



STUDY OF FUNCTIONAL OUTCOME OF DORSOLUMBAR SPINE FRACTURES TREATED WITH MINIMAL INVASIVE SPINE SURGERY

Orthopaedics

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ABSTRACT

Introduction – Spine disorders including spinal instability, bone spurs, ruptured discs, scoliosis, or spinal malignancies, minimally invasive spine surgery (MIS) aims to stabilize the vertebral bones and spinal joints as well as relieve pressure on the spinal nerves. **Aims & Objectives** - To study the functional outcome of dorsolumbar spine fractures treated with minimal invasive surgery, to study complications of post minimal invasive spine surgery and the course of recovery and physical activity in the study patients, also to evaluate the neurological status post minimal invasive spine surgery. **Materials And Methods** – 35 patients were included in the study. Inclusion and exclusion criteria was followed. Routine investigations were carried out. Along with it radiographic examination, CT scan & MRI of cervical / thoracic / lumbar spine were also taken based on history. **Results** - The mean VAS In the present study group was 8.40 at presentation which came down to 1.65 at 6 month follow up which was statistically significant (p value= <0.001). The mean ODI score in the present study was 61.00% preoperatively which gradually decreased to 24.3% at the end of 6 months which was statistically significant (p <0.001). According to the modified Mcnab criteria at the final follow up at 6 months, 9 (25.71%) patients were excellent, 15 (42.85%) were good, 6 (17.14%) were fair, 5 (14.28%) patients were poor. **Conclusion** - Minimal invasive spine surgery is safe and efficient technique when compared to traditional open spine surgery.

KEYWORDS

Thoracolumbar fractures, Spine surgery, minimally invasive surgery (MIS), VAS Score

INTRODUCTION –

Spinal trauma is a common and leading problem in modern orthopaedics. It has been estimated that 6% of all fractures involve the spinal column. Traumatic fractures of the thoracolumbar spine, especially the thoracolumbar junction (T10–L2), are the most common fractures of the spinal column. Among this 60% of injuries are between T12-L2. Fractures of the thoracic and lumbar spine result from high velocity trauma, assuming bone density is normal. The narrow spinal canal in the thoracolumbar region predisposes to spinal cord damage resulting in a high incidence of neurological deficit. 15 to 20% patients with fracture at thoracolumbar level have associated neurological injury.³

Operative treatment of thoracolumbar fractures offers advantages of early improvement of neurological status, avoiding orthosis or cast especially in those with multiple extremity injuries, skin lesions and obesity. Prompt surgical stabilization allows immediate mobilization, earlier rehabilitation and better restoration of sagittal alignment.⁴ Surgical management of unstable thoracolumbar fractures traditionally involves posterior pedicle screw fixation, with pedicle screws at the levels immediately adjacent to the fractured vertebral body. Spine surgery has been transformed significantly by the growth of minimally invasive surgery (MIS) procedures. Easily acceptable to patients as less invasive with smaller incisions, MIS is often perceived as superior to traditional open spine surgery.^{5,6,7} This study aims to study the functional outcome of minimally invasive surgery (MIS) technique in posterior thoracolumbar instrumentation in spine fractures and to evaluate the perioperative outcome and complications of minimal invasive spine surgery.

MATERIALS AND METHODS –

A total of minimum 35 patients are included in this study. **Inclusion Criteria:** * Skeletally mature men and women (> 18 years), * Traumatic fractures of the thoracolumbar junction without neurodeficiency. * Patients who are willing to participate in the study. **Exclusion Criteria:** * Children and adolescent patients <18 yrs. * Patients treated

conservatively without surgery or fractures with neurodeficiency. * Patients with pathological fractures. * Patients who are medically unfit for surgery. * Patients with other injuries interfering with rehabilitation. * Patients with head injury. * Cervical spine fractures. * Patients not willing for surgery.

Routine investigations were carried out. Along with it radiographic examination, CT scan & MRI of cervical / thoracic / lumbar spine were also taken based on history. Written consent was taken from each individual. All the surgeries were performed under general anaesthesia with endotracheal tube taped securely. Sterile draping done & A 1- to 2-cm incision is proposed. The incision is then made down to the fascia. By using an electro-cautery, para spinal muscles were separated subperiosteally to expose the transverse process. Weinstein method of pedicle screw entry was preferred for Lumbar vertebra and Roy-Camille technique of pedicle entry for thoracic vertebra in all the cases. Pedicle screw were inserted 6.5 mm (diameter) * 40/45 mm (length). Once all the screws have been placed, select the proper length of the rod and contour it to maintain normal lumbar lordosis. fascia is closed with continuous sutures over a subcutaneous layer is sutured and skin is closed using ethilon 2.0. Post operative instructions and medications were given. Patients were followed up at 6, 12 and 24 weeks. At every follow-up history was taken pertaining to pain relief, level of activities and bowel-bladder function.

RESULTS -

In the present study, the number of patients in the age group of ≤ 30 years were 14.28 %, 31 - 40 years were 34.28%, 41-50 years were 28.57%, and above 50 years were 22.86%. Majority of the patients were between 31-40 years of age group (Table1 & Graph1). Male predominance was seen in the present study with 77.14% males to 22.86% females (Table2 & Graph2). There were 3 cases (8.57%) of Incomplete burst, 31 (88.57%) cases of wedge fractures and 1 (2.85%) case of split injury that were operated (Table3 & Graph3). Study had 7 (20%) patients with fracture at T12 level, 12 (34.28%) patients with fracture at L1 level, 3 (8.57%) patients had fracture at T12/L1,

4(11.42%) patient had fracture at L1L2, 6(17.14%)patients with fracture at L2 level and 3(8.57%) patient had fracture at L3 level (Table4 & Graph4). Also it had 21 (60%) patients having fall from height as the most common mode of injury, 14 (40%) due to road traffic accident (Table5 & Graph5). The number of patients admitted <24 hours were 16 (45.71%) and 1-7 Days were 14 (40%) of the cases and no of patients admitted > 7days after the injury were 5(14.28%) (Table6 & Graph6). 16 (45.71%) patients underwent surgery 3 days of injury , 17(48.57%) patients underwent surgery within 3 to 10 days. 2 (5.71%) of patients underwent surgery after 10days (Table 7 & Graph 7). 35(100%) patients were of grade E. On 6 week, 12 week and 24 weeks follow up all remained of grade E.

The mean pre operative kyphosis angle in the present study was 25.35 which decreased to 12.00 at 6 weeks follow up. The mean kyphosis angle at the final follow up was 7.95 which indicates that there is progression of kyphosis angle (to a mean of 5.95) over a period of 6 month with the p value of <0.001 which is strongly significant statistically. The mean VAS In the present study group was 8.40 at presentation which came down to 1.65 at 6 month follow up which was statistically significant (p value= <0.001). The mean ODI score in the present study was 61.00% preoperatively which gradually decreased to 24.3% at the end of 6 months which was statistically significant (p <0.001). according to the modified Mcnab criteria at the final follow up at 6 months,9 (25.71%) patients were excellent, 15 (42.85%) were good,6 (17.14%) were fair , 5 (14.28%) patients were poor (Table 8 & Graph 8). The mean duration of return to work in the present study group was 5.26 months. 60% patients (n=12) returned to their pre injury work and 25%(n=9) patients returned to a less demanding work. 15%(n=5) patients did not return to any work, the main reason for which was incomplete neurological recovery (Table 9 & Graph 9). The duration of hospital stay in present study was less than 10 days in 86% (30) patients and more than 10 days in 14% (5) patients (Table 10 & Graph 10). 1 (2.85%) patient had superficial surgical site wound infection and was managed accordingly. 1(2.85%) patient had hardware failure of the screw but patient did not develop any neurological complications due to it (Table 11 & Graph 11). Polyaxial screws for all the patients.

TABLE 1: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE AGE GROUP

Age group (years)	Number of patients	Percentage (%)
≤ 30	05	14.28
31 - 40	12	34.28
41 - 50	10	28.57
>50	08	22.86
Total	35	100.0

GRAPH 1: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE AGE GROUP

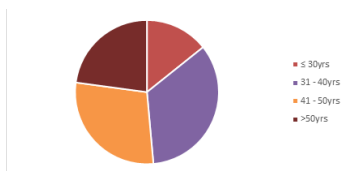


TABLE 2: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE GENDER

Gender	Number of patients	Percentage (%)
Male	27	77.14
Female	08	22.86
Total	35	100.0

GRAPH 2: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE GENDER

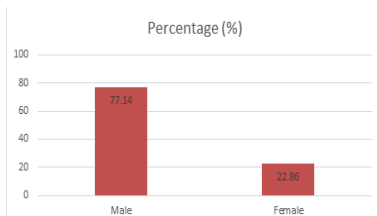


TABLE 3: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE TYPE OF FRACTURE

Type of fracture	Number of patients	Percentage (%)
Incomplete burst	03	8.57
Split	01	2.85
Wedge	31	88.57
Chance	00	00
Total	35	100

GRAPH 3: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE TYPE OF FRACTURE

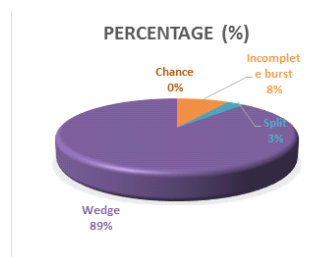


TABLE 4: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE LEVEL OF FRACTURE

Level of fracture	Number of patients	Percentage (%)
T12	07	20
L1	12	34.28
T12L1	03	8.57
L1L2	04	11.42
L2	06	17.14
L3	03	8.57
Total	35	100

GRAPH 4: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE LEVEL OF FRACTURE

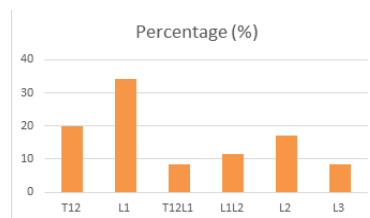


TABLE 5: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE MODE OF INJURY

Mode of injury	Number of patients	Percentage (%)
RTA	14	40
Fall from height	21	60
Total	35	100

GRAPH 5: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE MODE OF INJURY

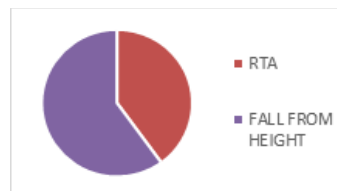
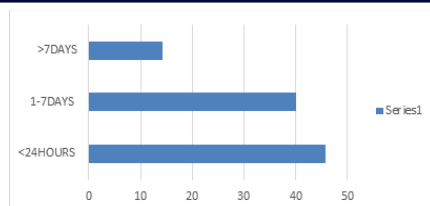


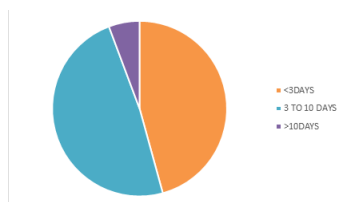
TABLE 6: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE DURATION OF INJURY TO ADMISSION

Duration of injury to admission	Number of patients	Percentage (%)
<24HOURS	16	45.71
1-7DAYS	14	40
>7DAYS	5	14.28
TOTAL	35	100

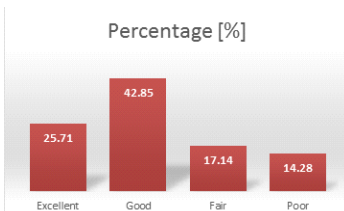
GRAPH 6: DISTRIBUTION OF STUDY GROUP ACCORDING TO THE DURATION OF INJURY TO ADMISSION

**TABLE 7 : DURATION OF INJURY TO SURGERY**

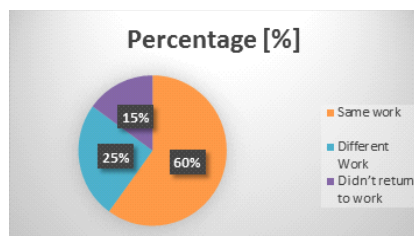
	Number of patients	Percentage (%)
<3DAYS	16	45.71
3 TO 10 DAYS	17	48.57
>10DAYS	02	5.71
TOTAL	35	100

GRAPH 7 : DURATION OF INJURY TO SURGERY**TABLE 8 : NEUROLOGICAL STATUS EVALUATION BASED ON ASIA CLASSIFICATION :**

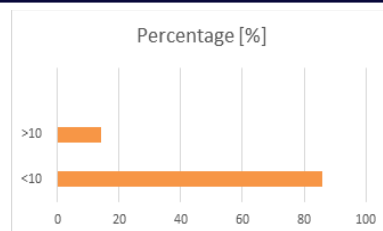
Modified Mcnab criteria	No. of patients	Percentage [%]
Excellent	09	25.71
Good	15	42.85
Fair	6	17.14
Poor	5	14.28
Total	35	100

GRAPH 8 : MODIFIED MCNAB CRITERIA AT 6 MONTHS**TABLE 9- RETURN TO WORK.**

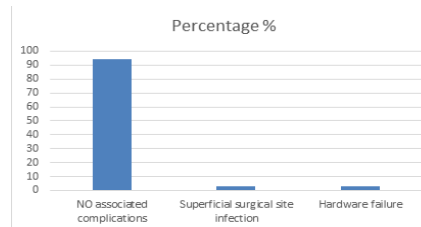
Return to Work	No. of patients	Percentage [%]
Same work	21	60
Different Work	9	25
Didn't return to work	5	15
Total	35	100

GRAPH 9 : RETURN TO WORK.**TABLE 10- DURATION OF POST OPERATIVE STAY IN HOSPITAL**

Stay in Hospital(days)	No. of patients	Percentage [%]
<10	30	86
>10	5	14
Total	35	100.0

GRAPH 10 : DURATION OF POST OPERATIVE STAY IN HOSPITAL**TABLE 11 : COMPLICATIONS**

Complications	Frequency	Percentage %
NO associated complications	33	94.28
Superficial surgical site infection	1	2.85
Hardware failure	1	2.85
TOTAL	35	100

GRAPH 11 : COMPLICATIONS

DISCUSSION -

In the study conducted by kotani et al,⁸ the mean age was 65 years. In the present study were in the 3rd and 4th decade of life with an average age of 41.6 years. In the present study we had 77.14% males and 22.86% female patients which indicates there is strong male preponderance. In the study conducted by Giorgi et al,⁹ had 47.25% males and 52.74% female patients which indicates there is strong female preponderance. Agarwal et al 57% males and 43% female patients which indicates there is strong male preponderance. In the study conducted by Alessandro et al,¹⁰ most common site of fracture was T12L1.

In the study conducted by Wang et al,⁷ they had 10 (58%) patients with fracture at L1 level, 3 (17%) patients with fracture at T12 level, 4 (23%) patients had fracture at L2 level. Wang et al⁷ in there study noted that three grades of improvement grades of improvement happened in one patient (from grade B to grade E), two grades of improvement were observed in 6 patients and one grade of improvement was found in 6 patients. In only one patient with partial neurological deficit (Frankel grade D) on admission, no improvement was observed. The results of these studies were similar to our study. Muralidhar et al¹¹ noted that among 30 patients 26 (86.7%) were improved, in that 17 (56.6%) cases showed one grade improvement, 8 (26.6%) showed two grade improvement and one (3.33%) improved three grade. Four cases (13.33%) fail to recover any grade according to ASIA scoring system. In the present study, 1 (2.85%) patient had superficial surgical site wound infection and was managed accordingly. 1 (2.85%) patient had hardware failure of the screw but patient did not develop any neurological complications due to it. In the study conducted by Alessandro et al,¹⁰ 15 (15%) patients had complications. 5 (5%) patients had intraoperative (screw and rod disconnections) complications, 10 (10%) patients had postoperative (screw disconnections, pedicle screw pullout, paraplegia with cauda equina, septic surgical wound dehiscence) complications. In the study conducted by Park et al,¹³ 1 (3.1%) patient had screw malposition, 1 (3.1%) patient had screw migration complications, 1 (3.1%) patient had deep wound infection, 1 (3.1%) had non union, 4 (12.5%) patients required surgical revision. In the study conducted by Wen Fein Ni et al,¹⁵ 1 (2.1%) patient had surgical site infection, 1 (2.1%) patient had loosening of screw.

The mean pre operative kyphosis angle in the present study was 25.35 which decreased to 12.00 at 6 weeks follow up. The mean kyphosis angle at the final follow up was 7.95 which indicates that there is progression of kyphosis angle (to a mean of 5.95) over a period of 6 months. In the study conducted by Peng Yang et al,¹⁴ pre operative kyphosis angle was 15.7 which decreased to 6. Another study done by Wang et al,⁷ pre operative kyphosis angle was 15.2 which is decreased to 3.2. In the present study, according to the modified Mcnab criteria at

the final follow up at 6 months,9 (25.71%) patients were excellent, 15 (42.85%) were good,6 (17.14%) were fair , 5 (14.28%) patients were poor. In the study conducted by Wang et al.⁷ 15/17 patients had good (9) to excellent (15) results.2 patients were fair.

CONCLUSION-

In conclusion, minimal invasive spine surgery is safe and efficient technique. When compared to traditional open spine surgery, minimally invasive spine surgery for thoracolumbar fractures results in much shorter hospital stays, less intraoperative blood loss, smaller incisions, reduced infection rates, and better pain treatment. Long-term, they offer effective kyphosis correction and stable stabilization and fusion of the spine. Short term 6 months follow up showed satisfactory functional outcome and fusion rates.

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