The treatment strategies of spine fractures in patients with ankylosing spondylitis

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Abstract

Purpose: Exploring surgical strategies for treating spine fractures in patients with AS.

Methods: We retrospectively reviewed the patients with ankylosing spondylitis and spine fractures who, between 2005 and 2012, underwent surgery at our spine and spinal cord institution. All patients were underwent surgery treatment, which included posterior instrumentation and
bone grafting, with or without decompression. The fractures healing and neurological function recovery were observed. The mean follow-up period was 45.1 (24-60) months.

**Results:** Nine patients were included in this study. Eight patients were treated with long posterior fixations. One patient was performed long posterior fixations and anterior bone graft. After treatment, the fractures were healing in all patients, and neurological function were improved to varying degrees. Surgery-related complications were not observed.

**Conclusion:** Posterior instrumentation and bone grafting was a satisfied method for treating spine fractures in patients with AS.

**Keywords:** Spine fractures, ankylosing spondylitis, surgery, posterior instrumentation, bone grafting

**Levels of Evidence:** Level IV

**Introduction**

Ankylosing spondylitis (AS) is a chronic systemic and inflammatory rheumatic disease leading to increased stiffness and eventually to a spontaneous fusion of all spinal segments [1, 2]. Low bone mineral density (BMD) and bone loss has been well documented in the spine and hips of patients with AS, from early on in the disease [3, 4]. The prevalence of osteoporosis in AS has been reported to be between 18.7% and 62% [5]. Vertebral osteoporosis often associated with the condition can weaken the spine as well as contribute to the risk of injury, and the brittle nature of the spine predisposes it to fracture with minor trauma [6].
Fractures in AS are often difficult to treat and surgical treatment may be fraught with complications. A multidisciplinary team approach with a thorough preoperative plan is essential for good outcomes in the high risk AS patients. The surgical approach depends both on patient characteristics as well as fracture location and pattern.

In this study, we reviewed spinal fractures in patients with AS that had been clinically diagnosed to better discover the management strategies and surgical program.

**Methods**

We retrospectively reviewed the patients with ankylosing spondylitis and spine fractures who, between 2005 and 2012, underwent surgery at our spine and spinal cord institution. During this period, nine patients with spine fracture were treated in our institution, 7 men and 2 women, with a mean age of 44.6 years (32-58 years). All the patients fulfilled the modified New York criteria for primary AS. Neuroimaging evaluation was obtained in all patients by using plain radiography, CT scan, and MR imaging.

Eight patients were treated with long posterior fixations. One patient was performed long posterior fixations and anterior bone graft because of the fracture was extremely unstable. The follow-up duration was calculated from the date of admission to the most recent evaluation. The mean follow-up period was 45.1 (24-60) months. The Clinical data of these patients were described in Table 1.

**Results**
Four patients sustained fractures after falling whilst walking or standing; one fell from a bicycle. Two patients sustained a fracture with traffic accidents, and two patients had no identifiable trauma. The fracture levels were T8-T9 in one patient, T10-T11 in one patient, T11-T12 in two patients, L1 in three and L2 in two (Table 1). All patients had neurological deficits, preoperatively. No patients had total loss of motor and sensory function below the injured level; three patients had motor weakness combined with a sensory deficit, and six patients had a sensory deficit.

Postoperatively, lower limb strength training, bowel and bladder function training were performed at rehabilitation center. All patients have been followed with plain radiographs or CT.

After treatment, the fractures were healing in all patients, and neurological function were improved to varying degrees (Table 1). Surgery-related complications were not observed. However, general complications included 1 case of pneumonia in patients. No patients were dead during follow-up.

**Typical case**

A 46-year-old man presented with back pain and moderate paraparesis of ASIA grade C after traffic accidents. Physical examination revealed the patient to be thoracolumbar kyphosis and tenderness positive. The pain feeling below L1 level and saddle zone was weakened. The muscle strength of lower extremity was grade 3. Computed tomography revealed a burst fracture of the lumbar one (L1) vertebral body with displacement of the spine. The patient was diagnosed 10 years ago with ankylosing spondylitis.
**Surgery method:** The patient was set in a prone position after general anesthesia. Conventional disinfection and draping were performed. A posterior longitudinal incision was made from the T9 to the L4 level. The size of the incision in this case was about 30 cm long. The skin, subcutaneous tissue, and muscular fascia were cut layer by layer. After exposing the vertebral lamina, the fracture dislocation of T12-T1 can be seen clearly. A posterior spinal fusion T10-L3 was performed utilizing ten pedicular screws besides the L1 level. C-arm was used to determine the location of pedicular screws. The laminectomy of T12 and L1 was performed for decompression. The lamina bone combined with allogenous bone were used for graft between the transverse and articular process from T10-L3. Two lateral connecting rods were placed to complete the fixation device. Finally, drainage tube was put in and closing the incision.

The operation time was 3h and blood loss for the surgical procedure was 400ml. The plain radiographs and CT of this patients before and after operation at 2 years follow-up were show in Figure 1. The fracture was healing and ASIA grade was improved from C to D, the muscle strength of lower extremity was improved from grade 3 to grade 4+. The owel and bladder function were normal.

**Discussion**

Bone is a major target in AS. Inflammation results in intravertebral bone loss and bone erosions [7]. What’s more, some studies indicate that vertebral fractures are a regular finding in patients with AS and their prevalence is higher in AS patients [8]. When the spinal fractures are considered in AS patients, diagnosis can be difficult, as fractures of the posterior arch are often difficult to visualize by conventional radiographic examination. And the complications are always more serious in AS patients, which include spinal cord lesions, nerve root lesions,
and the occurrence of paravertebral hematomas resulting in variable degrees of sensory or motor deficits. Hence, in cases of severe or persisting neurological deficits, surgery may be necessary.

The primary aim of surgical treatment is the maintenance of fracture realignment with adequate stabilization measures until the bone has healed completely [9]. The main surgical methods include anterior stabilization, posterior stabilization and combined 360°fusion. Decompression of spinal stenosis may be performed in the same operative session. The surgical approach depends both on patient characteristics as well as fracture location and pattern. For AS patients, an combined 360°fusion procedure increases the surgical time and the morbidity and mortality. Therefore, preoperative evaluation of the fracture pattern, posterior ligamentous restraint, neurologic compression and function, preexisting deformity, and bone quality must be performed [10]. Often these injuries are managed by a single posterior approach using screw fixation by a formal open fusion procedure.

Posterior stabilization is recommended for unstable fractures with the risk of possible translation and with a sufficiently stable anterior column [11]. In this study, eight patients were treated with long posterior fixations, and the treatment effect is satisfactory. The fractures were healing in all patients and no surgery-related complications were observed. Only one patient was performed long posterior fixations and anterior bone graft in this study because of the anterior column defect. This patients also get a prospective healing of fracture and functional recovery.

The clinical results of this study were consistent with the experience of other authors [12-14]. The posterior stabilization was the most often used and efficacious methods for treating spine fractures in AS patients. Combined 360°fusion was recommended for unstable injuries with translation or defects of the anterior column with an additional kyphotic deformity. Necessary decompression of laminectomy should be
performed when combing with compression symptoms.

In conclusion, patients with ankylosing spondylitis have a higher incidence of acute spinal fractures than the general population. These fractures are often unstable, which need surgical treatment. Surgical treatment commonly involves posterior instrumentation and bone grafting, with decompression if indicated. Fracture healing and neurologic improvement are satisfying in patients who undergo surgery in this study.

Reference


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Abbreviations

Ankylosing spondylitis (AS)

Bone mineral density (BMD)

Computed Tomography (CT)

Magnetic Resonance (MR)

Lumbar 1-5 (L1-5)

America Spinal Injury Association (ASIA)

Competing Interest

The authors declare that they have no competing interests.
Authors’ Contributions

XL.Z and RS.Z carried out the clinical study, participated in the design and drafted the manuscript. JJ.Y and ZJ.C contributed to the acquisition of data. W.J and Y.L performed the statistical analysis. XL.Z, RS.Z and ZH.J performed the operation.

Acknowledgements

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Figure legends

Figure 1:  
a-d: The X-ray and CT before operation

e-f: The X-ray after operation one month

g-h: The X-ray after operation two years

i-l: The CT after operation two years

Table 1 Clinical data and postoperative results
<table>
<thead>
<tr>
<th>Case no.</th>
<th>Age</th>
<th>Sex</th>
<th>Level of fracture</th>
<th>Mechanism of injury</th>
<th>Treatment</th>
<th>ASIA grade preoperatively</th>
<th>ASIA grade postoperatively</th>
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<tbody>
<tr>
<td>1</td>
<td>32</td>
<td>M</td>
<td>T8/9</td>
<td>Falling</td>
<td>Pedicle screw fixation (T6-T12)</td>
<td>D</td>
<td>E</td>
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<tr>
<td>2</td>
<td>46</td>
<td>M</td>
<td>L1</td>
<td>Traffic accidents</td>
<td>Pedicle screw fixation (T10-L3) with decompression (T12-L1)</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>49</td>
<td>M</td>
<td>L2</td>
<td>Fall from bicycle</td>
<td>Pedicle screw fixation (T11-L4) with decompression (L2)</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
<td>M</td>
<td>T11/12</td>
<td>Falling</td>
<td>Pedicle screw fixation (T9-L2) with decompression (T11-T12)</td>
<td>B</td>
<td>C</td>
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<tr>
<td>5</td>
<td>36</td>
<td>M</td>
<td>L1</td>
<td>No identifiable trauma</td>
<td>Pedicle screw fixation (T11-L3)</td>
<td>D</td>
<td>E</td>
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<tr>
<td>6</td>
<td>50</td>
<td>M</td>
<td>L2</td>
<td>Falling</td>
<td>Pedicle screw fixation (T11-L4)</td>
<td>D</td>
<td>E</td>
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<tr>
<td>7</td>
<td>42</td>
<td>M</td>
<td>T10/11</td>
<td>Traffic accidents</td>
<td>Pedicle screw fixation (T8-L1) and anterior bone graft with decompression (T10-T11)</td>
<td>C</td>
<td>D</td>
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<tr>
<td>8</td>
<td>58</td>
<td>F</td>
<td>L1</td>
<td>Falling</td>
<td>Pedicle screw fixation (T11-L3)</td>
<td>D</td>
<td>E</td>
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<tr>
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<td>36</td>
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<td>T11/12</td>
<td>No identifiable trauma</td>
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</table>
Figure 1:  a-d: The X-ray and CT before operation
e-f: The X-ray after operation one month
g-h: The X-ray after operation two years
i-l: The CT after operation two years