Posterior Spinal Fusion with 3.5mm Rods for Congenital Scoliosis: Effect on Spine Growth and Efficacy of Deformity Correction

Abstract

Background

Children with congenital scoliosis are often treated with spinal fusion at a young age. 3.5mm fusion rods may be utilized for deformity correction through posterior spinal fusion, though limited data exists regarding the effect on growth of the pediatric spine and long-term efficacy. We seek to investigate 1) effect of posterior spinal fusion with 3.5mm rods on spinal growth in terms of vertebral body height and width, and 2) efficacy of 3.5mm fusion rods in achieving and maintaining deformity correction.

Methods

We conducted a retrospective study of pediatric patients with congenital scoliosis who underwent posterior spinal fusion using 3.5mm rods between 2007 and 2014. Demographic information, diagnosis, and procedural data were collected, and serial radiographs were analyzed at the following clinical timepoints: preop, initial postop, 2 year postop, and long-term. Cobb angle, vertebral body heights and widths, and intervertebral disc space were measured at each timepoint. Measurements for the entire cohort were made by a single observer and were validated against measurements from two other trained observers for select radiographs. Statistical analysis was performed using paired T-test.

Results

Six patients were included in the retrospective cohort. Mean age at time of surgery was 3.1 years and mean length of follow up was 7.3 years. Cobb angle increased an average of 1.02 degrees per year (-0.63 to 3.48, st dev 1.57). Growth occurred among vertebrae within fusion constructs, though at a slower rate as compared to adjacent unfused vertebrae. Average vertebral body height change among fused vertebrae was 0.57mm per year vs 0.89mm per year for unfused vertebrae ($p=0.01$). Average vertebral body sagittal width change among fused vertebrae was 0.51mm per year vs 0.85mm per year for unfused vertebrae ($p=0.01$). Intervertebral disc height for discs within the fusion construct decreased on average 0.47mm per year, while intervertebral disc height for unfused discs increased on average 0.23mm per year ($p<0.01$).

Conclusion

Our data demonstrates continued vertebral body growth after posterior spinal fusion with 3.5mm rods, though at a slower rate as compared to adjacent unfused vertebrae. Intervertebral discs within fused spinal segments decreased in height, while unfused discs continued to grow. Our results suggest that decreased vertebral body growth rate as well as progressive loss of disc height contribute to the impedance of spinal growth across a fused segment. Further studies of larger sample size are warranted to assess correlation between post-fusion spinal growth, deformity progression, and clinical outcomes.