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Management of the Thoracolumbar Transdiscal Fractures Complicating Ankylosing Spondylitis: A Case Series

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Case Series

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Introduction: Ankylosing S[illegible]ondylitis (AS) is [illegible] inflammatory chronic rheumatic disease, wh[illegible]h, if not treated appropriately, exposes the formation of the ankylo[illegible]ed or bamboo s[illegible]ine. The ankylosed spine is very susceptible to fracture. T[illegible]aim of our wo[illegible]k is to report on our experience in the manage[illegible]ent of AS pa[illegible]s with thoracolumbar fractures and their evolution.

Material and m[illegible]th[illegible]ds: This was a retrospective, descriptive study including [illegible]ts followe[illegible] for AS and managed for thoracolumbar transdiscal fractu[illegible]s in our ins[illegible]tute, over a 14-year period. Patient data included age, sex, [illegible]ctures, clinical examination and paraclinical investigations. T[illegible]apeutic modalities and their evolution have also been reported.

Result[illegible] Six patients with the mean age of 4 men and 2 women was 57.1 years were managed in our department. The average duration of AS was 13.8 years. The average follow-up in our study was 6.1 years. In most cases, the reason for hospitalization was trauma, most often minor. The mean time to fracture diagnosis was 19.4 weeks. Two patients with thoracic fractures had preoperative neurological complications. Non-surgical treatment was indicated for 3 patients for various reasons. Surgical treatment was indicated for 3 patients. Four patients had a favorable outcome. A was complicated by sepsis on the material followed by septic shock and death and another patient was complicated by kyphosis consolidation.

Discussion: Transdiscal fractures results from fracture of the completely ankylosed spine. The mechanical stresses of this rigid spine prevent consolidation, leading to pseudarthrosis. These fractures were diagnosed on conventional radiography, CT and MRI. The management of transdiscal fractures

in patients with AS is controversial, and there is no consensus on management. Non-operative management has a place in the therapeutic arsenal. Surgery is reserved for treatment in patients with deficit and dislocation or three-column injuries. Circumferential arthrodesis with posterior instrumentation is considered the principal management.

Conclusion: Spinal transdiscal fractures in patients with ankylosing spondylitis remain a rare and serious complication, exposing them to neurological complications. The mechanical nature of the pain and the notion of trauma, even minor, should prompt consideration of this diagnosis. The proposed treatment will depend on the medical and surgical findings.

Keywords: Ankylosing spondylitis (AS); Spinal; Management; Patients; Fractures; Pain; Surgery

INTRODUCTION

Ankylosing Spondylitis (AS) is an inflammatory chronic rheumatic disease, which, if not treated appropriately, exposes patients to syndesmophyte formation and spinal deformation. It is characterized by ossification of the spinal discs, joints, and ligaments. Syndesmophytes form across the disc spaces culminating with osseous fusion of the entire spine and the formation of the ankylosed or bamboo spine. The ankylosed spine is very susceptible to fracture due to progressive loss of mobility and secondary osteoporosis. In patients in whom ankylosing spondylitis is diagnosed a significantly increased risk of vertebral fracture is present compared with individuals in the general population. These fractures can have a significant functional impact on the patient's daily life, and can sometimes lead to severe neurological injuries. Fractures in the cervical regions can be caused by minor traumatic injury witch was the most common situation. Delay in diagnosis is not uncommon, resulting in inappropriate immobilization and treatment. This is why mechanical pain and the notion of trauma, however minor, should prompt consideration of this diagnosis. A normal standard X-ray does not invalidate the diagnosis, and should lead to CT-scan and MRI. Whether surgical or orthopedic, the treatment is determined in terms of the patient's age, comorbidities, the functional impact, the stability of the fracture and the existence of neurological signs [1-4]. The aim of our work is to report on our experience in the management of AS patients with thoracolumbar fractures and their evolution.

MATERIAL AND METHODS

This was a retrospective, descriptive study including patients followed for AS and managed for thoracolumbar transdiscal fractures in our institute, over a 14-year period between 2010 and 2023. We excluded patients with missing data. All patients had been diagnosed and treated for AS in rheumatology for several years. Patient data included age, gender, functional signs and clinical examination especially the neurological evaluation and paraclinical investigations mainly the fracture characteristics. We used the Frankel score to assess neurological status [5]. Management of thoracolumbar transdiscal fractures were reported. We also recorded all complications encountered. Clinical and radiological follow-up was carried out systematically in all patients. Data were analyzed using SPSS software version 26.0. Patient anonymity was respected during data collection. Written informed consent was obtained from all participants.

RESULTS

Cases presentation: Based on these criteria, 6 fractures were observed in 6 patients. The mean age of 4 men and 2 women was 57.1 (38-83). Four patients had no particular history apart from AS. One patient, aged 72, had undergone coronary artery disease on 2 occasions, and one, aged 83, was suffering from heart failure and renal

failure at the hemodialysis stage. The average duration of AS was 13.8 years (5-23). All had an ankylosed spine with a bamboo spine appearance. The average follow-up in our study was 6.1 years.

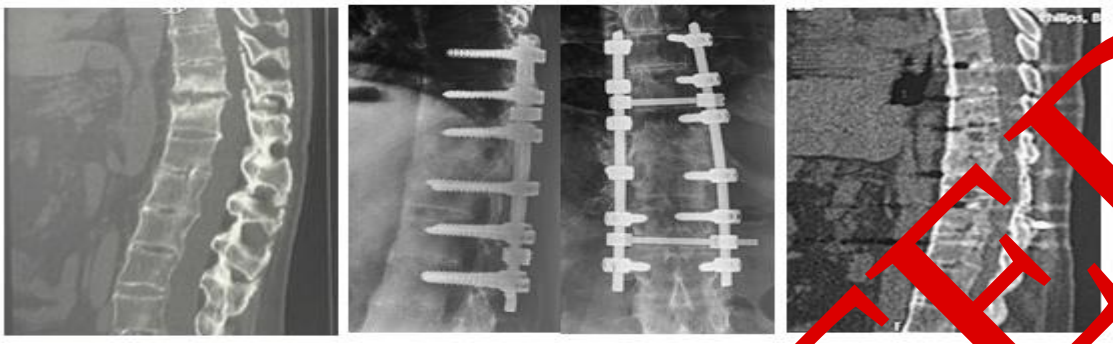
Clinical assessment: In most cases, the reason for hospitalization was trauma, most often minor, which was found in 2 patients. A suspected fracture after a trauma with gait disturbance was reported in one patient. A [illegible]e neurological deficit was found in one patient. A spinal fracture was found as part of an injury assessment of a polytrauma following a motor vehicle accident. Five patients all had spinal pain, 2 of whom had intermittent permanent, insomniac pain, resistant to medical treatment. The mean time to fracture diagnosis was 19.4 weeks (0-67). Fractures were transdiscal in all patients. Fractures occurred most frequently in the dorsal (n = 4), lumbar (n = 1) and dorso-lumbar spine (n = 1). Two patients with thoracic fractures had neurological complications. These were a complete paraplegia classified as Frankel A occurring immediately after the fracture in a patient with a transdiscal fracture of D10-D11, and a walking disability with an initial neurological status of Frankel C after minor trauma in a patient with a transdiscal fracture of D10-D11.

Medical imaging results: Standard radiographs for all 6 patients showed the fracture line in 3 cases, a pseudarthrosic appearance in 2 cases, and no obvious fracture line in only one case. CT scans for all 6 patients showed the fracture line in all cases, and a pseudarthrosic appearance in 2. MRI was carried out in only one case, for a patient with an initial neurological deficit, which showed the spinal cord involvement of this fracture (Figure 1).

Figure 1: Standard radiography and CT scan showing a transdiscal fracture D10-D11, additional MRI showed the spinal cord impact of this fracture.

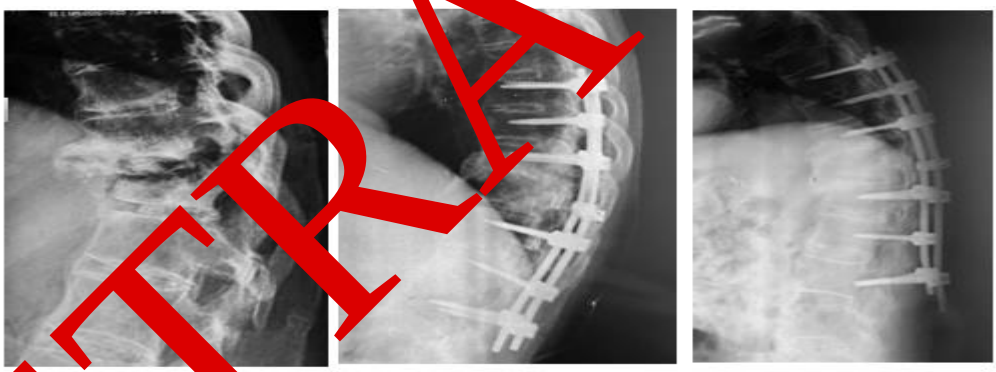
Treatment: Non-surgical treatment was indicated for 3 patients for various reasons. One patient, aged 40, had not undergone surgery due to the epidemiological circumstances of 2020 (COVID-19). The second patient had a transdiscal fracture as part of a polytrauma associated with severe head trauma, pneumothorax and multiple pre-peripheral fractures. The last patient had a long medical history and a high anesthetic risk. After consultation with the family, and despite the neurological deficit, corset immobilization was prescribed. Surgical treatment was indicated for 3 patients. The indication was severe pain unresponsive to medical treatment for pseudarthrosis in 2 cases (figure 2).

Figure 2: CT scan of a D11-D12 transdiscal fracture, operated on by circumferential arthrodesis iliac graft by anterior approach and synthesis by posterior approach radiological and scan results at 11 years postoperatively.



They underwent double approach circumferential arthrodesis. In the last patient, the surgical indication was neurological deficit. Given the urgency of the operation and the patient's history, it was decided to perform a liberation, graft and posterior synthesis (figure 3).

Figure 3: Pre- and postoperative X-ray of patient with FTD D10-D11 synthesized by a long fixation D7 at L2; Sepsis on material at 30 days postoperatively and on X-ray pulling out of distal screws.



Evolution: Four patients had a favorable outcome. Two patients who underwent circumferential arthrodesis surgery had fracture consolidation with disappearance of pain. The polytrauma patient treated with a corset had his fracture consolidated after one year (figure 4).

Figure 4: Post-traumatic and post-healing CT scan of a D10-D11 transdiscal fracture treated with a corset.

The patient who initially had a Frankel score A had total neurological recovery after immobilization and rehabilitation after 2 months. Unfortunately, a patient with a deficit who underwent posterior synthesis surgery was complicated by sepsis on the material and pulling out of distal screws requiring drainage lavage followed by septic shock and death after 40 days. On the other hand, the fracture of a patient who had undergone non-surgical treatment was complicated by kyphosis consolidation with no neurological status modification and he will be operated by osteotomies for kyphosis correction. A summary of the management of each patient is given in Table 1.

Table 1: Summary of patient data obtained pre- and posttreatment.

Case No.	Age (Years), Gender	Injury Level	Mechanism of Injury	Severity of Injury	Initial Frankel Score	Management	Evolution	Follow-up (Years)
1	40, Male	L2-L3	Fall	Minor	E	Nonoperative Management: Orthopedic treatment with corset immobilization	kyphosis consolidation; Will be operated by osteotomies for kyphosis correction; No neurological status modification	4.5
2	55, Female	D12-L1	Pseudarthrosis	Minor	E	Surgical treatment with double-approach circumferential arthrodesis	Consolidation; No neurological status modification	12
3	38, Male	D11-D12	Pseudarthrosis	Minor	E	Surgical treatment with double-approach circumferential arthrodesis	Consolidation; No neurological status modification	11
4	72, Male	D10-D11	Fall	Minor	C	Surgical treatment with liberation graft and posterior synthesis	Material sepsis requiring drainage lavage followed by septic shock and death after 40 days	40 days
5	55, Male	D10-D11	Motor vehicle accident	Major	E	Nonoperative Management: Orthopedic treatment with corset immobilizationn	Consolidation after 1 year; No neurological status modification	3.5
6	83, Female	D10-D11	Fall Impulse mechanism	Minor	A	Nonoperative Management by recumbency followed by rehabilitation	Consolidation after 1 year; Total neurological recovery	6

Altered Spine Biomechanics

In patients with ankylosing spondylitis, the spine loses flexibility and often becomes kyphotic due to generalized paravertebral ossification. This ossification primarily bridges the zygapophyseal joints, costotransverse joints, and the sacroiliac joint. The disease usually progresses from the lower to the upper spine (caudal to cranial direction) and, in the most severe cases, can affect the entire spine. Although ligamentous structures undergo ossification, this does not provide additional mechanical support to the spine. The loss of elasticity results in mechanical behavior similar to that of long bones. The rigidity and kyphotic deformity create a long, fused lever arm, putting patients at a high risk of spinal fractures even from minor or negligible trauma. There is also an increased risk of multiple fractures resulting from a single traumatic event. Spinal fractures in these patients often occur through the ossified disks and vertebral bodies, typically following an extension-distraction mechanism, which causes opening of the anterior column and a gap between the vertebral bodies.

DISCUSSION

Spinal fractures in patients with AS are a rare and little-known mechanical complication of AS. Their characteristics have become better known since the review of the literature by Westerveld et al., who analyzed data from 345 patients reported between 1980 and 2007. Both ectopic bone formation and osteopenia occur simultaneously an essential part of the pathologic pathways. In this pathology, the biomechanical behavior of the spine is stepwise transferred from articulation to a long-bonelike rigid lever. It is commonly referred to as "bamboo-spine" in AS. This pathology makes the spine both rigid and fragile. This fragility emphasized by the frequency with which minor injuries such as falls can result in extension fractures in AS. These patients have a more than 10 times increased fracture risk and higher incidence of associated neurological deficits than in non-AS patients. Approximately, vertebral fractures occur in 10% of these patients 10 years after diagnosis. In the current studies, cervical involvement predominates. Thoracolumbar involvement is found in only half of cases [6-8]. The predominance of males in study is similar to the ratio in other reports published in the literature. This finding is reflective of the higher incidence of AS in men [2,3].

The history, mechanism of injury, and physical examination of patients with AS is not always conclusive. In fact, there is generally a diagnostic delay in AS spinal fractures [7]. In our experience, the average delay was 19.4 weeks. There are several possible explanations for this delay in diagnosis. It may be due to the patient suffering from chronic spinal pain, but also to the physician who may report the pain as AS if he fails to inquire about the mechanical nature of the pain, the recrudescence of pain after minimal trauma, and the difficulty of interpreting the radiographic work-up in these patients with an ankylosed spine. According to a literature review published in 2017, neurologic deterioration from initial examination, preoperatively, was noted in up to 16% of patients. Other studies show higher frequency reaching 50%. Therefore, patients with traumatic fractures of the ankylosed spine are not only susceptible to initial neurological deficit but also to secondary neurological deterioration due to highly unstable fracture configuration [2]. Neurological complications affected only two of our patients.

In contrast, standard radiography is uninformative in almost 50% of cases in the literature (48%). The diagnosis can only be clarified by MRI or CT scan [4,9]. MRI is less sensitive than CT for visualizing the fracture line. MRI sensitivity is estimated at between 60% and 80%, while CT sensitivity is estimated at 94%. However, MRI offers a number of advantages over CT. It can visualize the fracture line within all the stabilizing structures of the spine (anterior and posterior longitudinal ligaments, yellow and interspinous ligaments, posterior joints), but above all, it enables neurological complications to be diagnosed. During the entire diagnostic process and until definite treatment, it is advised to maintain internal fixation and other necessary precaution measures to avoid fracture dislocation or secondary neurologic injuries [7,12].

The management of transdiscal fractures in patients with AS is controversial, and there is no consensus on management. Left untreated, this fracture usually progresses to pseudarthrosis. Some authors propose orthopedic treatment. In cases in which a deficit is absent or minimal and in which dislocation or three-column injury is absent, some studies recommend the recumbency without surgery [8,10,13]. When free of pain, patients are mobilized approximately 1 week after recumbency, placed in a thoracolumbar brace, and undergo sequential radiography. Any patient with nonoperative transdiscal fracture treatment and concomitant AS that has been immobilized must be monitored closely given the high risk of fracture dislocation, potential for progressive deformity and secondary neurologic deterioration associated with nonoperative treatment. In general, nonoperative treatment is only the second line of choice with inferior clinical outcomes when compared to surgical treatment. In our study,

recumbency was prescribed as the sole modality of treatment in one patient despite the neurological deficit because of multiple medical problems. The other 2 patients who underwent orthopedic treatment had no neurological deficits [2,6,7].

Surgery is reserved for treatment in patients with deficit and dislocation or three-column injuries. In a [illegible] it offers superior means of reduction, decompression of neural elements, maintained stability during bone healing and faster sufficient patient mobilization than nonoperative treatment [2,7]. Circumferential arthrodesis combined with double-approach anterior and posterior surgical instrumentation is considered, by several authors, to be the management of choice in transdiscal fracture [8,10,14]. The low bone density of the vertebral body, typical of AS, leads to a high rate of implant loosening, which is one of the main mechanical complications. Combining an anterior construct with a posterior fixation may speed up fusion. Multiple fixation points are strongly recommended, extending the instrumentation at least three levels above and three below the fracture site to avoid material loosening. The choice of the implant device was at the surgeon's discretion. Posterior long-segment internal fixation can also improve patients' pain, neurological function and kyphotic deformity. This procedure can be used as an ideal surgical treatment for elderly patients with underlying diseases and high surgical risk. Regarding neurological improvement, surgical treatment appears to be more effective than orthopedic treatment [3,9,10,13].

Outcomes are influenced by neurologic injury status and medical comorbidities. One-year morbidity and mortality rates of patients with AS remain way poorer than those of patients with non-fused spinal columns. Until now, complication rates and elevated mortality rates still remain significantly higher than in the usual spine trauma patient population without preexisting bony abnormalities. There are elevated numbers of wound healing problems and infection, venous thrombosis and lung embolism, pneumonia, and respiratory insufficiency. The only early complication in our small series was a by stasis on the material followed by septic shock. We also reported a late complication in a patient who had a kyphotic deformity [2,6,7]. The limitations of our study lie in its retrospective nature and small sample size, but this is a rare pathology, with essentially small series in the literature. A multicenter study would enable better generalization of results and could potentially lead to a consensus regarding fracture management in patients with OP.

CONCLUSION

Spinal transdiscal fractures in patients with ankylosing spondylitis remain a rare and serious complication, exposing them to neurological complications. The mechanical nature of the pain and the notion of trauma, even minor, should prompt consideration of this diagnosis. Fractures are difficult to diagnose on plain radiographs and therefore, both CT and MRI have been recommended to identify spinal injuries in patients with AS. The proposed treatment will depend on the medical and surgical findings. Numerous studies have reported the risks associated with non-operative management, but still has a place in the therapeutic arsenal. Surgical treatment has many advantages, such as deformity correction, immediate stability, decompression of the spinal canal and early mobilization. But this surgery is not without complications. Because of their increased risk for incurring spinal fractures, patients with AS need to be educated to seek medical evaluation after an accident, even a minor one.

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