

PROGNOSIS OF TRAUMATIC DIAPHRAGMATIC INJURY IN DHAKA MEDICAL COLLEGE HOSPITAL, DHAKA

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Abstract:

Introduction: Diaphragmatic injuries include wounds and diaphragmatic ruptures due to thoracoabdominal blunt or penetrating trauma. Their incidence ranges between 8 and 15%. The diagnosis is often delayed despite several medical imaging techniques. The mortality is mainly related associate Injury.

Aims: The aim of our study was to evaluate the prognosis, after surgery of our patient with diaphragmatic injury.

Patients and methods: We performed a prospective study over a period of two years, between January 2018 December 2019, at the department of thoracic surgery of Dhaka Medical College Hospital, Dhaka, Bangladesh. All patients diagnosed with diaphragmatic injury were included in this study. Each patient operated because traumatic diaphragmatic injury was evaluated in respect of age, sex, nature of injury, preoperative examination findings, laboratory test results, imaging methods, time of diagnosis, operation findings, concomitant injures to other organs, operations performed, length of stay in hospital and development of postoperative morbidity and mortality.

Results: Over the study period, 22 cases of diaphragmatic injuries were included. The female was 4 and 18 was male. The mean age of male patients 29.2±12.1 and female 28±11.6 years. RTA with blunt trauma chest was 12, 6 was fall from height and 5 were stab injuries. The most common injuries concomitant to traumatic diaphragmatic rupture were a haemothorax, rib fracture, stomach, colon, liver and spleen. Three patients developed wound infection and two patients died.

Conclusion: In high energy blunt and penetrating thoracoabdominal trauma, diaphragmatic injures should be suspected. An emergency thoracotomy or laparotomy followed by reposition of abdominal organ and repair of the defect of the diaphragm is the gold standard for the management of these cases.

Key words: Diaphragmatic rupture, Diaphragmatic hernia. Thoracoabdominal trauma.

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Introduction:

The diaphragm is an arched flat muscle that divides the thorax from abdominal cavity.¹ Traumatic diaphragmatic hernia are an unusual presentation of trauma and uncommon condition in developed countries but is not uncommon in our country². The etiologic factors are blunt trauma due to RTA (Road traffic accident),² penetrating injury and fall from heights. Left sided diaphragmatic injuries are more commonly reported in literature probably due to the protective effect of the liver on the right side.³

By and large diaphragmatic injuries are often related to thoracic and abdominal organs injuries (stomach, small gut, liver, spleen, kidney, lung, rib fractures) and severe complications (pneumothorax, haemothorax, haemo pneumothorax, lung contusion, pneumonia and respiratory distress) with a high mortality.³

Nevertheless, sometimes the classic clinical signs and symptoms of diaphragmatic injuries may initially not be present or associated damage may be so severe that definitive evaluation is delayed or even missed.³ Thus, the diaphragmatic wound will become larger and herniation of abdominal organs more likely producing respiratory distress or bowel obstruction or strangulation³. Radiological imaging plays a central role in diagnosis. Plain chest X ray and FAST (Focused assessment with sonography in trauma) although represent the most accessible and first line imaging modality in the trauma patients have a poor accuracy⁴. The only direct sign is represented by the visualization of herniated bowels or the nasogastric tube in the thoracic cavity. Contrast CT of both chest and abdomen with multi planar reconstructions is nowadays the imaging modality choice. It is able to directly detect diaphragmatic lesions, herniated bowels or indirect signs (i.e. dangling diaphragmatic signs, collar sign and hump and band sign³).

After diagnosis, conservative treatment is not suitable. Thoracotomy or laparotomy is done with reduction of the viscera and simple repair of the diaphragm with non-absorbable suture².

This study aims to evaluate the clinical characteristics, diagnosis and treatment methods of traumatic diaphragmatic rupture encountered in thoracoabdominal trauma.

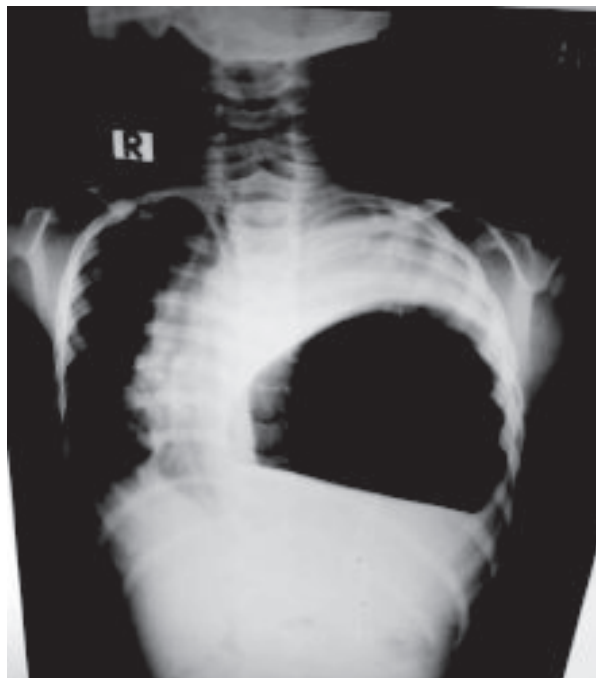


Fig.-1: Left sided Diaphragmatic hernia

Materials and Methods:

This study was conducted in January 2018 to December 2019 in the thoracic surgery department in Dhaka Medical College and Hospital. 22 traumatic diaphragmatic hernia cases were diagnosed and treated. All patients had surgical confirmation. We collected data, including demographic information (age and sex), manner of injury, preoperative examination findings, imaging methods, characteristics of the hernia (side, organs, length of rupture, etc.), length of hospital stay, and outcomes. Both acute and chronic traumatic diaphragmatic hernia were included here.

We performed intergroup analysis using the chi-square test or student's t test and $p < .05$ was considered statistically significant. We performed all analyses and calculations using SPSS-20.

Table-I

Age and sex distribution of the patients (n=22)

Age (years)	Male (%)	Female (%)	p-value
Up to 20 years	4(18%)	1(4%)	
21 to 30 years	7(32%)	2(9%)	
31 to 40 years	4(18%)	0(0.0%)	
41 to 50 years	2(9%)	1(4%)	
51 to 60 years	0(0.0%)	0(0.0%)	
Above 61 years	1(1%)	0(0.0%)	
Mean±SD	29.2±12.1	28.5±11.6	0.915

Unpaired t-test, ns= not significant

Table-II
Comparison between acute and chronic traumatic diaphragmatic hernia.

		Acute (n=5)	Chronic (n=17)	P value
Side	Left	4 (80.0%)	17(100.0%)	0.059 ^{ns}
	Right	1 (20.0%)	0(0.0%)	
MechanismOf injury	Blunt	4 (80.0%)	13(76.5%)	0.868 ^{ns}
	Penitrating	1 (20.0%)	4(23.5%)	
Intestinalhernia	Present	5 (100.0%)	17 (100.0%)	-
	Absent	0 (0.0%)	0(0.0%)	
Organinjury	Stomach	2 (40.0%)	0 (0.0%)	0.438 ^{ns}
	Other organs	3 (60.0%)	1 (5.9%)	
Surgicalapproach	Thracotomy	1(20.0%)	17 (100.0%)	0.001*
	Laparotomy	4 (80.0%)	0 (0.0%)	

Chi-square test, *significant, ns= not significant

Results:

22 patients had diaphragmatic rupture among which 21 cases were in the left side and one case was right. Among them female were 4, and male 18 and age <40 was 18, and >40 was 4. In mechanism of injury blunt trauma was 17 cases and penetrating injury was 5 cases.

Heniation of intestine was present at 22 cases. Among 22 cases stomach perforation were 2 cases and other organ injury was 4 cases. Thoracotomy was done in 18 cases and laparotomy was done in 4 cases. Postoperative mortality was in two cases and wound infection in 4 cases.

Discussion:

Traumatic rupture of the diaphragm from blunt and penetrating trauma remains a challenging clinical entity⁵. It has been reported that 75% of all diaphragmatic injuries occur by blunt trauma and 25% by penetrating trauma⁶. In our study 82% of all diaphragmatic injuries were caused by blunt trauma, due to road traffic accident and 18% by sharp object, like knife or gunshot injuries.

Penetrating diaphragmatic injuries as a result of knife or gunshot injuries affecting lower chest or upper abdomen may give rise to smaller defect⁶. Traumatic diaphragmatic rupture is more common on the left side than the right side after both blunt and penetrating trauma.

When evaluated with regard to blunt trauma its seen on the left side, right side and both sides in 65-85%, 15-35% and only in 1% of the patients, respectively⁷.

Blunt traumas can cause rupture from the congenitally weak posterior diaphragmatic region. More frequent presence of traumatic diaphragmatic injures on left side is correlated to various anatomical and clinical factors. These can be explained with the fact that diaphragm is congenitally weaker in the left. Medial postero-lateral tendimuscular area, the protective effect of liver on the right⁷.

Diagnosis is now much improved with the advent of faster higher resolution CT scanning 3-D coronal and sagittal reconstruction to increase the sensitivity of diagnosis of blunt traumatic diaphragmatic injuries⁸.

In our centre , we diagnosed the traumatic diaphragmatic injury by plain chest X-ray, FAST (Focussed assessment with Sonography in trauma), CT scanning of both chest and abdomen with multiplanar reconstructions which is able to directly detect diaphragmatic lesion or herniated bowels.

Diagnostic signs, either pathognomonic or suggestive on chest roentgenogram as follows are gas bubbles in the chest, nasogastric tube in the chest and positive gastrografen study.

Suggestive signs are irregularity of the diaphragmatic outline, elevated diaphragm, mediastinal shift without pulmonary or intrapleural cause, compression atelectasis of the lower lobe⁹.

The diagnosis of traumatic diaphragmatic hernia is not always easily made, in those cases, laparoscopy or thoracoscopy provides a means of diagnosis⁹.

In practice, the treatment of all traumatic diaphragmatic injury is surgical repair with no role for observation even in asymptomatic patient. The assumption has been that the defect will not heal and over time will increase in size. This can result in respiratory compromise, chronic abdominal pain and strangulation of the herniated organs with significant morbidity and mortality¹⁰.

Both acute and chronic diaphragmatic injury repair must follow two principles: complete reduction of herniated organs and water tight closer or reconstruction of the diaphragm¹⁰.

In acute cases an abdominal approach is advocated because it allows for identification and repair of associated intra-abdominal injuries. Traumatic diaphragmatic injury can also be approached via thoracotomy for chronic diaphragmatic hernia¹⁰.

In our study maximum cases as they were chronic diaphragmatic injuries, we did thoracotomy approach and we believe that the majority of these injuries were safely effectively repaired,

The type of repair for traumatic injuries is dictated by the extend of injury, patient stability, the surgical approach and surgeon preference. The American association for the surgery for the trauma has developed an organ injury scale, which identifies five grades of injury. Grade 1 is contusion or hematoma without rupture, grade 2 is laceration <2 cm, grade 3 is laceration 2-10 cm, grade 4 is laceration >10 cm with tissue loss > cm², grade 5 is laceration >25cm².

The majority of penetrating traumatic diaphragmatic injury are grade 1 or grade 2 and amenable to primary suture repair with nonabsorbable suture with no difference in the

durability of repair¹⁰. Laparoscopic staplers can also be used to close these defects and appear to provide similar tensile strength¹⁰. Irregularly shaped defects should be debrided and then repaired with nonabsorbable suture.

Additional considerations include the need for lavage of the thoracic cavity and whether to place a chest drain. Indications for lavage include contamination from aerodigestive injures or the presence of a significant hemothorax. If visualization is inadequate for lavage or clot evacuation, usually a better option is performing a simultaneous thoracotomy or VATS. Other indications for chest tube placement include pneumo or hemothorax, significant contamination or the presence of other injuries that require tube drainage. We recommend having a chest drain immediately above the traumatic diaphragmatic injury repair, as many patients will develop a significant sympathetic pleural effusion from the irritational cause by the injury and repair¹⁰.

Larger and more complex injuries (grade 3 to grade 5) are extremely uncommon with civilian firearms, although they may be seen with high velocity weapon blast injuries or short gun wound or blunt trauma. Grade 3 and grade 4 defects may be repair primarily but often require debridement and a complex reconstruction. These higher-grade defects usually require a prosthetic mesh to effect a tension free clouser¹⁰.

In our study 6 chronic traumatic diaphragmatic injures cases we used prosthetic proline mesh to close the defects.

Following diaphragm repair, pulmonary and wounds site complications are the most frequently seen complications. Morbidity and mortality rates vary according to the extent of concomitant organ injury, bleeding and shock status, where or not there are hernia related strangulation, incarceration, perforation or contamination, and damage to the respiratory and cardiovascular system^{4,11}.

In this study, the morbidity rate following repair of diaphragm rupture was 6 cases (27.27%) and mortality was 2 cases (9.09%). Mortality was due to organ failure following concomitant injury.

This study has some limitations. This study was conducted in a single centre and the study population was small. Patients who could not be diagnosed were not operated on.

Conclusion:

In high energy blunt and penetrating thoraco-abdominal traumas, diaphragm injuries should be suspected. Diaphragm injuries are seen more often on the left sided and require surgical treatment. Traumatic diaphragmatic injury can result in high rates of morbidity and mortality if missed or managed inappropriately. Despite advances in imaging, diagnosis without the presence of a hernia remains difficult and a high index of suspicion. All patients with penetrating injuries in high-risk zone inframammary fold superiorly to bottom of the costal margins inferiorly should be assumed to have a traumatic diaphragmatic injury until proven otherwise. All identified traumatic diaphragmatic injury should be surgically repair by either an open or minimally invasive approach.

In acute cases laparotomy is preferable as may have other associated organ injury but in chronic cases thoracotomy is best approach as there are adhesions of abdominal organs in the thoracic cavity. Most penetrating traumatic diaphragmatic injury can be closed primarily but more complex defects or chronic hernias may require more complex reconstructive options.

Outcomes with traumatic diaphragmatic injury are primarily related to patient factors and type and severity of associated injuries. Missed traumatic diaphragmatic injury that become chronic diaphragmatic hernias have the potential for major morbidity and mortality due to incarceration and strangulation of hernias contents.

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