



A Comparative Study of Management of Thoracolumbar Spine Injuries with Neurological Deficit by Steffee Plating and Conservative Method

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Abstract

In a prospective study conducted in the Postgraduate Department of Orthopaedics Govt. Medical College, Jammu, over a period of 2 years. Forty cases, both male and female in the age group of 20 to 50 years with thoracolumbar spinal injury between D11 and L2 vertebra with neurological deficit were included. Out of these forty cases, 20 cases were managed by posterior decompression and stabilization with Steffee plating and 20 cases of similar injuries were managed conservatively and comparison of the two groups was made. The results were analyzed according to neurological improvement as per Frankel's grading, the complications and the duration of hospital stay in both the groups. In operative group; 50% of the patients showed some degree of recovery with 30% of the patients showed full recovery. The mean postoperative correction of kyphosis was 12.5% and the average hospital stay was 23.7 days. 15% of the patients in operated group developed complications. In the conservative group; 30% of the total patients showed neurological recovery with 20% patients showed significant recovery (Grade D). There were various complications in 65% patients and the average hospital stay was recorded as 40.5 days. General complications were more in conservative group. In view of increased incidence of neurological recovery, decreased incidence of complications, decrease in hospital stay and ease of nursing care in case of operated group, we recommend posterior spinal fixation with Steffee plate system in patients with unstable dorsolumbar spinal fractures especially with incomplete neurological deficit to be adopted in operative practise.

Key Words

Thoracolumbar, Spinal Trauma, Steffe Plate System

Introduction

Although traditionally spinal injuries have been treated by non-operative methods, the indications for surgical treatment have crystallized with the development of better instrumentation and surgical technique. Operative decompression and internal fixation has become an accepted mode of treatment of patients with unstable fracture with partial neurological deficit. Harrington's distraction instrumentation has its own limitations like decreased flexibility of the spine, implant breakage, loss of fixation and loss of lumbar lordosis (1). The search for an ideal implant which could provide segmental rigid fixation and yet allow early mobilization with out support

has continued. Steffee (2) in 1986 reported a pedicular screw placement based on the concept of force nucleus of the vertebral body pedicle. The Steffee plate system is a versatile implant which can be used in traumatic, degenerative and neoplastic disorders of the spine. Since the treatment of thoracolumbar spine injuries with neurologic deficit is controversial and swings around conservative and operative treatment and there is no clear consensus regarding this, thus the present study was undertaken to compare the results of conservative and operative (*Steffee Plating*) treatment of thoracolumbar injuries.

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Material and Methods

A prospective study was conducted in the Department of Orthopaedics Govt. Medical College, Jammu, over a period of 2 years. Forty cases, both male and female in the age group of 20 to 50 years with thoracolumbar spinal injury between D11 and L2 vertebra with neurological involvement were included in this study. The fractures were classified according to Denis classification (3). Out of these forty cases, 20 cases were managed by posterior decompression and stabilization with Steffee plating and 20 cases of similar injuries were managed conservatively and comparison of the two groups was made. Patients with gross osteoporosis and stable/unstable fractures without neurological deficit were excluded from the study, as were patients with pathological fractures. All patients underwent a detailed clinical examination as part of our routine work up for any major spinal surgery. Special emphasis was laid on neurological status (Frankel's Grade) and radiology (vertebral body height, kyphotic angle) (*Fig-1*). CT scan & /or MRI scan of the patient was done to assess the bony injury and status of the cord respectively.

Patients in operated group were operated under GA in a prone position. Exposure through standard posterior midline incision was made. Laminectomy was performed at the involved level & any loose fragments in the spinal canal were removed. Spinal fixation was performed using the Steffee plate system (*Fig-2*). The pedicles were localized by the Weinstein's intersection and mamillary process methods. Cortical bone was removed from the point of entry and a probe was passed through it into the pedicle and vertebral body. A 2.0 mm K wire was used as a guide wire and placed in the hole. Once all the pedicles to be instrumented were probed, the holes were then tapped and screws of adequate length were tightened. For the dorsal spine 4.5mm and for the lumbar spinal 5.5mm screws were used. Contoured slotted plates were then placed over the screws and posterior tapered nuts tightened bilaterally to achieve the final reduction. The check nuts were then tightened on each screw. The extra machine threaded portion of the pedicle screw was cut. After ensuring adequate homeostasis, the wound was closed in layers over the suction drain. Back care and side turning was started same day and the patients were made to sit with anterior spinal hyperextension brace on 10th postoperative days. All patients were reviewed at monthly interval for first six months and subsequently every three months. Clinical neurological and radiological examination was repeated and progress recorded. The

patients managed conservatively, underwent a period of strict recumbency in a standard hospital bed for six weeks followed by ambulation after using anterior spinal hyperextension brace.

Statistical Analysis

Data was expressed in n (%) and analysed using chi square test.

Results

In the present study it was noted that all the fractures were due to trauma. Fall from the height was the single most common cause of injury while fall of the heavy object and road traffic accident beings other less common modes of injury (*Table 1*). In Majority of the patients injury was D11 –L1 level, with L1 being the most common fractured vertebrae in both the groups. Sixty five percent of the patients in operative group were in the age group of 21-30 years with mean age of 29.7 years where as in conservative group also sixty five percent of the patients were in the age group of 21-30 years. There were 75% male patients in the operative group 70% patients in the conservative group were males. However, a detailed statistical analysis of the two populations revealed no significant difference in the age, sex or level of vertebral injury distribution, i.e. the two populations were found to be comparable (*Table 2*).

Results were assessed in 20 operated patients available for follow-up on the basis of preoperative and postoperative neurological status, radiology (kyphotic angle, vertebral body height). Mobilization time and complications were given due consideration.

Neurological assessment was graded according to frankel grading. All patients in both the groups had some degree of neurological deficit. In operated group 50% of the patients showed some degree of recovery with 30% of the patients showing use full recovery (grade D & E). Only one patient out of 11 patients having complete cord injury (Frankel's grade A) showed recovery after surgical intervention.

In conservative group 30% of the total patients showed Neurological recovery with 20 % patients showed significant recovery (Grade D) whereas no patient having complete cord injury showed any recovery (*Table 3*). Kyphotic deformity was measured from the standard AP and lateral radiographs and comparison of preoperative, postoperative and follow-up values was done. The correction of kyphotic deformity was achieved in all 20 operated cases with a mean correction of 12.5°. It was

further observed that correction could be achieved to a higher degree if surgical stabilization was done early. Anterior vertebral Body height was calculated from the preoperative and postoperative lateral radiograph and 100% patients had improvement after surgery. No patient had decrease in vertebral height at final follow up. The mean preoperative height was 61.60% whereas postoperative mean height was 71.56%. We could achieve solid fusion in 90 % of the operated patients. In the present study there was one case of screw breakage and one screw was loosened and in both the implant had to be removed after the fracture union. Deep infection, bedsores, urinary tract infection (UTI), Respiratory tract infection and joint contractures were observed in both the groups but more in conservative group (Table 4). None of the patients in this study whether treated conservatively or operatively had any neurologic deterioration. In the operated group overall 20% patients developed complications as compared to 65% patients in conservative group (Table 4). There was gross difference in total hospital stay in two groups. The hospital stay in operated group was 12 -28 days (average 23.7days) as compared to conservative group 32-48 days (average of 40.5days).

Discussion

Harrington rods were first used in 1985 and were able to achieve the deformity correction and indirect decompression of the spinal canal but subsequent loss of correction was high (4). The hooks of the Harrington instrumentation violate the spinal canal. Moreover it could not provide three point fixation at the level of dorsolumbar

Table 1. Mode of Trauma

Mode of Trauma	Patients	
	Operative	Conservative
	n (% age)	n (% age)
Fall from Height	12(60)	15(75)
Road Traffic accidents	4(20)	3(15)
Heavy Object on Back	4(20)	2(10)

Table 2. Various Characteristics of the Two Populations

Attribute	Operative Group	Conservative Group	P Value
Sex			
Male	15	14	0.72 (NS)
Female	5	6	
Age			
<40years	17	16	0.67 (NS)
>40years	3	4	
Vertebral Level			
Dorsal Spine	5	7	0.49 (NS)
Lumbar Spine	15	13	

Table 3. Comparison of Outcomes Between the two Groups

Attribute	Operative	Conservative	PValue	
Neurological Outcome	Recovered By Frankel Grade	10	6	7.5 (NS)
	No Recovery	10		
Complications	Present	4	13	0.01 (S)
	No Complications	16		

Table 4. Specific Complications Related to Procedure

Complications	Number (n = 3)	%age
Screw loosening	1	5
Screw breakage	1	5
Plate breakage	0	0
Superficial infection	0	0
Osteomyelitis	1	5

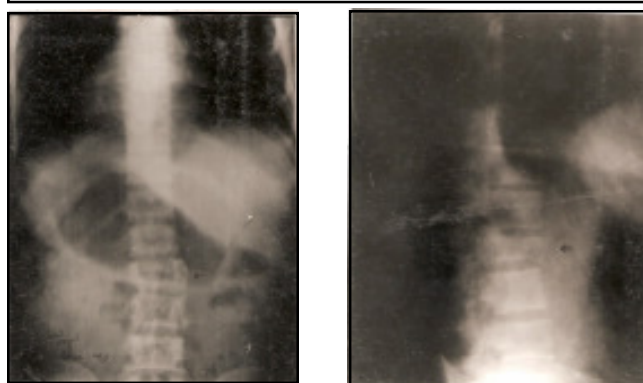


Fig 1. Preoperative AP & Lateral X-rays Showing L2 Fracture

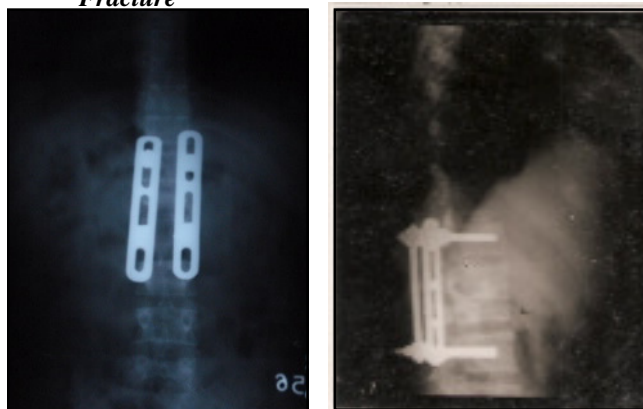


Fig 2. Postoperative AP and Lateral X-ray Showing Steffee Plating

junction and lumbar spine. Gertzbein *et al* (5) reported high rate of infection with the use of Harrington rods. Luque rods were used to provide segmental fixation but the distraction force is absent and it fails to prevent collapse in unstable burst fractures and sub laminar wires impinge on the spinal canal leading to neurological complications (6). An *et al* (7) compared the results of Harrington rod, Luque rod and Steffee plate and found



the former two systems maintained lumbar lordosis poorly and were more frequently associated with poor results. The pedicle offers the strongest point of attachment to the spine as well as the force from the posterior elements to the vertebral body is transmitted through the pedicle. Therefore, the system currently in use, insert some kind of screw, into the pedicle and vertebral body (8). Steffee plate system was developed as an alternative to Harrington rods segmental spinal instrumentation. Since Steffee plate is a slotted plate with nests in the slots, it permit solid fixation of the tapered nut. It is a versatile system and can be used in a variety of disorders resulting in instability of spine i.e. fractures and fracture dislocations, degenerative spine diseases, spondylolisthesis and tumors. Various authors (9-18) have conducted similar study in past. Good to excellent results in majority of their patients have been reported and thus these studies have recommended its use in thoracolumbar trauma (9,13,17). Poor results have also been reported by few (10,11,15,16,18) and were attributed to the extensive communication of the vertebral body and lack of anterior column support (12) as grafting was not undertaken in these cases. The results of the study were favorable when compared to the conservatively treated patients (13). In the operative group 50% patients showed neurological recovery as compared to 35% in the conservative group. However, this difference was found to be statistically insignificant ($p = 0.52$). In the operated group overall 20% patients developed various complications as compared to 65% patients in conservative group and this difference was statistically significant ($p = 0.01$) (Table 3). The hospital stay decreased significantly in operated group (23.7days) as compared to conservative group (40.5days). We did all the surgeries in the main operation theater due to lack of the image intensifier facility in the emergency operation theater causing delay of decompression of spinal cord, which should be done as early as the patients are fit for surgery. We used Indian made stainless steel implant in all the operated patients which prevented us from doing the postoperative MRI.

Conclusion

The ideal candidates for undergoing posterior spinal fixation with steffee plate system are patients with unstable fractures & incomplete neurological deficit. The study revealed that the apparently higher rate of neurological recovery in the operative group was not statistically significant. Nonetheless, in view of the significant decreased incidence of complications, decrease in hospital stay and ease of nursing care in case of operated group, we recommend this technique over conservative management of thoracolumbar fractures.

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