SPINAL SURGERY IN EARTHQUAKE VICTIMS

Muhammad Asad Qureshi, *Muhammad Saleem, **Abdul Hafeez Khan, Ahmed Raza, Iftikhar Ahmed Butt, ***Agha Shahid Khan, ****Zafar Chowdhry, *****Khalid Ahmed, ******Abid Qureshi, *******Max Aebi

Combined Military Hospital Rawalpindi, *Pannu Aqil and **Kharian, ***Johns Hopkins University Baltimore Maryland USA, ****University of Pittsburgh Pittsburgh USA, *****California Institute for Spinal Injuries and Disorders 4511 Rosemead Boulevard Picorivera California 90660 USA, ******John Muir Hospital Walnut Creek California USA, *******MEM Research Center for Orthopaedic Surgery University of Bern Switzerland

ABSTRACT

Objective: Objective of present paper is to document the operations performed in earthquake spinal injury patients and to analyze the results of surgery.

Study Design: This is a quasi-experimental study.

Place and Duration of Study: This study was conducted at the department of Orthopaedic and Spinal surgery at Combined Military Hospital (CMH), Rawalpindi. Study started after earthquake in Pakistan on 8th of October 2005 and ended in August 2006.

Patients and Methods: 250 patients with spinal injury were admitted at the three main army hospitals at Rawalpindi (CMH, MH and AFIRM) after earthquake on 8th October 2005. Out of these, 110 patients underwent 120 major spinal operations. 12 patients were received from other units for revision surgery. 75% of the patients were civilians and 25% were army personnel and their families. Average age was 28 years and range was 8-65 years. 56% patients were females and 44% were males. 46% patients had complete neurological deficit and 54% had incomplete neurological deficit. Most common associated injuries were fractures of tibia and fibula. Most common level of injury was at T12/L1 (55%). After surgery almost all patients had rehabilitation at AFIRM.

Results: Post-operatively excellent (>75%) or good (50-75%) correction of deformity was achieved in 90% of patients. 92% patients had mild or no pain, post-operatively. Neurological improvement was seen in all patients with incomplete deficit except four. Some patients with complete deficit also showed improvement. Overall there was 1.5 AIS improvement per patient. At last follow up 46% patients were walking independently and 51% were independent in wheel chair.

Conclusion: Spinal surgery in patients with unstable spines after major disaster should be carried out by properly trained surgeons as soon as possible and in a setup where facilities for proper rehabilitation are available as it carries best prognosis for these high risk and at times paralyzed patients.

Keywords: Spinal injury, earthquake, spinal surgery.

INTRODUCTION

7.6 magnitude earthquake on 8th of October 2005 at Pakistan resulted in 73,338 deaths and 128,304 injured patients [1]. There were more than 600 spinal injuries. More than 250 patients with spinal injuries were received at army hospitals at Rawalpindi (CMH, MH and AFIRM). These were managed by a combined team of specialists including Spinal Surgeon, Orthopaedic surgeons and Specialists in Rehabilitation Medicine. Initially volume of spinal injuries was not

Correspondence: Lt Col Muhammad Asad Qureshi, Consultant Orthopedic Surgeon, Combined Military Hospital, Rawalpindi.

known, so they were managed with all other orthopaedic cases. After first two weeks when it was realized that there were tremendous number of Spinal Injuries, Spinal Surgeon was spared by Surgeon General of Pakistan Army to do full time spinal surgery on these patients. Special wards for spinal injury patients were created at all three major hospitals of army at Rawalpindi and they were supervised by Spinal Surgeon and Specialists in Rehabilitation Medicine. Various Orthopaedic surgeons from peripheral hospitals were attached with Spinal Surgeon to assist in the management of these cases. In addition many eminent Spinal Surgeons of the world came over from USA and Switzerland for short durations to help.

There is very little data available in the world literature on the surgical management of spinal injuries in earthquake victims [2,3]. Theoretically if unstable spinal injuries are not stabilized early, it can lead to long term disastrous complications and adds to load of admitted patients in the already compromised state of hospital beds after major disaster. After surgical stabilization of these unstable injuries, these patients can be mobilized early and incidence of serious complications can be reduced, nursing care can be facilitated and many patients can be discharged out of acute hospital beds. At the same time it needs specialized training and aptitude to operate on the complex spinal injury cases to reduce the complication rate and produce good results.

Aim of present paper is to document the data for spinal injury operations performed on these earthquake victims and to analyze the results.

PATIENTS AND METHODS

This quasi-experimental study carried out at the Orthopaedic and Spinal Surgery department of Combined Military Hospital (CMH) Rawalpindi in collaboration with the two other major army hospitals at Rawalpindi: Military Hospital (MH) and Armed Forces Institute of Rehabilitation

Table-1: Rank of patients (n=110).

Rank	Total	Percent
Civil	83	75
Army	14	13
Family	9	8
Rtd	2	2
Rect	2	2

Table-2: Cities of patients (n=110)>

City	Total	Percent
Muzaffarabad	59	54
Bagh	32	29
Balakot	6	5
Rawalakot	2	2
Pattan	1	1
Patika	1	1
Mansehra	1	1
Lipa	1	1
Kotli	1	1
Kohala ak	1	1
Karak	1	1
Forward kahota	1	1
Batore	1	1
Batgram	1	1
Ath makam ak	1	1

Table-3: Diagnosis of patients (n=120).

Diagnosis	No	Percent
Fr dislocation	68	57
Burst fr	36	30
Chance fr	6	5
Wound back	5	4
Facet dislocation	2	2
Wedge comp fr	1	1
Prolapsed inter vertebral disc	1	1
Infected implant	1	1

Table-4: Region of spine involved (n=120).

Region	No	Percent
Cervical-C1-C6	2	2
Certhor-C7-T1	2	2
Thoracic-T2-T11	11	9
Thoracolumb-T12-L1	66	55
Lumbar-L2-L4	32	27
Lumbosacral-L5-S1	2	2
Sacrococ-S2-Co	5	4

Table-5: Asia impairment scale (Ais) (n=120)

Ais	No	Percent
A	55	46
B	17	14
C	21	18
D	15	12
E	12	10

Medicine (AFIRM). Spinal operations were performed at operation theatres of CMH and MH. Study started after earthquake on 8th Oct 2005 and ended in Aug 2006.

120 major spinal surgical operations were performed on 110 spinal injury patients out of over 250 spinal injury admissions at CMH, MH and AFIRM. 12 patients were received form other units for revision surgery, where primary surgery had failed. Rest of the patients was primary admissions in our unit.

Spinal injures were classified according to the Denis's Classification system into four major categories [4]:

Compression fractures, burst fractures, seat-belt-type injuries, and fracture dislocations.

Neurological deficit was classified according to American Spinal Injuries Association (ASIA) impairment scale (AIS) into [5]:

Complete, sensory only, up to grade 3/5 power, power grade 4/5 and complete neurological recovery.

OUTCOME MEASURES

Four outcome measures were defined:

Correction of deformity in percentage: excellent > 75% post-operative correction of deformity, good 50-75% post-operative correction of deformity, fair 25-50% post-operative correction of deformity and poor < 25% post-operative correction of deformity. Back pain: mild easily ignorable pain, moderate pain controlled with occasional medication, severe pain requiring continuous medication and excruciating pain not controllable with any measures. Mobilization status of patient: bed, wheel chair assisted, wheel chair independent, walking assisted and walking independent. Change in AIS after surgery on last follow up.

After surgery and stabilization of general condition of patient, in few days time, most of the patients were transferred to AFIRM for rehabilitation. At times there was full bed occupancy at AFIRM, leading to hold up of post-op cases at CMH and MH Rawalpindi.

Table-6: Associated conditions (n=26).

Condition	No	Percent
Fr Tibia Fibula	5	19
Scalp Laceration	3	12
Fr Pelvis	2	8
Head Injury	2	8
Fr Shaft Femur	2	4
Below Knee Amputation	1	4
Caries Spine	1	4
Finger Amputation	1	4
Fr Radius Ulna	1	4
Fr Ribs	1	4
Haemothorax	1	4
Wedge Comp Fr T8	1	4
Loose Implants	1	4
Mental Retardation	1	4
Pregnancy	1	4
Wedge Comp Fr L1	1	4
Fr Wrist	1	4

Table-7: Types of operations (n=120).

Operation	No	Percent
Pedicle Screw Fixation (Psf)	66	55
Spinal Osteotomy And Psf	16	13
Corpectomy And Anterior Fixation	8	7
Post Decompression	6	5
Posterior Total Vertebrectomy And Psf	5	4
Debridement	5	4
Removal Of Implant	4	3
Posterior Lumbar Interbody Fusion	3	2
Inter Spinous Wiring	2	2
Cervical Spine Anterior Plating	2	2
Trans Laminar Facet Screw Fixation	1	1
Percutaneous Cement Vertebroplasty	1	1
Cervical Spine Lateral Mass Plating	1	1

Table-8: Implants used (n=105).

Implant	No	Percent
M8 (Medtronics)	47	45
Moss Miami (Depuy, Jnj)	34	32
Fixator Internee (Synthes)	6	6
Universal Spine System (Synthes)	5	5
Expanding Cage + Plate (Local)	4	4
S/S Wire	2	2
Recon Plate	1	1
M8 + Pyramesh (Medtronics)	1	1
Dcp	1	1
Codman Cervical Spine Plate	1	1
Bone Cement	1	1
4.5mm Screws & S/S Wire	1	1
4.5mm Screws	1	1

STATISTICAL ANALYSIS

Record of all patients was kept in a custom built Microsoft Access Database, by the Spinal Surgeon. Data was analyzed using SPSS ver-10.0. Percentages were used to describe the data. Pearson Chi-Square test was applied to calculate the 'p' value for comparison of pre-op and post-op condition of patients.

RESULTS

120 major spinal surgical operations were performed on 110 spinal injury patients. 12 patients were received form other units for revision surgery, where primary surgery had failed. Rest of the patients was primary admissions in our units.

75% patients were civilians and 25% were army personnel and their families (table:1). Most of the patients were from districts Muzafarrabad and Bagh (table:2). Average age was 28 years, range 8-65 years (fig: 1). 56% (62) patients were females and 44% (48) were males. Most of the operations were performed during first ten weeks after earthquake (Fig:3).

Most common injury was fracture dislocation (57%) followed by burst fracture (30%) (table: 3). 55% injuries involved thoraco-lumbar junction (table: 4).

46% Patients had complete neurological deficit (AIS – A) while 54% had incomplete deficits (AIS – B, C, D, E) (table: 5). Most common associated injuries were fractures of tibia and fibula (table: 6).

Most commonly performed operation was open reduction of fractures followed by Pedicle Screw Fixation and bone grafting (fig: 4). As time passed by many injuries became fixed deformities necessitating complex operations like osteotomies and corpectomies (fig: 5, 6). Cervical spine injuries were quite rare in our series, probably most of the patients died at the spot and could not be evacuated after earthquake. Anterior Cervical spine Plating was done in one patient (fig: 7).

Table-9: Re-Operations (n=10).

Pt	No of Re-ops	Reason
Pt:1	6	Wound Infection, Ultimately Implats Were Removed And Infection Settled
Pt:2	1	Implant Failure Necessitating Revision Surgery
Pt:3	1	Staged Ventro-Dorsal Opearation On Two Different Days
Pt:4	1	Implant Failure – Removal Of Implant After Healing Of Fr
Pt:5	1	Implant Failure – Removal Of Implant After Healing Of Fr
6-17		12 Patients: Referred Cases From Other Units For Redo Surgeries

Table-10: Complications (n=38).

Complication	No	Percent
Blocked Cath Required Us Guided Rupture	1	3
Dead	1	3
Du Perforation	1	3
Malpositioned Screws	1	3
Neurogenic Pain	11	29
Pressure Sores	10	26
Pressure Sores, Dvt	1	3
Seroma	1	3
Spasticity	3	8
Wound Infection	8	21

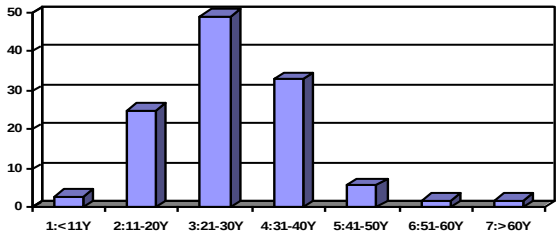

Fig. 1: Age distribution of patients.

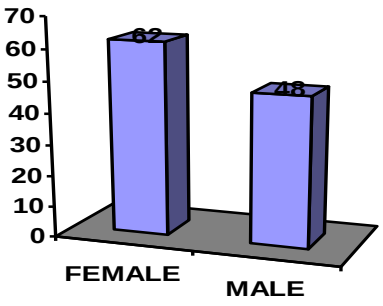

Fig. 2: Sex distribution of patients.

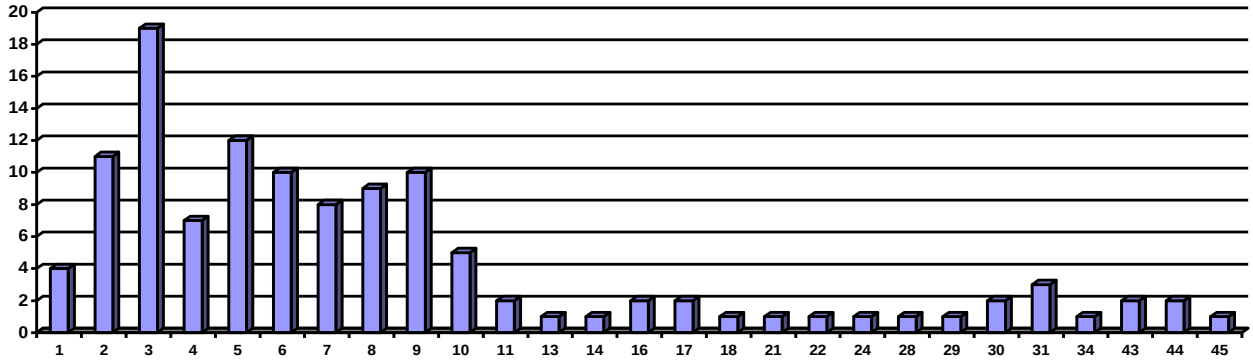

Fig. 3: Weekly operations.

Few patients required removal of spinal implants and various other type of spinal operations (table: 7). CD Horizon M8 pedicle screw and hook system (Medtronic, Sofamor Danek), MOSS Miami pedicle screw and hook system (DePuy, Johnson & Johnson) and Universal Spine System (Synthes) were the most common implant systems used in our surgeries (table: 8).

Only 34 spinal operations could be performed during first three weeks after earthquake (fig: 3) leading to start of formation of fixed spinal deformities in remaining patients. This led to more complex operations, requiring more time to perform, after first three weeks of injury. This was in part due to too many patients and too few people who could perform spinal surgeries. Later on many surgeries in fixed deformity patients were delayed due to formation of pressure sores or other complications due to prolonged bed rest. These patients were operated after healing of pressure sores or other infected foci. 12 cases were referred from other hospitals and units for re-do surgeries (table: 9).

Excellent (>75%) or good (50-75%) correction of deformity was achieved in 90% (107/120) of operations (fig: 9) this was calculated by measuring kyphotic angles and translations on pre-op and post-op x-rays. Correction of deformity was calculated relative to pre-op deformity in each patient individually.

92% patients had no or mild pain which could be easily ignored (fig: 10). This was compared with pre-op severe pain in all patients.

Fig. 4: Open reduction and short segment pedicle screw fixation of a burst fracture.

Fig. 5: Corpectomy of a thoraco-lumbar burst fracture and anterior cage and screw rod fixation.

At last follow-up 46% patients were walking independently and 51% were using wheel chair independently (fig: 11). Prior to surgery all patients were in bed.

Neurological improvement was analyzed using Pearson Chi-Square test and a highly significant improvement was noted (fig: 8): (p value < 0.001). Overall 45 patients showed 69 AIS improvements (1.5 AIS improvement per patient). Four patients had neurological deterioration to one level downwards.

There was one post operative death. This was in a patient with cervical spine injury who had associated chest injury. He was on ventilatory support and had severe chest infection, leading to ARDS and death. Other complications included pressure sores, neurogenic pains, wound infections, etc. (table: 10).

DISCUSSION

Surgical management of unstable spinal injuries is considered to be a superior method of treatment as compared to conservative method [6]. This has been proved in our series of cases as well. If we did not operate on these \patients, they would have occupied our acute beds and would have hampered admission of other acute cases.

Method of fixation of unstable spinal fractures has also improved remarkably over the last few decades [7]. Modern gold standard fixation method for unstable thoraco-lumbar spinal injuries is pedicle screw fixation [8]. This gives three column fixation and very good hold to achieve and maintain surgical correction. It has been shown that short segment fixation (one level above and below) has comparable results to long segment fixation in most of the cases. However, if complex deformities are reduced than at least two segments above and below should be stabilized [9]. This has held true in our series as well.

In some thoraco-lumbar burst fractures, if surgery is delayed more than two weeks, or in acute burst fractures which have torn posterior longitudinal ligament, it is not possible to reduce them posteriorly by ligamento-taxis. These cases require corpectomy and anterior decompression and fixation. However if there is persistent instability after anterior fixation, posterior fixation may be added, as a second stage procedure at same time or later on depending on circumstances. In burst fractures where only posterior surgery is contemplated and a large defect results in anterior column after

Fig. 6: Posterior total vertebrectomy in a malunited thoracic dislocation. reconstruction with long segment pedicle screw fixation.

Fig. 7: Anterior cervical spine plating for a facet dislocation with disc prolapse.

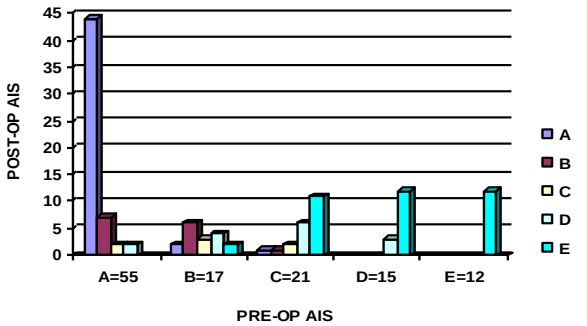

Fig. 8: Change in AIS after.

posterior fixation, anterior augmentation with bone graft is required as well [10].

In cervical spine burst fractures, primary anterior surgery, by doing corpectomy and plate reconstruction is a gold standard procedure [11]. For pure dislocations of cervical spine without disc prolapse posterior surgery by lateral mass plating is biomechanially a superior procedure as compared to inster-spinous wiring [12]. If there is a disc prolapse in addition to a dislocation than anterior surgery should be performed first (discectomy, bone grafting and plating). If this stabilizes spine adequately posterior surgery may be omitted, however if good stability is not achieved than lateral mass plating should be added posteriorly [13].

Regarding timing of surgery after spinal injury; it has been shown that early surgery carries good results [14]. This is true in ideal circumstances. In our setup there are very few people who can do this type of surgery and after a major disaster it is not possible to operate on all the patients at the same time. This shows the needs for development of the specialty of Spinal Surgery in our country. Further more after surgery these patients need rehabilitation. If there are no facilities for rehabilitation than continuum of care can not be established and surgery should not be performed [15]. This also highlights the association between spinal surgery and rehabilitation and need for development of specialty of rehabilitation medicine in our set up.

There is sparse data in world literature on spinal injury patients after earthquake. Present earthquake resulted in more than 600 spinal injuries. Maximum number of spinal injuries reported in literature prior to this was 140 spinal fractures in 1995 Great Hanshin Earthquake of the Kobe-Osaka area of Japan [16].

Chen [17] reports 86% correction of post traumatic kyphosis, in our cases 90% patients had excellent or good correction of pre-op deformity. Olumide [18] showed overall 0.72

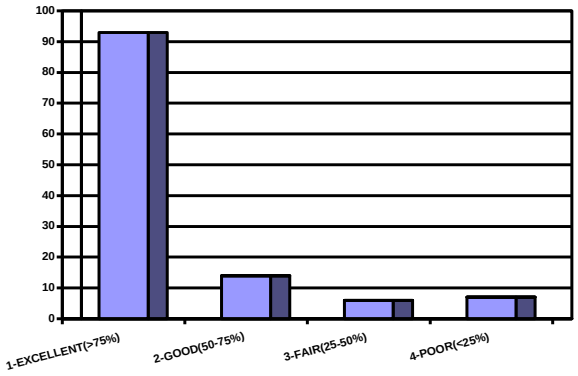

Fig. 9: Correction of deformity.

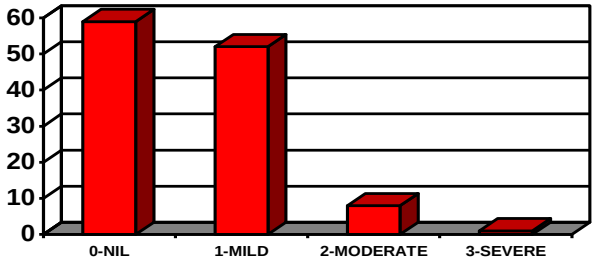

Fig. 10: Pain on last followup.

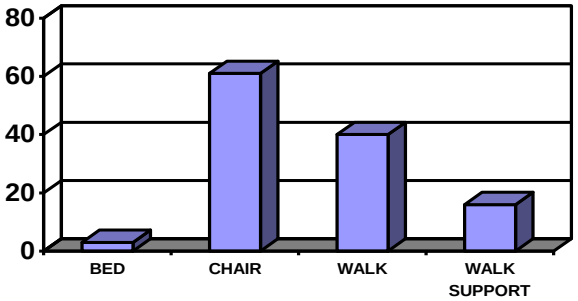

Fig. 11: Mobility on last followup.

Frankel grade improvement in in-complete deficit patients, while Nadeem [19] showed 0.9 Frankel grade improvement per patient in a study of 79 patients. Our study has shown 1.5 AIS (equivalent to Frankel grade) improvement per patient. It is important to note that in study of Nadeem 58% patients were in Frankel grade A while in our series only 46% patients were in AIS-A.

CONCLUSION

Spinal stabilization should be carried out early in cases of unstable spinal trauma by well trained personnel and in a setup where facilities for proper rehabilitation are

available post-operatively. This has given better results in a major disaster like 8th October 2005 earthquake as well as peace.

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