Surgical Site Infections After Pediatric Spine Surgery

Lorena V. Floccari, MD, Todd A. Milbrandt, MD*

KEYWORDS

• Surgical site infection • Pediatric spine • Scoliosis • Infection prevention

KEY POINTS

- There is a higher incidence of surgical site infection (SSI) in neuromuscular patients (5.3% to 14%) than in idiopathic patients (0.5% to 2.7%).
- Risk factors include incontinence, inappropriate perioperative antibiotics, prominent implants, length of fusion, obesity, malnutrition, pelvic fixation, increased operative time, blood loss/transfusion, and length of hospital stay.
- Back acne is a risk factor for delayed infection with *Propionibacterium acne*.
- Best practice guidelines include use of chlorhexidine skin wash, nutritional assessment, urine cultures, limiting operating room traffic, vancomycin powder, minimizing dressing changes, and antibiotic prophylaxis with cefazolin and gram-negative antimicrobial for high-risk patients.
- Treatment of acute infection includes aggressive debridement and antimicrobial therapy, whereas delayed infection requires implant removal.

INTRODUCTION

Surgical site infection (SSI) after pediatric spinal deformity surgery is a complication that results in substantial morbidity and cost. The 2015 updated Centers for Disease Control and Prevention's (CDC) guidelines[1,2] defines a superficial SSI as infection involving skin or subcutaneous tissue of the incision within 30 days of surgery, whereas a deep SSI involves deeper soft tissue structures within 90 days of surgery, in association with clinical signs or symptoms of infection, purulent drainage, positive cultures, or abscess formation.

In a 2009 retrospective case series, Hedequist and colleagues[3] found that the mean number of hospital days related to an SSI was 29 (range 6–171 days) and hospitalization cost $157,537 (range $26,877–$961,722). Prolonged courses of intravenous (IV) antibiotics and multiple surgeries for debridement, implant removal, and revision impose tremendous burden to patients, families, physicians, hospitals, and payers. The in-hospital costs pale in comparison with the personal and societal costs, including missed school, lost parental days of work, and psychological stresses to the involved patients and families.[4]

Given the high morbidity and cost incurred with this complication, SSI after pediatric spinal surgery is a major topic of research. This review focuses on recent advancements in the identification of risk factors, prevention strategies, diagnosis, and treatment of surgical SSIs in pediatric spine patients.

INCIDENCE

Despite modern advances in infection-preventative strategies, the postoperative SSI incidence has remained substantial, with an overall rate of 2.2% to 8.5% in series that combine deep and superficial

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Department of Orthopedic Surgery, Mayo Clinic, 200 1st Street Southwest, Rochester, MN 55905, USA
* Corresponding author.
E-mail address: Milbrandt.Todd@mayo.edu

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SSIs from all patients with scoliosis.[4–11] Previous literature demonstrates that patients with neuromuscular scoliosis (NMS) are at higher risk than patients with adolescent idiopathic scoliosis (AIS) for SSI, with a 0.5% to 2.7% rate in patients with AIS[4–6,12] versus 5.3% to 14.0% in the NMS population.[4–6,13–16] A retrospective review of 20,424 pediatric patients with scoliosis in the Scoliosis Research Society database supported these trends; the overall infection rate was 2.6%, with a 5.5% rate in patients with NMS versus 1.4% in idiopathic patients.[7]

RISK FACTORS

In recent years, an important focus of pediatric spinal SSI research has concentrated on defining risk factors for infection in order to clarify targets for preventative strategies. Glotzbecker and colleagues[17] performed a systematic review of risk factors for pediatric spine SSI and rated studies as grade A evidence (good), grade B (fair), or grade C (poor). Although there is a lack of high-quality evidence in the literature, several level II to IV studies revealed the risk factors as listed in **Box 1**.

Subramanyam and colleagues[18] also completed a systematic review of risk factors for SSI in a pooled population of pediatric patients with spinal deformity and found the following 5 factors statistically predictive of SSI:

- Inappropriate antibiotic use (wrong drug, only clindamycin, incorrect dose or timing, and/or continuation beyond 24 hours after surgery)
- Neuromuscular scoliosis
- Instrumentation
- Increased length of hospitalization
- Residual postoperative curve (considered to be a marker of surgical invasiveness or length of procedure)

Speculation as to the reason for a higher risk in patients with NMS includes a higher rate of urinary and fecal incontinence leading to wound contamination, excessive tension on the wound from body habitus, and poor preoperative nutritional status.

PREVENTATIVE STRATEGIES

Despite increased awareness of risk factors for SSI, there is a void in the literature of high quality evidence for infection prevention strategies. Glotzbecker and colleagues[4] performed a survey in 2013 among Pediatric Orthopedic Society of North America/Scoliosis Research Society (POSNA/SRS) members and found significant variability in the current practices of spinal deformity surgeons.

Box 1
Risk factors for SSI in pediatric spine patients

Grade B

- Urinary or bowel incontinence
- Positive preoperative urine culture
- Inappropriate antibiotic prophylaxis
- Prominent implants
- First-generation stainless steel implants (compared with newer titanium implants)

Grade C

- Malnutrition
- Obesity
- Blood loss
- Blood transfusion
- Increased number of levels fused
- Extension to pelvis/sacrum
- Increased operative time
- No use of drain

Risk factors were graded A (good evidence), B (fair evidence), or C (conflicting or poor-quality evidence).

From Glotzbecker MP, Riedel MD, Vitale MG, et al. What's the evidence? Systematic literature review of risk factors and preventive strategies for surgical site infection following pediatric spine surgery. J Pediatr Orthop 2013;33(5):485; with permission.