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SURGICAL OUTCOMES OF THORACOLUMBAR SPINE INJURIES TREATED WITH PEDICLE SCREW FIXATION AT BAC NINH PROVINCIAL GENERAL HOSPITAL

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ABSTRACT

Background: Thoracic and lumbar spine injuries are common and account for the majority of spinal trauma cases. The thoracolumbar junction is particularly vulnerable to injury due to biomechanical stress concentration at this transition zone. **Objective:** To evaluate the surgical outcomes of thoracolumbar junction fracture treatment using transpedicular screw fixation at Bac Ninh Provincial General Hospital from January 2021 to September 2023. **Methods:** A cross-sectional descriptive study was conducted on 60 patients with thoracolumbar junction fractures who underwent posterior pedicle screw fixation. Clinical characteristics, imaging findings, neurological status, and postoperative outcomes were analyzed. Neurological function was assessed using the Frankel classification, and radiological evaluation included kyphotic angle and vertebral body height measurements. **Results:** The mean age of patients was 48.5 ± 10.6 years. Males accounted for 73.3% and females for 26.7%. Occupational accidents were the most common cause of injury (45%). The most frequently injured vertebra was L1 (67.2%).

According to the Dennis classification, compression fractures accounted for 85%, burst fractures for 13.3%, and fracture-dislocations for 1.7%. Postoperative kyphotic angles showed significant improvement. Treatment outcomes were good in 96.6% of cases, fair in 1.7%, and average in 1.7%. **Conclusion:** Posterior transpedicular screw fixation provides favorable clinical and radiological outcomes in the treatment of thoracolumbar junction fractures. Compression fractures demonstrated better prognoses compared with other fracture types.
Keywords: Spinal injury; Thoracolumbar junction; Pedicle screw fixation

KẾT QUẢ PHẪU THUẬT ĐIỀU TRỊ CHẤN THƯƠNG CỘT SỐNG NGỰC - THẮT LƯNG BẰNG NẸP VÍT QUA CUỐNG TẠI BỆNH VIỆN ĐA KHOA TỈNH BẮC NINH

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TÓM TẮT

Đặt vấn đề: Chấn thương cột sống ngực và thắt lưng là tình trạng thường gặp, chiếm tỷ lệ lớn trong các trường hợp chấn thương cột sống. Đặc biệt, vùng bản lề ngực - thắt lưng dễ bị tổn thương do sự tập trung ứng suất cơ học tại vùng chuyển tiếp này. **Mục tiêu:** Đánh giá kết quả phẫu thuật điều trị gãy cột sống vùng bản lề ngực - thắt lưng bằng nẹp vít qua cuống tại Bệnh viện Đa khoa tỉnh Bắc Ninh từ tháng 01/2021 đến tháng 09/2023. **Phương pháp:** Nghiên

cứu mô tả cắt ngang được thực hiện trên 60 bệnh nhân bị gãy cột sống vùng bản lề ngực - thắt lưng được phẫu thuật cố định bằng nẹp vít qua cuống lối sau. Các đặc điểm lâm sàng, hình ảnh học, tình trạng thần kinh và kết quả sau mổ được phân tích. Chức năng thần kinh được đánh giá theo phân loại Frankel; đánh giá hình ảnh học bao gồm góc gù và chiều cao thân đốt sống. **Kết quả:** Tuổi trung bình của bệnh nhân là 48,5 ± 10,6. Nam chiếm 73,3%, nữ chiếm 26,7%. Tai nạn lao động là nguyên nhân thường gặp nhất (45%). Đốt sống bị tổn thương nhiều nhất là L1 (67,2%). Theo phân loại Dennis: gãy nén chiếm 85%, gãy nổ chiếm 13,3% và gãy trật chiếm 1,7%. Góc gù sau mổ cải thiện rõ rệt. Kết quả điều trị được đánh giá tốt ở 96,6% trường hợp, khá 1,7% và trung bình 1,7%. **Kết luận:** Phẫu thuật cố định cột sống bằng nẹp vít qua cuống lối sau mang lại kết quả lâm sàng và hình ảnh học khả quan trong điều trị gãy cột sống vùng bản lề ngực - thắt lưng. Gãy nén có tiên lượng tốt hơn so với các loại gãy khác.

Từ khóa: Chấn thương cột sống; Bản lề ngực - thắt lưng; Nẹp vít qua cuống

INTRODUCTION

Thoracolumbar spine injury refers to trauma involving the spinal segment from the eleventh thoracic vertebra (T11) to the second lumbar vertebra (L2), an area that represents a biomechanical transition zone between the rigid thoracic spine and the more mobile lumbar spine. Consequently, this region is particularly susceptible to traumatic injury and accounts for a large proportion of thoracic and lumbar spinal fractures [1,2].

The most common causes of thoracolumbar injuries include occupational accidents and traffic accidents. Although these injuries are generally less immediately life-threatening than cervical spine injuries, they often result in significant neurological deficits, chronic pain, spinal deformity, and long-term functional impairment, leading to substantial personal and socioeconomic burden. In North America alone, approximately 16,000 new spinal cord injury cases are reported annually [3]. Surgical management of thoracolumbar spine fractures has become widely accepted due to its advantages over conservative treatment, including improved spinal stability, early mobilization, and better neurological recovery. Among various surgical techniques, posterior pedicle screw fixation using systems such as CD Legacy has been shown to provide reliable fixation and favorable outcomes [4]. In Vietnam, advances in spinal trauma surgery over the past two decades have led to the widespread adoption of operative management for thoracolumbar fractures, with numerous studies reporting positive results. At Bac Ninh Provincial General Hospital, surgical treatment of thoracolumbar junction injuries has been routinely performed. *This study was conducted to evaluate the surgical outcomes of thoracolumbar junction fracture treatment using transpedicular screw fixation at Bac Ninh Provincial General Hospital from January 2021 to September 2023.*

METHODS

Study population: This study included 60 patients diagnosed with thoracolumbar junction fractures who underwent posterior spinal fixation using transpedicular

pedicle screws at Bac Ninh Provincial General Hospital between January 2021 and June 2023.

Inclusion criteria

- Patients aged 18 years or older, of either sex.
- Patients with or without neurological deficits.
- Availability of complete medical records, including clinical assessment, plain radiographs, and computed tomography (CT) scans of the spine.
- Patients diagnosed with thoracolumbar spine fractures involving vertebral levels T11 to L2, with surgical indications based on the Denis classification [5].

Exclusion criteria

- Patients transferred from other healthcare facilities who did not undergo surgical treatment at Bac Ninh Provincial General Hospital.
- Vertebral fractures secondary to pathological conditions, including osteoporosis, spinal tuberculosis, or bone tumors.

Study methods

- *Study design:* This was a descriptive clinical study with a cross-sectional design.
- *Sampling method:* A consecutive convenience sampling method was applied. All eligible patients who met the inclusion criteria during the study period were enrolled, resulting in a total sample size of 60 patients.

Data collection

Data were collected using a standardized protocol based on medical records and follow-up assessments:

- Preoperative and intraoperative data, as well as early postoperative outcomes during hospitalization, were extracted from patients' medical records up to June 2023.
- Postoperative follow-up data were obtained through scheduled outpatient visits at 1 month, 3 months, and

6 months after surgery, supplemented by telephone interviews when necessary.

Outcome measures and evaluation criteria

- *Demographic and clinical variables:* Age, Sex, Mechanism of injury

- *Neurological assessment:* Neurological status was evaluated using the Frankel grading system [1].

- *Radiological assessment:*

Plain radiography: Standard anteroposterior and lateral radiographs of the thoracolumbar spine (T10 - L5) were used to assess:

+ Level of the injured vertebra.

+ Number of fractured vertebrae.

+ Fracture pattern according to the Denis classification [5].

+ Regional kyphosis angle and vertebral body kyphosis angle, measured using the Cobb method [2].

+ Computed tomography (CT) was performed to further evaluate.

+ Fracture morphology based on the Denis classification.

+ Vertebral body comminution using the McCormack load-sharing classification [4].

+ Degree of spinal canal compromise.

- *Evaluation of treatment outcomes:*

Clinical and radiological outcomes were evaluated at 6 months postoperatively.

Neurological outcomes were assessed using the Frankel classification [1] and categorized as follows:

+ Good: Complete or near-complete recovery of motor, sensory, and sphincter function (improvement of ≥3 Frankel grades).

+ Fair: Partial recovery of motor and sensory function with mild sphincter dysfunction (improvement of 2 Frankel grades).

+ Moderate: Minimal or no neurological recovery, with persistent sphincter dysfunction (improvement of 1 Frankel grade).

+ Poor: No neurological improvement, postoperative complications, or death (no change in Frankel grade).

Postoperative radiological outcomes included assessment of:

+ Regional kyphosis angle.

+ Vertebral body kyphosis angle.

+ Vertebral body height restoration.

Statistical analysis: Data were analyzed using SPSS software version 22.0 (IBM Corp., Armonk, NY, USA).

RESULTS

General Characteristics

A total of 60 patients were included in the study. Male patients accounted for 73.3%, while female patients accounted for 26.7%. The most common age group was 40 - 60 years, representing 63.6% of the study population.

The mean age of the patients was 48.5 ± 10.6 years, with a minimum age of 22 years and a maximum age of 68 years.

Regarding the mechanism of injury, work-related accidents were the most frequent cause, accounting for 45% of cases, followed by domestic accidents, which accounted for 33.3%.

Table 1. Distribution of injured vertebral levels

Vertebral level	Number of vertebrae (n)	Percentage (%)
T11	0	0.0
T12	5	7.8
L1	43	67.2

L2	16	25.0
Total	64	100.0

The most commonly affected vertebral level was L1 (67.2%), followed by L2 (25.0%) and T12 (7.8%).

Table 2. Fracture classification according to Dennis

Fracture type	Number of patients (n)	Percentage (%)
Compression fracture	51	85.0
Burst fracture	8	13.3
Seat-belt fracture	0	0.0
Fracture-dislocation	1	1.7
Total	60	100.0

Compression fractures were the predominant injury pattern, accounting for 85.0% of cases.

Table 3. Neurological status according to Frankel classification before and after surgery

Frankel grade	Preoperative n (%)	6-month postoperative n (%)
A	1 (1.7)	0 (0.0)
B	1 (1.7)	0 (0.0)
C	3 (5.0)	1 (1.7)
D	4 (6.6)	1 (1.7)
E	51 (85.0)	58 (96.6)
Total	60 (100)	60 (100)

All patients with preoperative neurological deficits demonstrated improvement in Frankel grade at 6-month follow-up.

Table 4. Changes in vertebral body kyphosis angle

Time point	Minimum (°)	Maximum (°)	Mean ± SD (°)
Preoperative	4	24	12.9 ± 4.7
6 months postoperative	2	14	6.92 ± 2.2

The mean vertebral body kyphosis angle significantly decreased from 12.9 ± 4.7° preoperatively to 6.92 ±

2.2° at 6 months postoperatively, indicating effective correction of sagittal alignment.

Table 5. Changes in regional kyphosis angle

Time point	Minimum (°)	Maximum (°)	Mean ± SD (°)
Preoperative	11	34	19.57 ± 4.7
6 months postoperative	0	19	10.17 ± 4.6

Both vertebral body and regional kyphosis angles showed significant postoperative correction.

Table 6. Postoperative complications

Complication	Number of patients (n)	Percentage (%)
Pressure ulcer	0	0.0
Surgical site infection	1	1.7
Urinary tract infection	3	5.0
Other complications	0	0.0
No complications	56	93.3
Total	60	100.0

Postoperative complications were observed in only 4 of 60 patients (6.7%), with urinary tract infection being the most common (5.0%) and surgical site infection occurring in 1.7% of cases.

Table 7. Postoperative back pain severity at 6 months

Pain severity	Number of patients (n)	Percentage (%)
No pain	27	45.0
Mild pain (no medication required)	33	55.0
Pain requiring analgesics	0	0.0
Total	60	100.0

At 6 months postoperatively, 45.0% of patients reported no back pain, while 55.0% experienced only mild pain not requiring analgesics, and no patients required pain medication.

Table 8. Overall treatment outcomes

Outcome	Number of patients (n)	Percentage (%)
Good	58	96.6
Fair	1	1.7
Average	1	1.7
Poor	0	0.0
Total	60	100.0

Overall treatment outcomes were favorable, with good results achieved in 58 of 60 patients (96.6%), while only 2 patients (3.4%) had fair or average outcomes and no poor results were recorded.

DISCUSSION

In the present study, male patients predominated, accounting for 73.3%, with a male-to-female ratio of approximately 2.7:1. This finding is consistent with previous reports showing that thoracolumbar spine injuries occur more frequently in men, largely due to greater occupational exposure and participation in physically demanding or high-risk activities [3,4,6].

The mean age of patients was 48.5 ± 10.6 years, with the majority belonging to the 40 - 60-year age group. This age distribution differs slightly from reports from developed countries, where peak incidence is often observed in younger adults aged 30 - 50 years [7,9]. The higher mean age in our cohort may reflect the occupational structure in Vietnam, where middle-aged individuals remain actively engaged in manual labor, increasing their risk of spinal injuries [7,8].

Work-related accidents were identified as the leading cause of injury (45%), followed by domestic accidents (33.3%). This pattern contrasts with studies from developed countries, where traffic

accidents and high-energy falls are the predominant mechanisms of injury [2,6]. These differences likely reflect socioeconomic conditions and occupational safety standards, underscoring the need for improved workplace injury prevention strategies.

The thoracolumbar junction was the most frequently affected region, with L1 vertebra involvement accounting for 67.2% of cases, followed by L2 and T12. This distribution is consistent with biomechanical and clinical studies demonstrating that the thoracolumbar junction is particularly vulnerable due to the transition from the rigid thoracic spine to the more mobile lumbar spine [1,4,6].

According to the Denis classification, compression fractures accounted for the majority of injuries (85.0%), whereas burst fractures represented 13.3%, and fracture-dislocations were rare. Similar fracture patterns have been reported in studies focusing on low- to moderate-energy trauma, particularly occupational injuries [7,8]. In contrast, studies involving high-energy trauma often report higher proportions of burst fractures and fracture-dislocations [4,6]. The predominance of compression fractures in our study may partly explain the favorable neurological and functional outcomes observed postoperatively.

Preoperatively, most patients were classified as Frankel grade E (85.0%), with only a small proportion presenting neurological deficits. At the 6-month follow-up, neurological improvement was observed in all patients with preoperative deficits, and the proportion of Frankel grade E increased to 96.6%.

These findings are consistent with previous studies reporting favorable neurological recovery following

posterior pedicle screw fixation in thoracolumbar spine injuries, particularly in patients with incomplete neurological deficits [1,3]. Importantly, no cases of postoperative neurological deterioration were observed in our cohort, suggesting that posterior instrumentation provides adequate spinal stability while minimizing the risk of iatrogenic neural injury.

Significant correction of both vertebral body kyphosis and regional kyphosis angles was achieved at 6 months postoperatively. The mean vertebral body kyphosis angle improved from 12.9° preoperatively to 6.92°, while the regional kyphosis angle decreased from 19.57° to 10.17°.

These results are comparable to those reported in international studies evaluating posterior pedicle screw fixation, which have demonstrated kyphotic correction rates ranging from 40% to 60% [1,3,4]. Minor variations among studies may be attributed to differences in fracture morphology, fixation length, surgical technique, and postoperative rehabilitation protocols.

The overall complication rate in the present study was low, with surgical site infection occurring in only one patient (1.7%) and urinary tract infection in three patients (5.0%). No cases of implant failure or pressure ulcers were recorded. These findings compare favorably with previously published complication rates, which range from 5% to 15% in similar patient populations [2,3].

At the 6-month follow-up, all patients reported either no pain or mild pain not requiring analgesic medication, and 96.6% achieved good clinical outcomes. These results are consistent with previous reports demonstrating high rates of functional

recovery following posterior pedicle screw fixation for thoracolumbar spine injuries [5,9].

CONCLUSION

Spinal injuries at the thoracolumbar junction predominantly occur in men of working age, accounting for 73.3% of cases, with occupational accidents being the leading cause (45%). Computed tomography is the most valuable imaging modality for the accurate diagnosis and appropriate management of thoracolumbar spinal injuries. Posterior spinal fixation using transpedicular screws is recommended for patients with unstable fractures, as it provides rigid stabilization, facilitates neural decompression when indicated, promotes neurological recovery, and allows early mobilization to reduce postoperative complications.

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