Spine Deformity

www.spine-deformity.org

Spine Deformity 5 (2017) 189–196

Posterior Versus Three-Column Osteotomy for Late Correction of Residual Coronal Deformity in Patients With Previous Fusions for Idiopathic Scoliosis

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Received 22 July 2016; revised 23 November 2016; accepted 2 January 2017

Abstract

Study Design: Retrospective case series.

Objective: To compare the early results of posterior column (PCO) and three-column (3CO) osteotomies performed in patients with previously fused idiopathic scoliosis and review their abilities to achieve coronal correction of residual deformities.

Summary of Background Data: Residual deformity of previously fused AIS can accelerate adjacent segment degeneration secondary to lowest instrumented vertebra (LIV) tilt and rotation. Many of these patients are not satisfied with their cosmetic appearance and would choose revising the deformity when future surgery is indicated.

Methods: The data from 29 consecutive patients who underwent PCOs or 3COs for late revisions of idiopathic scoliosis were reviewed. Measurements included Cobb angle, focal osteotomy angle, and coronal balance. Perioperative data, complications, and patient-reported outcomes were also reviewed.

Results: Fourteen patients were treated with PCOs and 15 with 3COs. Global coronal correction was equal between the two groups. In the PCO group, where patients underwent a mean of 2.4 osteotomies, 20.2° of correction was obtained compared to 19.5° in the 3CO group ($p = .33$), which all underwent single osteotomies. The average coronal correction was 9.2°/osteotomy for the PCO group and 14.1°/osteotomy for the 3CO group ($p < .01$). Estimated blood loss was 1,417.5 mL in the PCO group compared to 3,199.3 in the 3CO group ($p < .01$). Five patients (36%) had intraoperative complications in the PCO group compared to 12 (80%) in the 3CO group ($p < .05$). There were no differences in operative times, length of stay, or patient-reported outcomes between groups.

Conclusion: PCOs and 3COs performed in patients with previously fused spines for idiopathic scoliosis are effective in achieving residual deformity correction. In cases of posterior fusions, where the patient has a mobile anterior column, PCOs should be considered over 3COs because of their decreased risk of blood loss and complications.

Keywords: Coronal deformity; Posterior column osteotomy; Three-column osteotomy; Late deformity correction; Posterior fusion mass

Introduction

Coronal deformity correction is the primary surgical objective in idiopathic scoliosis (IS) surgery. Since the advent of pedicle screw fixation as the gold standard for these procedures, the percentage of achievable correction has dramatically increased [1]. The average curve correction in IS surgery has been reported to be as high as 75 percent [2,3]. Older techniques have yielded less correction, and many patients are left with residual deformity following surgery that can be symptomatic over time, especially at adjacent levels, which have residual tilt and/or rotation. Symptomatic late presentations and indications for revision surgery in patients with previous fusions for scoliosis include pseudoarthrosis, proximal and/or distal segment degeneration, surgical site infection, and persistent residual deformity [4-8].

Author disclosures: SJL (is a consultant for Stryker and Medtronic and receives payment for lectures and travel for meetings from Medtronic, Stryker and AO); SGK (none); SK (none); AMG (none).

IRB approval: This study was reviewed and approved by University Health Network Research Ethics Board.

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2212-134X/$ - see front matter © 2017 Scoliosis Research Society. All rights reserved.
http://dx.doi.org/10.1016/j.jspd.2017.01.004

In revisions for late deformity, certain surgical goals are defined such as preserving and realigning the remaining mobile segments, correcting cosmetic residual deformity, and maintaining or creating adequate global balance. Previous fusions present challenges in achieving additional correction. Although the majority of patients opt for simple extension of their fusions, others with larger residual deformities or imbalances are considered for osteotomies of the fusion mass to improve their coronal and sagittal parameters.

In patients with previous posterior constructs without anterior fusions, it is hypothesized that posterior column osteotomies (PCOs) performed through the posterior fusion mass can provide a desirable coronal correction for residual deformities with lower risks and complications than what is observed with three-column procedures. In constructs with previous anterior fusions, three-column osteotomies (3COs) would be required to achieve additional correction.

The purpose of this article is to compare the early results of PCO and 3CO performed in patients with previously fused IS and review their ability to achieve correction of residual coronal and sagittal deformities.

Materials and Methods

Using a computerized database, 29 consecutive patients underwent late revisions for idiopathic scoliosis with corrective osteotomies. Surgical and nonsurgical options and their associated risks were reviewed with each patient. None of the patients were satisfied with their residual deformity and chose to undergo revisions with corrective osteotomies. All procedures were performed between 2005 and 2015 by the senior author at a single institution. A single observer not involved in patient care independently reviewed the patient records. Intraoperative and early complications were recorded. Radiographs and questionnaires were administered prospectively and reviewed retrospectively. The revision procedures included a posterior exposure, removal of the previous implants, and revision or addition of new screws/hooks and rods. Osteotomies were performed at or near the apex of the residual curve through the previous fusion mass. Free-hand technique was used for screw placement. The patients had predominantly coronal plane deformities. The osteotomies were fashioned to maximize coronal plane correction and provide the sagittal plane correction required to optimize the sagittal profile.

Surgical Procedure

Posterior column osteotomy

After exposure and instrumentation of the spine, levels appropriate for osteotomies were identified. These included levels at or near the apex of the residual curve with a mobile disc assessed by radiographs, magnetic resonance imaging, and/or computed tomographic scans.

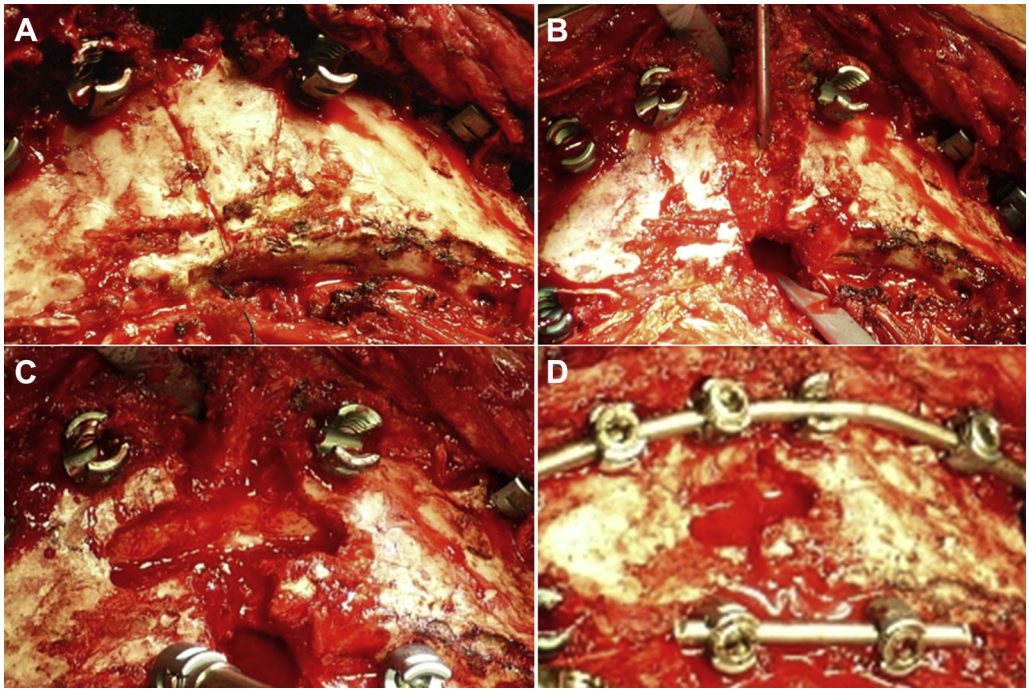

Fig. 1. Intraoperative photo series of a patient undergoing a three-column osteotomy for late correction of residual deformity: (A) Scoring of the fusion mass at the site of the osteotomy; (B) osteotomy of the posterior fusion mass, and the underlying anterior column; (C) completed osteotomy before closure showing laminectomy and fully removed posterior fusion mass at the apex of the deformity with preservation of the exiting nerve roots; (D) after convex proximal-to-distal osteotomy closure showing bone-on-bone contact. A temporary concave rod with loosened set screws was used to help guide osteotomy closure and limit translation at the osteotomy site.