



Case Report

Metastatic renal cell carcinoma of the lumbar spine with long posterior instrumented fusion and repetitive dislodgement of the set screws of the S2 alar-iliac screw

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ABSTRACT

Background: S2 alar-iliac screws (S2AIS) are widely used to anchor the pelvis to a lumbar fusion. Here, we report a patient who experienced repetitive dislodgement of the set screws of the S2AIS following a posterior instrumented fusion.

Case Description: A 68-year-old male presented with an L3 metastasis and L2–L3 subluxation attributed to renal cell cancer. Following an L2–L5 posterior decompression and T9–pelvic fusion utilizing bilateral S2AIS fixation, the set screws of the S2AIS repeatedly dislodged, requiring two additional operations. The final surgery required multiple anchors to the ilium and provided adequate fixation until the patient's expiration.

Conclusion: The set screw fixing force was weaker than the fixing force of the S2AIS; multiple iliac anchors effectively salvaged this condition.

Keywords: Dislodgement, Multiple anchors, S2 alar-iliac screw, Set screw

INTRODUCTION

Fixation at the lumbosacral spine junction remains a challenge for spinal surgeons.^[7,8] The S2 alar-iliac screw (S2AIS) is recognized as a rigid anchor with strong stabilization.^[1] Here, we report a patient who experienced repetitive dislodgement of the set screws of the S2AIS after a thoraco–lumbar–pelvic instrumented fusion.

CASE DESCRIPTION

History and examination

A 68-year-old male presented with 4/5 right iliopsoas and quadricep weakness accompanied by hypoesthesia of both anterolateral thighs and bladder dysfunction. The lumbar magnetic resonance imaging revealed an extradural compressive enhancing mass at the L2–3 level and invasions of the bilateral L2/3 and left L3/4 facets [Figure 1]. The lumbar computed tomography showed L3 dorsal osteolytic changes involving the left pedicle with L2–L3 subluxation [Figure 2].

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The neoplastic score for spinal instability was 16 [Table 1],^[4] whereas the revised Tokuhashi score was 9 points [Table 2].^[10]

Surgery

An L2–5 posterior decompression was performed; the pathology was diagnostic for spinal metastasis from renal cell cancer. This decompression was followed by a posterolateral thoraco–lumbo–pelvic fusion. Pedicle screws were placed bilaterally at T10–L2 and L5–S1; bilateral transverse process hooks at T9 accompanied these. In addition, S2AISs were

placed bilaterally, and a third rod was placed parallel to the center of the left and right rods to avoid rod breakage.

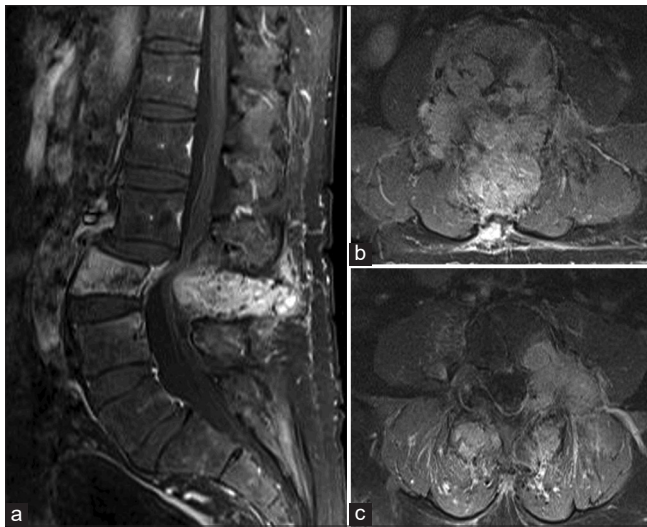


Figure 1: (a) Sagittal gadolinium-enhanced T1-weighted magnetic resonance imaging (MRI) showing an extradural enhancing metastatic tumor at L2–3. (b) Axial MRI at L2–3 revealed severe spinal stenosis and tumor invasion of both L2/3 facet joints. (c) Axial MRI revealing tumor invasion of the left L3/4 facet.

Table 1: Spinal instability neoplastic score system.

Element	Score
Location	
Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)	3
Mobile spine (C3-C6, L2-L4)	2
Semi-rigid (T3-T10)	1
Rigid (S2-S5)	0
Pain relief with recumbency and/or pain with movement/loading of the spine	
Yes	3
No (occasional pain but not mechanical)	1
Pain-free lesion	0
Bone lesion	
Lytic	2
Mixed (lytic/blastic)	1
Blastic	0
Radiographic spinal alignment	
Subluxation/translation present	4
<i>De novo</i> deformity (kyphosis/scoliosis)	2
Normal alignment	0
Vertebral body collapse	
>50% collapse	3
<50% collapse	2
No collapse with >50% body involved	1
None of the above	0
Posterolateral involvement of the spinal elements (facet, pedicle, CV joint fracture, or replacement with tumor)	
Bilateral	3
Unilateral	1
None of the above	0

Criteria of spinal instability: 0–6, stability; 7–12, indeterminate instability; 13–18, instability



Figure 2: (a) Axial computed tomography (CT) of L2–3 demonstrating osteolytic changes involving bilateral pedicles and part of the L2/3 facets. (b) Axial CT showing the destruction of the left L3/4 facet. (c) Sagittal L2–L3 CT image showing subluxation (arrow). (d) Sagittal CT image identifying further progression of subluxation one month later than (c) (arrow).

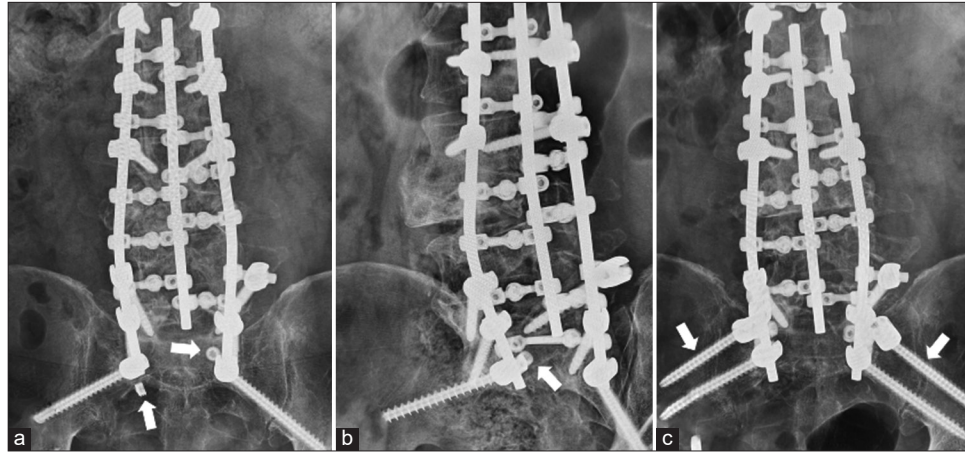


Figure 3: (a) AP X-ray at five months post-surgery revealing dislodgement of the bilateral set screws of the S2 alar-iliac screw (S2AIS) (arrow). (b) Oblique X-ray 12 months after the second surgery showing the repeated dislodgement of the right set screw of the S2AIS (arrow). (c) AP X-ray at the final follow-up showed the stability of the fusion with the S2AIS and iliac screws (arrow).

Table 2: Revised Tokuhashi score system.

Characteristic	Score
General condition	
Poor (performance status 10–40%)	0
Moderate (performance status 50–70%)	1
Good (performance status 80–100%)	2
Number of extraspinal bone metastases foci	
≥3	0
1–2	1
0	2
Number of metastases in the vertebral body	
≥3	0
2	1
1	2
Metastases to the major internal organs	
Unremovable	0
Removable	1
No metastases	2
The primary site of cancer	
Lung, osteosarcoma, stomach, bladder, oesophagus, and pancreas	0
Liver, gallbladder, unidentified	1
Others	2
Kidney, uterus	3
Rectum	4
Thyroid, breast, prostate, carcinoid tumor	5
Palsy	
Complete (Frankel A, B)	0
Incomplete (Frankel C, D)	1
None (Frankel E)	2
Criteria of predicted prognosis: 0–8, <6 mo; 9–11, ≥6 mo; 12–15, ≥1 year	

Postoperative course

The patient’s postoperative recovery was uneventful. He received local radiotherapy at a total dose of 30 Gy for residual

tumors. Although asymptomatic, radiographic assessment five months postoperatively revealed dislodgement of the bilateral set screws of the S2AIS [Figure 3a]. A second surgery was performed to replace the bilateral set screws; this construct was reinforced using transverse connectors between the S1 and S2. However, one year later, the right set screw dislodged [Figure 3b]. A third surgery confirmed that the right set screw had slipped out and the left set screw had loosened; therefore, the right S2AIS was replaced, and additional bilateral iliac screws were placed once the transverse connector had been removed [Figure 3c]. No further fixation failures occurred during the patient’s remaining life span of an additional year.

DISCUSSION

Efficacy and mechanical failure of S2AIS for thoracic-lumbar-sacral fusions

The mechanical demand at and around the lumbosacral junction following long-segment thoracolumbar-sacral fusion results in a 12–57% incidence of mechanical failure.^[2,5] Recently, the S2AIS has been described as a useful anchor for these extensive thoracic-lumbar-sacral constructs, lowering reoperation rates compared to other techniques.^[3] Nevertheless, set screw dislodgement occurs in 1.5–2.2% of S2AIS cases.^[5,6]

Drawbacks of using S2AISs to stabilize thoracic-lumbar-sacral fusions

The S2AIS achieves highly rigid fixation by crossing three cortical surfaces through the sacroiliac joint;^[3] the mechanical load around the lumbosacral junction could be easily concentrated and cause system failure below the sacrum.^[8,9] The size and fixation force of the set screws of the S2AIS

in the current system have the same specifications as other pedicle screws for the thoracolumbar spine. As the S2AISs are always inserted outward, compared to the pedicle screws for the thoracolumbar spine, the load direction applied to the screw head is not perpendicular to the set screw,^[6] this may have caused the repetitive set screw dislodgement seen in this case. To prevent such set screw dislodgement, multiple iliac anchors for the dispersion of mechanical loads may be effective.

CONCLUSION

The S2AIS has a strong fixing force; however, the set screw fixing force may be relatively weak. Multiple iliac anchors should be considered for extensive thoraco–lumbo–sacral fusions to prevent construct failure at the sacral level.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI.

REFERENCES

1. Chang TL, Sponseller PD, Kebaish KM, Fishman EK. Low profile pelvic fixation: Anatomic parameters for sacral alar-iliac fixation versus traditional iliac fixation. *Spine (Phila Pa 1976)* 2009;34:436-40.
2. Cho W, Mason JR, Smith JS, Shimer AL, Wilson AS, Shaffrey CI, *et al.* Failure of lumbopelvic fixation after long construct fusions in patients with adult spinal deformity: Clinical and radiographic risk factors: Clinical article. *J Neurosurg Spine* 2013;19:445-53.
3. Elder BD, Ishida W, Lo SF, Holmes C, Goodwin CR, Kosztowski TA, *et al.* Use of S2-alar-iliac screws associated with less complications than iliac screws in adult lumbosacropelvic fixation. *Spine (Phila Pa 1976)* 2017;42:E142-9.
4. Fisher CG, DiPaola CP, Ryken TC, Bilsky MH, Shaffrey CI, Berven SH, *et al.* A novel classification system for spinal instability in neoplastic disease: An evidence-based approach and expert consensus from the Spine Oncology Study Group. *Spine (Phila Pa 1976)* 2010;35:E1221-9.
5. Guler UO, Cetin E, Yaman O, Pellise F, Casademut AV, Sabat MD, *et al.* Sacropelvic fixation in adult spinal deformity (ASD); a very high rate of mechanical failure. *Eur Spine J* 2015;24:1085-91.
6. Hyun SJ, Jung JM, Kim KJ, Jahng TA. Durability and failure types of S2-alar-iliac screws: An analysis of 312 consecutive screws. *Oper Neurosurg (Hagerstown)* 2020;20:91-7.
7. Kebaish KM. Sacropelvic fixation: Techniques and complications. *Spine (Phila Pa 1976)* 2010;35:2245-51.
8. Kim YJ, Bridwell KH, Lenke LG, Rhim S, Cheh G. Pseudarthrosis in long adult spinal deformity instrumentation and fusion to the sacrum: Prevalence and risk factor analysis of 144 cases. *Spine (Phila Pa 1976)* 2006;31:2329-36.
9. Park SJ, Park JS, Nam Y, Yum TH, Choi YT, Lee CS. Failure types and related factors of spinopelvic fixation after long construct fusion for adult spinal deformity. *Neurosurgery* 2021;88:603-11.
10. Tokuhashi Y, Matsuzaki H, Oda H, Oshima M, Ryu J. A revised scoring system for preoperative evaluation of metastatic spine tumor prognosis. *Spine (Phila Pa 1976)* 2005;30:2186-91.

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