation - induced genotoxicity and cytotoxicity in human peripheral blood lymphocytes.

Methods: Glucosamine is widely prescribed as a dietary supplement used to treat arthritis. In this study, the radioprotective ability of glucosamine was evaluated against radiation - induced genotoxicity and cytotoxicity in human peripheral blood lymphocytes.

Results: Irradiation significantly increased the micronuclei frequency as compared to the control group. Contrary to that pretreatment with glucosamine before irradiation significantly reduced the frequency of micronuclei. Furthermore, pre - treatment with glucosamine significantly prevented the percentage of apoptotic lymphocytes. Also, glucosamine pretreatment significantly reduced the production of ROS in irradiated lymphocytes.

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