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## International Journal of Surgery

journal homepage: [www.theijs.com](http://www.theijs.com)

## Traumatic diaphragmatic hernia-our experience

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## ARTICLE INFO

## Article history:

Received 20 July 2009

Received in revised form

1 September 2009

Accepted 11 September 2009

Available online 22 September 2009

## Keywords:

Thoracoabdominal trauma

Penetrating and blunt diaphragmatic injury

Urgent surgery

## ABSTRACT

**Objective:** To review our experience in the management of traumatic diaphragmatic hernia.**Materials and methods:** The records of all patients operated for diaphragmatic hernia between January 1998 and October 2008 at S.D.S Sanitorium and Rajiv Gandhi Institute of Chest Diseases, Bangalore, India were reviewed. Details of their clinical presentation, mode of diagnosis, operative findings and post-operative outcome were analysed.**Results:** Twenty nine patients underwent surgery for traumatic diaphragmatic hernia. The cause of rupture was blunt trauma in 24(83%) patients and penetrating trauma in 5(17%) patients. In 21 (72%) patients the diagnosis was made within 24hrs and in 8(28%) patients the diagnosis was made after 24hrs. Thoracotomy was the most common surgical approach used in 20(69%) patients. Post operative morbidity was 24% and mortality was 13.8%.**Conclusion:** X-ray chest is still very useful in the diagnosis of diaphragmatic ruptures. Right sided ruptures are difficult to diagnose. Diaphragmatic hernia repair can be done through a thoracotomy with acceptable results in patients without concomitant intra abdominal injuries.

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## 1. Introduction

Diaphragmatic injuries occur in 1.1–3.9%<sup>1</sup> of the patients suffering from thoraco-abdominal trauma. Diaphragmatic rupture leads to a traumatic diaphragmatic hernia. Traumatic diaphragmatic hernia occurs in less than 50% of the patients with diaphragmatic injuries.<sup>2</sup> Diagnosis of diaphragmatic injuries is difficult and often delayed leading to increased morbidity and mortality.<sup>3</sup>

This report is a review of our experience with traumatic diaphragmatic ruptures.

## 2. Materials and methods

The records of all the patients operated for traumatic diaphragmatic hernia at S.D. Sanitorium and Rajiv Gandhi Institute of Chest Diseases, Bangalore, India between January 1998 and October 2008 were reviewed. During the study period a total of 2496 patients of thoracic trauma were treated at our centre of these 29 (1.1%) patients underwent surgery for traumatic diaphragmatic hernia. The following details were collected and used for analysis. Age, Sex, Presenting symptoms, Clinical findings, Findings on chest Xray, CT scan (Computerized Tomography), Operative approach,

Findings and Technique of repair, Postoperative course, Duration of hospital stay and Outcome.

After diagnosis, the patients were immediately taken up for surgery. Thoracotomy was the preferred approach if there were no features of intra-abdominal injury on clinical examination and abdominal ultrasonography. The diaphragmatic tear was repaired using interrupted prolene sutures after reduction of the herniated abdominal contents. Postoperatively patients were managed in the surgical intensive care unit.

## 3. Results

Of the 2496 patients of thoracic trauma treated at our centre during the study period, 29 (1.1%) patients underwent surgery for traumatic diaphragmatic hernia of which 25 (86%) were males and 4 (14%) females. The youngest patient was 18years and the oldest was 60 years, mean age was 33.6 ( $\pm$ 10.6) yrs.

Blunt injury was the cause of rupture in 24 (83%) patients and penetrating injury was seen in 5 (17%) patients. The blunt injuries included 15 road traffic accidents, 5 pedestrians hit by motor vehicles and 4 patients gave history of fall. The penetrating injuries included 4 stab injuries and 1 gunshot injury. Left sided rupture was seen in 23 (79%) patients and right sided rupture in 6 (21%) patients.

The mode of presentation was dyspnea in 15 (52%) patients, chest pain in 10 (34%) patients, 3 (10%) patients presented with

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shock and abdominal pain was the present in 2 (7%) patients. On clinical examination 22 (76%) patients had reduced air entry on auscultation. Bowel sounds were heard in the thoracic cavity in 2 (7%) patients.

In 21 (72%) patients the diagnosis of diaphragmatic rupture was made within 24 h and in 8 (28%) patients after 24 h with a range of 1–50 days. Among the patients diagnosed after 24 h, 4 (50%) patients had right sided rupture in whom the chest X-ray appeared normal. Three patients (37.5%) were asymptomatic after trauma presented to us late after 24 h. In 1 (12.5%) patient the diagnosis of diaphragmatic rupture was missed and referred late (Fig. 1). Chest X-ray was diagnostic in 20 (69%) patients (Fig. 2). CT thorax was required in 4 (14%) patients. Intra-operative diagnosis of rupture diaphragm was made in 5 (17%) patients.

The mode of presentation, the method of diagnosis and time to diagnosis of right and left sided diaphragmatic injuries have been compared in Table 1.

Associated injuries were present in 17 (59%) patients which included rib fractures ( $n = 7$ , 41%), head injury ( $n = 3$ , 18%), liver laceration ( $n = 3$ , 18%), colonic injury ( $n = 2$ , 12%), lung laceration ( $n = 4$ , 24%) scapula fracture and spine vertebral fracture ( $n = 2$ , 12%), splenic injury ( $n = 3$ , 18%).

The approach was thoracotomy in patients with a delayed diagnosis. In patients presenting early thoracotomy was done when abdominal injury was excluded by clinical examination and abdominal ultrasonography. Twenty (69%) patients underwent thoracotomy. When an intra-abdominal injury was suspected a laparotomy was done. Laparotomy was done in 8 (27.5%) cases, a thoracoabdominal approach was used in 1 (3.5%) patient.

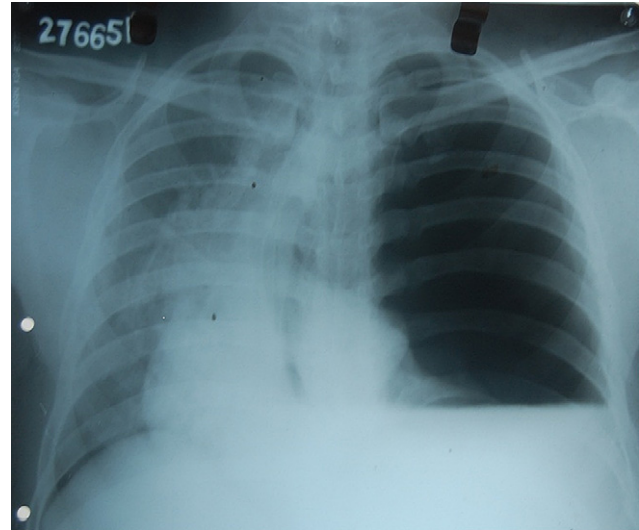
The most common site of rupture was central tendon seen in 12 (41%) patients, muscular part in 7 (24%) patients combined muscular and tendinous portion in 6 (21%) patients. In 4 (14%) patients the diaphragm had separated from its anterior attachment. The length of tear ranged from 6 to 10 cm. Eight (27.5%) patients required additional procedures.

Splenorrhaphy was done in 2 (7%) patients, suprapubic cystostomy in 1 (3%) patient, cecostomy in 2 (7%) patients, repair of gastric laceration in 2 (7%) patients and 1 (3%) patient who had presented late required a decortication procedure.

Nineteen (65.5%) patients were extubated on table, 8 (27.5%) patients required elective ventilation ranging from 12 h–5 days. The reasons for prolonged postoperative ventilation were head injury in 3 (37.5%) patients, shock in 4 (50%) patients and lung laceration in 1 (12.5%) patient. Postoperative morbidity was seen in 7 (24%) patients. Complications seen were renal failure ( $n = 1$ , 3.5%), wound infection ( $n = 2$ , 7%), peritoneal abscess ( $n = 1$ , 3.5%), liver failure ( $n = 1$ , 3.5%), respiratory failure ( $n = 1$ , 3.5%), sepsis ( $n = 1$ , 3.5%). Recurrent herniation requiring reoperation was seen in 1 (3.5%) patient. Mean Duration of stay was 20 days range 5–79 days. There were 4 deaths with a mortality of 13.8%. Two (50%) patients died due to sepsis, shock (25%) and renal failure (25%) were responsible for the death of the other 2 patients respectively.

**Table 1**  
Comparison of left and right sided rupture.

	Right sided rupture $n = 6$	Left sided rupture $n = 23$
Clinical symptoms	Dyspnea; $n = 4$ (67%) Chest pain; $n = 1$ (16.5%) Shock; $n = 1$ (16.5%) Abdominal pain; $n = 0$	Dyspnea; $n = 11$ (52%) Chest pain; $n = 9$ (39%) Shock; $n = 2$ (8.6%) Abdominal pain; $n = 2$ (8.6%)
Method of diagnosis	Chest Xray; $n = 0$ CT Scan; $n = 3$ (50%) Intra-operative; $n = 3$ (50%)	Chest Xray; $n = 20$ (87%) CT Scan; $n = 1$ (4.3%) Intra-operative; $n = 2$ (8.6%)
Time of diagnosis	<24 h; $n = 2$ (33%) >24 h; $n = 4$ (67%)	<24 h; $n = 19$ (83%) >24 h; $n = 4$ (17%)



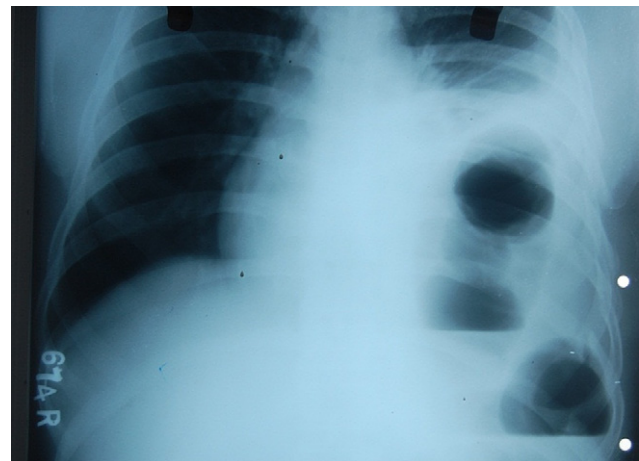
**Fig. 1.** Chest X-ray of a patient with left sided diaphragmatic hernia, shows features of left sided hydropneumothorax. CT scan done confirmed the presence of a diaphragmatic hernia.

#### 4. Discussion

Diaphragmatic injuries were first described in 1541 by Senneratus. The diagnosis of diaphragmatic injuries is challenging and requires a high index of clinical suspicion.<sup>4</sup> Diaphragmatic injuries should be diagnosed before the complications like diaphragmatic hernia and strangulation occur. The mortality and morbidity increases after the herniation and strangulation of the abdominal viscera in the thoracic cavity.<sup>5</sup>

The commonest etiology of diaphragmatic injury was blunt trauma seen in 24 (83%) patients, this compared well with other series.<sup>6,7</sup> Dyspnea and chest pain was the most common presenting complaint. The most common presenting symptom described is dyspnea.<sup>4</sup>

Eight (28%) patients were diagnosed after 24 h. This is in contrast with other series where diagnosis after 24 h was made in about 5–12% of the cases.<sup>4,8</sup> The most common cause of delayed diagnosis was right sided diaphragmatic rupture (50%). Missed diagnosis on initial evaluation is reported to be the most common cause of delayed diagnosis.<sup>8</sup>



**Fig. 2.** Chest X-ray of a patient with left sided diaphragmatic hernia showing bowel loops in the left hemithorax.

According to reports only 17% of the cases of right sided rupture are diagnosed by chest X-ray.<sup>9</sup> The diagnosis of right sided ruptures is difficult, serial chest X rays and CT scan are recommended in the diagnosis of right sided ruptures.<sup>10</sup> None of our patients of right side rupture could be diagnosed by chest X-ray.

Chest X-ray was diagnostic in 69% of the patients. CT scan was required for diagnosis in 14% of patients. In 17% the diagnosis was made on table.

Despite its limitations chest x-ray still plays a major role in the diagnosis of diaphragmatic injuries.<sup>4,8</sup> CT is reported to have a sensitivity of 71% (78% left and 50% right) and a specificity of 100% and an accuracy of 88% for left and 70% for right sided injuries.<sup>11</sup> In the diagnosis of right sided ruptures the use of MRI has also been reported.<sup>9</sup> VATS and visual inspection of the diaphragm have been described for the diagnosis of diaphragmatic injuries in hemodynamically stable patients.<sup>12</sup>

Associated injuries were present in 17 (59%) of patients. The most common associated injury was rib fracture 17 (59%) followed by intra-abdominal injuries 9 (31%). Rubikas et al<sup>11</sup> has reported associated injuries to be present in 86–88% of the cases. Fracture of the chest wall bones was reported to be the most common injury followed by intra-abdominal injuries.<sup>1</sup>

The approach was thoracotomy in 20 (69%) patients. Laparotomy was done in 8 (27.5%) cases, thoracoabdominal incision was used in 1 (3.5%) patients. In cases of delayed presentation thoracotomy is an accepted approach<sup>13</sup> as it is difficult to release the intra thoracic adhesions through a laparotomy. In acute presentations the recommended approach is a laparotomy<sup>13</sup> to explore intra-abdominal organs for associated injuries. We have found it is easier to reduce the herniated contents and repair the diaphragm through a thoracotomy when there are no intra abdominal injuries. The mortality was 13.8% which was comparable with the reported mortality of 1–28%.<sup>14,15</sup>

## 5. Conclusion

Diaphragmatic injuries are more common after blunt injury chest. Chest pain or upper abdominal pain with breathlessness is the most common mode of presentation. Some patients may be asymptomatic during the initial period after trauma. In spite of all the different imaging modalities available today X-ray chest is still very useful in the diagnosis of diaphragmatic ruptures. Right sided ruptures are easily missed on chest X-ray and hence CT scan and even MRI can be considered in patients with suspected right sided ruptures.

Right sided rupture is a common cause of delayed diagnosis. Patients with diaphragmatic ruptures who are asymptomatic after the injury are usually ignored and the diagnosis is delayed.

Diaphragmatic hernia repair can be done through a thoracotomy with acceptable results provided there are no intra abdominal injuries. In all diaphragmatic injuries presenting late thoracotomy is the preferred approach.

### Conflict of interest

None declared.

### Funding

None.

### Ethical approval

Ethical approval waived

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