Outcome of short segment fusion in thoracolumbar fractures using posterior instrumentation.

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Abstract:

Objectives: To assess the outcome of posterior short segment fixation in terms of vertebral height in thoracolumbar fractures.

A cross-sectional study was conducted at Orthopedic and spine unit Khyber Teaching Hospital Peshawar. The sample size was 58 patients and study duration was six months. The data was collected on predesigned questionnaire and analyzed with SPSS 22. Average age of the patients was 36.10±10.6 (mention %), 42 (72.4%), and 16 (27.6%) years. Among the patients, males were 33(56.9%) while females were 25(43.1%). Pre op mean anterior vertebral height was 24.6± 1.11 mm (range 22.5mm-26.5mm) while Post op mean vertebral height of fractured vertebrae was increased to 28± 3 mm (range 22.5mm -34.2 mm). In 43(74.1%) patients, 27(75.0%) had A3 type fracture and 16(72.7%) had A4 type of fracture. In all those patients who recovered/improved, 23(79.3%) were having pre op fractured vertebral height less than 25 mm and 20(69.0%) were having greater than 25mm. However, 15(25.9%) patient with vertebral height of fractured vertebrae remained same and did not improve/recover. After 6 months post op, patient neurology was improved mostly in patients with favorable outcome of vertebral height. Altogether, vertebral height and neurology wereincreased in majority of the patients. There was no implant failure noted.

Key words: Vertebral height, short segment fusion, thoracolumbar fractures, posterior instrumentation.

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Introduction

Thoracolumbar fractures (D10-L4) are the most common spinal fractures because of increased biomechanical stress at the junctional zone [1]. Peak incidence is in working age population i.e 20-40 years of age [2]. It results from very high energy trauma to the spine. According to different studies 50-60% involves transition zone D11-L2, 25-50% involves thoracic region and 10-14% affects lumber and sacral region[1,3].

Thoracolumbar fractures presentation depends on level of trauma i.e above L1 level it presents with upper motor neuron signs and below L1 it compresses cauda equina causing cauda equina syndrome[4]. At level of level of L1 it compress conus medullaris causing conus medullaris syndrome.[4] So it presents with pain, paralysis of lower limbs, fecal incontinence,deformity and different neurological pattern[4]. Spine fractures are diagnosed with 99% accuracy on CT scan and 87% on plane x-ray[5]. Cord injuries, ligamentous complex injuries can be assessed better with MRI.

Management of thoracolumbar fracture depends on stability and neurological function of the patient [6]. Stable spine fracture with intact neurology can be managed conservatively while unstable fracture having neurological deficits is managed surgically. Main goal of surgery is decompressing neurological structures and maintain stability[7]. There are multiple approaches for spinal fusion from anterior and posterior. Haris et al showed that, in thoracolumbar fractures posterior instrumentation give same results as combine anterior and posterior for kyphotic deformity correction, stability and neurological improvement [8]. Posterior approach is less extensive and have minimal blood loss for spinal fusion and stability [9].

In posterior approach, short segment fixation is the use of pedicle screw instrumentation one level cephalad and one level caudal to the fractured vertebra. In our setup, traditional short-segment posterior fixation (SSPF) is widely practiced. It provides three dimensional correction, preserve motion segments, immediate stability by restoration of vertebral heightand prevention of late neurological deficits [10].

In literature outcome of posterior short segment fixation has been extensively studied in terms of different variables [12]. Zhao QM et al. reported that vertebral height was significantly improved from 60.57±10.12% to 91.97±8.26% postoperatively [12]. In another study, Ozdemir et al. compared vertebral height between conservatively treated patients and operated patients. Vertebral height was significantly restored in operated group of patients as compared to conservatively treated patients [13] . Similar results were also given by Haq MI et al. in deformity correction at fractured vertebrae in 92% of his patients[14].

The purpose of this study was to assess the outcome of posterior short segment fixationin terms of vertebral height in thoracolumbar fractures. The impact of this study will strengthen this treatment modality and care of patient.

Materials and methods:

This descriptive cross sectional study was conducted at Orthopedic and spine unit Khyber Teaching Hospital Peshawar from July, 2020 to January, 2021. Sample size was 58 patients, calculated by using WHO formula for sample size calculation, 95% confidence level, outcome as good restoration of vertebral height (kyphotic deformity angle) in short segment fixation in 92% of thoracolumbar spine trauma patients[9], with 5% margin of error under WHO formula forsample size determination in health studies. Patients with single-level A3 and A4 fracture according to AO classification determined on AP and lateral radiograph of dorsolumbar spine, whose age was from 18-65 years, had American Society of Anesthesiologists (ASA) Grade I or II who had posterior short segment fixation done were included on the study, those who had pathological or osteoporotic vertebral fractures, Multilevel fractures, and those with previous Spine surgery at site of fracture was excluded from the study. Data was collected on predesigned questionnaire. Informed written consent was taken. Patients were assessed by researcher with detailed history followed by clinical examination. All patients were subjected to vertebral imaging, X-ray dorso-lumber spine AP and lateral view, and MRI spine to see for cord compromise. Fracture was classified according to AO classification system. Post operative patients were followed radiologically and clinically for a period of 6 months to see how much vertebral height were restored, graded according to ASIA scale and analyzed.

Radiological outcomes were analyzed in the form of restoration of vertebral height. Radiograph was reported by CPSP fellow radiologist in the department of radiology Khyber teaching hospital, Peshawar. Data was analyzed via SPSS 22. Mean and standard deviation was calculated for continuous variables while frequencies and percentages were calculated for categorical variable.

Results:

Mean age was 36.10±10.6 years, 42 (72.4%) were above forty years of age and 16 (27.6%) were below 40 years of age. Males were 33(56.9%) while 25(43.1%) were females. Regarding mechanism of injury 30 (51.7%) of the patients had road traffic accident (RTA), 11(19.0%) had history of fall from height and 17(29.3%) resulted from other injuries like physical assault.

Regarding presentation and imaging most of the patients (29.3%) has ASIA C and ASIA D injuriesdetails given in table:2. While according to AO classification, 36 (62.1%) patients had A3 type offracture while 22 (37.9%) patients had A4 type of fracture.

Pre op mean anterior vertebral height was 24.6± 1.11mm (range 22.5mm-26.5mm). Post op meanvertebral height of fractured vertebrae were increased to 28± 3 mm and range 22.5mm to 34.2 mm, in 43(74.1%) of patients in which 27(75.0%) were having A3 type fracture and 16(72.7%) were having A4 type of fracture. In all improved patients 23(79.3%) were having pre

op fracturedvertebral height less than 25 mm and 20(69.0%) were having greater than 25mm. In 15(25.9%) of patient's vertebral height of fractured vertebrae remains same and did not improved as shown in table 2.

After 6 months post op patient neurology was improved mostly in patients with favorable outcomeof vertebral height. Most of the patients i.e. 16 (27.6%) patients were having ASIA A which remains same details given in table.1.

Table No. 1. Clinical evaluation of patients according to ASIA scale

ASIA GRADE	Number of patients		
	Pre op	Immediate post op	After 6 months
E	0	2(3.4%)	14 (24.1%)
D	17 (29.3%)	15(25.8%)	10 (17.2%)
C	17(29.3%)	19(32.7%)	13(22.4%)
B	8 (13.8%)	6(10.3%)	5 (8.6%)
A	16 (27.6%)	16 (27.6%)	16 (27.6%)

Stratification of Final Outcome with Pre-Op Vertebral Height doesn't showed any significant difference, details given in table: 2.

Table No. 2. Stratification of Final Outcome with Pre-Op Vertebral Height

Final Outcome	Pre-Op Vertebral Height		Total	P Value
	≤ 25 mm	> 25 mm		
Favorable	23(79.3%)	20(69.0%)	43(74.1%)	0.37
Unfavorable	6(20.7%)	9(31.0%)	15(25.9%)	

Discussion:

Surgical fusion through posterior instrumentation is the most widely used method for unstable thoracolumbar fractures[6]. Short segment fixation is placement of screw in fractured vertebra

along with one level above and one level below. Various studies has been done on outcome of short segment fixation. In this study we have followed 58 post op short segmentfixation patients for 6 months to analyze out come in term of fractured vertebral height restoration.

In this study, mean and SD's for age was 36.10±10.597 comparable to the study done by Vaccaro AR et al(ds 10). We had 33(56.9%) were male and 25(43.1%) females in our study.

DeWald RL et al. also reported male predominance in his study[15]. This is because in our culture females are mostly home bounded and males comes out of their for working as a result they face greater chance of trauma than female.in contrast most of the studies major cause of thoracolumbar fracture in our setup is because of RTA i.e 30(51.7%) followed by falls from height[15]. This is because most of the people do not follow traffic rule and safety measures which result in high energy trauma to the spine. Neurology of the patients were analyzed after 6 months according ASIA scale in our study. 16(27.6%) of patient having ASIA A did not improved and have static neurology while 14(24.1%) of the patients improved to ASIA E which was not present in any pre op patient. Similar results were also shown by other studies [15, 16].

After 6 months follow up 43(74.1%) of our patients improved i.e their vertebral heights increased from 22.5mm to 34.2 mm. Zhao QM et al showed improvement of vertebral height from 60.57±10.12% to 91.97±8.26% post operatively [12]. Ozdemir et al also showed significant increase in vertebral height in post op patients comparatively to conservatively managed patients[13]. Results of our study were also comparable to Hamdan et al which showsrestoration of vertebral height in post operative patients[17]. All of our patients had short segment fixation. Screw were also placed in fractured vertebral body, similar fixation reported by El Behairy et al. with comparable results[18].

We had no lucency around screws in 94.8% of cases, moreover, bone bridges formation was found in 91.3% of patients and there were no screw dislodgment or breakage. This result shows low rate of implant failure which is also supported by Mahar et al[18] showing increased biomechanical stability using this technique. Other studies conducted by Guven et al. and Bolesta et al. also reported same result when same fractured level was included in short segment fixation[19,20].

Conclusion:

Vertebral height and neurology were increased in majority of the patients. There was no implant failure noted. So, posterior short segment fixation is a better technique and can be safely applied for stability of thoracolumbar fracture stability.

Qaisar khan: Literature Review, manuscript drafting.

Junaid zeb: Data collection & statistical analysis.

Sajawal khan: Data Interpretation,

Asif nawaz : Expert opinion and manuscript revision

Mohammad ayaz khan: Manuscript drafting and Proof reading

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