

Research Article**Delayed Presentation of Diaphragmatic Rupture: Our Experience with Six Cases****Mala TA¹, Gupta P², Gupta R³, Mani A⁴, Malla SA⁵, Kapoor M⁶**^{1,4,6}Department of Surgery, ASCOMS & Hospital, Sidhra Jammu (J&K), India-180017²Department of Radio diagnosis and imaging, ASCOMS & Hospital, Sidhra Jammu (J&K), India-180017³Department of Paediatric Surgery, SPMCHI, SMS Hospital, Jaipur, Rajasthan, India⁵S.S. Medical College, Rewa (M.P) India***Corresponding author**

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Abstract: With day to day increase in the events related to road traffic accidents, diaphragmatic injury is not uncommon especially on the left dome of diaphragm with the herniation of viscera like stomach, spleen, or even small intestine. We highlight our experience here because the presentation was surprising especially with one patient who presented with difficulty in breathing after one year following the blunt trauma abdomen. Diagnosis was made with the help of Computerized Tomography (CT) of the chest in three patients and in the rest three patients at the time of exploratory laprotomy. Surgical repair was done in all the cases and patients were doing well in postoperative period.**Keywords:** Diaphragmatic Hernia; Trauma; Diaphragm, FAST, BTDR

INTRODUCTION

Traumatic rupture of diaphragmatic is a grave injury especially when the patient presents with multiple injuries and diaphragmatic tear is missed in 7.2% of cases [1]. Due to varied presentation, availability of limited imaging options and association with multiple injuries, diagnosis is often delayed and remains elusive [2, 3]. Diaphragmatic tear occurs more commonly on the left side (50% to 88%) as compared to the right side (12% to 40%) probably due to protective effect by liver on right side [4, 5]. We report here six cases with varied presentation and try to emphasize on the early diagnosis and treatment of diaphragmatic rupture.

Objectives

Our aim was to review patients who presented to us with delayed blunt traumatic injury to diaphragm with herniation of viscera.

METHODOLOGY

In this retrospective study of Blunt traumatic diaphragmatic rupture, the medical records and

operative records of six patients treated for blunt diaphragmatic hernias who were admitted to our hospital were analyzed. The mode of injury was road traffic accident in all patients. Charts were reviewed according to: age, sex, signs and symptoms, types of injury, method of diagnosis, time to diagnosis, side and site of the rupture, associated injuries, surgical approach and procedure, herniated viscera, duration of hospitalization, postoperative morbidity and mortality. Mortality was calculated using only deaths related to blunt traumatic diaphragmatic rupture (BTDR) or the consequences of the trauma. Other causes of death were excluded. All the radiologic exams including CXR (fig. 1) and computed tomography (CT) (fig. 2) scans were performed and carefully reviewed in order to identify signs suspicious for BTDR that were overlooked at the initial radiologic interpretation. Laparotomy was done in all the patients and there were tears in the left dome with herniation of small gut loops and spleen (fig. 3). Contents were reduced and the defect was closed in all the patients (fig. 4) without any postoperative complications.



Fig. 1 (A &B): Showed left sided hemothorax

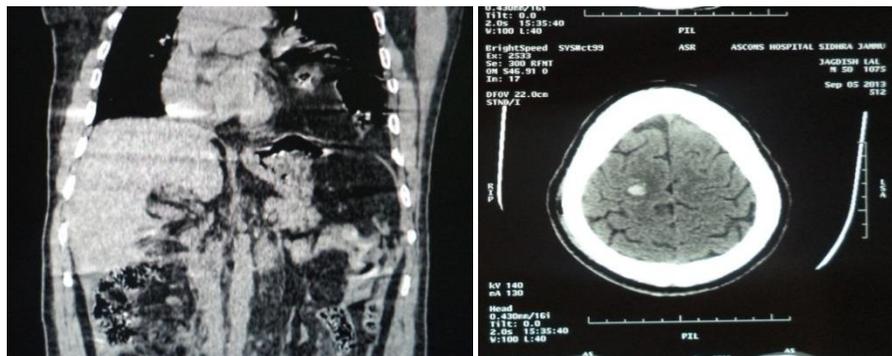


Fig. 2 (A &B): Showed tear in the left dome of diaphragm with herniation of gut loops with brain contusion (B)



Fig. 3 (A, B &C): Showed tears in the left dome of diaphragm with reduced gut loops



Fig. 4 (A & B): Showed closed defect with sutures.

RESULTS

In our study the mean age was 42.3 years and there were five males and one female. In our series the mode of injury was road traffic accident in all the patients. Two patients (33.3%) had lung contusions while two

(33.3%) had small subcapsular tears. Four (66.6%) patients had mesenteric tears and one (16.7%) had brain contusions. Fracture ribs were present in 3 (50%), hemoperitoneum 4 (66.6%), hemothorax 4 (66.6%), and other type of fractures in two patients

Table 1: Preoperative variables

Variables	Number	%
Age (years)	42.3 (mean)	
Sex	5	83.3
Male	1	16.7
Female		
Trauma type		
RTA	6	100
Falling	0	0
Crush	0	0
Hypovolemic shock	1	16.7
Associated injuries		
Lung	2	33.3
Liver	0	0
Spleen	2	33.3
Bowel	0	0
Mesentery	4	66.66
Brain	1	16.7
Fractured ribs	3	50
Other fracture	2	33.3
Hemothorax	4	66.66
Pneumothorax	0	0
Hemopneumothorax	0	0
Hemoperitoneum	4	66.66
Diagnosis time		
12 h	1	16.7
> 24 hours	2	33.3
>6 months	3	50
Side of diaphragmatic injury		
Right	0	0
Left	6	100
Diagnostic tools		
Right	0	0
Left	6	100
Chest X-ray (CXR)	6	100
CT-scan	3	50
Laparotomy	3	50

DISCUSSION

Diaphragm is the most important respiratory muscle which acts as a partition between the abdominal and chest cavities and is seen ruptured during blunt trauma. Road traffic accident is the common cause of BTDR in most reported cases [6-9]. Early diagnosis of diaphragmatic rupture is often difficult and delayed which results in increased morbidity and mortality. A high degree of suspicion, good past history along with past and present imaging modalities help in early and definitive diagnosis. The clinical diagnosis is unreliable as none of the clinical signs is specific for diaphragmatic rupture [20]. Approximately half of the cases had herniated tissues through the ruptured

diaphragm [9]. Diaphragmatic rupture is most commonly reported after trauma, either penetrating or blunt where the incidence is reported up to 6% [10]. Diaphragmatic rupture is left-sided in 70 to 90 percent of cases [11]. Right-sided tears are eight times less common than left-sided tears [12]. The less involvement of right sided is due to hepatic protection, strength of the right hemi-diaphragm, under-diagnosis of right-sided ruptures, and weakness of the left hemi-diaphragm at points of embryonic fusion [19]. Blunt trauma secondary to a motor vehicle accident is the most common cause of closed rupture of the hemi-diaphragm; here a massive force is applied to the upper abdomen or the lower chest which results in sudden

increase in intra-abdominal pressure relative to the intrathoracic pressure and causes diaphragmatic injury, either as a laceration or an avulsion [14, 15]. The rupture typically originates at the central tendinous or musculotendinous junction.

Many authors reported that BTDR is more common in young adults [16 -18, 20, 21] . Our study confirms this observation as it was more common in young adult males in the 4th to 5th decade of life. Road traffic accident was the most common reason of BTDR followed by falling from the height; this matches with many studies [18- 22]. Most TDR are more than 10 cm and occur in the posterolateral aspect of the left hemidiaphragm as this site is structurally weak because of its origin from the pleuroperitoneal membrane. Left-sided injuries results in herniation of abdominal contents into the left hemithorax, right-sided tears more frequently are not accompanied by herniated viscera, because of the protective effect of the liver [23].

The diagnosis of diaphragmatic tear should be suspected in any patient who has major trauma to the trunk, especially with fractured ribs, or if there is basal shadowing on the chest X-ray. Plain CXR has been reported to be useful for the diagnosis of diaphragmatic injury, with sensitivities ranging from 30% to 62% in the absence of a hernia, and up to 94% in the presence of a hernia [13]. On chest radiography signs are often masked by associated pleural effusion, lung collapse, consolidation, pulmonary contusion or non-specific diaphragmatic elevation. The presence of air filled viscus in the left chest is often diagnostic. Water soluble contrast may be helpful in delineation of gut in doubtful cases. If the patient is stable, FAST or CT may provide additional useful information. Diaphragmatic rupture can also be diagnosed by peritoneal lavage or induced pneumoperitoneum. The lavage fluid or air is observed to pass into the chest. However these procedures are not without risk of injury to the bowel or pulmonary collapse, and should be carried out with caution. Any induced pneumo- or hydrothorax should be aspirated promptly [30]. However, none of them in isolation has a high-sensitivity or specificity, and there is currently no gold-standard diagnostic test. CT is highly specific and detects acute diaphragmatic ruptures in approximately 2/3 of blunt trauma cases. The specificity and sensitivity increases when the spiral CT is used i.e. 61-71% and 87-100%, respectively in the diagnosis of diaphragmatic rupture [25-27]. The delay of diagnosis in our series was related mainly to delay of referral and absence of clinical signs of BTDR that became more obvious with radiologic follow-up. Thoracoscopy represents a useful diagnostic tool for BTDR and has a sensitivity, specificity, and positive predictive value of 100%. It has also been used for repair of diaphragmatic defects [22, 24].

To date, however, thoroscopic diagnosis and repair of BTDR has not been performed in most of the hospitals including ours. About half of the diaphragmatic disruptions are diagnosed for the first time at laparotomy or thoracotomy done for concomitant injuries [28, 29] as was in our cases. During recent decades, advanced diagnostic modalities and postoperative management lead to decreasing mortality rates due to delayed diagnosis of diaphragmatic herniation from 25% to 10% [39, 40]. When the diagnosis of diaphragmatic hernia is made immediately after admission, the preferred operative approach is through a laparotomy, this will help in thorough inspection of the abdominal organs including liver and spleen and any type of injury can then be dealt with. If the diagnosis is delayed by few days then thoracotomy is preferred because by this time adhesions may develop in the chest and the patient condition is also stable. Late presentations are also seen in these patients as in one of our case when the patient presents with respiratory distress after year of road traffic accident.

As the BTDR is difficult to diagnose and also many other lesions are seen associated with it which are the focus of attention, diagnosis of diaphragmatic tear is often delayed.

In our study, intraoperative diagnosis was made in three patients during laparotomy for surgical exploration of intra-abdominal bleeding. In our experience of associated injuries reported in all patients, the most common were spleen in the abdomen, and fractured ribs, small mesenteric tears and lung injuries in the chest and associated brain contusion in one patient. This result was confirmed by many authors [18-22, 31]. Trauma related syndromes were reported in our study and were comparable to other studies [18, 20, 31]. We highlight the importance of a high degree of suspicion for diaphragmatic injury considering even a laparotomy when imaging is unable to convincingly rule out such an injury. Past history or documentation of event ration should not preclude the diagnosis of TDR and these patients should receive a comprehensive work up to avoid the catastrophic risks of missing a TDR. Treatment of BTDR is surgical via laparotomy or thoracotomy. Acute cases should be treated via laparotomy as this will help in diagnosing other associated intra abdominal organ injuries. But the surgical approach in cases of delayed presentation should be by a thoracotomy, because there are considerable adhesions form between the herniated organ and the lung which results in difficult reduction from within the abdomen. Recently, laparoscopic and thoroscopic approaches have been used to treat BTDR not associated with intra-abdominal organ injuries [32, 33]. Once the contents were reduced, the defects were closed with silk sutures and the mesenteric tears were closed with vicryl sutures. Mesh repair is

used for large defect [33]. In one patient of our study defect was closed mesh as the defect was long and wide. Abdomen was closed and the patients were put under observations in intensive care units. There is excellent prognosis of diaphragmatic hernia repair. Even acute presentation of diaphragmatic hernia is not life threatening but patient may succumb from other associated injuries. Recurrence rate is very low [34-38]. Even delayed presentations can be repaired without difficulty. This article demonstrates the morbidity that could follow delayed diagnosis of BTDR. Patients with BTDR can present at any point of time from acute presentation to delay presentations. Therefore High index of suspicion and the use of relevant radiological investigation is required for early diagnosis. Despite the fact that the incidence of diaphragmatic hernia is uncommon, it should be suspected in patients with gastro-intestinal complaints and history of recent chest blunt trauma.

CONCLUSION

Blunt diaphragmatic hernia is an uncommon condition predominantly seen on left side. It is of paramount importance for the surgeon to diagnosis, treat and prevent serious morbidity and mortality associated with complications such as gangrene and perforation of herniated viscera.

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