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Introduction. Helical Tomotherapy (HT) is a modality for delivering intensity modulated radiation therapy (IMRT) treatments using a rotating linear accelerator mounted on a continuously moving slip ring gantry in synchrony with the couch motion. HT allows performing stereotactic radiotherapy treatments without fiducial markers due to its 3D imaged guided system. Lung SRBT treatments has been selected as a routine treatment in our facility. Effects of respiratory motion are reduced using an abdominal compression paddle to restrict tumor motion and normal tissue irradiation. Moreover, HT achieves very homogeneous dose distributions, leading to local tumor control and survival results comparable to surgery. These IMRT treatments require patient-specific verification previous to the irradiation, as routine in other IMRT modalities.
Purpose. The aim of this work is to describe the quality assurance (QA) protocol for the verification of lung SBRT treatments performed on HT.
Materials and methods. Prescription doses to PTV were between 45 and 60 Gy on 3 fractions. Treatment plans were recalculated using a solid water cylindrical phantom (Tomophantom) that allows simultaneous measurements with Exradin A1SL cylindrical ionization chamber (i.c.) in 29 different positions as well as radiochromic EBT2 film irradiation, usually located in a coronal plane. Dose measurements were compared to values from the HT treatment planning system (TPS). Film analysis was performed with OmniProm I'mRT software and gamma pass rate was evaluated.
Results. Dose differences between TPS calculations and i.c. measurements were mostly within +3%, with −0.7% mean value, ranged from −3% to 2%. Gamma analysis evaluation showed an agreement superior to 97% (95-100) for 3%,3 mm criterium.
Conclusions. The QA protocol proved to be an effective method for verification of lung SBRT treatments. Results showed good agreement between calculated dose from TPS and measurements with i.c. and film.

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Positioning protocol image guided for radiotheraphy

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Objective. To show the procedure we apply for our radiotheraphy treatments.
Material and methods. Linear accelerator ARTISTE SIEMENS. We check during the first three days the patient position relative to the treatment beams. We have determined by means of portal image or cone bean. We collect the movement X, Y, Z and the absolute vertical position of the couch in a database. We calculate on the fourth day the average of the three days and modify the initial SETUP. If with this corrected SETUP on the fourth day, no correction is necessary, we apply it for the rest of the treatment and do weekly checks. If on the fourth day, a correction is required, we repeat on the fifth and sixth day and on the seventh day we calculate the average and apply. If the application of the average does not need any correction we apply this average for the rest of the treatment. We have a weekly control check. If the average needs correction, we consider the patient unstable, and we will do portal image or cone bean, daily.
Results. 1. ORTHOGONAL PORTAL IMAGE, 3 initials + week: Breast, palliative: – 10 sessions 2. CONE BEAN 3 initials + week: Lung, otolaryngologist, Rectum, Cerebral, Lymph, Stomach, Pancreas, Esophagus 3. ORTHOGONAL PORTAL IMAGE + 1 week: Cranial irradiation 4. DAILY PORTAL IMAGE: Palliative care: 5 sessions 5. DAILY CONE BEAN: Prostate.
Conclusions. We collect in a database the necessary information that we use for a good daily positioning, minimizing an error that we could apply to the positioning of a patient every day.

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Rapid Arc vs IMRT of prostate plans: A dosimetric comparison

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Introduction. The arrival of Rapid Arc (RA) technique has gradually replaced IMRT treatments at our unit.
Objectives. To evaluate the dosimetric outcomes of prostate treatment plans and the possibility of reduction of peripheral dose and treatment delivery time.
Material. Ten cases are planned to target a prescription dose of 78 Gy of mean dose in PTV and D95 > 95%, in 2 Gy/fraction, for a 5 field IMRT (G265°, G312°, G0°, G47° and G95°) and two full Rapid arcs, delivered with Varian Clinac iX, for a beam energy of 6 MV and a maximum dose rate of 600 MU/min. The CBCT performance allows the acquisition of KV images for positioning and evaluation of changes in bladder and rectum size. Treatment planning system used is Varian Eclipse 8.9.17 with inverse

optimization algorithm PRO-II and AAA absorbed dose calculation algorithm. Dosimetric verification is mostly performed with ArcCheck (Sun Nuclear Corp.), a cylindrical detector array.
Methods. Several parameters are analysed in the obtained data set: total MU, treatment time and usual OAR limits values (Quantec) are compared in key risk organs: rectum, bladder and femoral heads.
Results and conclusions. Neither the treatment time nor the values obtained for bladder and rectum (V50, V60, V65, V70, V80 and mean dose) show statistically significant differences. Nevertheless, we do find them in D1cm3 femoral heads: 27 ± 3.9 Gy for RA vs. IMRT 36.8 ± 4.02 Gy, D50% body: 520 ± 155 cm^3 for RA y 924 ± 311 cm^3 in IMRT and total MU: RA 553 ± 30 vs. IMRT 824 ± 70. RA plans get better sparing dose values to D1 cm^3 femoral heads and an assessable peripheral dose and total MU reduction.

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Total body irradiation (TBI) 3-D treatment planning

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Introduction. TBI is often used in conditioning regimens prior to bone marrow transplantation.
Aim. We describe a 15 MV photon beam irradiation technique with customized lungs shields.
Methods. A total dose of 10 Gy in 5 fractions on 3 consecutive days, with a gap of at least 6 h between fractions, will be delivered to the patient. The prescribed dose to the lungs is reduced to 8 Gy. The patient undergoes one torax CT scan (3 mm slice thickness) to determine the lung shields and a whole body CT scan (1 cm slice thickness), which will be used to calculate the dose distribution. In our institution it has been established a two parallel opposed beams (AP/PA) treatment technique at extended SSD distance (4 m), applied in different fractions (the patient lying on his side and switching position). Treatment fields are centered at the height of the pelvis. The reference point for dose specification is defined at mid-pelvis. Lungs are shielded during the PA irradiation. 3-D treatment planning is performed using XiO Treatment Planning System (ELEKTA). A TBI-specific 15 MV photon beam machine has been commissioned for this purpose. The dose calculation algorithm is superposition. During the treatment delivery, in-vivo dosimetry (OmniPro-InViDos) is performed to obtain an online dose verification. Six or more detectors are attached to the patient's body surface at dose-relevant points (head, lungs and pelvis). Mid-point doses are computed based on the entrance and exit doses.
Results. There is a good agreement between the planned dose and the mid-point doses obtained from the in-vivo measurements.
Conclusions. 3-D-TBI-planning guarantees a sufficiently homogeneous dose in the target volume under optimal sparing of the lungs. A whole body dose distribution can be obtained, which allows more precise dose adjustments during the planning process.

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Variation and reproducibility of SUV for use in radiotherapy contouring with PET/CT

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Objectives. The Standardized Uptake Value (SUV) is a useful tool to aid in the contouring in radiotherapy. Usually a SUV value of 2.5 or the 40% of the maximum value of SUV is used as background to contouring the lesion in the PET images. The SUV value depends on various physical and biological effects. The aim of this work is to test the reproducibility of the different modes of SUV calculation, its dependence with noise, reconstruction algorithm and concentration, to determine the most optimal parameter.
Materials and methods. We use a NEMA chest phantom with F-18 containing 6 spheres of volumes between 0.5 and 26.5 ml, with an initial background concentration of 0.5 uCi/ml. The lesion-to-background ratio was 1/10. Acquisitions were taken on a PET-CT Philips Gemini TF every two hours to see the change in SUV with noise and concentration. Studies were reconstructed using different algorithms and different bed times.
Results. SUVmax and SUVpeak depend on noise and reconstruction algorithm, with differences up to 20%. The SUVmean depends on selected volume with a variation of up to 15%. The SUVmedian shows less dependence on the selected volume, varying less than 1.5%. Also its dependence on noise and reconstruction algorithm is much lower than that of SUVmax. Variations of up to 30% in SUVmax are present due to dead time effects in higher dose concentrations.
Conclusions. Is important to choose the most stable and reproducible SUV calculation in order to minimize the effects of its possible variations. According to this study, the value that best meets these requirements is the SUVmedian.

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