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FRACTURE OF SPINE:

UNSTABLE FRACTURE OF THE THORACOLUMBAR SPINE, TO DETERMINE THE EFFECTIVENESS OF PEDICLE SCREW AND ROD FIXATION FOR MANAGEMENT.

Faisal Abdul Jabbar[1], Muhammad Hashim[2], Abdul Ali Khan[3], Shahid Ahmed[4], Rehana Ali Shah[5]

1. MBBS
Post Graduate,
Department of Orthopedics,
Abbasi Shaheed Hospital, Karachi.
2. MBBS
Post Graduate,
Department of Neurosurgery,
Abbasi Shaheed Hospital, Karachi.
3. MBBS, FRCS
Incharge Department of
Neurosurgery,
Abbasi Shaheed Hospital, Karachi.
4. MBBS, MCPS, FCPS
Professor and Head of
Department of Neurosurgery,
Abbasi Shaheed Hospital, Karachi.
5. MBBS, FRCS
Head of Department
Department of Orthopedics,
Abbasi Shaheed Hospital, Karachi.

Correspondence Address:
Dr. Faisal Abdul Jabbar,
Address: B-69, Block-3, Gulshan-e-Iqbal, Karachi-75300, Pakistan.
drfaisaljabbar1@gmail.com

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ABSTRACT… Objectives: In this study we analyze and study the effectiveness of pedicle screw and rod fixation for the management of unstable fractures of the thoracolumbar spine. The type of study is a **Study Design:** Case series. **Period:** 1.5 year duration from April 2014 to September 2015. **Setting:** Tertiary Care Centre in Karachi, Pakistan. **Materials and methods:** N= 35 patients were operated at our institute and included in the study. The inclusion criteria was all those patients who presented to us with unstable fractures of the thoracolumbar spine via the accident and emergency department of the hospital, and were operated upon and gave full informed consent to partake in the research were included in this study. All the patients were operated under general anesthesia. The short segment fixation with pedicle screw rod fixation using the posterior approach was the technique utilized for treatment. Rehabilitation was started immediately after the surgical procedure. Data was analyzed using SPSS version 23. **Results:** The study population consisted of n= 35 patients of which n= 25 (71.42%) were males and n= 10 (28.57%) were females, the mean age of the study population was 33.5 years. A history of fall from height was the most common cause of injury in n= 26 (74.28%) of the patients, next was automobile accidents in n= 9 patients (25.71%). Burst fracture was the most common type of injury. The sagittal angle was 23.5^{O} pre operatively and 10.75^{O} post operatively, and at follow up the loss of angle was found to be 4.80 respectively. The sagittal index values were as follows, pre-operative 0.53, post-operative 0.75 and 0.72 at follow up (final follow up). N= 30 (85.71%) patients showed improvement in their ASIA status, n= 19 (54.28%) showed single grade improvement, n= 10 (28.57%) showed double grade improvement, n= 1 (2.85%) showed triple grade improvement, while n= 5 (14.28%) cases did not show any improvement. The mean duration between injury and surgical intervention was 5.5 days with a range of 1 to 23 days, the major cause of this delay was delay in reaching the hospital. The most common complication observed was pressure sores in n= 4 (11.42%) and urinary tract infections (UTI) seen in n= 5 (14.28%) of patients, followed by implant failure in n=3 (8.57%) patients. **Conclusion:** According to the results of our study unstable burst fractures was the most prevalent type of fracture observed, there was a marked improvement in the radiological parameters post operatively, while the neurological improvement was decent. The technique of pedicle screw rod and fixation using the posterior approach provides good surgical outcome and better stabilization, with a fair amount of neurological improvement for these patients.

Key words: Fractures; Pedicle screw fixation; rod instrumentation; thoracolumbar spine; traumatic injury.

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INTRODUCTION

In the axial skeleton the most common site of injury is the junction of the thoracolumbar spine, the pressure forces face an abrupt change going from the stiff long kyphotic thoracic spine to the lordotic mobile lumbar spine at their respective junction. This zone is susceptible to injury, as it is a biomechanical weak point, and is the most common site of injury especially in motor vehicle accidents, falls and sports related trauma.[1] These injuries as with all kinds of traumatic injuries are more common in the male population as compared to the female population, and males are at quadruple risk of having these injuries as compared to their counterparts. During the injury to the thoracolumbar spine other organ systems

are also damaged in about 50% of the patients, and injuries which result in paraplegia at the level of the thoracic spine have a mortality rate of 7%.[2,3]

For the surgeons the goal of treatment of the thoracolumbar fractures is a stable, painless and balanced spine, with maximal mobility and neurological functioning. The best method of treatment to achieve the aforementioned results is still controversial. Stability determines the modality of treatment utilized, the McAfee et al classification provides a comprehensive view of the stability of the spine, the mechanism of failure of the middle column is determined by the axial distraction and compression or translation which determines and influences the post-operative stability.

The various types of fractures are as wedge compression fractures (isolated fracture of the anterior column from over flexion in the forward direction, usually not associated with neurological injury) stable burst fracture (in the anterior and middle spine) unstable burst fracture (anterior and middle column involved as they are compressed, also damage is sustained to the posterior column as due to compression, lateral flexion or rotation) chance fracture (horizontal avulsion fractures) flexion distraction injury (flexion axis is posterior to the anterior longitudinal ligament, involved anterior, middle and posterior column) translation injuries (fractures involving all the three columns, with misalignment of the neural canal, with possible neurological damage).

Surgical intervention is required in all the unstable fractures. There are various methods of treatment, the pedicle screw and rod fixation has its fair share of advantages such as shorter duration of hospital stay, fewer complications, less time of immobilization, better rehabilitation and reduced mortality and morbidity. In this study we analyze and study the effectiveness of pedicle screw and rod fixation for the management of unstable fractures of the thoracolumbar spine.

MATERIALS AND METHODS

The type of study is a case series, conducted for a period of 1.5 year duration from April 2014 to September 2015, at a tertiary care centre in Karachi, Pakistan. N= 35 patients were operated at our institute and included in the study. The inclusion criteria was all those patients who presented to us with unstable fractures of the thoracolumbar spine via the accident and emergency department of the hospital, and were operated upon and gave full informed consent to partake in the research were included in this study. The exclusion criterion was all those patients who refused to participate in the study, those who had stable fractures of the thoracolumbar spine, were unfit for surgery or had significant co morbid conditions.

Data was collected in a predesigned proforma which included but was not limited to the patients demographic data, age, gender, complete history and physical examination, mode of injury, time duration between injuries to presentation etc. The complete physical examination included the general examination for cervical spine, head, chest and abdominal injuries, along with complete neurological examination including the motor power, sensory, reflexes and bowel bladder functioning. The level of spinal injury and extent of cord damage was also noted using the American spinal injury association of neurological evaluation. The MacAfee's classification of the radiography was used to classify the type of fracture[4] in at least two view planes, more planes were utilized as per need.

The indication for the surgical stabilization of the spinal column was as follows, patients who had impairment in the neurological functioning as caused by fracture, patients with instability criteria of kyphotic deformity of more than 200 regardless of neurological stability and loss of body height of the vertebra of more than 50, were considered to be surgical candidates. Magnetic resonance imaging (MRI) was done of all the patients, and ASIA scale was evaluated. All the patients were operated under general anesthesia. After disinfecting the site of surgery the posterior approach was used in all the cases and stabilization was done using pedicle screw

rod system with C arm guidance, decompression of the cord with laminectomy of the affected segment (adjacent segments if need be) followed suit. A spinous process cut bone graft was utilized and placed at the posterolateral aspect. Post operatively all the patients received antibiotics for 3 to 5 days intravenously and then shifted to oral antibiotics for 5 more days.

Right and left lateral position was suggested to all the patients as the position for lying in bed, the drainage tubes were removed after 2 days and x ray was taken for checking the correction in the vertebral height, the kyphotic angle, implant position and reduction of fracture. The rehabilitation program was started for all the patients which included passive mobilization of lower limb joints and isometric muscular exercises. The occupational therapist and physiotherapists on hand also taught the patients and attendants appropriate bed care and other rehabilitative techniques. For bracing appropriate thoraco lumbo sacral orthosis were used, and patients were encouraged to sit with their braces on the third and fifth post-operative day. Sutures were removed on the 12th post-operative day, bowel and bladder training was also provided to the patients, and the catheter was removed in those who obtained bladder control. Rehabilitation was started immediately after the surgical procedure. For those patients who had incomplete injuries (paraplegia) had their activities restricted for 4 weeks and were told to wear the brace for 10 weeks duration. For those who received complete injuries (paraplegia) were advised to be confined to the bed so as to prevent the re collapse, and were allowed to mobilize upon the fracture consolidation as per radiographic evidence. All the patients were followed for a period of 18 months duration, every month for the first six months then every three months. On follow up the radiographs were taken to evaluate the fixation, index calculation and the sagittal angle. Data was analyzed using SPSS version 23, Continuous variable like age was expressed as mean +/- standard deviation while categorical variables like gender are given in percentage.

RESULTS

The study population consisted of n= 35 patients of which n= 25 (71.42%) were males and n= 10 (28.57%) were females, the mean age of the study population was 33.5 years. A history of fall from height was the most common cause of injury in n= 26 (74.28%) of the patients, next was automobile accidents in n= 9 patients (25.71%). The sites of injury in the patient population are listed in Table-I. Burst fracture was the most common type of injury observed in our study population followed by flexion distraction injury, in 80% and 14.28% patients respectively. All the patients underwent radiographic evaluation pre and post operatively and also upon follow up. The sagittal angle was 23.5^{o} pre operatively and 10.75^{o} post operatively, and at follow up the loss of angle was found to be 4.80 respectively. The sagittal index values were as follows, pre-operative 0.53, post-operative 0.75 and 0.72 at follow up (final follow up). The American Spinal Injury Association (ASIA) scale was used for the neurological evaluation of the patients and the results are listed in Table-II. N= 30 (85.71%) patients showed improvement in their ASIA status, n= 19 (54.28%) showed single grade improvement, n= 10 (28.57%) showed double grade improvement, n= 1 (2.85%) showed triple grade improvement, while n= 5 (14.28%) cases did not show any improvement. The mean duration between injury and surgical intervention was 5.5 days with a range of 1 to 23 days, the major cause of this delay was delay in reaching the hospital. The mean duration of surgery was 3 hours with a range from 2 to 4 hours respectively. The most common complication observed was pressure sores in n= 4 (11.42%) and UTI seen in n= 5 (14.28%) of patients, followed by implant failure in n=3 (8.57%), (n= 2 (5.71%) had screw breakage due to improper brace use, and required revision, the other case of screw breaking was treated conservatively. And the last patient of implant failure had slippage of the connecting rod with pedicle screw at 16th month postoperatively, which was managed conservatively.)

Characteristic	Percentage	Frequency
Level of injury		
T 12	11.42%	4
L1	68.57%	24
L2	20%	7
Type of Fracture sustained		
Flexion distraction injury	14.28%	5
Unstable burst fracture	80%	28
Translation injury	5.71%	2

Table-I. Level of injury and type of fracture sustained by the patient population.

Pre-operative		Follow up				
		A	B	C	D	E
A	6	5	1			
B	5			2	2	1
C	23				15	8
D	1					1
E	0					

Table-II. American spinal injury association scale classification of the patient population.

Figure-1. A pre-operative MRI image showing burst fracture

Figure-2. Figure showing failure of the implant

Figure-3. Figures showing post-operative radiographs from patients

Figure-4. Figures showing post operative radiographs from patients

DISCUSSION

One of the most common types of the osseous spine injury is fractures and dislocations of the thoracolumbar spine. In developed countries the most common cause of this type of injury is road traffic accidents, while in developed countries fall from height remains the most common cause of thoracolumbar spinal fracture. The aim of treatment for the surgeon is stabilization, decompression and mobilization to prevent further morbidity, accomplishing these goals reduce the burden on the patient and their families, by decreasing the length of hospital stay, and improving outcome. According to the results of our study the mean age of the patient population was thirty three years which is also consistent with other study[5], which reports a mean age of 30 years. In our study the most common cause of the thoracolumbar fracture was fall from height at a prevalence of 74.28% of the patient population, which is consistent with studies by Dipankar and Patro who observed the prevalence of fall related injuries to be 64.7% respectively, their study also reports the T12 and L1 injury to have a prevalence of 82% which is similar to the 80% prevalence in our study population.[6] According to a study by Gertzbein et al they found that unstable burst fractures were the most common in their patient population having a prevalence of 68% which is similar to our prevalence of 80%.[6,7] Mohammad F Butt et al in their study had the sagittal angles at 21.40 pre operatively 12.8 post operatively and 3.40 on the final follow up, which is similar to our values of 23.50 pre operatively, 10.750 post operatively and 4.8 on the final follow up.[8] in our study 85.71% patients showed improvement in their American Spinal Injury Association scale, 54.28% showed single grade improvement, 28.57% showed double grade improvement, 2.85% showed triple grade improvement, while 4.28% cases did not show any improvement, which is similar to the study by Aono H et al who also observed that the majority of patients in their studied showed an improvement of one grade in the ASIA scale.[9] Other studies comparing unilateral with bilateral screw fixation showed no difference in using unilateral or bilateral screw fixation.[10] And a large Meta-analysis of 365 patients did not show any difference between short segments as compared to long segment pedicle screw fixation, in our study we utilized the short segment pedicle screw fixation technique for our patients.[11] Over all n= 12 (34.28%) of the patients had some form of complication post operatively. The most common complication observed was pressure sores in 11.42% and UTI seen in 14.28% of patients, followed by implant failure in 8.57% of the patients. Mohammad M Butt et al report 50% complication in their study.[8] The limiting factors in our study were the small sample size and a relatively shorter duration of follow up, further studies with larger sample size are required to further strengthen the results of our study.

CONCLUSION

According to the results of our study unstable burst fractures was the most prevalent type of fracture observed, there was a marked improvement in the radiological parameters post operatively, while the neurological improvement was decent. The technique of pedicle screw rod and fixation

using the posterior approach provides good surgical outcome and better stabilization, with a fair amount of neurological improvement for these patients.

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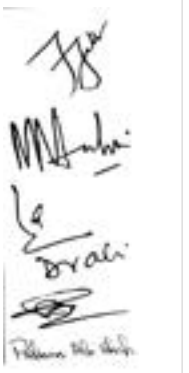
AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Faisal Abdul Jabbar	Corresponding author, write up, data analysis, literature review	
2	Dr. Muhammad Hashim	Write up, data collection, data analysis, literature review	
3	Dr. Abdul Ali Khan	Write up, data collection, data analysis, literature review	
4	Dr. Shahid Ahmed	Write up, data collection, data analysis, proof reading, final draft	
5	Dr. Rehana Ali Shah	Proof reading, final draft.	