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Clinical Study

# Incidence, impact, and risk factors of adverse events in thoracic and lumbar spine fractures: an ambispective cohort analysis of 390 patients

R. Andrew Glennie, MD, FRCSC[a], Tamir Ailon, MD, MPH, FRCSC[a], Kyun Yang, MD[a], Juliet Batke, MSc[a], Charles G. Fisher, MD[a], Marcel F. Dvorak, MD[a], Alexander R. Vaccaro, MD, PhD[b,c], Michael G. Fehlings, MD, PhD, FRCSC[d], Paul Arnold, MD[e], James S. Harrop, MD[b,c], John T. Street, MD, PhD, FRCSI[a,*]

[a]*Combined Neurosurgical and Orthopedic Spine Program, Blusson Spinal Cord Center, University of British Columbia, 818 West 10th Ave., Vancouver, British Columbia, Canada V5Z1M9*

[b]*Department of Orthopedic Surgery, Thomas Jefferson University, 925 Chestnut Street, Philadelphia, PA 19107, USA*

[c]*Department of Neurological Surgery, Thomas Jefferson University, 925 Chestnut Street, Philadelphia, PA 19107, USA*

[d]*Department of Surgery and Spinal Program, University of Toronto and University Health Network, 585 University Ave. Toronto, Ontario M5G2C4, Canada*

[e]*Department of Neurosurgery, University of Kansas Medical Center, 3901 Rainbow Blvd., Kansas City, KS 66160, USA*

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**Abstract**

**BACKGROUND CONTEXT:** Adverse events (AEs) in thoracic and lumbar spine fractures are common, but little is known about the type of AEs that are specific to this population. Furthermore, very little is known about the incidence and clinical impact of these AEs on patients in the presence of traumatic spinal cord injury and whether they are treated operatively or nonoperatively.

**PURPOSE:** The purpose of this study was to determine primarily the incidence of AEs in patients with thoracic or lumbar spine fractures treated both operatively and nonoperatively and their impact on length of stay (LOS) and secondarily the difference in the incidence of AEs in both neurologically intact and compromised patients.

**STUDY DESIGN/SETTING:** This is an ambispective cohort study at a quaternary referral center.

FDA device/drug status: Not applicable.

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* Corresponding author. Combined Neurosurgical and Orthopedic Spine Program, Blusson Spinal Cord Center, University of British Columbia, 818 West 10th Ave., Vancouver, British Columbia, Canada V5Z1M9. Tel.: (1) 604-875-5328; fax: (1) 604-875-8223.

*E-mail address*: john.street@vch.ca (J.T. Street)

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**PATIENT SAMPLE:** Patients admitted at our institution with thoracic or lumbar fractures from January 2009 to December 2013 were identified. Patients with full Spine Adverse Events Severity System (SAVES) data were included.
**OUTCOME MEASURES:** Number and type of AEs collected from SAVES were assessed. Impact of AE on acute LOS was also determined.
**METHODS:** Data on intraoperative, preoperative, and postoperative AEs were prospectively collected using the SAVES data collection. Logistic regression was used to model the likelihood of experiencing at least one AE based on the patient characteristics. The impact of the total number of AEs experienced by a patient and that of each of the most common AEs on LOS was determined using Poisson regression.
**RESULTS:** Three hundred and ninety patients were included in the final analysis. Two hundred and seventy-six patients (70.8%) were treated operatively. One hundred and forty patients (36%) experienced neurologic deficit as a result of their initial injury. Adverse events occurred 56% of the time in the operatively treated patients and only 13% of the time in the nonoperative group. The presence of neurologic deficit increased the risk of AEs especially in high thoracic (T1–T6) trauma increasing the odds of having an AE by 12.1 ($p<.0001$). The most common AEs were urinary tract infections (19.7%), neuropathic pain (12.3%), pneumonias (11.8%), delirium (10.5%), and ileus (6.2%). Length of hospital stay increased significantly with pneumonia ($p<.0001$) and delirium ($p=.0001$).
**CONCLUSIONS:** The presence of neurologic injury and the need for operative fixation of thoracic or lumbar injuries lead to a greater risk of AEs. Only pneumonia and delirium consistently increase LOS. 

*Keywords:* Thoracic; Lumbar; Adverse event; Operative; Traumatic spinal cord injury; Spine

## Introduction

Thoracic and lumbar spine traumas encompass a wide variety of injury patterns from low-energy vertebral compression fractures to high-energy fracture dislocations. A great deal has been published on the management of thoracic and lumbar spine traumas and the associated wide spectrum of injuries. This is reflected in the variability of analyses and publications on the subject matter. The majority of the literature focuses on a number of critical areas: appropriately classifying different injury patterns, operative versus nonoperative treatment, timing of operative intervention, operative techniques for fixation of unstable fractures, radiographic outcomes, and health-related quality of life (QOL) [1–6]. There is a paucity of literature, however, specifically about adverse events (AEs) in thoracic and lumbar traumas.

Operative and nonoperative management of these injuries has been debated over numerous decades. Classically, these fractures were initially treated nonoperatively with bed rest and body casting [7]. Practices have changed over time with improvements in operative management, spinal instrumentation, and evidence demonstrating a significant morbidity associated with prolonged immobilization. Surgeons transitioned into treating a greater number of fractures operatively with the rational that this would lead to better early pain relief, better fracture reduction, early ambulation, and an overall improvement in clinical outcome [8].

More recently, the evidence for these concepts is being challenged with large series demonstrating equivalent clinical outcomes in fractures treated nonsurgically [9,10]. In those injury patterns that are considered ‘‘stable,’’ most will be treated nonsurgically and will focus on early ambulation with appropriate analgesia [11]. However, there is great difficulty in defining ‘‘stable’’; thus, presently there is considerable effort invested in identifying those fractures that will fail nonoperative management and require surgical stabilization [2,12]. Clinical outcomes and QOL have been compared for operative and nonoperative groups. Very little is known, however, about any differences that may exist with regard to AE rates in patients treated surgically or nonsurgically [13–15].

Fortunately, most of these injuries will not result in neurologic injury. Larger trials have reported a 10% to 25% incidence of neurologic deficit [16,17]. The majority of these patients will be treated operatively because of ongoing compression of the neural elements, residual instability, and malalignment of the spinal column. Spinal cord injury (SCI) will often translate to a higher incidence of AEs with some authors quoting as high as 77% [18,19]. When only considering thoracic or lumbar traumatic SCI, however, there is less known about the incidence of AEs that are specific to this group of patients. For example, it is debated whether thoracic and lumbar SCI patients are susceptible to the same pulmonary complications that can be quite common with cervical SCI.

Identifying AEs is critical in this population and establishing predictive models to help potentially avoid these complications depending on which treatment patients receive. We present an analysis of thoracic and lumbar trauma patients undergoing treatment at a Level 1 trauma