Anterior Cage Fixation for Dorsal Spine Injuries -
One Year Study

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SUMMARY

This study was conducted during the year 2004 at Lahore General Hospital, Unit I, department of Neurosurgery. We operated on 37 patients for thoracic cage interbody fixation after trauma. Age range was from 15 to 70 years. Maximum number of cases (41%) was between 21-30 years of age. Male involvement was seen in 29 (79%) patients. Majority (65%) belonged to rural community and agriculture and industry were the major setup of injury. Majority belonged to poor socioeconomic class i.e., 83% (31). Level of injury was 37% upper dorsal spine, Main fracture types were burst fractures, compression fractures and fracture dislocations. Correction of deformity was achieved in majority of cases. Associated chest injuries were seen in 28% cases. Timing of surgery was as early as possible but it ranged from 2 hours to as long as 3 months. Neurological deficit ranged from complete paraplegia to power grade 4. Complications of the procedure are cage displacement in 6%, loosening in 5% and infection in 8%. Neurological status improved in 88% while kyphosis improvement occurred in 77% of the patients. Anterior cage fixation is a safe and effective treatment method for traumatic dorsal spine instability involving vertebral bodies.

Key words: Dorsal spine injury, cage fixation, dorsal spinal fixation, anterior interbody fusion.

INTRODUCTION

Controversy exists about the best treatment of unstable thoracic burst fractures. Objectives of the treatment are correction of kyphosis and canal decompression in case of a neurological deficit. Various conservative and surgical strategies have been tried 1. Anterior cage fixation is an established procedure. There are controversies about why, how, when to operate and when not to operate.2

PATIENTS AND METHODS

Study was conducted at Unit I, Department of Neurosurgery, Lahore General Hospital from January till December of 2004. Some 37 cases of anterior cage fixation has been done in trauma cases. Selection criteria included all patients with traumatic vertebral collapse with or without neurological deficit. Patients with pathological fracture, such as caries or tumours were excluded from the study. Surgery was done through anterior transthoracic approach. Dorsolumbar junction injuries were excluded because these are considered a separate entity needing combined thoraco-abdominal approach.

RESULTS

Age range of these 37 patients was from 15 to 70 years as shown in Table no.1.

<table>
<thead>
<tr>
<th>Age range in years</th>
<th>Number of Patients(Percentage)</th>
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<tbody>
<tr>
<td>11-20</td>
<td>7 (19%)</td>
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<tr>
<td>21-30</td>
<td>15 (41%)</td>
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<tr>
<td>31-40</td>
<td>10 (27%)</td>
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<tr>
<td>41-50</td>
<td>2 (6%)</td>
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<tr>
<td>51-60</td>
<td>2 (5%)</td>
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<tr>
<td>61-70 yrs</td>
<td>1 (2%)</td>
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</table>
Sex distribution
According to gender, observations were as follows.
- Male - 29(79%) patients.
- Female - 8(21%) patients.

Setup of trauma
Trauma occurred both in urban and rural communities, agricultural and industrial setups.
- Road side - 13(34%) patients.
- Industry - 9(25%) patients.
- Agriculture - 15(41%) patients.

Economic status
According to social class of the individuals following information was collected.
- Lower economic status - 31(83%) patients.
- Middle class - 6(17%) patients.
- Upper class - Nil.

Level of injury
- Upper dorsal spine - 14(37%) patients.
- Lower dorsal spine - 23(63%) patients.

Types of fractures
We observed different types of fractures.
- Burst fracture - 19(51%) patients.
- Compression fracture - 10(28%) patients.
- Fracture dislocation - 8(21%) patients.

Associated injuries
Associated injuries were seen in following cases.
- Intrathoracic injury - 10(28%) patients.
- Abdominal injury - 6(16%) patients.
- Long bones injury - 8(21%) patients.

Neurological deficit at presentation.
Neurological deficit ranged from complete paraplegia to power grade 4.
- Complete deficit - 29(79%) patients.
- Incomplete deficit - 8(23%) patients.

The decision of surgery was not based upon neurological deficit or its extent rather purely on instability of spine and compression. Any patient with compression or instability was offered surgery and all of them agreed no matter what the neurological status.

Timing of surgery
Our choice was to perform surgery as soon as patient is stable to tolerate the stress. but it ranged from 2 hours to as long as 3 months from the onset of symptoms.
- Within 6 hours - 1(2.7%) patient
- Within 1 week - 25(67.5%) patients
- Within 1 month - 5(13.5%) patients
- 1-3 months - 6(16%) patients.

Complications of surgery
Complications of surgery included, loosening, infection and displacement.
- Cage displacement - 2(6%) patients,
- Loosenig - 2(6%) cases.
- Infection - 3(8%) cases.

We had no cases with iatrogenic visceral, vascular or neural injury.

Results of surgery
- Neurological improvement - 32(87%) patients.
- No neurological improvement - 5(13%) patients.
- Kyphosis improvement - 77% patients.
- Pain relief - 27(73%) patients

DISCUSSION
The dorsal spinal injury is a high velocity injury. Patients affected are younger adults which are sole bread earners of their families.

Controversy exists about the best treatment of unstable thoraco-lumbar (TL) burst fractures, indications for surgery and criteria for fusion. Cage used in fixation also raises interesting discussions regarding its material and design. Objectives of surgery are canal decompression and kyphosis correction. We as a policy fixate posttraumatic spines if presented within 1 month. The decision was based on patient wishes. All cases with fixed deformity and established complete neurological deficit of more than 1 month duration were excluded.
Zou et al. documented that materials used for implant have been stainless steel, metal alloys and porous tantalum. We have used stainless steel alloy which is MR compatible.

Incidence

All the countries, cities, towns have unique road infrastructure, industrial and rural setups. The incidence of such injuries varies depending on all such factors. Male predominance (77%) is explainable because in our social system women are less frequently involved in hard physical labour outside homes. Majority of the patients belong to lower socioeconomic status. Age range was from 15 to 70 years. Maximum number of cases were between 21-30 years of age. Majority belonged to rural environment (65%). Agriculture ad industry were the major setup of injury. It shows that since we are an agriculture based country. According to types of fracture it was noticed that patients with fracture dislocation had fall from height, while compression fractures happened in road traffic accidents.

Clinical features

Argenson et al. have reported associated thoracic effusions (hemomediastinum, hemothorax) as 26.5% and scapular injuries to be 20%. The frequency of neurological impairment was seen in 30.4% with complete paraplegia in 20%, local hematoma in 32%2. In our cases associated chest injuries were seen in 2 cases.

According to Vialle & Ville, patients with thoracic trauma usually have high-energy injury, and should always be suspected in polytrauma cases with rib cage, sternum, cardiac, or pulmonary injuries. Management is complicated with long hospital stay. In our study all the patients presented with major trauma and average hospital stay has been 1 month (3 weeks to 8 months). Types of fracture have been burst fractures, compression fractures and fracture dislocations. According to Argenson et al compression fractures predominate, (54.2%) than comminuted fractures (20%), flexion-distraction fractures (2.8%), fracture-dislocations (23%). In 33.2% injuries were at multiple levels. We have seen presence of multiple levels was seen in 7% of cases.

Neurological deficit ranged from complete paraplegia to power grade 4.

Complications of thoracic injury include low blood volume shock, atelectasis and pleuritis.

Pathological principles

Thoracic fixation has been done for tumors as hemangioblastomas, and spondylolisthesis. In this study we have used it in trauma only

A multi-step surgical procedure can limit preoperative mortality in patients in critical general condition by avoiding an extended one stage dorsoventral spondylodesis.

Investigations

There is no controversy regarding investigations. MRI scan is the mainstay and considered better than all the other radiological investigations.

Different management principles

Conservative treatment can achieve only moderate delayed reductions. It is satisfactory for pain reductions. We choose not to manage patients conservatively rather to fix the spine whenever possible.

Timing of surgery has been studied and it is noticed that early stabilization is safe, and results in a reduced overall intensive care unit stay. In our study we tried to operate as early as possible. But it ranged from 2 hours to as long as 3 months since injury. Patients presented late because they got initial treatment from local quakes, general practitioners and primary care hospitals before coming to Lahore general Hospital. Once inside our setup, finances still play a role. People who could manage the expenditure of Rs. 11,000/- for the cage and another 10 thousands for the medicines choose for surgery. There were some patients who could not afford at all and their medicines were arranged from Zakat fund. It caused delay in surgery.

Correction of deformity was achieved in majority of cases (77%). Neurological status improved in majority (88%) of our cases. Complications of surgery are due to, inadequate or wrong level exposure it leads to injury to viscera, neural, or vascular structures. Visceral injury is commonly to lung and gastrointestinal tract. Neural
injury occurs to dura, lumbar plexus, sympathetic fibers and intercostal nerves. Vascular injury is less common. Bone graft itself can fracture, extrude, or make pseudoarthrosis. Metallic implant can get loosened, break, displace or malposition. There was no postoperative hemothorax or pneumothorax because all the patients had insertion of chest tube on thoracotomy closure.

**Posterior vs. anterior vs. combined approach**

Combined approach is done with a bisegmental posterior correction/fixation, followed by anterior corpectomy and titanium cage implantation 7-10 days later. Long term correction of kyphosis and lordosis and the mean regional back pain improved.

In a study posterior approach was used with unstable fractures because this permitted a complete decompression down to the posterior wall. The anterior approach was reserved for purely anterior compression, or residual compression after an initial posterior procedure. Cotrel-Dubousset instrumentation with Harrington rods were used and long term reduction was maintained.

Posterior bisegmental transpedicular correction/fixation and staged anterior corpectomy and titanium cage implantation is a safe and reliable surgical option. There is complete decompression, kyphosis correction, immediate stability and maintenance of correction. With rigid pedicle screw instrumentation there is a solid fusion, but there is increase in postoperative morbidity caused by disruption of the posterior musculature. Some centers still prefer bony fusion using Femoral ring allograft. They avoid Titanium cages because of inferior clinical outcome and the tenfold increase in cost. Anterior vertebrectomy, canal decompression, bone graft by iliac or titanium cage, and fixation with VertoFix system gave good results. According to Sprint et al. Titanium cage or a radiolucent cage with footprint and translaminar screws can give poor stability and suplemental pedicle screw are needed. Porous tantalum cage packed with autologous bone with supplementary pedicle screws give more reliable fusion than anterior staples. Zou et al. studied vertebrec-implant interface. They showed that the high presence of radioluencies and fibrous tissue are important in order to achieve bone ingrowth.

According to Karim et al. anterior pedicle screw fixation and augmentation of Anterior interbody fusion has potential advantages over the standard Anterior interbody fusion. Wang et al. have used Spinous process fixation with some success. Short posterior and only anterior instrumentation systems are associated with delayed kyphosis. Such fixations do not provide enough stability, and correction. Loss and settling of vertebrae can occur. Jenis et al have suggested that different fusion augmentation methods as Autologous growth factors with an appropriate carrier is a reasonable alternative to autograft and expensive bone induction technologies. Finiels are of the opinion that autologous bone graft complication can be avoided by Porous biomaterials. Chen et al. have used cages with Posterior lumbar interbody fusion and got good results. Pape is of the opinion that the internal fixator could be removed without endangering the stability of the fusion and roentogen stereophotogrammetric analysis is reliable indicator of fusion.

We have seen, with a follow up of 6 months that patients have stability and mobility to perform daily activities without pain. We have to see long term complications of cage fixation in our series.

**CONCLUSION**

Anterior cage fixation is a safe and effective method for traumatic dorsal spine instability involving vertebral bodies.

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Anterior Cage Fixation for Dorsal Spine Injuries


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