

Abstract: 169

The Feasibility of Radiation-free Diagnostic Monitoring in Adolescent Idiopathic Scoliosis Using a Novel, Upright Positional MRI Protocol

J. Auerbach¹, B. Lonner², L. Dean², Y. Goldstein²

¹Washington University School of Medicine, St. Louis, MO, USA, ²NYU Hospital for Joint Diseases, Orthopaedic Surgery, New York, NY, USA

Summary: Concern surrounding cumulative doses of ionizing radiation during diagnostic screening of curve progression in AIS has led to the search for radiation-free alternatives. Using a novel MRI protocol, we demonstrate that upright, positional MRI produces equivalent Cobb angle measurements to that obtained with traditional, standing plain film radiography. Radiation-free diagnostic screening for AIS with upright MRI can be performed safely, quickly (< 7min), at costs similar to scoliosis series Xrays, and may serve as an alternative/replacement for traditional ionizing imaging techniques.

Introduction: The concerns over the oncologic potential of cumulative doses of ionizing radiation in children and adolescents being monitored for AIS has led to the search for radiation-free diagnostic imaging modalities, including MRI.

Purpose: The purpose of this study was to determine if a novel, upright positional MRI protocol could produce reliable spinal curvature images compared with traditional X-ray.

Methods: Twenty consecutive patients (13F, 7M, average age 13.7yrs, range: 11-17yrs) with a diagnosis of AIS seen by a single surgeon were enrolled. Average major curve magnitude was 30.6d (range: 10-69d). Subjects underwent traditional plain radiographic scoliosis imaging (36" cassettes), followed within 1 week by upright MRI using a standardized protocol. Complete MRI data acquisition was performed in < 7minutes using a steady-state gradient echo 3D pulse sequence (TE=5.608, TR=14.720, Flip angle=30 deg). The two volumes were stitched together to facilitate multi-planar reconstruction analysis. Two independent observers measured the major and minor Cobb angle magnitudes on each set of plain film and MRI images.

Results: There was excellent inter-rater reliability between plain film radiography and upright MRI measurements for major Cobb angle (R=0.91) and very strong reliability for minor Cobb angles (R=0.81). Intra-rater reliability for both Xray and MRI measurements of major Cobb angles was excellent (R=0.96, 0.95, respectively). Intra-rater reliability for both Xray and MRI measurements of the minor Cobb angles was also excellent (R=0.96, 0.92, respectively).

Conclusions: Our results show that upright positional MRI is capable of producing major and minor Cobb angle measurements that highly correlate with traditional plain film radiographic measurements, and may therefore be a radiation-free alternative/substitute for diagnostic screening in AIS.

Significance: Radiation-free diagnostic screening for AIS can be performed safely, quickly (total data acquisition time: < 7min), and with costs comparable to Xray imaging. We submit that upright, positional MRI may serve as an alternative/replacement for traditional ionizing imaging techniques.