

Transpedicular Screw Fixation of Traumatic Thoracolumbar Spine Fracture Open Versus Percutaneous Technique

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ABSTRACT

Objective: To determine meantime to return to work of patients with traumatic thoracolumbar spine fracture managed with open versus percutaneous trans-pedicular screw fixation.

Materials and methods: A randomized controlled trial conducted in a joint venture of orthopedic and neurosurgeons in a private hospital of Lahore. Study was completed in six months duration from July to December 2022. 80 patients having traumatic thoracolumbar spine fractures presenting to the study hospital and falling in inclusion criteria were enrolled into this study. Two groups made containing equal number of patients in each (n=40). One group underwent open transpedicular screw fixation and other group underwent percutaneous trans-pedicular screw fixation. Monthly follow up was done and the time taken return to work (TTRW) was noted.

Results: Mean age of the patients was 34.62 years. There were 40(50%) male and 40(50%) female patients in the study group (n=80). Mean time taken return to work after the surgery was 3.1±0.61 months in group-A (percutaneous screw fixation) versus 5.2±0.84 months in group-B (open screw fixation). The difference in two groups regarding TTRW was significant (p<0.005). Male and female patients showed significant difference in TTRW within group-A (p=0.021) while no significance difference found in TTRW among male and female patients within group-B (p=0.18). Duration of the procedure had significant impact on TTRW (p=0.001).

Practical Implication: Percutaneous technique has been proved to be safer, quicker and minimal invasive method that should replace open technique. It is recommended to conduct comparative randomized controlled trials on larger study groups to obtain more data regarding outcomes of percutaneous versus open technique. This study helps us to understand comparatively safety, efficacy and feasibility of both techniques so that better treatment option may be used in such patients for better outcomes.

Conclusion: We concluded that time taken return to work was shorter in the patients treated by percutaneous technique of transpedicular screw fixation versus those patients treated by open technique. Percutaneous technique has shorter duration of the procedure, less morbidity, early recovery and more effective.

Keywords: Transpedicular screw fixation, Thoracolumbar spine fracture, Spinal cord injury, Time taken return to work

INTRODUCTION

Trauma may cause fractures as well as spinal cord injuries resulting in neurological deficit.¹ Vertebral fractures may be treated conservatively with closed reduction and functional bracing, bed rest or by surgical method using open reduction internal fixation of fractures.² Spine fractures fixation using pedicular screws is a very common method. Transpedicular screw fixation can be done via open method or by percutaneous technique.³ There is difference in recovery time following these different procedures.⁴ We aimed this study to determine mean time taken to return to work after percutaneous technique versus open method of transpedicular screw fixation in thoracolumbar spine fractures fixation. This study will help us to decide which technique is safe, quicker and better in terms of early recovery and reduced morbidity. Spinal cord injury cast a serious impact on the patient with significant morbidity.⁵ According to a previous study average 1.2 million people suffer from spinal cord injury (SCI) each year in USA.⁶ 90% cases of spinal cord injury result from road traffic accidents, fall from height and due to violence.⁷ SCI prevalence is high in adults than children. Men are prone to this injury in early and late adulthood while women are susceptible in their youth throughout. Age>60 years has bad prognoses. Old age people usually get this injury by falls due to their weak bones as osteoporosis is very common in old age. Thoracolumbar spine fractures occur in 60% cases after trauma.⁸ Transpedicular screw fixation is done in one vertebra above and one below the fracture vertebra. Open technique of fixation has various advantages as it can be used in kyphotic deformities, has more stability and indirect spinal cord decompression can be achieved but despite of these benefits this technique is associated with some serious complications like increased rate of infection, injury to paraspinous muscles, increased blood loss, prolong duration of the procedure and longer postoperative hospital stay. Late complications include muscle denervation leading to muscle atrophy. According to a previous

study average time taken to return to work (TTRW) in patients was 2.13 months after percutaneous technique as compared to 4.78 months after open technique of transpedicular screw fixation.⁹ Another study reported TTRW 9.7 months after percutaneous fixation as compared to 17 months after open fixation method.¹⁰ Recently many advances have been made in the diagnosis and treatment of patients with spinal cord injury resulting improvement in prognosis and early recovery. Central cord syndrome is very common injury occurring in spine fractures due to stenosis of spinal canal in cervical region causing sensory and motor dysfunction. Patients may develop paraplegia or tetraplegia depending upon the severity of injury. Early diagnosis and prompt treatment may prevent many complications in such patients.

MATERIALS AND METHODS

A randomized controlled trial conducted in a joint venture of orthopedic and neurosurgeons in a private hospital of Lahore. Study commenced in July and completed after six months duration in December 2022. Total 80 patients having traumatic thoracolumbar spine fractures presenting to the study hospital and falling in inclusion criteria were enrolled into this study. According to inclusion criteria patients of both genders between 16-60 years of age with traumatic thoracolumbar spine fractures presenting to the study hospital within 72 hours and neurologically intact with TELIS ≥4 were included in this study. Those with multilevel spine injury or complete spinal cord injury, polytrauma or multi-organ injury, vitally unstable patients or those who refused giving consent were not included in this study.²¹⁻²² Sample size was calculated using WHO sample size calculator. Non probability consecutive sampling technique was used for sample selection. Two groups were made randomly using lottery method containing equal number of patients in each (n=40). One group underwent open transpedicular screw fixation and other group underwent percutaneous trans-pedicular screw fixation. Monthly follow up was

done and the time taken return to work (TTRW) was noted. Data was documented on a self-made proforma. P-value <0.05 was considered significant. Means and standard deviations were determined for quantitative variables such as duration of fracture, age of the patient, duration of procedure and time to return to work. Frequencies and percentages were determined for qualitative variables like gender and mode of fracture fixation (open or percutaneous technique). Student t-test was applied on the collected data. Informed consent was taken from all the study cases.

RESULTS

In this study mean age of the patients was 32.12 ± 4.7 years in group-A and 33.91 ± 8.2 years in group group-B. Most of the patients were in age group of 21-30 years (27.5%) and 31-40 years (32. 5%). There were 40(50%) male and 40(50%) female patients in the study group (n=80). Mean time taken return to work after the surgery was 3.1±0.61 months in group-A (percutaneous screw fixation) versus 5.2±0.84 months in group-B (open screw fixation). Mean duration of fracture was 24 ± 10.3 hours in group-A and 31.8 ± 11.4 hours in group-B.

Table-1: Age distribution of cases in both study groups

Age (years)	Group-A (N=40)	Group-B (N=40)	Total (n=80)
<20	3 (7.5%)	01 (2.4%)	04
21-30	12 (30%)	11 (27.5%)	23
31-40	16 (40%)	13 (32.5%)	29
41-50	5 (12.5%)	09 (22.5%)	14
>50	4 (10%)	06 (15%)	10

Mean duration of procedure was 66 ± 12.7 minutes in group-A patients and 38 ± 19.2 minutes in group-B. The difference in two groups regarding TTRW was significant (p<0.005). Male and female patients showed significant difference in TTRW within group-A (p=0.021) while no significant difference found in TTRW among male and female patients within group-B (p=0.18). Duration of the procedure had significant impact on TTRW (p=0.001). Duration of fracture had no significant impact on TTRW (p=0.83). Mode of injury was fall from the height in 16(40%) and 20(50%) cases, road side accident in 18(45%) and 15(37.5%), violence in 06(15%) and 05(12.5%) cases respectively in group-A and group-B.

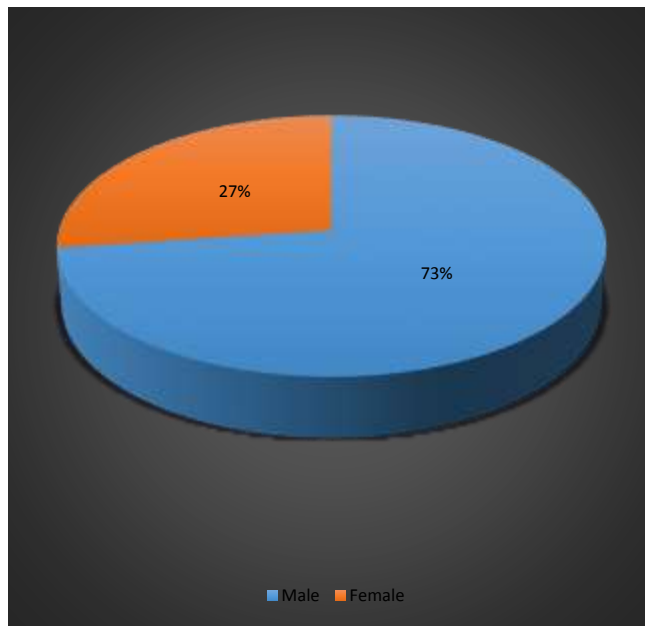


Figure-1: Gender distribution of cases in study group

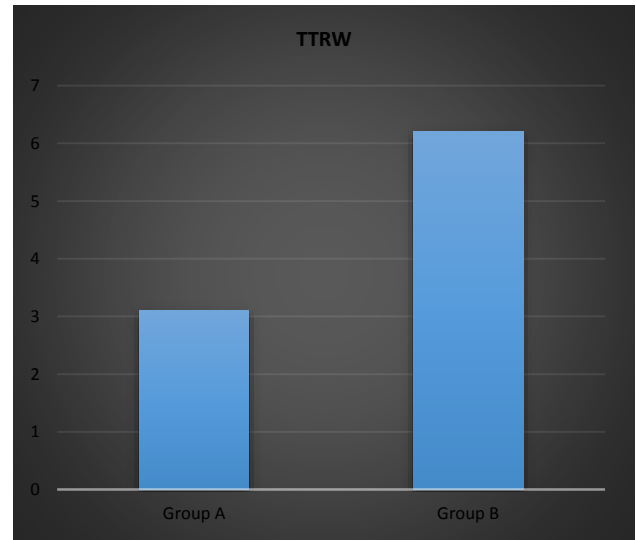


Figure-2: Average time taken to return to work (TTRW) in both groups

DISCUSSION

With the development in medical field many recent advances have been done in the diagnosis and management of spinal cord injury (SCI).¹¹ According to a recent European study percutaneous technique of trans-pedicular screw fixation (PPSF) is better, time saving and more effective procedure. It is minimal invasive with less bleeding reduced hospital stay and early recovery.¹² Russo et al in a prospective study compared outcomes of PPSF and open technique and concluded that patients managed with PPSF technique had short duration of procedure, less post-operative pain and less complications (5%) as compared to open technique (15%).¹³ In this study mean age of the patients was 32.12 ± 4.7 years in group-A and 33.91 ± 8.2 years in group group-B. Most of the patients were in age group of 21-30 years (27.5%) and 31-40 years (32. 5%). There were 40(50%) male and 40(50%) female patients in the study group (n=80). Mean time taken return to work after the surgery was 3.1±0.61 months in group-A (percutaneous screw fixation) versus 5.2±0.84 months in group-B (open screw fixation). Despite many advantages PPSF has few drawbacks like limited view of surgical site, lack of anatomical indicators and more risk of damage to facet capsule. This technique require special equipment and skilled surgeons, high dosage of xray required and long learning curve for surgeons with limited expertise. There is also risk of screw misplacement in this technique.¹⁴ Hayoun et al reported that blood loss in PPSF technique was 178 ml as compared to 227 ml in open technique (p=0.02), shorter mean hospital stay of 3.6 days after PPSF and 5.5 days after open surgery.¹⁵ Another study by Ying et al reported that pedicle screw position was accurate in 88% after percutaneous technique versus 67% after open technique (p=0.001).¹⁶ Chao et al studied transpedicular screw fixation in type A3 and A4 fractures of thoracolumbar spine by open and percutaneous technique successfully. They stated that radiation dosage used in percutaneous technique was 100% higher than used in open method. Postoperative Cobb angle of spine and risk of loss of correction were similar in both techniques.¹⁷ A previous study conducted in France by Yen et al reported that in thoracolumbar spine fractures percutaneous screw can be combined with intermediate screw in fractured vertebrae leading to more stable fixation and maintaining vertebral height.¹⁸ According to a local study conducted by Usman et al reported that 85% thoracolumbar spine fractures in their study group were due to fall from the height and 55% of them were involving T12-L1 spine. Burst fracture reported in 65% cases and 55% cases had normal neurological status. They reported decrease in ODI score from 40% to 23% in first six months.¹⁹ Another study conducted by Irfan et al I Pakistan

reported that frequency of pedicle breach was higher in percutaneous technique (11.3%) versus open technique (5.8%).²⁰

Medical resources, diagnosis, and treatment must improve in developing countries. There are limited resources: access to medical and health resources; knowledge about disease; awareness, trainings, and awareness about health. Health literacy is mandatory for any disease and facilitates the patients access to resources, databases, and trainings about the disease.²³⁻²⁹

Percutaneous technique has been proved to be safer, quicker and minimal invasive method that should replace open technique. It is recommended to conduct comparative randomized controlled trials on larger study groups to obtain more data regarding outcomes of percutaneous versus open technique.

CONCLUSION

According to the findings in our study we concluded that mean time return to work after percutaneous technique is significantly less than open technique. Percutaneous method is less invasive, safer and quicker with comparatively less postoperative complications and early recovery. Percutaneous transpedicular screw fixation is better than open method.

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