

ORIGINAL ARTICLE**Is Percutaneous Pedicle Screw Fixation Being Superior than open Pedicle Screw Fixation for the Management of Thoracolumbar Spine Fracture**IRFANULLAH SHAH¹, KHALID MEHMOOD², DANAH K KABRAH³, MOHAMMED M HALAWANI⁴¹Ex-Consultant Neurosurgery. Riyadh Care Hospital. Riyadh, Saudi Arabia. Consultant NeuroSpine. King Fahad Armed Forces Hospital. Jeddah. Saudi Arabia²Clinical Fellow in Neurosurgery. Ninewells Hospital Dundee. Scotland United Kingdom.³House Officer, Department of Neurosurgery. King Fahad Armed Forces Hospital. Jeddah. Saudi Arabia⁴Ex-Consultant NeuroSpine and Head of Neurosurgery Department. Riyadh Care Hospital. Doctor Halawani Spine Clinic, Exit 14. Eastern Ring Road. Riyadh, Saudi ArabiaCorresponding author: Irfanullah Shah, Email: irfanullahshah@gmail.com**ABSTRACT**

Thoracolumbar fractures are common axial skeleton fractures. Mainly affecting T10-L2, considered TL junction. Management is according to the fracture type and spinal stability. Open traditional approach carries more complication as compared with minimally invasive percutaneous fixation, but it is considered having same long term outcome. We have evaluated our local data if the minimally invasive technique is superior than the open one in terms of short-term outcome.

It has been seen that MIS for TLF is superior in terms of early recovery and return to work, when compared the open technique retrospectively.

INTRODUCTION

Thoracolumbar spine (TLS) fractures are among the most common spinal fractures of axial skeleton¹. Two third of these fractures are between T10 to L2², which is due to biomechanical transition of a fixed thoracic spine into flexible lumbar spine.³ Motor vehicle accidents and fall from height are the leading causes of these fractures.⁴ Incidence of TLS fractures is higher in young people, nevertheless it is not uncommon in elderly population.^{5,6} Management of these fractures had remained without much agreement, meanwhile multiple classifications and guidelines have been published so far, fairly made it easier to decide. Typically, stable TLS fractures need to be offered non-surgical option whereas, the majority of unstable fractures ought to go for surgical stabilization.⁷ Presence of neurological deficit, which is present in 15-20 % of cases⁸, is another indication for surgical decompression and fixation with or without fusion.^{9,10} Main goals of surgical intervention in complete spinal cord injury is to stabilize the spinal column to facilitate early rehabilitation and to avoid other systemic complications. (Figure 01) Whereas, rational for intervention in incomplete spinal cord injury is to decompress the neural tissue to provide optimum environment, to regain the possible neurological function, to avoid further worsening and to stabilize the spinal column to facilitate physical therapy.¹¹ (Figure 02) Surgical approaches have also been varying over last decades from highly invasive to minimally invasive ones.

Fixation with pedicle screws for spinal fractures has received global consensus as it offers all three columns stabilization when equated with previous methods including hooks, wires and rods etc. At first, Magerl¹² devised the procedure for temporary external fixation of spine. Further to that Dick et al¹³. in particular, developed it to the "fixateur interne" which had been lead to minimally invasive percutaneous fixation¹⁴

Although there is no overall accord on the most

appropriate surgical option for TLS fracture, nevertheless PPSF is gaining more acceptance as an alternative to the conventional open procedure.¹⁵

Keeping in view the facts this study was designed to assess the outcome of percutaneous pedicle screw fixation (PPSF) compare with open pedicle screw fixation (OPSF) for TLS fracture which will help spinal surgeons locally to analyze and fairly choose the either technique in their practice for the management of TLS fracture.

MATERIAL AND METHODS

This is retrospective descriptive study conducted at Riyadh Care Hospital department of NeuroSpinal surgery from March 2015 to February 2018. All the data were collected on the designed performa. Patients were divided into two groups randomly i-e OPSF and PPSF groups subject to surgery approach. Patients with age greater than 18 years of either gender were included in present study. Patients having thoracolumbar vertebral fracture with TLICS score > 4 were part of this study, fractures were classified according to AO spine thoracolumbar spine injury classification system.¹⁶ Patients having history of trauma more than 6 days, multilevel spinal injury, concomitant other significant visceral injury, pathologic fracture and those did not do MRI, excluded from the study. After collecting detailed history, the ASIA (American spinal injury association) impairment score was tabled.¹⁸ All patients had done X-ray, CT scan and MRI pre-operatively for assessment of fracture morphology, and status of the posterior spinal ligamentous integrity. All patients received pain management according to their needs, surgical group received local infiltration of surgical wound at time of wound closure, which decreases the post op need of narcotics. After surgery patients received pain management and next day referred for rehabilitation to mobilize as tolerated, to encourage the patients justly. All these patients were followed for six months as per their outpatient record. Bio-data including age, sex, mechanism of injury, operative

time, operative blood loss, post-operative hospital stay, visual analogue pain score and neurologic evaluation at first, second, third day of surgery and final follow up.

Data collected were entered and analyzed through SPSS version 19. Continuous data were reported as means and standard deviations. Independent t-tests were used to compare the outcomes in between the groups which were 2 tailed and p values less than 0.05 was considered as significant.

RESULTS

Total 44 patients who fulfilled the criteria of inclusion, were studied. All patients were divided equally in both groups 22 in each. Mean age of the all patients was 44.95 + 8.38 years. Out of 44 patients, 31 were male (70.5%) while 13 patients (29.5%) were female. Regarding mechanism of injury, 34 patients (77.3%) had RTA while 10 patients (22.7%) had history of fall from height. Regarding the level of fracture, most common was L1 fracture in 11 patients (25.0%) as shown in table 1.



Figure 1

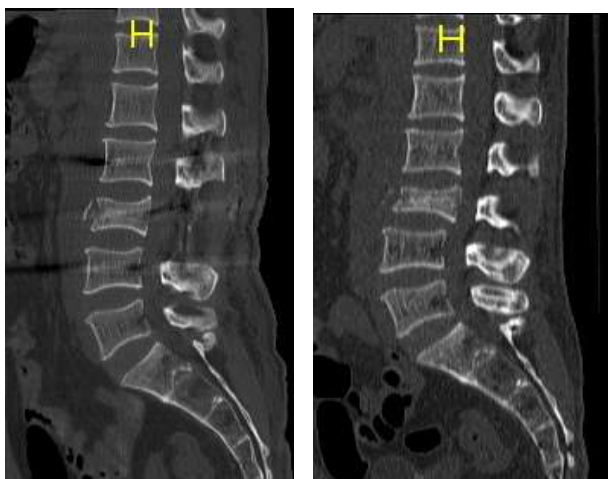


Figure 2

Total operative time in all patients was 139.09 + 24.26 minutes and estimated blood loss in all patients was 261.81 + 147.32 ml. total hospital stay in all patients was 5.20 + 1.86 days and VAS score in all patients at 1st POD, 3rd POD ant at the end of 6th month follow up was 5.90 + 1.84, 3.93 + 1.37 and 1.86 + .86 1.56 respectively. Comparison

of between two groups in term of hospital stay, estimated blood loss, operative time and VAS score given in table 2.

Table 1: demographic representation of the two groups.

Variables	Total	PPSF	OPSF
No of patients	44	22	22
Mean age	44.95 + 8.38	45.95 + 8.87	43.95 + 7.93
Gender			
Male	31 (70.5%)	16(72.72%)	15(68.18%)
Female	13 (29.5%)	06(27.27%)	07(31.81%)
Mechanism Of injury			
Fall from height	10 (22.7%)	5(22.7%)	5(22.7%)
RTA	32(72.72%)	17(77.3%)	15(68.2%)
Sports	4(4.5%)	--	2(9.1%)
Level of injury			
T8	1(2.3%)	1(4.5%)	--
T9	2(4.5%)	1(4.5%)	1(4.5%)
T10	1(2.3%)	1 (4.5%)	--
T11	4(9.1%)	3(13.6%)	1(4.5%)
T12	8(18.2%)	3(9.1%)	5(22.7%)
L1	11 (25%)	5(22.7%)	6(27.3%)
L2	8(18.2%)	5(22.7%)	3(13.6%)
L3	4(9.1%)	2(9.1%)	2(9.1%)
L4	3(6.8%)	--	3(13.6%)
L5	2(4.5%)	1 (4.5%)	1(4.5%)

Table 2: Perioperative and post-operative different variables of the patients in both groups

Variables	Total	PPSF	OPSF	P Value
	44	22	22	
Operative time	139.09+ 24.26	120.22 + 18.14	157.95 + 10.98	0.014
Estimated Blood Loss	261.81+ 147.32	123.63 + 20.36	400 + 63.39	0.004
Hospital Stay	5.20 + 1.86	3.63 + .65	6.77 + 1.23	0.012
VAS at 1 st POD	5.90 + 1.84	4.31 + .64	7.5 + 1.10	0.002
VAS at 3 rd POD	3.93 + 1.37	3.00 + .69	4.86 + 1.24	0.009
VAS at 6 th months post op	1.86 + .68	1.59 + .59	2.09 + .68	0.704

DISCUSSION

Conventional posterior approach to thoracolumbar spine provides wide exposure of anatomy for placement of pedicle screws while providing extra confidence to surgeon who can see and feel the relevant anatomy. On the other hand, it carries high postoperative morbidity especially due to extensive muscle dissection causing denervation of peri-spinal muscles leading to muscle weakness, persistent back pain, prolonging hospital stay and delayed mobilization ultimately delaying in return to routine life.^{19,20}

In recent past, the unique procedure of percutaneous pedicle screw fixation (PPSF) has been gaining popularity due to its decreased muscle trauma, minimum peri-operative bleeding and decrease operative time, which boosts the patient early mobilization and back to life.

Primarily this novel technique was used for treating degenerative diseases of spine, at later stages PPSF commenced universally for TLS fractures and it has become preferred approach by the spinal surgeons for

management of TLS fractures with its encouraging over all outcome.

In this present study mean age of the patient is 45.95 + 8.87 years which is slightly higher than kumar et al²¹ and Helton LA et al²² and consistent with Abimbola A. et al.²³ males proportion in our study is higher in relation to international literature, which states that males are dominantly involved in outdoor activities as compared to females in this part of the world. Vertebral fracture mostly occurs due to high energy trauma. Majority of our patients (77.3%) were involved in RTA followed by fall in 22.7% patients. Our findings of mechanism of injury are consistent with kumar et al,¹⁷ although the percentage is lower but the leading cause of TLS fracture was road accident. Similar findings were seen in Helton LA et al²² and Abimbola A. et al.²³ Most common vertebra affected in our study were lumbar vertebrae compared to thoracic vertebrae which is consistent with findings of international studies.^{21,22,23} Some authors have divided the TLS fracture at different level of vertebrae like middle thoracic, thoracolumbar, middle lumbar and lower lumbar levels. According to this division in present study most of the fractures were observed at junction of thoracolumbar region which is again the commonest site universally,^{21,22} which is due to conversion of lumbar lordosis into thoracic kyphosis which is relatively a fixed area of the vertebra with minimal force transfer. In the literature, it has been observed that the most common affected vertebra in trauma is L1 vertebra,²⁵ which is consistent with our finding as well. The total operative time in present study was much lower in percutaneous approach compared to open conventional approach which was clinically significant and our findings are even with international studies results,^{19,21,22} although time taken in percutaneous approach was little high when compared to other studies. This was due to our initial learning curve in percutaneous approach which is comparable to the Sherief_AE et al results.²⁶ It has been observed that in experienced hands time taken in both open and minimal approach was practically same.²²

Among the advantages of percutaneous approach is minimal bleeding which was 83.86 + 19.99 ml in our case and clinical significant compared to open approach. Our results for estimated blood loss are comparable with international studies.^{21,22,23} post-operative pain is the clinically important complaint experienced by the patient that significantly restrict the moments by patient which may lead to critical complications like chest infection and DVT etc. we analyzed, there was momentous difference in pain perception in patients who went under percutaneous approach compared to open conventional one. Our findings about pain perception are similar to the results of other international studies.^{1,22,23,24} but on the contrary in kumar et al²¹ they found insignificant pain difference in between the two groups. In present study patients who underwent percutaneous approach had decreased analgesic requirements when compared to open technique. It has been seen that decreased postoperative pain is associated with decreased analgesic requirement, early mobilization and rapid recovery, reduced hospital stay and hospital expenditures. With the advent of minimal approach in surgery, hospital stay has been minimized, which was appreciated in TLS fractures. Patients who underwent

percutaneous approach for management had decreased hospital stay when compared to conventional approach. Our finding of decreased hospital stay is also alike to literature.

There are controversies in the management of the spinal fractures without neurological symptoms. Some advocate the conservative management which may be associated with limited movement and discomfort while others favor the minimal invasive management with such as vertebroplasty, percutaneous pedicle screw fixation, resulting in stabilizing the fracture, reducing pain, earlier out of bed mobilization and return to normal routine activity quickly, in our study we did not include the patients with stable TLS fractures.^{27,28}

In present study, none of the patient had developed post-operative neurologic deficit.

There are some limitations in our study. Firstly, our study sample size is smaller with short follow up duration. Secondly, it was the retrospective study. Thirdly we did not record the screw displacement post-operatively as well as complications. For this, long term randomized controlled and multicenter studies are required to establish our findings.

CONCLUSION

Thoracolumbar fracture can be managed very well with both OPSF or PPSF. PPSF had superiority over OPSF in terms of operative time reduced blood loss, decreased pain and analgesic requirements, decreased hospital stay and early return to work.

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