



Blunt Traumatic Diaphragmatic Injuries - An Experience of 5 Years

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Abstract

Traumatic diaphragmatic rupture is caused by blunt and penetrating force. It is associated with high morbidity and mortality. High index of suspicion is required to not to miss this injury. Comprehensive combination of Chest x-ray, clinical features and CECT suffice to detect this injury. Early surgery still remains the gold standard investigation and treatment of choice. The purpose of this study was to present our experience with the management of this injury.

Introduction

Diaphragmatic injuries (DI) occurs due to blunt or penetrating injury. Patient can have both early or delayed presentation. Incidence of diaphragmatic injuries is 0.8-1.6% of blunt trauma abdomen.¹ In cases of penetrating injury, the incidence of diaphragmatic hernia increases to 10-15%.² Multiple injuries are associated in 94-100% of patients.³ The high index of suspicion of diaphragmatic injuries and early radiological tests can help in early diagnosis of diaphragmatic

injuries. Delayed presentation of DI is associated with increased morbidity and mortality.⁴ We conducted a retrospective study to evaluate the clinical, and radiological findings and to discuss the approach for management DI and their outcome.

Material and methods

Our hospital is a tertiary care trauma referral centre. We retrospectively analyzed the patients with suspected DI admitted in our unit from 2009-2014. Only patients with blunt DR were included

in the study. There 10 patients who underwent laprotomy for diaphragmatic injuries.

Exclusion criteria

- Patients with penetrating injuries

Results

1. There were 10 patients, of them 7 were males and 3 were females.
2. The mean age of presentation was 34.3 years.
3. Mode of injury- motor vehicle accident in 4 patients, assault as a cause was found in 1 patient, fall from height in 3 patients, one patient had DI after being hit by bull, we had one unknown patient who unfortunate enough to be mentally challenged also so no mode of injury could be ascertained.
4. There were 7 patients who presented in immediate post injury period and 3 patients presented as post traumatic diaphragmatic hernia. (Table I).
5. Associated injuries- patients who presented immediately had associated injuries. Three patients had bowel injury in the form of transverse colonic gangrene,

serosal tears over ileum and gastric perforation respectively, one patient had head injury and one patient had associated laceration of size 2*1 cm at lower lobe of left lung. (Table II)

6. Site of diaphragmatic injury – left hemidiaphragm was injured in all the cases.
7. Hemodynamic parameters - Seven patients were hemodynamically unstable. Out of them 4 had evidence of mediastinal shift, three had associated bowel injuries. One patient with delayed post traumatic injuries group presented to us in unstable condition due to associated stomach volvulus causing hematemesis.
8. Clinical presentation – All of the patients in our study presented with severe epigastric pain average visual analogue scale was 7.8/10. Impaired breath sounds were present in all of them, six patients presented with vomitings, intrathoracic bowel sounds heard in 4 patients.(Table III)
9. Diagnosis at presentation- Correct diagnosis in all patients was made by chest and abdominal x- rays and CECT scan.

Table I : Timing of presentation and associated injuries.

	Immediate post injury patients (n=7)	Post traumatic diaphragmatic hernia (n=3)	
Presented at			
	Just after trauma	Patient 1.	8 months
		Patient 2	1 year
		Patient 3.	3.7 years

Table II - Associated injuries

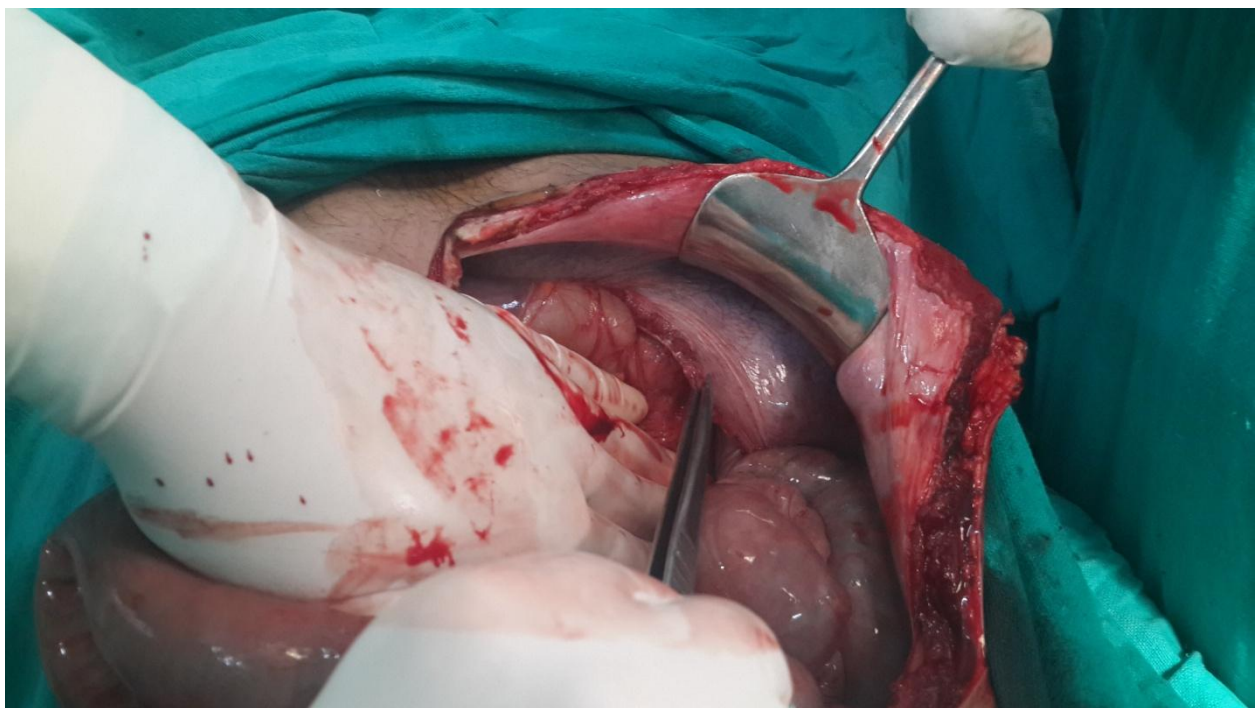
Associated injury	Number of patients
Head injury	2
Bowel injury	3
Stomach volvulus	1
Lung injury	1

Table III: Clinical presentation of Diaphragmatic injuries

Clinical presentation	Number of patients
Shock	7
Severe pain	10
Impaired breath sounds	10
vomitings	6
Intrathoracic bowel sounds	4

Management

We operated all the 10 patient via midline abdominal laprotomy and thoracotomy was not required. One patient had severe respiratory distress preoperatively and required intubation at presentation in emergency room. Left hemidiaphragm was ruptured in all of them. Six patients had rupture in posterolateral part of left diaphragm (figure I), two patients had rupture in central part and 2 had anterior rupture in left diaphragm. After complete reduction of viscera back into thoracic cavity thorax was inspected (figure II) washed and diaphragm was repaired with full thickness interrupted prolene 1-0 (figureIII). Associated injuries were dealt accordingly

**Figure I -** Intraoperative image of left diaphragm rupture. Colon can be seen going into thorax.

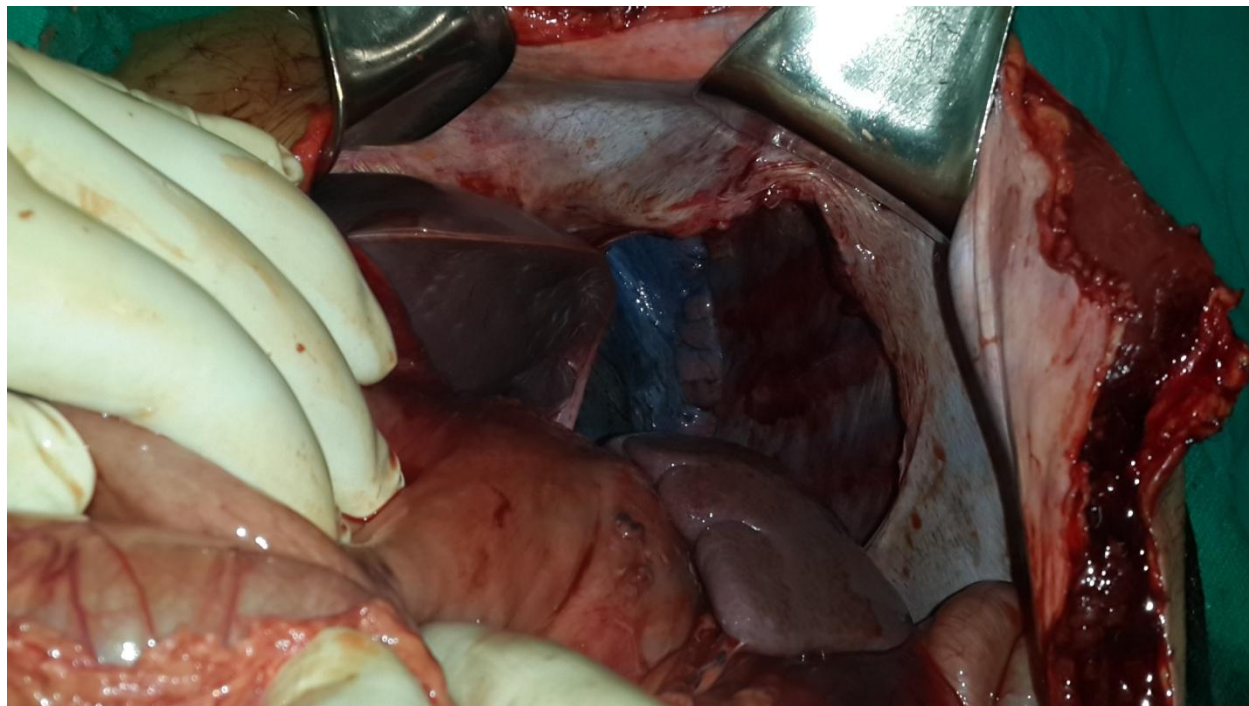


Figure II : After all the contents reduced back. Lung seen in thorax and rupture of left diaphragm.

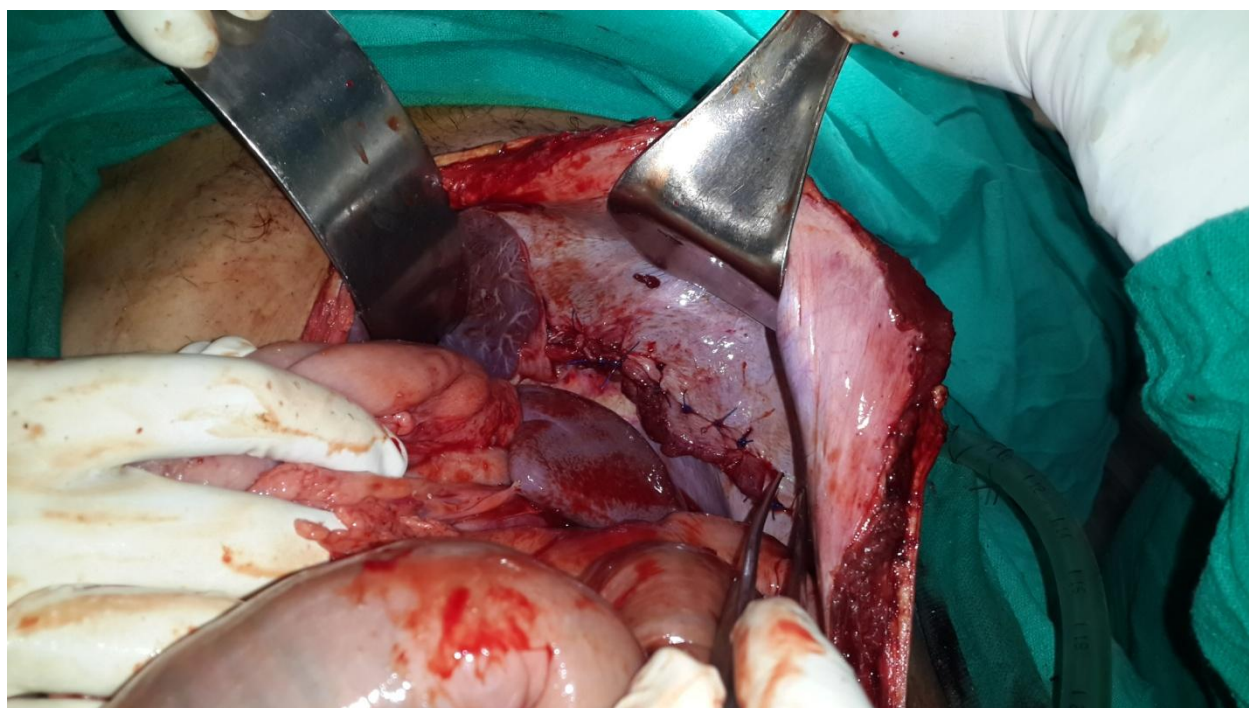


Figure III: Diaphragm repaired with Polypropylene 1-0 with interrupted fashion.

Survival and follow up

All the 10 patients are surviving till date and are without any complication.

Discussion

Pathophysiology of injury

Traumatic diaphragmatic rupture as a result of blunt trauma is produced by sudden increase in

the pleuroperitoneal pressure gradient that occurs at areas of potential weakness along the embryological point of fusion.⁵ Automobile accidents and fall from a height are the most common cause of blunt injury to the diaphragm⁶ In present study also motor vehicle accidents was most common cause. Left hemidiaphragm is more commonly injured than right side in majority of the cases.^{7,8} This fact was true in our study also.

Clinical features

A high index of clinical suspicion and radiological imaging studies makes an accurate diagnosis of DI. The clinical signs in the diagnosis of early diaphragmatic injury include diminished expansion of the chest wall, impaired resonance, adventitious sounds, intrathoracic bowel sounds, cardiac displacement, circulatory collapse, cyanosis and dyspnea and asymmetry of the hypochondria⁹ In cases of delayed presentation symptoms of partial or complete intestinal obstruction may be present. In our series the patients had vomitings, respiratory compromise, shock and intrathoracic bowel sounds were also auscultated. In our experience, in patients with high index of suspicion of DI we routinely insert a Ryle's tube and then on pushing 20 ml air forcefully by a syringe, if a strong 'clunk' is heard in thorax aggressive work-up of DI should be done.

Diagnostic tests

Chest X ray is the initial and valuable diagnostic test. Elevation and absence of a sharp left hemidiaphragm and coiled nasogastric tube into the

thorax on X-ray chest formed the basis of our diagnosis of diaphragmatic hernia. According to Meyers et al These findings are found only in 25-50% of case.¹⁰ Nevertheless x-rays are and will remain initial test of choice. CT is the imaging modality of choice in the evaluation of severe blunt abdominal trauma.¹¹ CT has a sensitivity of 61–71% and a specificity of 87–100% as an aid in the diagnosis of acute traumatic diaphragmatic rupture.¹² The CT signs of diaphragmatic rupture include discontinuity of the diaphragm, visceral herniation, and waist like constriction of the bowel, which has been called the 'collar sign'.¹³ The evaluation of the diaphragm by laparotomy remains the "gold standard" for diagnosis.

Treatment

Repair of the diaphragmatic ruptures can be performed by the classical open method or with minimally invasive methods. Open exploration can be carried out through the abdominal or the thoracic route. In case of associated acute injuries, the basic resuscitative measures of Advanced Trauma Life Support of the Trauma Care Manual (1997) should be applied first. The basic principles of trauma surgery, like control of hemorrhage and shock, should be closely followed-up. Options for repair include laparotomy, laparoscopy, thoracotomy and VATS. The choice would be influenced by a variety of factors such as the cavity with severe associated injuries or significant haemorrhage, expertise and equipment availability. The cavity to open first, thorax or abdomen is often highly depends on surgeons diagnosis and priority. It is important to

recall misleading situations in the presence of DI such as intra abdominal bleeding giving rise to massive chest tube output. These situations may lead to the wrong cavity being opened first. DI is often repaired as an emergency. Repair should be done with non absorbable sutures in a continuous or interrupted fashion in single or double layer closure. A tube thoracostomy is usually needed for haemothorax, or for evacuation of contamination from rupture of hollow abdominal viscera. Contamination mandates irrigation of the pleural. In cases of diaphragmatic disruption due to massive trauma, prosthetic non-absorbable mesh material is used to reconstruct the diaphragm. The operative repair of a rupture is simple if performed immediately. We successfully repaired the diaphragmatic ruptures with interrupted polypropylene suture in all the cases of early presentation group. Delayed repair is difficult because of adhesions and atrophy of the diaphragm and hence there are higher chances of dehiscence. The non-absorbable prosthetic meshes are required to repair such chronic injury. We performed dual mesh repair in 2 patients of late presentation group. With cellulose coated side of mesh facing the viscera.

Conclusion

The best approach for managing DI is the high index of suspicion in such cases. Chest X-ray is the initial test of choice. In cases of equivocal Xrays CT scan should be done. Treatment of DI consists of early repair on laparotomy with careful evaluation of other associated violent injuries. With an increase in experience and expertise,

laparoscopy and thoracoscopy, especially VATS, are finding their places in both diagnosis and definitive management of diaphragmatic injuries but still basic knowledge of safe and early surgery are saviours of these patients.

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