A THREE YEARS PROSPECTIVE STUDY OF SPINAL INJURIES TREATED BY INTERNAL FIXATION WITH ADJUSTABLE TITANIUM CAGE

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ABSTRACT

Background: The incidence of spinal trauma has risen sharply world wide in recent years, the main contributors being road side accidents, sports injuries and fall from heights. **Objective:** The objective of the study is; to assess the postoperative out come of the intervertebral titanium cage, in patients operated for traumatic unstable thoracolumber burst fractures. **Patients & Methods:** This is a prospective study, carried out in the Department of Neurosurgery, Sheikh Zayed Hospital, Rahim Yar Khan, during 3 years, from 1st November, 2005 to 31st October, 2008. All the patients of adult age of either sex, with spinal injury underwent a neurological and radiological assessment, and those patients rendered fit for surgery, were operated upon with an intervertebral adjustable titanium cage. The patients were followed up for one year. **Results:** The study comprised of 37 patients, of all ages with 30 males and 7 females, all were received in the emergency department. The majority of the patients had L1 fracture 19 (51%) followed by D12 fracture in 10 (27%). The main cause of spinal injury was fall from height in 80% and road side accidents in 20% of cases. The neurological status of the patients received in emergnecy showed paraplegia in 41% while paraparesis in 59% of patients. The neurological outcome of 37 patients after one year of follow up showed marked improvement in 22 patients of incomplete spinal cord injury (paraparesis) who showed 100% improvement in their weakness in comparison to little or no improvement in 15 patients of complete spinal cord injury (paraplegia). **Conclusion:** Our experience with usage of the titanium cage in traumatic vertebra has shown to be very promising, especially in patients of paraparesis and it can become a main stay of surgical management in thoracolumber burst fractures in our setup.

Key words: Titanium cage, spinal injuries, anterior spinal fixation.

INTRODUCTION

Fusion cage was first time used for fusion of unstable motion segments in horses suffering from "wobblers syndrome." During last decade, there has been an increasing interest for their use in humans, not only in the lumbar spine but also in the cervical spine.[1,2] The incidence of spinal trauma has risen sharply world wide in recent years, the main contributors being road side accidents, sports injuries and fall from heights. The most common of the fractures encountered were seen around the junctional zones like C7-T1 and T12-L1. The majority of thoracolumber spine fractures and fracture dislocations are unstable injuries. These traumatic conditions of the thoracic and lumbar spine are a major societal expense and a leading cause of disability which require stabilization so as to allow early mobilization of the patient. Last but important goal is to decompress directly or indirectly the neural elements.[4,5,6]

Various modalities of treatments have been tried ranging from simple measures like immobilization to surgical treatment like Leminectomy, Posterior spinal instrumentation techniques using rod-hook systems or screw rod and screw plate system. Latest treatment option is anteriorly placed titanium cage with bone graft after Corpectomy.[3]

Anterior instrumentation in the treatment of thoracolumber fractures has progressed significantly during last two decades.[12] These fixation systems have evolved to meet the anatomic, biomechanical, and imaging challenges associated with internal fixation of the thoracolumber spine. Initially, the threaded cylindrical titanium cages that became popular in late 1990's helped the success rate of the procedure by providing more firm fixation of the disc space, after disc surgery. [7,8,11] Now titanium cages filled with auto graft are frequently used to replace broken vertebral bodies. [9,10] The objective of current study was; to assess the postoperative out come of the intervertebral titanium cage, in patients operated for traumatic unstable thoracolumber burst fractures.

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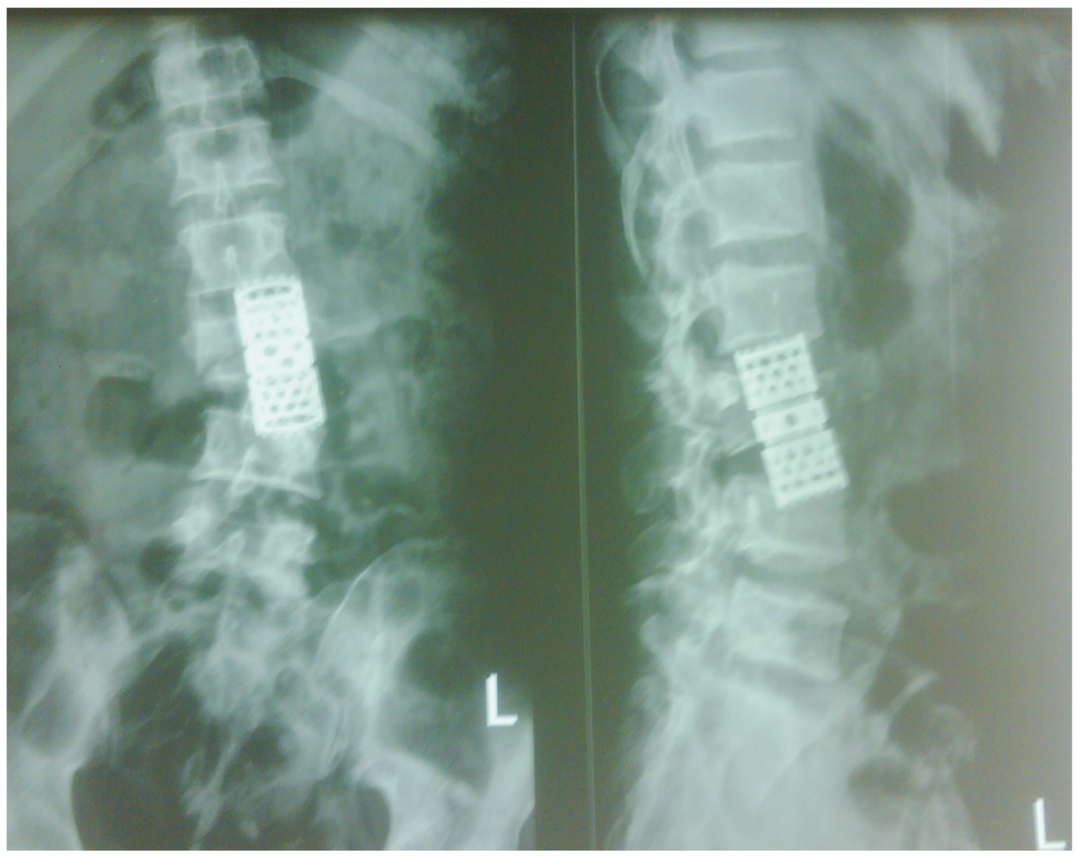
PATIENTS AND METHODS

This prospective study was conducted in the Department of Neurosurgery, Sheikh Zayed Hospital, Rahim Yar Khan. It was conducted during 3 years, from 1st November, 2005 to 31st October, 2008, with one year follow up of each patient. All patients were received in the Emergency Department, within one to two days after trauma. After initial treatment and detailed clinical examination of the patients, a Computed Tomography (CT) Scan / CT mylography of affected spinal region was done to assess the anatomical status of the spine and spinal cord.

Patients of adult age and of either sex, fit for surgery, who had spinal injury of thoracolumber spine causing burst / wedge fracture of vertebral body, resulting in either spinal canal compromise or unstable spines were also included in the study. Patients having carries spine, gunshot injury to spine, osteoporosis, and secondaries resulting in the fracture of the vertebra, or unfit / unwilling for surgery were excluded from the study.



All patients underwent surgery and a cylindrical titanium cage filled with bony auto graft was used. The patients were hospitalized postoperatively for variable time as necessary for each patient and after discharge, a follow up time of 1 year which was planned in four visits at 1, 3, 6 and12 months.

Before surgery all patients underwent a routine anesthetic evaluation followed by surgery with at least 3 pints of blood in hand. In operation theatre injured vertebra was confirmed and marked with a C-arm image intensifier. A left costotransverse incision was made two level above focused vertebra; one / two ribs were dissected out and removed for better exposure. The peritoneum / pleura was swept away followed by splitting the Psoas muscle in the lumber vertebral fractures, segmental vessels were coagulated to secure haemostasis then fractured vertebra was exposed, followed by corpectomy along with the disc removal above and below, hence relieving the compression over the spinal cord. Decompression of spinal cord was achieved in all cases. Meanwhile, a suitable size adjustable spinal titanium cage was prepared and filled with the bone graft taken from the iliac crest / extruded vertebral body. [4,5,6] The cage was then placed in the defect and fixed by opening up the treaded edges. The position & stability of cage was confirmed on image intensifier, a drain was placed in situ and the wound closed in layers. In case of thorocotomy, under water seal drainage was placed. Next day patient underwent, a bed side X-ray of the chest and thoracolumber spine. The drain was usually removed

on the 2nd postoperative day. The patient was kept immobilized for 1-2 months. It was desirable that spine / spines which were operated upon, were stable and pain-free under normal loading, deformities of the spine or instrument failure were also observed. On each follow up visit patient had a thorough neurological assessment checking his motor / sensory system and sphincter control. X-ray of the thoracolumber spine anteroposterior and lateral views were mandatory to assess the position of spinal cage.

RESULTS

A total of 37 patients were included in study and were operated upon, with anterior decompression and a cylindrical titanium cage filled with bony auto graft. Most of the patients, 19 (51.35%) had L1 fracture and the level of injury of the rest is shown in the table I.

The gender ratio showed 7 (19%) women and 30 (81%) men. Their ages ranged form 17 to 40 years;

Table I: Number of patients against level of injury

Level of injury	No. Of patients
D5	1
D6	1
D8	1
D9	1
D11	2
D12	10
L1	19
L2	2
Total	**37**

Table II: Type of spinal injury

Complete (Paraplegia)	Incomplete (Paraparesis)
15 Patients (41%)	22 Patients (59%)

15 (41%) were paraplegic and 22 (59%) were paraparetic cases, as shown in table II.

The causative factor of spinal injury in our cases was fall from trees (80%), while picking their fruits, and road side accidents (20%). Most of the cases were received during the mango, date and jambolan seasons. The interval of time between the accident and the operation was 2-10 days, depending upon their fitness for anaesthesia / surgery. The follow up was planned in 4 visits, (1, 3, 6 and 12 months). The patients followed the usual schedule, except 2 patients which were lost to followup and placed in no recovery category.

The neurological condition preoperatively and outcome at one year postoperatively, of 37 patients is given in Tables; III and IV and after one year of follow up it shows marked improvement in 22 patients of incomplete spinal cord injury (paraparesis) in comparison to little or no improvement in 15 patients of complete spinal cord injury (paraplegia). In each follow up visit the sensations and motor power in both lower limbs was assessed as under; Motor power assessment was done measuring the power of myotomes of hip, knee and ankle joints. Both flexors and extensors of the spine were assessed from power G-o to G-5 the results are shown in table III.

Sensory system in both the lower limbs was assessed by checking touch and pain sensations in various dermatomes. The results are shown in table IV.

Similarly control of sphincters was assessed both by history and local clinical examination of the patient. The results are shown in table V.

We observed hundred percent improvement in 22 patients. While in 15 complete paraplegic patients, 3 (20%) had normal sphincter control and 6 (40%) patients showed near normal control of their urinary sphincter (who were able to pass urine with some suprapubic pressure). 2 patients were lost to follow up and were placed in paraplegic with no improvement group; i-e. showing no recovery.

In a period of 1 year of follow up the main complications we observed were, sacral bed sore in total paraplegic patients, these patients had to undergo series of dressings and debridement's and some had a rotational flap. There were 8 patients who had a superficial wound infection. Not a single case of cage displacement was noted. Three patients complained of severe backache for some time.

DISCUSSION

Spinal injuries are one of the most common cause of disability and death.[1,2] Its incidence is on rise in the

Table III: Assessment of motor system

Pre-Operative				Post-Operative (After 1 Year)			
Type of injury	Power G0-G5			Type of injury	Power G0-G5		
	Go	G1-3	G4-5		Go	G1-3	G4-5
Paraparesis 22 patients	-	13	9	Paraparesis 22 patients	-	7	15
Paraplegia 15 patients	15	-	-	Paraplegia 15 patients	12	3	-

Table IV: Assessment of sensory system

Pre-Operative				Post-Operative (After 1 Year)			
Type of injury	Sensations			Type of injury	Sensations		
	Normal	decreased	Absent		Normal	Improved	Absent
Paraparesis 22 patients	11	7	4	Paraparesis 22 patients	15	7	-
Paraplegia 15 patients	-	-	15	Paraplegia 15 patients	-	3	12

Table V: Assessment of urinary sphincter control

Pre-Operative			Post-Operative (After 1 Year)		
Type of injury	Sphincter control & Urinary Retention		Sphincter control & Urinary Retention		
	Normal sphincter	Urinary Retention	Normal	Improved	Unaffected
Paraparesis 22 patients	10	12	22	-	-
Paraplegia 15 patients	-	15	3	6	6

developing world. The main aim of treatment is early diagnosis and alignment of the broken vertebra as soon as possible, so as to preserve the spinal cord functions. Though most thoracolumbar and lumbar burst fractures can be treated conservatively, but unstable fractures or fractures resulting in neurological deficits usually require surgical treatment.[3,13,14,15] The middle column fractures of dorsal or lumbar spine significantly affects spinal stability and may lead to spinal cord injuries. Those fractures involving two of three columns should be treated as an unstable spine[1]. Retropulsion of fractured fragments may cause considerable spinal canal compromise leading to compression and damage of spinal cord or thecal sac. It results in paraplegia / paraparesis.[23] In the T_{12} or L_1 burst fractures, if compression is more than 50% in the sagittal plane of the canal, the risk of neurological injuries increase significantly and tend to progress.[18] In burst fractures spinal cord / thecal sac is compressed anteriorly, so the operation should be focused on decompression of anterior part of spinal canal. Decompression of nervous tissue is main goal of surgery.

Anterior decompression and reconstruction supplemented with instrumentation is superior to posterior fixation with pedicle screws for an unstable burst fracture.[16]

With same view we conducted this study using anterior decompression of the spinal canal and fixation with titanium cage in all our patients. Little literature is available about the efficacy or outcomes of using cylindrical mesh titanium cages for postcorpectomy reconstruction.[5] The cylindrical mesh titanium cage is a successful adjunct in restoring and maintaining saggital plane alignment after thoracolumbar corpectomy. It provides an effective method for anterior column reconstruction.[17, 19, 20]

Since, spine is a motion system composed of vertebrae, the instrumentation alone is not enough for a long-time fixation of a fractured spine. Loosening will appear regardless of the use of

titanium cage or pedicle screws. Postoperative stability comes in two stages: initial stability and long-term stability. The initial stability depends on the internal fixation, and the long-term stability come from bony fusion[22]. Titanium cage packed with bone graft for vertebral reconstruction have multiple benefits. It allows safe decompression of neural structures and promotes maximal neurological recovery. It provides immediate stability which allows early mobilization. Deformity is corrected, with restoration of saggital alignment which reduces the incidence of low back pain.[24] In our study of 37 patients, there were 81% males and 19% females, with their age ranging from 17 to 40 years. Wang et al [22] have described similar results in a study of 22 patients with 86% males and 14% females. He described falling from height to be the most frequent reason in 77.27% followed by road side accidents in 22.72%. Similarly most common encountered vertebral fracture was at L1 (63.63%) and D12 (31.81%). In our experience in this study, the mode of injury was also fall from height and road side accidents in 80% and 20% respectively. L1 being the commonest vertebra fractured (51%) followed by D12 in 27%, similar to the study mentioned above. Another regional study done by Sahoo et al, [24] showed male dominance of 84% in comparison to 16% females. Age of their patients ranged from 21 to 40 years. The mode of injury was road side accidents in majority of the patients (60%) in contrast to our study (20%). Abnormal engagement of our young adults in manual picking up of fruits from their trees directly, is the main reason of high incidence of fall from height in our study (80%). Another contributory factor could be slow traffic and little development of roads in this area resulting in less road side accidents (20%).

A similar local study done by Raza et al [25] has shown, male dominance (60%), age (14 to 65 years), high incidence of fall from height (66.7%) as etiological agent and majority of the burst fracture seen at L1 (40%) and D12 (23.3%) level are four similar parameters comparable to our study. The study of Raza et al [25] showed 93% improvement in neurological status of their patients. The other 2 studies, Sahoo et al, [24] and Wang et al. [22] showed improvement in most of the patients in their neurological status from a lower grade to a higher one. Our results regarding neurological improvement of patients are also comparable to the results of three above mentioned studies. [22, 24, 25]

CONCLUSION

Our results are very promising especially in incomplete spinal injuries, where most of the patients returned to near normal activities. While in complete paralysis it may improve sphincter control and help in early rehabilitation. Use of Interbody cage is a useful technique for achieving spinal bony fusion with acceptable clinical success rate in appropriately selected patients and can become a mainstay of surgical management for thoracolumbar fractures.

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Hazrat Ali (رضی اللہ عنہ) said:

Man is a wonderful creature; he sees through the layers of fat (eyes), Hears through a bone (ears) and speaks through a lump of flesh (tongue).