Conclusion: The differences between the intra-fracture patient displacements observed through CTV overlapping using CBCTs and through the surface markers registration seem to be clinically acceptable for the PTV considered. The relatively greater spread using markers is probably due to the larger portion of patient’s surface covered by the OARs compared to the CTV region. Considering the adopted PTV margin, the non-invasive OAR could be therefore used to monitor the intra-fracture movements as alternative to a post treatment CBCT, possibly using markers positioned in a restricted area around the target.

EP-1758
Centro Diagnostico Italiano, Cyberknife, Milano, Italy

Purpose or Objective: SBRT is now an accepted treatment for inoperable pts with stage I lung cancer and oligometastatic disease. Particularly for SBRT, tumor motion must be taken into consideration due to high dose per fraction. It is unclear which system provides the best accuracy for target localization. The aim of this study is to evaluate the role of lung optimization treatment (LOT) simulation for the best tumor tracking using Cyberknife SBRT.

Material and Methods: From September 2014 to July 2015 we evaluated 143 consecutive pts referred to our department for tracking modality. For everyone a CT scan was performed in inspiratory and expiratory phase. During the simulation the position and setup were the same as those during the treatment. The real-time images were compared to the DRRs where the target was evidenced. Cyberknife includes a small 6 MV LINAC mounted on a robotic arm, two diagnostic X-ray sources (installed in the ceiling of the treatment room) attached to digital image collectors, placed orthogonally to the patient to provide real-time treatment guidance, and a table remotely controlled that can move around different axes and adjust the patient position.

Results: According to the accuracy of the LOT system in target identification we observed these solutions: we treated 102 pts (71%) with Xsight lung technique, 80 pts in 2-view modality in which only one camera was used. Xsight lung along with Synchrony Respiratory Tracking can automatically track and adjust the beam to tumor motion, using the lesion as a fiducial. The CTVs were expanded by 3 mm in all directions to create the CTVs. Cyberknife includes a small 6 MV LINAC mounted on a robotic arm, two diagnostic X-ray sources (installed in the ceiling of the treatment room) attached to digital image collectors, placed orthogonally to the patient to provide real-time treatment guidance, and a table remotely controlled that can move around different axes and adjust the patient position.

Conclusion: LOT simulation system is a very effective, useful and non-invasive technique. Dramatically reducing PTV margins and consequently the risk of potential toxicities related to the high doses, LOT simulation system and Xsight lung are considered the best choice in the management of lung lesions in our clinical practice.

EP-1759
Treatment of moving targets with active scanning carbon ion beams

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Purpose or Objective: We report the preliminary clinical results organ motion mitigation strategies in the treatment of moving target with active scanned carbon ion beams.

Material and Methods: Since September 2014 26 patients with tumors located in the upper abdomen and chest were treated with active scanned carbon ion beams. Patients were affected by pancreatic adenocarcinoma, HCC, biliary tract cancers and sarcoma of the spine retroperitoneum and heart. Tight thermoplastic mask was selected as the optimal abdominal compression device. 4D CT scan with retrospective reconstruction, with phase signal obtained with Anzai system (Anzai Medical Co., LTD), was employed for planning. Automatic assignment of raw data to respiratory phases was checked and, if necessary, modified by the medical physicist. Planning was performed using end expiration phase. Planning CT scans were visually checked for motion artifacts. Contouring was performed on end expiration phase and on the adjacent 30% expiration and 30% inspiration phases. Beam entrance was selected in order to avoid the bowel in the entrance channel. The lung diaphragm interface was contoured in the different respiratory phases and beam angles were chosen to avoid passing tangential to the lung diaphragm ITV. IMPT was used for plan optimization. Plans were recalculated in adjacent phases and if DVHs were degraded in an unacceptable way they were modified iteratively. Weekly verification 4D CT scans were performed and, if needed, a new plan was re-optimized adaptively. Set up was verified with gated orthogonal X rays and non-gated cone beam CT in treatment room. Threshold for gate-on signal was initially set at 10% pressure signal dynamic and qualitatively adjusted in an asymmetric way according to results of plan recalculation in 30% expiration and inspiration. Gating signal was fed to the accelerator to enable beam delivery. Each slice was re-scanned 5 times to smears out possible interplay effects. Acute and early toxicity was scored according to CTCAE 4.0 scale.

Results: GTV and diaphragm excursion between end expiration and adjacent 30% phases was reduced to less than 5 mm. GTV (95%) and critical OARs (D1%) DVH in 30% inspiration and expiration phases showed on average minimal (less than 1%) differences as compared to planning end expiration plan. Toxicity was minimal with no G3 event. G2 toxicity was observed in 15% of the patient during treatment and in 10% of the patients at 3 months. Median follow up was rather short (3 months) nevertheless in 23 patients the dose limiting OAR was either stomach or small bowel or esophagus, therefore early toxicity data are informative.

Conclusion: Active scanning with carbon ion beams for the treatment of moving target using abdominal compression, 4D simulation, robust planning, gating and rescanning is feasible and safe. Longer follow up is needed to evaluate oncological outcome.

EP-1760
Correlation and directional stability of principal component of respiratory motion in the lung
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Purpose or Objective: To evaluate the role of lung optimization treatment (LOT) simulation in the treatment of moving target with active scanned carbon ion beams.