

Results: RapidArc produced superiorly conformal plans compared to 3DCRT (conformality index 1.37 (1.17–1.64) 3DCRT and 1.06 (0.93–1.19) RA; $p=0.003$). The hotspot within the PTV was greater for RA plans when comparing identical PTV volume coverage (106.4% (103.4–109.9) 3DCRT and 109% (106.0–113.6) RA). RA produced greater sparing of lung volumes with significant differences in V13 (31.1% (6.6–80.9) 3DCRT and 27.4% (4.3–82.7) RA; $p=0.015$), V20 (23.1% (5.3–65.7) 3DCRT and 13.3% (1.7–51.3) RA; $p=0.022$), and MLD (10.9 Gy (3.1–27.7) 3DCRT and 9.2 Gy (2.5–22.8); $p=0.0022$). The V5 was not statistically different ($p=0.071$). RA also provided lower mean heart doses (16 Gy (1.1–33.9) 3DCRT and 13.5 Gy (1.0–30.3) RA; $p=0.0058$).

Conclusion: RA is a feasible modality for primary radiation of oesophageal carcinoma. Compared to 3DCRT, RA provided better sparing of lung and heart volumes. Further study is required to validate this finding especially with respect to normal tissue complication probability modeling.

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POSTER

Combined Whole Brain Radiotherapy and Simultaneous Integrated Boost for Multiple Brain Metastases Using the Volumetric Modulated Arc Therapy Technique

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Background: Using the Volumetric modulated Arc therapy (VMAT) technique, we performed this study to evaluate the effects of the whole brain radiotherapy (WBRT) with a simultaneous integrated boost in patients with multiple brain metastases.

Materials and Methods: For five patients with multiple brain metastases, two RT plans for each patient were generated: (1) an integrated VMAT (iVMAT) plan consisting of WBRT with a simultaneous integrated VMAT boost and (2) a sequential 2-Dimensional WBRT followed by a VMAT boost (2DVMAT) plan. In iVMAT plan, dose prescription was 5 Gy in 10 fractions without normalization. For the comparison, we evaluated the averaged quality of coverage (QOC), homogeneity index (HI) and conformity index (CI). Doses to organ at risk (OAR), a mean dose (D_{mean}) to the brain and a maximum dose (D_{max}) to the lens were evaluated by use of dose-volume histograms (DVHs).

Results: The average of monitor units (MUs) of iVMAT and 2DVMAT plan were 1,118 and 1,012 respectively. The iVMAT plan showed better HI (1.12) and CI (1.30) compared with 2DVMAT plan (HI 1.26 and CI 1.67). However target coverage result (QOC) improved with 2DVMAT plan (0.95) compared with iVMAT plan (0.90). For the sparing of OAR, the D_{mean} to scalp was on average 5.7 Gy lower with iVMAT plan (9.1 Gy) compared with 2DVMAT plan (14.8 Gy). Whereas, the D_{max} to lens were on average 7.4 Gy with iVMAT plan and 7.1 Gy with 2DVMAT plan.

Conclusions: In patients with multiple brain metastases, iVMAT plan showed more conformal and homogenous target coverage and an improvement in scalp sparing compared with 2DVMAT plan. The future studies enrolling more patients will be necessary to draw the conclusive results.

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POSTER

Feasibility of Frameless Cranial Radiosurgery With Infrared Markers Fixed to an Immobilization Mask That is Monitored Under X-ray and Infrared Image Guidance System

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Purpose: In frameless radiosurgery using the NovalisTX and ExacTrac system, stereotactic localization is achieved using an infrared (IR) camera system combined with an array of passive IR markers that has a 1:1 relationship to the localizer array used in CT which is then fixed above a thermoplastic mask. After positioning with the camera, changes in the patients position with respect to the mask system are then corrected using stereoscopic imaging with 6D automatic fusion. For larger patients, due to contact of the array with the patient's chest, localization accuracy can be compromised due to an inability to fit the array over the patient. The goal of this study is determine the feasibility of performing frameless radiosurgery by replacing the array with IR markers fixed directly to the immobilization mask.

Methods and Materials: An anthropomorphic head phantom with 5 hidden targets was used for the study. A mask was fabricated to which several IR markers were fixed. The phantom was scanned with the standard array and then with IR markers placed directly on the mask. Plans were generated for each target and phantom positioning was tested first with the default array and then with the IR markers fixed on the mask. Initial positioning by ExacTrac was verified with cone-beam CT and orthogonal kV/MV planar

images. The differences in phantom shifts found by ExacTrac for positioning with the array vs. with IR markers on the mask were recorded for each target at 5 table angles typically used in clinical practice. Each target was tested twice for a total of 50 shift comparisons.

Results and Discussion: The mean absolute differences in translational shifts between positioning with the array vs. with IR markers on the mask in the vertical, longitudinal and lateral directions was 0.19 ± 0.14 mm, 0.19 ± 0.18 mm and 0.26 ± 0.27 mm respectively. The mean absolute differences in rotational shifts in the vertical, longitudinal and lateral directions was $0.20 \pm 0.17^\circ$, $0.11 \pm 0.08^\circ$, and $0.01 \pm 0.08^\circ$ respectively. The differences observed for both translation and rotation between the two methods used were small. Using a tolerance level of $0.7 \text{ mm}/1^\circ$, no additional shift would be required at the 95% confidence level with the exception of lateral translations which slightly exceeds tolerance.

Conclusion: This phantom study shows that using IR markers fixed directly to the mask when patient geometry does not allow for the use of default IR marker array allows for sub millimeter localization.

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Comparing the Outcome of Treatment With Different Techniques and Dosages of Radiotherapy in Hodgkin Lymphoma

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Introduction: There are approximately 7,500 new cases of Hodgkin lymphoma diagnosed each year in the United States. Men are more susceptible than women (1.4:1). The role of radiotherapy in the treatment of Hodgkin's disease and non-Hodgkin's lymphoma has changed considerably in the last few decades so in this study we try to compare the outcome of using different technique of radiotherapy in treatment of Hodgkin lymphoma.

Material and Method: In this retrospective study, one hundred six patients aged 20 to 50 years who had documented Hodgkin lymphoma which were admitted in Emam Khomeini hospital were assessed. They were treated with three different technics of radiotherapy, the first one is Mantle, the second is inverted and the third one is Tonsil, three ranges of dosages were used, the first is under 2500CGy, the second 2500–4000CGy and the third one is more than 4000CGy and their response to the treatment were evaluated.

Results: 74 (69.82%) patients were male and 32 (30.18%) were female. 64 patients after treatment, they had positive response and they did not have recurrence, from this number of patients, 38 (59.37%) were male and 26 (40.62%) were female. These patients were divided into three groups from the aspect of pathology, the first group had Nodular sclerosis (NS), the second is Mixed cells (MC) and third group is Lymphocyte predominant (LP). 34 patients had NS which 16 (47.1%) of them were male and 18 (52.9%) were female. 20 (58.8%) had a positive response to the treatment but 14 (41.2%) patients had recurrence and did not respond to the treatment. 58 had MC which 48 (82.8%) were male and 10 (17.2%) patients were female, 40 (69%) patients answered to treatment but 18 (31%) did not answer and 14 had LP. 10 (71.4%) were male and 4 (28.6%) were female, in this group 12 (85.7%) patients, unfortunately did not respond to the treatment but 2 (14.3%) of them did answer to the treatment. The effective radiotherapy dosages which is used for the treatment of Hodgkin Lymphoma is 2500–4000CGy, in this study, we used three ranges of radiotherapy doses, the first group consisted of 8 patients got under 2500CGy and 2 (25%) of them had positive response to this dosage but 6 (75%) had negative response, the second group which is consisted of 64 patients got 2500–4000CGy that 40 (69.5%) of them had positive response but 24 (37.5%) did not answer and 34 patients which were in the third group got more than 4000CGy that 20 (58.8%) of them had positive answer to the treatment but 34 (41.2%) of this group did not answer and had recurrence. Finally, we used three techniques of radiotherapy as a main treatment in our Hodgkin lymphoma patients, the first one is Mantle, the second technique is Inverted and the third one is Tonsil but Para Aortic and Pelvic techniques were not used. Among 62 patients which answered to our treatment, the Mantle technique was used for 56 (90.3%) of them, Inverted is used for 4 (6.5%) and lateral face is used for 5 (3.2%) of patients.

Conclusion: The most common technique which is used for Hodgkin lymphoma is the Mantle and the number of patients which answered to Mantle technique is more than the other techniques of radiotherapy and the most effective dosages which can be used are 2500–4000CGy.