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Marcel Sincari,
Margarida Conceição,
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Pitfall in surgical treatment of patients with ankylosing spondylitis and fractures

Marcel Sincari[1], Margarida Conceição[1], Mark-Daniel Sincari[2]

[1] Neurocirurgery. Unidade Local de Saúde de Viseu Dão-Lafões, EPE, Portugal
[2] FMUC, Portugal

Abstract

This article presents a brief description of the concept of fractures in patients with ankylosing spondylitis and the most commonly used surgical techniques, followed by the report of four cases treated for circumferential arthrodesis.

Keywords
ankylosing spondylitis,
arthrodesis,
cervical vertebrae

Introduction

Achylosing spondylitis is a chronic autoimmune inflammatory disease, predominantly affecting the spine and sacro-iliac joints. It affects males 3 times more than females.[1]

Chronic inflammation of vertebral and paravertebral tissues results in their ossification, fusion and increased stiffness of the spine. Another characteristic of spondylitic spines is the presence of osteoporosis and kyphotic deformity, the latter leading to reduced visual range and less balance, thus predisposing to a greater risk of falls. All of these factors increase the risk of fractures of the cervical and thoraco-lumbar spine in this subgroup of patients.[2,3]

Fractures in spondylitic columns behave like long bone fractures, producing fractures that affect the three columns of Denis[10], which increases the risk of unstable behavior, as well as an increased risk of associated neurological injury.[4]

The characteristic vertebral calcification of these columns results in altered vertebral anatomy, making safe transpedicular instrumentation in these fractures difficult. Surgical treatment of spinal fractures in patients with spondylithic spines therefore presents a greater risk of postoperative complications.[5]

In approximately 50 to 70% of spondylitic fractures, they occur at the C5-C6 level.[6] Therapeutic discussions have debated between isolated anterior, isolated or combined posterior instrumentation.[7]

Isolated anterior fixation has the highest rate of non-union and instrumentation failure, as it only fixes the anterior and middle spine.[8] Isolated posterior fixation presents better results than anterior fixation, however, there is still a risk of spinal non-union. previous.[9] In this sense, combined fixation has been shown to be the approach with the highest

Corresponding author:
Marcel Sincari

Unidade Local de Saúde de Viseu Dão-Lafões, EPE,
Portugal

sincari1973@gmail.com

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fusion rates, as it fixes all three columns. However, it still presents a high risk of postoperative complications.[7]

The objective of this study was to report four clinical cases of fractures of the cervicodorsal region in patients with ankylosing spondylitis treated surgically with circumferential arthrodesis. The question we intend to answer is whether combined cervicodorsal circumferential arthrodesis is a safe and effective procedure for obtaining arthrodesis of these fractures.

Clinical cases

Case 1

66-year-old patient, with a complex somatic history: Ankylosing spondylitis diagnosed at age 42; End-stage renal disease on hemodialysis; Arterial hypertension; Dyslipidemia; Type II diabetes mellitus; Ischemic heart disease, with angioplasty in 2001, 2003 and 2006; Benign thyroid nodules; Pericarditis due to Staphyloccous epidermidis in 2017; Ex-smoker. The patient went to the Emergency Department due to a fall from his own height, with cervical and back pain complaints, without neurological deficit. The patient also reported loss of horizontal vision secondary to dorsal kyphosis marked over years of evolution. A CT scan of the cervicodorsolumbar spine was performed, which revealed a trans discal fracture of C6-C7 and T12-L1. Cervical MRI was not performed due to a conflict between the patient's kyphosis and the space available to perform the respective examination (Figures 1A,B).

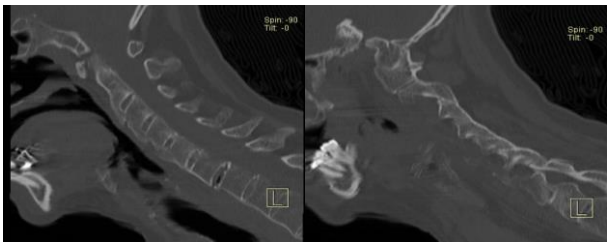

Figure 1. **A.** Cervical CT: Transdiscal C6-C7 fracture.

The patient initially refused surgical treatment and was discharged with an indication for conservative treatment with a cervical collar and dorsalumbar external rigid fixation. After 3 months of evolution of the traumatic episode, he reported worsening cervical and dorsal pain, without neurological deficit, and also reported poor adherence to the prescribed conservative treatment. Cervical and dorsolumbar CT revealed the presence of a non-union of C6-C7 and T12-L1 (Figure 2A and 3A).

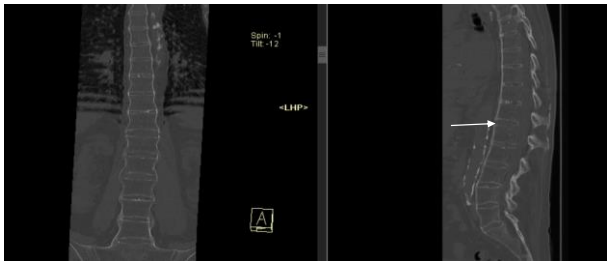

Figure 1. **B.** Discontinuity of the anterior and posterior longitudinal ligament Th12-L1.

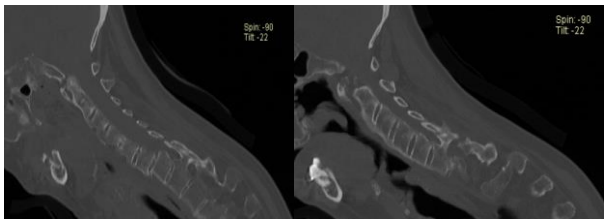

Figure 2. **A.** C6 anterior lithesis, larger opening of the posterior fracture.

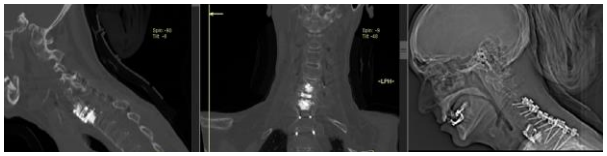

Figure 2. **B.** Postoperative CT reveals good positioning of the arthrodesis material.

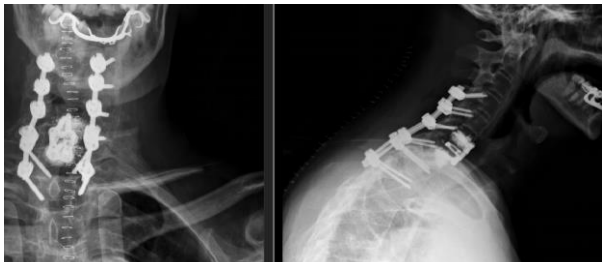

Figure 2. **C.** Postoperative cervical x-ray.

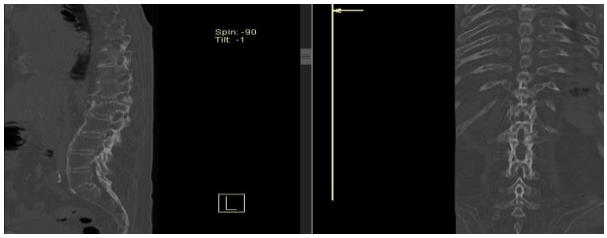

Figure 3. **A.** Preoperative CT - Non-union of Transdiscal Th12-L1 Fracture.

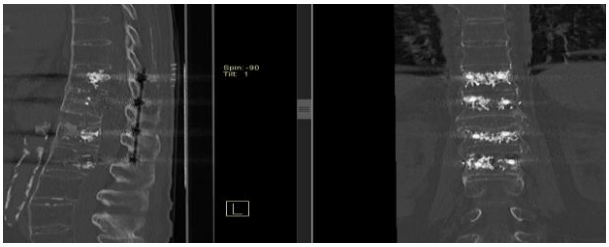

Figure 3. **B.** Postoperative dorsolumbar CT: posterior cemented fixation T11-L2.

He accepted surgical treatment and underwent combined cervical arthrodesis and T11-L2 percutaneous fixation with cemented screws (Figure 3B). Cervical surgery began with C6-C7 anterior arthrodesis with an interbody cage and anterior plate with cemented screws, with reduction of C6-C7 segmental kyphosis. After an anterior approach, he underwent C5-T2 posterior arthrodesis with C5-C7 posterior fixation to the lateral masses, T1-T2 transpedicular instrumentation and C5-C7 laminectomy (Figure 2 B,C). After combined cervical surgery, T11-L2 percutaneous fixation was performed with cemented screws. The postoperative period was uneventful, with recovery of horizontal vision.

After a year of follow-up without axial complaints, he died suddenly after a dialysis session.

Case 2

A 74-year-old patient with a long history of ankylosing spondylitis suffered a road accident that resulted in neck trauma. She presented with cervical pain complaints, without neurological deficits. Cervical MRI revealed a C7 transnasomatic fracture (Figure 4A).

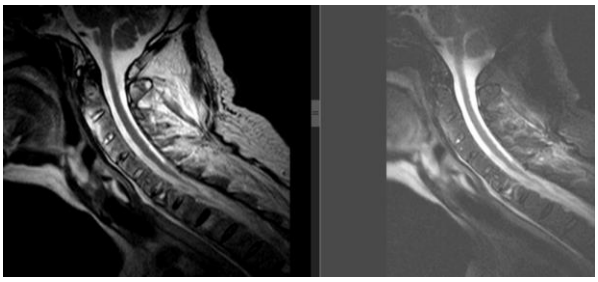

Figure 4. **A.** Cervical CT: C7 transomatic fracture.

The patient underwent combined surgery, with a C6-C7-T1 anterior arthrodesis with an anterior plate and cemented screws being performed first, followed by C5-C7 posterior fixation to the lateral masses, T1-T2 transpedicular. It was decided intraoperatively to perform a C5-C7 laminectomy due to extravasation of intracanal cement during the execution of the anterior cemented screws, detected with fluoroscopy (Figures 4 B,C), which on the postoperative control CT scan was considered irrelevant.

Figure 4. **B.** Postoperative CT and X-ray.

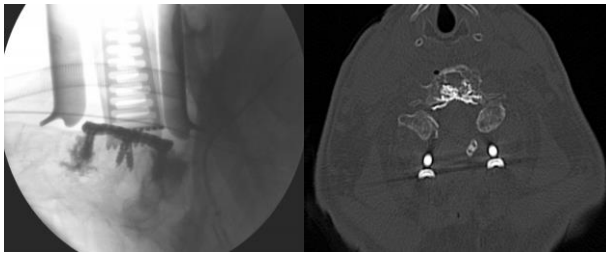

Figure 4. **C.** Intra-canal cement leakage was detected intraoperatively, asymptomatic and considered irrelevant in the axial sections of the cervical CT.

In the immediate postoperative period, he presented paresthesias of the left upper limb, with spontaneous resolution after 2 days of evolution.

Case 3

An 81-year-old man with a history of ankylosing spondylitis had an episode of lipothymia. During the episode of lipothymia, a third person held the patient, preventing him from falling, which resulted in a cervical flexion movement.

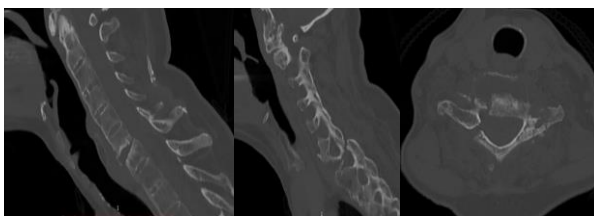

Figure 5. **A.** C6-C7 transdiscal fracture, C7 lamina fracture on the right.

After recovering from lipothymia, the patient reported intense neck pain and went to primary

health care, where he underwent a simple cervical x-ray and was advised to use a cervical collar. The patient continued to have the aforementioned neck pain, associated with clinical neurological worsening after a week of evolution. He reported loss of muscle strength in his right upper limb and dexterity in his right hand. Neurosurgery consultation was referred 3 months after the trauma, with grade 3 muscle strength of the right upper limb. He underwent CT and MRI which revealed a C6-C7 transdiscal fracture (Figure 5A, B).

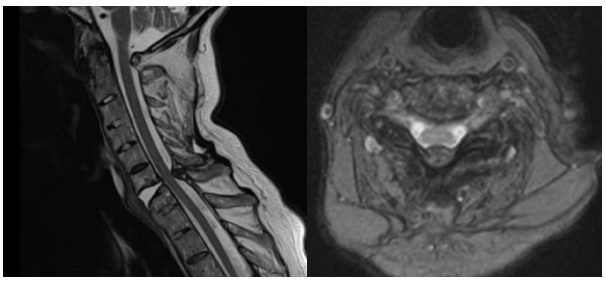

Figure 5. **B.** MRI confirms C6-C7 fracture, posterior ligament cord compression.

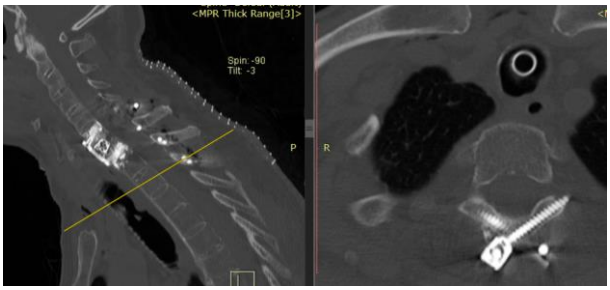

Figure 5. **C.** Cervicodorsal CT: cervical circumferential arthrodesis: C6-C7 anterior arthrodesis with cylinder and anterior plate with cemented screws. C5-Th2 posterior arthrodesis, in C5, C6 with transpedicular screws and in C7 with unilateral intralaminar screw, Th1, Th2 with crossed intralaminar screws, cross link.

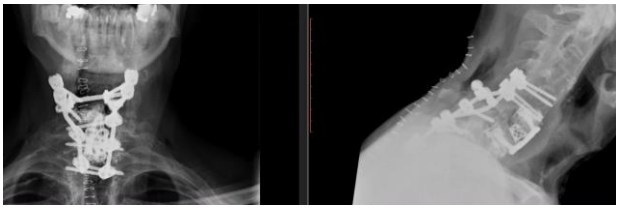

Figure 5. **D.** Postoperative cervico-dorsal radiography

He underwent surgery, and cervicodorsal circumferential arthrodesis was performed: C6-C7 anterior arthrodesis with cylinder and anterior plate with cemented screws and C5-T2 posterior arthrodesis (transpedicular screws in C5-C6, C7 unilateral intralaminar screw and crossed intralaminar screws T1 and T2 (Figures 5C,D). Postoperatively, dehiscence of the posterior cervical surgical wound was observed, which was treated with vacuum dressings and, to facilitate closure of the wound, a resection of the dorsal spine apophyses was performed, with the wound appearing fragile, but stable during the operation. follow up (Figure 5 E)

Figure 5. **E.** Appearance of the wound after epithelialization.

Case 4

An 84-year-old man went to the hospital 10 days after the fall with superior paraparesis (FM 0 distally and FM2 proximally) with a C6 transomatic fracture with dissociation (Figure 6A).

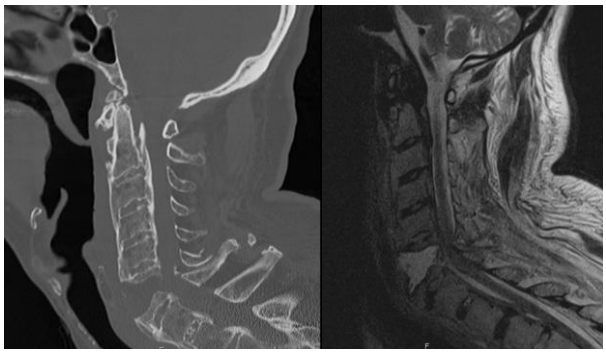

Figure 6. **A**. Preoperative cervical CT and MRI: C6 transomatic fracture.

It was decided to stabilize the fracture by performing circumferential arthrodesis, starting via the anterior approach. After anterior fixation with a C5-C6 plate with cemented screws in anterior cervical flexion to reduce dissociation, the patient was placed in a ventral position with the head fixed in Mayfield and when performing radiography, dislocation of the C5

body screws was soon noticed (Figure 6B) . The initial plan was maintained and continued with C3-Th2 posterior fixation (C3-C7 lateral mass and Th1, Th2 with intralaminar cruciate screws (Figure 6C) and C3-C6 laminectomy, without complications. Cervical CT and post-preratorial radiography reveal acceptable fixation with restoration of fracture alignment. He was discharged 10 days postoperatively with slow, progressive improvement in motor deficit.

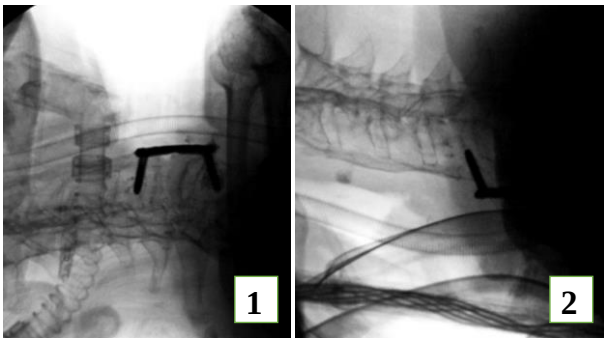

Figure 6. **B**. **1.** Intraoperative radiography after fixation with anterior plate with cemented screws. **2**. Radiograph after ventral positioning with pull out of the C5 body screws.

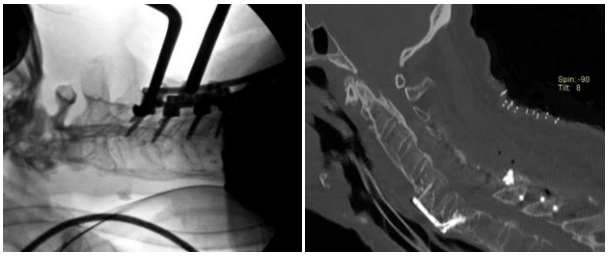

Figure 6. **C**. Intraoperative radiography and post-operative cervical CT reveal good alignment of the fracture.

Discussion

The four cases reported and submitted to cervicodorsal arthrodesis via a combined approach in patients with fractures and ankylosing spondylitis, occurred without major complications and with the achievement of fracture arthrodesis.

Patients with ankylosing spondylitis are usually patients with multiple associated comorbidities, often with respiratory and renal impairment and advanced age. These patients thus represent a systemic medical-anesthetic challenge, but also a local one, since cervico-dorsal fractures represent, from a technical point of view, a difficult area for the anesthesiologist, with neurological risk associated with intubation and positioning of the patient.[1,2,5,7].

At the surgical level, they also represent a challenge, both due to the instability of these fractures and the technical difficulty that these patients present to the surgeon. Surgical treatment must be meticulously planned and adapted case by case, taking into account comorbidities, type and degree of instability of the fracture. The high mechanical instability of these fractures, the high rigidity of the spondylitic columns, osteopenia and the technical difficulty of the instrumentation caused by the change in the local anatomy of the spine of these patients, significantly increases the risk of non-union of these fractures and mechanical failure of the instrumentation. Several strategies can be used to improve the safety and quality of instrumentation with the aim of obtaining stable fixation and fracture consolidation associated with minimizing instrumentation-related complications. These fractures can be fixed via a posterior, anterior or combined approach. Isolated pathways carry an increased risk of fixation failure, Figure 7 illustrates the failure of the isolated anterior pathway.

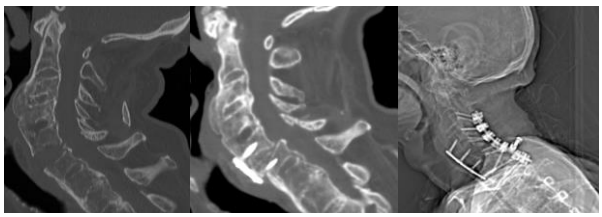

Figure 7. Cervical fracture initially treated only via the anterior approach with construction failure and neurological worsening and the need for circumferential arthrodesis.

The advantage of the isolated posterior approach lies in less aggression and surgical time, and is therefore associated with a lower risk of complications than the combined approach, but the isolated posterior approach is inferior in terms of robustness to the combined approach (Figure 8).

In turn, the combined approach allows superior mechanical fixation, as well as the reconstruction of comminution/deficient bone stock in the anterior column. In this sense, the posterior route should be reserved for patients without anterior column comminution or in patients who cannot tolerate the combined route. The combined approach should therefore be reserved in cases with significant loss of anterior bone stock or comminution of the vertebral body, in order to obtain anterior support and reduce mechanical stress on the posterior fixation. [1,2,5,6,7,8,9].

In our reported cases, circumferential arthrodesis via a combined approach was always chosen, in order to obtain an anterior reconstruction, increase the mechanical resistance of the construction in order to obtain a safe arthrodesis, as well as reduce segmental kyphosis and thus restore the horizontal vision of these sick. It is worth highlighting a case of dehiscence of the posterior surgical wound, which may be due either to the greater risk of healing difficulties inherent to the posterior route compared to the anterior route, or to the underlying inflammatory pathology of these patients, with marked paravertebral muscular atrophy secondary to disuse. caused by the rigidity of these columns.

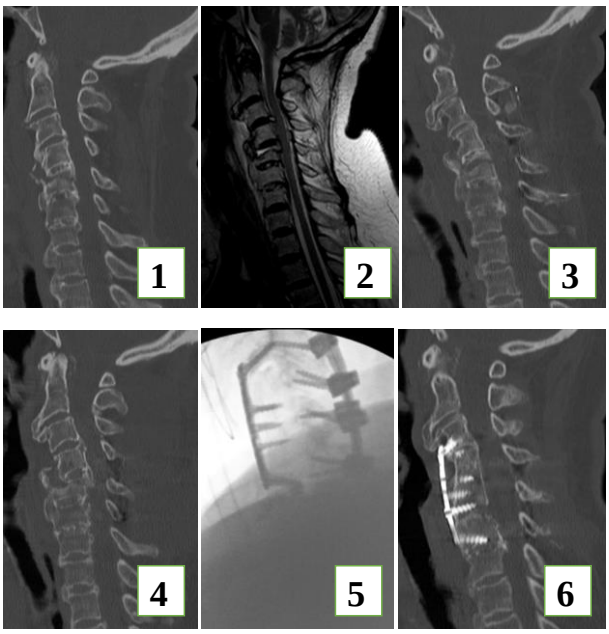

Figure 8. **1.** CT-C5 transomatic fracture. **2.** MRI confirms the C5 transomatic fracture. **3.** CT scan after posterior fixation with good fracture alignment. **4.** CT in the immediate postoperative period, after dramatic neurological worsening, reveals disassembly of the posterior construction and misalignment of the fracture. **5.** Intraoperative images during anterior arthrodesis with tricortical iliac self-graft and plate. **6.** Postoperative CT reveals good positioning of the graft and plate.

The use of anterior plates is associated with a risk of screw pull-out, associated with high osteopenia of these spines. The use of cemented screws is an option that increases the mechanical resistance of the previous construction[1,2]. In our clinical cases, all screws used in the anterior plate were reinforced with cement, with one case of screw pull-out occurring. It should be noted, however, that in one case there was leakage of endocanal cement without neurological sequelae, meaning that the use of mechanical reinforcement is not without risks.

At a posterior level, the change in local anatomy, as well as the overlap of the glenohumeral joints, makes safe transpedicular instrumentation of C7 and the upper thoracic vertebrae difficult through the use of fluoroscopy or free-hand. Two solutions can be used to overcome this difficulty: the use of transpedicular screws for navigation or the use of intralaminar screws, the latter of which have the advantage of being able to be used in a free-hand manner, reducing exposure to radiation and reducing time surgical, hemorrhage and infectious risk when compared with navigated transpedicular instrumentation. The disadvantage in relation to transpedicular navigated instrumentation is that they are biomechanically inferior, since they instrument only the posterior column, compared to the instrumentation of the three columns provided by the transpedicular screw [1,2,5,6,7,8,9], although there are comparative studies between fixation with transpedicle screws and intralaminar crossed screws that reveal similar resistance.

Mc Guird compared Th1, Th2 transpedicular fixation versus intralaminar fixation in cadavers and determined the minimum biomechanical difference in cases of long cervicodorsal fixation11. Kretzer in another cadaveric study determined similar stability in cases of transnaspedicuar and intralaminar fixation involving Th1 and Th2[12].

In two reported cases, the instrumentation of T1 and T2 was free-hand transpedicular, since adequate bone references were identified intraoperatively for the safe performance of this technique. In the third and fourth case, it was decided to use intralaminar screws in T1 and T2, due to the fact that the local anatomy was distorted by the underlying pathology and the fact that the hospital unit did not offer the navigation option at the time of the surgery, Surgical technique has been previously described[13].

The main limitation of this study is that it deals with reports of four clinical cases, and therefore, without statistical power. The main strength of the study lies in the fact that the cases were operated on by the same surgeon, subjected to the same surgical technique and with thorough pre-, intra- and post-operative preparation and description, thus allowing reliable conclusions to be drawn from the reported cases.

Conclusions

We can conclude that combined cervicodorsal arthrodesis in patients with fractures and ankylosing spondylitis is a safe treatment and allows good arthrodesis rates to be obtained without mechanical failure of the construction. These cases are challenging, need good preoperative assessment and correct surgical planning. The patients usually are old, fragile, with comorbidities and every mistake or misunderstanding of complexity of pathology can lead to catastrophic complications. The follow up must be very tight during first years, until the fusion is confirmed.

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