Purpose: Our objective was to investigate delivery quality assurance (DQA) tools for robotic radiosurgery using the CyberKnife™ (Accuray, USA). We evaluated different phantoms and methods to measure agreement with the planned dose. We also studied procedure time.

Methods: For absolute dose verification we used a 0.125cc micro ion chamber (TM31010, PTW, Germany) with 1) the ellipsoid shaped UMT Phantom (Iba Dosimetry, Germany) and 2) a cubic shaped custom-made phantom from water-equivalent RW3 with multiple densities. For spatial dose verification we used axial and sagittal oriented gafchromic EBT2 film with phantoms provided by Accuray (BallCube2 with 1) head phantom and 2) hemisphere on motion platform) and evaluated the tests with FilmQA™ (3Cognition, USA).

Results: The UMT phantom was used for 12 patient cases (AvgRx = 31.6Gy +/-28.4Gy, 3-7 fractions). An average difference of -0.8% +/- 2.9% between the calculated dose in the phantom plan and the measured dose was observed (average mean dose to ion chamber = 8.86Gy +/- 12.26Gy). The custom made phantom was used for 13 test cases. An average difference of 3.88% +/- 8.23% (RayTrace with surface correction) and 3.63% +/- 4.67% (MonteCarlo) between the calculated mean dose and the measured dose was observed. We believe the larger differences for our custom-made phantom are due to magnification of surface corrections with the cubic shaped phantom. The FilmQA™ analysis for 3 test cases showed in average 97.7% +/- 0.9% pixels passing Gamma (dose= +/- 3%, distance=2mm) when comparing film to the predicted dose distribution. The average time for the DQA was 32min +/- 19min and 10min for FilmQA™ evaluation.

Conclusions: DQA with ellipsoid phantoms provided accurate agreements for CyberKnife™ plans. FilmQA™ proved itself as an easy to use tool that provides additional spatial dose information. Due to the complexity of CyberKnife™ treatments we recommend an absolute dose measurement as DQA for every patient. We further recommend additional film measurements for irregular shaped targets.