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ORIGINAL ARTICLE

Placement of Percutaneous Screw through pedicle of fractured Vertebrae in fixation of Thoracolumbar spinal fractures - an observational analysis

KHALID MEHMOOD[1], IRFANULLAH SHAH[2], MUHAMMAD ASLAM[3], MOHAMMED M HALAWANI[4]
[1]*Clinical Fellow in Neurosurgery. Ninewells Hospital Dundee. Scotland United Kingdom.*
[2]*Consultant NeuroSpine. King Fahad Armed Forces Hospital. Jeddah. Saudi Arabia*
[3]*Associate Professor Neurosurgery, Chandka Medical College, Shaheed Mohtarma Benazir Bhutto Medical University Larkana*
[4]*Ex- Consultant NeuroSpine and Head of Neurosurgery Department. Riyadh Care Hospital, Doctor Halawani Spine Clinic, Eastern Ring Road. Riyadh, KSA*
Correspondence to Dr. Khalid Mehmood, Email: khalid.mehmood@nhs.scot

ABSTRACT

Aim: To investigate the safety and effectiveness of percutaneous pedicle screw placement at the level of fractured vertebrae in the treatment of thoracolumbar spinal fractures.
Methods: The experiment enrolled 40 participants in stages. Percutaneous pedicle screw fixation classified patients into two groups: those who had a fractured vertebra insertion of pedicle screw (fractured group) and those who did not (the "unfractured group") (control group). The duration of the surgery and the volume of blood loss were both documented. In clinical study, both the ODI and the visual analogue scale were utilized (VAS). Cobb angle, vertebral body index (VBI), and anterior vertebral body height were used for radiographic follow-up (CA).
Results: The two groups did not differ significantly in terms of operation time and intraoperative blood loss. VAS and ODI scores remained stable across all follow-up periods. In comparison to the control group, the fragmented group exhibited a higher rate of rectification and a lower rate of AVBH and VBI loss. There was no significant difference between the two groups in terms of CA correction and correction loss following surgery.
Conclusion: If a patient suffers a type A fracture of the thoracolumbar spine, percutaneous screw fixation combined with intermediate screws may be beneficial in assisting the patient in healing and preserving their vertebral height.
Keywords: Thoracolumbar spinal fractures, screw, vertebrae

INTRODUCTION

The 60–70% of all spinal fractures occur in the thoracolumbar (TL) junction, which encompasses vertebrae from T11 to L2[1,2]. One of the most controversial treatment choices for the patients with thoracolumbar fractures and having no neurological deficit is still up in the air. Nonoperative treatment has been proven in clinical studies to reduce fractures and improve long-term clinical results, at cost of strict bed rest, which again carries it concerns, overall surgical treatment has been found to be more successful[3]. Since it allows for three-column fixation in thoracolumbar fractures, posterior short-segment pedicle instrumentation has become increasingly common in the treatment of thoracolumbar fractures. The standard open method may result in long-term consequences such as a loss of muscular function and discomfort because of paraspinal muscle stripping[6,7].

Percutaneous Pedicle screw fixation, a newer treatment method for thoracolumbar fractures, has lately been reported to decrease soft tissue injury and post-operative morbidity. The preservation of the posterior para spine musculature, less blood loss, quicker surgery times with fewer infection risks, lower post-surgical discomfort, and a shorter hospital stay are some of the benefits of percutaneous pedicle screw fixation, according to anecdotal data[8-10]. Because the posterior column of the vertebrae in most thoracolumbar fractures is still intact, many places of fixation are frequently available. Since Dick's 1994 biomechanical research of pedicle screw fixation in fractured vertebrae, it has been established that pedicle screw fixation can give a stronger fixation with less reduction loss than standard screw fixation[11-13].

In a biomechanical investigation, the introduction of intermediate screws into short-segment pedicle screw fixation considerably enhanced stability and divide stress on each pedicle screw[14-16]. Only a few randomized controlled clinical trials have been undertaken on the use of an intermediate screw in percutaneous screw repair of damaged vertebrae. The principal purpose of this clinical research was to investigate if insertion of percutaneous pedicle screw at the injured vertebra was safe and successful.

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METHODOLOGY

Between June 2019 and Jan 2020, researchers at the Riyadh Care Hospital, conducted a randomized controlled experiment after approval from Ethical Review Board. The study enrolled 40 patients between the ages of 18 and 60 with a single-level thoracolumbar fracture (T11–L2) and osteochondral injury type A. Pregnancy, double pedicle fractures, substantial fractures in other regions, concurrent injury to other major organ systems, and a prior history of spine surgery were all considered contraindications. To participate in the study, each patient signed a written informed consent form that had been authorized by the hospital's ethics committee. Patients were divided into two groups based on whether or not they arrived at the hospital with a fractured vertebra (control group).

Surgical Procedures: According to the previous literature, Wang[17] given precise instructions to the crew on how to do the procedure. For all of our procedures, we used a combination of controlled general anesthesia. Each patient underwent spinal surgery while in prone position on a radiolucent operating table with Wilson spinal frame. The skin was marked with pedicle access lines with the help of fluoroscope. A 10–20mm incision was made into the subcutaneous tissue at the skin entrance. After inserting a guide wire, surgeons dilate the muscles attached to the paraspinal fascia using a series of dilators. A set of cannulated instruments used to place pedicle screws with fluoroscopic on the guide wire. Pedicle screws were used to secure the upper and lower pedicles on either side of the fracture. For placement of pedicle screw in fractured vertebrae medial pedicle wall was never crosses on AP images, as trajectory was made straight. Smaller sized screws were placed in fractured vertebrae (Fig. 1). After confirmation with two views images rod was placed and fixed. Throughout surgery, C-arm fluoroscopic images were used to monitor pedicle trajectory. Following surgery, a plain film was required to establish proper fixation. Each procedure was performed by the same team of surgeons. A single instrumentation technique was used without fusion. Following surgery, Post op care:

Patients were given antibiotics at the time of incision and continued accordingly. Patient was mobilised next day after his post-operative pain improved. Routine activities were resumed as tolerated by the patient. By contrast, violent and severe behaviors were outlawed for six months. All patients received mechanical thrombo prophylaxis. All patients were evaluated at the

NeuroSpinal outpatient clinic after two weeks, then monthly twice and then at three months. Post-operative CT scans were done before discharging the patient (Fig. 2) to compare the preoperative one (Fig. 3).

Observation Index: Both the blood loss and the duration of the surgery were recorded. The data were analyzed using the Oswestry Disability Index (ODI) (ODI). The intensity of back pain was quantified using a visual analogue scale (VAS). X-rays were used to determine the anterior vertebral body height, the Cobb's angle, and the vertebral body index (VBI) (VBI). In one of the vertebrae, an abnormally high level of AVBH was identified (as well as those above and below it). The AVBH percent was determined[18]. Calculate a person's CA by halving the upper and lower vertebrae's superior endplates. The VBI was calculated using the anterior and posterior wall heights, as well as their distance from one another. An unaffiliated third party evaluated the data and discovered no evidence of tampering.

The statistics of the variables

The statistical analysis was conducted using the SPSS. The data for this study were analyzed using two-sample t tests, chi-square tests, and ANOVA. The data were represented using the average and standard deviation (SD). P values of 0.05 or greater were considered significant in all trials.

RESULTS

It had a total of 40 participants, 29 of which were men and 11 of whom were women. A control group (A) and a fractured individual group (B) were formed after randomization, each with twenty patients. Patients in both groups are summarized in Table 1 by demographics, fracture site and type, and injury cause. There were no significant differences between the two groups. A total of twenty patients were assigned to each of two groups following randomization: the fractured group and the control group. Table 1 summarizes the demographic characteristics, fracture site and type, and injury etiology of patients in both groups. There were no statistically significant differences between the two groups. There was no statistically significant difference in operation time or intraoperative blood loss between the two groups (P > 0.05). The second table is shown below.

Table 1:

Demographics	**Group A (n=20)**	**Group B (n=20)**
Age in Years (Mean ±SD)	38.43 ±9.1 SD	40.2 ±8.8SD
Gender (M/F)	15/5	14/6
Causes		
Traffic Accidents	11	12
Falls	8	6
Others	1	2
Levels of fracture		
T12	3	4
L1	13	12
L2	4	1
Types of fracture		
A1	6	5
A2	13	4
A3	1	11

Table 2:

Characteristics	**Group A**	**Group B**	**P Value**
Surgery time in minutes (mean ±SD)	54.29 ± 10.5	62.38 ± 11.6	0.453
Blood Loss Intra-operatively in ml (mean ±SD)	46.09 ± 9.6	50.69 ± 12.1	0.631
VAS Pre operatively (mean ±SD)	6.3 ±1.9	6.8 ±1.8	0.423
VAS (1 week) Post op (mean ±SD)	2.2 ±0.7	2.6 ±0.9	0.645
VAS (1 month) Post op (mean ±SD)	1.2 ±0.4	1.3 ±0.7	0.821
VAS (1 year) Post op (mean ±SD)	0.8 ±0.6	0.9 ±0.6	0.424
ODI Pre operatively (mean ±SD)	77.9 ±8.3	81.2 ±10.5	0.531
ODI (1 week) Post op (mean ±SD)	25.2 ±6.3	26.2 ±7.2	0.444
ODI (1 month) Post op (mean ±SD)	11.2 ±5.2	12.3 ±6.1	0.334
ODI (1 year) Post op (mean ±SD)	9.5 ±4.7	10.1 ±4.6	0.632
AVBH (6month) Post op (%)	7.2 ±5.4	5.4 ±1.4	0.03
AVBH (1 year) Post op (%)	8.4 ±1.6	6.1 ±1.3	0.02
VBI (6month) Post op (%)	6.2 ±1.9	2.5 ±1.5	0.03
VBI (1 year) Post op (%)	6.8 ±1.8	3.3 ±1.5	0.02
CA (6month) Post op (°)	2.6 ±1.2	2.2 ±1.4	0.423
CA (1 year) Post op (°)	2.8 ±1.3	2.5 ±1.4	0.564

Both the control and fragmentation groups had similar preoperative VAS scores, but their postoperative VAS levels were significantly lower. Comparison of the VAS scores of the two groups over time revealed no significant differences in scores (P> 0.05). Both groups' ODI scores were significantly higher one week, six months, and one year after surgery (P >0.05). However, there was no significant difference in VAS scores between the control and fragmentation groups. Both healthy and broken patients showed significant improvements in the Cobb's angle, VBI, and AVBH for injured vertebrae in Table 2. Although there was no statistically significant difference in CA one week, six months, or a year after surgery, the fractured group performed significantly better on AVBH and VBI (P <0.05) than the control group. Six months and a year after surgery for vertebral injuries, the AVBH and VBI of patients were significantly different between the two groups (P<0.05). CA rectification losses did not differ significantly between groups (P>0.05).

Fig. 1

Fig. 2:

Fig. 3:

DISCUSSION

The less invasive spine fixation procedures were supposed to minimize soft tissue damage, such as muscle necrosis, atrophy, and discomfort. As with open surgery, a minimally invasive technique for thoracolumbar injuries has been widely researched and proven to be equally effective[21]. According to Aaker, Percutaneous pedicle screw treatment of thoracolumbar fractures resulted in a shorter operative time and hospital stay, less intraoperative blood loss, and a lower rate of infection, according to a meta-analysis of comparable studies[27].

In comparison to open procedures with short-segment pedicle screw fixation, the intraoperative elements of our study were superior, including operation time (58.3 minutes on average) and blood loss (48.2ml on average). Cobb angle correction and vertebral body height restoration were both equally achieved in open procedures. In terms of back pain alleviation, VAS and ODI scores were comparable to open surgery[7,8,10]. According to these findings, percutaneous posterior short-segment stabilization appears to be effective in the treatment of thoracolumbar fractures. Pedicle screws are utilized in conventional short-segment fixation only at the levels directly next to the fractured vertebra (one level above and one level below the fracture level). Numerous studies have demonstrated that pedicle screw instrumentation is ineffective when bypassing the fractured vertebrae and has a high failure rate[29,30]. In this study, 40 patients had either percutaneous short-segment fixation with intermediate screws or traditional screw fixation.

We were able to perform significantly better initial AVBH and VBI adjustments with the short segment technique with broken level than with the controls using radiologic data. The AVBH and VBI corrective losses were statistically significant between the fragmented and control groups, with values. The initial CA correction, which ranged between 15.6 ±4.0 and 3.0 ±1.2 and the correction loss, which was 2.6 ±1.5°, did not differ substantially between the fragmentation and control groups. According to this study, conventional four-screw fixation is more successful than pedicle screw fixation for restoring the height of damaged vertebrae. When it comes to completion time, the experimental group spent 62.38±11.6SD minutes, whereas the control group spent 54.29 ±10.5SD minutes. The surgeons shed a substantial amount of blood throughout the surgery (46.09ml, compared to 50.69 ml). An intermediate screw may be utilized to repair a vertebra that has been injured without increasing blood loss or processing time. There was an instrumentation issue in the control group. When a patient returned for a follow-up appointment, he noticed that the implant's damaged surface had been fractured by a screw. According to our findings, the pedicle screw failed due to an increase in the load placed on it. The percutaneous pedicle screws used in our study were all successfully inserted using conventional fluoroscopy. Our strategy is bolstered by the fact that navigation devices can increase instrument precision while also reducing time during fluoroscopic examinations[31]. This study contains numerous shortcomings. The long-term outcomes of this study may differ from the short-term outcomes, particularly after implants are removed. This trial had a very restricted number of participants. To properly evaluate the technique's overall efficacy, a large number of patients must be recruited and followed over an extended period of time.

CONCLUSION

Percutaneous pedicle screw fixation with intermediate screws outperformed conventional open screw fixation in terms of wound healing, preserving damaged vertebral height, and reducing segmental kyphotic angle. Percutaneous pedicle screw stabilization with a fracture-level screw may be a successful treatment option.

Conflict of interest: Nil

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