CASE REPORT

Fracture in ankylosing spondylitis after minor trauma: Radiological pitfalls and treatment by percutaneous instrumentation. A case report

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Summary Patients with ankylosing spondylitis may experience spinal fractures even after minor injuries. The diagnosis of non-dislocated spinal fracture is based on clinical symptoms and radiological findings. Difficulties in interpreting the imaging studies can result in considerable diagnostic delays. We describe the steps of the radiological diagnosis in a patient with a fracture of L2 that was not visible on standard lumbar spine radiographs. Magnetic resonance imaging (MRI) T2 STIR sequences allowed determining the location and showed signs of a recent fracture. Then, MRI T1 images and computed tomography provided a detailed evaluation of the fracture line. In patients with ankylosing spondylitis, fracture instability is common, making surgical treatment mandatory. Open surgery is associated with substantial rates of infection and implant loosening. Percutaneous instrumentation has not yet been evaluated for the treatment of spinal fractures in patients with ankylosing spondylitis. This minimally invasive surgical technique enables multilevel internal fixation and may constitute an interesting alternative to open surgery.

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Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory joint disease that predominantly involves the axial skeleton, causing fusion of the facet joints and intervertebral discs responsible for the typical kyphotic bamboo spine \cite{1}. Another feature of AS is spinal demineralisation, which is typically seen in the vertebral bodies and increases the risk of spinal fracture even after minor trauma \cite{2}. These fractures are often difficult to detect on standard radiographs, because the normal anatomical landmarks are lacking and the abnormal spinal stiffness precludes optimal exposure of the spine \cite{3}. Computed tomography (CT) is considered critical for confirming the diagnosis of spinal fracture in AS. Nevertheless, the images may be challenging to interpret \cite{4}. Spinal fractures in AS are often unstable, requiring

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surgical treatment, which is associated with substantial rates of complications such as postoperative infection and implant loosening [5]. We describe the steps of the radiological diagnosis and percutaneous fixation in a patient with AS presenting an L2 fracture caused by a low-energy injury.

Case report

A 54-year-old man was admitted in September 2010 for low back pain after a fall from his height while moving house 10 days earlier. He had a history of AS and kidney transplantation. Findings from the physical examination consisted in cervico-thoracic kyphosis and tenderness to palpation of the lumbar spine at L2. The neurological findings were normal.

Anteroposterior and lateral radiographs of the lumbar spine showed a bamboo spine typical for AS, with no evidence of osteolysis (Fig. 1). By magnetic resonance imaging (MRI), the T2 STIR sequence disclosed high signal intensity from the body and neural arch of L2, consistent with a recent fracture. The T1 sequence provided a detailed evaluation of fracture line morphology (Fig. 2). CT showed a serrated fracture line through the fused processes between L1 and L2 that was seen clearly only upon re-evaluation of thin bony sections (0.6 mm) in the sagittal plane (Fig. 3). Nevertheless, the appearance of the fused facet joints and of the pedicles was difficult to interpret.

This fracture in a patient with AS involved all three spinal columns and was therefore considered unstable. Percutaneous instrumentation from T11 to L5 was decided to stabilise the fracture via minimally invasive internal fixation. Intraoperatively, six Jamshidi needles were advanced through the pedicles under fluoroscopic guidance. Anterior fluoroscopy views were used to identify the projection of the pedicle isthmus, whose anatomical contours were, however, blurred by the areas of fusion due to the AS. Therefore, the height and orientation of the Jamshidi needles were chiefly assessed on the lateral views, and the progression and convergence of the needles were subsequently evaluated on the anterior views (Fig. 4). The percutaneous instrumentation technique was otherwise identical to that used in standard trauma surgery. Guidewires, a tap, and cannulated screws were used. Patients with AS have compact cortical bone contrasting with demineralisation within the vertebral bodies that requires multilevel anchoring, with instrumentation extending over three vertebrae above and three below the fracture level, to ensure favourable stress distribution on the implants.

Ambulation was started on the first postoperative day, with no brace. The patient was discharged home on the sixth day. After 6 weeks of rest, a 6-week course of physical therapy was given to strengthen trunk posture and restore the pre-fracture level of self-sufficiency (Fig. 5). Radiographs obtained 18 months after surgery showed preserved...
spinal alignment with no implant migration (Fig. 6). However, bone healing was difficult to assess on the standard radiographs. Follow-up CT findings indicated healing of the L2 fracture (Fig. 7), and MRI showed disappearance of the high signal on T2 STIR images and of the fracture line on T1 images (Fig. 8).

**Discussion**

The risk of spinal fracture is increased 4-fold in AS patients compared to the general population, and 5% to 15% of all AS patients experience a spinal fracture at some point during their life [6,7]. These fractures usually involve all three spinal columns and are therefore highly unstable, with a high rate of neurological complications ranging from 33% to 58% for thoracic and lumbar fractures and even higher rates at the cervical spine [3,5,8–10]. The frequently delayed diagnosis is a major concern in these patients, in whom the challenges met in interpreting the imaging studies translate into absence of appropriate spinal immobilisation. The proportion of fractures that are missed initially ranges from 19% to 60% [3,8,9]. These diagnostic delays explain the up to 15% rate of secondary neurological complications before fracture treatment [7,11].

CT is considered the reference standard for identifying the fracture line in patients with spinal fractures and AS [3,12]. De Peretti et al. [4] described four CT morphological types: type I with anterior opening after an impact on the extended spine; type II with a serrated non-displaced fracture line; type III, in which the fracture line is not visible; and type IV, consisting in fractures that are not specific of AS and more closely resemble usual post-traumatic fractures. Type II fractures are visible by CT only when the slices using a bone window are thin. Type III fractures clearly raise major diagnostic challenges. In patients with pain and no visible fracture line by CT, radionuclide bone scanning may indicate a recent bony lesion. Furthermore, after a low-energy trauma, MRI shows the fracture and provides information on the time of occurrence. Therefore, MRI should be performed routinely in addition to CT [11]. At the acute phase, MRI reveals post-traumatic oedema within the vertebral body and posterior bony structures [12]. The increased signal intensity is readily detected on the T2 STIR sequence, and the T1 sequence shows the shape of the fracture line.

Non-operative treatment can be used in patients with non-displaced fractures [11]. However, the unyielding kyphotic deformity makes bracing difficult, and surgery is therefore often required to treat these unstable fractures. Patients with AS often exhibit a number of co-morbidities, including cardiovascular disease, which increase mortality in the event of a fracture [7,13]. In addition, the auto-immune process and the fatty degeneration of the paraspinal muscles increase the postoperative risk of infection to about 14% after open surgery [5]. Percutanous instrumentation limits the invasiveness of the surgical approach, thereby diminishing the risk of bleeding and infection due to muscle dissection [14–16]. Bone density within the vertebral bodies is typically reduced in AS [17], leading to a high rate of implant loosening of about 10% to 15% [5,8]. Consequently,
multiple anchor points must be created, by extending the instrumentation over at least three vertebral levels above and three below the fracture site. Long-segment percutaneous spinal fixation may provide improved spinal support in patients with unstable fractures [18]. Another means of increasing the strength of implant fixation may consist in cementing the pedicle screws into the vertebral bodies. Percutaneous pedicle screw placement can be achieved by using the anatomical landmarks described by Wiesner et al. [19]. Fluoroscopy-based navigation or intraoperative CT reconstruction may increase the accuracy and safety of this technique [20,21].

**Conclusion**

Spinal fractures in patients with AS can occur after minor injuries. The diagnosis of non-displaced fractures relies on the clinical symptoms and imaging study findings. The MRI T2 STIR sequence shows the site and age of the fracture. The MRI T1 sequence and CT allow evaluating the fracture morphology. Surgery is often needed, given the instability of these fractures and high risk of non-union. Percutaneous instrumentation allows multilevel internal fixation and may constitute an interesting alternative to conventional surgery.
Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References