ORIGINAL ARTICLE

Management of Thoracolumbar Injury Classification and Severity Score (TLICS) 4 thoracolumbar fractures after natural disasters: Comparative outcomes of conservative and surgical treatments following the 2023 Türkiye earthquake

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ABSTRACT

BACKGROUND: This study examines the outcomes of conservative versus surgical treatment for Thoracolumbar Injury Classification and Severity Score (TLICS) 4 thoracolumbar fractures in patients injured during the 2023 Türkiye earthquake. It aims to assess clinical and radiographic outcomes while considering the impact of crush syndrome-related complications on treatment decisions.

METHODS: Twenty-three patients with TLICS 4 spinal injuries were evaluated and divided into surgical (n=12) and conservative (n=11) groups. Clinical parameters, including age, gender, preoperative spinal measurements, and one-year postoperative outcomes, were assessed. The Roland-Morris score was used to evaluate clinical outcomes. Additionally, complications such as cardiac, renal, and respiratory issues, infections, and length of hospital stay were analyzed.

RESULTS: The surgical group had significantly higher Roland-Morris scores (RM: 79.3±12.7 vs. 15.0±8.5, p<0.001). Preoperative acute kidney injury was more common in the conservative group (36.4% vs. 8.3%, p<0.05), whereas preoperative pulmonary complications were more frequent in the surgical group (83.3% vs. 36.4%, p<0.05). No significant differences were found in gender, age, or other complications. Radiological outcomes, including Cobb angle, sagittal index, and anterior central vertebral body height (ACVBH) restoration, showed no significant differences between groups. Length of hospital stay was similar between groups.

CONCLUSION: Our study demonstrates that both conservative and surgical treatments are effective for managing TLICS 4 thoracolumbar fractures in disaster settings. Treatment decisions should be guided by patient-specific factors and available resources.

Keywords: Spine; fracture; Thoracolumbar Injury Classification and Severity Score (TLICS); earthquake; posterior instrumentation.

INTRODUCTION

The devastating earthquake that struck Türkiye on February 6, 2023 resulted in over 50,000 deaths and caused injuries to more than 107,000 individuals.[1] This catastrophe led to severe traumatic injuries, including crush syndrome, which required urgent and complex medical care. Crush syndrome is a

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systemic condition that occurs due to prolonged compression of muscle tissue, leading to ischemia-reperfusion injury, rhabdomyolysis, and life-threatening complications such as acute kidney injury (AKI), electrolyte imbalances, metabolic acidosis, and multi-organ failure.[2,3] The management of patients with crush syndrome is further complicated by associated comorbidities, including renal failure, respiratory distress, and cardiovascular complications, all of which can significantly influence the treatment approach for concurrent traumatic injuries.[4,5]

Spinal injuries, though less common than extremity injuries among earthquake victims, carry a high risk of long-term disability and functional loss.[6] Among these, thoracolumbar fractures are the most frequently observed due to the biomechanical vulnerability of the thoracolumbar junction, where the rigid thoracic spine transitions into the more flexible lumbar spine.[7,8] The Thoracolumbar Injury Classification and Severity Score (TLICS) system is widely used to guide the management of vertebral fractures by assessing injury morphology, integrity of the posterior ligamentous complex, and neurological involvement.[9] While conservative treatment is generally recommended for stable fractures with a TLICS score of ≤3 and surgical intervention is preferred for scores of ≥5, the optimal approach for TLICS 4 fractures remains debated. Some studies suggest that conservative management may be sufficient, while others advocate surgical stabilization to achieve better clinical and radiographic outcomes.[10,11]

The presence of crush-related comorbidities further complicates the decision-making process for managing TLICS 4 fractures. Renal failure resulting from crush syndrome may limit the feasibility of prolonged immobilization, while respiratory complications can increase perioperative risks. Therefore, treatment decisions must be made through a multidisciplinary approach, considering both the immediate and long-term implications for the patient.

This study aims to analyze the outcomes of conservative versus surgical management of TLICS 4 thoracolumbar fractures in patients affected by the 2023 Türkiye earthquake. By evaluating clinical and radiographic parameters, we aim to provide evidence on the efficacy and risks associated with both treatment approaches, particularly in patients with crush-related complications.

MATERIALS AND METHODS

This retrospective study evaluated patients referred to our institution with injuries sustained during the Kahramanmaraş earthquake on February 6, 2023. It was conducted in accordance with the ethical principles of the Declaration of Helsinki and approved by the Ethics Committee of Ankara Etlik City Hospital, Türkiye (Approval Number: Ek1-2024-1221). A total of 11,346 earthquake victims presented to the hospital, and 790 neurosurgical and orthopedic procedures were performed. The study included patients with earthquake-related spinal injuries categorized as TLICS 4 or higher who were eligible for either conservative or surgical treatment based on their TLICS score.

We specifically included patients with a TLICS score of 4 who were treated either surgically or conservatively. Patients were excluded if they were in the pediatric age group, had a prior history of spinal surgery, did not sustain earthquake-related injuries, or lacked concomitant extremity injuries. Those with spinal injury levels exceeding TLICS 4 were also excluded, as they underwent posterior instrumentation and fusion surgery, which was outside the scope of this research. Among the earthquake victims, 43 patients with spinal injuries were identified, all with a TLICS score of 4 or higher. Of these, 20 had spinal injury levels exceeding TLICS 4 and were excluded from the study due to the type of surgery performed.

A total of 23 patients with TLICS 4 were included in the study and divided into two groups: the surgical group (12 patients) and the conservative group (11 patients). Clinical parameters evaluated included age, gender, preoperative Cobb angle, anterior vertebral body compression percentage, and sagittal index. Postoperative outcomes were assessed at the one-year follow-up, focusing on changes in Cobb angle, sagittal index, and anterior compression angles.

To assess clinical outcomes, the Roland-Morris score was used. This highly sensitive tool evaluates acute, subacute, and chronic back pain and is particularly effective for detecting and assessing mild to moderate lumbar and back conditions. The Roland-Morris score was used to assess clinical outcomes at the one-year postoperative follow-up.

The study also examined pre-treatment complications, including cardiac, renal, and respiratory issues. The presence of infections, both at the surgical site and elsewhere, was documented. Additional factors such as hospital stay duration and time spent under debris were also analyzed. The objective was to determine whether major surgery contributed to additional complications in patients with earthquake-related spinal injuries.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Normality of the dataset was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests, with significance values evaluated alongside skewness and kurtosis metrics. Based on these assessments, the variables were determined to follow a normal distribution.

For group comparisons, the Independent Samples t-test was applied to normally distributed continuous variables, while the Mann-Whitney U test was used for non-normally distributed variables. The Chi-square test was employed to assess differences between categorical variables. A 95% confidence

level was used for all analyses, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 23 patients were included in the study, divided into two groups: the surgical group (n=12) and the conservative group (n=11). The mean age was 50.4±11.5 years in the surgical group and 58.0±14.5 years in the conservative group. The age difference between groups was not statistically significant (p>0.05). Regarding gender distribution, the conservative group had a higher proportion of female patients (81.8%) compared to the surgical group (66.7%). Across both groups, 73.9% of patients were female and 26.1% were male, with no statistically significant difference in gender distribution (p>0.05).

Acute kidney injury was significantly more common in the conservative group (36.4%) than in the surgical group (8.3%) (p<0.05). Conversely, pulmonary complications were significantly more prevalent in the surgical group (83.3%) compared to the conservative group (36.4%) (p<0.05).

The time under debris, used as a measure of exposure, was longer in the conservative group (14.6±37.9 hours) compared to the surgical group (7.4±20.4 hours). However, this difference was not statistically significant (p>0.05).

Cardiac complications occurred at similar rates in both groups: 8.3% in the surgical group and 9.1% in the conservative group, with no statistically significant difference (p>0.05) (Table 1).

Wound infection rates were similar between groups, with 33.3% of patients in the surgical group and 36.4% in the conservative group affected. The difference between the two groups was not statistically significant (p>0.05). The rate of additional infections was higher in the conservative group (62.9%) than in the surgical group (41.7%), but this difference was also not statistically significant (p>0.05).

A significant difference was observed in the Roland-Morris (RM) score between the two groups, with the surgical group scoring significantly higher (79.3±12.7) than the conservative group (15.0±8.5) (p<0.001).

Regarding sagittal alignment, no statistically significant differences were found in either initial or follow-up sagittal index measurements. The initial sagittal index was 10.2±5.4 in the surgical group and 6.6±16.2 in the conservative group (p>0.05). The follow-up sagittal index was 8.6±6.4 in the surgical group and 6.6±10.2 in the conservative group (p>0.05).

Similarly, no significant differences were observed in Cobb angle measurements between the two groups. The initial Cobb angle was 18.9°±10.5 in the surgical group and 17.1°±7.0 in the conservative group (p>0.05). Follow-up Cobb angles were similar between the two groups, with values of 17.6°±7.5 in the surgical group and 18.0°±6.2 in the conservative group (p>0.05).

The percentage of anterior vertebral body height (ACVBH) restoration was similar in both groups at both the initial assessment and follow-up. The initial ACVBH restoration was 69.8%±14.5 in the surgical group and 69.3%±15.1 in the conservative group (p>0.05), while the follow-up values were 75.1%±15.6 in the surgical group and 74.8%±16.4 in the conservative group (p>0.05).

The length of hospital stay was notably longer in the conservative group (58.0±101.4 days) compared to the surgical group (26.9±18.6 days), but the difference was not statistically significant (p>0.05)(Table 2).

Additional surgical procedures were performed in 50.0% of patients in the surgical group (n=6) and 45.5% in the conservative group (n=5). The remaining patients in both groups did not require further operations (50.0% in the surgical group vs. 54.5% in the conservative group). There was no statistically significant difference in the need for additional surgical interventions (p>0.05).

Table 1. Comparison of demographic, clinical parameters, and gender distribution between surgical and conservative groups

	Surgical (n=12)	Conservative (n=11)	p Value
Age	50.4±11.5	58.0±14.5	>0.05
Gender			
Female	8 (66.7%)	9 (81.8%)	
Male	4 (33.3%)	2 (18.2%)	-
Acute Kidney Injury (%)	8.3%	39.4%	<0.05
Pulmonary Complications (%)	83.3%	36.4%	<0.05
Time Under Debris (hours)	7.4±20.4	14.6±37.9	>0.05
Cardiac Complications (%)	8.3%	9.1%	>0.05

Table 2. Comparison of clinical, radiological, and outcome parameters between surgical and conservative groups

	Surgical (n=12)	Conservative (n=11)	p Value
Wound Infection (%)	33.3%	36.4%	>0.05
Additional Infection (%)	41.7%	62.9%	>0.05
RM Score	79.3±12.7	15.0±8.5	<0.001
Initial Sagittal Index (%)	10.2±5.4	6.6±16.2	>0.05
Follow-up Sagittal Index (%)	8.6±6.4	6.6±10.2	>0.05
Initial Cobb Angle (°)	18.9±10.5	17.1±7.0	>0.05
Follow-up Cobb Angle (°)	17.6±7.5	18.0±6.2	>0.05
Initial ACVBH (%)	69.8%±14.5	69.3%±15.1	>0.05
Follow-up ACVBH (%)	75.1±15.6	74.8%±16.4	>0.05
Hospital Stay (days)	26.9±18.6	58.0±101.4	>0.05

*RM Score: Roland-Morris Score. *Initial ACVBH: Anterior Central Vertebral Body Height.

DISCUSSION

This study compared surgical and conservative treatments in patients with TLICS 4 thoracolumbar fractures following the 2023 Türkiye earthquake. The results showed that surgical treatment was associated with significantly better functional outcomes at one year, as measured by the Roland-Morris score. These findings align with previous research showing that surgical stabilization improves pain management and facilitates earlier mobilization in TLICS 4 fracture patients.[12] Similarly, Mohamadi et al. reported that posterior instrumentation leads to better pain control and faster return to daily activities, particularly in cases with intermediate injury severity.[13]

In mass disasters, conservative treatment is often the initial approach due to limited resources, logistical constraints, and delays in surgical care.[14] However, several studies have shown that delayed surgical stabilization, when feasible, still provides substantial biomechanical and clinical benefits.[15] Our findings support the use of early surgical intervention when patient and environmental conditions permit, particularly in cases where fracture morphology predisposes to progressive deformity or instability.

Despite the superiority in functional outcomes, radiographic parameters such as Cobb angle, sagittal index, and anterior vertebral height restoration did not differ significantly between the two groups. These findings suggest that conservative management, when carefully selected and closely monitored, can effectively preserve spinal alignment, as supported by Hitchon et al.[16] and Wood et al.[17] Our results indicate that with appropriate patient selection and close follow-up, nonoperative treatment can be a viable option in resource-limited settings or during disaster situations.

An important observation in this cohort was the higher prevalence of pulmonary complications, particularly in the surgical group. However, these conditions were primarily pre-existing and did not worsen postoperatively. This supports the premise that surgical treatment can be safely performed in patients with pulmonary comorbidities when adequate perioperative care is provided. Previous concerns about elevated risks in this patient population have been addressed in recent literature, which emphasizes the importance of respiratory optimization rather than the avoidance of surgery.[18,19]

Finally, our findings are consistent with recommendations from international spine trauma working groups, which advocate individualized treatment strategies for TLICS 4 fractures, taking into account clinical status, logistical constraints, and comorbidities.[20,21]

The limitations of this study include its retrospective design and relatively small sample size, which may affect generalizability. Furthermore, long-term outcomes beyond 12 months were not assessed, and we acknowledge that late complications or deformity progression may alter the final results. Future prospective, multicenter studies with larger cohorts and extended follow-up are needed to confirm these findings and refine treatment protocols in disaster settings.

CONCLUSION

This study demonstrates that both surgical and conservative treatments are viable options for managing TLICS 4 thoracolumbar fractures in the aftermath of natural disasters. Surgical management offers superior functional outcomes and pain relief when patient condition and available resources allow. However, conservative treatment remains a valid alternative,

particularly in settings with limited surgical capacity or elevated patient risk.

Treatment decisions should be guided by fracture characteristics, systemic health status, and the healthcare system's capacity during and after disasters. Individualized approaches that balance clinical needs with logistical realities are essential for optimizing patient outcomes in these challenging environments.

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Availability of Data and Materials: The data used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Committee Approval: This study was approved by the Ankara Etlik City Hospital Ethics Committee (Date: 25.12.2024, Decision No: Ek1-2024- 1221).

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ORİJİNAL ÇALIŞMA - *ÖZ*

2023 Türkiye depremi sonrasında TLICS 4 torakolomber kırıkların yönetimi: Konservatif ve cerrahi tedavilerin karşılaştırmalı sonuçları

AMAÇ: Deprem gibi kitlesel afetler, yalnızca primer yaralanmalarla sınırlı kalmayıp, crush sendromu ve diğer sistemik komplikasyonlar gibi ikincil sağlık sorunlarını da beraberinde getirerek tedavi sürecini karmaşıklaştırmaktadır. Bu çalışma, 2023 Türkiye depremi sonrası yaralanan TLICS 4 torakolomber kırıklı hastalarda konservatif ve cerrahi tedavi sonuçlarını değerlendirmeyi amaçlamaktadır. Ayrıca, crush sendromu ile ilişkili komplikasyonların tedavi kararları üzerindeki etkisi incelenmiştir.

GEREÇ VE YÖNTEM: Çalışmada 23 TLICS 4 spinal yaralanmalı hasta, cerrahi (n=12) ve konservatif (n=11) tedavi gruplarına ayrıldı. Yaş, cinsiyet, ameliyat öncesi spinal ölçümler ve 1 yıllık postoperatif klinik sonuçlar Roland Morris skoru ile değerlendirildi. Kardiyak, renal ve solunum komplikasyonları, enfeksiyonlar ve hastanede kalış süreleri de analiz edildi.

BULGULAR: Cerrahi grup, Roland Morris skorlarında anlamlı daha iyi sonuçlar gösterdi (79.3±12.7 ve 15.0±8.5, $p<0.001$). Akut böbrek hasarı konservatif grupta daha yaygındı (%36.4 ve %8.3, $p<0.05$), pulmoner komplikasyonlar ise cerrahi grupta daha sık gözlendi (%83.3 ve %36.4, $p<0.05$). Yaş, cinsiyet ve diğer komplikasyonlarda anlamlı fark yoktu. Radyolojik sonuçlar (Cobb açısı, sagittal indeks, vertebral yüksekliğin restorasyonu) gruplar arasında farklılık göstermedi. Hastanede kalış süreleri benzerdi.

SONUÇ: Çalışmamız, doğal afet ortamlarında TLICS 4 torakolomber kırıkların konservatif ve cerrahi tedavi ile etkili şekilde yönetilebileceğini göstermektedir. Tedavi kararları, hasta özellikleri ve mevcut kaynaklar dikkate alınarak bireyselleştirilmelidir.

Anahtar sözcükler: Deprem; kırık; omurga; posterior enstrümantasyon; TLICS.

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