Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v29i04.6915

OUTCOME OF SPINE FIXATION FOR UNSTABLE FRACTURES AT DORSOLUMBAR JUNCTION INCLUDING FRACTURED VERTEBRAE IN PEDICULAR SCREW FIXATION

Naseer Hassan[1], Muhammad Gulzar khan[2], Anwar Imran[3], Sardar Sohail Afsar[4*]

[1]Associate Professor/ Incharge Neurosurgery Department, Qazi Hussain Ahmed Medical Complex, Nowshera Pakistan
[2]Assistant Professor Orthopaedic Department, Jinnah Teaching Hospital, Peshawar Pakistan
[3]Assistant Professor Orthopaedic Department, Jinnah Teaching Hospital Peshawar Pakistan
[4]Chairman and Associate Professor, Nowshera Medical College and Qazi Hussain Ahmed Medical Complex, Nowshera Pakistan

***Corresponding author:** Dr. Sardar Sohail Afsar,
Chairman and Associate Professor, Nowshera Medical College and
Qazi Hussain Ahmed Medical Complex, Nowshera, Pakistan
Email: dr_sardarsohail@yahoo.co.uk

ABSTRACT

Background: Injury of the spinal cord with loss of neurological function is the most devastating life-changing injury. Each year a large number of Pakistani population sustain spinal injuries. Studies on spinal injuries have been published in Pakistan but the exact incidence of spinal injuries in Pakistan is still unknown.

Objective: To assess the outcome of spine fixation for unstable fractures at dorsolumbar junction including fractured vertebrae in pedicular screw fixation

Methodology: This prospective multi-centre study was conducted at Department of Orthopaedics and Spine Surgery, Qazi Hussain Ahmed Medical Complex, Nowshera and other private medical centers in Peshawar Pakistan, from August 2021 to August 2022. A total of 130 patients were included in this study with single level fractures from D11 to L2. Complete history and physical examination were done in each case. X-rays of the whole spine and MRI of dorso-lumbar region were done in all cases. Patients were evaluated both radiologically and clinically. All these parameters were measured before surgery immediately after surgery and at 6 months post-operatively. The data was analyzed using SPSS soft ware version 23.

Results: A total of 130 patients were included in this study. The mean age (SD) of the enrolled patients was 32.8 (±2.11) years. There were 97 (74.62%) male patients while the female patients were 33 (25.38%). A statistical significant improvement was observed post-operatively in Cobb angle, anterior vertebral height, posterior vertebral height and sagittal index. ($p<0.05$). Statistical significant improvement in Oswestry disability index (ODI) and reduction in VAS was observed in our study. ($p<0.05$). The post-operative complications were observed in only 12 (9.24%) Patients.

Conclusion: In our study, Trans-pedicular screw fixation including the fractured vertebrae gave excellent radiological and clinical outcome. It improved the biomechanical stability by giving extra pedicle for fixation which shorten the fixation segment and also helped in reduction and deformity correction. We therefore strongly recommend fixation of the fractured vertebra in trans-pedicular screw fixation of dorso-lumbar spine fractures.

Key words: Spine fixation; Unstable fractures; Dorsolumbar junction

INTRODUCTION

Injury of the spinal cord with loss of neurological function is the most devastating life-changing injury.[1-3] In the United States, spinal cord injuries occur at an annual rate of 30 cases per million inhabit- ants, which translates into 8,000 new cases per year.[4-6] Each year a large number of Pakistani population sustain spinal injuries.[7] Studies on spinal injuries have been published in Pakistan but the exact incidence of spinal injuries in Pakistan is still unknown.[8-10] Unstable vertebral burst fractures are two or three column fractures according to the Three Column Concept of Denis[11] and all vertebral fractures with more than 50% loss of vertebral height, more than 20 degrees angulation or more than 50% spinal canal com- promise need surgical intervention.[12] A uniform consensus has not yet been developed for the standard treatment of unstable burst fractures or fracture dislocation.[13] With surgical spine fixation patients could expect to become mobile early, perform rehabilitative remedies, overcome anatomic fractures, and improve, in most cases, nervous functions by using decompression and fixation.[14,15] Different procedures of posterior fixation of thoraco-lumbar spine fractures e.g. hooks and Harrington rods have undergone tremendous improvement over the last couple of decades. Moreover, pedicle screw fixation has revolutionized spinal surgeries all over the world.[16] Short-segment posterior fixation is the most common and simple treatment. It offers the advantage of incorporating fewer motion segments in the fu- sion.[17,18] There are biomechanical advantages of posterior fixation including the fractured vertebra (PFFV) over conventional short-segment fixation. It will be biomechanically stronger by inserting screws at the fracture level which in turn may omit the need for further anterior reconstruction. Studies have shown the inclusion of the fracture level in short segment fixation.[19,20] This study was designed to evaluate the radio- logical and clinical results of transpedicular screw fixation of spine fractures including the fractured vertebra.

METHODOLOGY

This prospective multi-centre study was conducted at Department of Orthopaedics and Spine Surgery, Qazi Hussain Ahmed Medical complex Nowshera and other private medical centers of Peshawar Pakistan, from August 2021 to August 2022. Study protocol was approved by the ethical review board of respective Hospitals. Informed written consent was taken from the patients. A total of 130 patients were included in this study with single level fracture from D11 to L2. Complete history and physical examination was done in each case. X-rays of the whole spine and MRI of dorso-lumbar region was done in all cases. Pathological spine fractures, osteoporotic spine fractures and poly trauma patients requiring immediate fixation of other long bones or other operative interventions were excluded from the study. All patients with unstable dorso lumbar fractures were fixed from posterior with transpedicular screws and rods. We included fracture vertebrae in the fixation by putting trans-pedicular screws in fractured vertebrae. Patients were evaluated both radiologically and clinically. Radiological parameters were anterior and posterior vertebral heights, Cobb angle and sagittal index and clinical parameters were back pain using Visual Analogue Score (VAS) and disability using Oswestry disability index (ODI). All these parameters were measured before surgery immediately after surgery and at 6 months post-operatively. The data was analyzed using SPSS soft ware version 23.

Results

A total of 130 patients were included in this study. The mean age (SD) of the enrolled patients was 32.8 (±2.11) years. There were 97 (74.62%) male patients while the female patients were 33 (25.38%). (Figure 1) Based on the causes of fractures, the most common cause was falling from the height observed in 71 (54.62%) cases followed by road traffic accident in 55 (42.31%) cases and 4 (3.08%) were others.(Figure 2) Based on the type of fracture, the most common fracture was L1 observed in 75 (57.69%) cases followed by L2 in 46 (35.38%) and 9 (6.92%) patients had Th 12 fractures.(figure 3) A statistical significant improvement was observed post-operatively in Cobb

angle, anterior vertebral height, posterior vertebral height and sagittal index. ($p<0.05$).(table 1) Statistical significant improvement in Oswestry disability index (ODI) and reduction in VAS was observed in our study. ($p<0.05$.(table 2) The post-operative complications were observed in only 12 (9.24%) Patients.(Figure 4) Bases on types of complications, Dural Tear was observed in 6 patients while Metal Failure and Wound Infection was observed in 3 patients. (Figure 5)

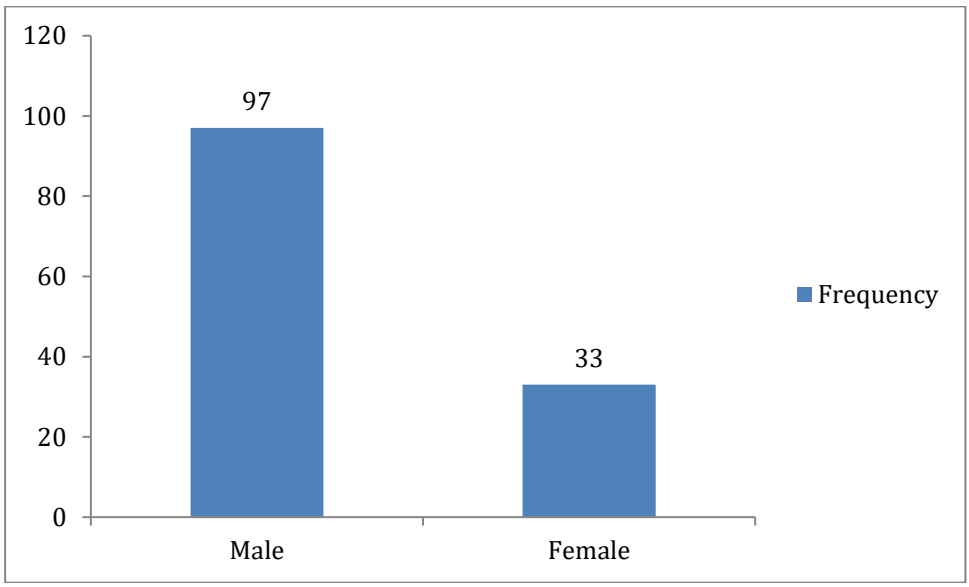

Figure 1: Gender wise distribution of patients

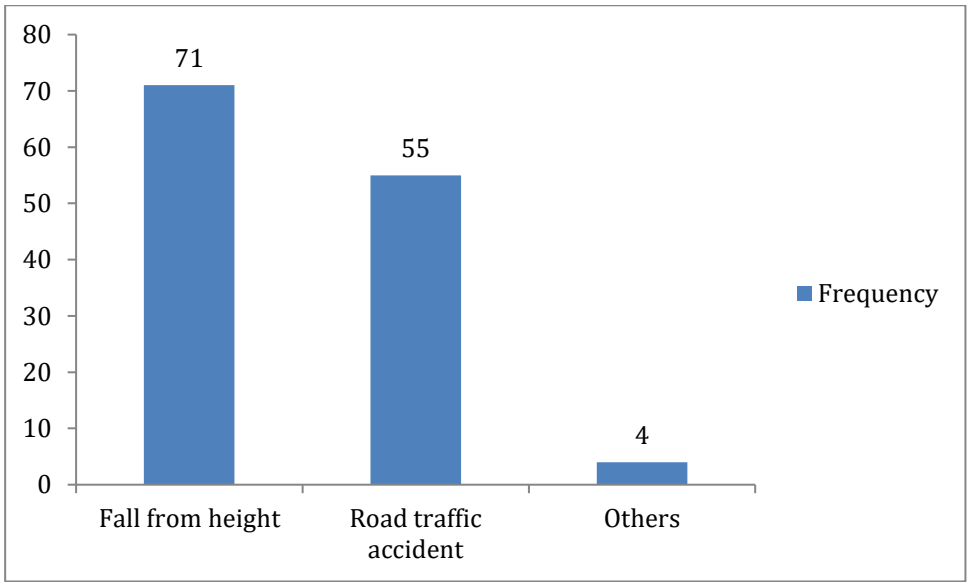

Figure 2: Distribution of patients based on causes of fracture

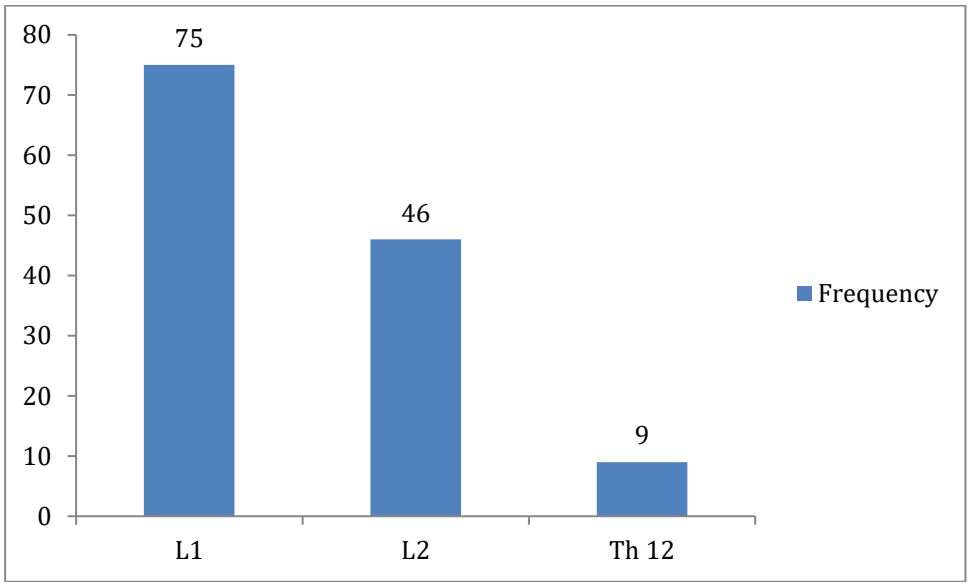

Figure 3: Distribution of patients based on types of fracture

Table 1: Post-operative outcomes in our patients

Parameter	Pre-operative	Post-operative	p
Cobb angle	9.11±2.21	3.36±0.09	0.001
anterior vertebral height	17.99±3.34	26.11±2.21	
posterior vertebral height	26.01±3.11	37.99±5.31	
sagittal index	18.33°	7.23°	

Table 2: Pre-operative and post-operative ODI and pain score

Parameter	Pre-operative	Post-operative	p
Oswestry disability index (ODI	72.01±11.76%.	42.21±16.55%	0.001
pain score (VAS)	8.23±4.11	1.12±4.09	0.001

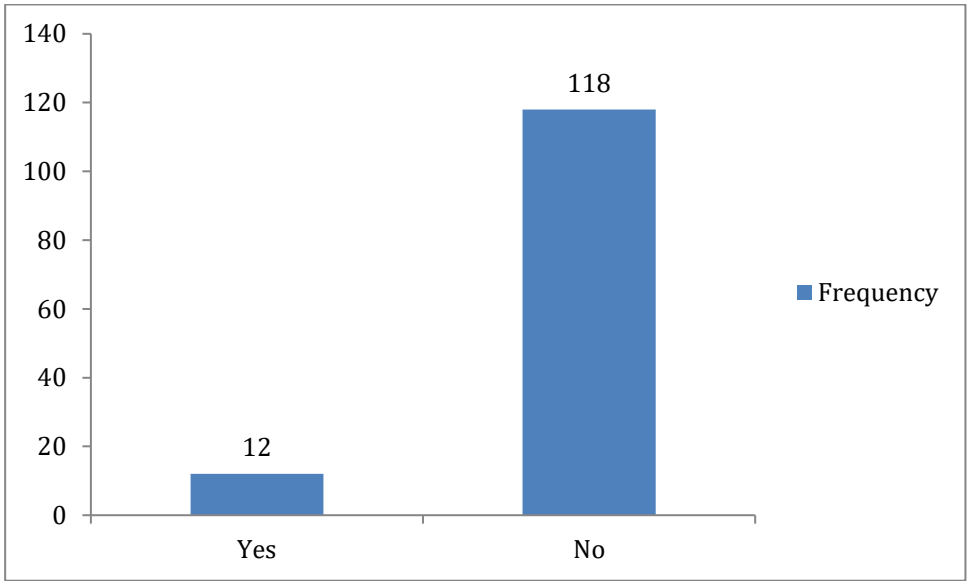

Figure 4: Distribution of patients based on complications after surgery

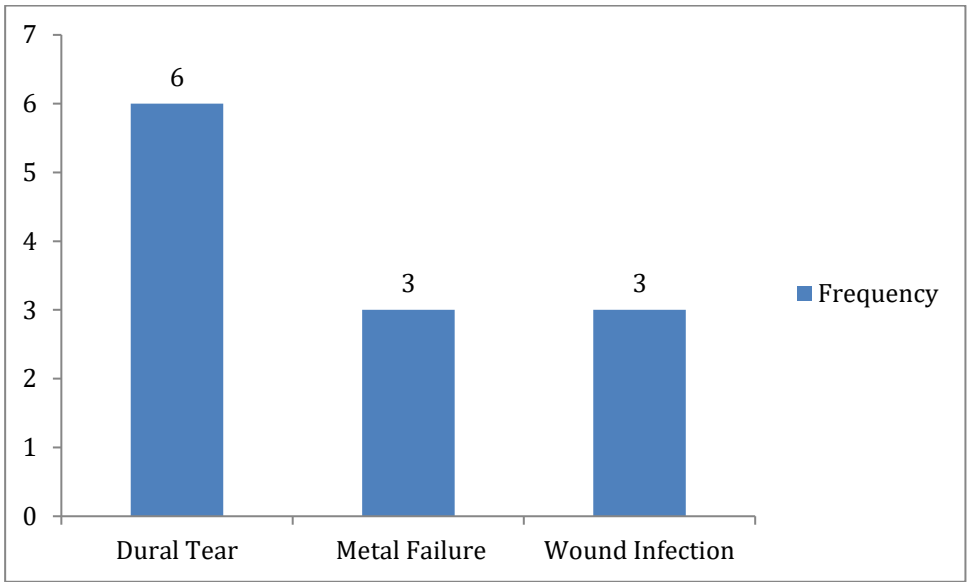

Figure 4: Distribution of patients based on types of complications

DISCUSSION

Decompression of neural components, avoidance of late neurological damage in unstable fractures, and early mobilization are all reasons for surgical intervention in thoracolumbar unstable fractures.[21] A patient's quality of life may be significantly impacted by neurologic sequelae and kyphotic deformities caused by thoracolumbar/lumbar spine burst fractures.[22] When it comes to dealing with unstable thoracolumbar/lumbar burst fractures and those with present or probable nerve handicaps, the majority of clinicians agree that surgery is necessary. Acute spinal instability and final failure of the damaged segment are the end consequences of spinal segments that have lost more than 50% of their vertebral body height or have an angulation deformity of more than 25° in biomechanical and clinical investigations.[23] In our study, a total of 130 patients were included in this study. The mean age (SD) of the enrolled patients was 32.8 (±2.11) years. There were 97 (74.62%) males patients while the female patients were 33 (25.38%). (Figure 1) Based on the causes of fractures, the most common cause was falling from the height observed in 71 (54.62%) cases followed by road traffic accident in 55 (42.31%) cases and 4 (3.08%) were others. Based on the type of fracture, the most common fracture was L1 observed in 75 (57.69%) cases followed by L2 in 46 (35.38%) and 9 (6.92%) patients had Th 12 fractures. These findings were comparable to the previous studies.[24, 25] L1 fractures were majority found in 67 (56.3%) cases followed by L2 in 40 (33.6%) and 12 (10.1%) patients had Th 12 fractures.[26] When broken vertebrae are included into the implant assembly, no implant failure or 10° corrective loss occurs. For thoracolumbar fractures with mild to moderate instability, unilateral pedicle screw fixation via the pedicle of the fractured vertebra coupled with the short segment of pedicle screw is successful.[27] In our study, A statistical significant improvement was observed post-operatively in Cobb angle, anterior vertebral height, posterior vertebral height and sagittal index. ($p<0.05$). Statistical significant improvement in Oswestry disability index (ODI) and reduction in VAS was observed in our study. ($p<0.05$). These findings are comparable with previous study who found significantly improvement in Cobb angle, anterior vertebral height, posterior vertebral height and sagittal index with p value <0.05. Oswestry disability index (ODI) was improved to 41.13±19.42% from 70.6±16.43%. Mean pain score (VAS) was reduced to 1.01±5.23 with p value <0.05.[28] In a recent research, averages for anterior and posterior vertebral height were 0.60.1 before and after surgery and 0.90.2 after the procedure was completed, respectively. This indicated considerable post-operative improvement and was sustained after the procedure was completed.[29] The mean pre-operative kyphosis angle in another research was 22.9°–7.6°. After surgery, the temperature dropped to a much more manageable 9.2°6.6°.[30] At the beginning of our research, the mean Cobb angle was 7.354.57, but at the end of the study, it had decreased to 2.181.71. According to Sapkas et al.[31], long segment stability was linked to improved outcomes in the long term follow

up. In terms of patient satisfaction, roughly (80%) of patients treated with long segment had minor impairment, but only about 45% of patients treated with short segment had minimum disability. In our experience, patients who had transpedicular screw fixation with their damaged vertebrae have had exceptional radiological and clinical results. Increased biomechanical stability was achieved by including an extra pedicle for fixing, which resulted in a reduction in the length of the fixation segment while also correcting abnormalities. As a result, we strongly recommend that the fractured vertebra be fixed when transpedicular screw repair of dorso-lumbar spine fractures is performed.

CONCLUSION

In our study, Trans-pedicular screw fixation including the fractured vertebrae gave excellent radiological and clinical outcome. It improved the biomechanical stability by giving extra pedicle for fixation which shorten the fixation segment and also helped in reduction and deformity correction. We therefore strongly recommend fixation of the fractured vertebra in trans-pedicular screw fixation of dorso-lumbar spine fractures.

REFERENCES

1. Zhou F, Zou J, Gan M, Zhu R, Yang H. Management of fracture-dislocation of the lower cervical spine with the cervical pedicle screw system. Ann R Coll Surg Engl. 2010;92(5):406- 10. ,
2. Cisneros FD. Tratamiento delas fracturasdelsegmento cervical inferior (c3 a T1). Ortho-Tips.2007;3(3):178-87.
3. Cisneros FD, Hurtado AP. Incidencia de laslesiones vertebral- estraumáticasen el Servicio de Cirugía de Columna de un hospital de concentración delistema deseguridad social. ActaOrtop Mex. 2003; 17(6): 292-7.
4. OcampoRomán RI. Instrumentación de la vertebra fracturada; unaopciónválida de tratamientoenfracturas de la unióntora- co-lumbar. Columna.2011; 1:3-9.
5. Jones TM, Anderson PA, Noonan KJ. Pediatric cervical spine trauma. J Am Acad Orthop Surg. 2011;19(10):600-11.
6. Nowak DD, Lee JK, Gelb DE, Poelstra KA , Ludwig SC. Central cord syndrome. J Am AcadOrthop Surg. 2009;17(12):756- 65.
7. Khan KM, Bhatt i A, Khan MA. Posterior Spinal Fixation with Pedicle Screws and Rods System in Thoracolumbar Spinal Fractures .JCPSP. 2012;22 (12): 778-782
8. Raja IA, Vohra AH, Ahmed M. World J M. Neurotrauma in Pakistan. World J Surg 2001; 25:1230-7.
9. Rathore MF, Rashid P, Butt AW, Malik AA, Gill ZA, Haig AJ. Epidemiology of spinal cord injuries in the 2005 Pakistan earthquake. Spinal Cord 2007; 45:658-63.
10. Qureshi MA, Saleem M, Khan A, Raza A, Butt IA, Khan AS, et al. Spinal surgery in earthquake victims. Pak Armed Forces Med J 2006; 56:382.
11. Heckman JD, editors. Rockwood and Green's fractures in adults. 6th edition. New York: Lippincott Williams & Wilkins; 2006:p. 1402-33.
12. Kim HS, Park SK, Joy H, Ryu JK, Kim SW, Ju CI. Bone cement augmentation of short segment fixation for unstable burst fracture in severe osteoporosis. J Korean NeurosurgSoc 2008;44:8-14.
13. Liao JC, Fan KF, Chen WJ, Chen LH. Posterior instrumentation with transpedicular calciumsulphate graft for thoraco- lumbar burst fracture. Int Orthop 2009;33:1669-75.
14. Aebi M, Ett er C, Kehl T. Stabilization of the lower thoracic and lumbar spine the internal spine skeletal fixation system. Indication, technique, and first results of treatment. Spine 1987;12:544–51.
15. Bradford DS, Akbarnia BA, Winter RB: Surgical stabilization of fractures and fracture dislocation of the thoracic spine. Spine 1977; 2:85–196.
16. Whang PG, Vaccaro AR. Spinal Pedicle Fixation Revisited: The Role of X-rays and Other Surgical Factors. Spine 2006;31:717-21.

17. Alanay A, Acarolu E, Yazici M, et al. Short-segment pedicle instrumentation of thoracolumbar burst fractures: Does trans- pedicularintracorporeal grafting prevent early failure? Spine 2001; 26: 213–17.
18. Knop C, Fabian HF, Bastian L, et al. Fate of the transpedicular intervertebral bone graft after posterior stabilization of thora- columbar fractures. Eur Spine J. 2002; 11: 251–57.
19. Mahar A, Kim C, Wedemeyer M, Mitsunaga L, Odell T, John- son B, Garfin S. Short-segment fi xation of lumbar burst fractures using pedicle fixation at the level of the fracture. Spine 2007; 32: 1503–07.
20. Guven O, Kocaoglu B, Bezer M, Aydin N, Nalbantoglu U. The use of screw at the fracture level in the treatment of tho- racolumbar burst fractures. J Spinal Disord Tech. 2009; 22: 417–21.
21. Rengachary SS, Ellenbogun RG. Principles of Neurosurgery. China: Elsevier Health Sciences; 2005
22. Gertzbein SD: Scoliosis research society. Multicenter spine fracture study. Spine. 1992, 17: 528-540.
23. Verlaan JJ, Diekerhof CH, Buskens E, et al: Surgical treatment of traumatic fractures of the thoracic and lumbar spine: a systematic review of the literature on techniques, complications, and outcome. Spine. 2004, 29: 803-814.
24. Mohammad Salah Eldein Abd Elhafez, Mohammad Ibrahim Abulsoud, Mahmoud Moursy Saleem Moursy. Outcome of Pedicular Fixation of Unstable Dorsolumbar Fractures. (October 2019) Vol. 77 (5), Page 5570-5578
25. Joaquim AF, Daubs MD, Lawrence BD et al. (2013): The spine journal, retrospective evaluation of the validity of thoracolumbar injury and severity score. Spine J., 13 (12): 1760
26. Kanna RM1, Shett y AP1, Rajasekaran S2Posterior fi xation including the fractured vertebra for severe unstable thoracolumbar fractures. Spine J. 2015 Feb 1;15(2):256-64.
27. Waqar Alam, Faaiz Ali Shah, Roohullah Jan, Muhammad Ayaz Khan, AbdUllah Shah, Amer Aziz. Outcome of spine fi xation for unstable fractures at dorsolumbar junction including fractured vertebrae in pedicular screw fi xation. Pak J Surg 2018; 34(4): 333-33
28. Md. KamrulAhsan, ZabedZahangiri, M. A. Awwal, NazninZaman, Md. HamidulHaque and Abdullah Al Mahmud. Posterior fi xation including the fractured vertebra in short segment fi xation of unstable thoracolumbar junction burst fractures. Bangabandhu Sheikh Mujib Medical University Journal. Vol 9, No 2 (2016):81-87
29. Kanna RM1, Shett y AP1, Rajasekaran S2Posterior fi xation including the fractured vertebra for severe unstable thoracolumbar fractures. Spine J. 2015 Feb 1;15(2):256-64
30. Sapkas G, Kateros K, Papadakis SA (2010): Treatment of unstable thoracolumbar burst fractures by indirect reduction and posterior stabilization: short segment versus long- segment stabilization. The Open Orthopaedics Journal, 4: 7-13.