

Outcome of Non-operative Treatment of Extension Fractures in Patients with Ankylosed Spines - A Case Series



David Yen^{1,*}

¹Department of Surgery, Queens University, Kingston, Ontario, Canada

Abstract:

Background: Surgical treatment is the mainstay of management in patients having fractures in fused spines. However, these patients also tend to be older and have comorbidities resulting in increased morbidity and mortality with operative management. Therefore, there has been more recent interest in the risks and benefits of nonoperative treatment in these patients.

Objective: Extension pattern fractures have an intact posterior element hinge resulting in lower risk of translation. Therefore, we wanted to determine the outcome of nonoperative treatment of extension pattern fractures in patients with fused spines.

Methods: We conducted a retrospective review of all patients with fused spines having extension thoracolumbar fractures without neurologic deficit treated nonoperatively at a University Health Sciences Centre over an 8-year period.

Results: We had a complete set of data for 14 patients. There was a morbidity rate of 29% and a mortality rate of 14%. All of our patients had a significant positive change in their Cobb angle, indicating closure of the fracture gap without translation in either the sagittal or coronal planes. Remodelling of the fracture lines was found in all 14 patients and in 11 there were also bridging osteophytes across the fracture. No patients developed neurologic deficits.

Conclusion: By demonstrating the successful healing of extension fractures treated nonoperatively with morbidity and mortality in keeping with that of reports of patients with fused spines managed operatively, we added support to conducting future randomized studies of operative *versus* nonoperative treatment in this patient population.

Keywords: Ankylosing spondylitis, Diffuse idiopathic skeletal hyperostosis, Ankylosed spine patients, Extension pattern spine fractures, Thoracolumbar fractures, Operative vs nonoperative treatment.

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Received: September 29, 2023

Revised: November 23, 2023

Accepted: November 28, 2023

Published: February 02, 2024

*Address correspondence to this author at the Department of Surgery, Queens University, Kingston, Ontario, Canada; Tel: 613-548-2545; 613-985-2312; Fax: 613-548-2518; E-mail: yend@queensu.ca

Cite as: Yen D. Outcome of Non-operative Treatment of Extension Fractures in Patients with Ankylosed Spines - A Case Series. Open Neurol J, 2024; 18: e1874205X284901. <http://dx.doi.org/10.2174/011874205X284901231219073608>



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1. INTRODUCTION

Ankylosing spondylitis (AS) is a chronic inflammatory disease of interest to spinal surgeons because there is bone formation leading to fusion of the spine [1, 2]. Diffuse idiopathic skeletal hyperostosis (DISH) is a noninflammatory condition with the hallmark finding of

ossification of the anterolateral aspect of the thoracic spine [3]. There is altered biomechanics affecting the spine in common to both AS and DISH, putting patients with these disorders at increased risk of spinal fractures [4-9]. In addition, DISH and AS share important features, such as poor bone quality, advanced patient age, and the

presence of comorbidities [10]. On the basis of their comparison of spine fractures in patients with DISH or AS, Caron *et al.* found these 2 groups to be sufficiently similar to permit combining them as ankylosed spine patients (ASP) for more meaningful future outcome assessments [10].

Westerveld *et al.* reported that surgical treatment may be favorable for patients with an ankylosed spine and spinal fracture, as this treatment option may be associated with lower complication and mortality rates and may lead to neurological improvement more frequently [5]. They included all fractures of the axial skeleton, with most of their patients having injuries to the cervical spine. More specifically, Schwendner *et al.* stated that in AS and DISH patients with fractures of the thoracolumbar spine, posterior-only instrumentation of three levels above and below the fracture level with or without additional decompression, is recommended [4].

However, this patient population tends to have several comorbidities [10, 11]. Schwendner *et al.*, in their review of operative treatment, found that 80.0% of patients developed complications during their hospitalization and the 30-day mortality was 10.0% [4]. Moussallem *et al.* [11] reported that in their AS and DISH patients with thoracolumbar fractures treated surgically, there was a 67.5% morbidity rate and 60-day mortality of 4.9% while Tan *et al.* [12] reported an overall morbidity rate of 71.4%. Chen *et al.* included all ankylosed spine patients with AO type A, B, and C fractures involving the cervical, thoracic, and lumbar and found 1-year mortality similar regardless of treatment modality concluding that there may be a larger role for nonoperative management [13].

AO subtype B3 injuries are described as disruption of the anterior tension band of the spine that may pass through either the intervertebral disc or through the vertebral body but with an intact posterior element hinge preventing gross displacement [14]. We have previously reported on a case of successful nonoperative treatment of a lumbar spine extension injury in a patient with AS [15]. Therefore, we were motivated to find a subgroup of fractures that were relatively more stable that we could treat nonoperatively. We present a case series of extension thoracolumbar spine fractures without neurologic injury in patients with fused spines treated non-operatively.

2. MATERIALS AND METHODS

All patients with AS or DISH having extension thoracolumbar fractures (AO B type) without neurologic deficit treated nonoperatively at a University Health Sciences Centre from July 2014 to July 2022 were retrospectively studied.

The electronic medical record was used to obtain the patient demographics and imaging.

The diagnosis of AS or DISH was obtained from the radiology report. Imaging was reviewed by two staff surgeons (one in Neurosurgery and the other in Orthopaedic Surgery) and consensus was obtained for the Cobb angles, AO Spine Injury Classification, fracture

healing, and fusion across the fracture.

Data were entered into an Excel spreadsheet and imported into International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) Version 29 for Windows (Armonk, New York, 2023) for statistical analysis. Data were initially analyzed descriptively, including means, standard deviations and medians. Pre and post-operative data were compared using the Paired Samples t-tests and the Wilcoxon Signed Ranks test with a P value of <0.05 considered to be statistically significant.

3. RESULTS

We had 18 patients, of which 2 were lost to follow-up and 2 died (post admission day 6 and 13). Therefore, we had a complete set of data for 78% of patients in this series with a mean radiologic follow-up of 23 months (range 1 to 107 months).

Our patients were older and had pre-existing comorbidities, with a mean ASA of 3, diabetes in 50%, cardiac disease in 28%, and lung disease in 50%. There were more males than females, DISH than AS patients, and thoracic than lumbar fractures (Table 1).

Table 1. Demographics.

Mean Age (range)	Gender (M/F)	Mean ASA (range)	Fusion Type (DISH/AS)	Fracture Level T/L/both
74 (49-94)	13/5	3 (2-5)	15/3	15/2/1

CT scans were available for all 14 of the patients at the time of injury and were used to measure the initial Cobb angles. CT scans were available for follow-up in 11 of the 14 and used to measure the final Cobb angles with plain Xrays used to measure the final Cobb angles in the other 3 patients (Table 2).

Table 2. Sagittal alignment.

-	Mean	Std Deviation	T-test		Wilcoxon Signed Ranks Test	
Initial Cobb angle in degrees (n=14)	-0.3	6.3				
Final Cobb angle in degrees (n=14)	8.0	8.5				
Change in Cobb angle in degrees (n=14)	8.3	4.0	t=7.698	Two-sided P <.001	Z=3.298	Sig. (2-tailed)<.001

All of our patients had a significant positive change in their Cobb angle without translation in either the sagittal or coronal planes. There was remodelling of the fracture lines in all 14 patients and in 11 there were also bridging osteophytes across the fracture. No patients developed neurologic deficits.

We had a morbidity rate of 29% with major complications including atrial fibrillation, pneumonia, exacerbation of COPD, COVID, and urosepsis. We had a mortality rate of 14% with 2 deaths. One of these was a patient who had a cardiac arrest and suffered their spine fracture during CPR. A cardiac rhythm was re-established after resuscitation, but they had developed anoxic brain injury, never regained consciousness and had life support discontinued on post-admission day 6. The second death was of a patient with pre-existing coronary artery disease and aortic stenosis who developed progressive cardiopulmonary failure shortly after suffering their fracture and died on post-admission day 13.

4. DISCUSSION

In comparing their initial to final imaging, all of our patients had a significant positive change in their Cobb angle without translation in either the sagittal or coronal planes (Table 2). We postulate that unlike flexion or burst fractures, there is an intact posterior paraspinal muscle complex in extension thoracolumbar spine fractures that acts as a hinge to prevent posterior opening and translation. As a result, when these patients are upright, the extension deformity reduces and because there is no comminution of the vertebral body, this is a mechanically and neurologically stable fracture pattern.

The increase in Cobb angle from the initial to final imaging corresponds to the closing of the gap and compression across the fracture. We believe that this facilitated the remodelling of the fracture lines found in all 14 of our patients and the formation of bridging osteophytes in 11.

Consistent with other studies on fractures in ASP, our patients were older and had pre-existing comorbidities [10, 11], and this put them at risk for morbidity and mortality. Our morbidity rate of 29% and mortality rate of 14% are reported by others in treating this group of patients operatively [4, 11, 12].

A set back in our study is that CT was available for measurement of the final Cobb angle in only 11 of the 14 patients with plain films used in 3 and 1 of the patients only had 1 month of radiologic followup. Therefore, there may have been a difference in the accuracy of the measurements, however, the trend is consistent as there was an increase in Cobb angle from the initial to final imaging in all 14 patients.

Another set back in our study is selection bias because it is a case series of patients managed nonoperatively. However, we have been able to demonstrate the successful healing of extension fractures with morbidity and mortality in keeping with reports of ASP managed operatively.

CONCLUSION

By demonstrating the successful healing of extension fractures treated nonoperatively with morbidity and mortality in keeping with that of reports of patients with fused spines managed operatively, we have added support to conducting future randomized studies of operative

versus nonoperative treatment in this patient population.

LIST OF ABBREVIATIONS

AS	=	Ankylosing Spondylitis
DISH	=	Diffuse Idiopathic Skeletal Hyperostosis
ASP	=	Ankylosed Spine Patients

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethics and consent clearance was obtained from the Queens University Health Sciences & Affiliated Teaching Hospitals Research Ethics Board (HSREB) TRAQ #: 6039570.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

This is a chart review and patient consent has been waived by the HSREB.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article are archived and available from the author, [D.Y.], on special request.

FUNDING

None.

CONFLICT OF INTEREST

The author has no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Dr. Peter Ellis, MD, FRCSC, reviewed the imaging and Wilma Hopman, MA conducted the statistical analysis.

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