Recurrent Delayed Surgical Site Infections in Adolescent Idiopathic Scoliosis

Bradley Osemwengie, MD
Caroline Granruth, MD
Tensae Assefa, MD
Amrit Khalsa, MD

Department of Orthopaedic Surgery
University of Pennsylvania

Introduction

Adolescent idiopathic scoliosis (AIS) is a deformity of the spine characterized by lateral deflection and rotation of the vertebral bodies.[1] It is the most common type of scoliosis in children of age 10 to 18 years, and typically presents between 10-12 years of age. It occurs more frequently in females, with a 10:1 female-to-male ratio. Diagnosis is made by a measured Cobb angle of > 10 degrees on a standing AP radiograph. The most common presenting pattern of deformity is a right convex curvature of the thoracic spine, which causes forward rotation and protrusion of the right shoulder.[1,2]

Nonoperative treatment is aimed at preventing curve progression and primarily consists of bracing. Studies have shown that for Cobb angles of 25-45 degrees, consistent bracing for >13 hours/day can significantly decrease curve progression to < 50 degrees.[2] Although various kinds of bracing designs exist, there is no evidence that one brace is superior in preventing curve progression.[3] Surgical indications for AIS include Cobb angle > 50 degrees and sequela such as restrictive pulmonary function. Posterior spinal fusion (PSF) has become the mainstay of surgical treatment for severe AIS to correct and prevent further progression of spinal deformity.[4]

Delayed infection after PSF for AIS is an uncommon complication but is one of the leading causes of late revision surgery. It is defined as the development of a surgical site infection (SSI) > 1 year after primary spinal surgery. Mechanisms include late activation of bacteria implanted at the time of index surgery or hematogenous seeding.[5] Studies have described different treatment modalities for delayed infection after PSF including implant removal, implant exchange, implant retention, and/or long-term antibiotics.[6] We present the case of one AIS patient with two instances of delayed infection after PSF treated with both implant retention and ultimately implant removal.

Patient Presentation

An otherwise healthy 7-year-old girl was observed to have asymmetric shoulder height. After a thorough evaluation, she was diagnosed with idiopathic scoliosis. Nonoperative treatment was initiated with back bracing to prevent curve progression. By the age of twelve, despite compliance with bracing up to 13 hours/day, there was persistent curve progression (Cobb angle 41 degrees) as well as worsening pulmonary function with new onset asthma (Figure 1). Surgical treatment was indicated for curve correction, and the

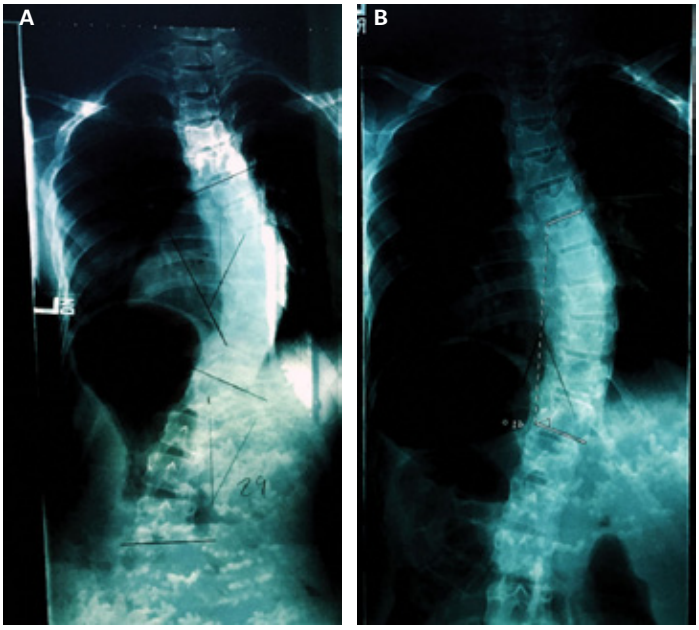

Figure 1. Preoperative thoracolumbar x-rays. **(A)** PA x-ray showing scoliosis of the thoracic spine; **(B)** PA of thoracolumbar spine showing a Cobb angle of 41 degrees.

patient underwent a T2-L3 posterior spinal fusion (PSF) on January 2007 by a fellowship-trained pediatric orthopedic spine surgeon. The case was prolonged (>8 hours), requiring intra-operative transfusion, and the patient remained intubated in the ICU for comfort until post-op day 1. The patient was also noted to have new onset right sided Horner's syndrome post-operatively (ptosis and miosis). Her hospital course was otherwise uncomplicated, and the patient was discharged home on post-op day five. She completed three months of physical therapy and had a full recovery with asthma resolution. Postoperative x-rays demonstrated appropriate hardware alignment (Figure 2).

At eighteen months postoperatively, the patient was noted to have an erythematous area of fluctuance on her lower back, at the distal aspect of her surgical incision. She had no systemic symptoms, but an infectious workup revealed elevated ESR and WBC, consistent with a surgical site infection. She underwent surgical incision and drainage of her infection on August 2008 with implant retention. Intra-operatively, it was apparent that the infection extended both proximally and distally with several pockets of purulent material deep to fascia and surrounding bone. After thorough debridement of soft tissue, bone, and hardware, the proximal half of the wound was primarily closed in layers. The distal half of the incision was left open down to bone, and a negative pressure wound therapy (NPWT) vac was placed to fill the defect. Culture specimens obtained in the operating room grew Staphylococcus epidermidis. The patient continued NPWT for two months postoperatively until the wound granulated and healed completely by secondary intention. She also completed a six-week course of IV levofloxacin. She continued to have a full recovery at her post-operative visits through ten years of follow-up without evidence of recurrent infection or pseudoarthrosis.

On April 2023, sixteen years after her index spinal fusion surgery, she began experiencing new onset mid back pain. She was found to have an area of fluctuance at the distal aspect of her incision and presented to the outpatient office for an evaluation the next day. On exam, the patient was neurovascularly intact. There was a 3 cm fluid collection at the distal aspect of her surgical incision that was tender to palpation with purulent drainage. A bedside culture was performed with minor sterile debridement, which later grew few Staphylococcus hominis, and few anaerobic gram-positive rods. X-rays at the time showed intact hardware. MRI of the entire spine revealed two thoracolumbar abscesses, measuring 2 x 3.7 x 6.5cm on the left side, and 1 x 2.3 x 3.8 cm on the right side (Figure 3). A CT was obtained and demonstrated complete fusion without concern for pseudarthrosis (Figure 4). The patient proceeded with surgical intervention in the form of irrigation and debridement with removal of hardware.

Hospital Course

The patient went to the operating room on April 2023 for irrigation and debridement with T2-L3 removal of hardware and NPWT placement. Gross purulence was noted intraoperatively, as well as complete bony fusion

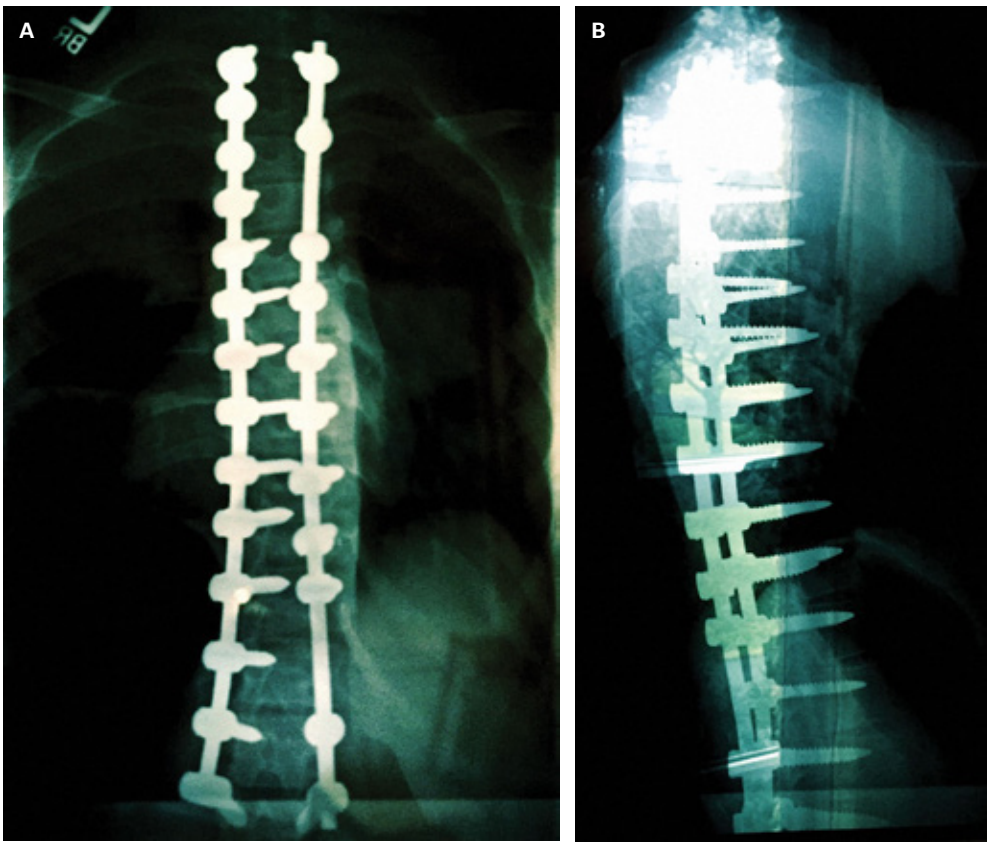

Figure 2. Postoperative thoracolumbar x-rays. **(A)** PA x-ray showing T2-L3 posterior spinal fusion; **(B)** Lateral x-ray of thoracolumbar spine showing T2-L3 (PSF).

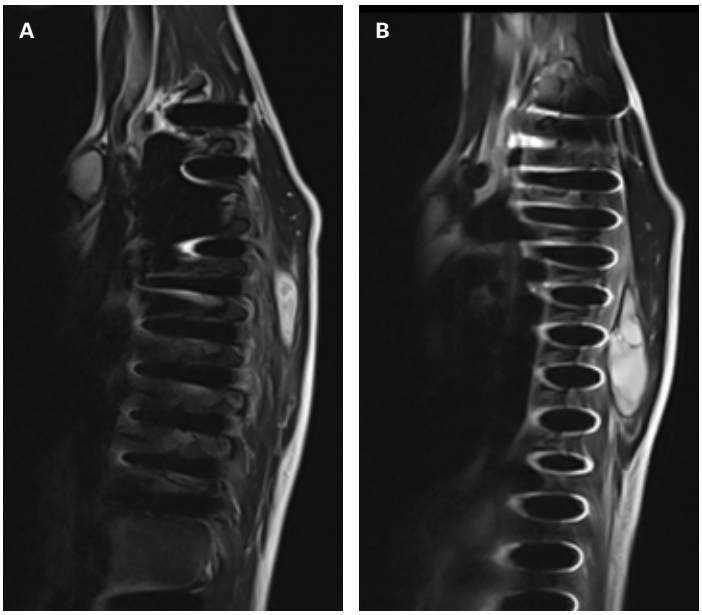

Figure 3. (A,B) Sagittal T2 MRI images of thoracolumbar spine showing two abscesses in the thoracic region.

Figure 4. CT sagittal scan of **(A)** thoracic and **(B)** lumbar spine showing no evidence of hardware loosening or fracture.

from T2-L3. All hardware was removed, and non-viable tissue was extensively debrided. Following this, plastic surgery performed a complex wound closure using rotational myocutaneous flaps. An incisional vac was placed along with 3 drains.

The patient was started on empiric vancomycin and cefepime postoperatively, which was narrowed to daptomycin pending culture growth. Culture specimens obtained in the operating room grew Cutibacterium acnes. Her hospital course was complicated by acute blood loss anemia requiring blood transfusion. She was stable for discharge home on post-op day seven. She completed a six-week course of IV antibiotics. Following this, she completed a six-week course of oral doxycycline. The patient was closely followed by infectious diseases (ID), plastic surgery, and orthopedic surgery during this time, and was progressing appropriately. Thoracolumbar x-rays were obtained during each postoperative office visit, most recently on June 2024, showing interval removal of spinal hardware with stable bony alignment (Figure 5).

Discussion

We report a case of recurrent, delayed surgical site infection in a patient with AIS. Multiple studies have analyzed the rates of infection after scoliosis surgery, with infection rates ranging from 1% - 5% for AIS.7 Risk factors for infection after scoliosis surgery include non-idiopathic pathology, revision surgery, and utilizing growing constructs.8-9 The most isolated pathogens include Staph aureus, Staph epidermidis, and Cutibacterium acnes (C. acnes).10

C. acnes is a gram-positive anaerobic bacillus located in pilosebaceous glands, usually responsible for late postoperative surgical site infections (SSI) due to its indolent nature.11 Prior studies have described the prevalence of C. acnes in delayed infection after AIS.12, 13 A 2018 case control study was unable to identify any significant risk factors for the development of this infection.14

Figure 5. Standing thoracolumbar x-rays obtained two months postoperatively after removal of hardware.

Conclusion

This is a case report denoting the presence of two delayed surgical site infections in a patient that underwent thoracolumbar fusion for adolescent idiopathic scoliosis. Although this is a rare complication for this procedure, vigilance must be maintained on the part of the patient and providers to detect any changes in skin, pain, or neurological status in this patient population as delayed infection is always a possibility. Due to the indolent nature of the infectious process, a high clinical suspicion should be maintained to prevent the long-term sequelae of a missed deep SSI.

References

1. Parent S, Newton PO, Wenger DR. Adolescent idiopathic scoliosis: etiology, anatomy, natural history, and bracing. *Instr Course Lect.* 2005;54:529-36.

2. Gomez JA, Hresko MT, Glotzbecker MP. Nonsurgical Management of Adolescent Idiopathic Scoliosis. J *Am Acad Orthop Surg.* 2016;24(8):555-64.

3. Weinstein SL, Dolan LA, Wright JG, et al. Effects of bracing in adolescents with idiopathic scoliosis. N *Engl J Med.* 2013;369(16):1512-21.

4. Von Heideken J, Iversen MD, Gerdhem P. Rapidly increasing incidence in scoliosis surgery over 14 years in a nationwide sample. *Eur Spine J.* 2018;27(2):286-292.

5. Clark CE, Shufflebarger HL. Late-developing infection in instrumented idiopathic scoliosis. *Spine (Phila Pa* 1976). 1999;24(18):1909-12.

6. Smith JS, Shaffrey CI, Sansur CA, *et al.* Scoliosis Research Society Morbidity and Mortality Committee. Rates of infection after spine surgery based on 108,419 procedures: a report from the Scoliosis Research Society Morbidity and Mortality Committee. *Spine* (Phila Pa 1976). 2011;36(7):556-63.

7. Warner SJ, Uppstrom TJ, Miller AO, *et al.* Epidemiology of Deep Surgical Site Infections After Pediatric Spinal Fusion Surgery. *Spine* (Phila Pa 1976). 2017;42(3):E163-E168.

8. Cahill PJ, Warnick DE, Lee MJ, *et al.* Infection after spinal fusion for pediatric spinal deformity: thirty years of experience at a single institution. *Spine* (Phila Pa 1976). 2010; 35(12):1211-7.

9. Aleissa S, Parsons D, Grant J, *et al.* Deep wound infection following pediatric scoliosis surgery: incidence and analysis of risk factors. *Can J Surg.* 2011; 54(4):263-9.

10. Mackenzie, W.G. Stuart BS, MA1; Matsumoto, Hiroko MA1; Williams, Brendan A. BA1 *et. al.* Surgical Site Infection Following Spinal Instrumentation for Scoliosis: A Multicenter Analysis of Rates, Risk Factors, and Pathogens. *The Journal of Bone & Joint Surgery* 2013; 95(9):p 800-806

11. Kardile MP, Bains SS, Kuo CC, *et al.* Is Propionibacterium acnes becoming the most common bacteria in delayed infections following adolescent idiopathic scoliosis surgery? *Spine Deform.* 2021;9(3):757-767.

12. Gelderman SJ, Faber C, Kampinga GA, *et al.* A high prevalence of Cutibacterium acnes infections in scoliosis revision surgery, a diagnostic and therapeutic dilemma. *Spine Deform.* 2023. (2):319-327.

13. Hahn F, Zbinden R, Min K. Late implant infections caused by Propionibacterium acnes in scoliosis surgery. *Eur Spine J.* 2005; (8):783-8.

14. Swarup I, Gruskay J, Price M, *et al.* Propionibacterium acnes infections in patients with idiopathic scoliosis: a case-control study and review of the literature. *J Child Orthop.* 2018;12(2):173-180.