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Direct Stereotactic CBCT-guided Brain Radiosurgery Without an Imaging Localization Box

Lijun Ma [1]

1. Radiation Oncology, UCSF Medical, San Francisco, USA

Corresponding author: Lijun Ma, lijunma@radonc.ucsf.edu

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Abstract

Objective: Stereotactic CBCT (sCBCT) (Elekta AB, Stockholm, Sweden) has created voxel-by-voxel mapping of stereotactic coordinates for brain radiosurgery. In this study, we investigated the feasibility of replacing conventional localization box with direct sCBCT thus eliminating the need of performing stereotactic imaging scans on the same day of the treatment. Methods: For pre-treatment quality assurance checks, a cylindrical phantom embedded with a 3D grid was first scanned with the sCBCT unit and then with a standard serial CT scanner. The stereotactic coordinates of the 3D grid inside the phantom from the sCBCT scans were compared with those from the serial CT scans. In addition, surface markers and internal anatomical landmarks were identified on the MR studies (defined with a localization box) for a series of cases (n=10) and then crosschecked against the those defined with the sCBCT scans. Results: The maximum discrepancy in the phantom stereotactic coordinates from the sCBCT scans versus reference serial CT scans was < 0.3 mm (mean 0.12±0.08 mm). The stereo-coordinates of the patient's internal anatomical landmarks from the patient's MR studies and those defined with the sCBCT agreed within 0.5 mm (mean 0.28±0.30 mm). The largest discrepancy was noted near the superior skull surface area. Conclusions: Phantom and patient-specific quality assurance tests confirmed the submillimeter accuracy of sCBCT. As a result, direct sCBCT-guided brain radiosurgery can be safely performed without a tertiary imaging localization box .

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