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Clinical Study

Percutaneous dorsal instrumentation for thoracolumbar extension-distraction fractures in patients with ankylosing spinal disorders: a case series

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Abstract

BACKGROUND CONTEXT: Thoracolumbar extension-distraction fractures are rare injuries mainly restricted to patients suffering from ankylosing spinal disorders. The most appropriate surgical treatment of these unstable spinal injuries remains to be clarified.

PURPOSE: To report on a cohort of 10 patients treated with closed reduction and percutaneous dorsal instrumentation.

STUDY DESIGN: Case series.

PATIENT SAMPLE: Ten consecutive patients with ankylosing spinal disorders and thoracolumbar extension-distraction fractures (Type B3 according to the AOSpine Thoracolumbar Spine Injury Classification System).

OUTCOME MEASURES: Postoperative reduction, alignment, and implant position were analyzed by computed tomography. Loss of reduction was assessed on lateral radiographs by using the Cobb technique. Ambulation ability and pain were assessed at follow-up.

METHODS: Minimally invasive dorsal percutaneous instrumentation was performed in 10 consecutive patients (3 men, 7 women) with a mean age of 81.5 (range 72–90) years between May 2010 and December 2012. The mean postoperative follow-up time was 7.9 (range 4–28) months.

RESULTS: All 10 patients were treated with closed reduction and dorsal instrumentation; in no case was conversion to an open approach required. The mean operation time was 60.2 (range 32–135) minutes. None of the patients presented neurologic deficits. Cement-augmented screws were implanted in two cases. Sufficient radiographic correction was achieved in all patients; no case of loss of reduction was noted at final follow-up. In one case, complete hardware removal was performed 9 months after the index operation because of persistent back pain at the level of the implant. One patient died of postoperative inferior vena cava obstruction. At discharge, all patients were able to ambulate without the need for crutches or opioid analgesics. At final follow-up, all patients ambulated with full weight bearing; four patients reported persistent back pain.

CONCLUSIONS: In fragile patients with ankylosing spinal disorders and thoracolumbar extension-distraction fractures, closed reduction and percutaneous dorsal instrumentation provide a satisfying midterm functional outcome while minimizing perioperative risks compared with conventional dorsoventral procedures.

Keywords: Spinal fracture; Ankylosing disorders; Diffuse idiopathic skeletal hyperostosis; Ankylosing spondylitis; Dorsal instrumentation; Percutaneus spinal surgery

FDA device/drug status: Not applicable.

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EVIDENCE & METHODS

Context
Extension distraction injuries of the thoracolumbar spine are clinically challenging, particularly as they generally present in the setting of an ankylosed spine. The ideal surgical intervention for these injuries remains controversial and standard open approaches may be associated with substantial morbidity.

Contribution
The authors present a series of 10 patients treated using minimally invasive dorsal percutaneous instrumentation. Average follow-up encompassed less than 1 year. Satisfactory short-term outcomes are reported.

Implications
This small, selective study demonstrates the feasibility of applying minimally invasive dorsal percutaneous instrumentation to the treatment of extension-type fractures in the setting of the ankylosed spine. As a retrospective study involving only 10 patients, with only short-term follow-up and no controls, this investigation cannot be used to inform treatment approaches but should solely be viewed as a ''proof of principle.''
—*The Editors*

Introduction

Thoracolumbar extension-distraction fractures are rare and represent less than 3% of the injuries to the thoracolumbar region [1]. The mechanism leading to these lesions involves spinal hyperextension with or without the occurrence of anteroposterior translational movements [2]. Of note, until the introduction of the AOSpine Thoracolumbar Spine Injury Classification System in November 2013 there was no fracture classification system that did sufficiently account for this entity of spinal injuries [3]. For example, in the Denis classification, the description of distraction injuries is confined to lesions of the posterior ligament complex and the middle column, which are classified as flexion-distraction type or seat belt–type injuries [4]. The vast majority of the reported cases of thoracolumbar extension-distraction fractures are seen in patients suffering from ankylosing disorders, that is, diffuse idiopathic skeletal hyperostosis (DISH) and ankylosing spondylitis (AS) [5–9]. In this population, even simple falls may lead to devastating spinal fractures and concomitant neurologic deficits. In view of the substantial fragility of patients with ankylosing spinal disorders, a number of historic reports have advocated nonoperative treatment strategies [10,11]. However, poor clinical outcomes resulting from the biomechanical instability at the affected segment directed a change toward operative stabilization of these injuries [4,12,13]. To date, open surgical reduction with either posterior or anteroposterior fixation represents the standard treatment of these injuries [14–16].

To the best of our knowledge, the present study is the first case series of patients with thoracolumbar extension-distraction fractures treated solely by closed reduction with percutaneous dorsal instrumentation.

Methods

We analyzed the characteristics of 10 patients admitted to a Level I trauma center (university hospital) between May 2010 and December 2012 who were diagnosed with a thoracolumbar extension-distraction fracture (Type B3 according to the AOSpine Thoracolumbar Spine Injury Classification System [3]) after blunt spinal trauma. The cohort comprised three men and seven women with a mean age of 81.5 (range 72–90) years. All suffered from an ankylosing spinal disorder, either AS (n=1) or DISH (n=9). To measure preexisting comorbidities, the Charlson comorbidity index and the age-adjusted Charlson comorbidity index were calculated [17]. The dominating preceding trauma was a low-energy fall (n=8), whereas high-energy impacts (ie, road traffic accidents) were noted in two cases. Prehospital treatment included immediate immobilization of the cervical spine by applying a cervical collar (Stifneck; Laerdal Medical, Stavanger, Norway) and inline immobilization on a spine board (Laerdal Medical). In the emergency department, all patients were assessed and treated according to the Advanced Trauma Life Support guidelines. For initial spinal imaging, plain X-ray films (anteroposterior and lateral views) and computed tomography scans were acquired in all patients (Fig. 1, Left and Right). Spinal magnetic resonance imaging was available in three patients before surgery. In all patients, closed reduction and percutaneous dorsal instrumentation (Sextant II; Medtronic, Minneapolis, MN, USA [n=7] and Longitude; Medtronic [n=3]) were performed by spine surgeons with trauma experience under general analgesia (Fig. 2A–C).

Patients were positioned prone. In contrast with compression fractures where ligamentotaxis is used, a pillow was positioned exactly below the injury to allow a maximum of anterior bending. The reposition was monitored using lateral fluoroscopy. The operative approach resembles the method as used for percutaneous vertebroplasty; thus, four guide wires are placed transpedicularly. After fluoroscopic control of the guide wires, the cannulated screws are implanted by a Seldinger technique. The decision-making process in the selection of the number of instrumented segments/levels was governed by the goal to make the instrumentation as short as possible to preserve the unaffected motion segments. In contrast with compression injuries of the spine, the instrumentation is only performed to prevent translation and rotation, whereas it does not have to protect the anterior column against compressive forces.