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Radiosurgery and REF

Frameless image-guided intracranial stereotactic radiosurgery

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Introduction. Stereotactic radiosurgery is a well established technique for the treatment of both benign and malignant lesions of the brain. Radiosurgery was first described and implemented by Leksell. Classically the requirement for localization and immobilization of the targeted lesion demanded the use of a rigid, invasive stereotactic head frame. In the last years, technological advances lead us to achieve a less invasive technique. We describe the technique that we use in the treatment of the lesion in the brain with BrainLab Novalis linear accelerator with 6-MV X-rays. The system was equipped with ExacTrac IGRT and real-time infrared fiducial tracking. Patient immobilization was accomplished using a noninvasive mask system.
Methods. First we perform a volumetric T1 and T2 MRI and planning CT with Brainlab mask was fabricated to precisely immobilize the patient. The mask incorporated three nonperforated thermoplastic reinforcing straps over the forehead, below the nose, and over the chin. MRI and CT images are fussed in the contouring module of iPlan planning system. As the treatment is performed on stereotactic conditions, no margin from GTV to PTV is needed. Infrared fiducial reflectors were attached to the mask to assist in isocenter localization and in real-time monitoring of the patient's position during treatment. The patient was positioned on the treatment couch wearing the mask. The initial isocenter alignment was performed using stereoscopic infrared cameras and the infrared fiducial reflectors. Orthogonal X-rays of the patient's head were then acquired. Digitally reconstructed radiographs were computed from the planning computed tomography scans to simulate the oblique X-rays with the patient aligned to the isocenter. Rotational corrections in all three axes were determined by reconstructing several digitally reconstructed radiographs to simulate patient rotation and determine which radiograph best matched the X-rays. With determination of the rotations, the digitally reconstructed radiographs and X-rays were fused, translations were calculated, and the required rotations and translation of the patient were applied using the robotic table. A second set of X-ray fusions was then performed. If the resulting translation was <0.3 mm, the alignment was deemed acceptable.
Conclusions. Stereotactic frameless radiosurgery offers a more comfortable option of treatment for the patient and optimizes time and organization on the acelerador.

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Treatment of lung and liver lesions with SBRT and respiratory gating

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Introduction. Gating techniques can improve the accuracy of the treatment of lung and liver lesions with SBRT, by monitoring organ tumour motion and irradiating within a selected area of the respiratory cycle.
Methods. We have treated more than 300 lesions (lung and liver primary and metastatic lesions) with SBRT Adaptive Gating Technique. Prior to treatment, a fiducial marker is implanted and CT simulation is performed in breatholding with infrared external skin markers. Based on these external markers, internal tumour motion is correlated with the external respiratory signal. This omits the requirement for 4D-CT imaging. The outlined PTV includes CTV = GTV + 5 mm margin. As the tumour is strictly irradiated in a selected respiration window, no ITV is necessary. PET-CT is used to define the GTV in the case of liver metastases. The following doses are prescribed: liver (5 Gy × 10 or 15–20 Gy × 3), peripheral lung lesions (15–20 Gy × 3), and central

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