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ANALYSIS OF THE RESULT OF SURGICAL MANAGEMENT OF TRAUMATIC PARAPLEGIA IN THORACOLUMBAR SPINE FRACTURE: AN EXPERIENCE FROM A TERTIARY CARE HOSPITAL OF BIHAR.

Orthopedics

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ABSTRACT

Fractures of the thoracic and lumbar region constitute a spectrum of injuries ranging from the simple non-displaced fractures to complex fracture dislocations. **Methodology:** A prospective study was conducted in the department of Orthopedics of a tertiary care teaching institute, Darbhanga Medical College & Hospital located at Darbhanga, Bihar, India. Institutional Ethics Committee permission was sought before enrollment of study subjects in thestudy. The study period was February 2018 to January 2021. The cases included in this study were the patients attending outdoor and emergency with traumatic paraplegia involving the thoracolumbar spine. **Results:** 50 patients in whom posterior stabilization of the spine was done in this institution and followed up for a period ranging from 6 months to 2 years, 8 of 50 patients were lost to follow-up. Remaining 42 patients were considered for the study. Age of the patients ranged from 17 to 40 years. The median age being 27 years. Male female ratio was almost 3:1. Around 2/3rd of the patients was manual laborer. **Conclusions:** After recovery from spinal shock, the earlier the surgical compression done, the better the neurological and bowel/bladder function recovery both in complete and incomplete paraplegic cases.

KEYWORDS

Traumatic Paraplegia, Thoracolumbar Spine Fracture

INTRODUCTION

Fractures of the thoracic and lumbar region constitute a spectrum of injuries ranging from the simple non-displaced fractures to complex fracture dislocations. Anatomically and functionally, the thoracic and lumbar spine can be divided into three regions - thoracic spine (T1-T10), thoracolumbar junction (T10-L2) and the lumbar spine(L3-L5). The thoracic spine is functionally rigid due to coronally oriented facet joints, thin intervertebral discs and the ribcage.

So, it requires huge amounts of energy to produce fractures and dislocations. The narrow spinal canal in this region predisposes to spinal cord damage resulting in a high incidence of neurological deficit. The lumbar spine, on the other hand, is relatively flexible due to the thicker intervertebral discs, sagittal orientation of facet joints and the absence of the rib cage. The relatively lesser incidence of neurological injury in lumbar fractures can be attributed to the large size of the neural canal and the greater resilience of the cauda equina nerve roots [1].

Though fractures of the thoracolumbar spine are common injuries, 50% of these are unstable and can result in significant disability, deformity and neurological deficit [2]. Thoracolumbar fractures are more frequent in men, and the peak incidence is observed between 20 and 40 years [3]. Neurological injury complicates 20-36% of fractures at the thoracolumbar junction in different studies. The chances and extent of neurological deficit depend on the type of fracture [4].

Traumatic paraplegia is an unanticipated catastrophe in an individual's life, posing a huge economic as well as social burden. The healthcare does not end with fixation of spine and inculcates a programmed rehabilitation and preventive management plan involving multiple personnel and family members. Early surgery and comprehensive rehabilitation markedly reduce the overall morbidity of spinal cord injured patients by enabling the patient to lead an independent life [5].

In a developing country like India, where tertiary health care is not universally accessible and acceptable, the consequences of traumatic paraplegia and loss of manpower are well imaginable. Data of traumatic paraplegia at a tertiary care hospital from Bihar was analyzed with the analysis of the results of surgical management of traumatic paraplegia, complete or incomplete.

METHODOLOGY

Study type and design

A prospective study was conducted in the department of Orthopedics of a tertiary care teaching institute, Darbhanga Medical College & Hospital located at Darbhanga, Bihar, India. Institutional Ethics Committee permission was sought before enrollment of study subjects in thestudy. The study period was February 2018 to January 2021. The cases included in this study were the patients attending outdoor and emergency with traumatic paraplegia involving the thoracolumbar spine.

Inclusion criteria

Presence of traumatic paraplegia (complete or incomplete) with fracture and/or dislocation of the vertebra of thoracolumbar spine involving D8 to L5 spine, or fractures involving one or maximally two vertebrae, skin condition of the operative field normal patients and party agreed to have a surgical decompression

Exclusion criteria

Patients below 18 years or unfit for undergoing operation in preanesthetic check-up, patients with head injury or other gross injuries that may preclude undergoing operation, those with multiple vertebral injuries (> 2 vertebrae), injury of the spinal cord and paraplegia with high dorsal spine (above D8), patients presenting late (more than one month after injury), patients with traumatic paraplegia but without signs of cord compression on MRI (where paraplegia is due to cord edema or myelomalacia).

Data collection and surgical management

Informed consent was taken after proper counseling and proper pre-anesthetic check-up. The patients were evaluated by X-ray of spine (AP and Lateral view) and sometimes CT scan. Due to financial constraint contrast myelography was done only few cases. In most cases pedicle screw with plate or rod was used and posterior stabilization and posterior fusion with cortical cancellous bone graft from posterior iliac crest was done. In all the cases water bed was used during pre-operative and postoperative period to prevent bed sore. Preoperative and post-operative neurological charts (according to Frankel's grade and ASIA score (motor and sensory) was maintained with regular assessment for proper postoperative neurological recovery assessment.6 Recovery from spinal shock was noted by using clinical methods like return of bulbocavernosus reflex. Direct or indirect decompression was done. In most of the cases laminectomy was done for direct decompression.

Decompression was confirmed by using a narrow-gauge rubber tube. Condition of the spinal cord was checked by direct vision. Any retro-pulsed fragment compressing upon the cord was taken out. Pedicle screws were inserted into the proximal and distal stable vertebra under image intensification. Then the fracture was stabilized by rods or plates. The pedicle entry points were identified (by intersection method and confirmed by image intensifier guidance) and opened, probed all around and the pedicle screw was introduced. Preoperatively, features such as cord pulsation, cord atrophy and lacerations were looked for. Post-operatively, wound healing, amount of drainage, neurological recovery, radiological assessment, time taken ambulation and ultimate recovery were recorded. We used Frankel grade and ASIA scoring system for preand post-operative neurological assessment [6]. In all cases, long thoracolumbar brace was given to the patients after removal of stitches at 14th postoperative day. Patients were discharged with advice for follow-up.

Follow up

First follow up was done after 2 weeks, 2nd follow up after 6 weeks. Then monthly follow up until the radiological sign of solid fusion was seen on X-ray. Patients were assessed for neurological recovery and assessment of return of bowel and bladder function in every follow-up. Some case was referred to urosurgery department for management of bladder function problems.

RESULTS

Sociodemographic characteristics

50 patients in whom posterior stabilization of the spine was done in this institution and followed up for a period ranging from 6 months to 2 years, 8 of 50 patients were lost to follow-up. Remaining 42 patients were considered for the study.

Age of the patients ranged from 17 to 40 years. The median age being 27 years. Male female ratio was almost 3:1. Around 2/3rd of the patients was manual laborer.

Clinical characteristics

Dorsal spine was involved in 14 out of 42, rest had lumber spine involved. Maximum patients reported to hospital within 3 days of injury. Maximum elapsed time noted was 19 days. Complete decompression was done in 50% of the cases rest undergone incomplete decompression. Median time to complete decompression was 8 days while time to incomplete decompression was 10 days. Mechanism of injury among a little more than 50% of the cases was fall from height, rest suffered road traffic accident. Complete paraplegia was diagnosed in 55.2% of the patients. Type of fracture noted was true wedge compression among 66.7%, burst fracture among 23.8% and rest 9.5% was dislocated fracture. On initial observation, ASIA improvement score was recorded. Graded A among 52.4%, grade B among 28.6% and grade C among 19.1%.

Post-operative recovery

a. Sensory recovery - Sensory recovery (mainly touch) of traumatic patients was studied over weeks and results showed that majority (52.1%) recovered in 1st week itself. Other 12 patients took 2 weeks to recover and another 8 patients recovered over the next 2 weeks.
b. Motor recovery - In all cases of incomplete paraplegia, 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: power did not return at all.

Table 1: Onset of motor recovery among the patients under follow up (N = 42)

Duration in weeks	Among complete paraplegia patients	Among incomplete paraplegia patients
1st	1	10
2nd	4	7
3rd	8	2
4th	10	1

Table 2: Grading of motor recovery of various groups of muscles among patients of complete paraplegia over the weeks of follow up (N = 42)

Muscle group	Grading in post-operative period	Number of cases
Hip flexors	32	75
Hip abductors	23	57
Quadriceps	23	66
Hamstrings	23	84
Tibialis anterior	0	42
EHL	0	42
FHL	0	42
Gastro-Soleus	0	42

Stability of implant

We got 3 patients where there was pull-out of the screws completely out of pedicle. In one patient there was loosening of the outee/innie followed by loosening of the rod. In all three cases these happened within 4 weeks postoperatively. In these patients we had to continue on conservative management and solid bony fusion developed between 12 to 20 weeks.

Comparison of outcome of complete and incomplete paraplegia in terms of sensory and motor recovery

Table 3: Comparison of return of muscle power after decompression in incomplete paraplegia

Weeks	Grade 3	Grade 2	Grade 1	Nil
1st	80%	20%		
2nd	36%	36%	18%	9%
3rd	25%	25%	25%	25%

Table 4: Comparison of return of muscle power after decompression in complete paraplegia

Weeks	Grade 3	Grade 2	Grade 1	Nil
1st	11%	22%	22%	45%
2nd		16%	16%	68%
3rd			20%	80%

Table 5: Comparison of return of sensory recovery after decompression in incomplete paraplegia

Weeks	1st W	2nd W	3rd W	4th W
1st	80%	20%		
2nd	27%	54%	9%	9%
3rd		25%	50%	25%

Table 6: Comparison of return of sensory recovery after decompression in incomplete paraplegia

Weeks	1st W	2nd W	3rd W	4th W	Nil
1st		11%	11%		78%
2nd		12%			88%
3rd				20%	80%

DISCUSSION

Thoracolumber junction is the commonest area involved in spinal injury. This area represents the transition from thoracic kyphosis to lumber lordosis and the axis of the body passes in front of this junction when the patient is erect. So, there is anterior bending moment working at this junction resulting in maximum stress concentration in this area which may be responsible for implant failure in this junction [7].

Decompression in the spinal injury is one of the most controversial concepts. Both experimental and clinical findings of Benzel EC et al, Dolan EJ et al, and Maiman DJ et al clearly documented the role of neural decompression in improving the neurological outcome [8-10]. The essential key to reduction of intracanal fragments in brust fractures is dictation. So, any device used posterior must have large distractive force. The pedicular screw system can provide large amount of distraction. Open up the collapsed anterior segment at specific level by appropriately contouring the rod according to the saggital curvature of the spine. Vaile et al. also provided evidence that transpedicular decompression in experienced hand is usually able to restore an almost normal cross-sectional area at the affected level of spinal canal [11].

In present study, decompression was done in patients with >50% collapse of the vertebral body and with canal narrowing, posterior-laterally by scooping out the retro pulsed bony fragments from the canal as well as pushing some of the fragments anteriorly. Cord injury consists of the primary contusion, secondary injury due to cellular changes at the injury site and the effects of ongoing neural compression. The first mechanism is amenable only to preventive treatment. Intensive investigation for effective agents is underway that may modify the secondary injury response. The use of methylprednisolone in the immediate post-injury phase has been shown to marginally improve outcome innational acute spinal cord injury study investigations, but this improvement has not been substantiated in other studies, and its role remains controversial. In our study we have routinely used injection methylprednisolone with a dosage and indication as recommended by NASCIS, but we have not found any neurological improvement with use of methylprednisolone in all of the 22 patients in whom it was used [12-18].

Regarding the procedure of decompression, we had two options in our hand, either direct or indirect decompression. In most of the early cases we have found, indirect decompression was satisfactory as seen on image intensifier. Laminectomy, screw fixation followed by slight distraction was all to be done in cases of early decompression. But in late cases (beyond 11 days) it has been found that the decompression was not possible only by postural reduction. After pedicle screw fixation good amount of power was necessary to distract the fracture fragments and for the decompression. In late cases, extensive fibrosis and bleeding of the operative field made the procedures difficult and time consuming. The distorted anatomy of the old fracture made the situation more problematic.

But the timing of surgery for spinal cord injuries is controversial. Most authors agree that in the presence of a progressive neurological deficit, emergency decompression is indicated. In patients with complete spinal cord injuries or static incomplete spinal cord injuries, some authors advocate delaying surgery for several days to allow resolution of cord edema, whereas others favor early surgical stabilization. There is no conclusive evidence in the literature that early surgical decompression and stabilization improve neurological recovery or that neurological recovery is compromised by a delay of several days.

Studies by Bohlman et al, Transfeldt et al, Bradford et al, and others have documented return of neurological function after anterior decompression done more than a year after the initial injury [19-22]. For neurological normal patients with unstable spinal injuries and those with nonprogressive neurological injuries, we believe that open reduction and internal fixation should be carried out as soon as possible.Mirza et al. in a recent study concluded that patients who sustain acute traumatic injuries to the cervical spine with associated neurologic deficit may benefit from cervical decompression and stabilization within 72 hours of injury. Surgery within 72 hours of injury is not associated with a higher complication rate. Early surgery may improve neurological recovery and decrease hospitalization time in patients with cervical spinal cord injuries [23]. In some patients in our study, it has been found some return of sensory or motor function was possible even when the MRI findings showed there was complete transaction of the cord.

CONCLUSION

In our series of 46 cases of traumatic paraplegia, 22 cases were complete paraplegia and 20 cases were incomplete paraplegia, 4 cases being lost in follow-up after analysis of the results we could draw the following conclusions: • After recovery from spinal shock, the earlier the surgical compression 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. • Higher dosage of methylprednisolone is not effective for betterment in the neurological outcome. • In early cases indirect decompression is possible, but in late cases direct decompression has to be done. • Even with MRI findings of complete transection of cord, some inexplicable sensory recovery took place, which mandates surgical decompression in all cases, be it early or late.Motor recovery can continue for over 6 months after decompression. • At 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 the cases.

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