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Research Article

DIAPHRAGMATIC INJURY AND MANAGEMENT: OUR EXPERIENCE OVER 99 MONTHS AT A TERTIARY CARE CENTRE

Dheer S. Kalwaniya[1], Akshay Narayan[1], Satya V. Arya[1], Jaspreet S. Bajwa[1], Monish R[1], Rohit C[1], Nipun S[1] and Ashok K[2]

[1]Department of General Surgery, safdarjung Hospital, New Delhi
[2]Department of Preventive and Social Medicine, SAFDARJUNG Hospital, New Delhi

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A B S T R A C T

Background:-Road traffic accidents have emerged as a major cause of morbidity and mortality since the advent of motorised vehicles due to industrialisation and thoraco-abdominal trauma contributes to this morbidity and mortality in a great way. When missed during primary evaluation, the diaphragmatic hernias can have late presentation, that may range from mild respiratory discomfort or intestinal obstruction to strangulation of bowel presenting drastically. Our aim in this study is toanalyse and review the experience in the presentation, diagnosis and management of diaphragmatic hernia with postoperative outcomes.

Methods: This study was a retrospective observational study conducted at a tertiary care hospital of New Delhi. In this study, the data of patients with thoracic trauma attending the surgical unit from May 2011 to March 2019 have been collected for analysis. A total of 1576 patients of thoracic trauma patients were treated at our centre of which 19 (1.2%) were diagnosed to have diaphragmatic hernia and underwent surgery for the same.

Results: Post-operative complications were higher in case of patients who were present to the hospital after the 24 hours of trauma (63.6%) compare to the patients who attend the hospital within 24 hours (37.5%). It was noticed that patients, had associated injury (58.3%) other than diaphragmatic hernia were prone to more postoperative complications compare to patients who had not (42.9%).

Conclusion: Present study revealed that in time hospitalization, early diagnosis and management of thoracoabdominal trauma patients is a keyfactor for better post operative outcomes as well as to prevent further complications related to trauma and surgery.

INTRODUCTION

Road traffic accidents have emerged as a major cause of morbidity and mortality since the advent of motorised vehicles due to industrialisation and thoraco-abdominal trauma contributes to this morbidity and mortality in a great way. Of these thoraco-abdominal trauma patients, diaphragmatic injuries are seen in 1.1-3.9%[1]. Diaphragmatic hernias secondary to trauma occur in less than 50% patients with diaphragmatic injuries[2] . These injuries can occur due to both blunt and penetrating trauma. Pre-operative diagnosis in these is often difficult and missed as these injuries are masked by other major injuries like head trauma or major skeletal injuries. This delay in diagnosis adds to the morbidity and mortality associated with these diaphragmatic injuries. When missed during primary evaluation, the diaphragmatic hernias can have late presentation, that may range from mild respiratory discomfort or intestinal obstruction to strangulation of bowel presenting drastically.

Corresponding author:* **Dheer S. Kalwaniya
Department of General Surgery, safdarjung Hospital, New Delhi

Many a times the diaphragmatic rupture may not even be suspected pre-operatively as there may not be a history of trauma, as the injury might have been so trivial that it may not have caused any external injury or discomfort and hence may be not have been evaluated at the time of its occurrence[3,4] . One as a surgeon should keep a high index of suspicion for diaphragmatic injuries in patients with thoracic or thoraco-abdominal trauma and patients should be evaluated and re-evaluated for the same and in case of a patient needing exploratory laparotomy, a stringent exploration of the abdominal cavity and its upper limits should be done to exclude diaphragmatic injuries.

METHODOLOGY

This study was a retrospective observational study conducted at VardhmanMahavir Medical College &Safdarjung Hospital, New Delhi a tertiary care teaching institute in Indiawhich caters to population from Delhi as well as adjoining states. In this study, the data of patients with thoracic trauma attending the surgical unit from May 2011 to March 2019 have been collected for analysis. A total of 1576 patients of thoracic

trauma patients were treated at our centre of which 19 (1.2%) were diagnosed to have diaphragmatic hernia and underwent surgery for the same. The following details were collected for analysis. Demographic details, historywith clinical examination findings, findings on imaging [Chest X-ray (figure1), USG FAST, CT chest(figure2)], post-operative outcome and complications.

Figure 1 chest X ray of patient in erect position showing multiple air fluid levels in left chest region indicating bowel herniation through left diaphragmatic injury.

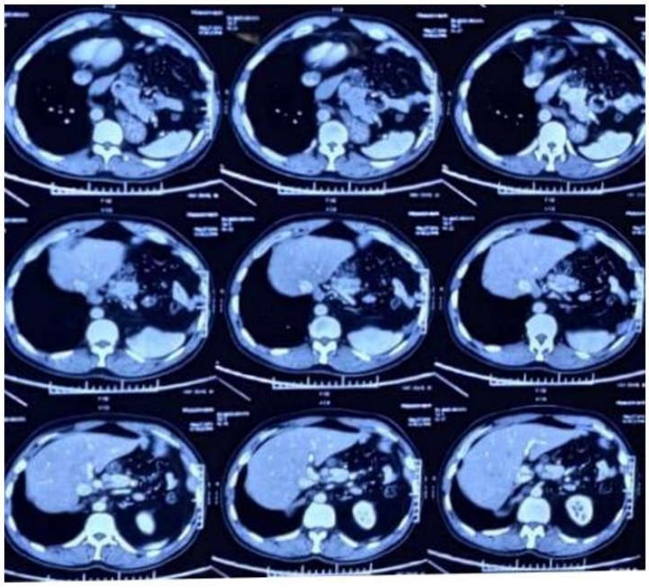

Figure2 Contrast enhanced axial CT images of mediastinal window, show herniation of stomach, spleen , left kidney and bowel loops into the left hemithorax. There is shift of mediastinum to the right side.

All patients underwent Exploratory Laparotomy with reduction of herniated contents with repair of diaphragm using interrupted No. 1 prolene sutures, in cases wherein the defect was very large and not amenable to primary suturing, a prolene mesh was placed and fixed with prolene sutures (figure 3). All patients were followed up in the surgical OPD for six months. Statistical analysis was done using a licensed version of SPSS 21. Descriptive analysis was done by calculating proportions, means and standard deviation. Chi square/Fishers Exact test for qualitative and t test for quantitative variable were applied.

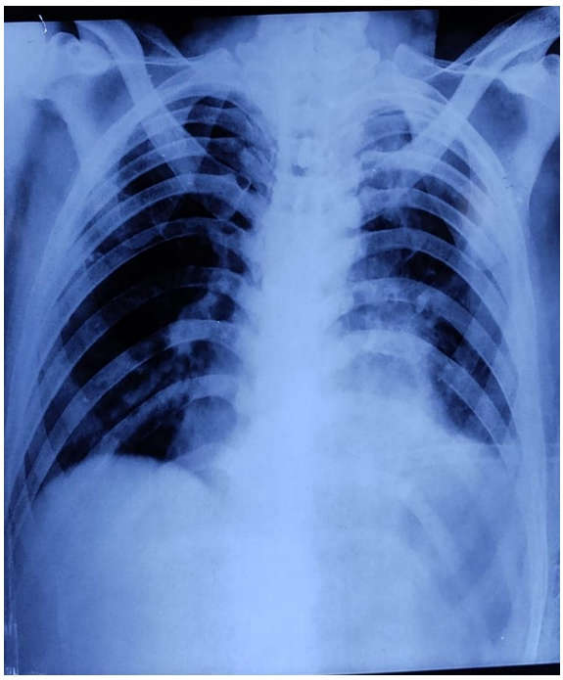

Figure 3 post operative chest X ray PA view showing expanded left lung with intercostal drainage(ICD) tube in situ after repair of diaphragmatic rent.

RESULTS

Out of the 1576 patients of thoracic trauma treated at our centre, 19 (1.2%) were diagnosed to have diaphragmatic hernia. Of these 18 (94.73%) were males and one patient was female (5.27%). The mean age of study participants was 37.79 years with SD of 9.8.Minimum age of patient was 18 years and oldest patients was 54 years old.Maximum patients (36.8%) belongs to age group of 40-50 years. The mode of injury in all 19 patients was blunt trauma.

Table 1 Distribution of study participants according to age (N-19)

Age (years)	Number of patients	Percent
<20	01	5.3
20-30	03	15.8
30-40	06	31.6
40-50	07	36.8
50-60	02	10.5

There was quite a bit of variation in the time of presentation. 08 (42.11) patients presented to the hospital within 24 hours of sustaining injury while the remaining 57.89% had a varied time of presentation ranging from days to months and in some even years.

Table 2 Distribution of study participants according to their time of presentation (N-19):

Time of presentation	Number of patients	Percentage
<24 hours	08	42.11
>24 hours	03	15.79
>7 days	02	10.53
>30 days	02	10.53
>6 months	04	21.05

The most common presenting complaint among these patients was respiratory discomfort (shortness of breath) of varying degrees which was present in 16 (84.21%) patients. Some of the other complaints were chest pain (31.58%), abdominal pain (15.79%). One patient presented to us with complaints of obstipation.

Table 3 Distribution of study participants according to presenting complaints (N-19):

Presenting Complaints	Number of patients	Percentage
Shortness of breath	16	84.21
Chest pain	06	31.58
Abdominal pain	03	15.79
Obstipation	01	05.26

As many of these patients were victims of road traffic accidents and fall from height patients, they had other associated injuries as well. The most common associated injury that need management was fractured ribs with or without haemo or pneumothorax (42.11%). Other associated injuries included splenic injury (15.79%), liver injury (5.26%), head injury (15.79%), skeletal injury (21.05%). Some patients also presented with respiratory complaints and on probing gave history of trauma in the past for which they were not at all, or minimally evaluated. Such patients on evaluation were diagnosed to have diaphragmatic hernia but had no associated injuries. These patients constituted 36.84%.

Table 4 Distribution of study participants according to associated injuries (N-19)

Associated Injuries	Number of patients	Percentage
None	07	36.84
Rib fracture	08	42.11
Splenic injury	03	15.79
Liver injury	01	05.26
Head injury	03	15.79
Long bone fracture	04	21.05

All patients underwent routine blood investigations along with a Chest X-ray, USG abdomen and CT chest. 52.63% were diagnosed on a CT scan while 26.32% were diagnosed on a Chest X-ray. In 21.05% and mainly unstable patients, the diagnosis came as a surprise on exploratory laparotomy.

Table 5 Distribution of study participants according to mode of diagnosis (N-19)

Mode of Diagnosis	Number of patients	Percentage
Chest X-ray	05	26.32
CT chest	10	52.63
Laparotomy	04	21.05

All patients underwent Exploratory laparotomy with repair of the diaphragm either by primary suturing or by additionally placing a mesh. Three patients with splenic injury additionally underwent a splenectomy and among them 2 (66.7%) were suffered from postoperative complications.

Postoperative complications included the need for prolonged ventilation (47.37%), sepsis (10.53%). One patient developed Intra-abdominal Hypertension for which the abdominal sutures were removed and laparostomy was made, which was closed at a later date.

Table 6 Distribution of study participants according to postoperative complications (N-19)

Postoperative complication	Number of patients	Percentage
Prolonged Ventilation	09	47.37
Intra-abdominal Hypertension	01	05.26
Sepsis	02	10.53
None	09	47.37

*Multiple responses present

There was no recurrence or death reported in the 6 months follow up period.

Post-operative complications were higher in case of patients who were present to the hospital after the 24 hours of trauma (63.6%) compare to the patients who attend the hospital within 24 hours (37.5%) but this association was not found statistically significant. It was noticed that patients, had associated injury (58.3%) other than diaphragmatic hernia were more prone to postoperative complications compare to patients who had not (42.9%).

Table 7 Association of postoperative complications with time of presentation and associated injuries

Variables	Postoperative complications		p- value
	Present n (%)	Absent n (%)	
Time of presentation:			
Within 24 hours (n-8)	3 (37.5)	5 (62.5)	0.26
After 24 hours (n-11)	7 (63.6)	4 (36.4)	
Associated injuries:			
Yes (n-12)	7 (58.3)	5 (41.7)	0.51
No (n-7)	3 (42.9)	4 (57.1)	

DISCUSSSION

The present study was a descriptive, retrospective, hospital-based study aimed to analysis and review the experience in the presentation, diagnosis and management of diaphragmatic hernia with postoperative outcomes.

Diaphragmatic injuries were first described by Sennertus in 1541. Their diagnosis is difficult and challenging as these injuries can have an insidious asymptomatic course and may not be clinically apparent in a trauma patient and hence one should keep a high index of suspicion[3].

Traumatic diaphragmatic injury occurs in 0.8-7% of patients with blunt trauma and 10-15% patients with penetrating trauma.[4] It has been reported that 75% of all diaphragmatic injuries occur by blunt trauma and 25% b penetrating trauma.[5]In our study, all patients of traumatic diaphragmatic hernia had suffered blunt trauma. Injuries associated with sharp objects may be missed at first but may cause serious complications in the long term.[6]

The average age of the patient with traumatic diaphragmatic rupture in our study was 37.79 years. Similar observations were made in other studies that state, Diaphragmatic rupture due to blunt trauma is more common in the young adults[2,3,7-9] . 11 (57.89%) patients were diagnosed after 24 hours of injury. This is in contrast to other studies where diagnosis after 24 hours was made in only 5-12% of cases. [8,10] Missed diagnosis on initial evaluation is reported to be the most common cause for delayed diagnosis.[8]

The most common presenting complaints of patients was respiratory discomfort in the form of shortness of breath. The most commonly described presenting symptoms is dyspnoea.[10] Associated injuries were present in 12 (63.16%) patients. The most common associated injury was fractured ribs in 8 (42.11%) patients, followed by abdominal (21.05%), skeletal (21.05%) and head (15.79%) injuries. Similar findings have been reported by the Rubikas *et al* which found associated injuries to be present in 86-88% cases with fracture of chest wall bones to be the most common injury.[1]

Majority of our patients (78.95%) were diagnosed by imaging either by Chest X-ray or CT chest. However, in 04 (21.05%) patients the diagnosis came as a surprise on exploration.Plain X-ray chest has been reported to be useful for the diagnosis of diaphragmatic injury with sensitivities ranging from 30-62% in

the absence of hernia, and upto 94% in the presence of hernia[2]. Chest X-ray signs may be masked by associated pleural effusion or consolidation or lung collapse or contusion. In hemodynamically stable patients, a CT scan will provide additional information. The sensitivity and specificity of CT scan increases when spiral CT is used ranging from 61-71% and 87-100% respectively[11-13]. Right sided hernias are more difficult to diagnose and serial X-rays and CT scans are recommended[14] . Additionally VATS and visual inspection of diaphragm have been described for diagnosis in hemodynamically stable patients.[15]

In our study all patients were approached with an Exploratory laparotomy followed by reduction of hernial contents and repair of diaphragm along with management of any other intra-abdominal injury that might have been encountered. Surgical approaches to traumatic diaphragmatic injury vary as per the location of injury and operative duration. Laparoscopy and Laparotomy offers the opportunity of providing the most rapid diaphragmatic repair following trauma in acute settings. This approach facilitates a detailed intra-abdominal examination and abdominal organ reduction.[6,16,17] In cases of delayed presentation thoracotomy is an accepted approach[16] as it is difficult to release the intra-thoracic adhesions through laparotomy. VATS is as effective as laparoscopy for diagnosis and treatment of diaphragmatic injuries.[18, 19]

The prognosis of diaphragmatic hernia repair is excellent whether in the acute or delayed settings. The disease on its own is not life threatening even in the acute setting however the patient may succumb to other associated injuries. Recurrence rates for the same are also very low.[20-22]

CONCLUSION

To conclude diaphragmatic injuries can be commonly present after blunt trauma especially to the lower chest and upper abdominal areas. They can present acutely or may have an indolent course. In certain patients initial clinical examination and radiological investigationsmay not be that much pinpointing/ contributory to diagnosis. In such a clinical scenario, it is always advisable for the surgeons to suspectdiaphragmatic injury for early diagnosis and surgery.

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