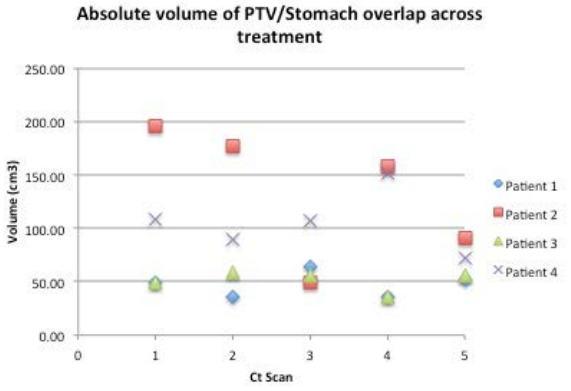

Conclusion: This study has shown that the position and volume of the stomach of a patient over the course of treatment is highly variable. In order to minimise the risk of toxicity of the stomach during treatment using high dose regimes (>50Gy) a stomach filling protocol may be required. Further work with a larger patient dataset is ongoing and the feasibility of stomach filling protocols will be explored.
Normal 0 false false false EN-GB JA X-NONE

EP-1795

Evaluation of CBCT protocols in craniospinal RT for pediatric medulloblastoma: a preliminary study

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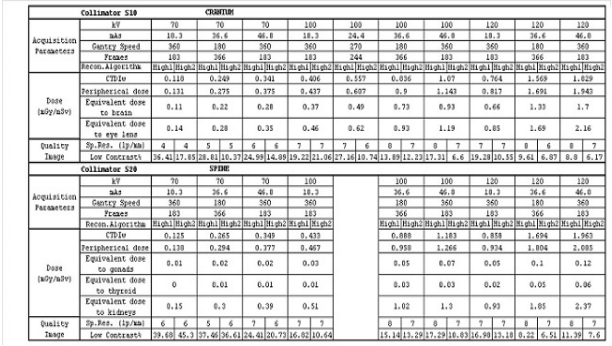
Purpose or Objective: The use of IGRT technologies, such as cone beam CT, improves treatment delivery accuracy: given that reduction of radiation dose is particularly relevant in pediatrics, an ideal IGRT method would minimize dose while enabling adequate visualization of relevant anatomy for target localization. However, setup accuracy parameters and predictors have not been extensively evaluated. We describe the preliminary results of a prospective evaluation of a low-dose CBCT protocol for IGRT in pediatric craniospinal radiation therapy.

Material and Methods: Various low-dose CBCT protocols with CTDI of 0.1-2 mGy/scan were prepared, and patient and IGRT characteristics were recorded in real-time. Different reconstruction algorithms were used to optimize cone beam images and registrations. Setup accuracy was quantified by hexapod table translations and rotations (6 dof) between planning CT vs daily CBCT acquisition. The shift vector magnitudes in polar coordinates were calculated. Descriptive statistics were performed (t-test). All these evaluations were made for craniospinal and for posterior fossa irradiation.

Results: Table 1 shows the parameters values (dose and image quality) of the examined protocols. Taking into account to the results, clinical protocols were defined for the three target volumes considered. Two patients (180cGy/13frs CSI + 180cGy/17frs post fossa) were studied with 30 daily pre-treatment CBCT. For the first patient, early phase of radiation therapy was delivered with anaesthesia. In CSI treatment, where junctions between beams are critical, only translations movements were considered. In cranial isocenter localization mean table shifts were 5.84 ± 0.98 mm (fast low dose,A) and 3.84 ± 3.21 mm (fast low dose) 3.6 ± 1.99 mm (fast high dose), with and without anaesthesia respectively; in the spinal setup evaluation mean table shift was 7.3 ± 2.1 mm (fast low dose,A) and 8.7 ± 0.2 mm (fast low dose), 6.8 ± 0.2 mm (fast high dose). Difference between setup accuracy according to patient's cooperation, with and without anaesthesia, is statistically relevant ($p<0.05$) for cranial localisation and not for the spine localisation and the statistical significance persists considering also the overall treatment. On the other hand difference between setup accuracy according to patient dose does not show statistical difference.



Conclusion: CBCT-derived table shifts for investigations with LD-CBCT and with HD-CBCT were statistically similar, suggesting that for pediatric radiation therapy setup evaluation can be safely performed with lower-dose IGRT. Moreover, these data support implementation of a LD-CBCT protocol also in pediatric hyperfractionated accelerated radiotherapy.

EP-1796

Definition of thresholds to detect anatomy changes using Delivery Analysis software for Tomotherapy.

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Purpose or Objective:
To determine the analysis parameters for quantitative assessment of the dosimetric impact of differences between the measured and calculated MVCT detectors sinograms. This difference is directly related to patient positioning and/or anatomical changes.

Material and Methods: Tomotherapy HD v5.0 associated to Delivery Analysis (DA) software (beta version) has been used for patient treatments. Consistency of MLC functioning is assessed by comparing opening-closing time measured by detectors versus calculated during planning. The quality assurance of the device validates its functioning. Detector response stability is continuously monitored (sd/mean<0.05%). DA software analyzes the difference of the detectors sinogram between a reference fraction and the fraction of the day, its influence is measured through the patient. The specific differences to a patient will therefore depend on its positioning and/or anatomical variations. From the analysis of each treatment session, alert thresholds will be defined.

Results: Considering margins used and expected dose accuracy, parameters of 2mm (DTA) and 3% (dose) were used associated to a threshold of 99% for gamma index analysis. We use them as a baseline to verify detectability on various treatments. With this level of detectability, the presence of gas in pelvic localizations, a loss of weight linked to a variation of 5mm thickness is detected. In the context of lung tumors, a reduction in tumor volume (associated with lung density change) is detected. The interpretation of these differences is not easy because of the movement of such gases, we have then added a condition for further analysis: three consecutive fractions not meeting the criterion result in a complete analysis or 15% of non consecutive fractions (conventional fractionation). A less than 95% result is immediately analyzed to determine visually on the MVCT scanner the reason : if it is weight loss, a new planning is realized.

Conclusion: Two strong points should be noted: a color code is associated to analysis results (red/green : fail/pass) and permits a relevant and fast systematic analysis. This information also applies to non-imaged areas, such as for medulloblastoma: although the MVCT is not acquired over the

entire treated length, it is possible to determine their spatial localizations. Thus, it is possible to adapt the scan lengths. On the other hand, to provide education, therapists can easily see the impact of their choices, eg set-up compromises.

EP-1797

Pelvic lymph node PTV margins in prostate IMRT

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Purpose or Objective: Very few data are available on the intrapelvic motion of pelvic lymph nodes (LN), likely associated with the linked pelvic vessels. The objectives of the study were to quantify the interfraction pelvic vessel motion and to deduce therefore rational PTV margins around the LN CTV, in a scenario of pelvic bone based prostate IGRT.

Material and Methods: The planning CT scans (CT0) and 7 per-treatment weekly CT scans of 20 patients having received IMRT for prostate cancer were used. The main pelvic vessels were manually delineated: common iliac (CI), external iliac (EI) and internal iliac (II) of both sides. The central lines of the vessels were first defined thanks to a 3D workstation (EndoSize®, Therenva) dedicated to the preoperative sizing before endovascular interventions. A pelvic bone registration was then performed. For a given vascular segment, the distance between its central line CL0 from CT0 and its central line CLi from the weekly CTs were calculated.The central line CL0 of each vascular segment was sampled every mm. The distance corresponded to the mean value of the distances between corresponding points of the two central lines (CL0 and CLi). The correspondance was established by considering the cross-section plane othogonal to CL0 at a given point and its intersection with CLi. For each patient, the mean and the standard deviation (SD) of the measurements of the 7 fractions were determined. The systematic error (Σ) of the whole population was calculated as the SD of the mean values. The random error (σ) of the whole population was calculated as the root mean square of the standard deviation values. The margins were calculated both with M. Van Herk formula (*IJROBP* 2000) and by geometrically computing margins covering 99% of the vessels displacements.

Results: The results are given for the first 10 patients. The mean (range) lengths (in mm) for IC, EI and II were 47 (18-84), 95 (78-120) and 38 (20-55), respectively. The systematic and random errors and the corresponding margins are given in the Table.

		Common Iliac	External Iliac	Internal Iliac
Ant/post	Systematic Error (Σ)	1.3	0.9	1.0
	Random Error (σ)	1.2	0.8	0.7
	Van Herk Margins	4.1	2.8	3.1
	99% Margins	5.1	4.3	4.6
Lateral	Systematic Error (Σ)	0.8	0.5	0.9
	Random Error (σ)	0.7	0.6	1.0
	Van Herk Margins	2.6	1.8	2.9
	99% Margins	3.6	2.7	4.0
Sup/Inf	Systematic Error (Σ)	0.7	0.7	1.7
	Random Error (σ)	0.7	0.7	1.6
	Van Herk Margins	2.2	2.3	5.2
	99% Margins	2.5	2.9	5.1

Table: Vessels displacements (systematic and random errors) and corresponding PTV margins (according to Van Herk formula and covering 99% of the displacements) around the LN CTV (in mm)

Conclusion: Pelvic LN PTV margins should be around 5 mm for the common and internal iliac CTV and 4 mm for the external iliac CTV.

EP-1798

Is there a true dosimetric improvement in lung SBRT using a 6-Degree of Freedom couch in IGRT era?

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Purpose or Objective: To investigate dosimetric impact of rotational errors on Stereotactic Body Radiation Therapy(SBRT),using Protura 6-Degree of Freedom(6-DoF)Robotic Patient Positioning System(CIVCO Medical Solution).

Material and Methods: Patients enrollment included:lung primary or metastatic tumors,maximum 3 lesions,preferably not in central position and until 5 cm.The target should be clearly evident at staging imaging.PTV was obtained adding 0.3 cm as margins to target(CTV).A kV-Cone Beam CT(kV-CBCT)was acquired before dose delivery.After 3D manual match,translational and rotational shifts were applied by the Protura Couch.Using MIM 5.5.2 software,a CT was generated by rigid registration in the CBCT wrong position,i.e. patient position at the moment of CBCT.Then,translational shifts were applied,obtaining a translated CT(tCT),i.e. CT in wrong position with only translational errors correction.Then,rotational errors were corrected too,obtaining roto-translated CT(rtCT).Initial treatment plan was copied to translated CT(tTP)and roto-translated CT(rtTP).Finally, dosimetric parameters were compared.

Results: From July to September 2015,13 patients were enrolled(10 with primary tumours and 3 with metastatic lesions;9 peripheral and 4 central lesions;mean volume 13,26 cc)with a median age of 74 yrs(range 58-86);52 CBCT studies,52 tTP and 52 rtTP were performed.No correlation was observed between magnitude of translational and rotational shifts.Dosimetric evaluation showed no important variations in CTV V95% for rotations(mean±SD 0.00±0.05).Ninety-one percent (91%)of all PTV V95% was≥ 95% in roto-translated plans;in the worst case a mean rotation of -0.3° caused a decreasing in V95%=93%.Small differences due to rotations were found in all Organs at Risk(OAR)matrices reported in Table 1.

	Spinal Cord Dmax (Gy)	Heart Dmax (Gy)	Esophagus Dmax (Gy)	Total Lung V(%) 20	Total Lung V(%) 12.5	Total Lung V(%)5
MEAN	0,0	0,0	0,0	0,0	0,0	0,0
SD	0,3	0,8	0,2	0,0	0,0	0,2
MAX	0,8	4,2	0,5	0,1	0,1	0,4
MIN	-0,8	-3,0	-0,3	-0,1	-0,1	-0,6

After rotational corrections,an improvement was observed in constraints values for OARs than reference planning dose(Table 2),although only 3% of all data had an improvement>5%.

Spinal Cord Dmax (Gy)	Heart Dmax (Gy)	Esophagus Dmax (Gy)	Total Lung V(%) 20	Total Lung V(%) 12.5	Total Lung V(%)5
37,8%	31,1%	28,9%	48,9%	57,8%	42,2%

Multiple regression and pairwise confront(post-hoc test)showed significative linear correlations between esophagus Dmax and roll(p=0.007) and pitch(p=0.020)rotation,total lung V12.5 and yaw(p=0.048).Regarding PTV coverage,V95% and V105%,no significant difference between tTP and rtTP was observed(Mann-Whitney test p>0.05).

Conclusion: These preliminary data show an improvement for OARs if rotational shifts are applied.Dosimetric benefits on lung tumours are small that is PTV margins are optimal for all shifts detected.Dosimetric evaluation in other sites is ongoing.