

Delayed Presentation of Traumatic Diaphragmatic Hernia: The Evaluation of Surgical Treatment Results

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ABSTRACT

Introduction: Diaphragmatic hernia could be caused by congenital disorders, blunt trauma or penetrating injuries. The diagnosis of traumatic diaphragmatic hernia is normally neglected during the first presentation leading to late complications and considerably increased mortality and morbidity among the patients.

Materials and Methods: In this retrospective, descriptive study, we reviewed the medical records of patients presented with traumatic diaphragmatic hernia who had undergone surgical operations between 1982-2015 in Ghaem Hospital and Omid Hospital affiliated to Mashhad University of Medical Sciences, Iran. The studied variables included age, gender, clinical symptoms, location of hernia, involved organs, type of imaging modalities, surgical techniques, length of hospital stay, mortality rate and surgical complications.

Results: In this study, 38 patients were diagnosed with traumatic diaphragmatic hernia consisting of 28 men and 10 women. In total, 79% and 21% of the patients suffered from penetrating trauma and blunt trauma, respectively. In addition, left-sided, right-sided and bilateral hernias were present in 33%, 4% and 1% of the patients, respectively. The most frequently herniated organ was the stomach, and the most common clinical symptoms were abdominal pain (84%) and dyspnea (53%). Initially, chest radiographs were performed on all the patients and thoracotomy was performed to repair diaphragmatic tears in all the cases (100%). In this study, 3 patients had previously undergone Hartmann's operation for gangrenous herniated colon, and devolvulation of gastric volvulus had also been performed on 3 patients. The main post-operative complications were reported to be pneumonia and respiratory insufficiency (2 cases), and the mean length of hospital stay was 6 days (5-8 days) which was longer (1-2 months) in patients with gangrenous bowel (3 patients). Furthermore, no mortality was reported during the course of hospitalization in these patients.

Conclusion: According to the results of this study, patients presented with blunt or penetrating traumas to the upper abdomen or lower chest require urgent attention as to immediately rule out diaphragmatic hernia in order to prevent later complications and mortality and morbidity among these patients.

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Introduction

Blunt or penetrating traumas are considered as relatively rare causes of diaphragmatic hernia;

a blunt abdominal trauma could result in the rapid rise of the intra-abdominal pressure, which

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leads to a rupture in the weak point of the diaphragmatic tissue (1).

In addition to blunt trauma, penetrating injuries caused by low- or high-velocity objects and stab wounds might also lead to diaphragmatic hernia in some cases (2).

Patients presented with diaphragmatic hernia may suffer from symptoms such as respiratory distress or bowel obstruction; these symptoms are normally caused by the dysfunction of the diaphragm, excessive pulmonary hypertension and bowel or gastric hernia (1).

Diaphragmatic hernia could be detected by CT scan, while chest X-ray (CXR), ultrasonography and Barium tests could contribute to the accurate diagnosis of hernia as well (3).

Furthermore, surgical operation is considered as an effective method in the treatment of diaphragmatic hernia, which could be performed using open or minimally invasive techniques. However, different complications including the recurrence of the diaphragmatic hernia, ileus, adhesions between intra-abdominal organs, pneumothorax, and atelectasis are likely to occur after surgical interventions (4).

Materials and Methods

This retrospective, descriptive study was conducted on patients diagnosed with diaphragmatic hernia who had undergone surgical operations between 1982-2015. The medical records of these patients were provided from the General and Thoracic Surgery Departments of Ghaem Hospital and Omid Hospital affiliated to Mashhad University of Medical Sciences, Mashhad, Iran. After reviewing the files, the required data were collected and recorded in prepared forms. The studied variables included age, gender, clinical symptoms, location of hernia, type of imaging modalities, surgical techniques, length of hospital stay and later complications in the course of the hernia.

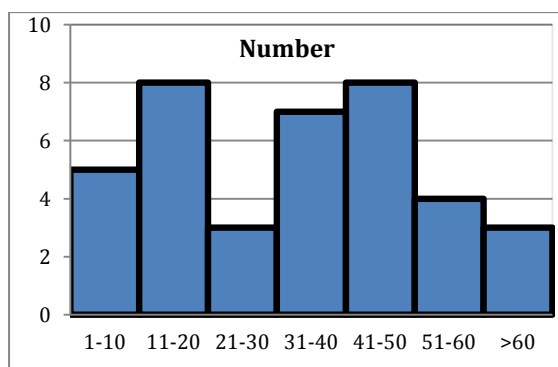


Figure 1. Age distribution of symptom presentation in patients with traumatic diaphragmatic hernia

Statistical analysis

Data analysis was performed using descriptive statistics in SPSS (V.16), and a P value of ≤ 0.05 was considered as significant. This study was approved by the Institutional Review Board of Mashhad University of Medical Sciences.

Results

In total, 38 patients (28 men and 10 women) diagnosed with traumatic diaphragmatic hernia who had undergone surgical operations between 1982-2015 were enrolled in this study.

Left-sided, right-sided and bilateral hernias were present in 33%, 4% and 1% of these patients, respectively. The patients were in 7 age groups (1-10,11-20,21-30,31-40,41-50,51-60,>60) and the highest incidence rate of hernia was observed in the two age groups of 11-20 and 41-50 years. Age distribution of the subjects in terms of symptom presentation is shown in Figure 1.

According to the results of this study, the main causes of diaphragmatic hernia in the patients were penetrating trauma (79%, N=30) and blunt trauma (21%, N=8). Although the stomach was observed to be the most frequently herniated organ, other organs such as the colon, spleen and liver were also affected by hernia. In patients presented with bilateral hernia, the most significant herniated organs were the stomach, omentum and colon (2.6%). In addition, the most common clinical symptoms were abdominal pain (84%) and dyspnea (53%), respectively.

Chest radiographs were also provided from all the patients. The CXR of the patients with left diaphragmatic hernia is shown in Figure 2.

In addition, CT scan, Barium enema, Barium swallow, and ultrasonography were performed on patients suspected of other disorders. The CT-scan of the patients with left diaphragmatic hernia is shown in Figure 3.

Diaphragmatic tears were repaired via thoracotomy in all the patients using 1-0 silk or nylon interrupted horizontal mattress suture



Figure 2. Chest radiography in left diaphragmatic hernia

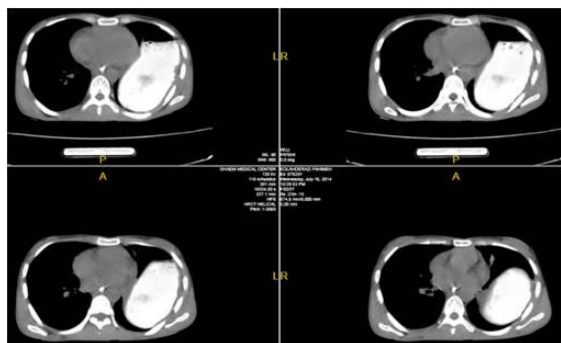


Figure 3. CT-scan of a patient with left diaphragmatic hernia

technique. In one patient presented with the herniation of colon after gastric pull-up due to esophageal cancer, Mersilene mesh was used for the reinforcement of the repairing suture while in another patient, Dual mesh was used in order to repair a wide defect in the diaphragm Figure 4.

On the other hand, 3 patients had undergone Hartmann's operation due to the gangrene of the herniated colon, while devolvulation and repair of the diaphragm had been performed on 3 patients presented with stomach volvulus.

In this study, post-operative complications included pneumonia and respiratory insufficiency, were aserved in 2 patients who had been supported by mechanical ventilation between 3-5 days. Moreover, the mean length of hospital stay was 6 days (5-8), which was longer (1-2 months) in patients with gangrenous colon (N=3) due to the treatment of fever, empyema and wound infection. Finally, no mortality was reported during the course of hospitalization.

Discussion

Blunt and penetrating traumas are among the most common causes of diaphragmatic injury. The actual incidence rate of diaphragmatic hernia is undefined as the preoperative diagnosis is normally a challenging process. Since it can remain asymptomatic for years, diaphragmatic hernia is usually identified if the patient is examined for other problems. During the Valsalva maneuver, the gradient between intra-abdominal and intra-thoracic pressure is raised up to 100 mmHg (normal: 2-10 mmHg), which might be due to intra-thoracic herniation (1).

During expiration, the uppermost anatomic location of the diaphragm could rise as high as the 4th and 5th thoracic right and left side spaces, respectively. In addition, the 8th thoracic dermatome is the lowest point of anatomic location of the diaphragm during deep inspiration. The lowest posterior point is attached to the 12th rib; therefore, if the penetrating trauma occurs in the anatomic area between T4 and T12, the diaphragm is likely to be injured (2).



Figure 4. Intra-operative image of traumatic Para-esophageal diaphragmatic hernia repaired with synthetic mesh

Diaphragmatic hernia most commonly occurs in the left hemi-diaphragm in blunt trauma, perhaps since the right hemi-diaphragm is protected by the liver and diaphragm weakness is more frequently observed on the left side. On the other hand, bilateral rupture is considered as a rare occurrence; the posterior central aspect of a hemi-diaphragm is commonly involved in blunt trauma, so the tearing could spread radially. Tearing is normally large (>10cm) in blunt trauma, whereas it is smaller (<2cm) in penetrating trauma. In penetrating trauma (e.g. stab wounds), the left hemi-diaphragm is concurrently affected, while the liver on the right and the stomach on the left side are the most commonly herniated organs due to the traumatic tear (5). In the present study, diaphragmatic hernia was more frequent in the left hemi-diaphragm, and bilateral hernia was reported in none of the patients.

Clinical symptoms of diaphragmatic hernia are associated with circulatory and respiratory dysfunction since the pulmonary and mediastinal contents are compressed by the abdominal pressure. Moreover, lung compression is known to result in mediastinal shift, and diaphragmatic hernia might occasionally be presented with pericardial tamponade due to the entrance of the bowel into the pericardial sac. In addition, the herniated structure into the thorax might be perforated, which could result in hydro-pneumothorax. Tracheal intubation could be a difficult process in these patients due to the tracheal deviation to the opposite side (6). In this study, the most common clinical symptoms were reported to be abdominal pain (84%) and dyspnea (53%), respectively.

The stomach on the left side and the liver on the right side of the hemi-diaphragm are the most frequently involved organs due to diaphragmatic defects, followed by other abdominal organs including the large or small intestines, omentum, liver and spleen (5). In the current study, the

stomach was reported to be the most commonly herniated organ among the patients.

In one study, Sersar et al. described a case of diaphragmatic hernia initially presented with the diagnosis of chylothorax. After repairing the ruptured stomach, they observed that the post-traumatic ruptured gastrothorax could sometimes be misdiagnosed with chylothorax (7).

Prompt diagnosis of diaphragmatic hernia is of paramount importance in order to prevent fatal complications, and CXR is considered as a useful diagnostic tool in this regard (8). In this study, CXR was observed to be an effective measure in the early diagnosis of diaphragmatic hernia.

On the other hand, chest radiograph was not able to precisely differentiate between diaphragmatic hernia and other pleural disorders such as pleural thickening, pleural effusion, empyema or malignancy, while thoracic ultrasonography was used as an efficient tool in the differentiation between hernia and the aforementioned disorders.

Furthermore, ultrasonography was able to distinguish fatty liver diseases, pleural effusion, diaphragmatic continuity, intestinal peristaltic movements, presence of fluid in the abdomen and movements of hemi-diaphragm (9). In this study, ultrasonography, CT scan, Barium enema and Barium swallow were used in case a definite diagnosis of hernia could not be achieved via CXR.

In one study, Magu et al. used multi-detector computed tomography (MDCT) with the sensitivity of 100%, accuracy of 95% and specificity of 93% for the diagnosis of traumatic diaphragmatic hernia. According to their findings, MDCT could be a highly accurate imaging modality for the detection of traumatic hernia in the diaphragm (10).

Thoracotomy is also considered as an appropriate surgical approach for the diagnosis of traumatic diaphragmatic hernia in patients with delayed presentation since in this method, the herniated organs and adhesions could be easily released in direct vision (3). In this study, diaphragmatic tears were successfully repaired via thoracotomy, with the exception of 3 patients with gangrenous colon, in whom laparotomy was used in addition to thoracotomy.

In a study on this subject, Gali et al. described a case of delayed diaphragmatic hernia in the lower chest caused by stab wounds, which was diagnosed after three and a half years. The patient was presented with intestinal obstruction and underwent surgical operation with a laparotomy incision. Jejunal loop was reported as the involved organ in the diaphragmatic defect,

which had become gangrenous and therefore, was resected. According to the researchers, diaphragmatic defects had to be ruled out after the presence of an injury in the thoraco-abdominal zone (11).

In another study, Jadowiec et al. described a case of diaphragmatic hernia presented 2 month after abdominoplasty. The patient had suffered blunt trauma to the thoraco-abdominal region about 20 years earlier, and the researchers concluded that operative compression due to abdominoplasty had caused the onset of symptoms in a previously diaphragmatic hernia (12).

Similarly, DeMuro described a case of diaphragmatic hernia in a patient presented with acute bowel obstruction. The patient had a history of blunt trauma 20 years earlier, and the diaphragmatic defect had been repaired successfully via laparotomy with interrupted 2-0 polypropylene sutures and pledgets (4). In another study, Kuy et al. presented a case of intrapericardial diaphragmatic hernia caused by blunt trauma to the chest wall, which was repaired during a laparoscopic procedure (13).

Conclusion

Although we need to study with large case series but we recommended in patients with blunt or penetrating traumas to the upper abdomen or lower chest, close attention is required as to immediately rule out diaphragmatic hernia since delayed diagnosis of hernia could lead to late complications in these patients, and is also associated with considerably higher mortality and morbidity.

Conflict of Interest

The authors declare no conflict of interest

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