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Management and Outcome of thoracolumbar spine injury cases at a tertiary care hospital

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Abstract
Introduction: Historically, thoracolumbar fractures have been treated with recumbency i.e. bed rest for a period of 8-12 weeks. This mode of treatment is accompanied with complications due to recumbency. It is very labor intensive. Cost of therapy in terms of hospital hours used, bed occupancy and care by trained personnel is very high. In a country like ours, where there is acute shortage of hospital facilities and trained manpower, conservative management, more often than not, ends up as benign neglect.
Methodology: This present study is a prospective study of posterior instrumentation with pedicle screw fixation and fusion in traumatic unstable thoracolumbar spine. During the period 23 cases of traumatic thoracolumbar spine fractures were treated operatively with posterior decompression, instrumentation and fusion. Of these, 3 cases were lost to follow up. Hence the results of 20 cases were evaluated
Results: In our study Type A fractures And type B fractures had incidence of 40% each. Amongst type A, Type A3 predominated. Amongst Type B, Type B2 predominated. Type C fractures accounted for 20% cases. B & C types of fractures were most commonly seen with RTA. These are high energy injuries that result in polytrauma. Complete or near complete paraplegia is common in this group.
Conclusion: Management of thoracic and lumbar spine fractures demands more skills in selecting the right patients for surgery and effective preoperative evaluation.

Keywords: thoracolumbar fractures, management, complications

Introduction

Injuries to spine are dreaded problems. They cause infinite morbidity and disability to the patient. If not treated urgently & rationally, patient may be confined to bed for his life [1].

Thoracolumbar spine is the most commonly injured part of the spine. Commonly it affects young adult males who are the major bread earners in a family. This causes infinite economic and emotional burden to the family in particular and society in general.

The treatment options for the unstable thoracolumbar spine fractures and fracture dislocations are ridden with controversies. Most authors agree that neurological improvement is independent of the treatment modality [1, 2]. But the advocates of surgical decompression point at theoretical advantages of surgery in improving neurological deficits. Lately, consensus is evolving around the world for stabilization of spine with fusion and instrumentation in unstable fractures.

Historically, thoracolumbar fractures have been treated with recumbency i.e. bed rest for a period of 8-12 weeks [2, 3]. This mode of treatment is accompanied with complications due to recumbency. It is very labor intensive. Cost of therapy in terms of hospital hours used, bed occupancy and care by trained personnel is very high [1]. In a country like ours, where there is acute shortage of hospital facilities and trained manpower, conservative management, more often than not, ends up as benign neglect. So there is an urgent need for exploring possibility of surgical stabilization, early mobilizations and rehabilitation of patients.

Surgical treatment can be by anterior, posterior, lateral or anteroposterior approaches. As most orthopaedicians and spine surgeons are more experienced in posterior approach, it is a safe alternative. Many instruments are available to stabilize spine by posterior approach. Historically, Harrington hook-rod construct or its modifications have been extensively studied [4]. Their main disadvantage is it spans at least 5-6 spinal segments. So newer options, especially pedicle screw and rod constructs which need shorter segment immobilization have gained popularity [5].

In variable screw placement system (VSP) the fixation achieved is more rigid as the screw is passed through the "force nucleus" of the vertebrae. This is the point through which five anatomical structures – the superior facet, the inferior facet, the lamina, the pedicle and the transverse process; channel all posterior forces that are transmitted to the body.

In this study, we have stabilized cases of the traumatic unstable thoracolumbar spine injuries with decompression and pedicular screw rod (Moss Miami) instrumentation. We evaluated all the patients for incidence, neurological recovery and radiological correction and maintenance.

Methodology

This present study is a prospective study of posterior instrumentation with pedicle screw fixation and fusion in traumatic unstable thoracolumbar spine. During the period 23 cases of traumatic thoracolumbar spine fractures were treated operatively with posterior decompression, instrumentation and fusion. Of these, 3 cases were lost to follow up. Hence the results of 20 cases were evaluated. All patients were initially evaluated in the out-patient department or casualty according to their presentation and then they underwent detailed assessment of their hemodynamics, spine, neurological status and other injuries if associated with trauma. The patient's epidemiological, historical, subjective and physical findings were noted. After initial investigations and hemodynamic stabilization, patients were assessed neurologically in detail. A neurological chart was maintained for each patient.

Methyl prednisolone was administered to all patients according to NASCIS, I, II, III protocol:- Methyl prednisolone bolus 30 mg /kg followed by 5.4mg/kg/s infusion for 24 hours. If bolus given within 8 hours of injury. Infusion for 48 hours if bolus given within 3 to 8 hours after injury.

All the patients had routine X-rays of thoracolumbar and lumbosacral spine in both AP and lateral views. In all patients CT scanning was done, MRI was done in affordable patients. The exact level of injury, type of fracture and mechanism of injury were ascertained. The preoperative neurological status was graded on the basis of ASIA grading. It was also used to assess post operative recovery and follow-up.

4 patients had significant additional injury. 2 patients had calcaneal fracture, which were treated conservatively. 1 patient had multiple rib fractures and was treated conservatively. 1 patient with talus fracture was treated with open reduction and internal fixation with 4mm cancellous screw in a second sitting after 7 days.

Results

The earliest intervention was 24 hours after the trauma. The time interval between trauma and surgery ranged from 24 hours to 10 days. The mean interval was 4.9 days.

Type of anaesthesia

All the patients were operated under intubation and general anesthesia.

Duration of surgery

The mean surgical time was 3 hours. The quickest was done in 2 hours 30 minutes. The most time consuming surgery was for 4 hours.

Implants

The implants of choice in our study was, Monoaxial pedicle screws with connecting rods (moss Miami). Since the patients admitted in our hospital were of low economic level, affordability was the major concern in using polyaxial pedicle screws. As polyaxial screws are costlier than monoaxial screws.

Blood Transfusion

All the patients were routinely transfused one pint of compatible blood per operatively. And post operative blood transfusion was done in required patients.

Average blood loss

Average blood loss was between 500-700 ml.

Follow-Up

The mean duration of follow-up was 11 months. It ranged from 6 months to 20 months.

Neurological Course

All the patients were assessed according to ASIA scale preoperatively, post operatively and during the follow up. 5 patients presented with complete paraplegia (25%) and 1 patient with Right lower limb monoplegia, 14 with incomplete deficits. None showed worsening of neurological status. Of the 5 patients who presented with ASIA grade A, 3 remained as Grade A. 1 had sensory recovery i.e. he improved to grade B. and one more patient improved to grade D. Right lower limb monoplegia recovered from A to D. Of the 4 patients who presented with Grade B, 3 patients improved to grade C. 1 patient improved to normal neurological status i.e. Grade E. Of the 7 patients who presented with Grade C, 5 recovered completely to Grade E. 2 patient improved to Grade D. Out of 3 patients who presented with Grade D status, 2 patients improved to Grade E and one patient did not show any improvement.

Table 1: Neurological course

	Neurological		At the end of follow up				
	Status	**A**	**B**	**C**	**D**		**E**
A	6	3	1	-	2		-
B	4	-	-	3	-		1
C	7	-	-	-	2		5
D	3	-	-	-	1		2

P VALUE= 0.028742

Since P Value <0.05, it is considered as statistically significant.

As many cells in the table were empty end results of A B C D were clubbed together and compared with end results of E.

Chi-square test is applied to get the P value for this clubbed status. The degree of freedom is 3.

To summarize, of the 20 patients, 16 patients showed neurological improvement by at least 1 grade i.e. 80% showed neurological improvement.

Radiological course

Sagittal angle

The mean sagittal angle preoperatively was 18.9^0. This marked Kyphosis improved significantly after operation to mean sagittal angel of 8.6^0 there was progressive loss of alignment during follow up to give a mean sagittal angle of 9.5^0. So the mean loss of correction was 0.9^0 (Table 8).

Table 2: Sagittal Angle

Pre-op	Post-op	Follow up
18.9^0	8.6^0	9.5^0

Sagittal Index

The sagittal index preoperatively was 0.42. This improved to 0.64 after surgery. There was loss of correction by 0.02 during follow up to give a mean value of 0.52. (Table 9)

Table 3: Sagittal Index

Pre-op	Post-op	Follow up
0.42	0.64	0.52

The following complications were observed in our study

Table 4: complications

Complications	No. Of patients
Uti	2
Pressure sore	2
Implant infection	2
Superficial infection	1
Outer nut loosening	1

1. Urinary tract infection

2 patients had urinary tract infection. Both the patients had no bladder control and had catheter in situ. They were treated with thorough bladder wash and appropriate antibiotics. All responded well to treatment. They were taught hygienic techniques and discharged.

2. Bed Sores

2 patients developed bedsores. The reason was thought to be non-compliance of the patient to posture change regimen. They were treated with antiseptic dressings, antibiotics and waterbed. An additional commercially available water ring tube was advised for the patient with sores over buttocks. They were told to alternate between sitting and lying in the bed. All the sores healed. They were taught the proper care of anesthetic back and buttocks and discharged.

3. Wound Infection

Three patients had wound infection. One was superficial. It responded to daily dressing and antibiotics according to culture and sensitivity.

The other 2 patients had deep infection. Inspite of thorough debridement and proper antibiotics, infection could not be eradicated. 1 patient had discharging sinus even after 2 months of surgery, so the implant was removed. Thorough debridement was done and antibiotics started according to C & S. Patient responded well. Another patient suffered with the similar problem and implant was removed after 3 months. Patient responded to antibiotics and debridement.

4. Implant Failure

One patient with L1 fracture presented with outer nut loosening of one pedicle screw during follow up. Since the patient was asymptomatic and there was no neurological deterioration, it was left alone. Probable reason for implant failure in this case was due to improper tightening of outer nut, stress due to early unprotected weight bearing by the patient. In 1 case due to infection, loosening of screws was seen.

Discussion

In our study Type A fractures And type B fractures had incidence of 40% each. Amongst type A, Type A3 predominated. Amongst Type B, Type B2 predominated. Type C fractures accounted for 20% cases. B & C types of fractures were most commonly seen with RTA. These are high energy injuries that result in polytrauma. Complete or near complete paraplegia is common in this group.

The patients were assessed according to ASIA (American Spinal Injury Association) scale. Assessment was made preoperatively, post operatively, and during the follow up. No patient had neurological deterioration. Of the 20 patients, 16 patients showed neurological improvements by atleast by 1 grade i.e. 80% cases. The average grade of improvement was 1.5 grades. In the study by Jerome M Cottler, of the 44 patients 14 patients improved neurologically i.e. 31.9%. Aebi. M *et al*. [6] showed 64.4% neurological improvement Nasser. M.G *et al* reported that neurological improvement occurred in 50% cases. The neurological improvement achieved was fair and comparable to other studies. Higher percentage of neurological recovery could be due to higher number of incomplete cord injury cases in our series and relatively less number of cases studied.

Radiologically patients were assessed by sagittal angle and sagittal index. The mean Kyphosis before surgery was 18.9,^{0} postoperatively it was 8.6^0. During the last follow up mean kyphotic angle was 9.5^0.

Loss of nearly 1 degree (0.95) of kyphotic angle was noted. Fusion was the added support for the maintenance of the sagittal angle.

R. Roy Camille *et al* reported less than 5^0 Kyphosis after reduction in 77% of cases. The mean loss was 3^0.

Aebi.M *et al* reported that the average preoperative kyphotic deformity was 20^0, 7^0 post operatively and 9^0 at last follow up. Essess *et al*. [7] reported that the average preoperative kyphotic deformity was 18.2^0. This was corrected to 3.5^0 postoperatively. During follow up loss of correction was 3.2^0.

Christian Knop *et al*. [8] reported mean kyphosis of 15.6^0 before surgery. Postoperatively lordosis of 0·4^0 was reported. Mean loss at follow up was 10^0. Sagittal index was 0.67 before surgery and 0.91 after surgery. During follow up there was no significant change.

In our series the mean duration from injury to surgery was 4.9 days. Average hospital stay was 25 days.

Table 5: Hospital stay

	Injury to surgery (days)	Total stay (days)
Aebi. M *et al*	4	16
Nasser. M *et al*	5.6	24
Present study	4.9	25

It is imperative that wide exposure is performed, till the tips of the transverse process, to achieve good posterolateral fusion. We have generally inserted pedicular screws before doing laminectomy, as it helps to decompress the cord by reducing retropulsion and reduce the chances of iatrogenic cord damage.

In one case, there was anterior compression of cord by bony fragments, which was not getting reduced, we did burring of the pedicle on one side to get better exposure to anterior aspect of the cord. Then we tamped the fragment to reduce it. We find this procedure to be safe and is a good alternative to additional anterior decompression.

The pedicle is surrounded by neurovascular structures on all sides. It is not advisable to put pedicle screws without the aid of radiology. Though C-arm usage increases the operative time and can cause radiation hazards to surgical team, its usefulness cannot be over emphasized.

Some authors recommend Somatosensory Evoked Potential monitoring currently during insertion of posterior instrumentation in patient who are neurologically normal or

have incomplete neurological deficits. This allows physiological monitoring as the fracture is reduced and distraction is applied to the spine. But we did not have facilities for SEP. So, we used C-Arm to assess anatomical reduction during distraction. We find this method to be safe as we did not have any neurological deterioration, but, we need a larger study group to come to any conclusion.

Though, the identification of pedicles was done by anatomical land marks of ridge on transverse process and facet joint, image intensifier was used in all the cases to confirm central placement of screw in the pedicle. It also helps in maintaining the depth of drilling, tapping and screw placements.

And for posterolateral fusion we preferred posterior iliac crest as a donor for generous cancellous graft. Facetal joints were freshened thoroughly before harvesting the bone graft. Thorough homeostasis was achieved before closing the wound in layers.

Conclusion

In our study, posterior stabilization with posterolateral fusion was found effective in restoring spinal stability, successful in correcting spinal angulations and maintenance. Study also showed a fair improvement in neurological status. Neurological recovery was good in patients with incomplete cord Injury. The results in our short series of 20 cases have been encouraging. But there is need for more cases and longer follow-up to come to categorical conclusion.

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