

A Comprehensive Review of Complication Rates After Surgery for Adult Deformity: A Reference for Informed Consent

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Received 27 October 2014; revised 9 April 2015; accepted 9 April 2015

Abstract

Objective: An up-to-date review of recent literatures and a comprehensive reference for informed consent specific to ASD complications is lacking. The goal of the present study was to determine current complication rates after ASD surgery, in order to provide a reference for informed consent as well as to determine differences between three-column and non-three-column osteotomy procedures to aid in shared decision making.

Methods: A review of the literature was conducted using the PubMed database. Randomized controlled trials, nonrandomized trials, cohort studies, case–control studies, and case series providing postoperative complications published in 2000 or later were included. Complication rates were recorded and calculated for perioperative (both major and minor) and long-term complication rates. Postoperative outcomes were all stratified by surgical procedure (ie, three-column osteotomy and non-three-column osteotomy).

Results: Ninety-three articles were ultimately eligible for analysis. The data of 11,692 patients were extracted; there were 3,646 complications, mean age at surgery was 53.3 years (range: 25–77 years), mean follow-up was 3.49 years (range: 6 weeks–9.7 years), estimated blood loss was 2,161 mL (range: 717–7,034 mL), and the overall mean complication rate was 55%. Specifically, major perioperative complications occurred at a mean rate of 18.5%, minor perioperative complications occurred at a mean rate of 15.7%, and long-term complications occurred at a mean rate of 20.5%. Furthermore, three-column osteotomy resulted in a higher overall complication rate and estimated blood loss than non-three-column osteotomy.

Conclusions: A review of recent literatures providing complication rates for ASD surgery was performed, providing the most up-to-date incidence of early and late complications. Providers may use such data in helping to counsel patients of the literature-supported complication rates of such procedures despite the planned benefits, thus obtaining a more thorough informed consent.

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Keywords: Adult spinal deformity; Complications; Three-column osteotomy; PSO; Scoliosis

Author disclosures: DMS (none), AY (none), JSS (none), MPK (none), JKS (none), CRG (grants from UNCF-Merck Science Initiative, grants from NREF, grants from Burroughs Wellcome Fund, outside the submitted work), VL (none), RAH (none), SB (none), KK (none), FS (none), CIS (none), CPA (none).

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Introduction

Patients with adult spinal deformity (ASD) may be significantly disabled compared with age-matched controls. Many present with pain, progression of curve, imbalance with respect to the sagittal and/or coronal plane, radiculopathy, and spinal stenosis [1,2]. When conservative treatments, such as nonsteroidal anti-inflammatory drugs, exercise, and physical therapy, do not effectively address the aforementioned symptoms, surgery is recommended [1,3,4]. Multiple studies have shown that reconstructive surgery for ASD patients can result in significant and durable improvements in health-related quality of life measures, decreased use of opioid medications, and decreased disability [5–8].

Over the past three decades, the population of ASD surgical candidates has drastically increased likely as a result of a combination of the growing aging population, technological advances in spinal instrumentation, and a broadened array of surgical techniques. For example, the introduction of third-generation pedicle screw instrumentation has facilitated improved deformity correction and stabilization. Moreover, three-column osteotomies (3CO) employing a powerful posterior-only correction strategy, including pedicle subtraction osteotomy (PSO) and vertebral column resection (VCR), have increased in frequency, especially in older patients [9–11]. As a result, many patients, who in the past may have been deemed high-risk and inoperable are now considered for major realignments and reconstructions [5,12].

When obtaining consent from patients for such complex operations, it is imperative to discuss the morbidity and mortality associated with the operation or the untreated condition, both of which increase with age [1,5,13]. Previous reviews of postoperative ASD complication rates have been conducted, but they include adolescent populations or are limited to a specific deformity etiology [14,15]. Moreover, these studies typically do not provide individual complication rates and do not stratify data based on the invasiveness of the osteotomy employed. Overall, the statistics provided by such studies may be outdated and unsuitable for wide applicability in adult deformity surgical candidates.

This paper is a comprehensive review of complication rates exclusive to ASD, with the ultimate goal of providing patients and surgeons with a guiding tool in the surgical decision-making process. The objectives of this review are to answer the following clinical questions:

What are the specific, peer-reviewed literature—supported perioperative (≤ 3 months) major and minor complication rates for patients with ASD?

What are the long-term (> 3 months) complication rates for this patient population?

Are there substantial differences in complication for non-3CO versus 3CO, both with respect to complication rate and complication type?

Methods

Search strategy

A query of the PubMed database was performed, as well as a review of the bibliographies of eligible articles. The broad search was designed to include the postoperative outcomes for ASD. The following search strings were used: “adult scoliosis surgery outcome,” “adult scoliosis complications,” “adult ‘spinal deformity’ surgery,” “three column osteotomy,” “pedicle subtraction osteotomy,” “vertebral column resection deformity,” and “sagittal imbalance adult surgery.” A filter for studies published in 2000 or later was employed so that studies would largely consist of third-generation instrumentation and the most modern surgical techniques.

Eligibility criteria

Criteria for possible inclusion were the following:

Articles published in 2000 or later

Articles written in English or with a complete English translation

Articles providing quantitative results with respect to perioperative (≤ 3 months) and long-term (> 3 months) complications and/or estimated blood loss (EBL) specific to ASD

Fully published, peer-reviewed, retrospective or prospective studies including randomized controlled trials, nonrandomized trials, cohort studies, case–control studies, and case series

Articles reporting the results of open or “hybrid” (a combination of open and minimally invasive techniques) approach surgeries

ASD involving the following etiologies: degenerative, idiopathic, neuromuscular, congenital, traumatic, infection-related (eg, tuberculosis), ankylosing spondylitis, osteoporotic, and iatrogenic.

Criteria for exclusion were the following:

Articles that did not provide clear, quantitative complication data specific to ASD surgery

Nonadult patients (patient age < 18 years)

Articles that did not have more than 95% of patients undergoing instrumented surgeries

Retrospective studies with less than a 24-month mean clinical and radiographic follow-up (FU) period, unless the patient population exceeded 300 or reported neurological complications only

Prospective studies with less than an 18-month mean clinical and radiographic FU period (because of the paucity of studies)

Studies including tumor-related deformity, unless it constituted less than 1.5% of the study population

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