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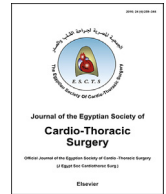


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Traumatic diaphragmatic hernia challenging diagnosis and early management

Mohamed Abdelshafy^a, Yusuf S.E. Khalifa^{b,*}

^a Department of General Surgery, Qena Faculty of Medicine, South Valley University, 83511, Egypt

^b Department of Cardiothoracic Surgery, Qena Faculty of Medicine, South Valley University, 83511, Egypt



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ABSTRACT

Background: Early diagnosis and management of traumatic diaphragmatic hernia (TDH) can be challenging for the emergency department or the trauma surgeon, as these injuries are often clinically masked by other associated severe injuries.

Methods: We retrospectively reviewed data of 50 patients diagnosed with an acute traumatic hernia from September 2014 to September 2017.

Results: 50 patients were included in this study. Blunt trauma was the main cause in 40 patients (80%) patients. TDH occurred more on the left side; in 72% of patients. The diagnosis was preoperative in 20 patients (40%). In our study, 74% of cases were repaired through abdominal approach and 26% patients through thoracic approach. Complications of TDH occurred in 30 patients (60%) and were mainly pneumonia in 16 patients (32%), only 8 patients (16%) died (6 patients of them had delayed referral and 3 patients of them had severe head injury).

Conclusions: TDH may be masked by associated injuries in multiple trauma patients and may lead to life-threatening intestinal and gastric strangulation. So, early diagnosis and treatment of TDH are important. Emergency physicians and trauma surgeon should maintain a high index of suspicion of TDH while dealing with patients assessed for abdominal or respiratory symptoms regardless the history of trauma was recent or delayed.

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1. Introduction

Traumatic diaphragmatic hernia (TDH) or rupture is a serious complication of abdominal or thoracic trauma. The incidence of TDH in trauma patients is around 0.8%–5% and occurs more commonly in males than females [2–4].

TDH occurs mostly in blunt trauma, and less frequently in penetrating injuries (13.3–55%) [5,6] and was described in rare cases of iatrogenic trauma as insertion of chest tubes [7]. It is more frequent on the left side and its width and dimension are bigger in blunt trauma [8].

* Corresponding author.

E-mail addresses: mabdelshafy138@yahoo.com (M. Abdelshafy), yusuf.shieba@med.svu.edu.eg (Y.S.E. Khalifa).

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TDH mainly presents with respiratory and abdominal complaints as dyspnea (86%), abdominal pain (17%) and diminished breath sound on the affected side (73%) [7].

Imaging investigations as chest X-ray (CXR), and computerized tomography (CT) are generally diagnostic. A positive CXR or with a high index of suspicious findings are effective for diagnosis especially when CXR is associated with other imaging techniques [6,9].

The diagnosis of TDH can be missed because of lacking typical symptoms and because it is associated with major injuries which result in its late presentation [10].

Also, the low index of suspicion of TDH plays a role in missing or delaying the diagnosis; any delay in the diagnosis of TDH can lead to increased morbidity and mortality. However, with failure of preoperative diagnosis, some cases are diagnosed intra-operatively [11].

So early detection and management of TDH are important to avoid the possible life-threatening complications as gastric and intestinal strangulation [12]. The approach may be through laparotomy [1,9] or thoracotomy [6,13]. Mortality ranges from 0 to 33%, often due to associated injuries [9,13].

2. Patient and methods

This is a retrospective analysis of data of patients in adult and pediatric age diagnosed with TDH either preoperatively or intra-operatively, at trauma unit (General Surgery and Cardiothoracic Surgery Departments Emergency and Trauma Unit) Qena faculty of medicine, South Valley University from September 2014 to September 2017. Data from 50 patients who had traumatic diaphragmatic hernias were collected from archives files.

Inclusion criteria: All patients referred to our trauma unit and had been diagnosed as TDH either preoperative by investigation or as intra-operative finding when exploration was done for any abdominal trauma.

Exclusion criteria: any cause of a traumatic hernia other than trauma as a congenital diaphragmatic hernia or acquired hiatal hernia.

All the cases underwent a diagnostic CXR, abdominal US and intravenous contrast-enhanced abdominal or chest CT in some cases to confirm the diagnosis and in suspicious cases.

All the cases were evaluated in terms of etiology, age, gender, presenting symptoms and signs, diagnosis either preoperatively or intraoperatively, early or late diagnosis, investigations, side of injury, concomitant organ injuries, treatment, early or late complications, and mortality rate.

Statistical analysis: the statistical analysis of data was done by using SPSS (Statistical Package for the Social Sciences version 10.0, SPSS Inc, Chicago, Illinois, USA) computer software for Statistical analysis under Microsoft window 8. For all statistical analyses, $p > 0.05$ was considered significant.

3. Results

50 patients were included in this study from September 2014 to September 2017. Ages of patients ranged from 3 months to 65 years with a median 25 years. Number of children (under 18 years) was 12 patients (24%). 42 patients were males (84%) and only 8 females (8%) with the male-female ratio of 5.25:1.

TDH occurred due to blunt trauma in 40 patients (80%), penetrating trauma in 9 patients (18%) and iatrogenic in one patient (after chest tube insertion) (2%). Main causes of penetrating trauma among 9 patients were firearm in 6 patients (12%) and penetrating sharp object in 3 patients (6%).

The main causes of blunt trauma were motor car accident in 20 patients (40%), 15 patients with motorcycle (bike) accident (30%), and 5 patients fall from height (10%). 35 patients (70%) patients were polytraumatized, isolated abdominal trauma in 9 patients (18%) and isolated chest trauma in 6 patients (12%).

The site of TDH was left in 36 patients (72%), right in 12 patients (24%) and central in 2 patients (4%) (Fig. 1 and 2) (Table 1).

The dimension of hernia was more than 5 cm in 43 patients (86%), and less than 5 cm in 7 patients (14%).

Presenting symptoms were dyspnea in 45 patients (90%) with the respiratory discomfort, associated with abdominal pain in 40 patients (80%).

There were positive findings in CXR done for the first time in 13 patients (26%) of all patients and (65%) of preoperatively diagnosed patients. After repeating CXR, we discovered positive finding in additional 3 patients to increase all positive finding in CXR to (32%) of all patients and (80%) of preoperatively diagnosed patients (Fig. 3, 4). CT chest was used to confirm the diagnosis and was positive in all patients which were diagnosed preoperatively.

Preoperative diagnosis was made in 20 patients (40%); 11 patients early diagnosed (22%) and 9 patients (18%) diagnosed lately due to delay of referral to our centre. 30 patients (60%) were diagnosed intraoperatively during surgery either through laparotomy or thoracotomy (Fig. 5).

In intraoperative exploration, there was a concomitant injury in most of the patients. There were 20 patients with splenic injury, 2 patients with pancreatic trauma, 10 cases of hepatic injury, 15 cases with lung injury and one case with cardiac injury.

Head trauma and orthopedic fractures were present in 30 cases.

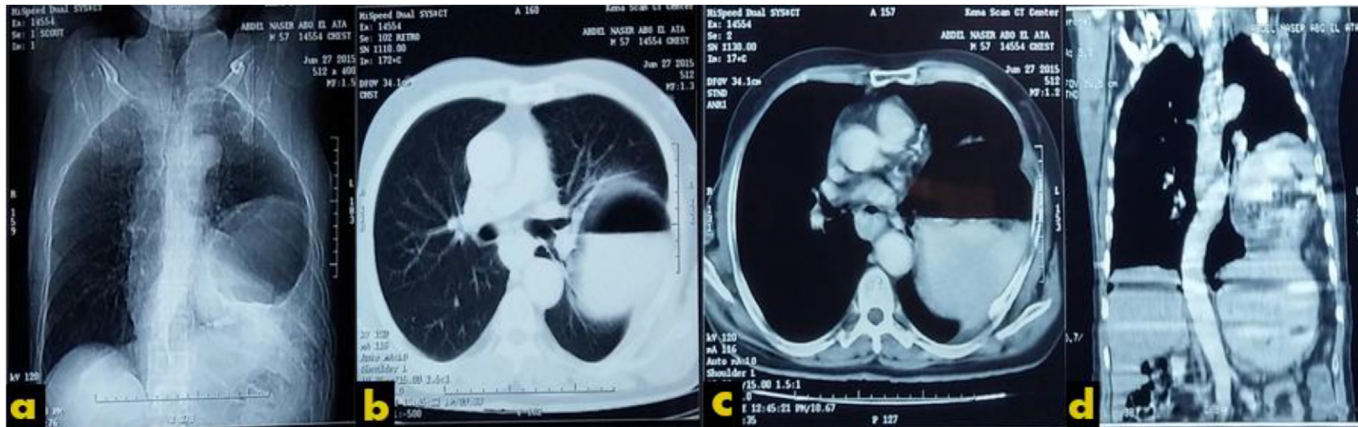


Fig. 1. CT Chest of left diaphragmatic hernia. a: Showing chronic TDH with gastric content in the left hemithorax. b: Pulmonary window showing air fluid level. c: Mediastinal window of cross sectional view showing gastric content in the left hemithorax. d: Coronal view.

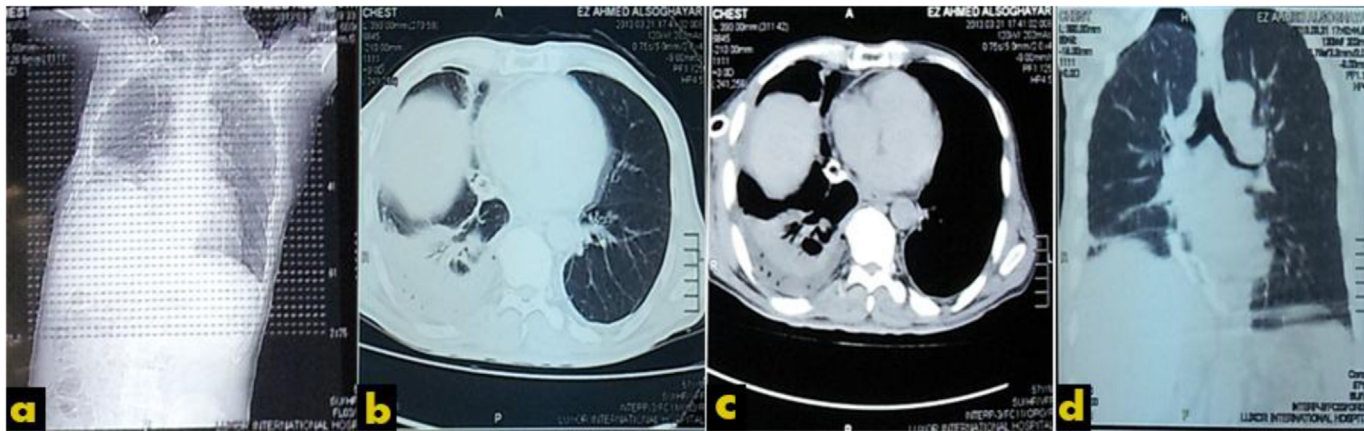


Fig. 2. CT Chest of right diaphragmatic hernia. a: Showing right sided multiple fracture ribs, Thoracostomy tube and elevated right copula. B: Showing liver in the right hemithorax. c: Showing lung contusion of right lower lobe. d: Coronal view with rim of pneumothorax.

Table 1

Patient's data.

Variable	(n = 50)
Male	42 (84%)
Female	8 (16%)
Mean age (years)	25
Side of injury	
Right	12 (24%)
Left	36 (72%)
Central	2 (4%)
Surgical approach	
Abdominal	37 (74%)
Thoracic	13 (26%)
Content	
No content	30 (60%)
Liver	2 (4%)
Stomach	9 (18%)
Intestinal loops	4 (8%)
Omentum	6 (12%)
Concomitant injuries	
Spleen	20 (40%)
Liver	10 (20%)
Lung	15 (30%)
Cardiac	1 (2%)
Orthopaedics and head trauma	30 (60%)
Technique of repair	
Direct closure	50 (100%)
prosthetic non-absorbable mesh	Nil

As regard repair of the diaphragm, 13 patients (26%) was repaired from the thoracotomy approach, and through an abdominal incision in 37 patients (74%) (Fig. 6). In polytraumatized patients, the resuscitative measures were done first followed by the insertion of a Ryle's Tube and intercostal tube if needed. On exploration, cautious inspection of the diaphragm was done a mild downward traction of the liver for the right hemidiaphragm and gentle downward retraction of the spleen. Subsequently, diaphragmatic lacerations were sewed with non-absorbable sutures. Prosthetic non-absorbable mesh was not used to reconstruct the diaphragm in our study; all cases were repaired by direct closure with interrupted polypropylene nonabsorbable sutures (Fig. 7).

Complications of TDH occurred in 30 patients (60%): pneumonia in 16 patients (32%), wound infection in 12 patients (24%) and mild pancreatitis in 2 patients (4%). All patients were successfully treated (Table 2).

Regarding mortality rates, only 8 patients (16%) died; mostly cases of delayed referral (6 patients) and 3 patients with a severe head injury.



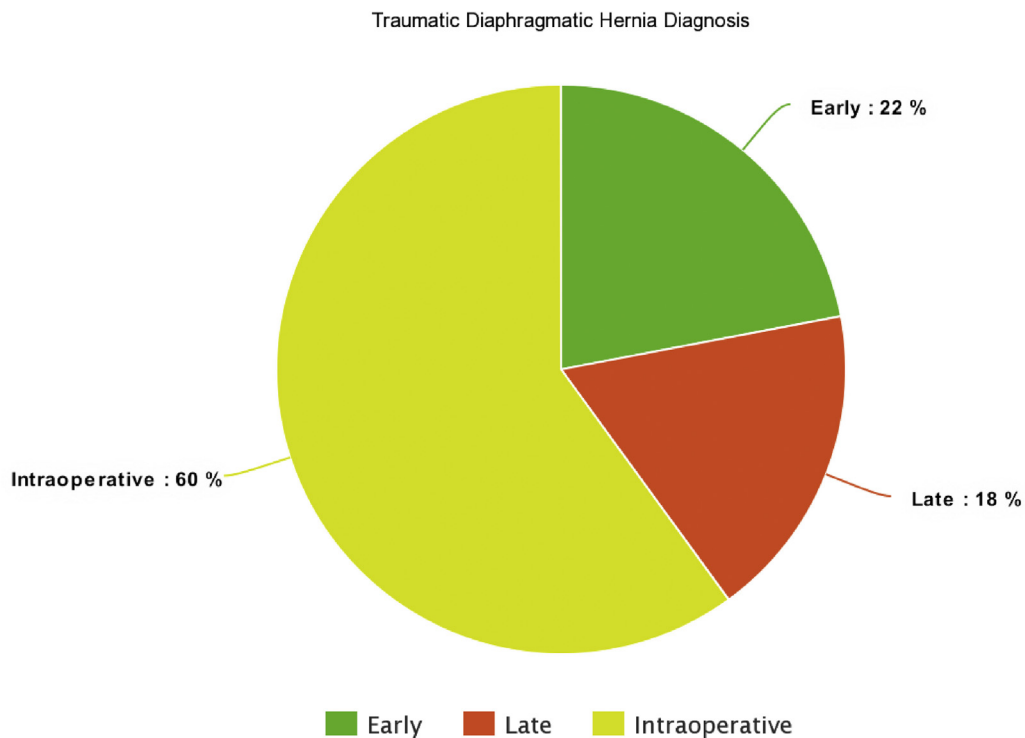
Fig. 3. CXR of young patient, a car cross over his abdomen.



Fig. 4. CXR of TDH, a nasogastric tube wrapped up to the chest.

4. Discussion

TDH was first described by Ambroise Paré in 1579 in a French artillery captain who had been shot eight months before his death from complications of the rupture [14]. Also, Paré described diaphragmatic rupture in people who had suffered blunt



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Fig. 5. Traumatic diaphragmatic hernia diagnosis.

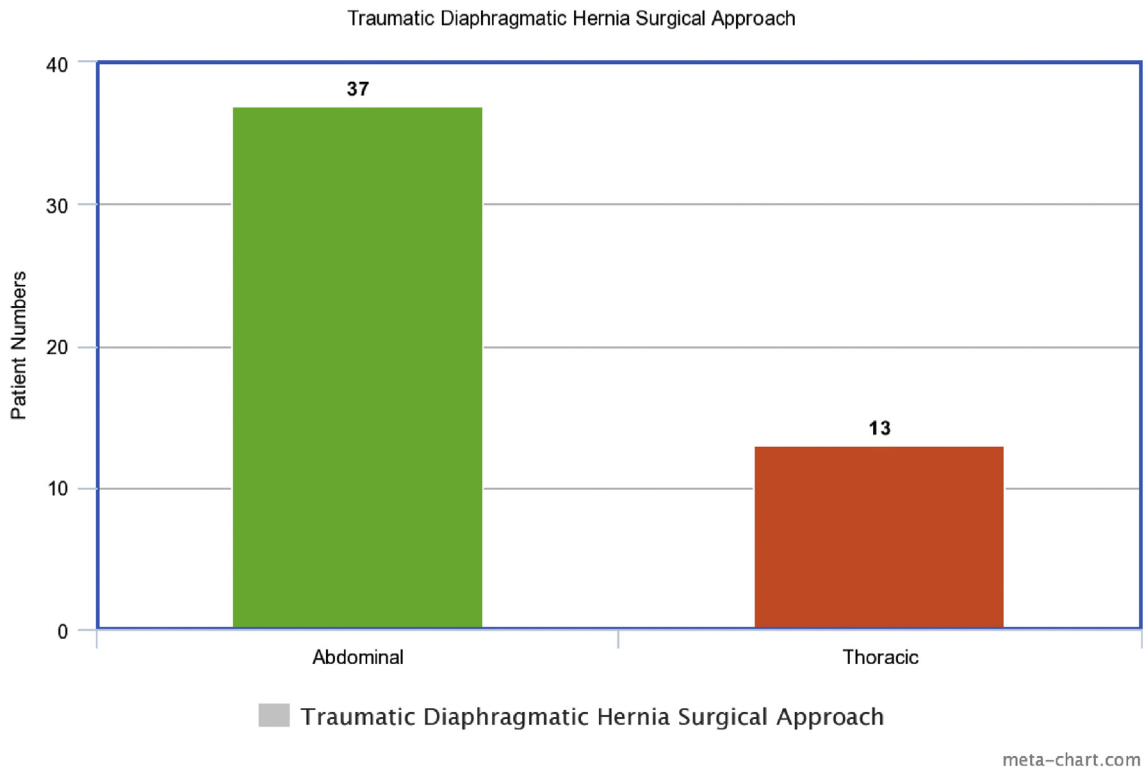


Fig. 6. Traumatic diaphragmatic hernia surgical approach.

and penetrating trauma by using their autopsies [14]. Petit was the first to establish the difference between acquired and congenital diaphragmatic hernia. In 1888, Naumann repaired a hernia of the stomach into the left chest that was caused by trauma [14].

TDH can be defined as the displacement of intra-abdominal organs into the chest through a pathological tear or rupture in the diaphragm due to trauma. Some authors use the term “a false hernia” and sometimes diaphragmatic rupture because TDH does not always have a hernial sac. However, the presence or absence of a hernial sac has only a little impact on the clinical course and management, and the term “post-traumatic diaphragmatic hernia” is generally accepted in the medical literature [15].

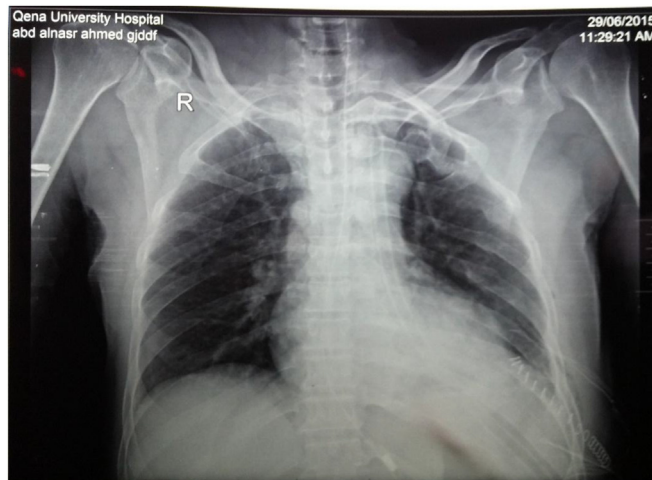


Fig. 7. CXR after TDH repair through trans-thoracic approach.

Table 2
Complications of ADH.

No. of patients	Complication
30 (60%)	All complications
16 (32%)	Pneumonia
12 (24%)	Wound infection
2 (4%)	Pancreatitis

Although it is a rare condition (0.8%–5.0%), it has an increasing incidence due to the high rate of motor vehicle accidents. In our study, 50 patients were included during three years; this high rate is explained by that our hospital is the only tertiary referring trauma hospital draining three governorates. The mortality rate was relatively high because it was associated with severe intra-thoracic or abdominal injuries; 8 patients (16%) and most of the deaths were due to delayed diagnosis (6 patients from 8 patients that represent 75%).

In this study, we found that TDH occurred more common in males than females with a male-female ratio of 5.25:1. This matches with other studies finding a higher prevalence of TDH in males with a male: female ratio ranging from 1.5 to 4.5:1 [16,17–18]. Our ratio was higher than the literature and this may be due to the traditions in upper Egypt exposing males more than females in driving, travelling and working.

It may occur after blunt or penetrating trauma, the incidence of TDH being higher in blunt trauma (87%) [2]. In this study we found that the incidence due to blunt trauma was 80% and after iatrogenic trauma 2%.

TDH occurred more commonly on the left (72% in our study vs. 53.3–100% reported in the literature) and this is because the right diaphragm is protected by the liver [2,7–9].

Most of the patients presented with respiratory symptoms as dyspnea, and abdominal pain and this became clinically evident only after herniation of abdominal viscera into the thorax. This may be masked by other injuries or may be less evident making the diagnosis difficult.

The first-line imaging exam is CXR and visualization of abdominal viscera shadow or intestinal, stomach gases in the thorax is pathognomonic of the diagnosis. Sometimes, TDH may occur without evident herniation of abdominal contents into the thorax or herniation occurs late. So CXR may give false negative results. CXR is reported to be pathognomonic or suspect findings in 85% in most studies [9,16]. In our study only 40% of patients were diagnosed preoperatively and CXR was 80% diagnostic in these patients. CT chest is the second-line imaging [19]. Chest or abdominal CT is required for any suspected post-traumatic injury that may extend to the diaphragm [20].

Diagnosis of TDH more commonly occurs during surgical exploration (10–75%) due to the associated injuries and poor specific clinical manifestations [8, 18, 21]. In this study, only 20 patients (40%) were diagnosed in preoperative period; 11 patients with early diagnosis (22%) and 9 patients (18%) diagnosed lately due to delay of referral to our center and 30 patients (60%) were intra-operatively diagnosed during surgery either for abdominal or chest emergency see Fig. 1.

Delayed diagnosis may be related to an occult TDH with no immediate herniation and can have a diagnostic delay of several days or even months and associated with low suspicion index especially in pediatric than in adult patients [21].

In our study, 74% of cases were repaired through abdominal approach and 26% of patients through thoracic approach see Fig. 6. In the available literature, laparotomy is the preferred surgical approach in acute cases [1, 9], sometimes associated with thoracotomy [6,13]. Thoracotomy access alone was described as the TDH repair technique in fewer cases with late presentation [1].

Regarding the complications, in this study, minor complications occurred in 60% of patients mainly pneumonia and wound infections that were successfully treated see Table 1.

Regarding mortality rates, only 8 patients (16%) died (mostly due to delayed referral in 6 patients, and 3 patients with associated severe head injury). In the literature, there is a wide range of both complications (11–62.9%) [8] and mortality (1–28.8%) [16,17] that is usually due to the associated injuries.

5. Conclusions

TDH is not uncommon in trauma patients and there is increase in its incidence. It is usually difficult to be preoperatively diagnosed as it is often clinically occult and may be masked by associated injuries in patients with multiple trauma. Any delay in diagnosis resulted in severe complications even death; so early diagnosis of TDH is necessary to avoid complications and high mortality rate.

So, for early diagnosis and effective management of TDH, a high clinical index of suspicion is required. Every emergency physician and trauma surgeon should keep in mind the possibility of TDH while dealing with trauma patients with abdominal or respiratory symptoms especially in children as the diagnosis of TDH is more commonly delayed than in adults.

References

- [1] Hanna WC, Ferri LE, Fata P, Razeq T, Mulder DS. The current status of traumatic diaphragmatic injury: lessons learned from 105 patients over 13 years. *Ann Thorac Surg* 2008;85(3):1044–8.

- [2] Jeyarajah R, Harford WV. Abdominal hernias and gastric volvulus. In: Sliesenger and Fordtran's gastrointestinal and liver disease. eighth ed. Saunders: Elsevier; 2006. 477–81.
- [3] Rashid F, Chakrabarty MM, Singh R, Iftikhar SY. A review on delayed presentation of diaphragmatic rupture. *World J Emerg Surg* 2009;4(August):32.
- [4] Nishijima D, Zehbtachi S, Austin RB. Acute posttraumatic tension gastrothorax mimicking acute tension pneumothorax. *AJEM (Am J Emerg Med)* 2007; 25:734–6.
- [5] Ramos CT, Koplewitz BZ, Babyn PS, Manson D, Ein SH. What have we learned about traumatic diaphragmatic hernias in children? *J Pediatr Surg* 2000; 35:601–4.
- [6] Okur MH, Uygun I, Arslan MS, Aydogdu B, Turkoglu A, Goya C, et al. Traumatic diaphragmatic rupture in children. *J Pediatr Surg* 2014;49:420–3. W.B. Saunders.
- [7] Karnak I, Senocak ME, Tanyel FC, Büyükpamukçu N. Diaphragmatic injuries in childhood. *Surg Today* 2001;31:5–11.
- [8] Hwang S, Kim H, Byun JH. Management of patients with traumatic rupture of the diaphragm. *Korean J ThoracCardiovascSurg* 2011;44:348–54.
- [9] Rattan KN, Narang R, Rohilla S, Maggu S, Dhaulakhandi DB. Thirteen years' experience of diaphragmatic injury in children from the post graduate institute of medical Sciences (PGIMS), Rohtak, India. *Malays J Med Sci* 2011;18:45–51.
- [10] Petrone P, Leppaniemi A, Inaba K, Soreide K, Asensio JA. Diaphragmatic injuries: challenges in the diagnosis and management. *Trauma* 2007;9:227–36.
- [11] Bodanapally UK, Shanmuganathan K, Mirvis SE, Sliker CW, Fleiter TR, Sarada K, Miller LA, M. Stein D, Alexander M. MDCT diagnosis of Penetrating Diaphragm injury. *Eur Radiol* 2009;19(8):1875–81.
- [12] Hanna WC, Ferri LE. Acute traumatic diaphragmatic injury. *Thorac Surg Clin* 2009;19(4):485–9.
- [13] Shehata SMK, Shabaan BS. Diaphragmatic injuries in children after blunt abdominal trauma. *J Pediatr Surg* 2006;41. 1727–31.
- [14] Asensio JA, Petrone P, Demitriades D. Injury to the diaphragm. commentary by Davis JW. In: Moore EE, Feliciano DV, Mattox KL, editors. *Trauma*. fifth ed. McGraw-Hill Professional; 2003. p. 613–6.
- [15] Crandall M, Popowich D, Shapiro M, West M. Posttraumatic hernias: historical overview and review of the literature. *Am Surg* 2007;73(9):845–50.
- [16] Chughtai T, Ali S, Sharkey P, Lins M, Rizoli S. Update on managing diaphragmatic rupture in blunt trauma: a review of 208 consecutive cases. *Can J Surg* 2009;52. 177–81.
- [17] Shah R, Sabanathan S, Mearns AJ, Choudhury AK. Traumatic rupture of diaphragm. *Ann Thorac Surg* 1995;60:1444–9.
- [18] Machmouchi M, Al Ibgahim K. Blunt traumatic diaphragmatic rupture in children. *Ann Saudi Med* 2003;23:69–71.
- [19] Dirican A, Yilmaz M, Unal B, Piskin T, Ersan V, Yilmaz S. Acute traumatic diaphragmatic ruptures: a retrospective study of 48 cases. *Surg Today* 2011;41: 1352–6.
- [20] Shanmuganathan K, Killeen K, Mirvis S, White CS. Imaging of traumatic diaphragmatic injuries. *Thorac Imaging* 2000;15:104–11.
- [21] Mahmoud AF, Raeia MM, Elmakarem MA Abo. Rupture diaphragm: early diagnosis and management. *J Egypt Soc Cardiothorac Surg* June 2017;25(2): 163–70.