

Clinical Series

The Seattle Spine Team Approach to Adult Deformity Surgery: A Systems-Based Approach to Perioperative Care and Subsequent Reduction in Perioperative Complication Rates

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Abstract

Study Design: Retrospective consecutive case review pre- and postintervention.

Objectives: Characterize the effects of the intervention.

Summary of Background Data: Complication rates in adult spinal deformity surgery are unacceptable. System approaches are necessary to increase patient safety. This group reported on the dual—attending surgeon approach, a live multidisciplinary preoperative screening conference, and the intraoperative protocol for the management of coagulopathy. The outcomes were demonstrated by complication rates before and after the institution of this protocol.

Methods: Forty consecutive patients in Group A were managed without the 3-pronged approach. A total of 124 consecutive patients in Group B had a dual—attending surgeon approach, were presented and cleared by a live multidisciplinary preoperative conference, and were managed according to the intraoperative protocol.

Results: Group A had an average age of 62 years (range, 39–84 years). Group B had an average age of 64 years (range, 18–84 years). Most patients in both groups had fusions from 9 to 15 levels. Complication rates in Group B were significantly lower (16% vs. 52%) ($p < .001$). Group B showed significantly lower return rates to the operating room during the perioperative 90-day period (0.8% vs. 12.5%) ($p < .001$). Group B also had lower rates of wound infection requiring debridement (1.6% vs. 7.5%), lower rates of deep vein thrombosis/pulmonary embolism (3.2% vs. 10%), and lower rates of postoperative neurological complications (0.5% vs. 2.5%) (not significant). Group B had significantly lower rates of urinary tract infection requiring antibiotics (9.7% vs. 32.5%) ($p < .001$).

Conclusions: These data suggests that a team approach consisting of a dual—attending surgeon approach in the operating room, a live preoperative screening conference, and an intraoperative protocol for managing coagulopathy will significantly reduce perioperative complication rates and enhance patient safety in patients undergoing complex spinal reconstructions for adult spinal deformity.

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Keywords: Complications; Adult; Deformity; System; Approaches

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Introduction

Complications in complex spinal reconstructive surgery in adults are a frequently observed phenomenon [1-8]. The surgical literature contains several reports that document blood loss exceeding a patient's baseline total estimated blood volume sustained during a corrective spinal fusion for scoliosis [9-12]. With the increasing frequency of complex reconstructive surgery for adult spinal deformity,

the same phenomenon is being described in this decade [13–16]. Rampersaud et al. [17] studied intraoperative adverse events and related postoperative complications in spine surgery and found an adverse incidence rate of 10.2%. As the evidence mounts that standardized protocols for high-risk spine surgery patients can reduce complications [18–20], spine surgeons are faced with an increasing need to develop strategies and protocols aimed at reducing risk and increasing patient safety. This need is perhaps nowhere greater than in surgical procedures that propose to correct adult spinal deformities, arguably some of the most dangerous and complication-ridden operations in the surgical armamentarium [3,6,21–27].

To date, many strategies are in use to attempt to reduce perioperative complications in adult deformity surgery. These include better preoperative planning strategies, the use of intraoperative vancomycin, and staging [19,28–33]. Although there are isolated strategies for reducing complications, few centers have studied institutional team protocols and their effect on mitigating complications.

The authors' center changed its approach to adult spinal deformity surgery owing to internal assessment of the complication rates. This approach centers on the use of a live multidisciplinary complex spine conference to assess appropriateness of the proposed surgery. Two attending surgeons are used in the operating room, to increase efficiency and shorten surgical time. The third tenet of the approach uses an intraoperative protocol to manage coagulopathy. This article describes this 3-pronged protocol and tests the hypothesis that the institution of this protocol will lead to a decrease in the incidence of perioperative complication rates.

Methods

Before instituting a major spine protocol, the attending spinal surgeon would see and book any major spine case. The case was not required for presentation in front of a live multidisciplinary spine conference. In addition, treatment could be done with a physician's assistant or a resident instead of 2 attending surgeons. There was no intraoperative protocol to manage or track coagulopathy, and each treatment would be done with an anesthesiologist who was assigned on the day of surgery. A team of complex spine anesthesiologists dedicated to complex adult spinal surgery did not exist. The major spine protocol that was developed is described in this article in preoperative, intraoperative, and postoperative phases. The surgeons in both arms of the study are the same.

Major Spine Protocol

Preoperative

Patients referred to the authors' surgical spine clinic who appear to have scoliosis as an underlying diagnosis have a standard set of preoperative studies, including 36-inch

anteroposterior and lateral spine films, as well as a dedicated lumbar spine X-ray with flexion-extension views. Patients with symptoms of radiculopathy or neurogenic claudication will also have magnetic resonance imaging of the lumbar spine. Radiographic evaluation includes measurement of sagittal and coronal balance, pelvic parameters, and Cobb angles of major and/or minor curves [34]. A computed tomography scan of the spine and a dual-energy X-ray absorptiometry scan are ordered for potential operative patients. An Oswestry Disability Index and European Quality of Life-5 Dimensions (EQ-5D) questionnaire are obtained for all preoperative patients [35–39].

A patient will enter the researchers' major spine pathway (MSP) by either meeting any of the following criteria: 6 or more levels of fusion; 6 or more hours of case duration; spinal deformity surgery, and/or surgeon expertise deeming the surgery to be sufficiently complex; and significant comorbidities in the cardiac, pulmonary, hemostatic, or neurologic systems. The authors characterize a spinal deformity as scoliosis, kyphosis, or flat-back or any revision case that requires at least 6 levels of fusion. All MSP patients are presented at a monthly conference attended by an internist, a physical medicine and rehabilitation physician, at least 2 members of the dedicated complex spine anesthesiology team, the nurses who coordinate the complex spine patient class, and the operative surgeons. The anesthesiologists and internist review each patient's history and medical issues before the conference. A written summary of the patient's past medical history, relevant laboratory values, screening tests (electrocardiogram, echocardiogram, etc) is then generated and sent via secure e-mail to the conference participants.

Discussion for each patient focuses on both the proposed surgical correction and the preoperative and postoperative medical issues relevant to the patient. Approximately 25% of patients presented at the conference have medical conditions rendering them unsuitable for the extent of surgical treatment proposed; thus a nonoperative plan is generated [40]. Some patients require medical optimization or further studies before a final decision can be made. The surgeon conveys the result of the conference to the patient.

Once a patient has been presented at the conference and deemed a surgical candidate, the surgeon will order any remaining studies described previously, if not already completed. All surgical patients attend a 2-hour class run monthly by clinic nurses and 1 of the spinal deformity surgeons that focuses on the postoperative recovery period and allows for a question-and-answer session. All patients are then engaged in a consent process that includes a discussion of risks including bleeding, infection, proximal junctional kyphosis, rod/hardware failure, postoperative neurologic injury, stroke, death, and blindness during spine surgery [3,41–44].

All patients with normal preoperative coagulation and hematologic panels have 6 U of packed red blood cells and 2 U of thawed plasma typed and crossed. If abnormalities

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