Purpose: To evaluate the dosimetric accuracy of stereotactic radiosurgery (SRS) with cone-beam computed tomography (CBCT) guided patient localization.

Methods: A Novalis TX linear accelerator with high definition multileaf collimator (HDMLC) was used for SRS treatments. 20 patients immobilized with the noninvasive BrainLab U-frame system and thermoplastic mask were selected to evaluate the dosimetric accuracy of CBCT image-guided SRS by the BrainLab iPlan Phantom Mapping module. The contours of the PTV and critical organ were transferred directly from the planning CT and MR images to the CBCT images after image registrations. The delivered dose distributions could be calculated and analyzed by copying the original treatment plans to the CBCT images and assigning the treatment isocenters on the CBCT images according to the couch shifts acquired after planning CT and CBCT image registrations. The CT electron density calibration curve used for original plans was also applied for the CBCT-based planning.

Results: The average minimum dose, mean dose, and maximum dose in PTV of the original plans and the CBCT plans were 95.45±3.80%, 92.88±3.25%, 110.59±1.81% and 110.11±2.40%, 116.55±3.11% and 115.93±2.78%, respectively. In the original treatment plans, the average 100% prescription dose coverage of GTV and PTV were 99.99% and 99.81%, respectively. In the CBCT plans, the average 100% prescription dose coverage of GTV and PTV were 99.90% and 98.20%, respectively. The average conformity index of the original plans and the CBCT plans were 1.846 and 1.863, respectively.

Conclusions: Data demonstrated that the dose distributions calculated in the CBCT images were comparable to the original treatment plans. The CBCT plans only indicated a slightly higher conformity index and lower average minimum dose, mean dose, maximum dose, GTV coverage, and PTV coverage compared to the original treatment plans. Therefore, the CBCT guided localization was considered effective to assure dosimetric accuracy in SRS.