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COMPARISON OF POSTERIOR OPEN SCREW FIXATION WITH PERCUTANEOUS FIXATION AMONG TRAUMATIC THORACOLUMBAR FRACTURE PATIENTS.

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ABSTRACT… Objectives: To compare outcome and adverse events of open posterior pedicle screw fixation with percutaneous posterior pedicle screw fixation among patients suffering traumatic thoracolumbar fractures in our population. **Study Design:** Retrospectively Analyzed. **Setting:** Department of Neurosurgery, DHQ Teaching hospital, Gujranwala. **Period:** June 2015 to May 2019. **Material & Methods:** The patients who underwent open pedicle screw fixation (group 1) and percutaneous fixation (group 2) for traumatic thoracolumbar fractures information's collected included patient's age, gender, operation time, intra-operative blood loss, duration of radiation exposure during surgery, hospital stay duration, non-union at 6months and post-operative screw malpositioning and infection. **Results:** Out of 82 patients, 60.9 (n=50) underwent open pedicle screw surgery and 39.1% (n=32) underwent percutaneous fixation. Both cohorts had similar preoperative data including age (p=0.54) and gender (p=0.505). In comparison to open surgery group, the patients who underwent percutaneous fixation had significantly lesser operation time (46.63 + 6.25 minutes vs 89.88 + 9.05 minutes, p<0.01), lesser intraoperative blood loss (78.75 + 23.93 ml vs 330.40 + 101.87ml, p<0.01), greater intraoperative fluoroscopic exposure time (400.19 + 31.22 seconds vs 190.06 + 30.28 seconds, p<0.01), and lesser hospital stay time (3.13 + 0.871 days vs 5.08 + 1.209days, p<0.01). The incidence of post-surgery complications like screw malpositioning (p=0.621) and infection (p=0.733) was similar in both cohorts. The fracture union rates were also comparable in both cohorts (p=0.664). **Conclusion:** Minimally inavsive percutaneous posterior pedicle screw fixation had lesser operation time, blood loss, and hospital stay duration and greater fluoroscopic exposure than conventional open posterior pedicle screw fixation among patients with traumatic thoracolumbar fractures in our studied population. It also had a similar radilogic outcome and post-operative adverse events like screw malpositioning and local infection, showing the non-inferiority as compared to conventional open instrumentation. Prospective trials with large sample size are required to find superiority if any of one modality over other exists in our people.

Key words: Open Pedicle Screw Fixation, Operation Time, Percutaneous Fixation, Thoracolumbar Fracture.

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INTRODUCTION

Thoracolumber fractures are common among persons suffering multiple traumas during road trafice accidents.[1] Its overall incidence is 64 per 100,000 people per year[2], where dominent etiology is high energy accidents in young persons and osteoporosis in elderly poeople.[3] Among these pateints, nearly one third have concomitent spinal cord trauma with variable neurologic deficient.[4] Thoracolumber fractures have significant socioeconomic impact due to prolonged morbidity, ongoing chronic pain and prolonged abcence from work. The treatment of thoracolumber fractures depend upon severity of injury. It may be conservative management including strict rest, close reduction and functional bracing or it may require posterior pedicle screw fixation. This surgical management is of two types. One is conventional open posterior pedicle screw fixation[5] and other is newly emerging minimally invasive percutaneous approach.[6,7] Literature shows that open instrumentation is associated

with prolonged operation time, massive blood loss, higher infection rate, more hospital stay, significant postoperative muscle atrophy.[4,8] Percutaneous pedicle screw fixation is emerging as relatively safe option for thoracolumbar fractures.[9]

These majority literature findings were from Western population, local studies about comparison of percutanoeous pedicle fixation with open technique are scarce. No study to our knowlege has analysed such comparison in our population. It was hypothesized that percutaneous fixation is not inferior to open posterior pedicle screw fixation in term of outcome and adverse events among patients suffering thoracolumber fractures in our population. Therefore, the objective of this study was to compare the outcome and adverse events of conventional open posterior pedicle screw fixation with minimally inavsive percutaneous posterior pedicle screw fixation among patients suffering traumatic thoracic and lumbar fractures who presented at neurosurgery departemet of DHQ taeching hospital, Gujranwala.

MATERIAL & METHODS

The patients who underwent open posterior pedicle screw fixation or percutaneous posterior pedicle screw fixation for traumatic thoracolumbar fractures at the Department of Neurosurgery, DHQ Teaching hospital, Gujranwala from June 2015 to May 2019 were retrospectively analysed. Inclusion criteria were (1) patients with traumatic thoracolumbar fractures who otherwise not required ICU admission for other vital organs like brain, lungs or heart involvement. (2) both genders (3) any age group patients not already operated for lumbosacral fracture. Patients complicated by respiratory infections or who went for ICU admission due to multiple traumas during accident and patients with lumbosacral fractures of other etiologies like osteoporosis and tuberculosis were excluded. The patients who underwent open posterior pedicle screw fixation were labelled as group 1 while patients who underwent percutaneous posterior pedicle screw fixation were labelled as group 2. Informations collected included patient's age, gender, operation time, intra-operative blood loss, duration of radiation exposure during surgery, hospital stay duration, radiologic outcome or non-union at 6months and post-operative adverse events of screw malpositioning and infection. Postoperative imagings obtained at 1- and 6-months' follow-up were analyzed for problems with hardware (loose or broken screws), and lucent portion around the work area. In addition to that other postoperative complications were also noted. Non-union of fracture[10,11] was defined by cessation of healing process both in periosteal and endosteal regions without bridging. We defined it by no calcification, visible as less than 20% lucency around screws on radiographs, at follow up visit after 6 months. Union of the fracture was defined by calcification/ fusion of fracture in 6months. In these cases, adequate lucency i.e. upto 70-80% was seen around screws on radiographs. All findings were recorded in a structured performa. Statistical Package for Social Science (SPSS), version 25 was used. Means with standard deviations were computed of quantitative variables, and frequencies-percentages for qualitative variables. Chi-square test for independence and Independent sample T test were used for qualitative and quantitative variables respectively to determine their significant association with type of surgery. The p values were taken statistically significant if < 0.05.

RESULTS

Out of 82 patients with traumatic thoracolumbar fracture patients, 55 (67.1%) were male while 27 (32.9%) were female. (Figure-1). 50 patients underwent open posterior pedicle screw fixation, while 32 underwent percutaneous posterior pedicle screw fixation. Both cohorts had similar preoperative findings. In both procedure groups, there was no statistically significant difference of mean age of the patients (51.72 + 19.20 years vs 48.94 + 21.13 years, p=0.54), and gender distribution (68%male and 32% female in group 1 vs 65.6% male and 34.4% female in group 2, p=0.505) (Figure-1 & Table-II).

In comparison to open posterior pedicle screw fixation group, the patients who underwent percutaneous posterior pedicle screw fixation had significantly lesser operation time (46.63 +

6.25 minutes vs 89.88 + 9.05 minutes, p<0.01), lesser intraoperative blood loss (78.75 + 23.93 ml vs 330.40 + 101.87ml, p<0.01), greater intraoperative fluoroscopic exposure time (400.19 + 31.22 seconds vs 190.06 + 30.28 seconds, p<0.01),and lesser hospital stay time (3.13 + 0.871 days vs 5.08 + 1.209days, p<0.01) (Table-I).

The radiological outcome and post-operative complications were comparable in both procedure groups. There were similar results in both groups regarding post-operative screw malpositioning (4% in group 1 vs 3.1% in group 2 p=0.664). The post-operative infection rates were also comparable (14% vs 9.4%, p=0.733). The fracture union/fusion rates at 6 months follow up were excellent with both type of procedures and no one had statistical superiority over other (96% vs 96.9%, p=0.664) (Table-II).

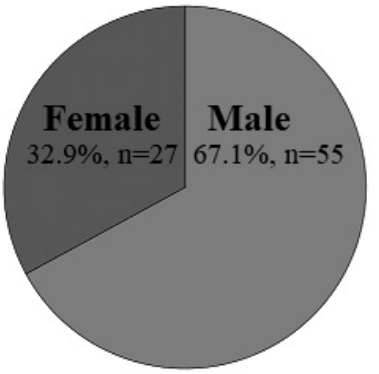

Figure-1. Gender wide distribution of patients suffering traumatic thoracolumbar fractures in our studied population (n=82)

Quantitative Variables	Posterior Pedicle Screw Fixation		Mean Difference	P-Value
	Open (mean + SD)	Percutaneous (mean + SD)		
1. Age (years)	51.72 + 19.20	48.94 + 21.13	2.78	0.54
2. Operation time (minutes)	89.88 + 9.05	46.63 + 6.25	43.25	<0.01
3. Blood loss (ml)	330.40 + 101.87	78.75 + 23.93	251.65	<0.01
4. Flouro time (seconds)	190.06 + 30.28	400.19 + 31.22	-210.13	<0.01
5. Hospital stay (Days)	5.08 + 1.209	3.13 + 0.871	1.95	<0.01

Table-I. Various quantitative variables comparison with type of procedure (Open pedicle screw fixation vs Percutaneous pedicle screw fixation) in traumatic thoracolumbar fracture patients (n = 82) *
***Independent sample T-test was used**

Predictors / Factors	Posterior pedicle screw fixation		Total	P-Value
	Open	Percutaneous		
Gender:				
Male	34 (68%)	21 (65.6%)	55 (67.1%)	0.505
Female	16 (32%)	11 (34.4%)	27 (32.9%)	
Screw malpositioning:				
Yes	2 (4%)	1 (3.1%)	3 (3.7%)	0.664
No	48 (96%)	31 (96.9%)	79 (96.3%)	
Postoperative infection:				
Yes	7 (14%)	3 (9.4%)	10 (12.2%)	0.733
No	43 (86%)	29 (90.6%)	72 (87.8%)	
Non-union at 6months:				
Yes	2 (4%)	1 (3.1%)	3 (3.7%)	0.664
No	48 (96%)	31 (96.9%)	79 (96.3%)	

Table-II. Various qualitative variables comparison with type of procedure (Open pedicle screw fixation vs Percutaneous pedicle screw fixation) in traumatic thoracolumbar fracture patients (n = 82) *
***Chi-square test for independence was used**

DISCUSSION

Traumatic thoracolumber fracture is one of the most devastating injuries having a great influence on patients, their families, and the society. In a study from United Arab Emirates[12], spinal fractures were more common in the lumbar region (57 %), where 90% bearer were male gender. In our study, 67.1 % patients with thoracolumbar fractures were male. In a similar study from Brazil, trauma led to spinal fracture with 81.6% prevalence in male gender.[13] In a prospective analysis of 46 patients[14], mean age of the patients suffering thoracolumbar fractures was 51.05 years. The affected age decade was same in our patienst, where mean age was 50.63 years. In large sample size study from china[15], among 781 patients undergone percutaneous pedicle fixation, post-infection rate was 0.5%. Adawi et al[16] from Egypt found 5.5% post-surgical infection rate among thoracolumbar fracture patients who underwent open posterior screw fixation. In our study, infection rate was 14% with open posterior surgery and 9.4% with percutaneous pedicle fixation which is high than seen in available studies. This needs better perioperative and post-operative wound care. In the study from China[15], screw malpositioning rate was just 2.1%.

In our study, we encountered screw malpositioning in two cases in open surgery group and one case in percutaneous approach group and overall rate of malpositioning was 3.7%. In our study, only one case from group 1 and two cases from group 2 showed non-union at 6 months, where lucency around screws on radiographs was not more than 20% while rest all cases got union/ fusion with 70-80% lucency around screws. The management of non-union[17,18] tarumatic thoracolumbar fracture is indivisualized based on case characteristics. It may require repeat surgery, for example, percutaneous fixation case may require open instrumentation or simple prolongation of conservative rest may suffice. Phan K et al[8] found taht hospital stay was short in group of percutaneous instrumentation, however no difference was found in incidence of screw malpositioning and post-procedural infection rate between open and percutaneous approach groups. Similarly, Jan Kocis and colleagues[14] revealed that outccomes of both procedure types was same in term of post-operative Cobb angle[19], however operation time was significantly less in percutaneous pedicle screw method.

Feg Tian et al[4] did metanalysis of 9 studies including 433 patients and concluded that periprocedural blood loss, operation time and hospital stay duration, all were significantly less in group of patients undergone percutaneous pedicle instrumentation while in both i.e. percutaneous and open pedicle surgery groups, Oswestry Disability Index[20,21], radiological outcome, hospital cost and adverse events risk were similar. The findings of present study in our population were in concondarance to international data where statistically significantly less operative time, intraoperative blood loss, and hospital stay duration was observed in percutaneous fixation group with a similar post procedural screw malpositioning and infection risks and a similar radiological outcome at 6 months. However, additionally, our study told that this minimally invasive equally effective percutaneous approach with so much benefits in term of less hospital stay and operation duration and less blood los, has one disadvantage of more exposure of surgeons to flouroscopic radiations. This radiation exposure was statistically significantly high in this percutaneous fixation group as compared to open fixation group. This radiation exposure hazards however can be overcome by choosing better operans as well as lead sheets and curtons around flouroscope head while taking X-rays images of operating area.

CONCLUSION

Minimally inavsive percutaneous posterior pedicle screw fixation had lesser operation time, blood loss, and hospital stay duration and greater fluoroscopic exposure than conventional open posterior pedicle screw fixation among patients with traumatic thoracolumbar fractures in our studied population. It also had a similar radilogic outcome and post-operative adverse events like screw malpositioning and local infection, showing the non-inferiority as compared to conventional open instrumentation. Prospective trials with large sample size are required to find superiority if any

of one modality over other exists in our people.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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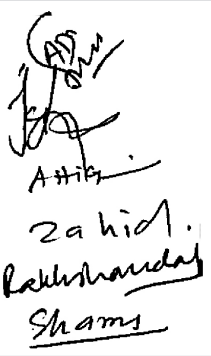
1	Muhammad Adnan	Data collection, analysis & literature.	
2	M. Jahangir Khan	Literature search and outlining of the paper.	
3	Attique ur Rehman	Planning & write up.	
4	Hassaan Zahid	Write up.	
5	Rakhshanda Jabbar	Proof reading & revision.	
6	Shahzad Shams	Consultation, supervision & proof reading.	