Spinal Trauma in Patients with Ankylosing Spinal Conditions

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39.1 Introduction

Ankylosing spinal conditions are a constellation of mixed conditions causing fusion of the spine. The most well recognized condition is ankylosing spondylitis (AS), which is a systemic chronic autoimmune spondyloarthropathy typically affecting younger males in the third decade of life and causing progressive spinal fusion in a caudal to cranial direction commencing at the sacro-iliac joints. It is believed to affect 0.2% of the Caucasian population (lower in other populations) and 90% of patients are HLA-B27 positive. Most have the classic radiographic appearance of squaring of the vertebra with "shiny corners" at the attachments of the annulus fibrosis (Romanus lesions), marginal syndesmophytes, osteopenia and ultimately a bamboo spine. Other spondyloarthropathies causing ankylosis of the spine include psoriatic arthritis, enteropathic arthritis and chronic reactive arthritis. However, multi-level spinal ankylosis is rare in these conditions and in those with an ankylosed spine their presentation, workup and treatment is similar to AS.

When injured, the spine can fracture anywhere but most often fractures in the mid-cervical and cervicothoracic junction (80%) and less at the thoracolumbar junction. Most commonly, these fractures are extension type unstable fractures involving all three columns typically through the intervertebral disc. The stiff fractured spine acts as long bone fractures and therefore secondary dislocation and deterioration of neurologic status is common. A peculiarity of these fractures is the high epidural haemorrhage rate [6], which increases the risk of neurological injury and mortality. However, due to the progressive compressive effect of the haemorrhage, neurological symptoms often present late and therefore clinicians should be aware of this progressive phenomenon.

In ankylosed spine, particularly in AS, stress shielding in the fused spine and increased bony resorption leads to osteoporosis contributing to a higher fracture risk. Many fractures therefore occur as a result of a low energy trauma mechanism and about 50% are missed on standard plain x-ray films [3]. It is important to note that up to a third of ankylosing patients with a spinal injury will have an unrecognized non-contiguous injury level and nearly 80% of these will result in a neurological injury if not treated early, therefore a whole spine CT or MRI scan is necessary [2].

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B. Meyer, M. Rauschmann (eds.), *Spine Surgery*, https://doi.org/10.1007/978-3-319-98875-7_39

The present case should illustrate that innocuous injuries can result in unstable spinal fractures and that they are hard to identify clinically and on standard radiographs.

39.2 Case Description

A 69 year old female with a known history of AS presented to the emergency department after a fall from standing height at home landing onto her left shoulder sustaining a proximal humerus fracture. She had mild bruising around her eyes and along the bridge of her nose in the distribution of her glasses' frame. She did not complain of any neurological concerns but did complain of mild neck pain. She was discharged in a shoulder immobilizer for the management for her proximal humerus fracture but returned 4 days later due to continued neck pain. Her cervical spine x-ray showed prevertebral soft tissue swelling at the C5/6 level, but no fracture line could be identified (Fig. 39.1).

Cross-sectional CT scan imaging revealed the chalk-stick fracture affecting all three columns (Fig. 39.2).

She therefore underwent C4–7 anterior stabilization with a compression plate. She made an unremarkable recovery with serial radiographs illustrating fracture union (Fig. 39.3). She has subsequently been discharged.

39.3 Discussion of the Case

39.3.1 Diagnosis

This case illustrates the challenges in diagnosing unstable three-column spinal injuries in patients with ankylosing spinal conditions. The patient sustained a fairly innocuous fall, all be it sufficient enough to cause an undisplaced proximal humerus fracture. However, this minor trauma was sufficient to cause a potentially unstable chalk-stick fracture in her ankylosed spine. The distracting injury sustained to her proximal

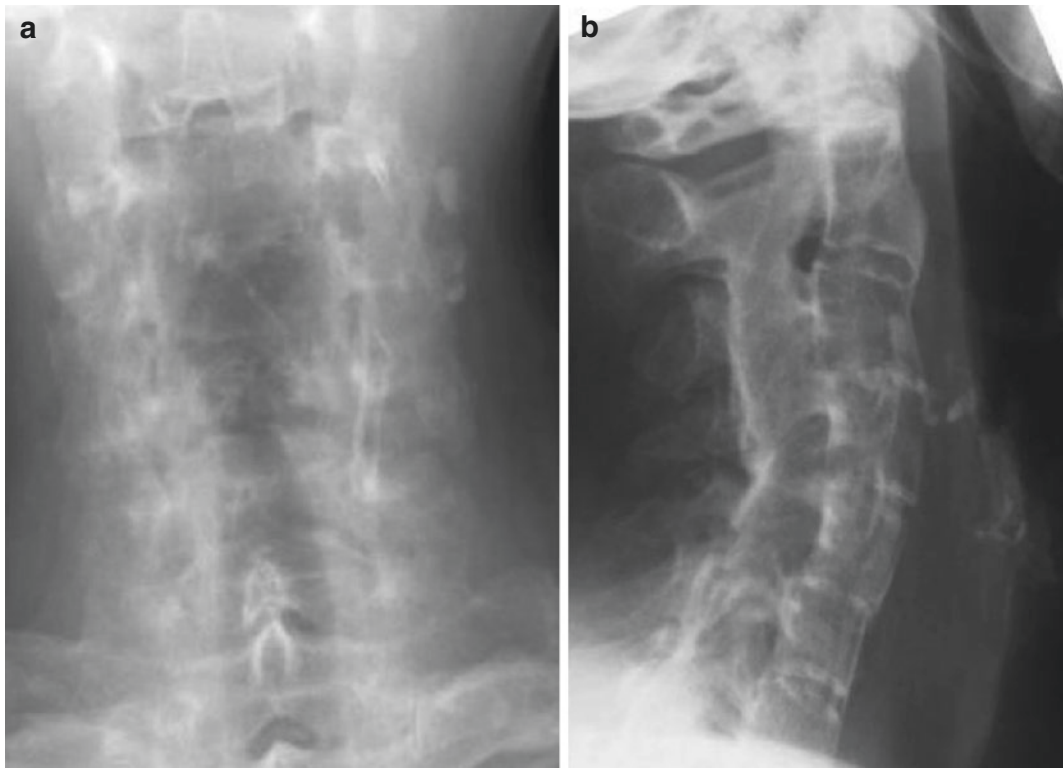

Fig. 39.1 AP and lateral erect cervical x-rays demonstrate prevertebral soft tissue swelling but fail to identify the fracture

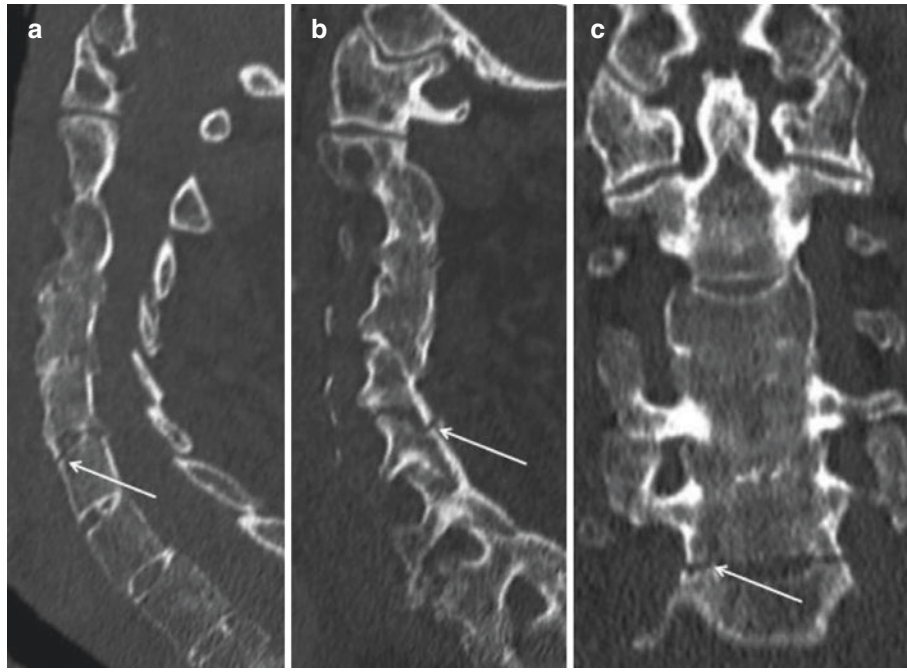

Fig. 39.2 Midline (**a**) and para-central (**b**) sagittal, as well as a coronal (**c**) CT scan. The arrows point to the 3-column chalk-stick fracture

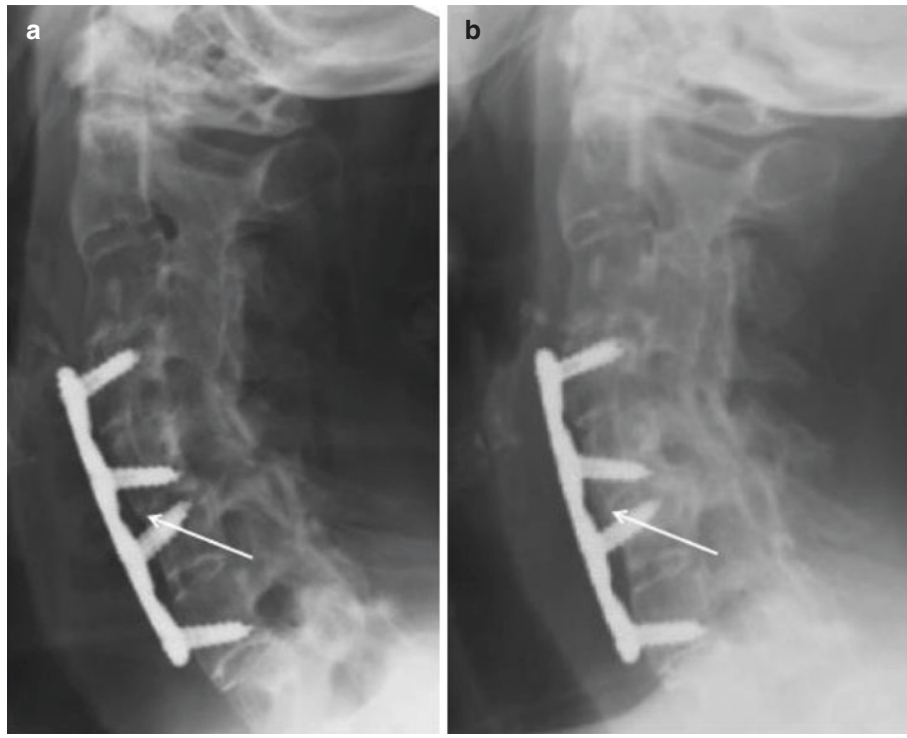

Fig. 39.3 Immediate post-operative (**a**) and 6-month post-operative (**b**) lateral erect x-rays. The arrow illustrates the fracture line

humerus limited her initial recognition of neck pain. However, in retrospect the clinicians should have recognized the injury pattern to her periorbital region suggesting forehead impact and an extension injury to her neck. A recognition of the importance of increased vigilance in patients with AS may have ensured the patient obtained appropriate spinal imaging at first. In addition, the radiographs attained on her re-presentation are challenging to interpret. It was only with heightened awareness of the subtleties of fractures in AS that the pre-vertebral soft tissue swelling was identified and cross-sectional imaging attained.

The present case illustrates a rather common scenario in fractures in the ankylosed spine, whereby either a low energy trauma does not prompt imaging or it is missed on conventional radiographs. An up to 50% rate of failing to identify fractures in these patients using standard radiographs has been reported and therefore cross-sectional imaging should take precedence and is mandatory to exclude or confirm a diagnosis [3]. It is of note, however, that CT and MRI are complementary and neither can detect 100% of fractures. Particularly in injuries of the posterior column, MRI is useful as they may be missed with a CT [5].

39.3.2 Choice of Approach and Fixation

The principles of surgical stabilization of ankylosing spinal conditions are similar to those of long bone fractures. Because of the long lever arms and high local force at the fracture site, fixation with long constructs and multiple fixation points are required. This is particularly important in those with associated osteopenia which is a frequent finding in ankylosed spines, particularly AS. The intervertebral discs (IVD) of the ankylosed segments do not need to be spared as their function has been eliminated by the fusion. However, the surgeon needs to be mindful of the challenges of fixation due to osteoporosis and deformity.

Given the potentially unstable injury of fractures in ankylosed spines with a risk of neurologic injury upon secondary dislocation, operative intervention was chosen to ensure optimal stability and healing of the fracture. She did not have an epidural haematoma which influenced the decision on an anterior versus posterior approach. Instead, an anterior approach was selected because her extension-type injury was felt to have resulted in anterior tension failure and an anterior approach would allow to ensure accurate reduction and compression of the fracture.

While there remains a paucity of literature on the specific management of spinal trauma in ankylosing spinal conditions especially with regard to the surgical approach, posterior approaches seem to be the more commonly chosen surgical technique for stabilization of subaxial fractures of the cervical spine [4]. The advantages of a posterior approach seem to be the possibility of easily extending the fixation to decrease the lever arm on the fractured segment and access to perform a multilevel decompression in the presence of a neurologic deficit or epidural hematoma. It may also be easier to access the spine from posterior in the presence of a significant kyphotic deformity of the cervical spine. However, the posterior approach may be more invasive than an anterior approach. The failure rate of anterior fixation has been reported to be up to 50% in one study [1]. If inadequate fixation is found in the anterior approach particularly due to reduced bone density, an additional posterior fixation is required. While anterior-posterior approaches are the most invasive, they are indicated especially in cases of coincident deformity correction during fracture fixation. In the present case, anterior fixation was adequate and resulted in healing of the fracture.

39.4 Conclusions and Take Home Message

Fractures of the subaxial cervical spine in ankylosing spine conditions are frequently missed due to the low energy trauma mechanism, distracting injuries and the fact that 50% of fractures are not

visible on standard radiographs. A high level of suspicion is thus required and cross-sectional imaging such as CT or MRI of the whole spine mandatory. Close attention to the patients' neurological status needs to be maintained due to the high rate of epidural hemorrhage. These fractures are typically unstable and delayed diagnosis and conservative treatment may result into loss of alignment, secondary dislocation and a neurological deficit. While the majority of fractures are treated surgically using a posterior approach, an anterior approach can result into healing of the fracture if adequate fixation is achieved. Due to reduced bone density and the long bone nature of the fracture, long fixations should be chosen.

Pearls

- 50% of fractures of the subaxial cervical spine in ankylosing spine conditions are missed on standard radiographs
- Cross-sectional imaging is mandatory with a high-level of suspicion even after low energy traumas such as simple falls
- Attention needs to be maintained to the neurological status due to the high rate of epidural hematomas
- The majority of fractures are treated surgically using a posterior approach, an anterior approach can result into healing of the fracture if adequate fixation is achieved

Editorial Comment

In addition to all the caveats regarding injuries in this patient group, I would like to add that per SOP in my unit a patient with an AS condition even after minor trauma is assumed to have a spinal fracture until proven otherwise. To rule out a fracture a CT and MRI of the complete spine is mandatory. Every fracture in these patients is to be regarded as highly unstable, because it is essentially a long-bone fracture and surgery is basically the treatment of choice in all cases.

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