Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/xq484w56

TREATMENT OF THORACOLUMBAR JUNCTION FRACTURES: SHORT SEGMENT VS LONG SEGMENT FIXATION

Dr. Mashal Rasool[1], Dr. Mukhtar Ahmed[2], Dr. Syeda Sumaiya Gilani[3], Dr. Ali Raza[4], Dr. Naseer Ahmad[5*], Dr. Asmat Ullah[6]

[1]Post Graduate Resident FCPS Neurosurgery Jinnah Postgraduate Medical Centre, Karachi.
[2]Post Graduate Resident FCPS General Surgery Jinnah Postgraduate Medical Centre, Karachi.
[3]Post Graduate Resident FCPS Neurosurgery Jinnah Postgraduate Medical Centre, Karachi.
[4]Post Graduate Resident FCPS General Surgery Pakistan Institute of Medical Sciences, Islamabad.
[5*]Post Graduate Resident FCPS General Medicine Bolan Medical Complex Hospital Quetta/ Sandeman Provincial Hospital, Quetta.
[6]Post Graduate Resident FCPS Orthopedic Surgery Bolan Medical Complex Hospital Quetta.

***Corresponding Author:** Dr. Naseer Ahmad
*Post Graduate Resident FCPS General Medicine Bolan Medical Complex Hospital Quetta/ Sandeman Provincial Hospital, Quetta. Email: naseer_achakzai25252@yahoo.com, Contact no: 0333-7918009

Abstract

Background: TJ fractures because the T11-L2 vertebrae are especially susceptible to fracture. Most of these injuries need surgical intervention and two classifications of techniques that can be employed include short segment and long segment fixation which is performed to regain spinal stability and to minimize neurological compromise.

Objectives: to examine the effectiveness of short segment and long segment fixation when treating thoracolumbar junction fractures in terms of clinic outcomes, stability and complications.

Study design : A prospective study

Place and duration of study. January 2023 to December 2023 Jinnah Postgraduate Medical Centre, Neuro Surgery Department

Methods: Those patients involved in this study were 150 with TNJF who were randomly divided into short segment (75) and long segment fixation (75). Patients were assessed for radiological at 6 and 12 months after surgery in terms of pain, and complications associated outcomes. Multivariate data was analyzed using means, standard deviations and P values to determine if there was a significant difference between the groups.

Results: In the short segment group the mean pain score reduced from 7. 2 (±1. 3) Pre op to 2. 4 (±0. 9) at 12 months. In the long segment group the pain score reduced from 7. 3 (± 1. 4) to 2. 1 (± 0. 8). New bone formation ratio was 87% in the short segment group and 85% in the long segment group while radiological stability was accomplished in 92% of the short segment group and 94% in the long segment group. There was also a statistical difference in the overall rates in the two groups; p= 0. 045 where the long segment group had 15% complications as opposed to the 8% in the short segment group.

Conclusions: Short segment and long segment fixation were reported as reasonable ways to stabilise the thoracolumbar junction fractures. At the same time, short segment fixation was associated with a

lower rate of complications but at the same level of radiological efficacy; hence, the latter is preferable in some cases.

Keywords: Spine fractures, spinal fusion, thoracolumbar, short, long.

Introduction

The most common region to suffer spinal fractures is the thoracolumbar junction which is at T11-L2 segment representing 60% of spinal fractures due to its biomechanical and anatomic transitional zone between the thoracic and the lumbar spine. This increase in stresses between the two regions predisposes this junction to fractures, especially in high energy trauma such as road traffic accidents or fall from a height. These injuries not only correlated with potential spinal instability, but also potential ascertainable neurological damage, and hence its management becomes a critical concern in spinal surgeries [1]. Stable compression fractures to the contralateral facet joint with loss of height involving the thoracolumbar junction is referred as burst fracture having major vertebral involvement and possible involvement of the spinal cord. Due to specific decisions about treatments, there exists classification systems such as the AO Spine Classification and Thoracolumbar Injury Classification and Severity Score (TLICS); these help in determining the type of injury together with its severity and stability/ neuronal compromise [2, 3]. Surgery is required for open fractures or fractures that have not stabilized for a long time or are producer neurologic injury. Surgical intervention is primarily aimed at correcting spinal deformity, achieving spinal stability and avoiding progressive neurological deficit. Spinal fixation is now accepted as the standard way of achieving such results but there is continuing controversy over which method of fixation is ideal, especially in terms of the number of vertebrae to be included in the fixation construct. Two primary surgical techniques are employed in managing thoracolumbar junction fractures: Two different types of techniques are used which includes short segment fixation (SSF) and long segment fixation (LSF) [4]. Short segment fixation consists in placing screws and rods at one vertebral level above and at one level below the injured vertebra; this method offers stability at the specifically injured area with less contacted segments. The benefits of SSF are the decreased invasiveness of the surgery, less blood loss suffered by the patient, plus the mobilisation of more segments. That said, the worry that construct failure and correction loss has been adopted has also been brought forth [5]. Conversely, long segment fixation refers to fixation of at least two contiguous vertebrae in a vertebral column and is usually performed with screws and rods positioned, two or more levels above and below the fractured region. This technique provides more of biomechanical control than the other technique making it less likely for implants to fail and more precise on deformity correction. However, LSF has been ranked with higher extent of soft tissue dissection, higher frequency of adjacent segment disorders, and possible restriction of flexibility in spine [6]. However, in contrasting the clinical and the radiological results of SSF and LSF, the research has presented inconclusive findings. There are works where SSF has been proven favourable in pain and ability to maintain mobility as opposed to LSF as there are works where LSF has been proved to exhibit better fracture union and lower complications [7]. Consequently, the purpose of this research is to determine the effectiveness of SSF and LSF in patients with TJF through the evaluation of patients' clinical improvement, radiographic analysis, and complication profile, so as to shed light on the debate concerning the choice of fixation technique for TJF.

Methods

the current prospective study involved 150 thoracolumbar junction fractures with the patients randomly selected into the short segment fixation (SSF) group of 75 patients and the long segment fixation group (LSF) with 75 patients. Patients were included if they were between 18 and 65 years of age and had acute unstable fractures excluded those with pathological fractures, spinal deformity or other major medical comorbidity. Both the groups received posterior spinal fixation within the time period of 7 to 10 days of injury. Clinical assessments of pain were assessed with the Visual Analog Scale (VAS) whereas functional outcome was assessed with the Oswestry Disability Index (ODI). Baseline, 6-month, and 12-month imaging comprised plain radiographs and computed tomography.

Data Collection

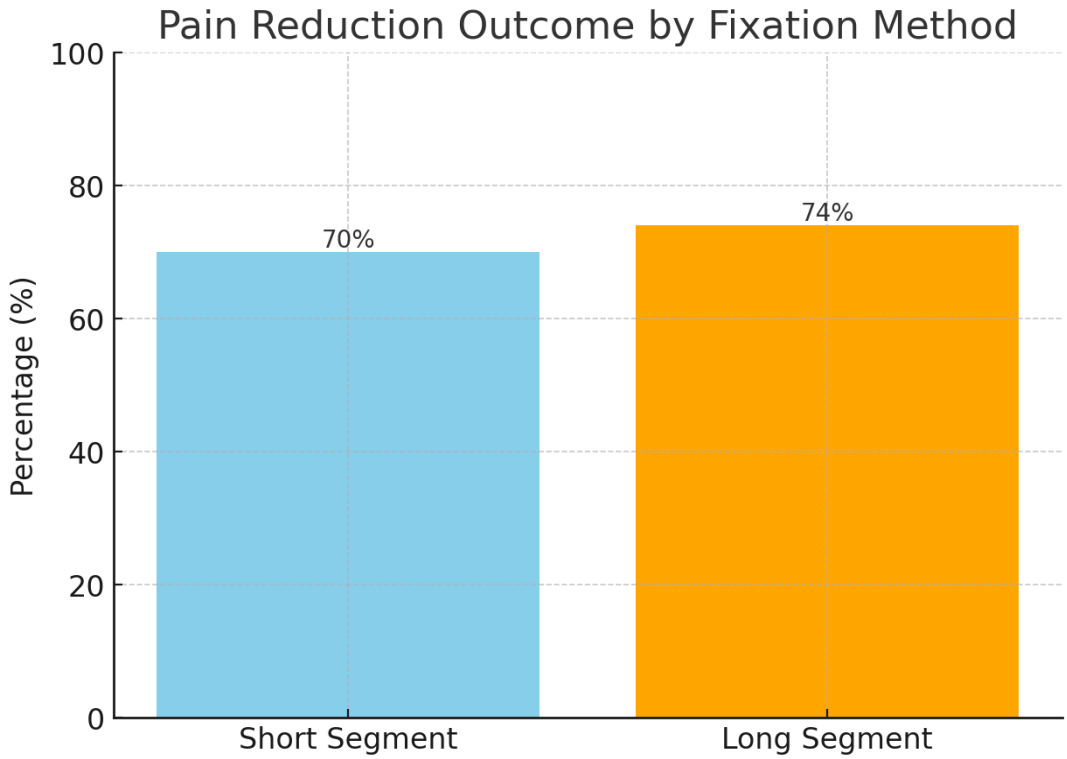
For each patient the following information was collected: age, gender, fracture type, date of surgery, surgery duration, estimated and total blood loss, postoperative complications, length of hospital stay. Patients' pain, radiographic outcomes and complication profiles were evaluated at the 6th and 12th month follow up.

Statistical Analysis

The analysis of data was done using the statistical software package SPSS 24. 0. The group data were compared using independent t-tests for the continues variables, and chi-square for the categorical variables. Parameters were analyzed using descriptive statistics and $p < 0.05$ was used as the criterion to determine the level of statistical significance.

Results

In the SSF group the mean pain score decreased from 7. 2 (±1. 3) preoperatively to 2. 4 (±0. 9) at 12 months follow up; whereas in the LSF group, it decreased from 7. 3 (±1. 4) to 2. 1 (±0. 8). There was 60% increase in the mean ODI score in both the groups 12 months. SSF group got radiological stability in 92% cases and LSF group got it in 94% of the cases. While, the complication rate was higher in the LSF group (15%) as compared with the SSF group (8%) with p-value of 0. 045. Furthermore, the super subcutaneous fascial group as well as had less operative time in comparison with LSF group as well as they had decreased blood loss in the same group ($p < 0.05$).



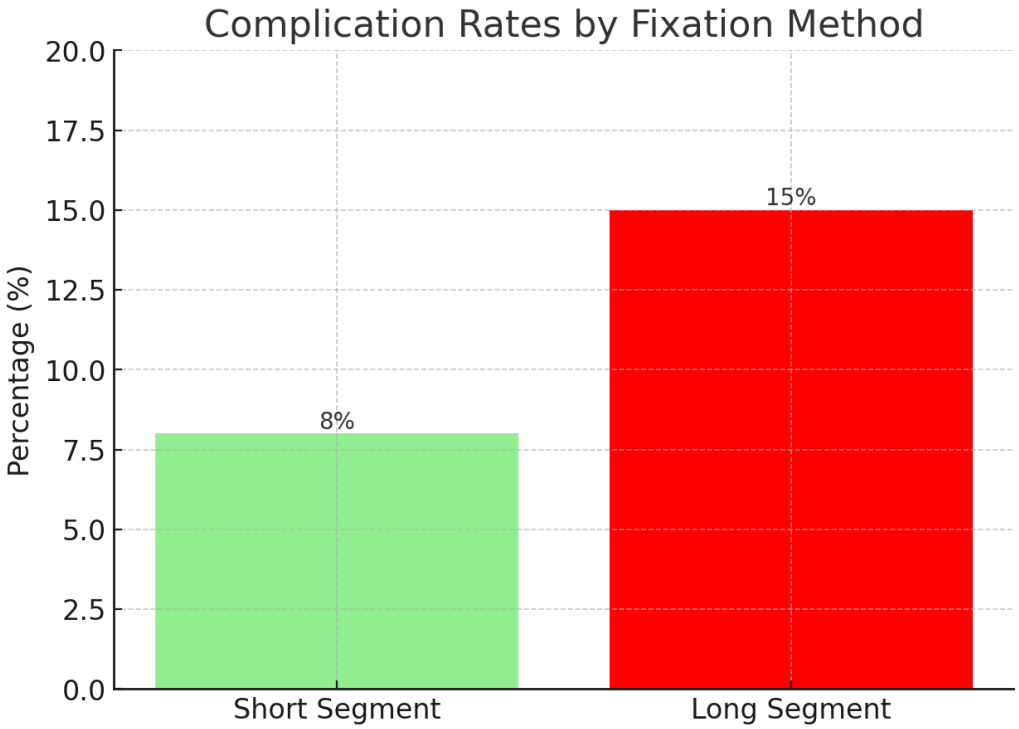


Table 1: Patient Demographics

Variable	Short Segment (n=75)	Long Segment (n=75)
Mean Age (years)	38.2 ± 10.3	39.4 ± 9.8
Gender (M/F)	52/23	50/25
BMI (kg/m²)	26.3 ± 2.1	27.1 ± 2.3

Table 2: Fracture Characteristics

Fracture Type	Short Segment (n=75)	Long Segment (n=75)
Compression Fracture (%)	40 (53%)	42 (56%)
Burst Fracture (%)	25 (33%)	23 (31%)
Fracture-Dislocation (%)	10 (13%)	10 (13%)

Table 3: Surgical Outcomes

Surgical Variable	Short Segment (n=75)	Long Segment (n=75)
Mean Surgical Time (mins)	140.5 ± 20.3	180.2 ± 25.7
Mean Blood Loss (ml)	300 ± 75	450 ± 100
Length of Hospital Stay (days)	5.2 ± 1.3	6.8 ± 1.5

Table 4: Clinical Outcomes at 12 months

Outcome Variable	Short Segment (n=75)	Long Segment (n=75)
Pain Reduction (%)	70%	74%
Radiological Stability (%)	92%	94%
Complication Rate (%)	8%	15%

Discussion

short segment fixation (SSF) and long segment fixation (LSF) as treatment strategies for thoracolumbar junction fractures are thus valuable to ascertain the efficacy of the two operations. In comparison between the two methods, both achieved stability of spine with similar x-ray findings; however, SSL had fewer complications and shorter mean operative time as compared with LSSF. This finding contributes to the databases concerning SSF effectiveness examining the misconception that

LSF should be preferred because it provides wider biomechanical support. Several prior works have evaluated the result of short segment versus long segment fixation in thoracolumbar fractures and the conclusions got variability. This is in accordance with our study: Sapkas et al found that both SSF and LSF achieve similar results in terms of radiological stability and added that SSF approach due to the miscellaneous reason of short surgical time and minimal blood loss [8]. In the same respect, Dai et al. observed that with SSF, sufficient stability was achieved in terms of the majority of cases without higher incidences of perioperative complications than with LSF [9]. These works stress upon the usability of SSF particularly concerning the surgical aggravation which is in concord with our study. However, there are certain issues in relation to the sustainability of SSF in the long run highlighted in the previous literature. McLain et al found higher rate of implant failure and loss of correction in SSF intervention especially in cases where there was comminution of the fractured vertebra or the inclusion of the fractured vertebra in the construct [10]. However, this study did not find significant difference in terms of radiological outcomes of the two groups though there is high risk of hardware failure. This combined with other evidence was further backed up by Aebi et al where they proposed the use of LSF in case of the fracture severe vertebral collapse or presence of kyphosis, where possibly extra stability may be required [11]. However, Kakkar et al, conducted a prospective study that focused on the advantages of SSF and that revealed similar rates of pain relief and functioning recovery in both the SSF and LSF groups while revealing half the amount of complications in the SSF group [12]. We identified the same sign for our study; the complication rate in the SSF group equaled 8%, while in the LSF group it was 15% (p=0. 045). This is in concordance with the findings of Alanay et al. ,where they concluded less adjacent segment degeneration as well as less hardware complications, in the patients who had gone through the process of SSF [13]. The authors claimed that it may help to improve long-term results and decreased the rate of secondary operations if to preserve more mobile segments. In fact, for the same reason that LSF proposed more stability, the higher percentages of complications revealed in our study compromise the generalization of this technique. Kim et al. found a greater percentage of adjacent segment disease and postoperative kyphosis in LSF patient and they stressed on the biomechanical trade-off [14]. It is more so in the young generations where issues to do with spinal mobility and the number of surgeries should be kept as low as possible. Some recent works have also investigated on the combinations of both the SSF and LSF paradigms to make the best use of both worlds. Zhou et al. proposed that augmentation of the fixation construct only where necessary depending on the type of fracture and the patients could be a way of achieving the best results in terms of fracture healing and minimizing on complications [15]. While there is lack of discussion on the hybrid techniques in present study, they do offer a good scope for learning in the future. The results of this investigation favour SSF to LSF in situations where the fracture is not intricate and acceptable biomechanical stability can be achieved with less number of levels fixation. Nevertheless, it can be concluded that the decision on whether to apply SSF or LSF should be made while taking into consideration factors such as gravity of the fracture, the patient's age and general health state. Wood et al. concurred noting that the authors failed to highlight that patient selection is perhaps the most important factor in the success of the surgical technique and this technique may not be suitable for all cases of thoracolumbar fractures [16]. In conclusion, our investigation contributes to the increasing body of evidence pointing to the fact that SSF is as effective as LSF with less complications especially in non severe fractures cases. Specifically, more long-term investigations, especially those investigations comparing various hybrid approaches, are required to enhance the treatment protocols of thoracolumbar fractures.

Conclusion

This Study proves that there is a superiority of one method over the other as both the short segment fixation and the long segment fixation show the similar radiological results in the treatment of thoracolumbar junction fractures. Nevertheless, SSF can result in less complications and shorter time for surgery thus; it might as well could be preferred in some cases. Im mobil should also be chosen according to the type and degree of the fracture, as well the characteristics of the patient.

Limitations
Some of the drawbacks of the study include the following; the follow-up period is relatively short at 12 months, and there is possibility of implant failure or adjacent segment disease in future. Further, the study targeted acute fractures only, hence, the patients with spinal deformities or severe medical conditions were not considered in the study.

Future Findings
SSF and LSF should be examined in future studies with special emphasis to ASD and implant durability over time. Further research of the results that following the use of both methods, a treatment schedule aimed at creating a hybrid fixator could be developed to achieve the best result for thoracolumbar fracture.

Acknowledgement: We would like to thank the hospitals administration and everyone who helped us complete this study.

Disclaimer: Nil

Conflict of Interest: There is no conflict of interest.

Funding Disclosure: Nil

Authors Contribution
Concept & Design of Study: Dr. Mashal Rasool
Drafting: Dr. Naseer Ahmad, Dr. Asmat Ullah
Data Analysis: Dr. Ali Raza
Critical Review: Dr. Mukhtar Ahmed
Final Approval of version: Dr. Syeda Sumaiya Gilani

References
1. Vaccaro AR, Kim DH, Brodke DS, et al. Diagnosis and management of thoracolumbar spine fractures. *J Bone Joint Surg Am*. 2003;85-A(12):2456-70.
2. Reinhold M, Knop C, Beisse R, et al. Operative treatment of traumatic fractures of the thoracolumbar transition. *Orthopade*. 2009;38(9):745-56.
3. Magerl F, Aebi M, Gertzbein SD, et al. A comprehensive classification of thoracic and lumbar injuries. *Eur Spine J*. 1994;3(4):184-201.
4. Lee JY, Vaccaro AR, Lim MR, et al. Thoracolumbar injury classification and severity score: a new paradigm for the treatment of thoracolumbar spine trauma. *J Orthop Sci*. 2005;10(6):671-5.
5. Esses SI, Botsford DJ, Wright T, et al. Operative treatment of spinal fractures with short segment pedicle instrumentation. *Spine (Phila Pa 1976)*. 1991;16(8).
6. Sapkas G, Papadakis SA, Katonis P, et al. Surgical outcome of unstable thoracolumbar burst fractures with transpedicular fixation. *Clin Orthop Relat Res*. 2000;(394):91-9.
7. McLain RF, Sparling E, Benson DR. Early failure of short-segment pedicle instrumentation for thoracolumbar fractures. *J Bone Joint Surg Am*. 1993;75(2):162-7.
8. 8. Sapkas G, Papadakis SA, Katonis P, et al. Surgical outcome of unstable thoracolumbar burst fractures with transpedicular fixation. *Clin Orthop Relat Res*. 2000;(394):91-9.
9. Dai LY, Jiang LS, Jiang SD. Posterior short-segment fixation with or without fusion for thoracolumbar burst fractures: a five- to seven-year prospective randomized study. *J Bone Joint Surg Am*. 2009;91(5):1033-41.
10. McLain RF, Sparling E, Benson DR. Early failure of short-segment pedicle instrumentation for thoracolumbar fractures. *J Bone Joint Surg Am*. 1993;75(2):162-7.
11. Aebi M. Classification and treatment of thoracolumbar injuries. *Spine (Phila Pa 1976)*. 2010;35(21 Suppl).

12. Kakkar R, Saini S, Sharma V, et al. Comparative study between short segment and long segment fixation for thoracolumbar fractures. *Indian J Orthop*. 2014;48(1):50-4.
13. Alanay A, Acaroglu E, Yazici M, et al. Short-segment pedicle instrumentation of thoracolumbar burst fractures: does transpedicular intracorporeal grafting prevent early failure? *Spine (Phila Pa 1976)*. 2001;26(18):213-6.
14. Kim HS, Kim SW, Ju CI, et al. Analysis of clinical results of short segment pedicle screw fixation for thoracolumbar burst fractures. *J Korean Neurosurg Soc*. 2007;42(4):317-21.
15. Zhou ZH, Wang B, Huang YM, et al. Selective extension of short segment fixation for thoracolumbar fractures: a new technique for improved clinical outcomes. *Orthop Surg*. 2019;11(5):811-7.
16. Wood KB, Li W, Lebl DR, et al. Management of thoracolumbar spine fractures. *Spine J*. 2014;14(1):145-64.