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SHORT COMMUNICATION

Thoracic Injuries in Indian Kashmir during Earthquake, 2005

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Abstract

Background: Earthquakes cause horrendous devastation with lots of deaths. This study was conducted to determine the patterns of thoracic injuries in the 2005 earthquake victims of Indian Kashmir referred to the CVTS Dept. of Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Soura, India.

Methods: Of the 468 patients received by SKIMS, 87 patients had either isolated chest injuries or multiple organ trauma. Chest injuries were identified and categorized for appropriate management to be instituted. The patients were followed up for next four years for functional outcome.

Results: There were 51 females and 36 males. Their mean age was 35 years. 83.91% had isolated chest injuries while 16.09% had associated injuries. For patients with isolated chest trauma, the Mean Injury Severity Score (MISS) was 8.79 and for multiple organ trauma it was 36.42. 27.59% were treated conservatively, and 41.38% had only chest tube. 31.03% were operated; 37 surgeries were done. 87.36% of the patients showed excellent recovery in functional outcomes. Females have shown more long term PTSD than males.

Conclusion: Massive calamities like earthquakes cause multiple types of injuries in the affected population. Categorization of the victims in different groups so as to provide specialized and multi-specialty integrated care is imperative. In accordance with earlier studies, we found that high MISS is associated with high mortality.

Keywords: Earthquake; Thoracic trauma; Pattern; Thoracic injury; Functional outcome

Introduction

An Earthquake of magnitude of 7.6 on Richter scale occurred on the 8th of October 2005 epicentered in Pakistan Administered Kashmir and in North West Frontier Province (NWFP) near the city of Muzaffarabad at 9:30. The quake was comparable to the one in San Francisco in 1906, in Quetta in 1935 earthquake, and in Gujarat in 2001. The quake caused horrendous devastation with about 80,000 deaths in Pakistan Kashmir while officials report that nearly 1,400 people also died in Indian Kashmir with over 7000 injured. In Indian Kashmir, the victims were treated in different hospitals in periphery and in main central hospitals located about 80 Km away from the main scene of devastation. Earlier studies have reported varying percentages of thoracic injuries, i.e. 4%[1], 10%[2,3], 12.9%.[4] We studied the patients who sustained thoracic trauma in Kashmir earthquake in 2005 on the Indian side.

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Materials and Methods

Of the 468 patients in the casualty department of SKIMS , 87 (18.59%) patients were admitted under the Dept. of CVTS which had isolated the chest injuries or multiple organ trauma cases. Thirteen patients were brought dead, of whom six had severe chest injury as the cause of death. They were excluded from the study. The associated injuries of the patients were recorded.

The pattern of injuries varied from simple rib fractures to massive diaphragmatic ruptures. The patients were managed by various modalities ranging from

conservative to surgical interventions. They were followed for the next four years and the outcomes were determined.

Sixty eight (78.16%) patients were directly brought to our emergency from the site of disaster while nineteen (21.84%) were referred from other nearby hospitals after having been given initial treatment for other associated injuries.

The patients who presented in shock were stabilized haemodynamically on admission with fluid and blood transfusions as and when indicated. A general clinical assessment was made and the patients were referred for X-rays, CT, MRI and USG. Chest injuries were identified and categorized for appropriate management to be instituted. For the vascular injuries in the limbs, fracture stabilizations were done prior to any other surgical intervention. All the procedures required by a particular patient were carried out in one sitting, taking due care to attend the injuries as per the severity. The patients with poly-trauma were also examined by other specialists and proper treatment was instituted. Complete segregation of patients was done depending upon the type and combination of injuries sustained. Mean Abbreviated Injury Score (mAIS) and Mean Injury Severity Score (mISS) for individual injury groups and all injury groups combined was calculated. The patients were also provided with psychiatric treatment and psychological counseling due to the psychological impact of such a disaster.

All the surviving patients were followed up for four years and their functional outcomes were determined . Periodic assessment of lung functions by spirometry and CT scan was done to establish optimum postoperative functioning.

Results

Of the 87 patients, 51 (58.62%) were females and 36 (41.38%) males (Table 1). The age of patients affected ranged from 2.5 to 78 years with a mean of 35 years. Most of the patients were in the middle age group. More females were affected in each age group than males.

Of the 87 patients received, 73 (83.91%) had isolated chest injuries while 14 (16.09%) had associated injuries of the other organs. The pattern of injuries in the chest ranged from simple rib fractures to lung contusions to diaphragmatic ruptures. Mean Abbreviated Injury Score (mAIS) and mean Injury Severity Score (mISS) was calculated in each injury group and for all patients taken togather. The patients were divided into three groups on the basis of treatment required. Group 1 was treated conservatively; group 2 needed only chest tubes and group 3 major surgeries.

Eighty one (93.10%) of all the patients had one or more rib fractures. The rest of the 6 (6.90%) patients had chest trauma not associated with any fracture of the ribs. Thirty patients (34.48%) had haemothorax, 21 (24.14%) had pneumothorax and 18 (20.69%) had chest wall lacerations (Table 2).

The injuries associated with chest trauma included abdominal trauma, fractures of axial skeleton and head trauma. All the patients with abdominal trauma had haemoperitoneum, the cause of which included liver, spleen and mesenteric rupture (Table 3).

Axial skeletal fractures included fractures of the limbs, spine and pelvis. One patient had spinal fracture with paraplegia while three had fractures of both lower limbs, two of them having pelvic fractures as well. One patient had fracture in the right humerus and right shaft of the femur with pelvic fracture. Five patients had vascular injuries involving femoral,[2] popliteal[3] and brachial[1] arteries. There was one popliteal and one median cubital vein injury. The patients with head trauma had injuries ranging from simple skull fractures with extradural hemorrhage to combined subdural hemorrhage and subarachnoid hemorrhage.

Mean AIS and ISS for all the patients was 3.79 (SD: 2.73) and 13.26 (SD: 12.9), respectively. For

Table 1: Sex Distribution in each age range

Age range (years)	No. of patterns			
	Male		Female	
	No.	%	No.	%
1-20	9	25.0	13	25.5
21-40	12	33.3	16	31.4
41-60	9	25.0	15	29.4
61-80	6	16.7	7	13.7
Total	36		51	

Table 2: Type of injuries in patients based on mAIS and mISS in both genders

No.	Type of injury	No. of patients	Males	Females	mAIS	mISS
1	Simple rib #'s single or multiple	15	7	8	1.80	4.47
2	Rib #'s with chest wall lacerations	18	6	12	2.33	5.67
3	Rib #'s with hemothorax	14	6	8	3.21	11.36
4	Rib #'s with pneumothorax	9	4	5	2.89	9.33
5	Rib #'s with lung contusion	5	3	2	3.40	11.80
6	Rib #'s with ruptured diaphragm	4	3	1	4.00	16.00
7	Rib#'s with hemopneumo thorax with lung contusion	8	2	6	3.63	13.38
8	Rib #'s with hemothorax with he-moperitoneum	4	1	3	7.75	31.75
9	Rib #'s with hemopneumo thorax with associated head trauma	4	1	3	7.25	29.75
10	Lung contusion with # axial skele-ton with hemoperitoneum	3	2	1	8.25	41.67
11	Diaphragmatic rupture with hemoperitoneum with # axial skeleton	3	1	2	11.67	47.00
	Total	87	36	51		

Table 3: The procedures undertaken in earthquate

No	Procedure	No. of patients
1	Conservative	24
2	ICTD only	36
3	**Major surgeries**	37
A	Thoracotomies	19
	Repair of lung laceration	4
	Lobectomy	5
	Ligations of injured IC vessels	5
	Pneumonectomy	1
	Repair of diaphragm	4
B	**Vascular repair**	**7**
	Femoral Arteries	2
	Popliteal Arteries	3
	Popliteal Vein	1
	Brachial Artery	1
C	**Laparotomies**	8
	Splenectomy with repair dia-	1
	phragm	2
	Repair of liver laceration	1
	Mesenteric with diaphragm repair	1
	Repair of diaphragm only	2
	Mesenteric repair only	1
	Splenectomy only	
D	**Craniotomies**	3
	EDH	1
	Contusion	1
	Decompressive craniotomy	1

patients with isolated chest trauma, mISS was 8.79 and for those with multiple organ trauma it was 36.43. Of the 87 patients, 24 (27.59%) were treated conservatively in that they did not require any chest tubes or surgery but they might have required ventilation as in some patients with lung contusions or those

with flail chest. Thirty six (41.38%) were treated with chest tube insertions only with or without elective ventilation. The remaining 27 (31.03%) patients were operated; among them 37 surgeries were done including thoracotomies, laparotomies, craniotomies and vascular interventions. Laparotomies and craniotomies were done by general surgeons and neurosurgeons, respectively.

All the patients with chest tube insertions for minimal to mild hemothorax had their tubes removed after their drainage was less than 50 ml and serous. In all cases, the chest tubes were not left in situ for more than 7 days. In patients in whom thoracotomies were done for hemothorax and rupture diaphragm, the chest tubes were removed on the 3rd day. Lung resection surgery (lobectomy and pneumonectomy) was done only when more than 2/3rd of the lobe or lung was damaged and could not be salvaged. Of the 16 patients with lung contusions, 2 had lobectomy and one required pneumonectomy because of continuous haemoptysis. The rest of the lung contusions healed completely with almost normal lung functions attained as seen on regular follow up. The patients with vascular repairs had reverse saphenous vein grafts done in all popliteal, one brachial and one femoral artery. Other femoral arteries were repaired primarily. The popliteal vein was repaired primarily while the cubital vein was ligated. All the repairs in the surviving patients were successful and there were no postop amputations.

There were 9 (10.34 %) deaths with 7 (77.78%) patients having sustained polytrauma. The other two had massive haemothorax as the result of rib fractures. Among the dead ones, 6 (66.67%) were females and 3 (33.33%) males. Mortality was higher in patients with high mean Injury Severity Score. For isolated chest injury patients, mean ISS was 8.79 and in patients with polytrauma it was 36.43.

The patients who had had repair of lacerations or lung resection surgeries were followed up for the next four years with repeated chest x-rays done after every 3 months and CT scan chest after every 6 months in the first year followed by chest x-ray after every 6 months and CT scan after every 12 months in next three years. This was associated with periodic pulmonary function tests (PFT) done every 6 months. Those who had simple rib fractures with no under- lying lung injury were followed for the next one year by repeat chest x-ray after every six months and PFT every 3 months. All showed good recovery with normal lung functions.

The psychological impact of a disaster of such a scale is massive. Loss of property coupled with loss of family members causes mental stress that has tremendous bearing on the future well being and mind of the surviving members. This combined with the disability due to injury and fear of future causes tremendous mental problems. These patients are prone to developing Post Traumatic Stress Disorder (PTSD). Affective and anxiety disorders are extensive. Recognition of these is imperative in an earlier stage. All the patients were put on anxiolytics postoperatively as soon as oral intake was resumed. This was continued till the follow up period varying in duration from one year to four years. Five (6.41%) of our surviving patients are still on antipsychotic treatment four years after the calamity. Four of them are females and one male. Non-specific chest pain syndromes requiring anxiolytics were seen to occur more commonly in female patients**.**

Discussion

The earthquake that occurred on the 8th of Oct. 2005 in Kashmir was devastating in its magnitude both in terms of loss of life and property as well as in terms of post trauma stress suffered by the patients. Massive calamities like earthquakes cause multiple types of injuries in the affected population. Categorization of the victims in different groups so as to provide specialized care is imperative.

Thoracic injuries are common in earthquakes. Earlier studies have reported varying percentages of thoracic injuries. Toker ***et al.*** reported 4% major thoracic trauma in Marmara earthquake that struck Turkey on August 17, 1999.[1] Ozdogan ***et al.*** reported that approximately 10% of the casualties of a severe earthquake are expected to include thorax and lung injuries.[2] Also, Ghodsi reported 10% thoracic injuries in Bam earthquake.[3] Yoshimura ***et al.*** reported 12.9% chest injuries in Hyogo Prefecture earthquake in Japan in 1995.[4]

Our study too reported a considerable number of thoracic injuries comprising about 18.59% of the casualties received by the hospital. In mass casualty situations, demands always exceed the capacity of the personnel and facilities. Mass casualties such as sailing ship disasters and war casualties have occupied the attention of surgeons since the 17th century.[5,6] In the last few years, there has been an increased incidence of civil disasters; the spectrum of possible catastrophes has also increased dramatically as a result of an

increasing technologically sophisticated society.[7,8]

Injuries to the thorax in the earthquake settings present a major challenge to the emergency medical staff, as the injured must be retrieved from beneath the collapsed rubble such as buildings, pipelines, machinery, or heavy furniture. Treatment of blunt chest trauma in these settings is frustrating as it would be relatively simple under more stable conditions; however, timely access to the victims is often denied due to inaccessibility, leading to high mortality in these patients. Due to the delay in retrieval, quick triage and referral to an unaffected hospital are essential to ensure a greater chance of survival.[3]

Ours was the first experience with such a disaster with this massive influx of casualties leading to immense work load on surgical specialities and super specialities involving general surgery, neurosurgery, plastic surgery and CVTS in particular. Chest wall injuries and hemo/pneumothorax comprise a considerable number of injuries in survival victims of earthquakes. Consequently, the majority of these patients can be treated with observation or tube thoracostomy.[3] Eighty one (93.10%) of all the patients received had one or more rib fractures, thus making it the commonest injury sustained followed in decreasing order by thirty hemothorax cases (34.48%), 21 pneumothorax (24.14%), and 18 chest wall lacerations (20.69%).

It has been established that mAIS and mISS of patients with polytrauma is higher than those having either isolated or superficial chest injury and that mortality increases with the increase in magnitude of both these parameters.[1,3] Our study was consistent with earlier reports and we found that increased value of mISS (36.43) did increase the mortality rate. In the past, post-traumatic stress disorder (PTSD) has been underscored or even ignored, especially in calamitous settings.[9] Recent studies and increasing knowledge about PTSD have led to greater awareness and the implementation of diagnostic tools for early recognition. We recognised this fact and thus started antipsychotic treatment and counselling of our patients so as to prevent descendence into more chronic form of mental stress. Every natural calamity and its circumstances exert psychological stress on the people affected. Concerns about future existence, the loss of family members, loss of property, and disability due to injury, together with fear, neglect, and helplessness can disrupt mental equilibrium. Regular psychiatric treatment and psychotherapy may help alleviate this major problem. We, however, accept that a comparative study is required to establish if early institution of antipsychotic treatment helps alleviate PTSD. While superficial chest trauma with haemo/ pneumothorax is the commonest injuries sustained in earthquakes, there can be a combination of injuries that pose a lot of challenge. This was a descriptive study of patients who suffered thoracic trauma of different types, their treatment and their follow up four years after the disaster. Although we had no prior experience with such a calamity, we succeeded in utilizing our meager resources and provided specialized care where needed. Despite this, much remains to be done in our part of the world to help provide more integrated specialized care to patients in such horrendous circumstances.

Conflict of interest: None declared.

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