ORIGINAL ARTICLE

Retrospective Study: Outcomes of Percutaneous Pedicular Screw Fixation VS Conservative Management in Unstable Burst Fracture Patients in Tertiary Care Center in Eastern Thailand

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ABSTRACT

BACKGROUND: Nowadays management of patients with thoracolumbar burst fracture who have the Thoracolumbar Injury Classification and Severity (TLICS) score equal to 4 are still controversial.

OBJECTIVE: To determine the outcome of patients who undergo surgical intervention and conservative management.

METHODS: Retrospective study was designed, and fifty patients who had thoracolumbar burst fracture and a TLICS score of 4 between 2023-2025 at Phrapokklao hospital were enrolled. The surgical and non-surgical groups were assigned. The data was collected via previous medical records. Demographic data, time to return to work, visual analog scale (VAS), Cobb angle and anterior vertebral body height loss were all collected. The data was analyzed by multivariable Gaussian linear regression.

RESULTS: The majority of participants were female (56%). The mean age of the patients was 50.7 years old. The most common level of injury was L1 (58%) and the main cause was from falling from heights (74%). The surgical group showed clinical outcomes demonstrating a significant reduction in time to return to work, with an adjusted mean difference of −18.84 days (95% CI: −35.37 to −2.32, p=0.027). A significant reduction in the Cobb angle was also observed, with an adjusted mean difference of −10.67 (95% CI: −14.64 to −6.70, p<0.001). Similarly, anterior height loss was significantly reduced with an adjusted mean difference of −23.16 (95% CI: −29.50 to −16.81, p<0.001). In contrast, there was no statistically significant difference in pain scores at 3 months, as measured by the Visual Analogue Scale (adjusted mean difference = −0.51, 95% CI: −1.66 to 0.63, p=0.369).

CONCLUSION: Surgical management for thoracolumbar burst fracture with a TLIC score equal to 4 resulted in better time to return to work and improve the Cobb angle and anterior vertebral body height loss within a 3-month period of the injury.

KEYWORDS: thoracolumbar burst fracture, burst fracture, kyphosis, neurological deficit, pedicle screws

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INTRODUCTION

Thoracolumbar burst fractures are a common spinal injury, representing 21% to 58% of all fractures at the thoracolumbar junction. Among patients with this type of fracture, 30% to 50% are found to be neurologically intact, meaning they have no nerve damage[1]. Most cases are caused by falling from heights or high-energy traffic accidents[2].

In Chanthaburi Province, a large portion of the population works in agriculture. According to the 2025 Labor Force Survey (Quarter 4), there are 377,650 workers in the province, and 147,538 of them (39%) work in agriculture and forestry[3]. This career field is highly related to the occurrence of thoracolumbar burst fractures due to the nature of the work. In the present, the data about the incidence of fracture in Chanthaburi was limited.

Nowadays, medical professionals still debate whether the best treatment for these fractures is surgery or conservative (non-surgical) treatment[4-9]. Surgical intervention is recommended for patients with a Thoracolumbar Injury Classification and Severity Scale (TLICS) score greater than 4, whereas conservative management is advised for those with a score below 4. The most controversial cases are those with a TLICS score of 4[8-9]. To compare the two treatment methods, researchers generally look at clinical outcomes (how the patient feels) and radiologic outcomes (what the plain radiographs show)[4,10].

This study was conducted to compare the outcomes of surgical and non-surgical treatment for patients who have a Thoracolumbar Injury Classification and Severity (TLICS) score equal to 4. The study focuses on the time taken to return to work, pain levels using the Visual Analog Scale (VAS), and results from radiologic follow-up.

METHODS

Study design and participants

This study is a retrospective study performed in Phrapokklao Hospital, a tertiary care center in Eastern Thailand.

A total of 50 patients who had thoracolumbar burst fracture and a TLICS score of 4 between 2023-2025 at Phrapokklao hospital were enrolled in this study.

This study was approved by the Chanthaburi Research Ethics Committee/Region 6, in compliance with approval document COA. No. 068/68.

Sample size calculation

The sample size was calculated to evaluate the efficacy of percutaneous pedicular screw fixation in patients with unstable burst fractures. Based on prior data, the mean time to return to work in the conservative management group was 71.0±28.6 days, while the percutaneous pedicular screw fixation group was expected to have a mean of 50.3±26.7 days. A one-sided hypothesis test was used, with a significance level (α) of 0.05 and a statistical power of 0.80. Assuming equal allocation between groups (1:1 ratio), the required sample size was calculated using Stata. The minimum sample size was 23 patients per group. Twenty-five patients were enrolled in each treatment choice in this study.

Inclusion and Exclusion criteria

The inclusion criteria for participants in this study were patients aged older than 18 years with a single level thoracolumbar burst fracture, a Thoracolumbar Injury Classification and Severity (TLICS) score equal to 4, with the fracture being caused by a high energy mechanism and the duration of follow up was greater than 3 months

The exclusion criteria were patients who had multiple levels thoracolumbar burst fracture, prior thoracolumbar surgery, presence of neurological

deficit and multiple traumatic patients.

Surgical intervention

The surgical intervention for participants who had thoracolumbar burst fracture was performed by minimally invasive surgery (MIS) technique. Percutaneous pedicular screw methods were conducted; the length of fixation was based on the McCormack load sharing classification system.

Conservative intervention

The nonoperative intervention for participants who had thoracolumbar burst fracture was the use of the Knight Taylor brace (Thoracolumbosacral orthosis). The period of wearing this orthosis was three months and the ambulation was permitted after the pain relief.

Data collection

Participants were categorized into two groups: those who underwent operative treatment and those who received conservative treatment with a thoracolumbosacral orthosis support. After identifying participants, the data was collected via medical history record in intrahospital and outpatients record.

The variables recorded included sex, age, level of injury, etiology of injury, choice of treatment, time to return to work, treatment complications, initial pain score, initial Cobb angle, initial anterior vertebral body height loss, pain score after 3 months, Cobb angle after 3 months, and anterior vertebral body height loss after 3 months. The pain score was assessed by assigning a VAS score.

Statistical analysis

Descriptive statistics were used to summarize baseline characteristics. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were expressed as frequency and percentage. Comparisons between groups were performed using the independent t-test for continuous variables and the exact probability test for categorical variables, as appropriate.

The primary research question, a multivariable Gaussian linear regression model was applied to evaluate the effect of treatment on outcomes while adjusting for potential confounders. The covariates included baseline pain score (VAS0), age, sex (male), level of injury (T11), cause of injury (motorcycle accident), initial Cobb angle, and initial anterior vertebral height loss.

The results of the regression analyses were reported as adjusted mean differences with 95% confidence intervals (95% CI) and corresponding *p*-values. A two-sided p-value of <0.05 was considered statistically significant. All statistical analyses were performed using Stata.

RESULTS

Demographic data

The majority of the participants were female accounting for 28 out of 50 patients (56%). The mean age of the group was 50.1 years old and 51.3 years old in the surgical and conservative groups, respectively. The vertebral body of lumbar level one was the area that fractured mostly occurred (52% in surgical group and 64% in conservative group) in thoracolumbar burst fracture and the main causes of the fracture was from falling from heights (74%) and motorcycle accidents (26%). At the baseline, the visual analog scale (VAS) scores for the surgical and conservative groups were 7.88 and 8.44, respectively. The initial Cobb angles measured 14.32° in the surgical cohort and 15.00° in the conservative cohort. Additionally, anterior vertebral height loss was recorded at 25.0% and 25.9% for the surgical and conservative groups, respectively. All baseline characteristics was insignificantly difference when compared by independent t-test.

Clinical outcomes

Patients with thoracolumbar burst fracture who

had TLICS score equal to 4 and decided to take a percutaneous pedicular screw fixation had an earlier recovery rate (time to return to work 50.28 days compared to 71.0 days in conservative group, p=0.011). The degree of pain described by Visual Analog Scale (VAS) showed indifference between both groups. No treatment complications were found in this study.

Table 1 Baseline Characteristics of Unstable Burst Fracture Patients.

Baseline characteristics	Surgical Management (n=25)	Conservative Management (n=25)	*p*-value
	n (%)	n (%)	
Gender			
Male	11.0 (44.0)	11.0 (44.0)	1.00
Female	14.0 (56.0)	14.0 (56.0)	
Age (years), mean±SD	50.1±13.6	51.3±14.0	0.76
Level of injury			
T11	1.0 (4.0)	1.0 (4.0)	0.22
T12	5.0 (20.0)	7.0 (28.0)	
L1	13.0 (52.0)	16.0 (64.0)	
L2	6.0 (24.0)	1.0 (4.0)	
Cause of injury			
Falling	17.0 (68.0)	20.0 (80.0)	0.52
Motorcycle accident	8.0 (32.0)	5.0 (20.0)	
VAS score at initial, mean±SD	7.9±2.0	8.4±1.3	0.24
Cobb angle at initial (degrees), mean±SD	14.3±5.8	15.0±5.3	0.66
Anterior height loss at initial (%), mean±SD	25.0±13.9	25.9±12.4	0.79
Treatment complications	-	-	-

Radiologic outcomes

The surgical cohort demonstrated an improvement in the Cobb angle, which decreased from an initial 14.3° to 8.9° at follow-up. Conversely, the conservative group experienced a significant progression of deformity, with the Cobb angle increasing from 15.0° to 20.3°. Similarly, anterior vertebral height loss improved in the surgical group (reducing from 25.0% to 19.0%) but continued to worsen in the conservative group (increasing from 25.9% to 41.3%). The differences between the two groups for both parameters were highly statistically significant (p<0.001).

Multivariable Gaussian Regression was adjusted by VAS0, gender (male), age, level of injury (T11), cause of injury (motorcycle accident), Cobb angle at initial, and anterior height loss at initial time of injury.

A total of 50 patients with unstable burst fractures were included in the study. Clinical and radiological outcomes were analyzed using a multivariable Gaussian regression model, adjusting for confounding variables including age, sex, diagnosis, mechanism of injury, baseline visual analog scale (VAS) score, initial Cobb angle, and baseline anterior height loss.

Table 2 Crude Effect in Clinical and Radiological Outcome of Unstable Burst Fracture Patients.

Baseline Characteristics	Surgical Management (n=25)	Conservative Management (n=25)	*p*-value
	Mean±SD	Mean±SD	
Time to Return to Work (days)	50.3±26.7	71.0±28.6	0.011
Visual Analogue Scale (VAS)			
Initial	7.9±2.0	8.4±1.3	0.24
3 months	3.5±2.1	3.8±1.5	0.64
Mean difference ($VAS_{3\ mo.} - VAS_{initial}$)	-4.4±2.5	-4.7±2.1	0.62
Cobb angle (degrees)			
Initial	14.3±5.8	15.0±5.3	0.66
3 months	8.9±6.6	20.3±6.9	<0.001
Mean difference ($Cobb_{3\ mo.} - Cobb_{initial}$)	-5.4±7.3	1.2±6.1	<0.001
Anterior Height Loss (AHL) (%)			
Initial	25.0±13.9	25.9±12.4	0.79
3 months	19.0±11.5	41.2±15.1	<0.001
Mean difference ($AHL_{3\ mo.} - AHL_{initial}$)	-6.0±11.7	15.4±11.9	<0.001

Table 3 Adjusted Effect in Clinical and Radiological Outcome of Unstable Burst Fracture Patients

Parameters	Adjusted mean difference	95% CI	*p*-value
Clinical Outcome			
Time to return to work (days)	-18.8	(-35.37 to -2.31)	0.027
VAS score at 3 months	-0.5	(-1.66 to 0.63)	0.37
Radiologic outcomes			
Cobb angle at 3 months	-10.7	(-14.64 to -6.70)	<0.001
Anterior height loss at 3 months	-23.2	(-29.50 to -16.81)	<0.001

The analysis demonstrated significant improvements in several key parameters. Time to return to work was significantly reduced, yielding an adjusted mean difference of —18.84 days (95% CI: —35.37 to —2.32, p=0.027). Radiologically, both the Cobb angle and anterior height loss saw significant reductions, with adjusted mean differences of -10.7 (95% CI: -14.64 to -6.70, p<0.001) and -23.2 (95% CI: -29.50 to -16.81, p<0.001), respectively. However, the difference in VAS pain scores at the 3-month follow-up was not statistically significant (adjusted mean difference = -0.5, 95% CI: -1.66 to 0.63, p=0.37).

DISCUSSION

The result from this retrospective study showed that at the 3-month period of follow-up in patients with thoracolumbar burst fracture who have TLICS score equal to four, patients who undergo a surgery have better clinical outcomes and radiologic outcomes compared to conservative groups. Pedicular screw fixation enhances the stability of the fracture leading to faster recovery rate and rapidly return to work. Also, the fixation can significantly improve the radiological outcomes of the thoracolumbar burst fracture patients resulting in further decrease spinal malalignment and further kyphosis.

The outcome of this study had contrary results with the previous two similar studies. The study by Kirkham et al. in 2015 determined that the patients who were treated nonoperatively had less pain and better functional outcome within a 22-year period of follow up[6]. Andrew et al. in 2018 also conducted the research comparing surgical and nonsurgical groups in patients with thoracolumbar burst fracture who had a TLICS score equal to four, the result showed no difference in clinical and radiologic outcomes in a 6-month period of follow up[8].

The predominant factors that brought about diverse outcomes with the previous study was the minimally invasive technique for pedicular screw fixation. The percutaneous procedure results in lesser blood loss, shorter length of hospital stay and postoperative pain[1]. Short segment fixation also showed non-inferiority compared with long segment fixation[11].

Our research introduced a new perception about the treatment of thoracolumbar burst fracture. The surgical intervention can result in shorter time to return to work and improve in Cobb angle and anterior vertebral body height loss in plain radiographic film. Current trend of treatment can be counselling to the patients for appropriate treatment based on patients' unique backgrounds and occupation.

The limitation of our study is the period of follow up. Longer periods of documentation would result in more obvious outcomes between groups and more precise for the clinical and radiographic data. Further research may find the correlation between patient demographic data and each specific consequence of the results.

This study has several strengths. First, a multivariable regression approach was employed to adjust for potential confounders, thereby improving the validity of the estimated treatment effects. Second, clinically relevant covariates, including radiographic parameters and injury characteristics, were incorporated into the analysis. Third, the study evaluated a functional outcome—time to return to work—which is highly relevant to real-world clinical practice and patient-centered care.

Post hoc power analysis demonstrated very high statistical power for time to return to work, Cobb angle, and anterior height loss (power = 0.999, 1.000, and 1.000, respectively), indicating that the study was adequately powered to detect meaningful differences in these outcomes. In contrast, the analysis of VAS showed low statistical power (power=0.170), suggesting that the study may have been underpowered to detect a significant difference in pain outcomes. Therefore, the non-significant findings for VAS should be interpreted with caution, and future studies should ensure adequate power to evaluate pain-related outcomes.

This study was designed as a retrospective therapeutic study, which is inherently subject to selection bias due to the non-randomized allocation of treatment based on clinical judgment. In addition, confounding is an important concern in observational research. Although we adjusted for measured confounders using multivariable Gaussian regression—including baseline VAS, age, sex, diagnosis, mechanism of injury, baseline Cobb angle, and anterior vertebral height loss—residual confounding from unmeasured variables may still exist. Future studies with larger sample sizes may benefit from the use of propensity score methods to further reduce confounding bias or future prospective therapeutic studies are warranted to minimize selection bias, ensure comparability in treatment allocation, and allow for more rigorous and unbiased evaluation of clinical outcomes.

Information bias is another potential limitation,

as retrospective data collection may be incomplete or inaccurately recorded, leading to misclassification of exposures or outcomes. To mitigate this issue, we utilized data from reliable sources, such as electronic medical records and radiographic reports, and applied clearly defined criteria for all study variables.

Finally, missing data may have introduced bias despite efforts to handle incomplete records. To address this, we applied predefined inclusion and exclusion criteria to ensure the quality and completeness of the data used in the analysis.

Conclusion: Surgical management for thoracolumbar burst fracture which TLIC score equal to 4 resulted in improved time to return to work and improve in Cobb angle and vertebral body height loss within a 3-month period after the injury.

CONFLICTS OF INTEREST: None

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ORIGINAL ARTICLE

การเปรียบเทียบผลลัพธ์ของการรักษาการแตกหักของกระดูกสันหลังหักชนิดแตกกระจายออกด้วยการผ่าตัดและการรักษาแบบประคับประคองในโรงพยาบาลพระปกเกล้า จังหวัดจันทบุรี

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บทคัดย่อ

ที่มาของปัญหา: แนวทางการรักษาผู้ป่วยที่มีภาวะกระดูกสันหลังส่วนอกต่อเอวหักแบบแตกกระจาย ซึ่งมีคะแนน Thoracolumbar Injury Classification and Severity (TLICS) เท่ากับสี่ยังเป็นที่ถกเถียงกันอยู่

วัตถุประสงค์: เพื่อประเมินผลการรักษาด้วยวิธีการผ่าตัดและไม่ผ่าตัด

วิธีการศึกษา: การศึกษานี้เป็นการวิจัยแบบย้อนหลัง โดยรวบรวมข้อมูลจากเวชระเบียนของผู้ป่วยจำนวน 50 ราย ซึ่งเข้ารับการรักษา ณ โรงพยาบาลพระปกเกล้า ระหว่างปี พ.ศ. 2566 ถึง 2568 โดยแบ่งผู้ป่วยออกเป็นกลุ่มที่ได้รับการผ่าตัดและกลุ่มที่ไม่ได้รับการผ่าตัด ข้อมูลที่รวบรวมประกอบด้วย ข้อมูลทางประชากรศาสตร์ ระยะเวลาในการกลับไปทำงาน ระดับความปวดโดยประเมินจาก Visual Analog Scale การวัดมุมความโค้งของกระดูกสันหลัง และการลดลงของความสูงของตัวกระดูกสันหลังส่วนหน้า

ผลการศึกษา: ผู้เข้าร่วมวิจัยเป็นเพศหญิงร้อยละ 56 อายุเฉลี่ย 50.7 ปี ตำแหน่งที่ได้รับบาดเจ็บมากที่สุดคือระดับ L1 เท่ากับร้อยละ 58 และสาเหตุหลักเกิดจากตกจากที่สูงเท่ากับร้อยละ 74 เมื่อเปรียบเทียบผลการรักษาพบว่ากลุ่มที่ได้รับการผ่าตัดลดระยะเวลาของการกลับไปทำงานอย่างมีนัยสำคัญ −18.84 วัน (95% CI: −35.37, −2.32, p=0.027) ลดมุมความโค้งของกระดูกสันหลัง อย่างมีนัยสำคัญ -10.67 องศา (95% CI: -14.64, -6.70, p=<0.001) ลดการลดลงของความสูงของตัวกระดูกสันหลังส่วนหน้า อย่างมีนัยสำคัญร้อยละ -23.16 (95% CI: (-29.50, -16.81, p=<0.001) คะแนนระดับความปวดที่ระยะเวลาสามเดือนแตกต่างกันอย่างไม่มีนัยสำคัญ -0.51 คะแนน (95% CI: -1.66, 0.63, p=0.369)

สรุป: การรักษาผู้ป่วยที่มีภาวะกระดูกสันหลังส่วนอกต่อเอวหักแบบแตกกระจายและมีคะแนน TLICS เท่ากับ 4 ด้วยวิธีการผ่าตัดส่งผลให้ผู้ป่วยใช้ระยะเวลาในการกลับไปทำงานได้เร็วกว่า ปรับแก้มุมโค้งของกระดูกสันหลังและความสูงของตัวกระดูกสันหลังส่วนหน้าได้มากกว่าการไม่ผ่าตัดที่ระยะเวลาสามเดือนหลังเกิดการบาดเจ็บ

คำสำคัญ: ภาวะกระดูกสันหลังส่วนอกต่อเอวหักแบบแตกกระจาย, ภาวะกระดูกสันหลังหักแบบแตกกระจาย, ความผิดปกติทางระบบประสาท, การรักษาด้วยการผ่าตัด, การรักษาแบบประคับประคอง