



A Study on Management of Dorso-Lumbar Spinal Injuries with Posterior Instrumentation

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Abstract

The spinal traumas are common and leading problem in orthopedic practice. The individuals are at risk of high energy trauma in the modern era and spinal trauma is commonly associated with it. Thoraco-lumbar fractures are serious injuries of concern, if left untreated may result in marked morbidity and disability to the patient.

Methods: *This prospective study was undertaken in the Department of Orthopedics in MGM hospital, attached to Kakatiya Medical College, Warangal. Twenty adult patients with acute thoracolumbar injuries who gave the consent for surgery admitted during the study period were included as study sample. Patient selections were according to the inclusion and exclusion criteria and were surgically treated with pedicle screw and rod system.*

Results: *The most common vertebrae involved in this series were between T11 - L2 to the extent up to 75%. In 75% of the patients, the fractures were reduced by using polyaxial implants and in 25% of the patients both monoaxial and polyaxial implants were used. The average regional angle during pre operative stage was $16.5^{\circ} \pm 5.02^{\circ}$ and $4.45^{\circ} \pm 4.15^{\circ}$ during 1 year post operative period. There was a significant difference between pre-operative and post-operative regional angles. The advantages are restoration of vertebral body height, mean regional angle, and mean wedge angle in thoracolumbar fractures.*

Conclusions: *The findings of this study show that pedicle screw-rod instrumentation is the best system used in treatment of vertebral fractures. Neurological recovery was seen significantly when all cases with neurological deficits were clubbed together.*

Keywords: *Dorso-Lumbar Spinal Injuries, Pedicle Screw and Rod System.*

Introduction

Orthopedicians are often faced with patients of spinal trauma. The incidence of it is on rise in modern era due to increased RTA ^[1-3]. The thoracolumbar injuries have peak incidence for

patients under age of 30 years and also it has greater frequency in geriatric patients thus exhibiting a bimodal distribution ^[4]. Thoracolumbar fractures are of serious concern since they can cause marked morbidity and

disability if left untreated. The overall incidence of fracture of spine is about 6% in trauma patients and 2.6% of patients also have some degree of neurological injury. These kinds of fractures may also be associated with sensory or motor disturbance including bladder, bowel functions, erectile dysfunction and kyphosis. If the patients are non-ambulatory it can result in bed sores and increased risk of pulmonary infections^[5]. The trauma of thoracolumbar is greater in thoracolumbar junction especially between T12-L5^[6]. 15 -20% of fractures of thoracolumbar level are also associated with neurological injuries^[7]. The older method of treatment by recumbency for 8 -12 weeks is usually accompanied with complications and requires skilled personnel and increases the cost to the patients^[8-10]. In resource limited countries like India these kind of management is difficult and victims are neglected. Hence the goal of treatment of every spinal injury is to restore the patient function to maximum as possible with disability free life. Spinal column injuries the treatment is focused on protecting the uninjured neural tissues and maximizing recovery of injured tissues. Surgical stabilization of spinal column can prevent further mechanical injury to the damaged cord tissue. Different surgical approaches such as anterior, posterior, lateral or antero-posterior approaches are used. The posterior approach is usually the safe alternative for surgery and spine can be stabilized by posterior approach with many available instruments^[11]. Harrington hook-rod construction and its modifications have been extensively studied however the disadvantage it spans for 5-6 spinal segments. The newer options with pedicle screw plate or rod construction which needs shorter segment immobilization have gained increased usage^[12]. The variable screw placement system [VSP] is more rigid the screw is passed through the force nucleus of vertebrae. This is a point through which the superior facet, the inferior facet, the lamina, the pedicle and transverse process channel all posterior forces that are transmitted to the body. With this background we

in the present study tried to study the outcome of surgical treatment of unstable thoracolumbar spine injuries with or with decompression with pedicle screw and rod instrumentation. The clinical outcome were recorded with Denis work and pain scale.

Material and Methods

This is a prospective interventional study undertaken in the Department of Orthopedics. Adult patients with acute thoracolumbar injuries admitted to MGM hospital attached to Kakatiya Medical College, Warangal were included in this study after obtaining their informed, valid written consent. This study was undertaken from July 2017 to September 2019. Clearance from institutional ethical committee was obtained before initiating the study. A total of n=20 adult patients with acute thoracolumbar injuries who gave the consent for surgery admitted during the period of study were included as study sample. A detailed history was obtained for evaluating the mode of trauma, ASIA grading, sensory level and to check for any spinal deformity. They were clinically and radiologically evaluated for ensuring the thoracolumbar fracture. Plain X - ray in antero-posterior and lateral views were obtained and the instability of the spine was confirmed using White and Punjabi criteria of spinal instability^[13]. Laboratory investigations were carried out before surgery. MRI/CT scan was conducted to evaluate the relationships and instability of the spine. Those patients with unstable spine were explained about advantages and disadvantages of the surgery. The inclusion and exclusion criteria were as follows;

Inclusion Criteria

1. Traumatic thoracic, lumbar or thoracolumbar fractures.
2. Unstable fractures with or without neurological deficits.
3. Patient with complete spinal cord injury for the purpose of stabilization.
4. Contagious fracture of thoracolumbar spine.

Exclusion Criteria

1. Patients not willing for surgery.
2. Patients medically unfit for surgery.
3. Traumatic cervical fracture with traumatic quadriplegia.
4. Patient age more than 60 years.

Position the patient is prone on a padded spinal operating table on a 4 poster frame encouraging more lordosis. A posterior midline incision was made centering over the involved spinal unit and extending 2 levels above and below. The incision was deepened to expose posterior elements of the vertebrae one level above and one below the injury. The dissection was carried laterally to the tips of the transverse processes, maintaining meticulous haemostasis. The pedicles were identified, by identifying the point of convergence of a horizontal line along centre of transverse process and vertical line along centre of superior facet. Pilot hole done with Trocar and blunt Kirschner wires placed into the pedicle and position confirmed by intensifier in both AP and Lateral views. Pedicle probe was passed in pedicle at the region of least resistance and pedicles were tapped with 5.5mm/6.25 mm taps depending on size. Rod contouring template placed in the slots of implants which are shaped to reflect natural curve of spine. A 10 mm rod was selected and bends using cam action bending instrument to match template. The rod is held with self locking long rod holder and aligned and placed in the slots of the implants and fixed by inserting the screw. Using angled spreader, distraction is applied by placing the prongs of spreader straddling the rod and in contact with the head of the implant. Adequate distraction is applied for correction of deformity and the screw is tightened with long hex screw driver. A thorough haemostasis was achieved and the wound was closed in layers over drain. Clean dressing was applied. Post operative IV antibiotics (third generation cephalosporin + aminoglycoside) for 5 days. Oral antibiotics were then continued till the suture removal. Physiotherapy was started from first day post operatively. Patients were allowed to roll from

side to side from the second day. Sutures were removed on 11th day. They were allowed to sit up and were mobilized on a wheel chair after application of thoracolumbar belt on third or fourth post operative day. Neurological status was watched and Patients were allowed to wear spinal jacket for about 6 weeks. Those with incomplete neurological deficits were given physiotherapy and gradually ambulated. All the patients were followed up in OPD every 4th week after surgery for 6 months and at each follow up clinical, radiological & neurological examination was done to assess spinal stability. At the end of 6 month of follow up the patients were evaluated clinically by using Denis work and pain scale. Evaluation of neurological status with ASIA grading and radiological assessment of deformity was done at the time of admission, 12th week, 24th week and 1 year.

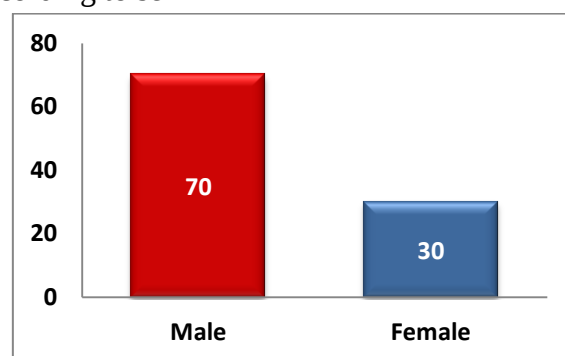
Results

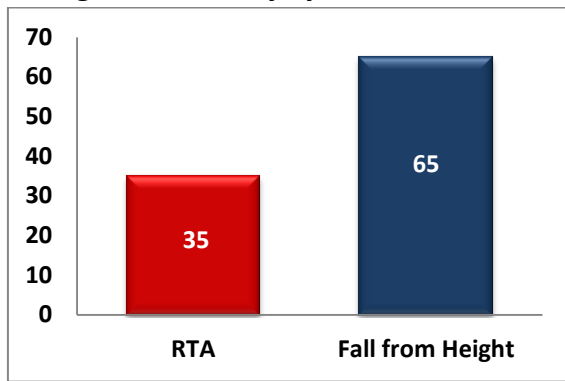
Table 1: Distribution of the study group according to age

Age Group	No	%
Less than 20 years	1	5
21 - 30 years	3	15
31 - 40 years	7	35
41 - 50 years	8	40
More than 50 years	1	5
Total	20	100

40% of the patients are between 41-50 years of age, 70% of study group patients are males and 30% of are females. T12-L2 Vertebral Involvement is 80%. Mode of Injury in 65% of the patients is fall from height

Graph 1: Distribution of the study group according to sex



Graph 2: Distribution of the study group according to mode of injury**Table 2:** Distribution of the study group according to vertebral involvement

Vertebra	Frequency	Percent
T7	1	5
T8	1	5
T11	1	5
T12	4	20
L1	7	35
L2	5	25
L3	1	5
Total	20	100

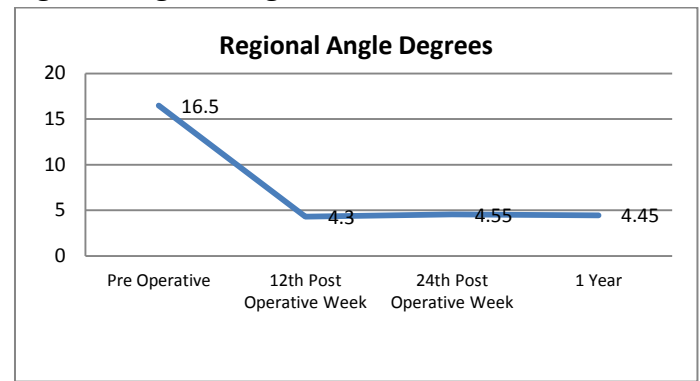
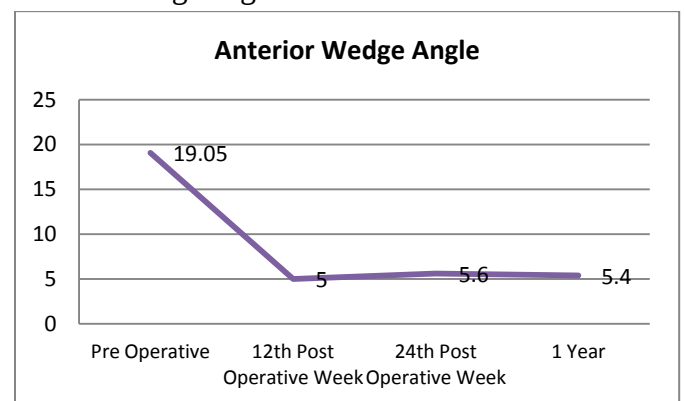
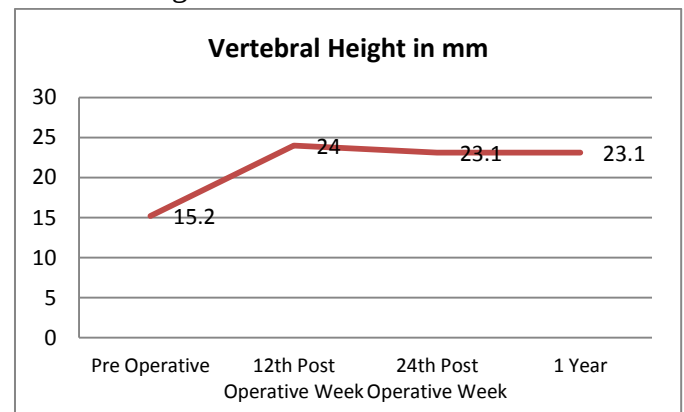
The distribution of type of fractures revealed compression fractures were present in n=11(55%) of cases, Distraction fractures in n=6(30%) cases and rotational fractures in n=3(15%) of cases. The mean duration of injury in patients was 2.6 days. The mean duration from injury to surgery was 5.55 days and Mean duration of stay in the hospital was 29.5 days. The duration of injury to surgery was less than 2 days in n=15 (75%) of patients and more than 2 days in n=5(25%) of patients.

Table 3: Mean Duration of injury, Injury to surgery and stay

Duration of injury, Injury to surgery and stay [days]	Mean $\pm$ SD
Duration of Injury	2.60 $\pm$ 0.5
Duration of Injury to surgery	5.55 $\pm$ 0.8
Duration of stay	29.5 $\pm$ 10.5

Table 4: Distribution of study group according to implants used

Type of implants	Frequency	Percent
Polyaxial	15	75.0
Monoaxial + polyaxial	5	25.0
Total	20	100

Graph 3: Distribution of study group according to regional angle in degree**Graph 4:** Distribution of study group according to anterior wedge angle**Graph 5:** Distribution of study group according to vertebral height in mm**Table 5:** Distribution of study group according to ASIA Grade

ASIA grade	Pre Operative n (%)	12 th Post operative week n (%)	24 th Post operative week n (%)	1 year n (%)
A	3 (15)	2 (10)	1 (5)	1 (5)
B	1 (5)	0 (0)	0 (0)	0 (0)
C	6 (30)	5 (25)	1 (5)	1 (5)
D	7 (35)	6 (30)	6 (30)	4 (20)
E	3 (15)	7 (35)	11 (55)	14 (70)

Table 6: Distribution of study group according to complications

Complications	Frequency	Percent
Nil	17	85.0
Screw fracture	2	10
Screw misplacement	1	5.0

Table 7: Distribution of study group according to Denis work scale & Denis pain scale

Denis Scale	Frequency	Percent
Denis work scale		
W1	2	20.0
W2	7	35.0
W3	6	30.0
W4	5	25.0
Total	20	100
Denis pain scale		
P1	9	45.0
P2	6	30.0
P3	4	20.0
P4	1	5.0
Total	20	100

Discussion

The present study was undertaken in the department of Orthopedics MGM hospital and Kakatiya Medical College, Warangal, Telangana. N=20 patients with thoracolumbar fractures were included in the study. The mean age of the cases in the study was 38 years and 70% of the cases in this study were male and 30% were females. Sasso RC et al;^[14] in their study found spinal trauma cases were 77% males and 23% females with the mean age of 34 years. Other similar studies have found the average age of 31 years with male predominance in spinal fractures. The mode of injury in the cases of this study showed 70% of patients had fall from height. Alvine GF et al;^[15] noted it as 52% and Razak M et al;^[16] noted 69% of the injuries due to fall from height. In the present study 55% of patients had Type A fractures, 30% had Type B fractures and 15% had Type C fractures^[17]. Nasser et al;^[18] have also similar percentage of involvement in spinal fractures. In the current study the commonly involved vertebrae was T11-L2 to the extent up to 75%. Alvine GF et al;^[15] noted to the extent of 70%, Sasso RC et al;^[14] noted to the extent up to 80% and Razak M et al;^[16] noted up to 92% of the

fractures were at the level of T11 - L2. In the current study the mean duration from injury to admission to the hospital was 2.6 days and the duration of injury to surgery was 5.55 days. The mean duration of hospital stay was 29.5 ± 6.5 days. Sasso RC et al;^[14] in their study have found the average time interval between injuries to surgery was 4 days and the mean duration of hospital stay was 16 days. Razak M et al;^[16] have found the mean duration to surgery as 5.6 days and the mean duration of hospital stay were 24 days. In our study we had operated 25% of patients with 4 days of injury and 75% were operated after 4 days of injury. The majority of patients (75%) the fractures were reduced by using polyaxial implants and rest of the patients both types monoaxial and polyaxial implants were used. The Mean regional angle in pre-operative stage was $16.5^{\circ} \pm 5.02^{\circ}$. It was reduced to $4.45^{\circ} \pm 4.15^{\circ}$ during 24th post operative week. Nasser MG et al; have shown that Kyphotic angle was 23.6° preoperatively and 7° post -operatively and 11.5° at last follow-up. In a similar study by Alvine GF et al;^[15] found that the sagittal plane angulation was 12° pre-operatively and $^{\circ}$ post operatively and 6° at follow up. Razak M et al;^[16] have shown that the average kyphotic angle was 20° pre operatively, 7° post operatively and 9° at latest follow up. The ASIA grading for neurological state^[19] was done during the pre-operative period. We in this study found were graded 15% as grade A, 5% as grade B, 30% as C, 35% as D and 15% as Grade E. During last follow up, grade A was 5%, grade B was 0%, C was 5%, D was 20% and E was 70%. Nasser R et al;^[18] have found that patients with neurological deficits show at least one grade improvement at the latest follow up. Similar findings of improvement in grade I at least have been shown by other studies^[14, 16]. Similarly Alvine GF et al;^[15] have noted that neurological improvement was found in 50% of cases and 40% improving with grade I and 20% with grade II and had decrease in neurological levels. In this study 85% of patient did not show any complications, screw fracture and screw

misplacement was found in 15% of patients. Razak M et al;^[16] in their study have found 2 cases of hardware loosening with 3 misplaced pedicle screws. The present study also showed that 20% of patients were able to return to their work and 35% were able to return to previous employment with some restriction, 30% were unable to fulfill the previous employment needs but worked for full time in new employment. 25% were unable to return to the fulltime previous work. 45% of patients had no pain, 30% patients reported with occasional minimal pain with no need for medication, 20% had moderate pain with occasional needs for medication 5% had moderate to severe pain affecting the daily activities.

Conclusion

The present study finds that pedicle screw-rod instrumentation is one of the best systems used in treatment of vertebral fractures. The advantages are restoration of vertebral body height, mean regional angle, and mean wedge angle in thoracolumbar fractures. The number of complication is also minimal with this system. Neurological recovery was better when all cases with neurological deficits were clubbed together.

Conflict of interest: None

Source of support: Nil

Ethical Permission: Obtained

References

1. Jens R. Chapman Sohail K Mirza H. Rockwood, Green Fractures in Adults. Lippincott Williams and Wilkins, 5th edition; Vol. 2: 1295 - 1466.
2. Alpentaki K, Bano A, Pasku D, Mavrogenis AF, Papagelopoulos PJ, et al. Thoracolumbar burst fractures: a systematic review of management. Orthopedics 2010;33: 422-429.
3. Oner FC, Wood KB, Smith JS, Shaffrey CI. Therapeutic decision making in thoracolumbar spine trauma. Spine (Phila Pa 1976) 2010; 35: S235-244.
4. Blick EM. Source of orthopedics, Baltimore, Lippincott Williams and Wilkins, 1948;236 - 238.
5. Burney RE, Maio RF, Maynard F. Incidence, characteristics, and outcome of spinal cord injury at trauma centres in North America. Arch Surg 1993; 128(5):596-99.
6. Riggins RS. Kraus JF. The risk of neurological damage with fractures of the vertebrae. Journal of Trauma 1977; 126-133.
7. Benson DR. Keenen TL. Evaluation and Treatment of Trauma to the Vertebral Column. Journal of Bone and Joint Surgery 1990; 39: 577-588.
8. Leventhal MR. Fractures, dislocations, and fracture dislocations of spine. Campbell's operative orthopedics; Edited by S. Terry Canale; 9th Edn, 1998, Vol 3:2747-2779.
9. Guttman L: Spinal cord injuries - comprehensive management and research. Oxford: Blackwell Scientific publications: 137-176, 1976.
10. Watson - Jones R: Fractures and Joint Injuries. Ed. J.B. Wilson, Edinburgh: Churchill Livingstone: 789-792, 1982.
11. Robert W. Bucholz, James D. Heckman: Rockwood and Greens Fractures in adults"; Lippincott Williams and Willkins; 5th edition; Vol 2; 1293-1466, 2001.
12. Francaviglia N, Bragazzi R, Maniello M, Berucci C. Surgical treatment of fracture of thoracic and lumbar spine via the transpedicular route. British Journal of Neurosurgery 1995; 9(4): 511-18.
13. White AA, 3rd, Johnson RM, Panjabi MM, Southwick WO. Biomechanical analysis of clinical stability in the cervical spine. Clin Orthop Relat Res.1975;109: 85-96.
14. Sasso RC, Cotler HB, Reuben JD: Posterior Fixation of Thoracic and Lumbar Spine Fractures using DC Plates and

- Pedicle Screws. Spine 1991; 16:S134-S139.
15. Alvine GF, Swain JM, Asher MA, Burton DC. Treatment of thoracolumbar burst fractures with variable screw placement or Isola instrumentation and arthrodesis: case series and literature review. J Spinal Disord Tech. 2004; 17(4):251-264.
 16. Razak M, Mahmud MM, S.A. Hyzan MY, Omar A, Short segment posterior instrumentation, reduction and fusion of unstable thoracolumbar burst fractures - a review of 26 cases, Med J Malaysia. 2000; 55 Suppl C: 9 - 13.
 17. Maximilan Reinhold, Laurent Audige, Klaus John Schnake, Carlo Bellabarba, Li Yang Dai, F Cumhuri Oner. AO spine injury classification system: a revision proposal for the thoracic and lumbar spine. Eur Spine J 2013; 22(10):2184-01.
 18. Nasser R, Yadla S, Maltenfort MG, Harrop JS, Anderson DG, Vaccaro AR, Sharan AD, Ratliff JK. J Neurosurg Spine. 2010 Aug; 13(2):144-57.
 19. Burns S, Biering-Sørensen F, Donovan W, Graves D, Jha A, Johansen M, Jones L, Krassioukov A, Kirshblum, Mulcahey MJ, Schmidt Read M, Waring W. International Standards for Neurological Classification of Spinal Cord Injury, Revised 2011. Top Spinal Cord Inj Rehabil 2012;18(1):85-99.