Orthopaedics & Traumatology: Surgery & Research 102 (2016) 227–232

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Original article

Anterior screw-plate fixation in adolescent idiopathic scoliosis: 15-year outcomes

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ARTICLE INFO

Article history:
Received 3 February 2015
Accepted 15 December 2015

Keywords:
Idiopathic scoliosis
Anterior spinal fusion
Sagittal alignment

ABSTRACT

Background: Few published data are available on long-term outcomes of anterior spinal fusion for adolescent idiopathic scoliosis (AIS). The objective of this single-centre retrospective study was to assess clinical and radiological outcomes of one-stage anterior spinal fusion achieved using precontoured titanium anterior screw-plates.
Hypothesis: Our hypothesis was that anterior instrumentation produced both good functional outcomes and good correction in the coronal and sagittal planes.
Material and methods: This procedure was performed in 111 patients between 1975 and 1993. Among them, those who underwent a comprehensive evaluation at least 15 years later were included. The SRS-30 questionnaire and Oswestry Disability Index (ODI) were used to assess functional outcomes. Radiographic outcomes were evaluated on antero-posterior and lateral full-spine radiographs obtained pre-operatively, post-operatively, and at last follow-up.
Results: The study included 35 patients, who were re-evaluated after a mean of 21 years (15-31 years). Mean pre-operative Cobb's angle was 44°, mean age at surgery was 14.7 years, mean SRS-30 score was 3.65/5, and mean ODI was 14.9%. At last follow-up, mean Cobb's angle was 14.7° and 25 patients exhibited coronal misalignment with a mean deviation of 12 mm. In the sagittal plane, the mean sagittal vertical axis (SVA) measured using the C7 plumb line was -28 mm, with 8 mm of anterior translation compared to the post-operative value (36 mm). The functional outcome assessed using the SRS-30 score correlated significantly with pelvic tilt and anterior SVA translation.
Conclusion: Anterior spinal fusion produces good long-term functional outcomes in AIS. Correction is both satisfactory and sustained. Anterior SVA translation over time may be associated with better functional outcomes.
Level of evidence: IV (retrospective study).

1. Introduction

Anterior spinal fusion has been used for many years to treat adolescent idiopathic scoliosis (AIS). Little has been published, however, about the long-term outcomes. The development of posterior segmental instrumentation and fixation techniques has shifted interest away from anterior fusion [1,2], despite the lack of firm evidence that Cotrel-Dubousset instrumentation or similar procedures produce better correction [3].

The primary objective of this study was to assess clinical and radiological outcomes after anterior spinal fusion achieved using precontoured plate-and-screw fixation in patients with AIS.

2. Material and method

A single-centre retrospective study was conducted based on the 111 patients with AIS treated with anterior screw-plate instrumentation between 1975 and 1993. Among these patients, those who underwent a clinical, functional, and radiological assessment 15 years or more after the procedure were included.

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http://dx.doi.org/10.1016/j.otsr.2015.12.011
1877-0568/

For each patient, the following data were recorded: body mass index (BMI), occupation, number of pregnancies, and presence of pain in any of four predefined categories (cephalad end of the fusion, low back pain, nerve root pain, and intercostal neuralgia). The 30-item Scoliosis Research Society questionnaire (SRS-30) [4] and Oswestry Disability Index (ODI) [5] were used to evaluate functional outcomes. Radiological data were recorded by two independent observers (GR and TO) from anteroposterior and lateral long films of the spine taken preoperatively, postoperatively, and at last follow-up. The spinal curvatures were categorised according to the Lenke classification [6,7] and standard measures of coronal and sagittal spinal alignment were recorded [8–10].

Descriptive and statistical analyses of the radiographic data were performed to look for correlations linking functional outcomes to radiographic parameters at last follow-up (continuous analysis). Thus, Pearson's correlation coefficient (r) was estimated under the hypothesis of a linear distribution. The correlation was considered significant if P was less than 5% and borderline if P was between 5% and 10% (test vs. 0). Radiological variables that correlated significantly with functional outcomes were entered into a multivariate model. Then, changes in each variable over time were assessed by computing the slope for each patient and using Wilcoxon's test to compare the mean slope to 0.

2.1. Operative technique

The technique was the same in all patients. Thoraco-phrenolumbotomy was performed through the rib overlying the apex of the curvature, on the side of the convexity.

The next step was extraperiosteal exposure of the spine from its lateral edge to its anterior aspect. Fragments of the resected rib were grafted into each intervertebral space. Instrumentation involved placing a precontoured plate over the lateral aspect of the spine, then screwing it into each vertebral body in the cephalic to caudal direction.

A fibular strut whose length was equal to the height of the instrumentation was harvested. A bone chisel and mallet were used to freshen the entire length of the instrumented spinal segment. The strut was fit snugly into tapered cuts made in the highest and lowest vertebras.

In the cephalad direction, the instrumentation ended at the highest vertebra in the curvature. When correction of the suprajacent curvature was less than 50%, this vertebra was included in the instrumentation. Caudally, the instrumentation ended at the stable vertebra as defined based on Dubousset criteria [11]. The mean number of vertebras included in the instrumentation was nine for type 1 AIS and six for type 5 AIS (Fig. 1).

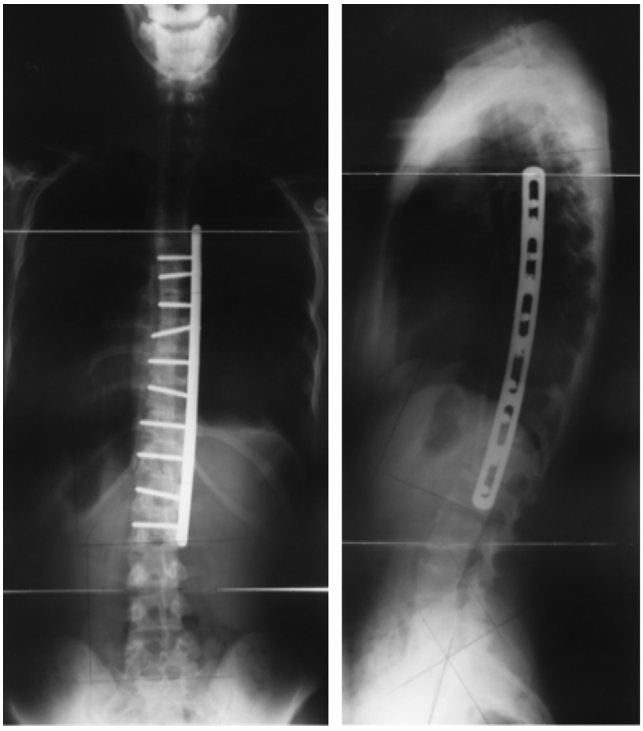

Fig. 1. T5-L2 fusion: anteroposterior and lateral radiographs after 1 year.

3. Results

3.1. Overall results and functional outcomes

Of the 111 patients, 35 (31.5%), including 29 females, were re-evaluated after 15 years or more. Mean age at surgery was 14.7 years (range: 11–21 years). Comparisons of the included patients and overall population for age, sex ratio, and instrumentation length showed no statistically significant differences. Patient distribution according to the Lenke classification is shown in Table 1 (Fig. 2).

Mean follow-up was 21 years (range: 15–31 years). Of the 29 females, 11 had had one pregnancy and 10 two pregnancies. At last follow-up, 31 (89%) were in paid employment. Revision surgery had been performed in 2 females: 1 required removal of the fixation

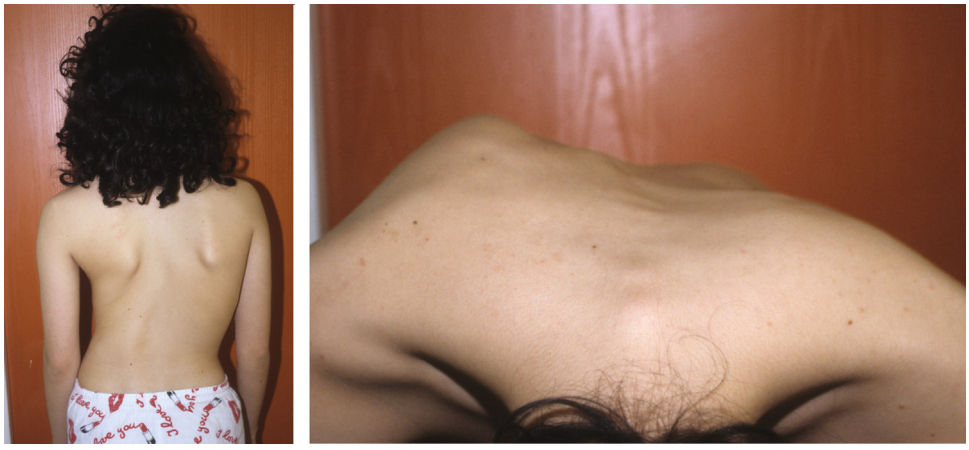

Fig. 2. Thoracolumbar scoliosis: clinical appearance before surgery.