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Thirty-Day Reoperation and Readmission Rates After Correction of Adult Spinal Deformity via Circumferential Minimally Invasive Surgery—Analysis of a 7-Year Experience

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Abstract

Study design: Single-center retrospective analysis of consecutive patients who have undergone circumferential minimally invasive surgery (cMIS) for correction of adult spinal deformity (ASD).
Objectives: To study the rates of reoperations and readmissions within the first 30 days following cMIS for correction of ASD.
Background: Hospital readmission and reoperation rates have been emphasized as an important measure of quality and cost-effectiveness of care. However, there is little information about the readmission rates following cMIS correction of ASD.
Methods: This is a retrospective cohort study of 214 consecutive patients with ASD who underwent correction using cMIS involving at least 2 levels. Major complications encountered during surgery or within 30 days following the index procedure that needed reoperation or readmission were recorded. The primary outcomes measured were early readmission, and early reoperation.
Results: An average of 4 levels were fused. Nineteen complications were noted in the 30-day period following the index surgery, giving an early complication rate of 8.9%. Twelve of those complications occurred during the initial hospitalization and 7 complications occurred after the patient had been discharged home. Forty-seven percent of the complications occurred within the first 3 years of our experience, 37% in the next 2 years, and only 16% in the following 3 years. The 30-day readmission rate was 3.3%, which showed no statistically significant difference based on the number of levels fused.
Conclusions: Our study delivers significant evidence that efforts to reduce hospital readmissions for ASD patients should begin by concentrating on the postoperative complications. Although minimally invasive approaches will not eliminate all complications, they may have an effect on reducing the rate of major complications, most notably the rate of postoperative infection. This in turn can lead to a substantially lower readmission and reoperation rate as is reported in our study.
Level of Evidence: Level IV, case series.

Keywords: Adult spinal deformity; MIS; Reoperation; Readmission

Introduction

Reoperation and hospital readmission rates have been emphasized as an important measure of quality and cost-effectiveness of care [1,2]. Furthermore, with the introduction of bundled payments at the horizon, physicians and hospitals must consider the incidence of early reoperations and readmissions as they negotiate reimbursement models for episodes of care.

Adult spinal deformity has traditionally been treated surgically with open approaches; however, with a better understanding of surgical anatomy, combined with technological

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advancements, minimally invasive surgical (MIS) techniques have been gaining popularity in the treatment of ASD. These MIS techniques have shown good results in the treatment of ASD, with Oswestry Disability Index and Visual Analog Scale scores comparable to those of open surgery [3-7]. Commonly used MIS approaches for spine deformity correction currently include anterior lumbar interbody fusion, transforaminal lumbar interbody fusion (TLIF) [8-14], lateral lumbar interbody fusion [6,15-20], axial lumbar interbody fusion (AxiaLIF) [4,6,21,22], and MIS posterior instrumentation and fusion [6,7,23,24]. Circumferential minimally invasive surgery (cMIS) involves a combination of these techniques to achieve interbody fusion and posterior instrumentation and fusion and has reported successful results in treatment of moderate ASD (Cobb angle 35°–75°; sagittal vertical axis <10 cm) [25].

These MIS techniques offer the potential of reducing the morbidity associated with regular open surgeries because of their less invasive nature and have been shown to result in lower rates of infection, blood loss, and muscle dysfunction [4,25-27]. As such, minimally invasive procedures may lead to better postoperative pain management, shorter hospital stays, and lower healthcare costs [4]. Considering the high prevalence of ASD in the elderly population [3], it is certainly valuable to asses less invasive techniques that may offer a reduced risk of adverse events.

Although there have been limited reports of early complications and readmissions associated with open surgery for spine deformity, there is no information about readmission following cMIS correction of ASD. Schairer et al. [28] reported an 8.4% rate of unplanned readmissions at 30 days and 12.3% at 90 days following discharge after spinal fusion for adult spinal deformity (ASD). McCarthy et al. [1] reported a readmission rate of 27% for spine-related procedures following ASD surgery at an average follow-up of 4.8 years. However, they did not report on the early reoperation and readmission rates. Pugely et al. [2] analyzed a multicenter clinical registry and reported a 30-day readmission rate of 9.0% after lumbar deformity surgery and 3.3% after lumbar discectomy. Wound-related complications accounted for the most common reason for readmission [2].

Therefore, the purpose of this study was to assess the early reoperations and readmissions associated with surgical correction of ASD using cMIS. The study also looked at the learning curve associated with this treatment strategy. We hypothesize that cMIS techniques for ASD will show a trend of low rates of readmissions and reoperations and that these rates will decrease with increasing experience.

Materials and Methods

This is a retrospective cohort study of 214 consecutive patients (127 females, 87 males) with ASD who underwent correction using cMIS involving at least 2 levels. The study was approved by the institutional review board. All patients were operated on by the senior author at a single institution between January 2007 and June 2014. Lateral lumbar interbody fusion was performed at the operated levels between T12 and L5. For the L5–S1 when included in the fusion, the patients underwent either AxiaLIF or TLIF if the sagittal balance was satisfactory. If more correction was needed, then anterior lumbar interbody fusion was performed at the L5–S1 level. All patients also underwent MIS posterior spinal instrumentation and fusion at all the levels involved. Our MIS technique for surgical correction of ASD has been previously described elsewhere [5,6].

Data collection was performed by reviewing the hospital charts and records of the patients. Complications encountered during surgery or within 30 days following the index procedure that needed reoperation or readmission were recorded. The primary outcomes measured were early readmissions and early reoperations. Early readmission was defined as any readmission of a patient to the hospital within 30 days of the index procedure. Early reoperation was defined as an unplanned operation performed on the patient within 30 days of the index procedure. Additional data collected included patient's age, preoperative diagnosis, number of levels fused, length of stay during the initial hospitalization, time at which the complication occurred, and the intervention performed.

The majority of patients included had a preoperative diagnosis of adult scoliosis (n = 180) that included idiopathic scoliosis (n = 80), degenerative scoliosis (n = 88), and iatrogenic scoliosis (n = 12). Other diagnoses included were degenerative disk disorder (n = 10), kyphosis (n = 9), and spondylolisthesis (n = 15). Furthermore, Table 1 reports the number of patients stratified by the amount of coronal and/or sagittal deformity.

The patients were divided into 3 groups based on the number of levels fused. Group 1 had patients with fusion performed at 2 to 3 levels, Group 2 had patients with fusion performed at 4 to 8 levels, and Group 3 had patients with fusion performed at 9 or more levels. Seventy-seven patients met the criteria for inclusion into Group 1, 115 patients for Group 2, and 22 patients for Group 3. One hundred and eighty seven patients had purely lumbar fusions (L2–S1), 13 patients had purely thoracic fusions (T2–T10), and 14 patients had fusions involving the thoracolumbar region (T10–L2).

Table 1
Number of patients stratified by the amount of coronal and/or sagittal deformity.

Deformity parameters	Number of patients
Cobb angle <30° and SVA <4 cm	78
Cobb angle <30° and SVA >4 cm	63
Cobb angle >30° and SVA <4 cm	27
Cobb angle >30° and SVA >4 cm	46
Total number of patients	214

SVA, sagittal vertical axis.