

Rapid Progression of Scoliosis Requiring Re-Instrumentation after Implant Removal Due to Infection Following Posterior Spinal Fusion and Instrumentation

Keita Nakayama¹⁾, Toshiaki Kotani¹⁾, Tsuyoshi Sakuma¹⁾, Shunji Kishida¹⁾, Yuta Muramatsu¹⁾, Yu Sasaki¹⁾, Keisuke Ueno¹⁾, Yasusi Iijima¹⁾, Tsutomu Akazawa²⁾, Masashi Yamazaki³⁾ and Shohei Minami¹⁾

1) Department of Orthopedic Surgery, Seirei Sakura Citizen Hospital, Sakura, Japan

2) Department of Orthopedic Surgery, St Marianna University Hospital, Kawasaki, Japan

3) Department of Orthopedic Surgery, Tsukuba University Hospital, Tsukuba, Japan

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An 11-year-old girl was diagnosed with Lenke type 1A Adolescent Idiopathic Scoliosis (AIS). The Cobb angle was 56°, and the Risser grade was 0 (Fig. 1). The patient underwent posterior spinal fusion and instrumentation (PSFI) (T2-L2) with pedicle screw and cranial claw hook instrumentation (Fig. 2). Postoperative laboratory data suggested infection. Moreover, she experienced postoperative wound breakdown and a staphylococcus species from the cranial wound, which resolved with antibiotic therapy. A bulge appeared in the skin of her back three months postoperatively because of right cranial rod protrusion. During a second surgery, the right upper rod was cut and the right proximal hooks were removed (Fig. 2). One year after the initial surgery, reddened skin in the cranial wound and an elevated C-reactive protein level suggested infection relapse, which was managed by a third surgery. The partial left rod was cut and the left proximal hooks were removed (Fig. 2). After the third surgery, she did not undergo brace treatment. All three operations were performed in the previous hospital.

Four years after the initial surgery, when the patient was 15 years old, her right thoracic curve had increased to 98° (Fig. 3). She was referred to our hospital for revision surgery. There were no localized or laboratory findings indicating infection. A radiograph with the patient in a bent position revealed that her main right thoracic curve was fairly rigid (Fig. 3).

A two-stage surgery was planned for the severe rigid scoliosis. All implants were removed during the first surgical

stage. On the fused segment at the apex, the lamina was covered with rigid ossification, requiring a Ponte osteotomy. The patient used a maximum 20 kg halo-wheelchair traction for one month postoperatively, and her right thoracic curve remained rigid with an 85° angle. During the second surgical stage, an additional osteotomy and corrective revision, consisting of fusion using segmental pedicle screws at T3-L3, were performed. After the rod was inserted, motor-evoked potentials disappeared from every channel. We adjusted the rods to reduce the correction force, and motor-evoked potentials appeared. However, after the patient recovered from anesthesia, both her legs were completely paralyzed.

Nevertheless, one day after surgery, her muscle strength had completely recovered, and she was able to walk within a few days with no signs of neurological abnormality. We used cefotiam 2 g per day for three days after surgery, and there was no sign of infection. The surgery improved her scoliosis to 63° (Fig. 4). Moreover, CT after final surgery showed all pedicle screws were appropriately inserted.

Rapid curve progression occurred in this case after partial removal of the implants. Whether or not infection after spine surgery should be treated using implants is controversial. Some studies have reported that implant removal and intravenous administration of antibiotics can silence infection after PSFI^{1,2)}. However, some studies reported that removing the implant only led to curve progression after surgery^{3,4)} in patients who underwent PSFI and developed late infections.

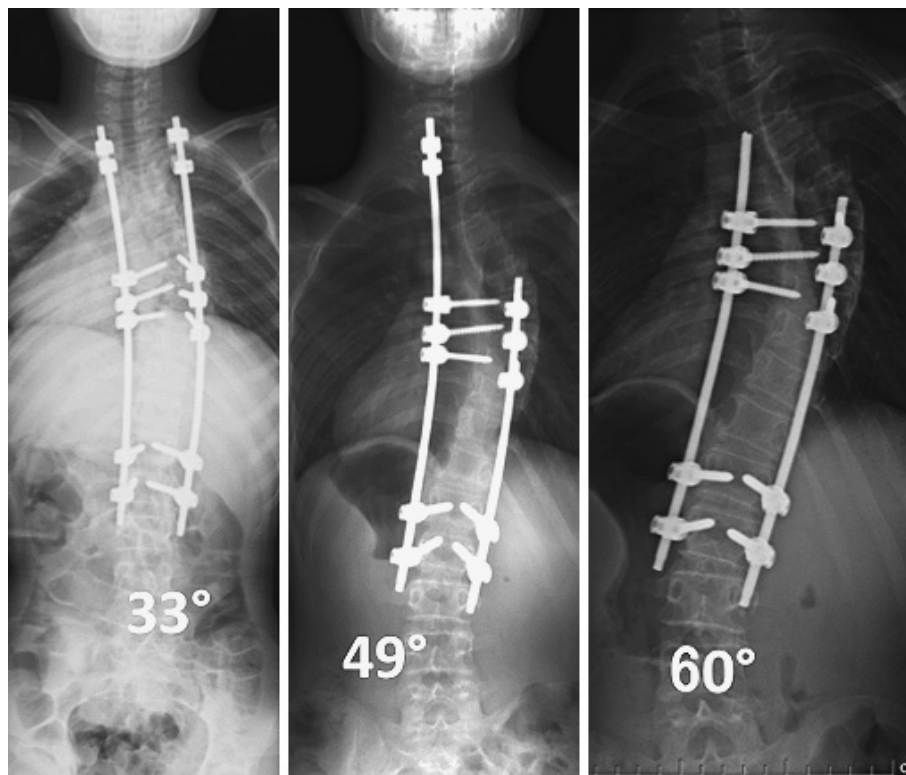
Corresponding author: Keita Nakayama, keita_nakayama@hotmail.co.jp

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Figure 1. Standing radiographs before initial surgery. The right thoracic Cobb angle was 56° before her initial surgery.



After initial surgery After second surgery After third surgery

Figure 2. Standing radiographs after initial surgery, second surgery, and third surgery.

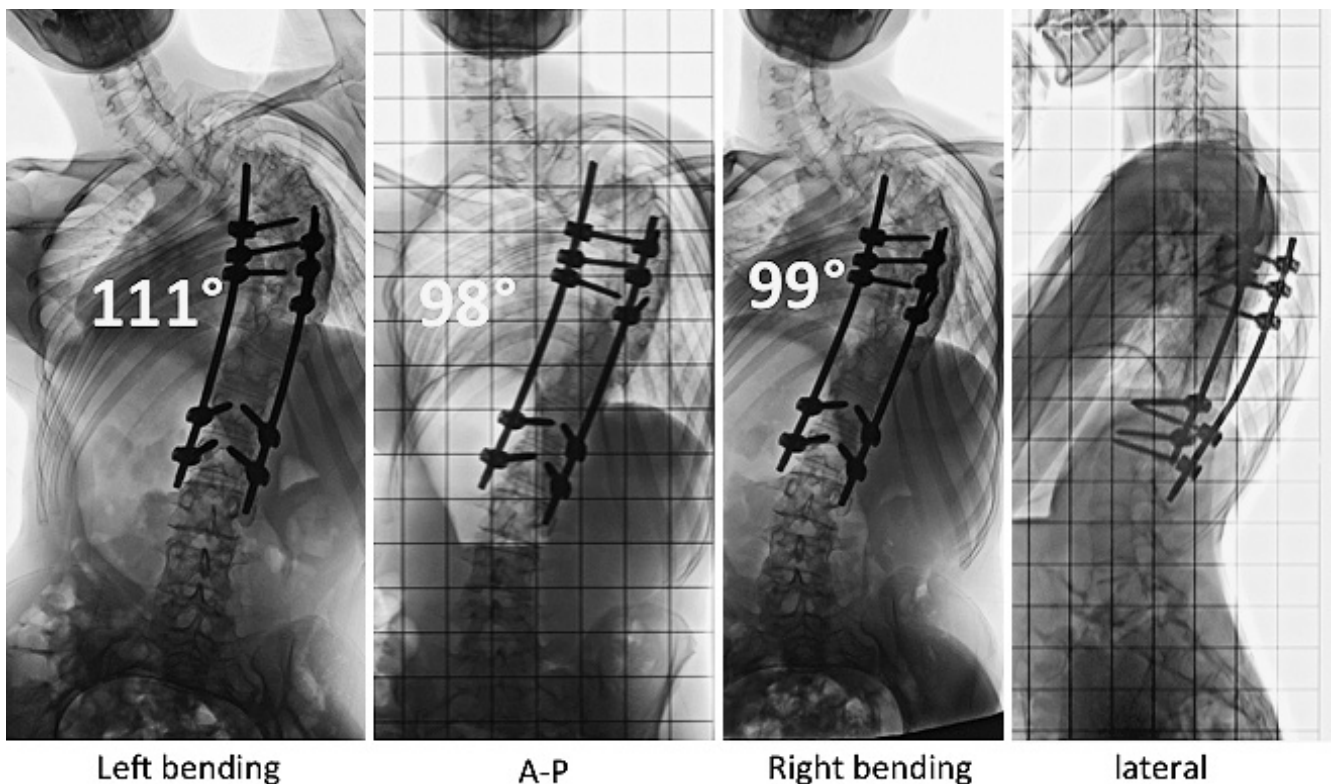


Figure 3. Standing and bending radiographs prior to reinstrumentation. Four years after the initial surgery, her right thoracic curve had increased to 98°.

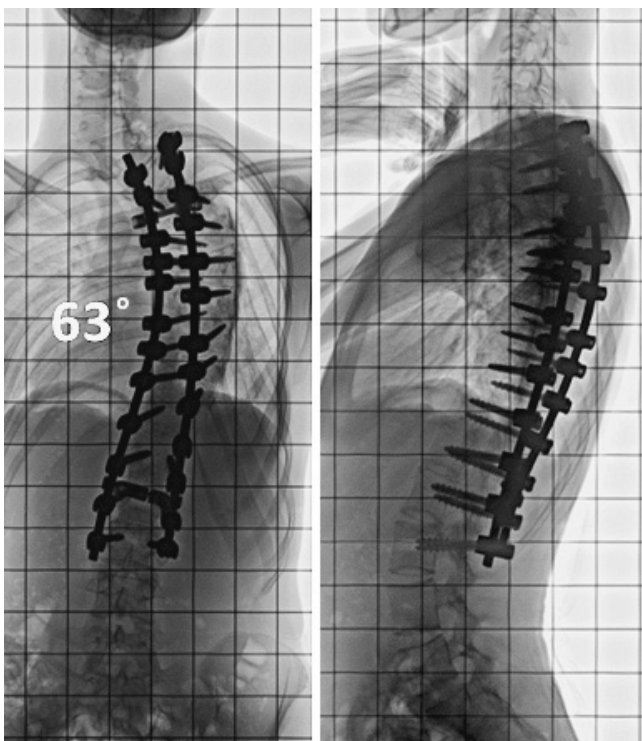


Figure 4. Radiographs after second-stage reinstrumentation surgery. The right thoracic Cobb angle was 63° after second-stage reinstrumentation surgery.

On the other hand, some reports indicate appropriate debridement and intravenous antibiotic therapy can help patients avoid implant removal^{5,6}.

The outcome of our case indicated that debridement delay meant lack of infection control and the patient's inability to retain the implants.

The second important point from our case was the need to perform difficult reinstrumentation surgery because of the rigid curve. Rapid curve progression and a rigid spine requiring osteotomy in the same patient appear to be conflicting situations. Kotani et al., explained the phenomenon by a pseudarthrosis which might have been covered by a weak sheet of bone resembling mature bone fusion³.

Our case has led us to make the following important recommendations: 1) we should be aware that rapid curve progression can occur after implant removal; 2) we should explore every available option to help scoliosis patients with infections retain their implants. If we must remove implants to control the infection, we should perform reinstrumentation surgery without delay for patients whose scoliosis progresses.

Conflicts of Interest: The authors declare that there are no relevant conflicts of interest.

Author Contributions: Keita Nakayama wrote and prepared the manuscript, and all of the authors participated in the study design. All authors have read, reviewed, and ap-

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