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Assessment of improved organ at risk sparing for meningioma for structures that are associated with better quality of life after therapy. Moreover, a combination of observed between the 3 evaluated treatment concepts. However, Conclusions: Looking at target coverage no significant differences was observed between the 3 evaluated treatment concepts. However, combining particles and photons spares OARs more beneficially compared to sole photon treatments. Moreover, a combination of carbon ions and photons may result in limiting doses to those structures that are associated with better quality of life after therapy.

OC-0345
Assessment of improved organ at risk sparing for meningioma for mixed or single photon and particle beam treatments

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Purpose/Objective: To investigate the combination of photons, protons and carbons for an optimal study design for the treatment of meningioma. Meningioma lesions frequently show an aggressive local growth and a high incidence of tumor recurrences after neurosurgical resection. The rapid dose fall-off of particles and the increased RBE of carbons could be of potential benefit leading to increased local tumor control and better overall survival.

Materials and Methods: Based on the gross tumor volume (GTV) two different planning tumor volumes (PTV) were constructed for 4 meningioma patients: The initial PTV (PTVinit) treated with 25x2 GyE and the boost PTV (PTVboost) with 3x4 GyE. For the initial clinical target volume (CTVinit) a margin of 1 cm was added to the GTV adapted to the surrounding tissue. CTVinit plus 3 mm formed PTVinit and for PTVboost the GTV was enlarged by an isotropic margin of 3 mm. Different organs at risk (OAR), delineated using pre- and post operative MRI information adapted to the planning CT, were considered: eyes, optical nerves, chiasm and brainstem. Intensity modulated photon plans (IMXT) were created with Monaco (V3.0, Elekta) and intensity modulated proton and carbon ion plans (IMPT and 12C) using the TPS XiO (V4.41, Elekta-CMS) and TRiP98, respectively. For IMXT 6 beams were used as PTVinit plans and 4 beams for PTVboost plans. IMPT and 12C treatment plans were created assuming fixed beams. Two beams separated by a couch angle of 20-30° from ipsilateral side were used for PTVinit and two beams from cranio-caudal direction for PTVboost. Using the software CERR (Version 4.1, May 2012) dose matrices for the following combinations were generated: IMXT + IMXT or IMPT or 12C; IMPT + IMPT or 12C; 12C + 12C. Plan quality was analyzed by evaluating conformity and homogeneity index (CI, HI) according to ICRU83, V95%, D2% and D50%; D2%, D50% and Vd (0.6), VMAT+IMIT = 97.7% (0.8), VMAT+IMXT = 96.7% (0.8)). Looking at OAR sparing, generally VMAT+VMAT was found to be the worst. Mean doses were on average 4 GyE higher for rectal wall and 1.5 GyE for bladder wall compared to combined modalities. VMAT+IMXT and VMAT+IMXT had similar tendency of sparing OARs, except for Vd2%GyE, Vd50GyE of the rectal wall, where photons in combination with carbons were on average better by 2 GyE.

Conclusions: Looking at target coverage no significant differences was observed between the 3 evaluated treatment concepts. However, combining particles and photons spares OARs more beneficially compared to sole photon treatments. Moreover, a combination of carbon ions and photons may result in limiting doses to those structures that are associated with better quality of life after therapy.

PROFFERED PAPERS: RTT 4: TREATMENT PLANNING: DOSIMETRIC CONSIDERATIONS

OC-0346
Dosimetric evaluation of TomoDirect, helical tomotherapy and field-in-field techniques in breast radiotherapy

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Purpose/Objective: This study evaluated field-in-field (FIF) tangential technique, TomoDirect and helical tomotherapy (HT) in terms of target dose homogeneity, conformity and degree of organs-at-risk (OARs) sparing. The results provided useful reference to recommend optimal treatment strategy for patients, including the consideration of left or right side breast cancer and with or without supraclavicular fossa (SCF) lymph nodes involvement.

Materials and Methods: Total of 30 breast cancer patients with SCF lymph nodes involvement were recruited and planned by FIF, TomoDirect and HT. They were divided equally (n=15) in two arms of left and right side group. Conventional field arrangement of SCF field and tangential opposing fields were employed for FIF planning with subfields using multileaf collimator (MLCs) for shielding hotspots and heart (for left breast cancer patients). TomoDirect used three anterior-oblique fields for the SCF target and seven fields for the chestwall target. With the same prescription, target coverage, dose homogeneity and conformity were evaluated. Degree of OARs sparing was assessed by means of maximum dose, mean dose and various dose-volume parameters. Beam-on-time of the three techniques were recorded and compared to evaluate treatment delivery efficiency.

Results: The present dosimetric comparison proved that advanced IMRT techniques of tomotherapy had definite target dosimetric advantages over FIF technique. HT generally increased low dose volumes compared with the other two techniques. This study showed that only TomoDirect achieved high degree of OARs sparing with good target dose dosimetry. However, there was a significant volume of high dose outside the SCF target and the dose distribution was unlikely to be satisfactory in TomoDirect. TomoDirect also resulted in higher contralateral breast dose when chest target lied across patients’ midline or on patients with highly concave chest wall. TomoDirect required 30% longer treatment delivery time than FIF and HT (p<0.01) as greater modulation factor was needed to bring down the higher target dose. The presence of cardiac shield on the left-sided breast further deteriorated the target coverage as compared to right-sided breast using the same FIF technique (p<0.01).

Conclusions: Highly conformal IMPT and 12C plans could be generated with a non-gantry scenario. Improved OAR sparing favors sole 12C and proton plans, which is should be included in future trial design for meningioma patients.
Conclusions: Since FIF technique was simple and achieved reasonable dosimetric results, it is recommended for treating right breast cancer. Because of the highly conformal and homogenous target dose, HTs recommended for breast cancer patients with SIB lung nodes involvement and patients with chest wall target crossed midline and/or with concave chest wall. Both tomotherapy techniques were more favourable for left breast cancer as good target dosimetry was maintained. The advantages of TomoDirect might outweigh its inferior treatment delivery efficiency and provide an alternative treatment strategy only for patients require maximum sparing of OARs.

OC-0347

Adjuvant RT for Gastric Cancer: A dosimetric comparison of 3D-CRT, RapidArc® and conventional IMRT techniques

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Purpose/Objective: To compare RapidArc® (RA), 3D conformal (3D-CRT) and conventional IMRT planning for non-metastatic gastric cancer using dosimetric analysis.

Materials and Methods: In a retrospective study, ten patients previously treated with 3D-CRT at our institution were re-planned using IMRT and RapidArc techniques. Site based institutional dose volume constraints were used to guide plan optimization, based on risk of normal tissue complication probabilities. 3D-CRT plans with three to five-fields were compared with IMRT plans containing up to nine dynamic fields and VMAT plans with two arc therapy beams. Target coverage was analyzed using V95, conformity and homogeneity indices and DVH parameters (D1, D2, D50, D98, D99). Clinical criteria of organs at risk (OAR) tolerance doses were based upon D33 and D66, but for plan comparison, further DVH metrics were assessed.

Results: Median values are reported (Table 1).

Conclusions: RA plans required lower Monitor Units than IMRT for the same target coverage, with comparable PTV conformity and improved sparing of OARs. RA planning is superior to IMRT and SIB but at the expense of PTV conformity.

OC-0348

Feasibility of IMRT with an integrated boost for oesophageal cancer

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Purpose/Objective: To compare RapidArc® (RA), 3D conformal (3D-CRT) and conventional IMRT techniques in a low dose level (V5Gy<50%) for the heart, mean lung dose, as well as the total number of objective or constraint violations encountered for each planning technique. Subsequently, the most suitable IMRT technique was applied to plan an integrated boost to the primary tumour of an additional 28×0.4Gy = 11.2Gy, without compromising the original OAR constraints. PTVboost margins around the primary tumour were 1 cm.

Results: Planning results are summarized in Table 1 (mean ± SD). PTV volumes were on average 506 ± 253 cc. Boost volume (PTVboost) was on average 190 ± 87 cc. IMRT resulted in a significantly more conformal dose to the target volume than 3D-CRT. Heart dose was significantly lower when using IMRT. Mean lung dose and V20Gy were significantly lower for IMRT plans, at the expense of higher lung volumes receiving a low dose level (V5Gy). Despite small differences between the four IMRT techniques, the 7 beam PA arrangement was considered the most suitable configuration. Including an integrated boost using this technique resulted in a small but acceptable increase in heart and lung dose. Mean dose to the PTV was much larger and slightly less conformal, whereas conformity of the boost dose to PTVboost was excellent.

Conclusions: IMRT planning with an integrated boost for oesophageal cancer is feasible with a relatively simple and straightforward technique, and is capable of producing a conformal dose distribution with adequate heart and lung sparing.

OC-0349

DVM comparison of whole breast radiotherapy (WBRT) in prone and supine position.

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Purpose/Objective: To compare prone position (PP) with the standard supine position (SP) in women undergoing tangential fields WBRT after breast conserving surgery.

Materials and Methods: From September 2010 we simulated selected patients in the two positions according to volume of breast, mobility of patient and tolerance of the patient in PP. In SP deep inspiration breath hold was performed when treating the left breast. Ipsilateral breast PTV, heart and ipsilateral lung were contoured and the dose distribution was compared using dose-volume histograms (DVH). PTV receiving at least 90% of the prescription dose (V90%) was assessed in SP and PP. Statistical significance were calculated using the paired Student's t-test.

Results: from gantry 0° (AP) or 180° (PA), for 26 patients with oesophageal cancer. Prescription dose to the primary tumour and involved lymph nodes was 28×1.8Gy = 50.4Gy, applied as a planning objective to the PTV: V95%=95% (and V100%<2%). PTV margins were 1.5 cm. Constraints for organs at risk (OAR) were Vmean<50% for the heart, mean lung dose (Dmean) = 16Gy, and V20Gy<30% for lungs and both kidneys, whereas lung sparing was considered dominant over heart sparing. Dose distributions were compared regarding mean dose to the PTV, CI, conformity index (CI) of the 95% isodose, heart and lung dose, as well as the total number of objective or constraint violations encountered for each planning technique. Subsequently, the most suitable IMRT technique was applied to plan an integrated boost to the primary tumour of an additional 28×0.4Gy = 11.2Gy, without compromising the original OAR constraints. PTVboost margins around the primary tumour were 1 cm.

Results: Planning results are summarized in Table 1 (mean ± SD). PT...