

“Traumatic Diaphragmatic Rupture Experience of 40 Cases”

Mohammad Abid Khan, Viqar Aslam*, Manzoor Ahmed,
Abdul Baseer, Mohammad Imran, Kaleem ullah, Syed Zahid,
Amer Bilal

**Department of Cardiothoracic Surgery, and
General Surgery* Postgraduate Medical Institute,
Lady Reading Hospital, Peshawar**

“Traumatic Diaphragmatic Rupture. Experience of 40 Cases”

Mohammad Abid Khan, Viqar Aslam*, Manzoor Ahmed, Abdul Baseer, Mohammad Imran
Kaleem ullah. Syed Zahid, Amer Bilal

Department of Cardiothoracic Surgery, and General Surgery* Postgraduate Medical
Institute, Lady Reading Hospital, Peshawar

Objective: Experience with traumatic diaphragmatic hernias was reviewed to identify pitfalls in the diagnosis and treatment of this injury.

Material and Methods: A Computerized chart review of all patients admitted to the Thoracic Unit with traumatic diaphragmatic ruptures was undertaken for the period of January 2001 to June 2010

Results: We retrospectively analyzed 40 patients who presented between January 2001 and June 2010 with traumatic diaphragmatic rupture, caused by blunt injuries in 33 (82.5%) and by penetrating Injuries in 7 (17.5%). There were 36 (90%) cases of acute diaphragmatic rupture and 4 (10%) cases of post traumatic hernia. Average age of the patients was 30 years ranging from 12-70 years. Traumatic diaphragmatic hernia was right-sided in 5 (27.8%) patients and left-sided in 13 (72.2%). The diagnosis was made by chest X-ray, thorax and upper abdominal computed tomography, and upper Gastrointestinal contrast study. The most common herniated organs were omentum (n=11), stomach (n=10), Spleen and colon (n=9), small gut (n= 8) and liver (n=2). Repair of diaphragmatic hernia was performed through a thoracotomy in 36 cases and in 4 cases through thoracotomy. The mortality rate was 7.5% (n=3). Chest pain, abdominal pain, Or dyspnea were the predominant symptoms

Conclusions: Early diagnosis and treatment reduce intra-and post-operative morbidity and mortality

Key words:

Diaphragmatic Hernia, Repair, Trauma.

INTRODUCTION

Traumatic rupture of the diaphragm is no longer an uncommon entity. Injuries of the diaphragm often challenge the surgeon by the subtle presentation in the face of more obvious injuries¹.

Review of the historical clinical literature, including the series of Carter et al², reveals that the majority (80-90%) of blunt diaphragmatic ruptures have occurred on the left side. The less common right-sided ruptures have more severe associated injuries and result in greater hemodynamic instability. They required greater force of impact, possibly because the liver provides protection or because of a weakness in the left diaphragm. An autopsy series, however, revealed that left- and right-sided ruptures occurred almost equally. Most likely, these ruptures do occur equally, but the more severe injuries associated with right-sided ruptures cause more deaths and thus a lower rate of patient survival until diagnosis in the hospital. The relative frequencies of right-sided (20-30%) and bilateral (5-10%) ruptures have increased each decade, probably because improvement in trauma care has increased survival rates of patients with significant injuries.

A delayed or missed diagnosis at the time of initial trauma, and life-threatening catastrophic sequelae of the untreated patients compound the problem. Traumatic rupture of the diaphragm is an increasing event due to thoracoabdominal injuries: these can be divided into penetrating (25%) and non-penetrating ones (75%)^{3, 4}. Knives, bullets and sharp edges or fractured ribs are the most common penetrating objects in civilian life. Non-penetrating traumas on lower chest or upper abdomen, due to traffic accidents, are mostly responsible of diaphragmatic blunt injuries

Since no single investigation provides a reliable diagnosis of diaphragmatic rupture on arrival at hospital, the diagnosis is frequently missed or delayed unless co-existing associated injuries demand immediate intervention⁵. Approximately 69% of hernias are left-sided, 24% are right-sided, and 15% are bilateral. Left-sided rupture is more common owing to hepatic protection, increased strength of the right hemi diaphragm and weakness in point's diaphragmatic embryologic fusion. Children have equal rates of rupture per side, likely due to laxity of liver attachments^{6- 8}

Our study was to identify pitfalls in the diagnosis and treatment of traumatic diaphragmatic hernias by reviewing the experience of Thoracic department, Lady Reading Hospital, Peshawar.

MATERIAL AND METHODS

The records of 40 patients who presented with blunt and penetrating diaphragmatic injury, whether early or late, and were treated in our Thoracic Trauma unit, Lady Reading Hospital, Peshawar from January 2001 to June 2010 were reviewed retrospectively. All the patients were admitted through out-patient department or referred from other units. All was properly assessed before surgery. Motor car accident and history of fall was the main cause of blunt trauma while fire arm injury was causing the penetrating injury to the diaphragm. Diagnosis was made on Chest radiographs (CXR) initially, in some cases computed tomography (CT) scans was done to confirm the diagnosis. nasogastric intubations was done in all cases. The preoperative data and operative procedures were recorded. Diaphragmatic hernias were approached by thoracotomy alone mainly on right side and with or without thoracoplasty on left side. one lung ventilation was facilitated, by double lumen tube on right side and single lumen tube which was pushed to the right on left side diaphragmatic injuries. The operative approach was represented by thoracotomy at the seventh interspace. thoracoplasty was done to facilitate abdominal contents delivery into the abdomen. Repair was tried mostly by non absorbable sutures and only in three cases was done with prolene mesh graft to facilitate reconstruction of diaphragm. Chest intubations were done on the affected side added by low grade suction. Chest tube was removed once the lung was fully expanded. nasogastric suction was done in all cases till the bowel movements returned to normal. Initially oral sips were allowed gradually switching to solid foods in cases when bowel was affected. Chest physiotherapy and incentive spirometry was done in all cases. Parameters examined included age, sex, injury pattern, injury severity, mortality and outcome. All patients with pediatric age and with multi organ injuries were excluded.

RESULTS

We retrospectively analyzed 40 patients who presented between January 2001 and June 2010 with traumatic diaphragmatic rupture, caused by blunt injuries in 33 (82.5%) and by penetrating injuries in 7 (17.5%). There were 36 (90%) cases of acute diaphragmatic rupture and 4 (10%) cases of post-traumatic hernia. Average age of the patients was 30 years ranging from 12-70 years. Traumatic diaphragmatic hernia was right-sided in 11 (27.5%) patients and left-sided in 29 (72.5%). Chest pain, abdominal pain, and dyspnea were the predominant symptoms. (TABLE 1) CXR were obtained for all patients, and were suggestive of diaphragmatic injury, Computed tomography, and upper gastrointestinal contrast study was done in 17 patients to confirm the diagnosis. In 37 patients injury was repaired primarily with non-absorbable suture and the 3 were repaired using a prolene mesh graft. The most common herniated organs were omentum (n=11), stomach (n=10), Spleen and colon (n=9), small gut (n=8) and liver (n=2). (TABLE 2) In all the patients chest intubation was done on the operated side. Chest tube was removed when lungs were fully inflated ranging from 2 to 7 days. All the patients remained in thoracic intensive care unit for an average of 2 days. All the patients were given chest physiotherapy and incentive spirometry to promote lung expansion. Morbidity was 13/40 (32.5%) includes pneumonia 9 (22.5%) Abdominal distention 3 (7.5%) ARDS 4 (10%) Urinary tract infection 3 (7.5%) (TABLE 3) Most of the patients settled with antibiotic therapy, intense physiotherapy and nebulization. Patient with abdominal distention settled with nasogastric suction and keeping the patient nil by mouth till the bowel movements returned to normal. The mortality rate was 7.5% (n=3). Patients were followed for six months none of the patients had recurrence or any other major complication after surgery.

DISCUSSION

Diaphragmatic injuries are relatively rare and result from either blunt trauma or penetrating trauma. The incidence of acute diaphragmatic rupture has been reported in up to 7% in blunt trauma, to as high as 15% in penetrating injuries. The underlying mechanism for diaphragmatic rupture in blunt injuries is due to a high energy acceleration-deceleration impact that results in a sudden surge in the intra-abdominal pressure. The left diaphragm is more commonly involved, as the weakest point of the diaphragm is at the left posterolateral aspect as it originates from the pleuroperitoneal membrane. The right diaphragm is congenitally stronger, and any impact is further cushioned by the liver.

Diagnosis and treatment are similar regardless of mechanism, although many management issues are specific to blunt trauma. Diaphragmatic rupture can present in the acute or chronic form. It has been reported that 75% of injuries to the diaphragm are caused by blunt trauma.^{9; 10.} This is particularly true for ruptures of the right hemidiaphragm. In the acute setting, immediate massive herniation of the intra-abdominal contents through the defect can cause marked respiratory distress and gastric outlet obstruction. Herniated abdominal viscera can be confirmed radiographically by identifying loops of bowel in the thoracic cavity or finding the nasogastric tube coiled in the thorax on chest radiographs. Delayed diagnosis of traumatic diaphragmatic hernia is not unusual, especially when there is no chest symptom at the time of the trauma and there is another injury, which distracts any attention to the diaphragmatic rupture^{11, 12}

Traumatic diaphragmatic hernias usually require early surgical treatment so that intestinal obstruction, strangulation and cardiorespiratory embarrassment are avoided³. A patient's prognosis depends on the size of the hernia and extent of damage to the affected organs in chronic cases. These injuries can be repaired using a Trans thoracic or Trans abdominal approach. In cases of large defects, repair may require mesh, typically non-absorbable polytetrafluoroethylene mesh.

Some reports have supported the role of video-assisted thoracoscopic surgery (VATS) in the management of diaphragmatic injury, with a sensitivity and specificity of 100% being quoted¹³. The authors feel that VATS is best reserved for stable patients when intra-abdominal and contralateral diaphragmatic injuries are excluded. Routine surgical repair of any diaphragmatic defect is accomplished by interrupted or continuous non-absorbable sutures and placement of chest tube(s) in the affected thoracic cavity. Some have performed the same procedure using absorbable material, but the authors feel that they may not be as reliable, and thus were not used in our institution. Very large diaphragmatic defects may require closure with a non-absorbable patch.

Treatment of choice is mainly based on the clinical situation therefore the timing of these procedures should be in accordance with the hemodynamic and respiratory status of the patient. Surgical repair is necessary, even for small tears, because the defect will not heal spontaneously. The pleuroperitoneal pressure gradients favor enlargement of the defect with herniation of abdominal contents.

The pressure difference between the two cavities might cause a herniation that could result in strangulation and perforation of the abdominal organs, which will increase morbidity

and mortality. The choice of surgical approach includes thoracotomy, laparotomy, or both if necessary. A laparotomy is recommended for patients' diagnosed early, allowing exploration of the intraabdominal organs for associated injuries. Thoracotomy is necessary for isolated Diaphragmatic rupture and late cases, to safely separate adhesions between abdominal organs and the thoracic wall. Thoracotomy is more suitable for stable patients without intra-abdominal injuries or contra lateral diaphragmatic injuries. The diaphragm is better visualized and repaired through the chest. This decision must be handled with caution as the patient must be able to withstand one-lung ventilation and any intra-abdominal injury would be missed ¹⁴ Thoracotomy was the preferred incision in our study, but 3 patients underwent thoraco laparotomy to facilitate gut contents reduction into the abdomen.

The prognosis is generally good with immediate repair. Minimally invasive techniques for diaphragmatic repair are becoming more common than before. With advances in technology and surgical skills, repairing both acute and chronic diaphragmatic hernias is possible with laparoscopic, thoracoscopic, or combined approaches¹⁵.

CONCLUSION

Early diagnosis and treatment reduce intra-and post-operative morbidity and mortality in ruptured diaphragmatic cases.

REFERENCES

1. Waldschmidt ML, Laws HL. Injuries of the diaphragm. *J Trauma* 1980; 20:587–91.
2. Carter BN, Giuseffi J, Felson B. Traumatic diaphragmatic hernia. *Am J Roentgenol Radium Ther Nucl Med.* Jan 1951;65(1):56-72.
3. Mihos P, Potaris K, Gakidis, et al. Traumatic rupture of the diaphragm: experience With 65 patients. *Injury* 2003; 3: 169-72.
4. Shah R, Sabanathan S, Mearns AJ, et al. Traumatic rupture Of the diaphragm. *Ann Thorac Surg* 1995; 60: 1444-9
5. Mintz Y, Easter DW, Izhar U, Edden Y, Talamini MA, Rivkind AI. Minimally invasive procedures for diagnosis of traumatic right diaphragmatic tears. A method for correct diagnosis in selected patients. *Am Surg* 2007;73:388-92
6. Shehata SM, Shabaan BS. Diaphragmatic injuries in children after blunt abdominal trauma. *J Pediatr Surg* 2006; 41:1727-31.
7. Nain RK, Sarita M, Kanupriya A, Simmi R. Traumatic Diaphragmatic herniation. *Indian J Pediat* 2005; 72:985-6.
8. Barsness KA, Bensard DD, Ciesla D. Blunt diaphragmatic rupture in children. *J Trauma* 2004; 56:80-2.
9. Boulanger BR, Milzman DP, Rosati C, Rodriguez A. A comparison of right and left blunt traumatic diaphragmatic rupture *J Trauma* 1993; 35:255–60.
10. Heiberg E, Wolverson MK, Hurd RN, Jagannadharao B, Sundaram M. CT recognition of traumatic rupture of the diaphragm. *AJR Am J Roentgenol* 1980; 135:369–72.
11. Lerner CA, Dang H, Kutilek RA. Strangulated traumatic diaphragmatic hernia stimulating a subphrenic abscess. *J Emerg Med* 1997; 15:849- 53.
12. Zimmermann T. An unusual trauma in labour: Diaphragmatic rupture. *Zentrald Gynakol* 1999; 121: 92-4.
13. Mintz Y, Easter DW, Izhar U, et al. Minimally invasive procedures for diagnosis of traumatic right diaphragmatic tears: a method for correct diagnosis in selected patients. *Am Surg* 2007; 73:388-92
14. Athanassiadi K, Kalavrouziotis G, Athanassiou M, et al. Blunt diaphragmatic rupture. *Eur J Cardiothorac Surg* 1999; 15:469-74.

15. Ahmed N, Whelan J, Brownlee J, Chari V, Chung R. The contribution of laparoscopy in evaluation of penetrating abdominal wounds. *J Am Coll Surg* 2005; 201:213-6.

CLINICAL PRESENTATION

Table 1

Presentation	Frequency n=40	%age
Chest pain	40	100
Abdominal pain	33	82.5
Dyspnoea	25	62.5
cough	18	45

VISCERA AFFECTED

Table 2

Organs involved	Frequency (n=40)	%age
Omentum	11	27.5
Stomach	10	25
Small gut	8	20
Spleen and Colon	9	22.5
liver	2	5

MORBIDITY AND MORTALITY n=40

Table 3

Morbidity	13/40 32.5%
Pneumonia	9 (22.5%)
Abdominal distention	3 (7.5%)
ARDS	4 (10%)
Urinary tract infection	3(7.5%)
Mortality	3(7.5%)