

“A PROSPECTIVE STUDY OF OUTCOME OF SURGICAL MANAGEMENT OF TRAUMATIC PARAPLEGIA”

Orthopaedics

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ABSTRACT

Background: Traumatic paraplegia is an unanticipated catastrophe in an individual's life, posing a huge economic as well as social burden. We evaluated all the patients for neurological improvement after surgical management of traumatic paraplegia in traumatic thoracolumbar fractures.

Materials And Methods: This is a prospective interventional study undertaken in the Department of Orthopedics. Adult patients with acute traumatic paraplegia injuries admitted to Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, were included in this study after obtaining their informed, valid written consent. This study was undertaken from December 2018 to September 2020. Clearance from institutional ethical committee was obtained before initiating the study.

KEYWORDS

Pedicle screw, Traumatic Paraplegia, Thoracolumbar belt.

INTRODUCTION

The spinal traumas are common and leading problem in orthopedic practice. The individuals are at risk of high energy trauma in the modern era^{1,2,3}. Traumatic paraplegia lumbar 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 infections⁴.

Thoracolumbar segment is second most commonly involved segment in the spinal cord following spinal injuries followed by cervical segment. It constitutes 30 to 60% of all spinal injuries. The trauma of thoracolumbar segment is high in thoracolumbar junction to the extent up to 60% between T 12 to L2⁵. Only 15–20% of the fractures at thoracolumbar level are associated with neurological injury⁶. Thoracolumbar injuries classically exhibit a bimodal distribution, with peaks among males under 30 years of age and in the geriatric population⁷.

Historically, the traumatic paraplegia were treated by recumbency (bed rest for a period of 8-12 weeks)^{8,9}. This modality of treatment is often accompanied by complications. The recumbency is very much labor intensive. This method of treatment is costly since it requires care by highly skilled personnel and the number of bed day's used¹⁰. 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. For patients sustaining a spinal column injury, the treatment focus is protecting uninjured neural tissues, maximizing 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.

Historically, Harrington hook-rod construct or its modifications have been extensively studied⁴. Their main disadvantage is it spans at least 5-6 spinal segments. So newer options, especially pedicle screw plate or rod constructs that need shorter segment immobilization have gained popularity¹¹.

In this study, we stabilize the cases of the traumatic paraplegia with decompression and either pedicular screw and rod instrumentation. We have evaluated all patients for maintenance of spinal correction and neurological improvement after posterior instrumentation in thoracic and lumbar spinal fractures and clinical outcome in terms of spinal scoring system called as Denis work and pain scale.

OBJECTIVES

The aim of this study is to evaluate the surgical management of traumatic paraplegia and Assessment of neurological improvement after surgical intervention in cases of traumatic paraplegia classified by Frankel scoring.

1. To evaluate the results of surgical decompression of the cord.
2. Results on only posterior stabilization.
3. Age distribution of the patients.
4. To study efficacy of pedicular screw and rod fixation system (ZETA system) in achieving 'stabilization' in thoracic and lumbar fractures of spine.
5. To evaluate the clinical and radiographic results of the management of acute traumatic paraplegia by pedicle screw fixation.

MATERIALS AND METHODS

This is a prospective interventional study undertaken in the Department of Orthopedics. Adult patients with acute traumatic paraplegia injuries admitted to Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, were included in this study after obtaining their informed, valid written consent. This study was undertaken from December 2018 to September 2020. Clearance from institutional ethical committee was obtained before initiating the study.

METHOD OF COLLECTION OF DATA:

Sample Size:

Twenty adult patients with acute traumatic paraplegia 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 traumatic paraplegia. 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. 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.

Procedure- Pedicle Screw Segmental Spinal Instrumentation:

Position the patient prone on a padded spinal operating table on a 4 poster frame encouraging more lordosis. 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 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 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. Using a rongeur cortical bone was removed around the pedicle entry point. Pilot hole is made with use of sharp Trocar with stopper. Centralizers or Blunt Kirschner wires 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 quadrants with a pedicle sound 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 straight or curved 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 5 days. They were switched over to oral antibiotics till suture removal. Intravenous dexamethasone 4 mg IV was given for 3 days. 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 on third or fourth post operative day. A close watch was kept for any improvement or deterioration in the neurological status.

RESULTS

This prospective interventional study was undertaken in the Department of Orthopedics in Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga. This study was undertaken from December 2018 to September 2020. Twenty adult patients with acute traumatic paraplegia who gave the consent for surgery admitted during the study period were included as study sample.

Table 1. Distribution Of The Study Group According Age Group And Sex

Age group	Male n(%)	Female n(%)	Total
21 – 30 years	2 (12.14)	1 (20)	3 (15.0)

31 – 40 years	6 (40)	2 (40)	8 (40.0)
41 – 50 years	5 (33.3)	1 (20)	6 (30.0)
More than 50 years	2 (13.3)	1 (20)	3 (15.0)
Total	15 (100)	5 (100)	20 (100)
Mean $\pm$ SD	40.8 $\pm$ 11.1	41.1 $\pm$ 12.1	41 $\pm$ 11.5
t value p value	0.044, 0.966, NS		

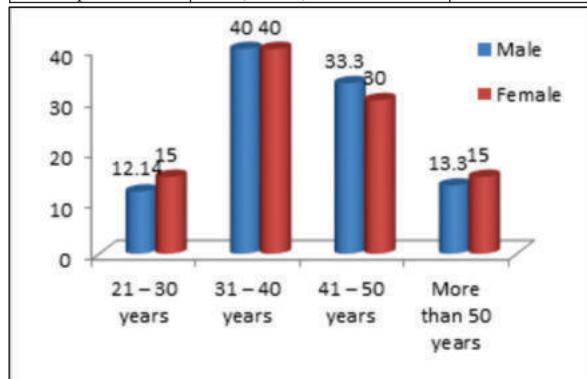
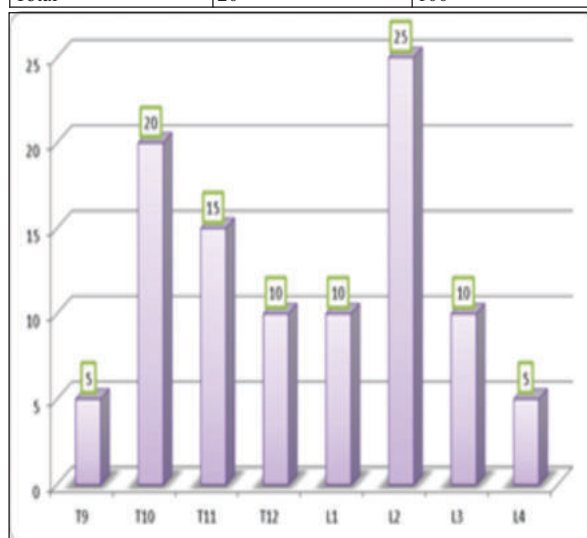


Table no 1 shows the distribution of the age group and sex. The mean age of the study group was 41 years with a standard deviation of 11.5 years. The mean age of males was 40.8 $\pm$ 11.1 years and females age was 41.1 $\pm$ 12.1 years. There was no significant difference between the age of males and females. Forty percent of the males and females belonged to 31 – 40 years, 33.3% of the males and 20% of the females belonged to 41 – 50 years, 13.3% of the males and 20% of the females were aged more than 50 years, 6.7% of the males and 26.7% of the females belonged to more than 50 years.

Table 2. Vertebra Affected In The Study Group

Vertebra	Frequency	Percent
T9	1	5.0
T10	4	20.0
T11	3	15.0
T12	2	10.0
L1	2	10.0
L2	5	25.0
L3	2	10.0
L4	1	5.0
Total	20	100



The most common vertebra involved in the study group was L2 to the extent of 25% followed by T10 (20%), T11 (15%), T12 (10%), L1 (10%) and L3 (10%).

Table 3. Mode of Injury

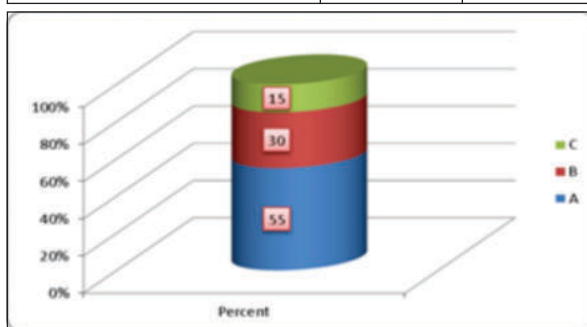
Mode of injury	Frequency	Percent
Fall from height	13	65.0
RTA	7	35.0
Total	20	100



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 accidents.

Table 4. 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



About 55% of the patients had type A fractures, 30% had type B fractures and 15% had type C fractures.

DISCUSSION

The traumatic paraplegia are common and leading problem in orthopedic practice. The individuals are at risk of high energy trauma in the modern era^{1,2,3}. Traumatic paraplegia 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 infections⁴.

Age And Sex Distribution

The mean age of the study group was 41 years with a standard deviation of 11.5 years. The mean age of males was 40.8 ± 11.1 years and female's age was 41.1 ± 12.1 years in this study.

These results were almost comparable to a study by Uzumcugil et al. Alvine et al in their study found that average age was 31 years, with a male predominance. Sasso RC et al, in their study had 77% males and 23% females with a mean age of 34 years. Razak M, et al in their study found that average was 30 years with a male predominance. However the mean age in this study group was higher compare to these studies.

Table 5. Comparison Of Studies For Mean Age.

Study	Mean Age (years)	Sex
Alvine GE et al ¹⁵	31	Male
Uzumcugil et al ¹⁶	39.3	Male
Sasso RC et al ¹⁷	34	Male
Razak M, et al ¹⁸	30	Male
This study	41	Male

Mode Of Injury

In this study group, 65% of the patients had injury due to fall from height. Alvine et al noted it as 52% and Razak noted 69% of the injuries due to fall from height.

Classification Of Fractures

About 55% of the patients had type A fractures, 30% had type B fractures and 15% had type C fractures in this study. Alvine et al¹², Sasso et al¹³, Nasser et al¹⁴ have also noted similar findings.

Level of Injury

The most common vertebrae involved in this series were between T11 – L2 to the extent up to 50%. While Alvine¹⁵ noted to the extent of 70%, Sasso et al¹⁷ noted to the extent up to 80% and Razak et al¹⁸ noted up to 92% of the fractures were at the level of T11 – L2.

Time Duration

In this study, the mean duration of injury to admission to hospital was 2.6 days, duration of injury to surgery was 5.55 days and mean duration of stay in hospital was 29.5 ± 6.5 days. Sasso et al noted that the average time interval between injuries to surgery was 4 days and mean hospital stay was 16 days. While Razak et al¹⁴ noted the average time duration to surgery was 5.6 days and average hospital stay was 24 days. In this study about 25% of the patients were operated within 4 days of the injury and about 75% were operated after 4 days of injury.

Implants

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.

Radiological Parameters

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 24th post operative week.

Nasser M.G et al., noted the kyphotic angle was 23.6° on admission, 7° post – operatively and 11.5° at latest follow-up. Alvine et al., noted that sagittal plane angulation was 12° pre operatively, 1° post operatively and 6° at followup. Sasso et al., noted that the kyphotic angle was 17.6° pre operatively, 3.5° post operatively and 11.6° at latest follow up. Razak M. et al., noted that the average kyphotic angle was 20° pre operatively, 7° post operatively and 9° at latest follow up.

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. 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.

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