

Clinical Profile of Thorax and Lung Injuries Associated with the 2011 Van Earthquake in Turkey



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ABSTRACT

The 7.2 and 5.6 magnitude earthquake that struck Turkey on October 23 and November 9, 2011, was one of the deadliest earthquakes in recent decade. Our aim is to determine the clinical profile of crush thoracic traumas resulting from the massive Van earthquake. A retrospective review was undertaken of 39 intervention for chest traumas. Sex distribution was 21 female and 18 male patients. Thoracic cage, pulmonary parenchyma, and pleura traumas were included in the study. Among the total of 425 hospitalized patients, 39 (9.1%) were thorax and lung injuries. Pneumothorax and rib fractures were the two most frequent pathologies. There were pneumothorax or hemothorax in 31 (79%) patients, bronch ruptures in 2 (5.1%) patients, diaphragmatic ruptures in 2 (5.1%) patients, flail chest in 2 (5.1%) patients and sternal fracture was detected in 2 (5.1%) patients. Totally, 76 ribs fractures were found in 27 (69%) patients, There were 36 (92%) patients with pulmonary parenchymal injuries and 31 (79%) with pleural injuries. Thoracotomy was performed in 4 (10%) patients, while 37 (95%) patients underwent tube thoracostomy. Carinal reconstruction was performed in a patient with bronchus and trachea injuries. Four patients (10%) with severe trauma developed Acute Respiratory Distress Syndrome (ARDS) and two of them died because of developing ARDS. After the patients are admitted to the hospital, we should use an individualized treatment according to the patients recent clinical history and examination. At the same time, traumatic chest injury should be considered in planning the medical response strategies.

Key words: Earthquake, thoracic trauma, lung injury

2011 Türkiye, Van Depremi ile İlişkili Toraks ve Akciğer Hasarlarının Klinik Özellikleri

ÖZET

Van'da 23 Ekim ve 9 Kasım'da 7.2 ve 5.6 şiddetinde son 10 yılın en şiddetli depremi meydana geldi. Amacımız, şiddetli Van depreminden dolayı toraks travmasına maruz kalan hastaların klinik profilini ve sonuçlarını araştırmaktır. Göğüs travmasına maruz kalan 39 hasta retrospektif olarak değerlendirildi. Yaş dağılımı ele alındığında 21 olgu bayan, 18 olgu erkekti. Göğüs kafesi, akciğer parenkimi, plevral yaralanma durumu değerlendirildi. Deprem nedeniyle toplamda, yatırılan 425 hastanın 39'u (%9.1) toraks travması ve akciğer yaralanmasına maruz olgulardı. Pnömotoraks ve kot fraktürleri, en sık görülen 2 önemli patolojiydi. Pnömotoraks ve/veya hemotoraks 31 hastada (%79), bronş rüptürü 2 olguda (%5.1), diyafragma rüptürü 2 olguda (%5.1), yelken göğüs 2 olguda (%5.1), sternal kırık 2 olguda (%5.1) görüldü. Tesbit edilen kırık kot sayısı 76 idi (27 hastada, %69). Pulmoner parenkimal yaralanmalı olgu sayısı 36 olgu (%92), plevral yaralanmalı olgu sayısı 31 (%79) idi. Tüp torakostomi uygulanan olgu sayısı 37 (%95) iken, torakotomi 4 olguya (%10) uygulandı. Akut solunum yetmezliği 4 olguda (%10) gelişti, bu olgulardan ikisi eksitus oldu. Hastaneye hasta kabulü sonrası, hastaların yakın zamandaki klinik öykü ve değerlendirmesi yapılarak tedavi şekillendirilmelidir. Travmatik göğüs yaralanmalarında aynı zamanda tedavi stratejileri ve medikal tedavi seçenekleri de iyi değerlendirilmelidir.

Anahtar kelimeler: Deprem, göğüs travması, akciğer yaralanması

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INTRODUCTION

On October 23 and November 9, 2011 two catastrophic earthquakes was occurred in ancient city of Van with a magnitude of 7.2 and 5.6 (Richter scale). Van city is located in the eastern part of the Turkey with a highly ondulatd land as a extension of western Himalaya's. The massive destruction caused 636 people died, more than 4500 were injured, and more than 100 buildings were collapsed. Additionally, 30 000 houses were severely damaged. Because of the earthquake epicenter is close to the densely populated area the loss of life was greatly increased (1). In the English literature, chest traumas compose 10%-15% of all traumas and carry a mortality rate ranging from 8.2% to 33.3% (2,3). The leading cause of chest traumas is road traffic accidents, and the second through fourth most common causes are falls, assault, and work-related accidents, respectively (4,5).

In the recent limited reports, thoracic and lung injuries composed 7.6%-15.9% of the injuries arising from massive earthquake of the hospitalized patients (6,7). The data is very limited and in the light of the literature we evaluate the injured patients and we demonstrate a very important epidemiologic data with the aim to detect different types of chest injuries.

MATERIALS AND METHODS

Four hundred twenty five of 1800 trauma patients admitted to our hospital were hospitalized and treated with hospital care in different departments between October 23 and November 9, 2011, following the both earthquakes. 159 (37.4%) patients were treated in orthopedics surgery, 37 (8.7%) were in general and 16 (3,7) were in pediatric surgery, 39 (9.1%) were in thorax surgery. 34 (%8.0) patient were treated in neurosurgery, 62 (14.5%) were in internal medicine, 38 (8.9%) in intensive care unit and 40 (%9.4) were in the other departments Of those patients, 420 (98.8%) had records that could be accessed 39 patients who had crush thoracic trauma from the earthquake due to collapsed constructions were reviewed. Main clinical findings that alerted the clinicians to the possibility of crush thoracic injury were chest pain, cough, hemoptysis, respiratory distress, and dyspnea. Thirty-nine of 425 patients (9.1%) had thorax and/or lung injuries, and these records were examined in detail chest radiographs, physical examinations, and, in some cases CT scans of the thoraks were used in di-

agnosing the thoraks and lung injuries. Because of the limited capacity of the hospital and intensive care unit, some patients were transferred to reference hospitals during the hospitalization period. To avoid repetition in the census data, duplicate records were counted only in one hospital after matching the records.

RESULTS

The mean age of the patients was 39.7 (2-83) years, and the mean time from rescue to first intervention was 14.5 (0.3-108) hours. Twenty one patients (53.8%) were female and 18 (46.2%) were male. Twenty percent (n:8) (5 females and 3 males) were over the age of 60. Of the 39 patients, bone fractures were detected in 29 (76.9%) patients. Pulmonary parenchymal injuries, pleural injuries, and soft-tissue changes were detected in 36 (92.3%), 31 (79.4%), and 29 (74.3%) patients, respectively. The distribution of the thorax injuries is summarized in Table 1. Pulmonary parenchymal injuries was the most frequent pathology Of the 39 patients, 36(92.3%) has had pulmonary injury. The distrubution was 19 (52.7%) had a hemopneumothorax, 8 (20.5%) had unilateral pneumothorax, 3 (7.6%) patients had hemothorax, one patient (2.5%) had a bilateral pneumothorax. 2 (5.1%) patients were followed up in the clinic that had sternal fractures. Twenty seven (69.2%) patients had rib fractures and among them eighteen had multiple rib fractures (Figure 4).

Table 1. Conditions in 39 patients with crush thoracic trauma

Injury	n	%
Bone fractures	29	74.3
Rib	27	69.2
Sternum	2	5.1
Pulmonary parenchymal	36	66.6
Contusion	15	38.4
Laceration	11	28.2
Pleura	31	76.9
Pneumothorax	9	12.8
Hemothorax	3	15.3
Hemopneumothorax	19	48.7
Soft tissue of chest wall	25	64.1
Muscular awelling and fatty edema	21	53.8
Subcutaneous emphyzema	4	10.2
Other (bronch and trachea)	2	5.1
Diaphragmatic hernia	2	5.1
Pneumomediastinum	3	7.6

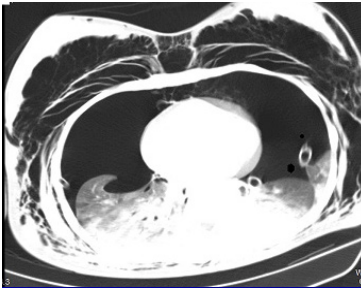


Figure 1. Under the rubble in the earthquake chest CT appearance of the 18 year old female patient who had detached bilateral main bronchi and underwent bilateral tube thoracostomy.

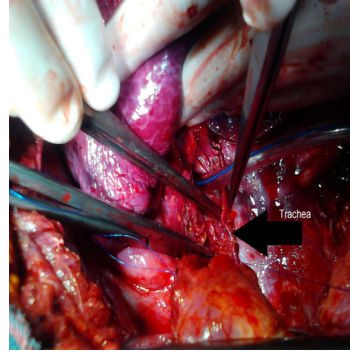


Figure 2. Intraoperative image of the case (trachea and bronch rupture)

Two of patients with rib fractures had flail chest. Inevitably these patients was connected to the ventilator. One of them was extubated from the ventilator without any problem at the twelfth day and the other patient on thirteenth day. Four patients (10.2%) with severe trauma developed crush syndrome and ARDS. These patients were intubated. Two of them Others were discharged after extubating the ventilator. Of the 39 patients, tube thoracostomy was performed promptly in 37(94%) patients on arrival at the hospital. Toracotomy was performed in 4 (10.2%) patients. Of the 4 patients, 2 (5.1%) patients had diaphragmatic hernia and 2 (5.1%) had bronch ruptures. One of the bronch ruptures patients had also trachea rupture (Figure 1,2,3). In that patient two of the bronch was seperated from the carina with a 6 cm tear in the membranous part of the trachea. Firstly, trachea was repaired primarily. After reconstruction of the trakea, two primary bronches were repaired primarily again. Due to severe lung contu-

sions the patient was died on 11th day postoperatively. The other patients who were treated with toracotomy was discharged from the hospital without any problem.

DISCUSSION

Surveillance of the injuries are especially one of the most challenging topics in crisis management of natural disasters. Although in the recent 2 decades earthquakes alone have caused more than one million deaths worldwide (8,9) and unknown numbers of injuries, there is little information about epidemiological features of victims. One of the most important reasons for that is critical caotic situation immediately after the disaster. Beyond that the excess work load and social and psychological aspect of subject aggravate it.

According to the limited data, females admitted to the hospital was slightly higher. The reason for that is their



Figure 3. Postoperative chest X-ray image of the case

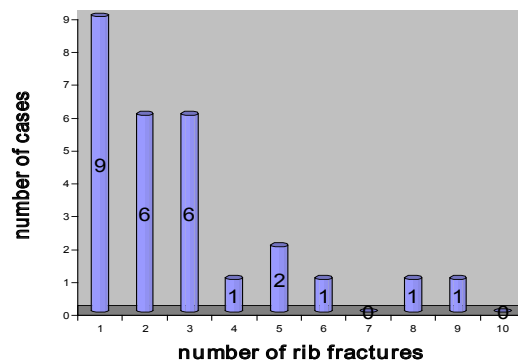


Figure 4. Graphic shows the number of fractured ribs per patient.

weak body relatively to the man and their attempt to protect their children. In 1999 Chi-Chi earthquake female fatalities were 1.1 times, in 1995 Hanshin earthquake 1.5 times and in 1994 Northridge 2.4 times more than males (10,11). There was also a significant difference in the age pattern of admitted victims. The lower number of children (<7 yr) is probably because they were protected by their parents. In our study, injuries due to chest trauma, similarly to recent data, the number of women were more than men in victims, and the number of children was slightly lower than published literature. The possible reasons in elderly group (>60 yr) is that they could reach to emergencies more difficultly due to chaotic environment and were physically weaker so died immediately during the earthquake.

The main type of thoracic trauma is rib fracture injuries in the earthquakes. It composes 27.0%-36.4% of chest injuries (6,7). According to Sirmali et al (4), rib fracture is also a common injury with an incidence of 38.7% , in patients with general or nonspecified thoracic trauma. The number of fractured ribs is a good indicator of the severity of the injury. Presence of more than three rib fractures is associated with the greatest prognostic difference, and the mortality rate increases with each additional rib fracture, with a total mortality ranging from 5.7% to 10% (4,12). First and second rib fractures usually indicate a severe injury, and the incidence of significant vascular injury would reach 14% (13). Flail chest is significantly life-threatening factor, with mortality ranging from 10% to 20% (14).

In our study, the incidence of rib fractured victims (66.5%;) %) was much more higher than the literature. However the mortality rate was 5.1%, slightly lower than the previous data. The incidences of fracture of the first and second rib and flail chest and the mean number of fractured ribs per patient were lower than in previous studies (4,12,9,15).

In the Kobe, Japan, earthquake (magnitude, 7.2 on the Richter scale), 12.9% of the patients seen in Kobe University Hospital had thorax injuries. The most common types of injuries in these patients were superficial lacerations and contusions (46.0%) followed by the fracture of ribs or the clavicle (34.9%) (6). The total number of thorax injuries in the Kobe earthquake is slightly higher than our total number of patients, but the patients hospitalized as well as the patients examined in the outpatient basis were included in the analysis

of the Kobe University Hospital. Only the hospitalized patients are included in our study,. The frequency of rib fractures was two times as much higher than Kobe earthquake (around 34%), pneumothorax was also much more frequent compatible with previous finding in the earthquakes in Turkey (70%) than in the Kobe earthquake (3.2%). In Turkey, most casualties were heavily entrapped survivors of totally collapsed buildings.

Some studies show that pulmonary contusion is also common thoracic injury, with a morbidity ranging from 23.7%to 49.6 (12,15), two studies of chest trauma caused by earthquake found a very low incidence of pulmonary contusion (6,16). However the incidence of pulmonary parenchymal injuries in our series (92.3%) was relatively high, which has a significant positive correlation with rib fractures. According to the studies of Yoshimura et al (6) and Ozdogan et al (16), the incidence of pneumothorax changes from 3.2% to 51.9%. As reported by Sirmali et al (4) pleural injuries including pneumothorax (46.9%), hemothorax (33.8) and hemopneumothorax(19.3%) are noted in 72.3% of the cases with rib fracture. Our results showed that pleural injuries had a significant positive correlation with rib fractures. The incidences of pleural injuries were relatively high (68.4% of the total study population), especially hemothorax and hemopneumothorax. These may be due to direct laceration by the splintered ribs.

Most common signs of tracheobronchial injuries are, pneumothorax, pneumomediastinum and persistent atelectasis. Pneumomediastinum is a much more sensitive indicator of airway damage (17). In our study, pneumomediastinum was detected in two patients with persistent pneumothorax, and definite diagnosis made with broncoscopic examination. A previous report declared that in the first few days, the medical teams concentrated on treating injuries caused directly by the earthquake (18). Surgical staff are the main medical disciplines needed at this stage (10,19). Thus we believe that surgical staff must be prepared for requested changes to their mode of activity and for extreme conditions.

Trauma is the most common cause of mortality through earthquake. Threatening injuries like intracranial hemorrhage, injury of intrathoracic and intrabdominal organs lead to immediate victims dead (20). in this study shows that the highest rate of injury was extremities fractures and the second most common was thoracic injuries.

In conclusion, after the patients are admitted to the hospital, we must plan individualized treatment according to the patients respective clinical features, and at the same time, traumatic chest diseases should be considered in planning the medical response strategies. We highly stress the high incidences of rib fractures, lung contusion, and hemopneumothorax as the noticeable features that need appropriate medical treatment.

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