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CASE REPORT

# High-energy occupational crush injury resulting in an unstable T12 flexion-distraction injury with burst fracture morphology and traumatic myelopathy: a case report

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## ABSTRACT

Background: High-energy occupational crush injuries to the thoracolumbar spine can cause severe mechanical instability and neurological damage. When compounded by spinal canal compromise and acute myelopathy, complex fracture patterns combining flexion-distraction and burst features present diagnostic and therapeutic challenges.

Case Presentation: A 36-year-old previously healthy male industrial worker presented to the emergency department following a high-energy crush injury from a heavy object. Neurological evaluation demonstrated intact consciousness (Glasgow Coma Scale 15/15) with complete bilateral lower-limb motor paralysis (Medical Research Council grade 0/5) and sensory loss affecting the lower extremities below the right hip and left knee. Initial computed tomography (CT) revealed an unstable T12 fracture extending through the posterior elements and bilateral pedicles (flexion-distraction/Chance pattern) with retropulsed T12 fragments causing moderate-to-severe spinal canal stenosis, alongside an acute T11 superior endplate compression fracture and displaced right 10th and 11th rib fractures. Magnetic resonance imaging confirmed T11 and T12 fractures, T12 retropulsion compressing the distal spinal cord, spinal cord edema, and traumatic myelopathy. The injury was categorized under the AO spine classification as a primary T12 Type B2 fracture with overlapping Type A burst features and a secondary T11 Type A1 fracture. The patient underwent urgent posterior instrumented fixation from T10 to L1 with posterior arch resection, T11 laminectomy, and a unilateral right T12 pedicle screw. Postoperative CT confirmed stable hardware without displacement or loosening. Postoperatively, the patient required comprehensive rehabilitation for a severe neurological deficit.

Conclusion: Severe thoracolumbar trauma should not be categorized by a single fracture label. Hybrid flexion-distraction and burst injuries are highly unstable conditions requiring urgent decompression, careful surgical planning, and stable instrumented fixation.

**Keywords:** Occupational crush injury, thoracolumbar fracture, T12 fracture, flexion-distraction injury, chance fracture, traumatic myelopathy, burst fracture, spinal cord injury.

### Introduction

Occupational injuries are a major cause of mortality and disability [1]. High-energy workplace trauma, particularly crush injuries from heavy falling objects, can produce severe spinal and thoracic damage requiring complex surgical care [2].

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The thoracolumbar junction acts as a biomechanical transition zone between the rigid thoracic spine and mobile lumbar spine [3]. Consequently, it is vulnerable to substantial stress from axial loading, flexion, and distraction forces during trauma [4]. The AO Spine Thoracolumbar Injury Classification System categorizes injuries into Type A (compression), Type B (tension band disruption), and Type C (translation) [5,6]. Flexion-distraction injuries (Chance fractures) result from failure of the posterior tension band [7,8], whereas burst fractures involve axial compression, posterior vertebral wall collapse, and potential retropulsion of bone fragments into the neural canal [9,10].

Computed tomography (CT) provides detailed evaluation of osseous alignment, fracture morphology, and canal compromise [11]. Magnetic resonance imaging (MRI) adds critical information regarding soft-tissue integrity, spinal cord edema, neural compression, and traumatic myelopathy [12]. In unstable injuries with neurological compromise, urgent surgical decompression and stabilization are recommended to restore alignment and facilitate rehabilitation [13,14].

This report describes an occupational crush trauma causing a hybrid T12 flexion-distraction and burst fracture with traumatic myelopathy managed via urgent posterior instrumentation and decompression.

## Case Presentation

A 36-year-old previously healthy male employee with no prior medical or spinal history presented to the emergency department following a high-energy occupational crush injury caused by a heavy object falling directly onto his back. Upon arrival, he was conscious, alert, and hemodynamically stable, with a Glasgow Coma Scale (GCS) score of 15/15, clear bilateral air entry, and a normal heart rate. Neurological assessment revealed severe neurological impairment characterized by complete lower-limb immobility with Medical Research Council (MRC) grade 0/5 muscle strength bilaterally, alongside sensory loss affecting the lower extremities below the right hip and below the left knee. Initial non-contrast CT of the chest and thoracolumbar spine demonstrated an acute T12 fracture extending through the posterior elements and bilateral pedicles, disrupting the posterior tension band consistent with a Chance-type flexion-distraction pattern. A retropulsed T12 vertebral body fragment produced moderate-to-severe spinal canal stenosis. Associated findings included an acute T11 superior endplate compression fracture with an intact posterior wall, displaced fractures of the right posterior 10th and 11th ribs extending to the vertebrocostal joints, small bilateral pleural effusions, and passive atelectasis. Subsequent thoracolumbar MRI confirmed posttraumatic T11 and T12 fractures with T12 retropulsion compressing the distal dorsal spinal cord, accompanied by distal cord edema and traumatic myelopathy. Based on the AO Spine Thoracolumbar Classification System, the injury was classified as an unstable primary T12 Type B2 flexion-distraction fracture with an overlapping Type A burst feature, accompanied by a secondary T11 Type A1 compression fracture.

Due to the acute neurological deficit, severe canal compromise, and mechanical instability, the patient underwent urgent posterior surgical intervention. Posterior instrumented stabilization was performed from T10 to L1. Due to T12 pedicle fracture involvement, fixation at T12 was achieved using a unilateral right-sided pedicle screw, combined with bilateral pedicle screws at T10, T11, and L1. Neural decompression was accomplished via posterior arch resection and a T11 laminectomy to address neural compression extending superior to the primary T12 body injury. Postoperative CT confirmed wide posterior decompression and stable hardware position without loosening, displacement, or breakage, alongside expected residual T12 retropulsion. Postoperatively, the patient was transferred for comprehensive inpatient rehabilitation to manage severe traumatic spinal cord injury.

## Discussion

High-energy occupational crush trauma often delivers combined biomechanical forces that produce hybrid fracture configurations [1,2]. While Chance (flexion-distraction) injuries and burst fractures are conventionally categorized as separate entities, high-energy impact can cause overlapping features [15]. In this patient, hyperflexion disrupted the posterior tension band and pedicles (Chance pattern), while axial compression caused vertebral body collapse and retropulsion into the canal (burst pattern) [15].

Standardized framework application using the AO Spine System allows accurate identification of such hybrid patterns (Type B2 with Type A burst features). Recognizing multi-column disruption is critical because single fracture labels may understate mechanical instability and spinal canal occlusion [15].

Cross-sectional imaging served distinct diagnostic roles [11,12]. CT demonstrated osseous disruption across the T12 pedicles and posterior elements, confirming the need for a unilateral right-sided pedicle screw at T12 during posterior fixation [11]. MRI established soft-tissue involvement, distal spinal cord compression, and cord edema, directly correlating with the clinical findings of lower-limb paralysis (MRC 0/5) and sensory loss [12].

Surgical intervention addressed both mechanical instability and neural compromise [13]. Posterior instrumentation from T10 to L1 stabilized the disrupted columns, while T11 laminectomy and posterior arch resection provided decompression to alleviate cord compression and prevent further neurological decline [13,14]. Following surgery, long-term rehabilitation

remains necessary to support recovery from severe traumatic myelopathy [13]. This case demonstrates that high-energy occupational crush trauma requires careful radiological characterization, accurate hybrid injury classification, and targeted surgical decompression and stabilization.

## Conclusion

Severe thoracolumbar trauma can produce overlapping flexion-distraction and burst fracture features that cannot be adequately described by a single fracture label. Combined hybrid injuries represent highly unstable patterns that require urgent decompression, careful surgical planning, and rigid multisegment posterior stabilization.

## List of abbreviations

| | |
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| CT | computed tomography |
| MRC | Medical Research Council |
| GCS | Glasgow Coma Scale |

## Conflict of interest

The authors declare that there are no conflicts of interest.

## Funding

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## Consent to participate

Patient consent was obtained according to the regulations of the participating institution.

## Ethics Approval

Ethical approval was obtained according to the regulations of the participating institution.

## Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and related clinical images.

## Availability of Data and Materials

All relevant clinical and radiological data supporting this case report are included within the manuscript.

## Authors' Contributions

All authors contributed to clinical data collection, manuscript preparation, critical revision, and final approval of the manuscript.

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