

A Prospective Study of Decompression with Pedicle Screw Fixation in Fracture of Thoracolumbar Spine

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Abstract

Background - The spinal traumas are common and leading problem in orthopaedic practice. Thoracolumbar fractures are serious injuries of concern, if left untreated may result in marked morbidity and disability to the patient. The fractures to spine are reported to be around 6% approximately of the trauma patients, of which around 2.6% of the patients sustains spinal cord or nerve root level neurological injury. Such fractures are commonly associated with motor and sensory disturbance, bladder and bowel disturbances, erectile dysfunction.

The use of decompression with pedicle screw fixation for preservation of remaining spinal cord function, restoration of spinal alignment, achievement of pain free fracture site, early mobilisation and maximal neurological recovery in thoracolumbar spinal injury patients.

Methods: This is a prospective interventional study undertaken in the Department of Orthopaedics at N.M.C.H patna . Adult patients with acute thoracolumbar injuries were admitted to Nalanda medical college and hospital, Patna were included in this study after obtaining their informed, valid written consent. This study was undertaken from May 2019 to october 2021.

Conclusion: The findings of this study show that pedicle screw-rod instrumentation is an excellent implant system used in treatment of vertebral fractures. There is a very high statistical significant restoration of vertebral body height, mean regional angle and mean anterior wedge angle Neurological recovery was seen significantly when all cases with neurological deficits were clubbed together. Complications related directly to pedicle screw-rod instrumentation like pedicle screw breakage, pressure sore and misplacement of screws are comparable with other studies. Early the interventions better the prognosis.

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I. Introduction

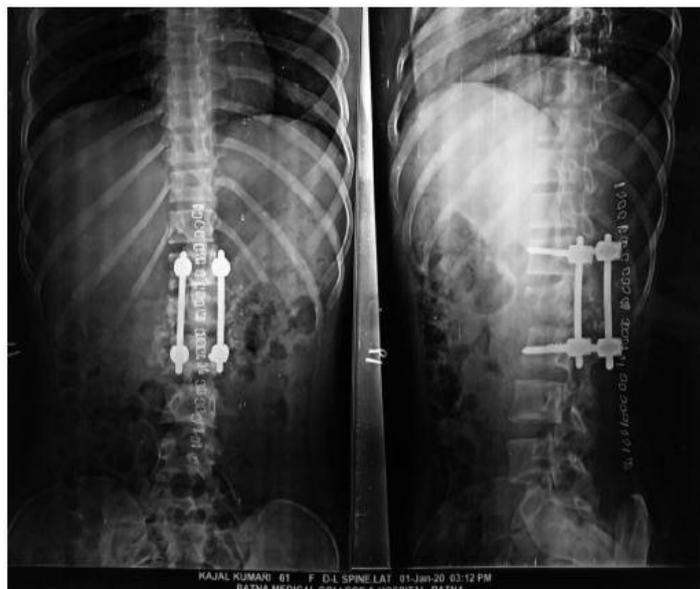
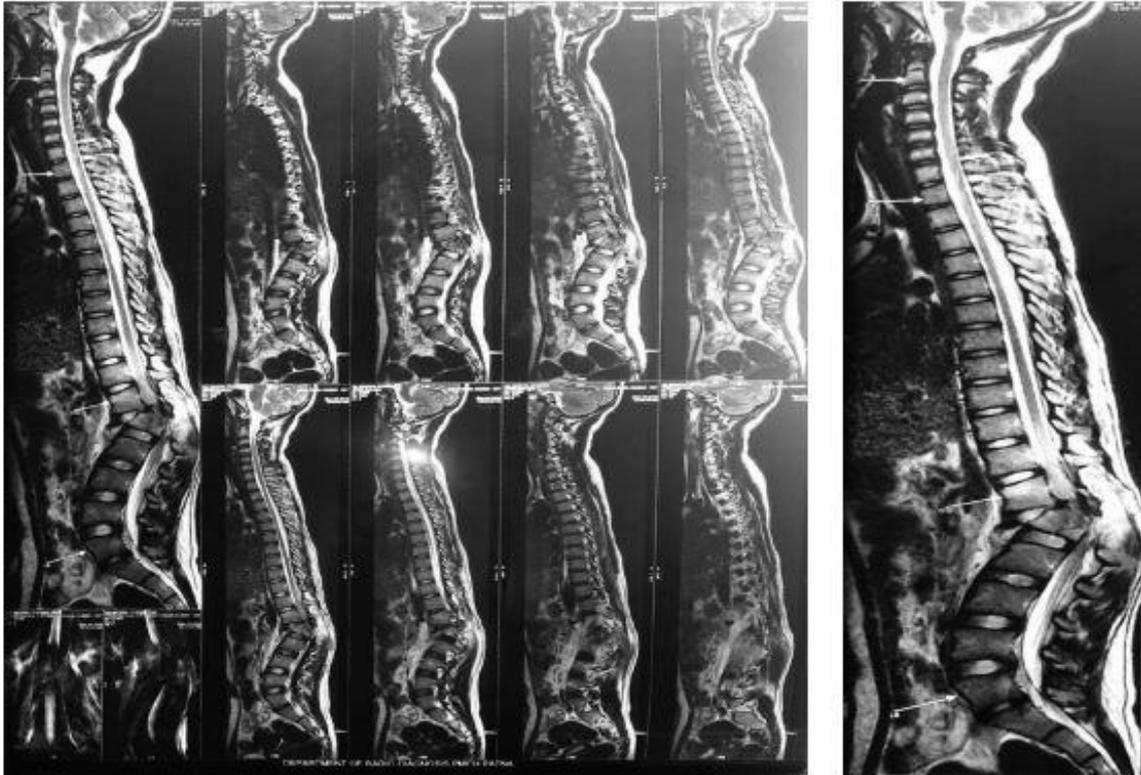
The spinal traumas are common and leading problem in orthopaedic practice. The individuals are at risk of high energy trauma in the modern era. Thoracolumbar fractures are serious injuries of concern, if left untreated may result in marked morbidity and disability to the patient. The fractures to spine are reported to be around 6% approximately of the trauma patients, of which around 2.6% of the patients sustains spinal cord or nerve root level neurological injury. Such fractures are commonly associated with motor and sensory disturbance, bladder and bowel disturbances, erectile dysfunction, deformities like kyphosis, scoliosis as result of neurological injury. The patients are also prone for bed sores and pulmonary infections.

Thoracolumbar segment is second most commonly involved segment in the spinal cord following spinal injuries followed by cervical segment. The trauma of thoracolumbar segment is high in thoracolumbar junction to the extent up to 60% between T 12 to L2 . Only 15 – 20% of the fractures at thoracolumbar level are associated with neurological injury. Thoracolumbar injuries classically exhibit a bimodal distribution, with peaks among males under 30 years of age and in the geriatric population. Historically, the thoracolumbar fractures were treated by recumbency (bed rest for a period of 8-12 weeks). This modality of treatment is often accompanied by complications. The care is often neglected to the victims due to attendant carelessness towards patients . So it is the need of the hour for exploring possibility of surgical stabilization, early mobilizations and rehabilitation of patients. The goal of treatment of every spinal injury is restoration of the patient to maximum possible function with disability free life. For patients sustaining a spinal column injury, the treatment focus is protecting uninjured neural tissues, maximising recovery of injured neural tissues and optimizing conditions for the musculoskeletal portions of the spinal column to heal in a satisfactory position. Surgical stabilization of the spinal column can prevent further mechanical injury to the damaged cord tissue. Operative intervention is intended to convey immediate stability to the spine, allow for the correction of deformities, and optimize

neurologic improvement by directly or indirectly relieving any residual impingement of the neural elements. The surgical treatments for thoracolumbar fractures are by different approaches such as anterior, posterior, lateral or antero-posterior approaches . Pedicle screw devices allow immediate stable fixation as the screw traverse all the three columns. The pedicle screws are passed one level above and one level below the fractured vertebra via posterior approach.

Case -1

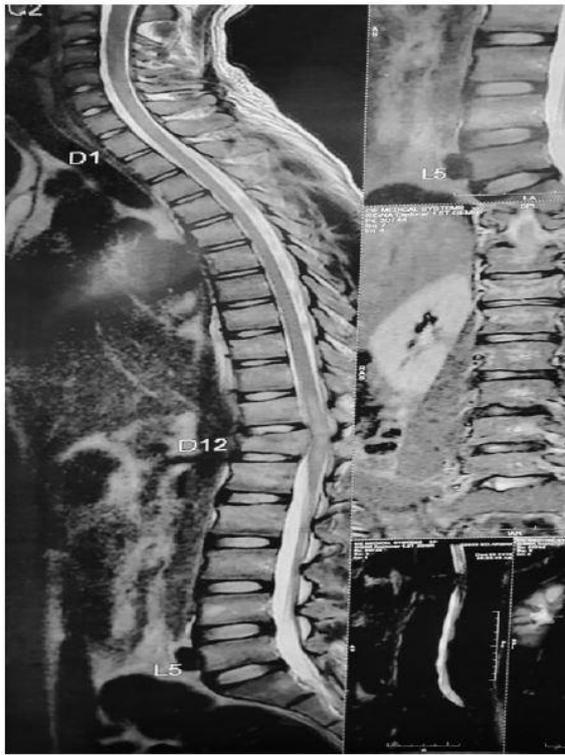
Preoperative xray and mri



Post operative x-rays

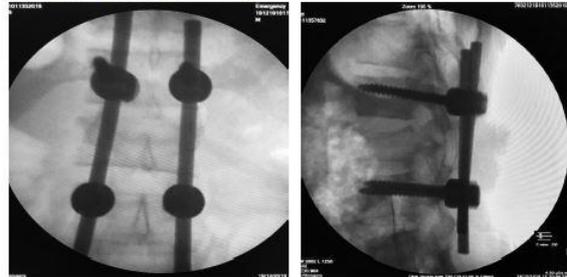
Case-2

Preoperative xray and mri



DIAGNOSIS: Traumatic paraplegia due to body compression fracture

Immediate post operative x-rays



the relationships and instability of the spine. Those patients with unstable spine were explained about advantages and disadvantages of the surgery.

• Inclusion criteria

- 1) Patients age between 20 to 70 years of age.
- 2) Traumatic thoracic, lumbar or thoracolumbar fractures.
- 3) History of trauma less than 30 days
- 4) Unstable fractures with or without neurological deficits.
- 5) Patients with incomplete neurological deficit.
- 6) Patient with complete spinal cord injury for the purpose of stabilization.

• Exclusion criteria :

- 1) Patients not willing for surgery.
- 2) Patients with significant comorbid diseases like diabetes, hypertension
- 3) Traumatic cervical fracture with traumatic quadriplegia.
- 4) Patient age less than 20 years and more than 70 years.

Preoperative work up

1. Plain radiograph (static and dynamic wherever necessary)
 - a. Anteroposterior views.
 - b. Lateral views.

To assess extent of degeneration, instability, mechanism of injury, fracture pattern and its severity and canal compromise or deformity.

2. Magnetic resonance imaging (MRI) was useful in determining
 - a. The condition of the spinal cord following trauma
 - b. Any soft tissue encroachment(intervertebral disc)of the spinal cord.

Surgical technique

Position the patient prone on a padded spinal operating table. care being taken to keep the nipples in females and the scrotum in males from free from pressure. This position avoids venous stasis and decreases intra abdominal pressure, thus reducing venous bleeding. All bony prominences were padded. The skin, subcutaneous tissues, and paraspinal muscles down to the level of lamina were infiltrated with 1:50000 epinephrine solution to minimize bleeding. A posterior midline incision was made centring 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 homeostasis. 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 or by locating eye on image intensifier. Using a nibbler, cortical bone was removed around the pedicle entry point. Pilot hole is made with use of sharp Trocar with stopper. Blunt sound probes were placed into the pedicle and their position was confirmed under image intensifier on both anteroposterior and lateral views. Pedicle probe was passed with rotating it over 30 degrees clockwise and anticlockwise so it entered the pedicle at the region of least resistance which is the centre of the pedicle. The depth of the pedicle was confirmed with probe by the markings on it and confirming its position by passing it to 80% of its depth. Now the pedicles were tapped with 5.5mm or 6.25mm taps depending on appropriate size. The pedicle was probed in all four walls with a pedicle sound probe to make sure that solid tube of bone exists and violation of pedicular cortex has not occurred and the screws of appropriate lengths were selected and inserted into the pedicles with help of monoaxial or polyaxial inserter depending on the implant used. During insertion the positions of the screws were checked with image intensifier in both anteroposterior and lateral views. A rod contouring template is placed into the slots of the implants. The template is shaped to reflect the natural curve of spine. A under contoured rod was used to create distraction-extension assembly. The appropriate sized rods (10mm) were selected and contoured using cam action bending instrument to match the template. The rods were held with self locking, long rod holder and aligned and placed over the slots on the implant placed. A rod pusher can be used to push the rod into implant slots. The rod is fixed by inserting the inner screw and outer nut with help of combined insertion device for inner screw and outer nut by gently aligning the inner screw with inner threads of the screw. Use 1-2 counter clockwise turns to engage inner threads. A slight click will confirm proper alignment of screws. The inner screw is rotated clockwise to engage 2-3 threads and is not tightened at this stage. Holding the ball catch holding it and outer nut is lowered and aligned and inserted by rotating clockwise to engage 2-3 threads only and is not tightened, the combi inserter is disengaged by lifting it clean and the assembly is inspected to ensure the threads are properly

engaged. All outer and inner screws are similarly inserted over the implant and the assembly is constructed. 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 inner screw is tightened with long hex screw driver. A thorough homeostasis was achieved and the wound was closed in layers over drain. Clean dressing was applied.

Post operative treatment

All the patients were given post op intravenous antibiotics (third generation cephalosporin + aminoglycoside) for 7 days. They were switched over to oral antibiotics till suture removal. Intravenous dexamethasone 6 mg IV was given for 3 days. Physiotherapy was started from 10th day post operatively. Sutures were removed on eleventh day. On the second day patients were allowed to roll from side to side. They were allowed to sit up and were mobilized on a wheel chair after application of thoracolumbar belt (hyperextension belt) on 10th post operative day. A close watch was kept for any improvement or deterioration in the neurological status. Those with incomplete neurological deficits were given physiotherapy and gradually ambulated. Patients with complete neurological deficits were given physiotherapy and ambulated on wheel chair. Routine postoperative X-rays were taken prior to discharge. The neurological grading and radiological parameters were recorded on 3rd day of the operation.

Follow up

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.

ASIA grading-

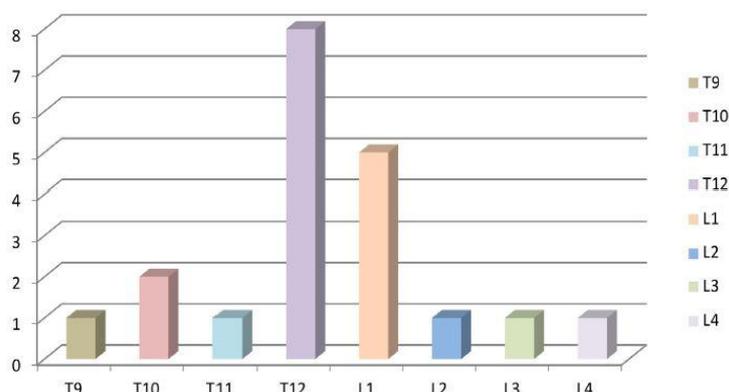
- Grade A – Absent motor or sensory functions
- Grade B – Sensations present, motor power absent
- Grade C – Sensations present, motor power present but not useful
- Grade D – Sensations present, motor power present and useful (grade 4 or 5)
- Grade E – Normal sensory and motor functions.

III. Results

All the fracture united within three months. The four patient who had iliac crest bone grafting also showed satisfactory incorporation of the graft. There was no fixation failure in the series. We didn't had any major complications. Hypertrophic scar developed in 2 patients. Except 2 patient we were able to achieve full range of motion in all cases. 4 patient present with neuralgia of which 2 patient in C7 and C8 nerve distribution and 2 patient have complete relief.

Eleven patient observed their DASH score in the range of 10 to 20 while 8 had less than 10 and three had more than 20. Mean DASH score of the patients in our series was 11.55. Functionally, this was very acceptable. In this series 20 out of 22 patients had full range of motion of the affected shoulder. Two had difficulty in abduction over 110°.

Graph. Vertebra affected in the study group
VERTEBRA AFFECTED IN THE STUDY GROUP



Graph 2 . ASIA grading for neurological status in the study group

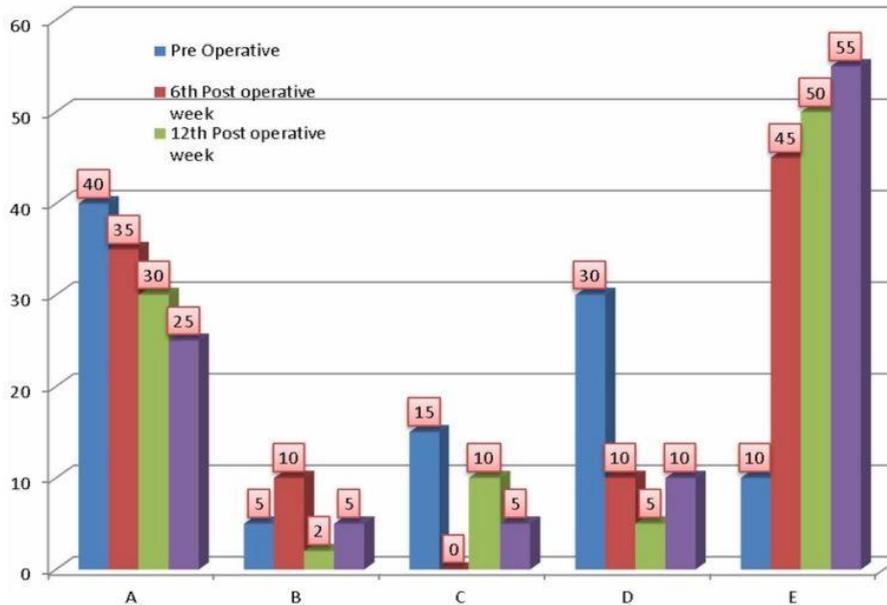


Table above shows the ASIA grading of the study group during pre operative, at 12th post operative week, 24th post operative week and 1 year post operative period. During pre operative period 40% were graded as grade A, 5% as grade B, 15% as C, 30% as D and 10% as Grade E. During 12th post operative week, the frankel grade A was 35%, B was 10%, C was 10% and E was 45%. During 24th post operative week Grade was 30%, B was 2%, C was 10%, D was 5% and E was 50%. During 1 year post operative period, grade A was 25%, grade B was 5%, C was 5%, D was 10% and E was 55%. There was statistically significant difference between the ASIA grading of pre operative and 12th post operative week and 1 year post operative period. But there was no statistically significant difference between the pre operative and 24th post operative week ASIA grading.

In the study group, 65% of the study group had injury due to fall from height. About 35% of the injuries were due to road traffic accident

Table 1 . Type of fracture

| Type of fracture | Frequency | Percent |
|-------------------------------|-----------|---------|
| A:Compression fracture | 11 | 55.0 |
| B:Distraction | 6 | 30.0 |
| C:Rotational | 3 | 15.0 |
| Total | 20 | 100 |

Graph 3. Type of fracture

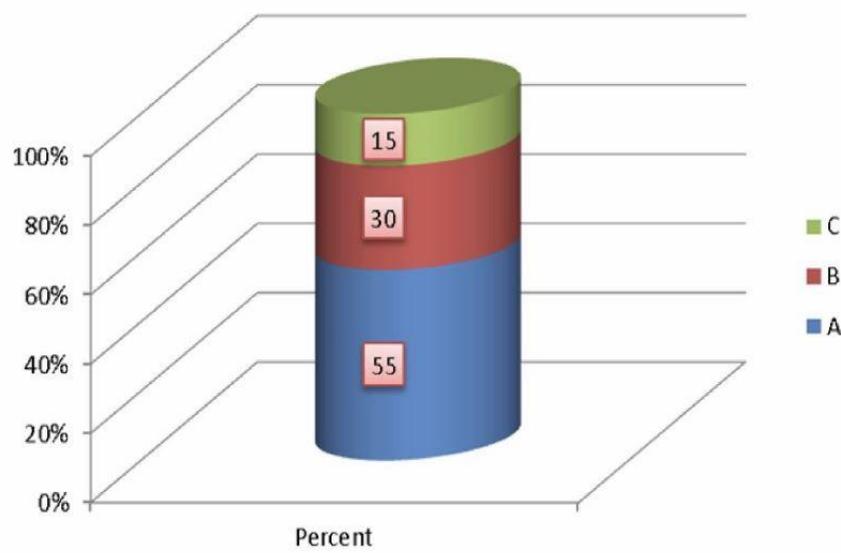
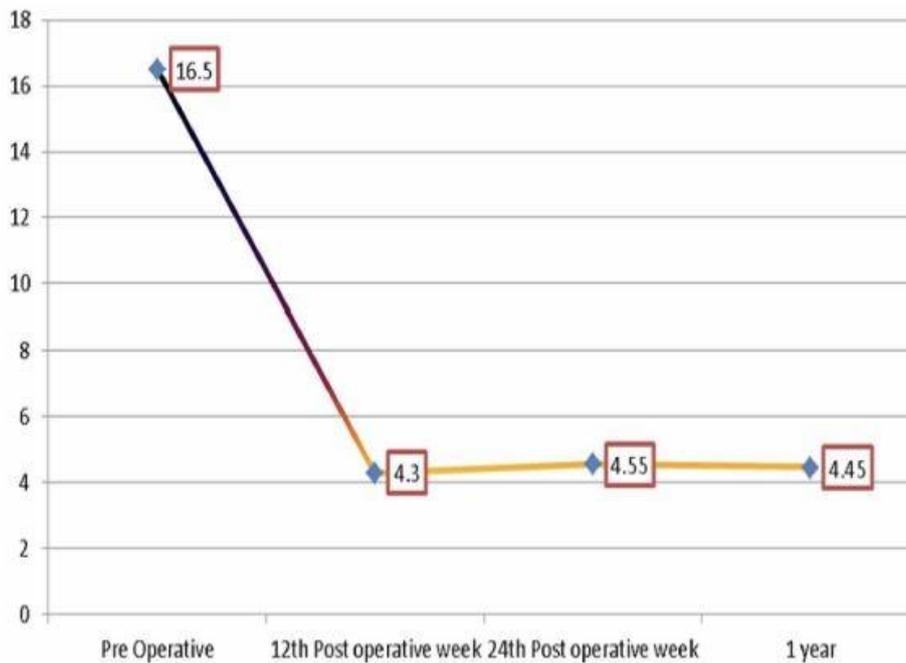


Table 2 . Regional angle in degree in the study group

| Regional angle in degree | Mean | SD | Minimum | Maximum |
|---|------|------|---------|---------|
| Preoperative | 16.5 | 5.02 | 4 | 24 |
| 12th postoperative week | 4.30 | 4.01 | 0 | 10 |
| 24th postoperative week | 4.55 | 4.14 | 0 | 10 |

Graph 4 .. Regional angle in degree in the study group



IV. Discussion

The spinal traumas are common and leading problem in orthopaedic practice. The individuals are at risk of high energy trauma in the modern era. Thoracolumbar fractures are serious injuries of concern, if left untreated may result in marked morbidity and disability to the patient. The fractures to spine are reported to be around 6% approximately of the trauma patients, of which around 2.6% of the patients sustains spinal cord or nerve root level neurological injury. Such fractures are commonly associated with motor and sensory disturbance, bladder and bowel disturbances, erectile dysfunction, deformities like kyphosis, scoliosis as result of neurological injury. The patients are also prone for bed sores and pulmonary infections. In a resource scarce country like India, the care is often neglected to the victims. So it is the need of the hour for exploring possibility of surgical stabilization, early mobilizations and rehabilitation of patients. The goal of treatment of every spinal injury is restoration of the patient to maximum possible function with disability free life. Operative intervention is intended to convey immediate stability to the spine, allow for the correction of deformities, and optimise neurologic improvement by directly or indirectly relieving any residual impingement of the neural elements.

Pedicle screw devices allow immediate stable fixation as the screw traverse all the three columns. The pedicle screws are passed one level above and one level below the fractured vertebra via posterior approach. This study used stabilization of the cases of the unstable thoracolumbar spine injuries with decompression and pedicular screw & rod instrumentation.

V. Conclusion

The findings of this study show that pedicle screw-rod instrumentation is an excellent implant system used in treatment of vertebral fractures. There is a very high statistical significant restoration of vertebral body height, mean regional angle and mean anterior wedge angle with this procedure in thoracolumbar fractures. Neurological recovery was seen significantly when all cases with neurological deficits were clubbed together. However, in patients who presented with ASIA type A neurological deficits, this procedure did not improve neurological status statistically but it helped to stabilize and helped in good nursing care and early mobilization of patient. Complications related directly to pedicle screw-rod instrumentation like pedicle screw breakage, pressure sore and misplacement of screws are comparable with other studies. Early the interventions better the prognosis.

This study is also not without limitations. This is cross sectional study where the group for comparison is not used to validate the value of pedicle screws. A standard sample size and sampling technique has not been used. However the study adds for the current knowledge base of thoracolumbar fractures and its treatment.

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