Pediatric Occipitocervical Fusion: Long-term Radiographic Changes in Curvature, Growth and Alignment

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Introduction

The authors assessed the rate of vertebral growth, curvature, and alignment for multilevel constructs in the cervical spine after OCF in pediatric patients and compared them with results of normal children in the literature.

Sagittal plane translation. Measured by the distance between cervical sagittal vertical axes on lateral radiographs (C1-C7 cervical alignment (SVA), arrow head) and from the axis centroid (C2-C7 SVA, arrow) to the posterior superior corner of C7

Methods

Cervical radiographs and computed tomography images from 18 patients after occipitocervical arthrodesis were assessed. Measurements were made from postoperative and last follow-up images in 16 patients to determine cervical spine alignment (CSA), C1-C7 sagittal vertical axis (SVA), and C2-C7 SVA, and curvature (cervical spine curvature [CSC] and C2-C7 lordosis angle). 17 patients had postoperative and last follow-up images to measure vertebral body height (VBH), vertebral body width (VBW), and vertical growth (VG%). Results for cervical spine growth were compared with normal parameters of 456 patients previously reported.

Cervical spine curvature is measured by the intersecting angle of a line drawn tangentially to the posterior border of C2 with a line drawn tangentially to the posterior border of C7.

Results

Ten patients were female and 8 were male. Constructs spanned O-C2 (n=2), O-C3 (n=7), and O-C4 (n=9). Mean age at surgery was 6.7 years (7 months–12 years) and mean follow-up was 44.4 months (24–101 months).

Dashed lines show vertebral body height (VBH) from C2 to C7. Perpendicular solid lines drawn from the midpoint of each VBH line show vertebral body width from C2 to C7.

The annual vertical-growth rate for our patients was 4.4 mm/yr. The VBW growth from C2-C4 ranged from 13.9% to 16.6% ($p < 0.001$). The VBW of C2 in instrumented patients appeared to have a smaller diameter compared with normal patients, especially among those aged 5 to <10 and 10 to 15 years old,

Mean CSA increased by 1.8±2.9 mm ($p<0.01$). Mean C2-C7 SVA and C1-C7 SVA increased by 2.3 mm and 2.7 mm, respectively ($p=0.3$). Mean CSC increased by -8.7° ($p<0.01$) and C2-C7 lordosis by 2.6° ($p=0.5$). The cumulative mean VG% of the instrumented levels (C2-C4) provided 51.5% of the total cervical growth (C2 -C7).

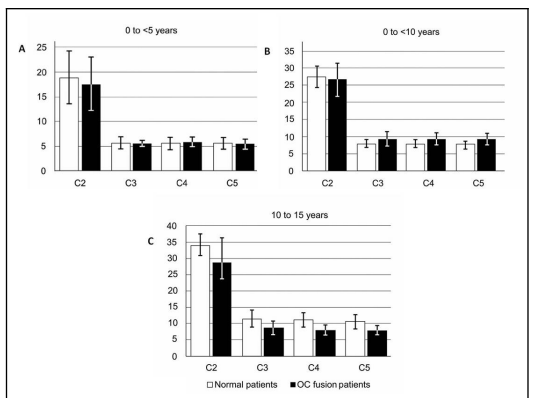
compensated by an increased diameter at the immediately inferior vertebral bodies. Cervical deformation, malalignment, or detrimental clinical status were not evident in any patients.

Conclusions

The craniovertebral junction and the upper cervical spine continue to present normal growth, curvature, and alignment parameters in children with OCF constructs as long as O-C4.

Learning Objectives

Clinical and radiographical data in pediatric patients after OC fusion.



Comparison of vertebral body height changes between 96 normal patients27 and 15 patients with occipitocervical (OC) fusion, at last follow-up, by age group