The Etiology, Associated Injuries and surgical management of Post Traumatic Diaphragmatic Hernia; A retrospective study

Manzoor Ahmad[1], Imran Tahir[1], Attiya Nasir[1], Amer Bilal[2], Muhammad Abid Khan[2], Fawad Ali[3]

[1]Department of Surgery Hayatabad Medical complex, Peshawar - Pakistan

[2]Department of Thoracic surgery, MTI, Lady Reading Hospital, Peshawar - Pakistan

[3]Department of Surgery, Saidu Group of Teaching Hospital, Swat - Pakistan

Address for correspondence
Imran Tahir
Department of Surgery, Hayatabad Medical complex
Peshawar - Pakistan.
E-mail:
drimranswati@gmail.com

Date Received: Sep 27, 2020
Date Revised: Nov 10, 2020
Date Accepted: Feb 15, 2021

Author Contributions

MA IT AB conceived idea, IT MBK FA drafted the study, MA IT collected data, IT AN FA did statistical analysis and interpretation of data, IT MA AB critical review manuscript, All approved final version to be published.

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Abstract

Background: Due to increasing urbanization and mechanization of life style incidence of road traffic accidents has increased. Because of these road traffic accidents the incidence of traumatic diaphragmatic injuries also increases. Our study was to evaluate retrospectively the etiology, associated injuries and surgical management of blunt diaphragmatic injuries. The present study was conducted to evaluate retrospectively the etiology, associated injuries and surgical management of blunt diaphragmatic injuries.

Methodology: This retrospective case study was conducted from January 2016 to January 2019 jointly by Thoracic surgery ward Medical Teaching Institute LRH Peshawar Pakistan and Medical Teaching Institute Hayatabad Medical Complex Peshawar Pakistan. Patients with any age and either sex with diaphragmatic injury post blunt trauma received in emergency or OPD or shifted from other ward were included in study. Patients with penetrating diaphragmatic injuries and congenital diaphragmatic hernias were excluded from the study. All the clinical presentations, demographic data, base line investigations and specific investigations were recorded on a proforma and analyzed.

Results: Total number of patients included in the present study were Thirty Five, out of these 35 patients 24 patients presented to emergency department, 07 patients presented late to our OPD with history of trauma and four patients were shifted to us from other wards. The age range in the present study was from 07 years to 62 years. Most of the patients in this study were in the age group of 18-48 years (68.9%). Male were 24(68.57%) and female 11(31.42%). Thirty one patients had left sided injury and 4 patients had right sided. Out of 35 patients 21 had road traffic accident. Seven patients who came to OPD were diagnosed delayed. Morbidity was 3 (8.57%). There was no mortality in the present study

Conclusion: Urbanization and mechanization has increased the incidence of road traffic accidents and increase diaphragmatic injuries as evident from this study. Early diagnosis and surgical repair has got good results.

Key words: Diaphragmatic injury; Blunt trauma; Urbanization

This article may be cited as: Ahmad M, Tahir I, Nasir A, Bilal A, Khan MA Ali F. The Etiology, Associated Injuries and surgical management of Post Traumatic Diaphragmatic Hernia; A retrospective study. Pak J Chest Med 2021; 27 (1):03-07

Introduction

Traumatic diaphragmatic rupture is a potentially serious condition which fortunately is relatively uncommon. Diaphargm is a muscular structure separating abdominal cavity from thoracic cavity. Due to sequence of events during embryological development left hemi-diaphragm is the weakest part & is most commonly injured in traumatic diaphragmatic injury. All patients under going emergency laparotomy for trauma around 5% have diaphragmatic injury.[1] On basis of mechanism of injury traumatic diaphragm injuries are divided into blunt & penetrating traumatic injuries. Focusing on the

etiology of thoraco abdominal trauma showed diaphragmatic injuries rates of 2.1% for blunt & 3.4% for penetrating trauma.[2] Penetrating traumatic diaphragm injury is typically caused by edged weapons, firearms & blunt trauma by fall, motor vehicle accidents and crush injuries etc.

Studies show that in between 75-80% cases blunt trauma cases causes injury in left hemi-diaphragm. In addition to embryogenesis responsible for this another supported idea is liver & its ligament provide some degree of protection for right hemi-diaphragm that is absent on left.[3] Occasionally blunt trauma to left hemi-diaphragm causes herniation of stomach, spleen or gut into left pleural space & herniated organs are at risk of strangulation. And if mediastinum is effected by herniation it may inhibit ventricular filling which result in low ejection fraction &low cardiac output .

Diaphragmatic rupture is a diagnostic& therapeutic challenge. Diagnosis is very challenging especially when there is no herniation of intra-abdominal organ into affected hemi-thorax through the diaphragmatic rupture or a similar equivocal sign, a definite diagnosis on a basis of chest x-ray (CXR) is very challenging.[4] Despite wide spectrum use of computer tomography (CT) as one of initial imagining method in trauma diagnosis of diaphragmatic rupture is still very taxing. Most of cases are discovered during operations.[4] Untreated traumatic diaphragmatic ruptures do not heal on their own & if missed it may present later in life with complications such as persistent complaint from diaphragm, herniation, and strangulation of intra-abdominal organs or respiratory distress.[5] More ever late repair become significantly difficult due to atropy of surrounding tissue than early repair.

The rationale of this retrospective study was to analyze the clinical presentation, suitable diagnostic methods & surgical management of patients with traumatic diaphragmatic ruptures.

Methodology

Subsequent to approval from ethical community this is a retrospective study conducted in Lady reading hospital & Hayatabad medical complex during time period extending from January 2016 to January 2019. This study was carried on patient who presented to Accident & emergency department of Lady Reading Hospital & Hayatabad Medical Complex with blunt trauma history via means of collision with fast moving object, fall from height or hit by blunt object during brawl. Also patients presented to outpatient department of these hospital with a history of blunt trauma and also patients with blunt trauma shifted from other wards or hospitals were also included in this study.

Patients with penetrating injuries and also patients with diaphragmatic hernia and no history of trauma were excluded from the study.

A proforma was filled with patient demographic data, clinical presentation with which he arrived to emergency or outpatient department, initial and late diagnostic methods which were applied, investigation findings and time of diagnosis, surgical plan adopted, associated injuries, hospital stay, and postoperative morbidity & mortality was recorded & analyzed.

Main diagnostic investigations chest X-ray (CXR) and ultrasound chest and abdomen was done in all cases, CT-Thorax &abdomen was done in most of cases and some elective cases fluoroscopy was done for diagnosis.

Abdominal approach was opted in majority of cases with right or left thoracotomy alone or with laparotomy was applied in some difficult cases.

Operative findings in majority of cases was rent in the posterolateral part of diaphragm which is the weakest part of diaphragm with size varying from few centimeters to huge defect in which mesh was applied in clear non-contaminated field. Some cases have diaphragm detached from its attachment to thoracic wall and one case the rent had gone to the other side also. Associated injuries were minimal in our observation.

All patients had chest intubation done during operation which was later removed at different interval in different cases. All defects were repaired with prolene 1 interrupted sutures.

Our post-operative plan included use of antibiotics, pain killer to relieve pain as it was responsible for main post-operative complication, early mobilization, chest physiotherapy, surgical wound care, serial chest x-ray, discharge & follow-up.

The most common complication noted in the present study was atelectasis mainly because of post-operative pain and reduced mobility of diaphragm. Few patients developed wound infection which was cured with culture sensitive antibiotics. There was no mortality in our study.

Patient were followed up to six month after discharge. With first visit after two week & then remaining every 2 month till 6 months. On each review Chest x-ray was repeated.

Results

Total of 35 patients were included in our study from January 2016 to January 2019. All these patients had

traumatic diaphragmatic hernia following blunt trauma, penetrating trauma and congenital diaphragmatic hernia were excluded. Out of these 35 patients 24 patients presented to emergency department, 07 patients presented late to our OPD with history of trauma and four patients who were admitted in other units post trauma and were shifted to our ward.The age range in our study was from 07 years to 62 years. Most of the patients were in the age group of 18-48 years (68.9%)

There were 24 (68.57%) male patients in our study and 11 (31.41%) female patients.

Thirty-one patients (88.57%) presented with left sided traumatic diaphragmatic hernia, while 4 patients (11.42%) presented with right sided traumatic diaphragmatic hernia. Most common presenting symptoms in these patients were chest and abdominal pain in 27 (77%) of the patients, followed by shortness of breath in 19 (54%) and vomiting in 10 (28.6%). On physical examination, air entry was decreased in 28 (80%) patients and bowel sounds were heard in the chest in 13 (37%). The patients who presented had different mechanism of injuries 21 (60%) patients had road traffic accident, 7 (20%) had history of fall, 6 (17%) patients had fall of heavy object or roof over them and one patient presented with crush injury between two objects. Chest x-ray was performed in all patients and was diagnostic in 27 (77%). Similarly all the patients underwent ultrasonography which was found to be positive in 30 (85.72%) patients at presentation. CT-Scan and fluoroscopy was performed in difficult cases and there diagnostic accuracy was (100%).

Common associated injuries in traumatic diaphragmatic hernia in our study group were, rib fracture in 12 (34.2%) followed by limb injuries 9 (25.71%) splenic injury in 6 (17%), liver injuries 4 (11.4%), head injury in 5 (14%) and pelvic fracture 01 (2.85%) (Table 1).

Table 1. Common Associated Injuries in Traumatic Diaphragmatic Hernia

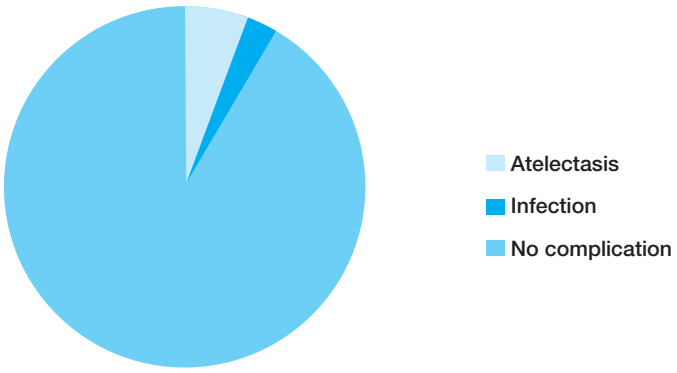
Associated Injury	Number of Patient	Percentage
Rib fracture	12	34.2%
Gastrointestinal injuries	9	25.71%
Splenic injuries	6	17%
Liver injuries	4	11.4%
Head injuries	5	14%
Pelvic fracture	1	2.85%

In preoperative findings 30(85.7%) had tear in posterolateral part of diaphragm, 4 patients (11.4%) had central tendon tear and 1(2.85%) patient had evulsion of diaphragm from its lateral and posterior attachment (Table 2).

Table 2. Preoperative Findings among study cases

Site of injury	Number of patients
Tear in posterolateral part of diaphragm	30 (85.7%)
Tear in central tendon	4 (11.4%)
Evulsion of diaphragm from its lateral & posterior attachment	1 (2.85%)

The most common complication noted in our study was atelectasis that is 2 patients mainly because of post-operative pain and reduced mobility of diaphragm. One patient developed wound infection which was cured with culture sensitive antibiotics so the morbidity was 3 (8.57%). There was no mortality in our study (Graph 1).



Graph 1: Post-operative Complication in all Patients

Discussion

Diaphragm is a dome-shaped septum stretching between sternum, lower ribs and the lumber spine horizontally and it consists of a central tendinous part and peripheral muscular portion. It has got two main functions:

1. It is prime respiratory muscle in respiration.
2. It separates the thoracic from the abdominal cavity.

Separation of two cavities has a great importance of clinical outcome in case of traumatic diaphragmatic injuries.[6]

On basis of mechanism of injury traumatic diaphragmatic ruptures are classified into blunt or penetrating diaphragmatic injuries.[7] Our study is only confined to blunt trauma or indirect trauma and is mainly caused by road traffic accidents, fall of heavy object or roof over the body and fall from height. Posterolateral part of the diaphragm is the most weakest part of diaphragm during embryological development, and that's why it's the most common part of diaphragm which becomes injured at time of high impact accidents or events.[8] In our study majority of the patients had posterolateral diaphragmatic rents.

The exact incidence of diaphragmatic rupture is not known, available literature data suggests that in major blunt trauma the incidence is 1–7% and in penetrating traumas it is 10–15%.[9]

Due to the fast growing urbanization and mechanization of life style in our society the most common cause of diaphragmatic injury is road traffic accidents and machine related accidents. However there are some very unusual and rare mechanisms of diaphragmatic rupture such as delivery, severe vomiting, heavy coughing, weight lifting or strenuous swimming after a jump into the water from a height.[10] In the present study most of the cases were of road traffic accidents that is 21(60%).

Traumatic diaphragmatic injuries are sometime hard to diagnose clinically as they can easily remain undetected at first examination and diagnosis is delayed after days or even years.[7] Clinical Diagnosis requires high level of suspicion. There are many reasons for this delayed diagnosis. First, polytrauma and other injuries are treated on priority basis as they are more apparent at the time of initial treatment. Second, defect in the diaphragm without herniation of abdominal organs can easily be overlooked on X-ray or even CT-scan as there are no clinical symptoms.[9] During surgery in poly-traumatized patient the diaphragmatic injury could be missed as the focus is on Damage control surgery. Also as traumatic diaphragmatic injury is less common it can be missed due to less experience. There are cases in which the patients are on mechanical ventilation with positive pressure ventilation the organs herniated in to the pleural cavity may be pushed down.[8] Therefore it is important that diagnostic work up should be done again after extubation in suspected cases, suspicion must be raised in patients with massive thoracic or abdominal trauma or when intrathoracic bowel sounds are heard or decreased or absent breath-sounds on auscultation.

Diaphragmatic rupture has wide spectrum of presentation, they may be asymptomatic or they may present with complications like respiratory distress, strangulation or perforation with its sequel, culminating in multi organ failure.[9]

Most diaphragmatic injuries are usually located on the left side,[11] our study also shows that 31 out of 35 diaphragmatic injuries were on the left side. Simpson Jet al. also have 95% left sided and only 5% right sided diaphragmatic hernias.[13] One theory regarding the left sided diaphragmatic injury is that left hemi-

diaphragm is physically weaker as a result of embryogenesis of diaphragm. Another supported idea is that liver and its ligament provide some degree of protection for right hemi-diaphragm that is absent on right.[3] Different studies also shows that right-sided injuries are easier to be missed and also cause a greater pre-hospital mortality.[12]

Diaphragmatic injuries are mostly associated with other organs or visceral injuries. Commonly associated injuries are pelvic fractures and rib fractures and head and limb injuries.[8] Our study also shows these injuries with the highest 8 rib fractures. Organs mostly involved are spleen, lungs and liver 6. In our study 4 patients had liver injuries with right sided diaphragmatic injury and 3 splenic injuries. Meyers BF et al. shoes that on left side diaphragmatic injury most commonly omentum and stomach herniates with 87.7% and 69.7% respectively in there study,[11] in our study it is 83.9% and 70.9% respectively. Blunt trauma to left hemi-diaphragm is usually associated with herniation of stomach, small gut or large gut in to left pleural space and making these organs at high risk of strangulation if not reduced urgently. Non reduced organs may inhibit ventricular filling which result in low ejection fraction & low cardiac output.[10]

Conclusion

Most of the patients who presented to the emergency department with diaphragmatic injury post blunt trauma chest and abdomen had history of road traffic accidents from urban areas. The early diagnosis and early surgical intervention has better post operative out come. Early diagnosis of diaphragmatic hernia due to trauma is difficult when herniation of abdominal viscera to the thoracic cavity is delayed. Common associated injuries with diaphragmatic injury are rib fracture, limb injuries, head injuries, splenic injury, and liver injuries with right sided diaphragmatic injury.

Urbanization and mechanization has increased the incidence of road traffic accidents and increase diaphragmatic injuries as evident from our study.

References

1. Beigi DAA, Masoudpour H, Sehat S, Khasemi EF. Prognostic factors and outcome of traumatic diaphragmatic rupture. Ulus Travma Acil Cerrahi Derg (Turkish Journal of Trauma and emergency Surgery)2010;16(3):215-19.
2. Rubikas R. Diaphragmatic injuries. Eur Jcardithorac Surg. 2001;20(1):53-57.
3. Bekassy SM, Dave KS, WoolerGH, LonescuMI. Spontaneous& traumatic rupture of diaphragm: long term results. Ann Surg. 1973;177(3) :320-4.
4. Tresallet C. Usefulness of CT reconstructed pictures for diaphragmatic rupture after blunt trauma. JAm Coll Sur. 2004;198:666-7.
5. Waldschmidt ML, Laws HL. Injuries of diaphragm. J Trauma .1980;20(7):587-92.
6. Morgan BS, Watcyn-Jones T, Garner JP. Traumatic diaphragmatic injury. J R Army Med Corps . 2010;156(3):139-149.
7. Dwivedi S, BanodeP, Gharde P, Bhatt M, Johrapukar SR. Treating traumatic injuries of diaphragm. JEmerg Trauma Shock. 2010;3(2): 173-6.
8. Chugtai T, Syed Ali, Sharkey P, Lins M, Rizoli S. Update on managing diaphragmatic rupture in blunt trauma:a review of 208 consecutive cases. Can J Surg. 2009;52(3):177-81.
9. Pantelis D, Burger C, Hirner A, Wolff M. Indirektetraumatische Zwerchfellruptur-Unfallm-echanismus und Diagnostik. Chirurg. 2005;77(4):360-66.
10. Hillenbrand A, Henne-Bruns D, Wurl P. Cough induced rib fracture ,rupture of diaphragm & abdominal herniation . World J Emerg Surg. 2006; 1:34
11. Meyers BF, McCabe CJ. Traumatic diaphragmatic hernia .Occult marker of serious injury .Ann Surg. 1993;218(6):783-90.
12. RashidF, ChakrabartyM, SinghR, Iftikhar S. A review on delayed presentation of diaphragmatic rupture. World J Emerg Surg. 2009;4:32.
13. Simpson J, Lobo DN, Shah AB, Rowlands BJ. Traumatic diaphragmatic rupture: associated injuries and outcome. Ann R CollSurg Engl. 2000;82(2):97–100.