TRAUMATIC PARAPLEGIA: EVALUATION OF FUCTIONAL RECOVERY OF THORACOLUMBAR FRACTURE FIXATION IN RELATION TO PREOPERATIVE NEUROLOGICAL DEFICIT

Original Article
Orthopaedics

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Abstract:
Fractures of thoracolumbar spine are common injury with variety of operative and non-operative management options. There remains debate as to the optimal treatment for a given patient & fracture. Our aim was to assess the function outcome after surgical treatment of fracture at thoracolumbar level treated with pedicle screw fixation with laminectomy & cord decompression.

Materials and methods: This was a retrospective randomized study comprised 50 patients with fracture thoracolumbar area treated with titanium pedicular screw fixation with laminectomy & cord decompression. The patients were followed up at 2nd week, 1month, 3months, 6months, 9months and 1year after surgery. The assessment of spinal instability according to Denis three column concept &criteria McAfee Et al & assessment of neurological improvement as per Frankle grading system in each follow up visits.

Results: At the end of 1 years of studywhen decompression done within 1st week in incomplete paraplegia 80% of the patients showed return of grade 3 power. In complete paraplegia cases, 11% of the patients had return to power upto grade 3 when decompression done within 1 week whereas no cases return of grade 3 power when decompression done after 2nd week.

Conclusion: After recovery from spinal shock, the earlier the surgical decompression done, the better the neurological and bowel/bladder function recovery both in complete and incomplete paraplegic cases. Reduction is better and easy and less time consuming in early decompression than in late.

Key words: *Fracture thoracolumbar vertebra, Titaniumpedicle screw, Laminectomy, Cord decompression*

Introduction

Fractures of the vertebral spine are among the most feared lesions among patients and physicians, and their consequences can be devastating, ranging from mild pain and discomfort to serious paralysis and even death.[1-4] Traffic accidents, falls, and sports accidents are the cause of the majority of these lesions.[3-7] Some degree of neurological lesion is also common.[8] The majority of these fractures occur in the thoracolumbar region, presumably because this is a junction of the thoracic spine, which is relatively immobile, and the lumbar spine, which is relatively mobile.[8,9] This is also the most common site of unstable burst-type fractures, representing about 15% of vertebral spine injuries.[7,10] In 1983, Denis[15] proposed his "three column spine" theory, taking the sagittal plane as reference Thus, thoracolumbar burst fracture was defined as a lesion that involves the anterior and middle columns. A burst fracture is characterized by displacement or rotation of the posterior cortical of the vertebral body, compressing the spinal canal and altering the stability of vertebral spine. Denis considered thoracolumbar burst fractures to be unstable, as they involve at least two of his "columns".[15] There are still controversies in relation to the stability criteria and the treatment options for burst fractures.[11-14] Radiographic signs that include enlargement of the interspinous and interlaminar space, translation of the vertebral body greater than 2 mm, kyphosis greater than 20 degrees, loss of height or compression of the spinal canal of more than 50%, and fracture of the articular processes, are the most widely accepted parameters for the assessment of stability of the fracture.[14,15] The best option for surgical treatment of thoracolumbar fractures remains controversial, despite the greater knowledge of biomechanics and advances in surgical techniques. To date, no one method has proven to be the most suitable for the treatment of all types of lesions of the vertebral spine. Anterior and posterior approaches are associated with satisfactory results in the treatment of thoracolumbar injuries. However, they are not without complication depending on various clinical and radiographic factors such as the patient's age, degree of impairment of the medullary canal, sagittal index, height of the vertebral body, degree of integrity of posterior elements and presence of neurological deficit. Posterior instrumentation is recommended by many authors, based on the excellent results achieved in terms of stability of the spine, anatomical alignment, postoperative neurological improvement, and low patient morbidity.

Material And Methods

This study was done retrospectively in the Department of Orthopaedics and Trauma Centre in J. A. Group of Hospitals, Gwalior (M. P.) from January 2015 to august 2016 for the period of 1 years. Total of 50 thoracolumbar fracture patients were operated with titanium pedicle screw fixation, laminectomy, cord decompression.

The study participants followed up for 1 year in postoperative period. The cases included in this study were the patients attending outdoor and emergency with traumatic paraplegia involving the dorsolumbar spine. Pre-operative and post-operative neurological charts (according to Frankel's grade ASIA score (motor and sensory) was maintained with regular assessment for proper post-operative neurological recovery assessment.

Inclusion criteria

The cases with of traumatic paraplegia (complete or incomplete) of dorsolumbar spine involving D8 to L5 spine, fractures involving one or maximally two vertebrae and skin condition of the operative field normal patients and patient agreed to have a surgical decompression are included in the study.

Exclusion criteria

Patients below 16 years of age, patients unfit for undergoing operation in pre-anaesthetic check-up, patients with head injury or other gross injuries that may preclude undergoing operation, patients with multiple vertebral injuries (>2 vertebrae.

Protocol

- Informed consent was taken after proper counselling and proper pre anaesthetic check-up. The patients were evaluated by X-ray of spine (AP and LAT view) and MRI Scan.
- Pre-operative and postoperative neurological charts (according to Frankel's grade and ASIA score (motor and sensory) was maintained with regular assessment for proper postoperative neurological recovery assessment.
- Recovery from spinal shock was noted by using clinical methods like return of bulbocavernous reflex. Direct or indirect decompression was done.
- In all cases air bed was used during pre-operative and post-operative period to prevent bed sore.
- All patients were operated

under general anesthesia in prone position on commercially made prone bar. A midline posterior approach was used. The extent of the injury was defined. Posterior decompression was performed whenever. Decompression also included undercutting 99the disrupted lamina and evacuation of any epidural hematoma from the enlarged epidural space. The facets and other bony structures were used to judge an anatomic reduction. The fracture was stabilized with bilateral pedicle screws under fluoroscopy control. For short-segment fixation, only the injured motion segment was stabilized. For long-segment stabilization, two segments above and below the injured vertebra were engaged with pedicle screws. Distraction was used to reduce the fragments of fractured vertebra, by the principle of ligamentotaxis. No bone grafting was done in any group. Postoperatively all patients ambulated on 10 th -14 thpostoperative day. The spinal brace was worn for three months postoperatively in all. The patients were operated at a mean interval of 10 days after hospitalization (rang 3-25 days). Sitting with back support and Tylor's brace was permitted 24 hours after surgery. Wheel chair mobilization was started 48-72 hours after surgery. The patients were discharged at an average of 14 days after surgery (range 6-28 days). After discharge, the patients were followed by means of regular visits to the spine injury clinic to assess the functional (neurologic) recovery and encourage early rehabilitation.

Follow-up

- First follow up was done after 2 week, 2nd follow up after 6 weeks. Then monthly follow up till 1 year. Patients were assessed for neurological recovery and assessment of return of bowel/ bladder function in every follow up.

Observation And Results

This study was conducted in the Department of Orthopedics, Jaya Aarogya Hospital,Gwalior over a period of 12 months to assess functional outcome operated case of fracture thoracolumbar vertebra with titanium pedical screw fixation, laminectomy, cord decompression. The patients reported to our hospital at a mean of 55 hours (range 8-120 hours) after the injury. The mean age of the patients was 31 years (range 10- 62 years). There were 30 male and 12 female patients. The cause of injury was fall from height 30 (tree - 20, building - 8, hill slope -2), motor vehicle accident in 12 .The level of injury was D9-3, D10-2, D11-3, D12-14, L1-9, L2-6, L3-3, L4-2. The fractures were classified according to Denis classification . There were 10 burst fractures and 28 wedge compression. The patients reported to our hospital at a mean of 55 hours (range 8-120 hours**)** after the injury. The mean age of the patients was 31 years (range 16- 65 years**).** There were 30 male and 12 female patients. Out of 42 patients complete paraplegic were 20 patients & incomplete were 22,in incomplete paraplegic patients 80% shown complete motor & sensory recovery at the end of 1 year of study whereas in complete paraplegic patients 60% patients shown complete motor & sensory recovery rest of the patients (complete & incomplete paraplegic)not recovered fully in both sensory , motor & bowel bladder.

Return of power in incomplete paraplegia

In all cases some return of power was there mostly from grade 3 or grade 4 or grade 5. **Return of power in complete paraplegia**

Hip flexors within grade 3 and 4, Hip abductors/Quadriceps/Hamstrings within grade 2 and 3, Tibialis anterior/ EHL/FHL and Gastrosoleus the power did not return at all.

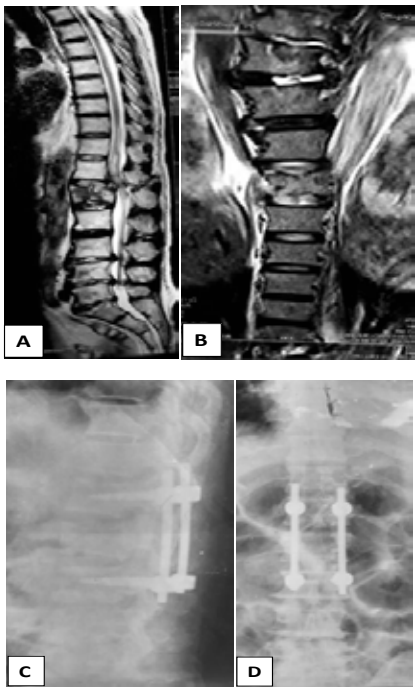


Figure -1 : [CASE:1] (A&B) Pre operative MRI (C&D) post operative X ray

Figure - 2 : Clinical images showing recovery of patient at the end of 1 year

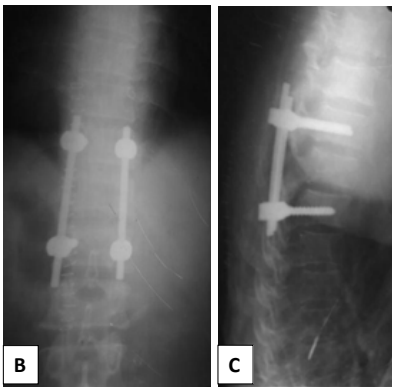


Figure -3 : [CASE:1] (A&B) Pre operative MRI (C&D) post operative X ray

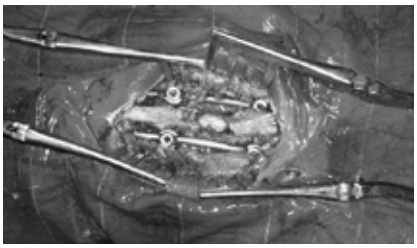


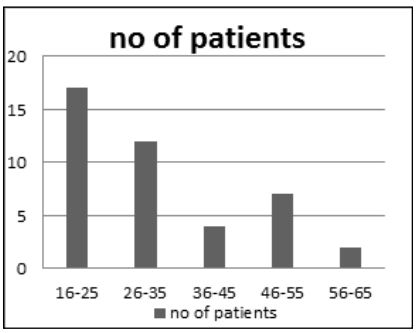
Figure -4 : image showing pedical screw with connecting rod and decompression of spinal cord

Stability of implants

We got 1 patients where there was pull-out of the screws completely out of pedicle. In one patient there was loosening of the rod. This happened within 4 weeks post-operatively. In these patients we had to continue on conservative management and solid bony fusion developed between 12 to 20 weeks.

Demographic Characteristic

Patients characteristics Number	
Age	
16-25	17
26-35	12
36-45	4
46-55	7
56-65	2
Sex incidence	
Male	Female
30	12

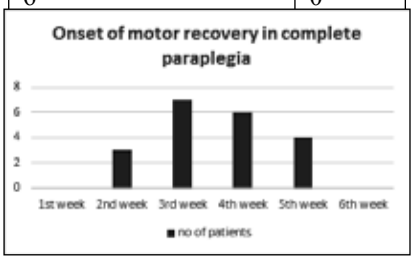


Clinical characteristic of traumatic paraplegia subjects

No of patients	No of patients
D9	3
D10	2
D11	3
D12	14
L1	9
L2	6
L3	3
L4	2
Days elapsed after injury at presentation	
0-3 days	34
4-7 days	8
Time of decompression (post injury)	
5-10 days	26
11-15 days	16
Mechanism of injury	
Road traffic accident	12
Fall from height	30
Paraplegia	
Complete	20
Incomplete	22
Initial Obsevation (ASIA impairment Scale)	
Grade	
A	
B	
C	
D	
E	
Classification of Fractures	
True wedge compression	28
Burst	10
Fracture dislocation	4

Onset of motor recovery in Complete paraplegia

Onset of motor recovery	No of cases
1st week	0
2nd	3
3rd	7
4th	6
5th	4
6th	0



Onset of motor recovery in incomplete paraplegia in study subjects

Onset of motor recovery	No of cases (Total cases 22)
1st week	8
2nd	9
3rd	4
4th	1

Post-operative sensory recovery in traumatic incomplete paraplegia patients

Onset of sensory recovery	No of Cases (Total cases 22)
1st week	10
2nd	8
3rd	2
4th	2

Post-operative sensory recovery in traumatic incomplete paraplegia patients

Onset of sensory recovery	No of Cases (Total cases 20)
1st week	4
2nd	4
3rd	2
4th	2

Comparison among return of muscle power after decompression at different time in incomplete paraplegia

	Grade 3	Grade 2	Grade 1	Nil
1st week	80%	20%		
2nd week	36%	36%	18%	9%

Comparison among return of muscle power after decompression at different time in complete paraplegia

	Grade 3	Grade 2	Grade 1	Nil
1st week	11%	22%	22%	45%
2nd week		16%	16%	68%

Complication in clinical study participants

Complication	Number of patients
Bed sore	2
Infection	2
Pull out of screws	1
Late back or leg pain	3
Prominence of screw	1
Post-op increase in neuro deficit	0

During follow-up

- Evaluation of any possible loss of function
- Assessment and analysis of any complication.

Functional outcome was assessed according to Denis three column concept &criteria McAfee Et al & assessment of neurological improvement as per Frankle grading system in each follow up visits. Pain, strength, sensitivity and activity were noted at each visit.

Discussion

Injury to thoracolumbar spine is among the most feared lesions among patients and physicians, and their consequences can be devastating, ranging from mild pain and discomfort to serious paralysis and even death.

The most common mode of injury in our series was fall from height (70%). This is contrary to the literature reports where motor vehicle accidents account for majority of spinal injuries (40-60%). More commonly men (70%) were involved than women (30%). After sustaining the injury, there was a delay of average 55 hours (range 4-120 hours) Controversy remains as to whether treatment of unstable spinal injuries should be operative or non-operative. Various literature reports have documented improved realignment and stabilization of fractures, and decreased hospital stay and recumbency after surgical fixation.[1,3,6,8,11] In the present series, all patients were able to sit with support 24 hours after surgery. Wheel chair mobilization was started 48-72 hours after surgery,which simplified the nursing care and facilitated early rehabilitation in our patients. The reason for using pedicular screw in our cases was as it provide good purchase, less implant failure & excellent stability to the spinal column. **Krompinger et. al**[2] postulated that in the absence of neural deficit, fractures with more than 50 percent canal compromise and a kyphosis more than 30 degrees require surgical intervention to prevent late instability. Thoracolumbar spine fractures without neural deficit were not stabilized by fixation as the kyphosis was less than 30 degrees in all these cases and therefore, not included in our series. The role of surgery in neural recovery is highly debated. Patient recovery by at least one Frankel grade of incomplete lesions treated non-operatively is about 65 to 70%,[17,18] although **Davies et al** reported an improvement rate of 95%.[19] In patients reviewed from the literature who underwent surgery, the recovery rates are somewhat higher (75-88%).[1,3,7,13] 80% of our patients improved completely(motor & sensory) in incomplete paraplegic patient whereas 60% cases completely recovered in complete paraplegic patient group. A few authors have reported better neurologic recovery with decompression[1,7,13] Anterior surgery is considered to be the most effective way of decompressing the spinal canal.[1] But most authors agree that there is no relationship between spinal canal narrowing,neurologic deficit and improvement in neurologic status after surgery and hence, there is no need of removing retropulsed bone fragments from the spinal

canal.[3,12,16,20,21] Spontaneous canal remodeling has been reported in both non-operatedand operatedcases.[11] **(Sjostrom L et al).**There are few reports to suggest that neurologic injury occurs at the time of trauma rather than being a result of pressure from fragments in the canal afterwards and question the need to operate simply to remove these fragments[20,21] **(Limb D et al).**A close relationship has been shown between the type of injury and Frankel grades, that is, fracture dislocation is associated with more severe neurologic grade than burst fracture[3] **(Gertzbein SD et al).**

In the present series, only 10% of patients remained wheel chair in incomplete paraplegic patient group. Where as 40% patients remain in wheelchair in complete paraplegic patients. Useful functional activity (ambulating with or without support) was achieved in 80 % patients in incomplete paraplegic patient group whereas 60% patients in complete paraplegic patients. Thus functional activities could be predicted to some extent from the initial Frankel grades. Functional activities were also directly related to the final Frankel grades of the patients. Early surgery and comprehensive rehabilitation markedly reduces the overall morbidity of spinal cord injured patients by enabling the patient to lead a independent life.

In our series we did early surgery (fixation & decompression with 1-2 weeks) & we noted that those patients treated surgically in 1st week improved early (80% patients recovered in incomplete paraplegic patients & 60% cases recovered in complete paraplegic patients).The role of surgery in neural recovery is highly debated. Patient recovery by at least one Frankel[17] grade of incomplete lesions treated non-operatively is about 65 to 70% , although **Davies et al** reported an improvement rate of 95%.[19] Decompression in the spinal injury is one of the most controversial concept. Though the initial may well be the determinant of neurological outcome, the role of decompression has always been debated. Both experimental and clinical findings of **Benzel et al, Dolan et al, Maiman et al**. clearly documented the role of neural decompression in improving neurological outcome[22,23,24]**.** Early surgery is recommended for burst fractures with deficit or unstable distraction and rotational injuries As per report published by **Deniset al,** there is improved neurological outcome in effective cord compression after injury, stands for our findings regarding post-operative neurological recovery in spinal injury patients.[25,26]

In present studies patients were divided in two categories:

- Decompression done within 1st week
- Decompression done in 2nd week Almost 75% of the cases showed some amount of sensory recovery within first 5 days of operation. The onset of sensory recovery continued for maximally upto 4th week post-operatively in the cases studied by us. Early surgery may improve neurological recovery and decrease hospitalisation time in patients with cervical spinal cord injuries. Timing of thoracolumbar spine stabilization in trauma patients impact on neurological outcome and clinical course. It was treated by surgical management, the onset of sensory recovery was earlier than motor recovery in all cases. Almost 75% of the cases showed some amount of sensory recovery within first 5 days of operation. The onset of sensory recovery continued for maximally upto 4th week post-operatively in the cases studied by us.

Conclusion

In our series 42 cases of traumatic paraplegia, 20 cases were complete paraplegia and 22 cases were incomplete paraplegia. We could draw the following conclusions: the earlier the surgical decompression done, the better the neurological and bowel/ bladder function recovery both in complete and incomplete paraplegic cases. Reduction is better and easy and less time consuming in early decompression than in late. All follow-up only incomplete injury cases could be converted to higher ASIA scale. Inspite of lack of restoration of vertebral height, neurological recovery can continue. Sensory recovery occurs earlier than motor recovery in all cases. Use of water bed and proper postural care definitely decrease the possibility of bed sore in all paraplegic patients.

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