

Deep Wound Infections After Pediatric Scoliosis Surgery

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Abstract

Study Design: Retrospective clinical and radiographic review.

Objective: The purpose of this study was to evaluate the characteristics of deep wound infection, as well as the potential factors that correlate to surgical site infection (SSI) in spine deformity surgery.

Summary of Background Data: Preventing SSIs in pediatric spinal deformity surgery is a crucial task. Recent data have shown that antibiotic-loaded allograft and properly timed preoperative antibiotic administration decrease SSIs. However, there remain controversies over the appropriate preoperative antibiotic selection.

Methods: We reviewed 851 spinal deformity surgeries that took place at a single institution from 2006 to 2010. In particular, preoperative and postoperative characteristics of the deep wound infections were evaluated.

Results: Twenty-four patients had SSIs. The mean age at surgery in the infected cohort was 14 years, mean length of surgery was 8 hours, and median estimated blood loss was 2,482 mL (%EBV: 66%). Approximately 67% of the infected patients had bowel/bladder incontinence, and 71% had prolonged intravenous access perioperatively. According to culture results, the most effective antibiotic to treat the infections was vancomycin. Preoperative antibiotics were administered within 30 minutes of incision (hospital protocol) in only 12.5% ($p = .001$) and within 1 hour of incision in 54% of the cases. The wound status within 3 days of surgery is as follows: 38% intact, 29% significant wound drainage, and 33% wound dehiscence. Methicillin-resistant *Staphylococcus aureus* (MRSA) and oxacillin-resistant *Staphylococcus epidermidis* were associated with intact wounds, whereas gram-negative pathogens were seen in dehisced or draining wounds ($p < .001$).

Conclusions: The authors showed that their cohort of patients with infection had a high rate of draining wounds, MRSA infections, administration of antibiotics more than 1 hour ahead of incision, and prolonged need for intravenous access after surgery. Efforts to mitigate these associations by using vancomycin prophylactically, doing meticulous wound closure to prevent drainage or dehiscence, and delivering antibiotics at an optimal time ahead of incision may lead to a decrease in infection rates in pediatric spinal surgery. Future prospective studies will be needed to validate this.

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Keywords: Surgical site infections; Pediatric scoliosis; Idiopathic scoliosis; Neuromuscular scoliosis; Antibiotics; Pathogens

Introduction

Postoperative spinal wound infections are relatively common and are associated with marked morbidity and poor long-term outcomes [1-3]. *Staphylococcus aureus* is

the most common offending organism. However, an increased incidence of other bacterial agents, including *Staphylococcus epidermidis*, or more virulent bacteria, such as methicillin-resistant *Staphylococcus aureus* (MRSA), has been reported [1-3].

Pediatric scoliosis surgery is a unique category of surgery involving posterior thoracolumbar anatomy, instrumentation, and the urinary/bowel incontinent neuromuscular population. There remain controversies over the appropriate preoperative antibiotic selection.

The purposes of the current study were to identify particular characteristics of patients with deep wound

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infections after spinal deformity surgery and to provide recommendations to prevent these infections. The following questions were examined:

- What were the demographic and medical comorbidities of the infected patients?
- What were surgical and postoperative factors predisposing to infection?
- Were gram-negative infections related to wound complications?
- Which instrumentation constructs were at-risk for infection?
- What was the ideal prophylactic antibiotic (intravenous and in the bone graft)?
- Were there errors in the timing of preoperative antibiotic administration?
- Which pathogens were causing these infections?

Materials and Methods

We reviewed all 851 spine deformity surgeries that were performed by five experienced fellowship-trained spine surgeons at a single institution between 2006 and 2010. All procedures that required an operative irrigation and debridement (I&D) within 6 months of index surgery, defined in this study as a deep wound infection, had a comprehensive review of demographic and medical comorbidities, intraoperative and postoperative complications, antibiotic prophylactic measures, overall infection rate, and consequent infecting pathogens. The following information was collected: sex, type of scoliosis (eg, adolescent idiopathic), form of cerebral palsy (CP; eg, quadriplegic), prolonged postoperative intravenous access (defined as access 6 days or more postoperatively), intraoperative complications, early postoperative wound complications (excessive wound drainage, wound dehiscence), perioperative antibiotic administered, infection rate among the different demographics, and intraoperative cultures from the I&D (Tables 1–9). Intraoperative complications were defined as neurologic (significant intraoperative

Table 1

Control cohort: demographics of pediatric spinal deformity patients without postoperative deep wound infections.

	Number of patients	Percentage
Male (boy)	360	44
Female (girl)	467	56
Cerebral palsy	179	22
Neuromuscular (non–cerebral palsy)	52	6
Adolescent idiopathic scoliosis	407	49
Congenital scoliosis	36	4
Syndromic scoliosis	35	4
Idiopathic early-onset scoliosis	57	7
Skeletal dysplasia	30	4
Osteogenesis imperfecta	7	1
Scheuermann's kyphosis	24	3

Table 2

Surgical site infection cohort: demographics of pediatric spinal deformity patients with postoperative deep wound infections.

	Number of patients	Percentage
Male (boy)	14	58
Female (girl)	10	42
CP	14	58
Neuromuscular (non-CP)	3	13
Adolescent idiopathic scoliosis	3	13
Congenital scoliosis	1	4
Syndromic scoliosis	3	13
Quadriplegic CP	13	54 (93 ^a)
Dystonic CP	1	4 (7 ^a)
GMFCS 1	0	0
GMFCS 2	0	0
GMFCS 3	2	8
GMFCS 4	10	42
GMFCS 5	4	17
GMFCS–n/a	8	33

CP, cerebral palsy; GMFCS, Gross Motor Functional Classification Scale; GMFCS–n/a, patients who are not neurologically impaired and whom GMFCS does not apply to; repeated I&D, an I&D was performed 6 months after the index I&D.

^a Frequency patients that met this category within only the CP sample.

neuromonitoring changes) and cardiac. If these intraoperative complications resulted in an abortion of surgery, this was defined as abortion of surgery due to an intraoperative complication. Bladder incontinence was defined preoperatively from the patient questionnaire and patient history.

Table 3

Surgical site infection cohort: summary of continuous variables.

	Mean	SD	Median	IQR	Minimum	Maximum
Height	n/a	n/a	156	21	85	186
Weight	n/a	n/a	41	22	12	108
MC Cobb	77	24	n/a	n/a	47	131
Number of days to I&D	n/a	n/a	20	15	10	90
Number of ICU days	n/a	n/a	6	9	0	30
Number of days intubated	n/a	n/a	3	4	0	15
Number of hospital days ^a	14	8	n/a	n/a	4	30
Age at time of surgery	14	5	n/a	n/a	1	20
Number of levels fused	15	5	n/a	n/a	3	19
Length of surgery (h)	8	3	n/a	n/a	3	15
Estimated blood loss (mL)	n/a	n/a	2,482	3,290	75	10,000
Number of units transfused	4	4	n/a	n/a	0	13
Peri abx start (min) ^b	n/a	n/a	57	40	3	280
Number of days of abx ^c	n/a	n/a	3	2	1	11

ICU, intensive care unit; I&D, irrigation and debridement; IQR, interquartile range; MC Cobb, major curve Cobb angle; SD, standard deviation.

^a Number of days in admission before irrigation and debridement.

^b Time from antibiotic administration to incision.

^c Number of days of perioperative antibiotic prophylaxis.

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