

Matched Cohort Analysis of Posterior-Only Vertebral Column Resection Versus Combined Anterior/Posterior Vertebrectomy for Severe Spinal Deformity

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Abstract

Study Design: Retrospective matched cohort analysis.

Summary of Background Data: Posterior-only vertebral column resection (P-VCR) is a potential alternative to combined anterior/posterior vertebrectomy (A-P/VCR) for the treatment of severe spinal deformity.

Objective: To examine a matched cohort of adult and pediatric patients with severe spinal deformity treated with A/P-VCR versus P-VCR.

Methods: Databases of 2 spine surgeons at 1 institution from 1994 to 2007 were reviewed. Patients were matched based on age at surgery (within 10 years), diagnosis, curve pattern, vertebrae resected (within 1), levels of vertebrae resected (within 2), levels fused (within 5), and minimum 2-year follow-up. A total of 34 P-VCR patients were identified who appropriately matched 34 A/P-VCR patients. The etiology of the deformity and type of curve were matched directly so that they were identical for each matched pair. The remainder of the inclusion parameters was matched as closely as possible between the 2 groups according to the criteria listed above.

Results: Final coronal Cobb correction P-VCR versus A/P-VCR showed that 52.6% versus 53.9% ($p = .8$) was similar, whereas P-VCR final sagittal Cobb correction was superior: 53.0% versus 40.0% ($p = .017$). The P-VCR group had a significantly shorter total operative time ($p = .002$) and total length of stay ($p = .003$). Complications rates were similar and relatively infrequent for both P-VCR and A/P-VCR, including wound infections requiring operative intervention, subsequent revision surgery, and transient motor deficits. Total Scoliosis Research Society scores improved from preoperative to final follow-up for both P-VCR ($p = .007$) and A/P-VCR ($p = .07$) groups.

Conclusions: Posterior-only vertebral column resection is a challenging yet safe and effective means of treating severe scoliosis and/or kyphosis. Compared with an A/P-VCR for severe spinal deformity, P-VCR demonstrated shorter operative time and hospital stay, as well as improved sagittal correction and Scoliosis Research Society scores.

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Introduction

The treatment of severe spinal deformity presents a significant challenge. Traditionally, a separate anterior and posterior approach was required to achieve sufficient correction and a stable fusion [1–3]. A corpectomy via an anterior approach is performed in the initial stage in an effort to release the apex of the rigid deformity. This approach allows for mobilization of a previously rigid segment, whereas the resected vertebral body and/or ribs can be used as autograft for augmentation of an anterior fusion. Subsequently, on the same day, or as part of a staged procedure, a posterior instrumentation and fusion is performed to complete the correction [1–3]. A complete laminectomy and/or pediculectomy can be performed during the posterior procedure to achieve a complete vertebrectomy [4]. This combined anterior/posterior vertebral column resection (A/P-VCR) has been the mainstay of treatment for rigid spinal deformities for many years. More recently, a posterior-only vertebral column resection (P-VCR) approach has been used as a potential alternative for the treatment of severe spinal deformity in an effort to obviate the need for a separate anterior procedure [5–9]. A complete laminectomy/pediculectomy is performed, and the entire vertebral body is then able to be accessed and resected via a bilateral costotransversectomy [5,8–9].

The concept of vertebral resection for correction of severe deformity was initially described by MacLennan [10] in 1922. In more recent years, this method was reported by Leatherman [11] in 1973 and later popularized by Bradford [12] in 1987. Later, in 1997, Bradford and Tribus [13] expanded upon their previous studies, describing the successful outcomes of 24 A/P-VCR procedures performed for severe spinal deformity. An alternative posterior-only approach was first reported by Suk et al. [5] in 2002, with encouraging results of 16 patients reported in 2005 [6]. Lenke et al. [8] went on to describe the successful clinical and radiographic outcomes of 35 pediatric severe spinal deformity patients treated with P-VCR at 2-year follow-up.

However, to date, there have been no studies available that directly compared traditional A/P-VCR with P-VCR. The purpose of this study was to examine a matched cohort of adult and pediatric patients with severe spinal deformity treated with A/P-VCR versus P-VCR, with a minimum 2-year follow-up. We hypothesize that the P-VCR approach may safely and effectively circumvent the requirement for a separate anterior procedure to attain sufficient correction and achieve a stable fusion in the treatment of severe spinal deformity.

Materials and Methods

This was a retrospective matched cohort analysis of patients with severe spinal deformity surgically treated with

A/P-VCR versus P-VCR. The P-VCR technique was described previously in a consecutive series of pediatric and adult patients [9]. All procedures, both A/P VCR and P-VCR, were consecutively performed at a single, large volume institution by 1 of 2 senior spinal deformity surgeons between 1994 and 2007. The database containing the consecutive series of A/P-VCR and P-VCR was evaluated to identify patients with a minimum 2-year follow-up. From the database of patients with eligible postoperative follow-up, P-VCR patients were individually matched with A/P-VCR patients based on the following criteria: age at surgery (within 10 years), etiology of the deformity (ie, degenerative, idiopathic, neuromuscular, congenital), curve pattern (ie, scoliosis, global kyphosis, angular kyphosis, kyphoscoliosis), number of vertebrae resected (within 1), levels of vertebrae resected (within 2), and levels fused (within 5). A minimum 2-year follow-up was required for inclusion in the study.

The authors obtained internal review board approval before data collection. An independent reviewer not involved in the surgical treatment conducted data collection and evaluation. All P-VCR procedures were performed by 1 of the surgeons. A consecutive series of 50 P-VCR procedures with a minimum 2-year clinical and radiographic follow-up at the time of the study were identified. The surgical databases of the 2 senior spine surgeons were then reviewed to identify A/P-VCR patients who appropriately individually matched the P-VCR patients according to the parameters mentioned earlier. The surgical technique and methods of bone grafting for the A/P-VCR procedures was similar between the 2 surgeons. A total of 34 P-VCR patients were identified who matched appropriately with 34 A/P-VCR patients. Unfortunately, to adhere to the strict matching criteria, the researchers were unable to find suitable A/P-VCR equivalents for 16 of the P-VCR patients.

Each P-VCR patient was directly matched to an A/P-VCR patient based on the etiology of his or her deformity (idiopathic, congenital, etc) and the type of curve (scoliosis, kyphosis, etc) so that the etiology and type of curve were identical for each matched pair. The remainder of the inclusion parameters was matched as closely as possible between the 2 groups according to the criteria listed above.

The mean age at surgery was similar for P-VCR and A/P-VCR patients: 22.3 years versus 23.0 years, respectively ($p = .89$). The length of posterior spinal fusion was similar for both P-VCR and A/P-VCR patients: 11.6 levels fused versus 10.4 levels, respectively ($p = .27$). The average number of vertebrae resected was identical for both groups for P-VCR, 1.6 vertebrae (range, 1–3 vertebrae) versus A/P-VCR, 1.6 vertebrae (range, 1–4 vertebrae) ($p = .78$). The levels of vertebrae resected were also matched to

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