



## The Etiology, Associated Injuries and Clinical Presentation of Post Traumatic Diaphragmatic Hernia

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### ▶ ABSTRACT

**Objectives:** The aim of this study was to evaluate the etiology, associated injuries and clinical presentation of post traumatic diaphragmatic hernia.

**Methods:** This study was a cross-sectional study being conducted in the department of Cardiovascular, thoracic surgery (CVTS) and Pediatric Surgery, Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Srinagar, Kashmir, India. All patients of post traumatic diaphragmatic hernia who were admitted in the department of CVTS and Pediatric Surgery, SKIMS, during the course of study (May 2009 to Nov. 2011) were included.

**Results:** From the commencement of the study 21 patients had traumatic diaphragmatic hernia. Most common presenting symptoms in traumatic diaphragmatic hernia were, chest discomfort and pain abdomen presented in 81% of patients, followed by breathlessness in 61.9% and vomiting in 47.6%. Common associated injuries in traumatic diaphragmatic hernia in our study group were, rib fracture in 47.6%, splenic injury in 28.6%, head injury in 23.8%, soft tissue injury in 23.8%, gut perforation in 19%, limb fracture in 14.3%, liver injury in 9.5%, pancreatic injury in 4.8% and renal injury in 4.8%.

**Conclusion:** Usually the patients of Post traumatic diaphragmatic hernia presents as emergency, early recognition and prompt surgical treatment is needed for better outcome. The Incidence of post traumatic diaphragmatic hernia when associated with blunt trauma abdomen and chest is very high (81%). A high level of suspicion is needed in these injuries. The 9.5% of traumatic diaphragmatic hernia may have delayed presentation. Early diagnosis of traumatic diaphragmatic hernia is most difficult when herniation is delayed.

**Keywords:** Post traumatic diaphragmatic hernia; Blunt trauma; Associated injuries.

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### Introduction

Post traumatic diaphragmatic hernias are commonly seen after blunt and penetrating trauma [1] called traumatic diaphragmatic hernia. The incidence of traumatic diaphragmatic hernia is 0.8 – 1.6% in patients admitted to the hospital for blunt trauma, male to female ratio is 4:1, blunt trauma accounts for 75% of ruptures and penetrating trauma accounts for the rest. Approximately 69% of traumatic hernias are left sided, 24% are right sided

and 15% are bilateral Rupture of the diaphragm can be the result of either penetrating or blunt injury of the abdomen as well as the thorax. A relatively large perforation of the diaphragm with herniation of abdominal contents into the chest cavity usually is associated with respiratory distress and requires urgent operative correction. However, small defect of the diaphragm without significant injury to other intra-abdominal or intra-thoracic organs can be present unnoticed for a long time until symptoms and signs of herniation of intra-

abdominal viscera. Rupture of the hemidiaphragm occurs in approximately 3.0% to 8.0% of the patients undergoing celiotomy after blunt abdominal trauma [2-4] and occurs in 0.8 to 5.8% of patients with major blunt force thoracic injury [5-7]. Motor vehicle accidents are responsible for up to 90% of all diaphragmatic injuries from blunt trauma [5]. Several factors explain the increased incidence of left hemidiaphragm rupture from blunt trauma. The left hemidiaphragm is relatively unprotected by abdominal viscera, such as the liver on the right side and it therefore, represents an area of relative weakness. The right diaphragm is stronger than the left and consistently requires a greater force to rupture [8,9]. The left hemidiaphragm is weaker due to a line of embryonic fusion between the costal and lumbar parts predisposing this site to injury [10]. Finally, right hemidiaphragm injuries are under-diagnosed in non-surgical series [5]. A positive pressure gradient of 7 to 20 cm of water exists between the peritoneal and pleural spaces. This gradient facilitates herniation of abdominal viscera through left diaphragm tears. The central location of the diaphragm and its close proximity to other structures accounts for the frequent association of diaphragm rupture with other injuries that are present in 52% to 100% of cases [2,6,9,11]. Common concurrent injuries include pelvic fractures (40-55%), splenic injury (60%), and renal injury. Liver trauma occurs in 93% of patients with right and 24% of patients with left hemidiaphragm rupture. Intra-thoracic injuries commonly associated with diaphragm rupture include multiple rib fractures, pneumothorax and hemothorax and lung contusion [12]. The patients with diaphragmatic hernia may present with marked respiratory distress [12], decreased breath sounds on the affected side, palpation of abdominal contents upon insertion of a chest tube, auscultation of bowel sounds in the chest. Paradoxical movements of the abdomen with breathing, diffuse abdominal pain, chest pain and vomiting [5].

## Materials and Methods

This study was conducted in the department of Cardiovascular, thoracic surgery (CVTS) and Pediatric Surgery, Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Srinagar, Kashmir, India. This was a prospective study of all patients of post traumatic diaphragmatic hernia who were treated in the department of CVTS and Pediatric Surgery, SKIMS and were operated during the course of study (May 2009 to November 2011) were included in the study. A detailed history was undertaken from each patient, laying special emphasis on mode of onset of symptoms, type of injury, age at presentation, gender,

other associated anomalies, mode of trauma, type of trauma causing injury, associated injuries, symptom predominating and time duration between trauma and presentation were noted. A detailed general, physical, systemic and local examination was made in each patients to rule out any associated anomalies, associated injuries, to see the involvement of other systems and type of injuries causing diaphragmatic hernia. Time period between trauma and presentation were enquired. If patient presented after one year of trauma was defined as Delayed presentation. Routine investigation was done like:- complete blood count, biochemical profile, chest x-ray FAST scan, other investigations done for the diagnosis were, CT Scan abdomen/chest and barium meal study. Diagnosis was established with chest x-ray in most of the patients and CT scan chest/abdomen and barium meal study was done in other patients to diagnose diaphragmatic hernia. All those patients who were presented with acute trauma with diaphragmatic hernia were subjected to emergency surgery after the diagnosis. Patients with delayed presentation of diaphragmatic hernia were subjected to elective surgery.

## Results

From the commencement of the study in May-2009 till its end in Nov-2011, 21 patients had traumatic diaphragmatic hernia. Most of the patients were in the age group of 40-60 years (42.9%). And (4.7%) of patients were in age group of more than 60 years. In our study 16 (76.1%) were males and 5 (23.80%) were females (Table 1).

Nineteen patients (90.5%) presented with post traumatic diaphragmatic hernia. The hernia was present on left side; right side was affected only in 2 patients (9.5%). Most common presenting symptoms in traumatic diaphragmatic hernia were chest discomfort and pain abdomen presented in 17 (81%) of the patients, followed by breathlessness in 13 (61.9%) and vomiting in 10 (47.6%). On physical examination, air entry was decreased in 19 (90.5%) of post traumatic diaphragmatic hernia. Bowel sounds were heard in the chest in 11 (52.4%). Tachypnoea was seen in 14 (66.7%) of patients,

**Table 1.** Age of the 21 patients with post traumatic diaphragmatic hernia.

Age (years)	Traumatic	
	No.	Percentage
1-10	0	0.0
10-20	3	14.3
20-40	8	38.1
40-60	9	42.9
>60	1	4.7
<b>Total</b>	21	100.0

**Table 2.** Focused Abdominal Sonography for Trauma in 21 patients with post traumatic diaphragmatic hernia.

	Post Traumatic diaphragmatic hernia	
	No.	Percentage
Positive	7	33.3
Negative	14	66.7
Total	21	100.0

tachycardia in 19 (90.5%) and hypotension was seen in 6 (28.6%) of patients. Chest x-ray was performed in all patients who were positive in 17 (81%).

All the patients underwent ultrasonography which was found to be positive in 7 (33.3%) patients at presentation (Table 2). CT-Scan was positive in all (100%) patients of traumatic group. Barium meal study was done in 10 patients of post traumatic traumatic diaphragmatic hernia. Contrast filled stomach or bowel was seen in 100% of patients. Blunt trauma was the most common type of injury causing diaphragmatic hernia accounting for 81%; penetrating injury was the cause in 19% of cases. Mode of trauma was, fall from height in 10 (47.6%) patients, road traffic accident in 6 (28.6%), assault in 4 (19.0%) and bullet injury in 1 (4.8%) (Table 3). Common associated injuries in traumatic diaphragmatic hernia in our study group were, rib fracture in 10 (47.6%) followed by splenic injury in 6 (28.6%) and head injury in 5 (23.8%) (Figure 1). Diagnosis was missed at first contact in 11 (52.4%) patients. Delayed presentation of diaphragmatic hernia was seen 2 (9.5%) patients in traumatic diaphragmatic hernia. All the patients underwent ultrasonography which was found to be positive in 7 (33.3%) patients at presentation (Table

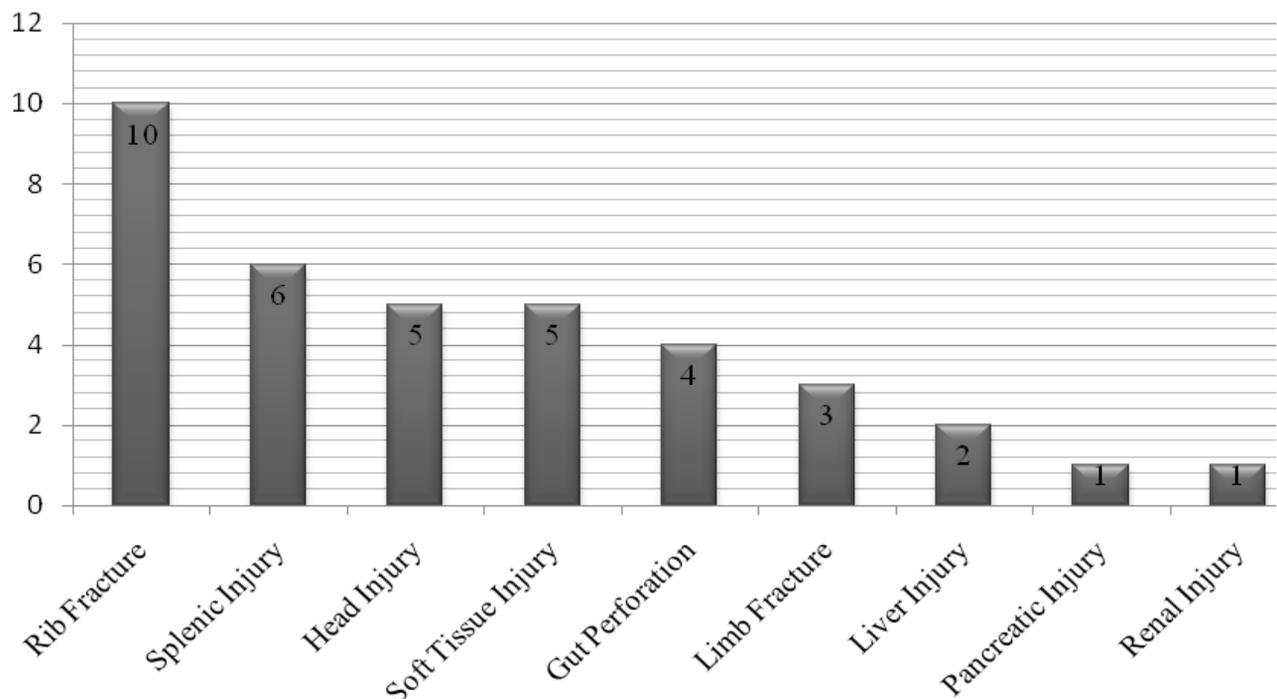
**Table 3.** Mode of trauma in 21 patients with post traumatic diaphragmatic hernia.

	Traumatic diaphragmatic hernia	
	No	Percentage
Fall from height	10	47.6
Road traffic accident	6	28.6
Assault	4	19.0
Bullet injury	1	4.8

2). CT-Scan was positive in all (100%) patients of traumatic group. Barium meal study was done in 10 patients of post traumatic traumatic diaphragmatic hernia. Contrast filled stomach or bowel was seen in 100% of patients. Blunt trauma was the most common type of injury causing diaphragmatic hernia accounting for 81%; penetrating injury was the cause in 19% of cases. Mode of trauma was, fall from height in 10 (47.6%) patients, road traffic accident in 6 (28.6%), assault in 4 (19.0%) and bullet injury in 1 (4.8%) (Table 3). Common associated injuries in traumatic diaphragmatic hernia in our study group were, rib fracture in 10 (47.6%) followed by splenic injury in 6 (28.6%) and head injury in 5 (23.8%) (Figure 1). Diagnosis was missed at first contact in 11 (52.4%) patients. Delayed presentation of diaphragmatic hernia was seen 2 (9.5%) patients in traumatic diaphragmatic hernia.

**Discussion**

Herniation of abdominal contents into the chest cavity cause respiratory distress symptoms and require urgent operative correction. However, late



**Fig. 1.** Associated injuries 21 in patients with post traumatic diaphragmatic hernia.

presentation of diaphragmatic hernia is also seen when the defect of the diaphragm is small and without significant injury to other intra-abdominal or intra-thoracic organs resulting unnoticed initial presentation for a long time until symptoms and signs of herniation of intra abdominal viscera.

We studied 21 patients of traumatic diaphragmatic hernia. The males were 16(76.1%) and females were 5(23.8%).most of the patients were in the age group of 40-60 years (42.9%). Aetiology was blunt trauma in 81% and penetrating trauma in 19%. Most common mode of trauma was fall from height (47.6%), followed by road traffic accident 28.6%. The 90.5% were affected on left side and 9.5% on right side. Kishore GS *et al*; in 2010 [13] reported left sided traumatic diaphragmatic in 85% of patients and right sided in 15%, Etiology was blunt trauma in 81% and penetrating injury in 19%, their ages ranged from 16 to 72 years (median 35 years). Thomas J Tarney in 1968 reported left sided diaphragmatic hernia in 95% and right sided 5%. In our study majority of patients with traumatic diaphragmatic hernia presented with chest discomfort (81%), pain abdomen (81%) breathlessness (61.9%), Vomiting (47.6%). While majority of patients in congenital group presented with breathlessness (75%), respiratory tract infection (75%), refusal to feed (66.7%). These observations were comparable to the study conducted by Aruna Jain *et al.* which show respiratory tract infection in 71%, refusal to feed 56%, and vomiting in 9%. Most common findings in our patients were decreased chest movement and breath sounds on the affected side, seen in 63.6% and 93.9% respectively. Bowel sounds in the chest were heard in 51.5% of the patients. Most common X-ray finding like bowel loops seen in the chest and distortion of diaphragmatic margins were seen in 81% of traumatic groups. On CT scan, herniation of abdominal contents into the chest cavity was seen in 90.5% of the patients Hemothorax was seen in 61.9%, pnemothorax in 28% and lung contusion in 38%. Barium meal study was done in 10 patients 100% Contrast filled stomach or bowel was seen.

Ultrasound abdomen showed FAST positive in 33.3% of traumatic diaphragmatic hernia. In our study associated injuries were present in 80.9% of traumatic diaphragmatic hernia. These observations

were in consistent with, Kishore *et al.*, [13] who reported in his study, associated injuries in 81% of cases. Most common associated injury was rib fracture (47.6%), followed by splenic injury (28.6%), head injury (23.8%), soft tissue injury (23.8%), and gut perforation (19%). Hood R M *et al.* in 1971 [14] reported in his study, splenic rupture in 25%, head injury in 18%, rib fracture in 25%, and gut perforation in 15% of patients. In our study diagnosis was missed at first contact in 52.4% of. Similar observations were made by Rocco S *et al.* in 2003 [15] in which he reported delayed diagnosis in 57% of patients. Thomas J Tarnay in 1968 [16] in his study reported the incidence of missed diagnosis of 30%.

All the patients were managed by surgery. Most common hernial contents in our patients were omentum and stomach, present in 87.9% and 69.7% respectively, followed by small gut 33.3%, large gut 28.6%, spleen in 9.5% St Peter SD *et al.*, [17] in 2007 showed that stomach was the most common organ found herniating into the chest (47.8%) followed by spleen (26%) and small bowel (13%). Thomas J Tarnay in 1968 showed in his study that small intestine was most common herniating organ 88%, stomach 60%, Colon 56%, spleen 54%, liver 51%, pancreas 24% and kidney 12%.

In conclusion, most of the patients with post traumatic diaphragmatic hernia presents in emergency department with history of blunt trauma chest and abdomen followed by penetrating injury to chest and abdomen. The early recognition and prompt surgical treatment is needed for better outcome. Delayed presentation of post traumatic diaphragmatic hernia is 9.5%. Early diagnosis of traumatic diaphragmatic hernia is most difficult when herniation is delayed. Herniation of abdominal contents into the chest cavity can occur weeks, months or even years after the traumatic injury to diaphragm. Fall from height in 47.6% and road traffic accidents in 48.6% are the common mode of trauma associated with diaphragmatic hernia, common associated injuries are rib fracture 47.6%, splenic injury 28.6%, soft tissue injury 23.8%, head injury 23%, gut perforation 19%, and liver injury 9.5%.

**Conflict of Interest:** None declared.

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