AbstractID: 8524 Title: Feasibility study of frameless angiographic localization of arteriovenous malformations (AVMs) for image-guided radiosurgical interventions

Purpose: We investigated the feasibility of novel approach for frameless 3D AVM localization within the coordinate space of an angiographic cone-beam CT (CBCT) dataset. The localization is based on characterization and calibration of 2D digital subtraction angiography (DSA) and CBCT acquisition modes available on a commercial flat panel detector C-arm neuroangiography system. This localization method in combination with image-guided Cyberknife delivery could provide consistent approach to frameless AVM radiosurgery. **Method and Materials:** We introduced preset AVM localization protocols comprising anterior-posterior (AP) and lateral (LAT) DSA series combined with CBCT without couch displacement between acquisitions. The AP and LAT C-arm positions were selected by matching AP/LAT phantom images to corresponding projections from the CBCT series. We subsequently evaluated the accuracy and the reproducibility of the 2D-3D correspondence for the various protocols by imaging a CBCT calibration phantom with embedded markers. Paired marker centers were automatically extracted in the AP/LAT images and the corresponding CBCT acquisition frames. The maximum and the mean distance between the marker centers were calculated as a metrics for 2D-to-3D correspondence accuracy. The reproducibility was investigated by repeating the imaging protocols in different sessions and displacing the C-arm between the sessions. **Results:** The accuracy of the DSA-CBCT correspondence depended on the protocol and the C-arm position for the DSA acquisitions within the protocol. For further clinical investigations we retained a protocol with an AP and left LAT DSA modes that reproducibly resulted in maximum/mean paired marker distance of 0.68 mm and 0.4 mm (AP) and 0.29 mm and 0.15 mm (left LAT) in the C-arm isocenter plane. **Conclusion:** With proper patient immobilization, frameless AVM localization within the angiographic CBCT dataset based on calibrated AP and left LAT views is feasible with an uncertainty of 0.7-0.8 mm.
Conflict of Interest: This work is supported by Siemens Medical Solutions.