moving. We converted angular velocity, which was acquired from gyroscope sensor, angle and compared with real motion. **Results:** The uncertainty of the signal from the gyroscope sensor was measured about 5% in an amplitude and period for each interval. The signal from the respiratory monitoring system was well matched with the real motion of moving phantom. **Conclusions:** We found the possibility of the respiratory monitoring system using the gyroscope sensor for the respiratory gated radiotherapy. So we plan to complement the respiratory monitoring system by combining gyroscope sensor with acceleration sensor which have been studied by authors for the respiratory monitoring system and apply to patients to train respiratory motion for increasing the accuracy of radiotherapy.

**EP-1668**

The efficiency of detection of GoldAnchor markers implanted in liver in patients irradiated using CKô system

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**Purpose/Objective:** The intension of use of fiducial markers is the easier location of the target volume and precise positioning of the patient during irradiation. The precise location of the tumor and thus, better protection of the healthy tissue allows delivery of higher doses of radiation without increasing the risk of side effects. **Materials and Methods:** The analysis was performed in the group of 36 patients (20 men, 16 women), aged from 45 to 62, diagnosed with metastases cancer to the liver. The patients were treated from November 2010 to July 2014. The patients had implanted 3 (thirty-two patients) or 4 (four patients) markers implanted in the liver. **Results:** In 3 patients (8%) who implanted three gold markers, the system detected one marker in each fraction. In 15 patients (42%) who implanted three gold markers, the system detected all markers in all fractions. In 14 patients (39%) who implanted three and 4 patients (11%) with implanted four gold markers, the system located two markers. To summarize of the total number of 112 markers implanted in 36 patients the CyberKnife system has correctly located the position of 74 markers (66%). In 51%, 41% and 8% of cases the CyberKnife system detected 2, 3 or 1 marker. There wasn’t a case where the system is not detected any marker. **Conclusions:** The analysis showed that the detection of gold markers in different fractions of radiotherapy in the same patient appears to be repeatable. Therefore, gold markers seem to be an effective tool for the precise location of the position of the irradiated volume during the treatment.

**EP-1669**

Analysis of the differences in bone- and soft tissue registration for stereotactic lung radiotherapy

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**Purpose/Objective:** In-room image guidance equipment makes it possible to acquire pre-treatment volumetric images with the patient in the treatment position. The image quality on the 3D lung scans visualizes not only the bony structures, but also provides adequate visualization of the tumour volume. The objective of this study is to investigate the possible advantages of tumour registrations compared to bone registration by analyzing the differences in tumour- and bone registration in kV-CBCT for stereotactic lung radiotherapy (relative shifts). **Materials and Methods:**

30 patients were included in this project. At treatment planning the patients were immobilized in the supine position, and underwent both deep expiration CT scan for treatment planning and 4D CT scan for target volume delineation. The ITV was defined as the tumour visualized on the Maximum Intensity Projected (MIP) reconstructed 4D CT images co-registered with the planning CT. Before treatment, patients were aligned according to skin marks followed by a CBCT acquisition and registration. The CBCT registration to the planning CT was performed in two steps; first the CBCTs were automatically registered to the bony structures in the spine. Secondly and finally, alignment was performed on the basis of soft tissue registration to the ITV (Figure 1a). A total number of 128 CBCTs were analysed and the difference between the bone- and soft tissue registrations were calculated. **Results:** Figure 1a) displays the frequency histogram of the relative shifts in the anterior-posterior (AP), superior - inferior (SI) and left-right (LR) directions. The difference between bone- and soft tissue registrations were largest for
shifts in AP and SI directions, both with the largest shift of ±1.2 cm, while the corresponding result for the relative shifts in the LR directions were +0.5 cm (Figure 1b). The number of shifts ± 0.3 cm was 31%, 28% and 12% in the AP, SI and LR directions respectively. The systematic (ξ) error based on the difference between the bony and soft tissue registration were 0.4 cm, 0.3 cm and 0.2 cm in the AP, SI and LR directions respectively. The corresponding random (σ) errors were 0.2 cm (AP), 0.2 cm (SI) and 0.1 cm (LR). Using bony structures as surrogate for the tumour (ITV) requires an AP margin of 1.1 cm, SI margin of 0.9 cm and LR margin of 0.5 cm (Table I), calculated according to the Van Herk formula (Seminars in Radiation and Oncology, 2004).

Conclusions: Large differences between bony and soft tissue registrations were revealed, and the use of bony structures as a surrogate for the tumour would result in a setup margin of 1.1 cm, 0.9 cm and 0.5 cm in AP, SI and LR directions, respectively. We concluded that the bony structures in the spine seem to be inappropriate as a surrogate for the tumour in lung stereotactic radiotherapy treatments.

EP-1670
Does the use of an endorectal balloon stabilise the rectum for patients receiving prostate radiotherapy?
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Purpose/Objective: In prostate external beam radiotherapy (EBRT), rectal distension and motion can affect the position of the prostate due to the close anatomical relationship. The greatest extent of motion is generally seen in the anterior/posterior plane and is strongly correlated with rectal filling. This is of particular relevance as the majority of tumour foci are found at the posterior of the prostate gland. The aim of this study is to establish if the use of an endorectal balloon (ERB) (QLRAD Rectal Pro 75) during radical EBRT stabilises the rectum compared to no bowel intervention.

Materials and Methods: Six patients were recruited into a local feasibility study. Patients received standard radical EBRT (60 Gy in 20 fractions) using volumetric modulated arc therapy (VMAT) with routine on-treatment cone beam CT (CBCT) imaging. No bowel preparation was given. Alongside routine practice, the patient had an ERB inserted at the initial planning scan then once per week immediately after treatment delivery. The ERB was not in-situ during EBRT.

Study images were obtained at the initial planning scan (1 CT image with and without ERB), and once per week during the treatment course (4 CBCTs with and without ERB). This allowed the patient to act as their own control to enable comparison of rectal stability with or without an ERB in-situ. All scans were exported to the Pinnacle (version 9.6) treatment planning system. For non-ERB images the rectum was outlined from 1 cm inferior to 1 cm superior to the planning target volume. For ERB images the balloon was outlined. Conformity of outlined volumes between the initial planning scan and the CBCT scans was assessed using the Dice similarity coefficient (DSC: 1=unity, 0=no overlap of volumes). Centroid shift (geometric centre of mass) was calculated to assess gross volume movement.

Results: The DSC values (mean ± standard deviation) for ERB and non-ERB volume comparisons were 0.84±0.06 and 0.67±0.07 respectively, and centroid shifts (mean ± standard deviation) were 0.57±0.27 cm and 0.62±0.34 cm respectively. Centroid shifts in the individual A/P, R/L and S/I planes are shown in the table. Centroid shifts in the individual A/P, R/L and S/I planes are close to the limiting spatial resolution of the images (planning: 1x1x2.5 mm; CBCT: 1x1x1 mm).

Conclusions: DSC results suggest that the use of an ERB helps to stabilise the shape of the rectum during prostate EBRT. However, the use of an ERB did not improve the positioning of the rectum, since the centroid shifts from the initial planning scan to the CBCT images were already small whether an ERB was in-situ or not. The main limitations of the study are the small number of patients involved, and the use of different regions as metrics in the ERB (balloon) and non-ERB (rectum) images.

EP-1671
Accuracy evaluation of the Optical Surface Monitoring System on EDGE linear accelerator for patient positioning
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Purpose/Objective: Frameless stereotactic radiosurgery (SRS) requires dedicated systems to monitor the patient position during the treatment to avoid target under-dosage due to involuntary shift. The new EDGE linear accelerator