

## Case Report

## Lateral position and utility of navigation for posterior fixation of unstable cervical fracture with ankylosing spondylitis

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**Abstract**

**Background:** Ankylosing spondylitis (AS) is a seronegative spondyloarthropathy within the spectrum of rheumatologic diseases. The systemic inflammation that characterizes AS leads to bone resorption and reformation. Pathologic remodeling may include kyphosis, osteoporosis, and multi-segment auto-fusion. Cervical fractures account for 53–78% of spinal trauma seen with AS. Surgical planning is often challenging owing to spinal deformity, medical comorbidities, the cervicothoracic foci of injury, and gross instability of these fracture.

**Case Description:** A 55-year-old male with AS was presented with a three-column injury at the C6 level. The C6 vertebra was fractured, minimally displaced, and there was a focal kyphotic deformity. Attempted posterior fixation 2 days after presentation was aborted; the patient could not tolerate prone positioning, and there were further technical limitations to a posterior approach. Cervicothoracic fixation from C2 to T2 was then performed using the right lateral decubitus position employing the Mayfield head holder, a beanbag, and spinal neuronavigation.

**Conclusion:** In this study, we presented a unique approach to posterior fixation of an unstable cervicothoracic fracture in a patient with AS utilizing the lateral position and neural navigation under intraoperative physiological monitoring.

**Key Words:** Ankylosing spondylitis, cervical, navigation, spine, trauma

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**Quick Response Code:****INTRODUCTION**

Ankylosing spondylitis (AS) is a seronegative spondyloarthropathy within the spectrum of rheumatologic diseases. There is a correlation with HLA-B27 and associated uveitis, inflammatory bowel disease, and sacroiliitis.<sup>[6]</sup> Sustained systemic inflammation leads to bone resorption and reformation. Pathologic remodeling manifests itself as kyphosis, osteoporosis, and multi-segmented auto-fusion of the spine.<sup>[1]</sup>

**Fracture risk of ankylosing spondylitis**

With AS, there is a fourfold increased risk of spinal fracture even with minor trauma; this correlates with a

greater than 20% risk of associated spinal cord injury.<sup>[5]</sup> Hyperextension injury is the most common mechanism that typically involves the lower cervical spine.<sup>[6]</sup> These

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injuries are typically unstable with three column involvement/displacement, and usually warrants surgical fixation. In patients with AS, cervical fractures account for 53–78% of spinal trauma.<sup>[2,6]</sup> There is 33% mortality with cervical involvement and a high incidence of delayed diagnosis and neurological deterioration.<sup>[3,10]</sup>

### Surgical planning with cervical ankylosing spondylitis

Surgical planning is often challenging owing to AS spinal deformity, medical comorbidities, the cervicothoracic locus of injury, and gross instability. An increased propensity for iatrogenic displacement and resultant neurological decline has been reported, particularly involving worsening with operative positioning.<sup>[10]</sup> To better address attendant deformity, this patient with AS and a C6 vertebral level fracture was managed with posterior fixation performed with the patient immobilized using a 3 pin head holder (Mayfield head rest) in the lateral position.

### CASE DESCRIPTION

A 55-year-old male with AS was presented with neck pain after falling off from a table while incarcerated. The non-contrast cervical computed tomography (CT) revealed a transverse three column fracture of the C6 cervical vertebra with minimal displacement; there was a mild kyphotic deformity and attendant evidence of multilevel auto-fusion of the spine consistent with the diagnosis of AS [Figure 1]. The patient's body habitus precluded performing an MR (e.g., severe kyphosis).

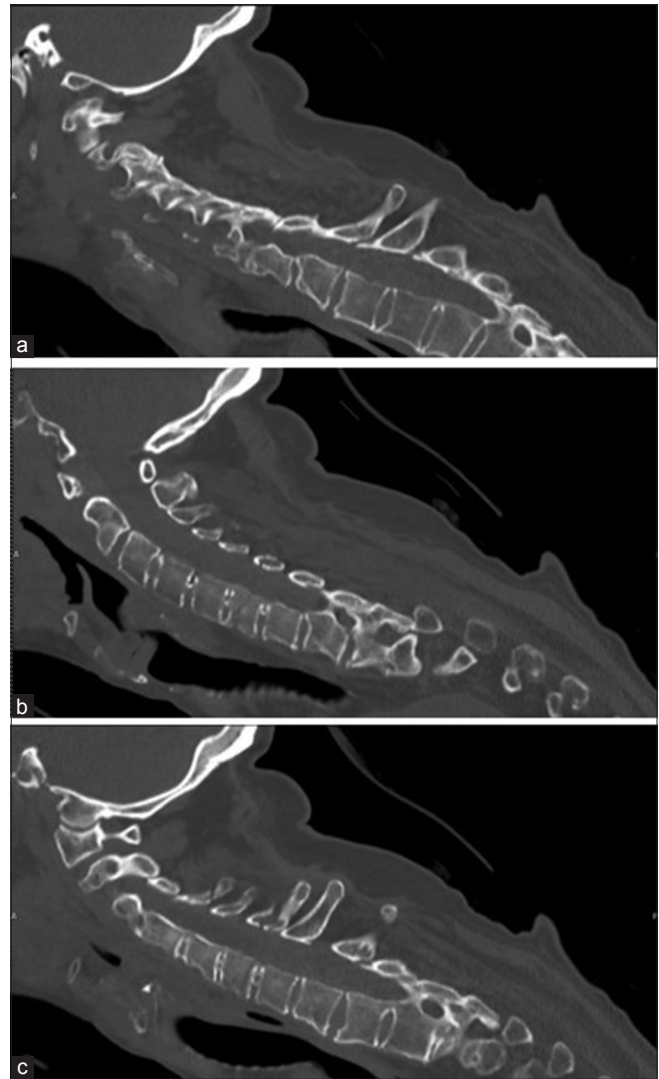
### Initial failed attempt at surgical positioning and treatment of C6 Vertebral fracture

Originally, the patient was intubated, and posterior fixation was attempted but aborted 2 days after admission (e.g., elevated peek pressures, inability to ventilate, and severe kyphosis). Somatosensory evoked potentials (SSEP) and motor evoked potentials (MEP) prior to and after positioning remained unchanged from baseline. The CT of the cervical spine following this aborted procedure revealed significant new malalignment and distraction of the fracture margin [Figure 2]. Nevertheless, the progressive displacement mandated surgical fixation.

### Secondary lateral surgical positioning and treatment of C6 vertebral fracture

Further, a cervicothoracic fusion from C2 to T2 was performed in the right lateral decubitus position using the Mayfield head holder, a beanbag, and spinal neuronavigation. Throughout surgery, the SSEP and MEP signals were stable (e.g., before, after positioning, and postoperatively).

Reduction of the fracture was achieved predominately by positioning the patient in the Mayfield head rest. Segmental instrumentation with cervical lateral mass screws and



**Figure 1: Initial cervical computed tomography imaging revealing a C6 transverse vertebral body fracture with extension into the posterior column with notable cervical kyphosis and findings consistent with ankylosing spondylitis. (a) Left sagittal, (b) Mid sagittal, (c) Right sagittal**

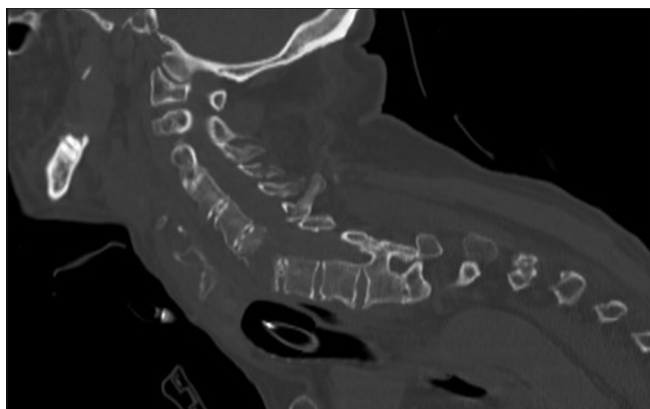
thoracic pedicle screws was performed uneventfully. This was followed by posterolateral arthrodesis with allograft.

### Outcome

Three weeks later, the patient remained neurologically intact and the wound healed. The postoperative CT confirmed adequate alignment, intact instrumentation, and a good reduction of the injury [Figure 3]. A tracheostomy and percutaneous gastrostomy tube were placed owing to the patient's prolonged ventilator dependence and debility. He was transferred to an inpatient rehabilitation center by the 4<sup>th</sup> postoperative week.

### DISCUSSION

Multiple factors increase the complexity and risk of surgical stabilization in patients with AS. Preoperative



**Figure 2: Computed tomography performed after failed positioning attempt reveals distraction of fracture margin with increased malalignment**

considerations often include greater medical comorbidities, such as severe hypoventilation due to hyperkyphosis.<sup>[6,8,9]</sup> Significant instability raises concerns over transfers and operative positioning. Furthermore, the patient's severe kyphosis can limit the ability to position the patient for surgical anterior and/or posterior approaches.<sup>[6,10]</sup>

### Failure of conservative treatment for ankylosing spondylitis

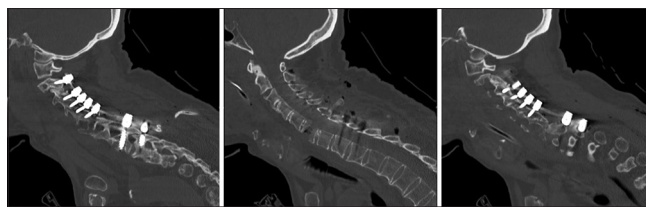
Conservative measures including bracing, traction, and halo fixation have significant complications that include pseudoarthrosis, progression of kyphosis, neurologic deterioration, and skin breakdown.<sup>[7]</sup> Although 33–46% of these injuries may be managed conservatively, non-operative management often leads to lack of reduction with a progressive deformity making delayed surgical intervention more challenging.<sup>[3,9]</sup>

### More success with surgery for ankylosing spondylitis

Surgical management improves survival and functional outcomes for AS.<sup>[2,4]</sup> One must be aware of the increased risk of neurologic injury associated with transfers and prone positioning for surgery in these AS patients.<sup>[1,5,10]</sup>

### Lateral operative approach to ankylosing spondylitis

Isolated posterior long-segment fixation has correlated with favorable radiographic and clinical outcomes.<sup>[4,9]</sup> In this study, limitations were circumvented by using a lateral position and navigation to facilitate the localization of anatomy with abnormal anatomic landmarks.



**Figure 3: Computed tomography reveals improved alignment with successful placement of lateral mass and pedicle screws for a cervicothoracic posterior stabilization**

## CONCLUSION

This case of AS uniquely demonstrates that an unstable cervicothoracic fracture (centered at C6) can be treated surgically utilizing the lateral position with neuronavigation. Circumvention of positioning difficulties allows for posterior long-segment fixation in the setting of severe anatomic abnormalities.

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### Conflicts of interest

There are no conflicts of interest.

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