Clinical Case of the Month

Treatment of fracture and complication of cervical spine with ankylosing spondylitis

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Case presentation

A 43-years old male suffered a fracture of his cervical spine at C 5/6 followed by tetraplegia below C 5. At the time of the accident his spine was affected by ankylosing spondylitis which had been present for several years. Decompression was done in a regional hospital with fusion between cervical vertebrae 5 and 6 (bonegraft) and stabilization between 5 and 7 (Codman-plate) by a ventral approach. In addition dorsal fusion was performed with wires and bone-chips. He developed aspiration pneumonia and artificial ventilation was necessary via a tracheal stoma. After transfer to the Spinal Cord Injury Center we found some pills and a tooth in the lungs. Several attempts were necessary to remove them by bronchoscopy. After finishing ventilation, radiological exploration demonstrated a severe dislocation of the fracture. Screws and implant had been torn off. Because of infection of the stoma we performed stabilization in a Halo-fixator with body-jacket and extended the cervical spine some millimeters every day until we obtained a nearly correct position. Meanwhile the patient was mobilized with physio- and occupational therapy. Eight weeks after the accident the fixator could be removed and the fracture was stable. The patient developed a 3 to 4 cm diameter pressure sore localized to the left shoulder and this was treated conservatively. Removing of the dislocated material is planned because of pressure to the oesophagus.

Conclusion: We believe this procedure avoids infection of the implant by open stoma in case of a new stabilizations approach.

First opinion

Fractures of the ankylosing spine (Bechterew's disease) always lead to an instability in all directions (flexion,

extension and rotation) which means that surgical procedures must compensate in every direction of instability bearing in mind that the bone density in these patients is poor due to the accompanying osteoporosis. This type of spinal fracture resembles fractures of the long bones. As mobility of the spine does not have to be considered, long plating distances can be chosen; at least two, sometimes more segments above and below the lesion with screws in each vertebral body. The primary surgeons used the 4th and 7th cervical body to anchor the plate, but did not screw additional bodies and missed penetrating the posterior wall. As angular stability between plate and screw was not provided, secondary angulation and pull out was a potential problem despite posterior sublaminar wiring by titanium cables. Wiring in osteoporotic bone is not advisable, as the wires cut through, so that a transarticular plating for a combined reconstruction should be used.

It is not known at which time the re-dislocation occurred exactly, as this was only noted after treatment in the intensive care unit. Possibly the repeated bronchoscopies under difficult conditions in an ankylosing spine were the reason for the dislocation.

Despite the tracheostomy I would have revised the dislocation surgically removing the dislocated plate and screws, and reducing the dislocation again, then using an anterior plating from C 4 to T 1 screwing in C 4 and C 5 and C 7 and T 1, probably also near the distal endplate of C 6. Titanium screws and plate would be appropriate with penetration of the screws through the posterior wall by one thread. Depending on the quality of fixation in the osteoporotic bone, additional posterior transarticular plating of the same distance would have to be considered.

The aim of the revision operation was to provide stability and immediate mobilization – not to improve the neurological deficit. However, the decompression

of the spinal canal might prevent secondary syringomyelia (or hydromyelia). Basically, the head position should be perfectly corrected in order to allow the patient good vision in the wheelchair for safety in propelling. This aim obviously has been reached by the treatment in the halo, but it certainly took longer and was much more uncomfortable as a revisional surgery.

The posterior wall of the esophagus is endangered by the plate dislocation, so that a defect by chronic pressure might occur. The plate therefore should be removed as soon as possible.

Second opinion

The treatment of patients with spinal cord injury (SCI) and ankylosing spondylitis (AS) is complicated by problems associated with AS. The general AS-related problems are the respiratory insufficiency due to the disturbed pneumodynamics as well as the high rate of alcoholism leading to withdrawal problems.^{1,2} Additionally, age-related problems have to be expected in this group of patients.

The ossified spine in AS is susceptible to fractures due to changed biomechanics with long lever arms and a severe osteoporosis.^{3,4} The main fracture location is the lower cervical spine and the cervical-thoracic junction.⁵⁻⁸ Non-operative treatment of cervical spine fractures in patients with AS often leads to pseudarthrosis due to the changed biomechanics with long lever arms and the complicated external fixation using a halo-vest because of the kyphotic deformity.^{9,10} Therefore, operative treatment of these fractures is beneficial.^{3,5,10} Nevertheless in operative treatment there are also some major problems related to AS. Due to the kyphotic deformity the anterior approach to the cervical spine is very difficult and the postoperative immobilization using a halo-vest is complicated. Because of the severe osteoporosis and the unfavorable biomechanics causing high implant loads, there is a high risk of implant loosening followed by loss of correction and pseudarthrosis as well as the development of ulcerations of the esophagus caused by the loosened anterior implant. In the light of this a combined anterior and posterior plate fixation is the standard treatment in our clinic and also recommended by others.^{3,10} Since there is no benefit for the patient with AS in short fusions, multi-level instrumentations should rather be applied for better stabilization. In order to prevent loosening of the anterior plate and to avoid postoperative halo-vest immobilization biocortical screw fixation should be considered due to an improved biomechanical stability compared to monocortical fixation.¹¹ Because of the potential risks due to the perforation of the posterior vertebral cortex, we have developed an expansion screw for monocortical fixation which provides the same biomechanical stability compared to bicortical fixation.¹² We have used this new implant successfully, especially in patients with osteoporosis.

One of our patients, a 57 year old man with AS and C5/6 fracture, was treated with a three-segmental anterior and posterior plate fixation C4 to C7 and anterior fusion C5/6. Five weeks postoperatively a proximal loosening of the anterior implant (Caspar plate with bicortical screw fixation) occurred. After anterior implant removal and anterior reinstrumentation using the new expansion screws the fracture consolidated without renewed implant failure.

In the present case we recommend the urgent removal of the anterior implant because of the high risk of a perforation of the esophagus due to esophageal ulceration caused by the loosened implant. Intraoperatively, stability testing of the segments C5/6 and C6/7 should be carried out. In case of instability due to a non-union, an anterior reinstrumentation with bicortical screw fixation or the new expansion screws should be used in order to prevent a pseudarthrosis. Additional postoperative halo-vest or stiff-neck immobilization should be performed until radiologically demonstrated fusion.

In the present case the biomechanical stability of the monocortical screw fixation of the anterior plate

Figure 1 Status after traction by halo-fixateur

seemed to be insufficient for the unfavorable biomechanics of the fractured cervical spine in AS. Because of the long lever arms, at least one uninjured segment proximal and caudal to the fracture should be included in the instrumentation. Additionally, the posterior instrumentation seems to be too short, and the biomechanical stability of the wiring technique is inferior to a plate fixation,¹³ especially in multi-segmental instrumentations.

Third opinion

Bone-grafting in patients with ankylosing spondylitis while doing the first fusion seems to be unnecessary because of rapid healing after a solid stabilization. This could be done with the application of two long dorsal plates to neutralize kyphotic forces. Additionally, a ventral stabilization should avoid a ventral opening of the fracture.

In this case of a severe dislocation and an open stoma, a ventral approach should be avoided. To do the external fixation with a Halo-fixator was correct even if there is the problem of pressure sores and difficulty in fitting a suitable jacket. Maybe the installation with screws to the pelvis could be possible. I would prefer a revision and stabilization with long plates by a dorsal approach. Experience shows that the fixation to the dorsal joints is durable.

Fourth opinion

On admission of the patient on the 3rd November 1997 to the spinal unit, the injury was already three weeks old. Even correcting the osteoligamentary dislocation neurological improvement could not be expected after that length of time.

Because of the ankylosing spondylitis the dislocation can be accepted. An operational revision could

not be seen in any reasonable relation to the expected result. I would have proceeded more or less the same way.

References

- 1 Foo D, Sarkarati M, Marcelino V. Cervical spinal cord injury complicating ankylosing spondylitis. *Paraplegia* 1985; **23**: 358–363.
- 2 Ohry A, Frankel HL. Rehabilitation after spinal cord injuries complicated by previous lesions. *Paraplegia* 1984; **22**: 291–296.
- 3 Olerud C, Frost A, Bring J. Spinal fractures in patients with ankylosing spondylitis. *Eur Spine J* 1996; **5**: 51–55.
- 4 Toussiro E, Wendling P. L'osteoporose de la spondylarthrite ankylosante. *Presse Med* 1996; **25**: 720–724.
- 5 Detwiler KN, Loftus CM, Godersky JC, Menezes AH. Management of cervical spine injuries in patients with ankylosing spondylitis. *J. Neurosurg* 1990; **72**: 210–215.
- 6 Fast A, Parikh S, Marin EL. Spine fractures in ankylosing spondylitis. *Arch Phys Med Rehabil* 1986; **67**: 595–597.
- 7 Murray GC, Persellin RH. Cervical fracture complicating ankylosing spondylitis: a report of eight cases and review of the literature. *Am J Med* 1981; **70**: 1033–1041.
- 8 Wade W, Saltzstein R, Maimann D. Spinal fractures complicating ankylosing spondylitis. *Arch Phys Med Rehabil* 1989; **70**: 398–401.
- 9 Deburge A, Guigui P, Ouahes M, Barre E. Cervical pseudarthrosis in ankylosing spondylitis. A case report. *Spine* 1996; **21**: 2801–2805.
- 10 Karlstrom G, Olerud S. Spinal pseudarthrosis with paraplegia in ankylosing spondylitis. A case report. *Arch Orthop Trauma Surg* 1981; **98**: 297–300.
- 11 Clausen JD et al. Biomechanical evaluation of Caspar and Cervical Spine Looking Plate systems in a cadaveric model. *J Neurosurg* 1996; **84**: 1039–1045.
- 12 Richter M et al. Biomechanical evaluation of a newly developed monocortical expansion screw for the use in anterior internal fixation of the cervical spine – in-vitro comparison with 2 established internal fixation systems. Spine submitted.
- 13 Cooper PR, Cohen A, Rosiello A, Koslow M. Posterior stabilization of cervical spine fractures and subluxations using plates and screws. *Neurosurgery* 1988; **23**: 300–306.