Which technique is dosimetrically superior in the treatment of breastcancer: VMAT or Fixed Field IMRT

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Published version

MURPHY, S. and DRURY-SMITH, Heather (2016). Which technique is dosimetrically superior in the treatment of breastcancer: VMAT or Fixed Field IMRT. Radiotherapy and Oncology, 119 (Supp 1), S788-S789.

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guarantee a better sparing of normal tissue. Obtained index are aligned with reported results in analogous studies with Tomotherapy. Gammaknife perfexion seems to be the technique able to guarantee better results in term of CI. OARs sparing in case of no co-planar beam delivered by LINAC exhibit worse performance than modulated technique.

Conclusion: Treatment of brain metastasis with Tomotherapy showed encouraging results in term of dosimetric outcome. Lesion size and prescription strategies showed a statistically significant influence on dosimetric distribution. Clinical outcome with frameless immobilization has proven feasible, well tolerated and able to increase patient compliance as exclusive treatment of brain oligo-MTS.

EP-1687

Improving target dose homogeneity in intensity-modulated radiotherapy for sinonasal cancer

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Purpose or Objective: It is challenging to achieve homogeneous target dose distribution in intensity-modulated radiotherapy (IMRT) for sinonasal cancer (SNC). To overcome this difficulty, we proposed a base-dose-compensation (BDC) planning technique, in which the treatment plan is further optimized based on the original plan with half of the prescribed number of fractions and finally the number of fractions of treatment plan was restored from a half to the total.

Material and Methods: CT scan data of 13 patients were included. Generally acceptable original IMRT plans were created and further optimized individually by (1) the BDC technique and (2) a local-dose-control (LDC) planning technique, in which the original plan is further optimized by addressing hot and cold spots. We compared the target dose coverage, organ-at-risk (OAR) sparing, total planning time and monitor units (MUs) among the original, BDC, LDC IMRT plans and additionally generated volumetric modulated arc therapy (VMAT) plans.

Results: The BDC technique provided significantly superior dose homogeneity/conformity by 23%-48%/6%-9% compared with both the original and LDC IMRT plans, as well as reduced doses to the OARs by up to 18%, with acceptable MU numbers. Compared with VMAT, BDC IMRT yielded superior homogeneity, inferior conformity and comparable overall OAR sparing. The planning of BDC, LDC IMRT and VMAT required 30, 59 and 58 minutes on average, respectively.

Conclusion: The BDC planning technique can achieve significantly better dose distribution with shorter planning time in the IMRT for SNC.

EP-1688

Evaluation of automatic brain metastasis planning for multiple brain metastasis

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Purpose or Objective: Recently Automatic Brain Metastasis Planning (ABMP) Element [BrainLAB] was commercially released by BrainLAB. It covers multiple off-isocenter targets at a time inside a multi-leaf collimator field and enables stereotactic radiosurgery (SRS) / stereotactic radiotherapy (SRT) with a single group of lineac-based dynamic conformal multi-arc for multiple brain metastases. In this study, dose planning of ABMP (ABMP-single isocenter dynamic conformal arc [ABMP-SIDCA]) for stereotactic radiosurgery of small multiple brain metastasis was evaluated in comparison with those of conventional multi-isocenter DCA (iPlan [BrainLAB]-MIDCA) and Gamma Knife [Elekta] SRS (GKRS).

Material and Methods: Simulation planning was performed with ABMP-SIDCA and GKRS was made in a case of multiple small brain metastasis (9 tumors of 0.2 to 0.7 ml in volume) which were originally treated with iPlan-MIDCA. First, dosimetric comparison was done between ABMP-SIDCA and iPan-MIDCA in the setting with PTV (planned target volume) margin of 2mm and D95=95% dose (19 Gy). Second, dosimetry of GKRS was compared with that of ABMP-SIDCA with PTV margin of 0, 1mm, and 2mm, and D95=100% dose (20 Gy).

Results: First, CI (1/Paddick's CI) and GI (V[half of prescription dose] / V[prescription dose]) in ABMP-SIDCA (mean, 1.36 and 5,12) were compatible with those of iPlan-MIDCA (mean, 1.53 and 4.84). Second, PIV (prescription isodose volume) of GKRS (mean, 0.23 ml) was between that of no margin- and 1mm-margin ABMP-SIDCA (mean, 0.10 ml and 0.28 ml). Considering dose gradient, the same tendency was observed. The mean of V[half of prescription dose] of GKRS, no margin-, and 1 mm margin-ABMP-SIDCA were 0.87 ml, 0.60 ml, and 1.37 ml respectively.

Conclusion: The conformity and dose gradient with ABMP-SIDCA was as good as those of conventional MIDCA by each lesion. If the conditions permit minimal PTV margin (1mm or less), ABMP-SIDCA might provide excellent dose fall-off compatible with GKRS and enable a short treatment time.
The author has no COI. However this study was performed by use trial of ABMP Elements provided by BrainLAB (Tokyo).

EP-1689

Which technique is dosimetrically superior in the treatment of breastcancer: VMAT or Fixed Field IMRT

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Purpose or Objective: To determine in terms of target coverage and organ at risk (OAR) doses which concomitant boost technique is superior in the treatment of breast cancer; VMAT or fixed field IMRT.

Material and Methods: 30 previously treated breast patients (15 Left, 15 Right) were re-planned with both VMAT and fixed field concomitant IMRT techniques. A two dose prescription was used similar to previous planning studies (1-3) using the same dose constraints as per the IMPORT HIGH trial (1). 40Gy in 15 fractions was planned to the whole breast while boosting the tumour bed to 48Gy in 15 fractions. A base plan consisting of the existing forward planned tangent fields delivered approximately 38Gy to the whole breast while the tumour bed was boosted with approximately 10Gy using an inverse planned IMRT option. A single partial arc starting and finishing at the tangent angles formed the VMAT portion and the ff-IMRT trial used the 2 existing tangent beam angles followed by 3 further equally spaced beams. Target coverage, heart, ipsilateral lung, contralateral lung and contralateral breast dose was measured. A Two-tailed t-Test sample for means was used to compare the dosimetric differences between the techniques using excel software. Statistical significance was defined as P<0.05.

Results: Maximum dose D2% was statistically lower for VMAT; 103.2% vs. 103.7% for ff IMRT whereas minimum doses were equivalent. No differences were found with ipsilateral lung mean and V5Gy doses, contralateral breast mean dose, heart mean dose, heart V5Gy and V10Gy doses. VMAT demonstrated statistically lower V2Gy doses to the contralateral lung (0.7% vs.1.6%) and heart for both left (19.0%/22.6%), and right (5.5%/8.8%) sided patients respectively. Whereas ff-IMRT boasted significantly lower ipsilateral lung V20Gy, V18Gy and V10Gy doses (7.9/8.6/13.1 vs. 8.1/8.8/13.4%) with VMAT respectively

Conclusion: Despite both VMAT and ff-IMRT plans reaching statistical significance in a number of OAR and target parameters there is no clear superior option and whether the differences are clinically significant is a different question. Both techniques met all mandatory dose constraints and the majority of cases surpassed all optimal dose constraints demonstrating the high quality of the planning technique. The incorporation of deep inspiration breath hold (DIBH) ensured doses to the heart were exceptionally low; mean heart dose for left breast cases averaged 1.4Gy for both treatment options. As neither technique has proven superior, the significantly reduced treatment times associated with VMAT make this a more desirable option to implement clinically.

EP-1690

Conversion of the Tomotherapy plans to the IMRT plans for prostate patients with hip prosthesis

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Purpose or Objective: To evaluate the SharePlan software in conversion of helical tomotherapy (HT) to a step and shoot IMRT (sIMRT) for patients with high-risk prostate cancer and hip prosthesis.

Material and Methods: Analysis was performed for 16 consecutive patients treated on HT.

The HT plans were converted to sIMRT plans. 3DCRT, sliding window IMRT (dIMRT) and VMAT plans for a c-arm linear accelerator (CLA) were created manually.

The doses in planning target volume (PTV), bladder, rectum, bowels, femoral heads and hip prosthesis were compared using: (i) a qualitative analysis of doses in averaged dose-volume histograms, (ii) a quantitative, ranking procedure performed for each patient separately, and (iii) statistical testing based on the Friedman ANOVA and Nemenyi method.

Results: For the bladder, rectum, and femoral head, the best dose distributions were observed for HT and sIMRT and then for dIMRT, VMAT, and finally for 3DCRT (p-values were, respectively, 0.002, 0.004 and p=0.024). For the bowels, 3DCRT was significantly different from the rest of the techniques (p=0.009). For the hip prosthesis, the differences were only between 3DCRT and HT/sIMRT (p=0.038).

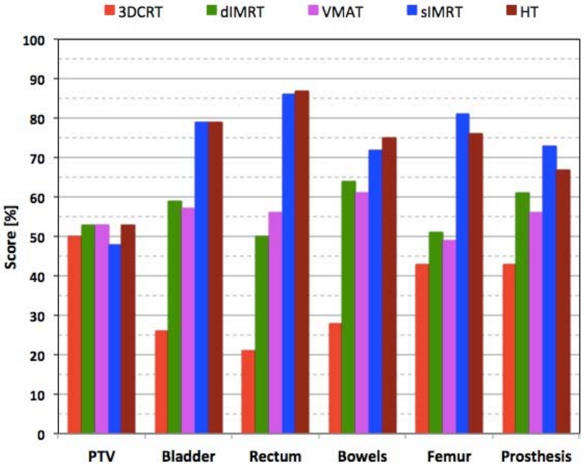
The first part of Table 1 shows mean doses and standard deviations computed from the average dose-volume histograms for planning target volume, hip prosthesis and organs at risk. The values presented in per cent and normalised up to the prescribed dose (46 Gy). The second part of Table 1 shows the statistical testing of the differences between dose distributions in these structures. The results of the Friedman ANOVA testing noted as the p-value. Results of the Nemenyi analysis presented as the groups (A, B, C). Statistical testing performed on the 0.05 significance level.

Technique	PTV	Bladder	Rectum	Bowels	Femur	Prosthesis
	Mean Dose (SD) [%]					
3DCRT	100.6 (0.5)	96.1 (2.3)	87.0 (6.1)	58.9 (42.2)	46.4 (16.7)	37.2 (10.7)
dIMRT	100.2 (0.4)	81.4 (14.5)	84.7 (12.4)	31.8 (19.8)	43.4 (12.3)	28.4 (8.7)
VMAT	100.8 (1.0)	82.2 (17.5)	82.7 (16.2)	32.5 (20.3)	45.1 (18.4)	31.4 (9.9)
sIMRT	100.7 (0.6)	63.3 (13.4)	59.1 (12.7)	26.4 (16.3)	30.3 (12.2)	22.9 (9.7)
HT	100.9 (0.6)	63.9 (13.7)	57.7 (10.4)	27.4 (14.6)	32.9 (13.2)	23.3 (9.8)
Technique	Similarity/Dissimilarity of the results					
	p = 0.881	p = 0.002	p = 0.004	p = 0.009	p = 0.024	p = 0.038
3DCRT	A	A	A	A	A	A
dIMRT	A	B	B	B	A	A B
VMAT	A	B	B	B	A	A B
sIMRT	A	C	C	B	B	B
HT	A	C	C	B	B	B

SD - standard deviation

Despite the greater scoring in the ranking procedure, HT/sIMRT did not differ statistically from dIMRT/VMAT. The scores were, respectively, 75% and 72% to 61% and 64%.

Figure 1 shows the ranking procedure for the dose distributions obtained in the planning target volume, hip prosthesis and organs at risk for: helical tomotherapy (HT, brown bars), plans converted on the SharePlan station (sIMRT, blue bars) and plans prepared manually for C-arm linear accelerators (3DCRT - red bars, dIMRT - green bars and VMAT - purple bars).



Conclusion: The SharePlan is an efficient tool for the conversion of HT plans for patients with prostate cancer and hip prosthesis. Dose distributions in sIMRT and in HT plans are similar and are generally better than in CLA plans.

EP-1691

A planning approach for lens sparing proton craniospinal irradiation in pediatric patients

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Purpose or Objective: Several reports support the potential benefits of proton therapy (PT) when compared to photon techniques in craniospinal irradiation (CSI) to reduce late toxicity and risk of secondary malignancies. PT is increasingly regarded as the gold standard for CSI, particularly in pediatric patients. Nevertheless, lens sparing with good coverage of the cribriform plate remains a challenge, especially in very young patients, as the lens dose increases significantly with decreasing age (Cochran et al, Int JRadiat Oncol Biol Phys 2008;70:1336-42). The technique and the beam arrangement used at our center for lens sparing in the treatment of the whole brain for our first 6 y.o. male patient, is described and compared with data reported in other studies.

Material and Methods: CSI is delivered by active scanning PT with three isocenters, using three cranial beams plus two additional postero-anterior spinal beams. Cranial and caudal field junctions are planned by the ancillary-beam technique (Farace et al, Acta Oncol 2015; 54:1075-8). The three-beams arrangement for brain irradiation includes two lateral opposed beams (gantry angle 90° and 270°), with couch angle ±15° to minimize the overlap between the cribriform plate and the lens, and an additional posterior beam. Single-field-optimization of the three equally-weighted beams is performed. A total dose of 36 Gy in 20 fractions is prescribed following international radiation guidelines for high risk medulloblastoma. During optimization, coverage of the cribriform plate is assumed as the priority goal and lens sparing as a secondary objective. Our technique is compared with two more conventional approaches: i) two opposed-lateral beams and ii) two angled (±20°) posterior-oblique beams.

Results: In figure A and B the dose distribution obtained by the lens-sparing technique on two slices at the level of the cribriform plate and of the lenses are shown. The coverage of the cribriform plate is similar in all beam arrangements. In Figure C, the dose volume histogram for the three beams' arrangement is shown. Adequate target coverage is obtained by all beam arrangements. In addition, the lens-sparing technique allowed to markedly decrease the dose to the