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## **An anthropomorphic phantom study of the accuracy of Cyberknife spinal radiosurgery.**

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**OBJECTIVE:** Stereotactic radiosurgery requires the highest degree of accuracy in target identification and localization. When targeting paraspinal lesions, the CyberKnife radiosurgical system (Accuray, Inc., Sunnyvale, CA) uses implanted stainless steel fiducials. The purpose of this study was to evaluate the total system for clinically relevant accuracy of this approach.

**METHODS:** The clinically relevant accuracy of the CyberKnife depends on 1) the accuracy of beam delivery, which in turn represents a compilation of robot and camera image-tracking errors, and 2) the inherent accuracy of target localization that stems from computed tomographic imaging and treatment planning. The clinically relevant accuracy was measured at three different CyberKnife facilities using head and torso phantoms loaded with packs of radiochromic film and expressed as a displacement of the dose contours from the treatment planning.

**RESULTS:** The mean clinically relevant error, as measured at three different CyberKnife facilities, was determined to be 0.7 +/- 0.3 mm, which did not vary with computed tomographic slice thickness in a range of 0.625 to 1.5 mm. The average treatment delivery precision was 0.3 +/- 0.1 mm. Fiducial tracking error was less than 0.3 mm for radial translations up to 14 mm and less than 0.7 mm for rotations up to 4.5 degrees.

**CONCLUSION:** For the treatment of relatively stationary spinal lesions targeted with fiducial tracking, the CyberKnife system is capable of submillimeter accuracy.

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