



## Socio-Demographic Characteristics, Classification, Management, Complication and Implant Status of Patients Undergoing Operative Treatment for the Thoraco-Lumbar Fracture at Tertiary Care Hospital

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**Abstract:** **Background:** Present study to evaluate the Socio-demographic characteristics, classification, management, complications and implant status among cases of Thoraco-lumbar fracture treated with short segment stabilization of thoraco-lumbar spine with or without one screw fixation in fracture vertebrae. **Methodology:** The present study included both prospective and retrospective patients of thoraco-lumbar injury admitted, operated or came for follow up in Department of Orthopedic Surgery at Indira Gandhi Medical College, Shimla between May 2019 to May 2020. They were divided in 2 groups; Group A included the patients with 4 screws while group B included the patients with 5 screws. Socio-demographic history was assessed and a thorough clinical & neurological examination was done for classification and other parameters. **Results:** The study included a total of 108 patients. Among them 64 were prospective and 44 were retrospective patients. 28 patient's fracture (Group A) were stabilized with 4 screw and 80 (Group B) were stabilized with 5 screws. There were 57 males and 51 females. Mean age was higher in group A (48.14 ± 4.35) as compare to group B (44.88±12.89). Fall from height was the most common mode of injury in both groups, group A (n=27; 96.4%) and group B (n=66; 82.5%) followed by Road Accidents. Majority of the patients were operated within 5 days of admission in both groups 17(60.7%) in group A and 58 (60.7 %) in group B. Dorsolumbar (D9 – L2) fractures were higher in both groups, in group A were 15 (53.6%) & 60 (75%) in group B. Majority of the fracture (N=51) were of A3.2 type followed by A3.3 (N = 28). Group A had a mean TLICS of 5.03±0.51 and Group B with 5.26±0.71. As per AO classification, majority of the patients had fracture type A3.2(N=51) followed by A3.3 (N = 28). Similarly, according to ASIA grading, most of the patients(N=75) were in grade D in both groups pre-operatively and in grade E (N=58) post-operatively as well as after 9-months follow up (N=91). According to Denis scale, majority had occasional minimal pain with no need of medication & Returned to sedentary work, without weight restriction at 9 months of follow up. In both groups maximum patient (Group A; 26, 92.8%), (Group B; 77, 96.2%) had no complication and Implant status was intact in most of the patients in both groups. **Conclusion:** Majority of patients were males, aged above 50 years, injured due to Fall from height, operated within 5 days of admission, had Dorsolumbar (D9 – L2) fractures and of A3.2 type. There was no statistically difference according to TLICS, AO classification, ASIA grading & Denis scale in both groups. Majority had no complication and had intact Implant status.

**Keywords:** Socio-demographic characteristics, classification, management, complication and implant status, thoraco-lumbar injury.

### INTRODUCTION

Thoraco-lumbar injuries account for a major chunk of the spine injuries and contribute about 30-50 % of the total<sup>1</sup>. These injuries are mostly associated with high energy trauma (MVA & fall from height), which can be debilitating to the patients and require surgical correction<sup>2</sup>.

About one-fifth of the patients with Thoraco-lumbar fracture have an associated neurological injury<sup>3</sup>.

The Thoracic and lumbar spine injuries are classified by various classification system like Denis system which classify it on the basis of stability and mechanism, AO system which classify injury on the basis of patho-morphological characteristics, thoracolumbar injury classification severity score (TLICS) which focussed on 3 key parameters to reflect the stability of disrupted spinal column namely the morphology of the injury; the integrity of the posterior ligamentous complex; and the neurologic status of the patient. The American Spinal Injury Association (ASIA) impairment scale or AIS describes a person's functional impairment as a result of a Spinal Cord Injury.<sup>4-11</sup>

The aim of surgery in these fractures include decompression of the neural components, fracture reduction, and providing a rigid fixation, and rehabilitation of the patient. Short-segment spinal instrumentation has been beneficial in the management of thoracolumbar spinal fractures for better correction of kyphotic deformity with greater initial stability, early painless mobilization, and indirect decompression of the spinal canal.<sup>12-13</sup>

Pedicle screw instrumentation provides less surgical exposure, correction of deformity and better stabilization of one motion segment above and below fracture. The combined screw fixation technique requires insertion of 1 screw into the fractured vertebrae, which can produce a forward driving force to enhance the reduction and reshaping and can be used to directly raise the end plate to assist in the restoration of the compressed vertebral height.<sup>12-13</sup>

The present study was designed to evaluate the Socio-demographic characteristics, classification, management, complications and implant status among cases of Thoraco-lumbar fracture treated with short segment stabilization of thoracolumbar spine with or without one screw fixation in fracture vertebrae.

## **AIMS & OBJECTIVES**

To evaluate the Socio-demographic characteristics, classification, management, complications and implant status among cases of Thoraco-lumbar fracture treated with short segment stabilization of thoracolumbar spine with or without one screw fixation in fracture vertebrae.

## **PATIENTS AND METHODS**

**Study Design-** It was a Cross-sectional hospital based study.

### **Study Area:**

The study was carried out in the Department of Orthopedic Surgery at Indira Gandhi Medical College, Shimla.

**Study Duration-** Between May 2019 to May 2020.

### **Study Population:**

A total of 108 patients with TLISS score of more than 4 were recruited in the study which include 44 retrospective patients who were operated for thoracolumbar fracture within 2 years before May 2019 & came for the follow-up of in the OPD and 64 patients who were operated between May 2019 to May 2020. All the patients with stable thoracolumbar fracture, comorbidities, and multiple level fracture were not included in the study.

### **Data Collection:**

Detailed socio-demographic history was assessed and clinical examination & neurological charting of all patients was done.

### **Operating Procedure:**

A posterior midline incision was given centering the affected vertebrae. Posterior elements were exposed subperiosteally by reflecting the erector spinae muscle laterally to the facet joint and just base of transverse processes distal to proximal, one level above and one level below the level of decompression. Point of insertion of screws was identified and cortical bone nibbled with a bone nibbler. A blunt awl was inserted into the pedicle and advanced through the pedicle. All the entry point were made where pedicular screws insertion were identified with probe. All the entry point checked with pedicular feeler for all four intact walls of pedicle (medial, lateral, superior & inferior). Adequate length and diameter screws are inserted as per direction and position of pedicular awl. Adequate length of rod selected and bend according to the curvature of spine. Rod was stabilised over the pedicular screw and blocker in top loading screw. Laminectomy was done in case where canal diameter is decreased more than one third and patient had neural deficit. Dural tear if found was repaired with 3-0 silk with continuous stitches. Gauge count was done before initiation of closure. Negative suction drain of 16 G was placed in the wound over the gel foam. Erector spinae muscle and overlying fascia was sutured. Superficial and thoracolumbar fascia closed meticulously. Injection vancomycin 1gm infiltrated locally in to wound. Subcutaneous sutures were applied. Negative suction secured with skin with No 1 silk cutting body. Skin staplers were applied. Post-operative routine lateral and anteroposterior radiograph were obtained to access the placement of pedicle screws and rods.

### **Operation Definition:**

#### **A) AO Classification**

1. Type A: comprises axial compression fractures affecting the vertebral body
  - a) Subtype A1: includes fractures with impaction of spongy bone without fragmentation
  - b) subtype A2: includes fractures with sagittal or coronal shearing

- c) subtype A3: consists of cases of partial or total comminution with or without retropulsion of fragments to the spinal canal. Subtype A3 can also be stratified as:
- i. A3.1, comprising incomplete burst fractures
  - ii. A3.2, burst with shearing
  - iii. A3.3, complete burst.
2. Type B: consists of fractures due to flexion-distraction.
3. Type C: consists of any fracture mentioned above with a superimposed rotational component.

**B) Denis Classification**

- a) Functional pain scale according to Denis. Score Criteria of the pain scale
- 1: No pain
  - 2: Minimal pain, without using medication
  - 3: Moderate pain, with occasional use of medication
  - 4: Moderate to severe pain, with constant use of medication
  - 5: Severe pain, with chronic use of medication
- b) Functional work scale according to Denis. Score Criteria of the functional work scale
- 1: Returned to heavy work
  - 2: Returned to sedentary work, without weight restriction
  - 3: Returned to work, but changed activity
  - 4: Returned to work, but only part-time
  - 5: Incapable of working

**C) Thoracolumbar injury classification and severity score (TLICS):Parameter were**

**a) Morphology: Morphology of the injury is divided into three patterns:**

- Compression
  - Wedge Compression Fracture: 1 Point
  - Burst Fracture: 2 Points
- Translation/Rotation: 3 Points
- Distraction: 4 Points

**b) Posterior Ligamentous Complex**

- Intact: 0 Points
- Suspected Injury Or Indeterminate: 2 Points
- Injured: 3 Points

**c) Neurologic Involvement**

- Intact: 0 Points
- Nerve Root: 2 Points
- Cord/Conus Medullaris (Incomplete): 3 Points

- Cord/Conus Medullaris (Complete): 2 Points
- Cauda Equina: 3 Points

**D) ASIA Impairment Scale**

Grade A: There is no motor or sensory function left below the level of injury.

Grade B: Sensory function, but not motor function, is preserved below the neurologic level (the first normal level above the level of injury) and some sensation is preserved in the sacral segments S4 and S5.

Grade C: Motor function is preserved below the neurologic level, but more than half of the key muscles below the neurologic level have a muscle grade less than 3 (i.e., they are not strong enough to move against gravity).

Grade D: Motor function is preserved below the neurologic level, and at least half of the key muscles below the neurologic level have a muscle grade of 3 or more (i.e., the joints can be moved against gravity).

Grade E: All motor and sensory functions are unhindered.

**Statistical Analysis**

Data was collected and entered in Microsoft excel spread sheet, cleaned for errors and analyzed with Epi Info V7 Software with appropriate statistical test in terms of frequencies, percentage, mean standard deviation etc.

**RESULTS**

A total of 108 patients were recruited in the study. Group A included the patients with 4 screws while group B included the patients with 5 screws. Group A consisted of 28 patients while group B had 80 patients.. 10 patients (35.7 %) in group A and 54 (67.5%) patients in group B were prospective cases. In retrospective group, 18 cases were in group A and 26 (32.5 %) were in group B. The age range of the participants was from 16 to 78 years. 12 (42.8%) patients in group A and 30 (37.5%) in group B were aged above 50 years. In our study mean age was higher in group A (48.14 ± 4.35) as compare to group B (44.88±12.89), with range (22-78) in group A and (18-65) in group B. In our study there were total 57 males and 51 females. Males were higher in group A (n=19; 67.8%) while females were higher in group B (n=42; 52.5 %) (Table-1).

**Table 1:** Distribution of patients according to groups & Socio-demographic Variables

	Group A : 4 screws		Group B : 5 screws (one intermediate screw)	
	No.	%	No.	%
<b>Type of patients</b>				
Prospective	10	35.7	54	67.5
Retrospective	18	64.3	26	32.5
<b>Age group</b>				

16-30 years	5	17.8	16	20
31-50 years	11	39.2	34	42.5
51-70 years	12	42.8	30	37.5
Mean Age	48.14±4.35		44.88±12.89	
<b>Gender</b>				
Male	19	67.8	38	47.5
Female	9	32.2	42	52.5
<b>Total</b>	<b>28</b>	<b>100</b>	<b>80</b>	<b>108</b>

In our study of 108 patients, fall from height was the most common mode of injury in both groups, group A (n=27; 96.4%) and group B (n=66; 82.5%) followed by

Road Accidents. Majority of the patients were operated within 5 days of admission in both groups 17(60.7%) in group A and 58 (60.7 %) in group B. (Table-2)

**Table 2:** Distribution of patient according to Mode of injury & Interval between admission and surgery in both groups

Mode of injury	Group A (n=28)		Group B (n=80)	
	No.	%	No.	%
Fall	27	96.4	66	82.5
RSA	1	4.6	13	16.2
Other	0	0	1	1.2
<b>Interval between admission and surgery</b>				
0-5 days	17	60.7	58	72.5
6-10 days	10	35.7	20	25
11-20 days	1	4.6	2	3.2
<b>Total</b>	<b>28</b>	<b>100</b>	<b>80</b>	<b>100</b>

In Our study of 108 patients we observed that Dorsolumbar (D9 – L2) fractures were higher in both

groups, in group A were 15 (53.6%) & 60 (75%) in group B (Table-3).

**Table-3:** Fracture vertebrae level in both groups

Fracture vertebrae level	Group A (n=28)		Group B (n=80)	
	No.	%	No.	%
D3-D8	11	39.3	7	8.8
Dorso-lumbar junction (D9-L2)	15	53.6	60	75.0
L3-L4	2	7.1	13	16.2

Group A had a mean TLICS of **5.03±0.51** and Group B with **5.26±0.71**. The classification based on the AO system suggested that the majority of the patients had fracture type A3.2 (N=51) followed by A3.3 (N = 28), and A3.1 (N =19), type B1 (N=2), type

C (N=1). Similarly, according to ASIA grading, it was observed that most of the patients (N=75) were in grade D in both groups pre-operatively and in grade E (N=58) post-operatively as well as after 9-months follow up (N=91) (Table-4).

**Table 4:** Distribution of patient according to various classifications

Grading System	Group A (n=28)		Group B (n=80)	
	No.	%	No.	%
<b>TLICS score</b>	5.04±0.51		5.26±0.71	
<b>AO classification</b>				
A2	0	0	1	1.25
A3.1	4	14.2	15	18.7
A3.2	9	32.1	42	52.5
A3.3	12	42.8	16	20.5
A4	3	10.9	3	3.75
B1	0	0	2	2.5
C	0	0	1	1.25
<b>ASIA grading (Pre-Operative)</b>				
A	1	3.5	0	0
B	2	7.3	4	5.5
C	5	17.8	11	13.7
D	17	60.7	58	72.5
E	3	10.7	7	8.75
<b>ASIA grading (post-operative)</b>				
B	2	7.3	2	2.5
C	1	3.5	4	5.5
D	6	21.4	35	43.8
E	19	67.8	39	48.8
<b>ASIA grading (Final Follow-up at 9<sup>th</sup> month)</b>				

<b>B</b>	1	3.5	2	2.5
<b>C</b>	1	3.5	3	3.8
<b>D</b>	4	14.2	8	10
<b>E</b>	22	78.8	67	83.8
<b>Denis scale (9-months)</b>				
<b>Denis Pain scale</b>				
<b>P1</b>	11	39.3	22	27.5
<b>P2</b>	14	50.0	54	67.5
<b>P3</b>	3	10.7	4	5.0
<b>Denis Work scale</b>				
<b>W1</b>	12	42.8	27	33.7
<b>W2</b>	11	39.2	42	52.5
<b>W3</b>	3	10.7	9	11.2
<b>W4</b>	2	7.3	2	2.5

According to Denis scale, There was no difference in pain and work scale at 9-months between both groups, However in this study group A 11 (39.3%) and in group B 22 (27.5%) of patients had no pain, 50% in group A and 67.5% in group B had occasional minimal pain with no need of medication, 10.7% in group A and 5.0 % in group B had moderate pain with occasional need for medication. In group A 12 (42.8%) patients in

group A and 27 (33.7%) in group B were returned to heavy work, 11 (39.2%) patients in group A and 42 (52.5%) in group B Returned to sedentary work, without weight restriction, 3 (10.7%) patients in group A and 9 (11.2%) in group B Returned to work, but changed activity while 2 (7.3%) patients in group A and 2 (2.5%) in group B Returned to work, but only part-time at 9 months of follow up (Table-4).

**Table-5:** Distribution of patient according to Complications & Implant status in both groups

Complications	Group A (n=28)		Group B (n=80)	
	No.	%	No.	%
No complication	26	92.8	77	96.2
Bed Sore	1	3.6	2	2.2
Paralytic ileus	1	3.6	0	0
Superficial infection	0	0	1	1.2
<b>Implant status</b>				
Intact	25	89.3	79	98.5
Broken	3	10.7	1	1.5

In both groups maximum patient (Group A; 26, 92.8%), (Group B; 77, 96.2%) had no complication, bed sore were observed in 1 patient in group A & 2 patient in group B, paralytic ileus was observed in 1 patient in group A and superficial wound infection was observed in one patient in group B which was managed with daily dressing and intravenous antibiotics. Implant status was intact in most of the patients in both groups, however 3 (10.7%) screw were broken in group A and 1(1.5%) screw were broken in group B (Table-5).

## DISCUSSION

Present study included patients undergoing operative treatment for the thoracolumbar fracture in the Orthopedics Department of Indira Gandhi Medical College, Shimla. Recruited patients had TLICS score of 4 or more and were operated with Pedicle Screw fixation which should be done as early as possible to help in good nursing care and mobilization of the patient and to prevent deterioration of the neurological status. Pedicle screw fixation via posterior approach which was the technique employed in the present study has been widely used for most thoracolumbar fractures owing to its three-column fixation and satisfactory clinical outcome as it provides adequate exposure and direct visualization.<sup>14-16</sup>

The mean age of the participants in the present study was (48.14±4.35) in group A and (44.88±12.89) in group B, in the studies in the past this has been seen that the age range of these kind of injuries is present in the range of 30 to 50 years, studies by Jei wei Tian *et al.*,<sup>17</sup> Guven *et al.*,<sup>18</sup> Farrokhi *et al.*,<sup>19</sup> Butt M *et al.*,<sup>20</sup> and have all findings similar to our study where the age is in the similar range. The reason of the age range can be attributed to the risk of accident involving RTA<sup>21</sup> or impact injuries which is generally present in this age group. Similar assumption can be made about the sex distribution of the study group which shows a male preponderance.

In our study of 108 patients, total 57 were males in both group A and Group B and 51 were females in both groups. Male were higher in group A (N=19) 67.8% while female were higher in group B (N= 42) 52.5%. The observation in the study are comparable to numerous studies established in literature, they include male preponderance & this reflect the fact that most outdoor activities are performed by male, so they are more prone for injuries.<sup>19-21</sup>

Most common type of mode of injury in our study was fall from height, in both group A shows (96.4%) and in group B (82.5%) followed by road side accident,

4.6% in group A and 16.2 % in group B. More than 90 % of patient had mode of trauma as fall from height which may be due to hilly terrain in the state. Modi *et al.*,<sup>20</sup> found that majority of fracture occurred from road side accident are most common cause in Western World. In Himachal Pradesh with hilly terrain most common cause is fall from height.

The level of the injury in the present study was mainly in the dorso-lumbar region, all the historical data and the studies suggest the proclivity if the dorso-lumbar spine for the injuries in the spinal fracture, previous studies by Alvine *et al.*,<sup>23</sup>, Sasso *et al.*,<sup>24</sup> and Razak *et al.*,<sup>25</sup> had similar findings in their study.

The neurological recovery was assessed using ASIA scale in the post-operative phase with encouraging results in nearly all the patients, there was no neurological deteriorating. Out of all 108 patients 101 had good neurological recovery the only patients with no signs of neurological recovery were patients with complete cord injury. Previous studies by other researchers also puts the neurological recovery in the range of 80 to 90% of the patients<sup>26,27,28</sup>, the recovery depends on the factors like extent of the spinal cord involvement, level of injury, neurological grade on the admission. A complete SC injury has less probability of recovery than an incomplete injury. The present study did not delve into the details of the causes of other dependent variables in the patients who did not recover but it can be assumed that the major accidents can be an important contributing factor in the non-recovery as these tends to cause additional cord damage which hinders the chances of recovery in these patients<sup>29</sup>.

Denis scale was used to assess the pain and functionality of the patients after operation, there was no significant difference in the reduction of pain in the two groups, however, the functionality showed a marked regain in the post-operative period with majority of patients returning to their old job, few of the patients who were involved in heavy work were ergonomically relocated to the new job with less physical labour, such patients were 3 in the group A and 9 in group B. Previous study using the Denis scale also found that the pain reduction was not significantly different in the groups<sup>30-31</sup>.

The complications noticed in the study population were very less and the incidence were comparable to other studies in the past by Razak *et al.*,<sup>25</sup> and Khan *et al.*,<sup>32</sup>, there was no neurological deterioration, apart from this the complications which were encountered were paralytic ileus, pressure sore, superficial wound infection and implant failure which was noted more in group A (10.7%) as compared to only 1.5% in Group B. the studies by Murlidhar *et al.*,<sup>33</sup>, Sanderson *et al.*,<sup>34</sup>, Jindal *et al.*,<sup>35</sup> and Zhang *et al.*,<sup>36</sup> have all put the implant failure in the range of 4-10%.

In our study of 108 patient total 4patients had screw breakage, was no neurological worsening in any these patients. The high rate of instrumentation failure in the group A ( 3 out of 28; 10.7 %)when compared with the group B (1 out of 80; 1.5%), (p - 0.053),Zhang C *et al.*,<sup>36</sup> reported 0.63% implant failure in group A( AFV - Adding fracture vertebrae) & 7.63% group B (CFV – cross fracture vertebrae), Muralidhar BM *et al.*,<sup>33</sup> showed 10 % of failure rate, Sanderson *et al.*,<sup>34</sup> showed 14 % of implant failure and Jindal N *et al.*,<sup>35</sup> showed 4.2 % of implant failure.

## CONCLUSION

Majority of patients were males, aged above 50 years, injured due to fall from height, operated within 5 days of admission, had Dorsolumbar (D9 – L2) fractures and of A3.2 type. There was no statistically difference according to TLICS, AO classification, ASIA grading & Denis scale in both groups. Majority had no complication and had intact Implant status.

Posterior decompression and short segment pedicle screw fixation with intermediate screw in fracture vertebrae has emerged as the treatment of choice for patients with fracture of the thoracolumbar spine as it is associated with better reduction of the fractured vertebrae and lower implant failure rate in addition to fewer instrument failures, without additional complications. Thus, insertion of intermediate screws into pedicle of the fractured thoracolumbar vertebra when considering a short segment posterior fixation is highly recommended.

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