ORIGINAL RESEARCH PAPER VOLUME-6 | ISSUE-8 | AUGUST - 2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

RAREEMERGENCY PRESENTATIONIN DELAYED DIAPHRAGMATIC HERNIA ANDTOTAL ORPARTIAL RECONSTRUCTION OF HEMIDIAPHRAGM WITHPROLENEMESH:IN FIVE CASES.

Medical Science

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ABSTRACT

Diaphragmatic rupture (DR) is a life-threatening condition and often results from either blunt or penetrating trauma. (DR) is usually associated with abdominal trauma however, it can occur as isolated injury. Acute traumatic rupture of the diaphragm may be silent and there is often a delay between the injury and the diagnosis. Tension gastrothorax(TGT), tension colothorax(TCT) and tension hepatothorax(THT)are life-threatening conditions and present dramatically with acute and severe respiratory distress. It develops when an intra-thoracichreniation of stomach,liver or colon through a diaphragmatic defect. Massively distended stomach and colon by trapped air or fluid causing mediastinaldisplacement. (TGT),(TCT)and (THT)is often missed as tension pneumothorax and managed as such leading to increased morbidity and mortality. Immediate clinical and radiographic evaluation should lead to accurate diagnosis followed by emergency decompression of the stomach,colon and liver. Reduction of herniated viscera must be done with laparotomy and repair of the diaphragmatic defect.Here we present five cases with(TGT),(TCT)and (THT).We have performed transthoracic decompression of stomach and colonin three caseswith chest tube insertion and emergencylaparatomy. In two cases,right sideemergency thoracotomy was performed. The aim of this report is to show our experiences in diagnosis,emergency management and repair of large defect of diaphragm. Because these unusualemergency condition, tension(GT),(TCT)and (THT) andreconstruction of large diaphragmatic defects with synthetic prosthesis has not been well characterized in emergency presentations of delay diaphragmatic hernia andare still a challenging issuein the literature reviews.

KEYWORDS:

Tension gastrothorax,Colothorax, HepatothoraxLaparotomy, ThoracotomyDiaphragmatic Hernia,Hynthetic Prosthesis.

Introduction

Delay presentation of diaphragmatic rupture(DR) is often a result of herniation of abdominal contents into the thorax[1]. Sudden increase in the intra abdominalpressure may cause a (DR) and visceral herniation[2]. The incidence of (DR) aftertrauma is 0.8–5% [3] and up to 30% of diaphragmatic herniation present with delay [3]. Incorrect interpretation of the x ray or only intermittent hernia symptoms are frequent reasons for incorrect diagnosis [4]. Traumatic diaphragmatic hernia is a frequently missed diagnosis and there is commonly a delay between trauma and diagnosis[3,4]. The complications of delay phase of a long standing herniation, manifesting as obstruction, strangulation and perforation[5]. The systematic review of the literature suggests, the mean duration time was ,on Day 9[6], to 50 years[7].Respiratory distress was the most presenting feature [1,8-9]. Abdominal pain was the next presenting feature [10,11]. Theother presentation was intestinal obstruction [5,8,9], tension faeco-pneumothorax [8,11,12] andhematemeisis and malena [13].Tension (GT),(TCT)and (THT) presents dramatically with acute and severe respiratory distress and cardiac arrest[1,8-9]. When (DR) develops the stomach , colon or liver herniated through a left or right sided diaphragmatic defect into the thorax is massively distended by trapped air or fluid[5,8,11,12]. This article focuses on symptoms, diagnosis and treatment of these life-threatening conditions and reconstruction of Large diaphragmatic defects with synthetic prosthesis and outcome in fivecases based on a case report and review of the literature.

Case1

A 24-year-old female patient referred to pulmonary medicine outpatient department with right sided chest pain,dyspnea and nonproductive cough for ten days. She had a past history of a minor trauma and she could continue her daily activities. On examination, she was febrile and had dyspnea. Respiratory rate of 26 breaths/min, oxygen saturation of 96% with room air, pulse rate of 98/min, and blood pressure of 120/70 mm Hg. On the chest examination, there was dull note over right chest wall area. Examination of other systems was within normal range. The chest X-ray of PA view revealed a heterogeneous opacity in right lower zone (Figure1). She was admitted in the chest clinic. Ultrasonography of abdomen revealed empty of right upper quadrant and liver position was vertical and was in the upper portion of pleural space .Computed tomography scan of thorax showed presence of liver and omentum,small intestine and colon in the right hemi-thorax (Figure2). She was diagnosed to have traumatic right side (DR)with herniation of liver and omentum,small intestine and colon. Liver was rotated vertically and changed its position and shift to the left side of hemithoraxand compressed heart and left lung. During the admission,symptoms of patient worsened while in emergency room, respiratory rate of 38 breaths/min, oxygen saturation of 76% with nasal O2, pulse rate of 110/min, and blood pressure of 90/60 mmHg.Patient was intubated and referred to operation room for emergency operation.A rightantero–lateral thoracotomy was performed immediately. There was a large defectof the diaphragm and about two–third of central portion of diaphragm was absent, through this defect,liver and omentum,small intestine and colon herniated to the top point of rightpleural space. The herniated organs was reduced to abdomen cavity with difficulty. The diaphragm was replaced totally with prolene mesh and fixed to rib with prolenestitches(figur3). An intercostal drain was placed in the left pleura. She made uneventful recovery. In five month follow-up the condition of patient was well.

FIGURE 1

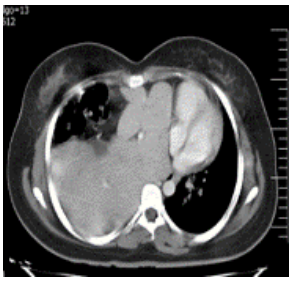

FIGURE 2

FIGURE 3

Figures 1and2 show CT-scan of patient show herniation liver,omentum and intestine in pleural space.Fig 3 display totally replacement of diaphragm with mesh.

Case 2

A 65-year-old man patient presented to pulmonary medicine outpatient department with right sided sever chest pain, right upper quadrant pain,dyspnea and productive cough for 15 days started after a severe physical activity. On examination, he was afebrile but dyspneic. Respiratory rate of 32 breaths/min, oxygen saturation of 96% with room air, pulse rate of 98/min, and blood pressure of 120/70 mmHg. On examination,abdomen was tender, especially in right upper quadrant and thethere was decreased breath sound on the right chest. Examination of other systems was within normal limits. Her chest X-ray PA view revealed a heterogeneous opacity in right lower zone (Figure 1). In past medical history he had a sever car accident six years ago but needed no surgery.He was admitted in the chest clinic. Ultrasonography of abdomen revealed, right upper quadrant was empty of liver,the liver position was vertical and was in the upper portion of pleural space.Computed tomography scan of thorax showed presence of liver and omentum , and colon with fecal material in the right hemi-thorax (Figure2). He was diagnosed to have traumatic right side (DR) with herniation of of liver and omentum , and colon .liver was rotated vertically and the liverposition was changed and shifted to the left side ofhemithorax,compressed the heart and left lung. Four hours after admission and during work –up, symptoms of patient worsened while she was taken up in the emergency room, respiratory rate of 38 breaths/min, oxygen saturation of 76% with nasal O2, pulse rate of 110/min, and blood pressure of 90/60 mmHg. Patient was intubated and referred to operation room for emergency surgery,tension hepato-colothorax. A right antero–lateral thoracotomy was performed immediately. There was a large defect of the diaphragm about 80% portion of diaphragm was absent, through this large defect,liver and omentum and colon was herniated to right pleural space. The liver was rotated to the upper portion of pleural space the herniated organs were reduced to abdominal cavity Position ofLiver corrected and reducedwith difficulty. The diaphragmwas replaced totally with prolenemesh and the edge of mesh fixed to rib with prolene stitches (figur3). An intercostal drain was placed in the left pleura. Postoperative right lower lobe was atelectasis due to plug and improved with bronchoscopy. 1n one year follow-up the conditions of patient was well.

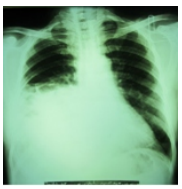

FIGURE 4

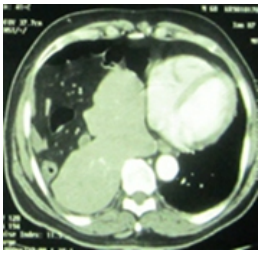

FIGURE 5

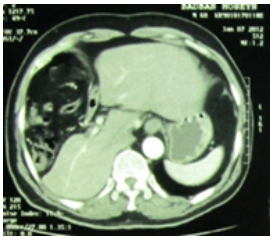

FIGURE 6

Figure4show right lower zone withopacification. Figure5 and 6 display CT-scan show herniated and vertically position of liver with displacement of mediastinum, and show omentumand colon.

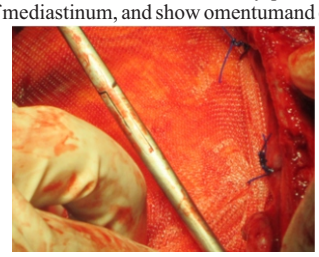

FIGURE 7

Figure 7show totally replacement of diaphragm with mesh and fixation to ribs.

Case 3

A 25-year-old man referred to our unit with 2 days history of progressive left sided chestpain,epigastric pain and dyspnea. There was no other positive history excepta penetrating truma of left hemithorax 2 year ago during an army training without Hemopneumothorax.On examination,he was distressed and in pain. Her pulse rate was 98 /min and regular, blood pressure was 90/60 mmHg and respiratory rate was 32/min. Examination of the chest wall and lungrevealed a decreased air motion in the left side, and was dull in percussion. There was a shift of mediastinum to the right side. The epigastrium andleft hypochondrium were tender. The haematological and biochemical parameters were within normal limits. The chest X-ray revealed a large air fluid level in the left hemithorax (Fig.8). An ultrasonogram of the chest and abdomen was performed which showed a large collection of fluid in thehemithorax but was not differentiated whether it was supradiaphragmatic or infra-diaphragmatic.A CT-scan of chest was performed,there was a massive hydropneumothorax. A clinical and imaging suspicion of hydropneumothrax was entertained and a chest-tube was placed which was no significant drainage and clinical situations of patient was not improved.

During theadmission the symptoms of obstruction worsened and shewas referred to emergency room.In emergency room with needle(16), multiple aspiration was performed, a large amount of air and greenish fluid was aspirated.After evacuation of air and 600 ml of gastric content,led to immediate relief of symptoms.There antero–lateral thoracotomy was performed immediately. There was a 7 cm linear tear in the left dome of the diaphragm through which the stomach, greater omentum, part of transversecolon had herniated into the left pleural space. The herniated organswas reductedto theabdomen. The diaphragmatic tear was partially repaired with prolene mesh and fixed to ribs. An intercostal drain was placed in the left pleura. He made an uneventful recovery except for left lower

atelectasis, which was treated with chest physiotherapy.

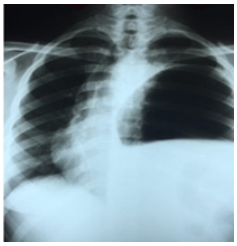

FIGURE 8

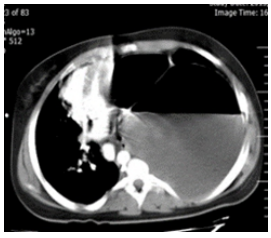

FIGURE 9

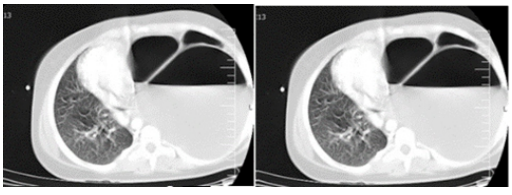

FIGURE 10

Figure8shows CXR with air fluid level and shift of mediastinum. Image 9displays CT –scan of chest shows large air fluid level with sever shift of mediasinum and collapse of left and right lung.Also figure 10 show CT –scan of chest show loculated large air fluid level with sever shift of mediasinum and collapse of left and right lung and heart.

Case 4

A previously healthy 19-year-old girl presented to the emergency department with a 6 hours history ofsever abdominal, left chest pain and increasing respiratory distress. Her respiratory rate was 36/min and heart rate was 110/min, auscultation of chest revealed diminished breath sound over the left side. This patient had a history of left side chest, knife injury and tube–thoracostomy was performed for hemothorax two year ago. A chest and abdominal x-ray(Fig 11) showed a large air-fluid level in the left hemithorax withair–fluid level and shift of the mediastinum to the right side with suspiciousof tension gastrothoraxand colothorax. Prompt insertion of a nasogastric tube was not possible. A chest CT scan was performed and showed a massive hydropneumothorax in the left hemithorax with septations (Fig. 12).During the procedure her symptoms of obstruction worsened while she was taken up for emergency room,a chest –tube inserted in left pleural space and 1800 cc mall odorous fluid with air exited. After this procedureOn the same day, the patient underwent left- later thoracotomy,stomach was collapse and a 4 cm perforation was found in the body of stomach and transvers colon was gangrene and multiple perforation was presented .thoracotomy incision extend to the abdomen(thoraco-abdominal). Transverse colon was resected and doublebarell colostomy was performed. Perforation of stomach was repaired. An8 × 6 cm defect was present in the central portion of left diaphragm.The diaphragmatic defect was repaired totally with prolene mesh. An intercostal drain was placed in the left pleura.The postoperative course was uneventful and she was discharged home 7 days after surgery. The colostomy was revised 8 week later.

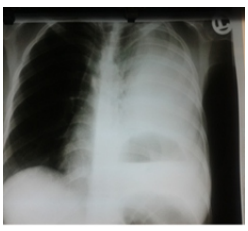

FIGURE 11

FIGURE 12

Figures 11 and 12 show left sideopacification and air –fluid level,multiple air –fluid level with intestinal obstruction.

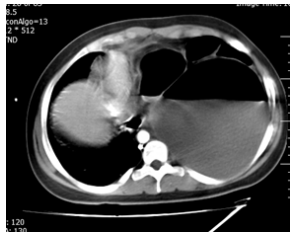

FIGURE 13

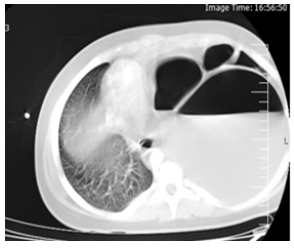

FIGURE 14

Figures13 and 14 display CT-scan with air –fluid collection,shift of mediatinum and septation.

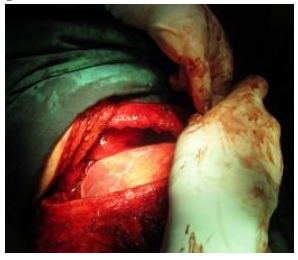

FIGURE 15

Case 5

A 16-year-old girl presented to our unit with 4 dayshistory of progressive left sided chestpain, dyspnea.In past history there was no positivehistory of trauma and no other chest disease. Onexamination, she was distressed and in pain. Her pulse ratewas 110 bpm, blood pressure was 100/70 mmHg andbreath rate was 38/min. Examination of the chestrevealed a decreased air entry in the left side, which wasdull in percussion. There was ashift of mediastinum to the right side. The epigastrium andleft hypochondrium were tender. The hematological and biochemical parameterswere within normal limits. The chest X-ray revealed alarge air fluid level in the left hemithorax (Fig. 1). A clinical suspicion of diaphragmatic hernia or massive hydropneumothorax was entertained and anasogastric tube was placed with no significant aspiration. An ultrasonogramof the abdomen was performed whichshowed a large collection of fluid in the left upper quadrant .A chest CT scan was performed and showed a massive hydropneumothorax in the left hemithorax(Fig. 2). During theevaluation, her symptoms of obstruction worsened while shewas reffered for emergency surgery. The patient had cardiac arrest as she entered theanaestheticroom. There was no air entry on the left sidewith a shift of mediastinum. She was intubated and a chest –tube inserted in

left pleural space and 2000cc greenish fluid with air exited. After this procedure O2 saturation was92% and The patient's vital signs improved immediately.Patient referredto ICU department. Percutaneous needle thoracostomy decompressed the stomach without causing spillage of gastric contents.Herniation of abdominal viscera into the thorax following traumatic diaphragmatic hernia can simulate acute tension pneumothorax. A case is presented of a blunt trauma victim with apparent acute diaphragmatic rupture, tension hemothorax, or tension hemopneumothorax. Nasogastric tube insertion demonstrated tension gastrothorax, but was followed by acute clinical decompensation. Percutaneous needle thoracostomy decompressed the stomach without causing spillage of gastric contents. Autopsy experimentation was performed to demonstrate that needle decompression of the distended stomach is well tolerated. Tension gastrothorax is a rare, life-threatening complication of traumatic diaphragmatic hernia. Although nasogastric tube placement should be attempted first, it may exacerbate the condition. Percutaneous needle decompression of the stomach through the chest wall can stabilize the situation and is safer and more rapid than chest tube placement, which might be either ineffective or dangerous. Paralyzing the patient with acute diaphragmatic rupture before tracheal and gastric intubation might prevent progression to tension gastrothoraxA laparotomy was performed immediately. Therewas an 8 cm linear tear in the left –lateral side of the diaphragmthrough which the stomach, greater omentum, had herniatedinto the left chest. . The stomach Herniation of abdominal viscera into the thorax following traumatic diaphragmatic hernia can simulate acute tension pneumothorax. A case is presented of a blunt trauma victim with apparent acute diaphragmatic rupture, tension hemothorax, or tension hemopneumothorax. Nasogastric tube insertion demonstrated tension gastrothorax, but was followed by acute clinical decompensation. Percutaneous needle thoracostomy decompressed the stomach without causing spillage of gastric contents. Autopsy experimentation was performed to demonstrate that needle decompression of the distended stomach is well tolerated. Tension gastrothorax is a rare, life-threatening complication of traumatic diaphragmatic hernia. Although nasogastric tube placement should be attempted first, it may exacerbate the condition. Percutaneous needle decompression of the stomach through the chest wall can stabilize the situation and is safer and more rapid than chest tube placement, which might be either ineffective or dangerous. Paralyzing the patient with acute diaphragmatic rupture before tracheal and gastric intubation might prevent progression to tension gastrothoraxHerniation of abdominal viscera into the thorax following traumatic diaphragmatic hernia can simulate acute tension pneumothorax. A case is presented of a blunt trauma victim with apparent acute diaphragmatic rupture, tension hemothorax, or tension hemopneumothorax. Nasogastric tube insertion demonstrated tension gastrothorax, but was followed by acute clinical decompensation. Percutaneous needle thoracostomy decompressed the stomach without causing spillage of gastric contents. Autopsy experimentation was performed to demonstrate that needle decompression of the distended stomach is well tolerated. Tension gastrothorax is a rare, life-threatening complication of traumatic diaphragmatic hernia. Although nasogastric tube placement should be attempted first, it may exacerbate the condition. Percutaneous needle decompression of the stomach through the chest wall can stabilize the situation and is safer and more rapid than chest tube placement, which might be either ineffective or dangerous. Paralyzing the patient with acute diaphragmatic rupture before tracheal and gastric intubation might prevent progression to tension gastrothoraxwere reduced. A 6 cm perforation were seen on the greater curvature.The patient's vital signs improved immediatel. The big defect of diaphragmatic was reconstructed with prolene mesh fixed to ribs. Anintercostal drain was placed in the left pleura. Shewas referred to the intensive care unit.Six hours after surgery, she presented symptoms and signs of re-expansion pulmonary edema. After doing conservative management the conditions of patient was improved.48 hour after surgery,patient was extubated and discharged on day 8 postoperation.

FIGURE 16

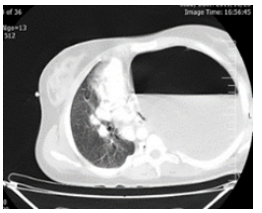

FIGURE 17

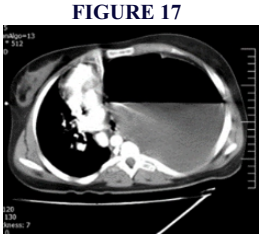

FIGURE 18

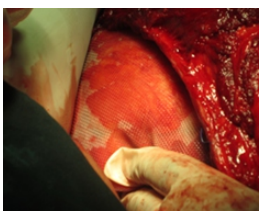

FIGURE 19

Figures 16,17, and 18 CXR show major air–fluid level with shift of mediastinum.CT scan show massive air-fluid level with shift of mediastinum.

Discussion

Diaphragmatic rupture is a rare complication of trauma, reported in 1%-7% of major blunttrauma patients and 10%-15% of penetrating trauma [1, 2, 6, 16].Tension gastrothorax describes a distended intrathoracic stomach witch herniation through a congenital or acquired diaphragmatic defect to the pleural space. Gastric distension in the pleural space can compress the lung and mediastinal shifting. This condition is liftrating [4, 5, 7, 14]. Horst, described pathophysiology events which lead to tension gastrothorax [9,15]. The cause of herniation is abdominal pressure increase, stomach herniates through a preexisting defect in the diaphragm. Then(TGT) may occur at any time when the stomach suddenly fills with air, fluid or food through one-way valve mechanism created by abnormal angulation of the gastroesophageal junction combined with gastric outlet obstruction caused at the level of the diaphragm [4,5,8,14].Two of our patients had heavy exercise and anther one had army effort in the mountain with past history of blunt and penetrating truma.The clinical picture of (TGT) is acute respiratory distress, chest wall and epigastric pain. Reduced or absent breathing sounds in the left hemithoraxand shifting of the heart bit to the right side. This condition is commonly been mistaken for a tension pneumothorax and managed leading to increased morbidity and mortality [4,5,8] As three of our patients which first diagnosis was (TGT)or tension bulla.After patients conditions become stable, chest x-ray is the first tool for differentiating between the above mentioned diagnoses. In the (TGT), the chest x-ray findings are: 1- a large air-filled structure with or without air fluid level in the left hemithorax.2- a superior rim formed by compressed left lung and stomach wall.3- there is not a stomach bubble in the left upper quadrant.4- the left hemidiaphragm shadow will be poorly defined .5- shifting mediastinum to the right [1,3,8,10]. As our patients had all above mentions.But in left-sided tension pneumothorax,the entire left lung is compressed and all lung surrounded by intrapleural air, hemidiaphragm depressed and well-defined [1,2,3,4,5,6]. First step in the management of tension gastrothorax is immediate placement of a large nasoor orogastric tube to decompress the dilated stomach [4,5,12,14,15]. If this maneuver fails, transthoracic needle decompression of the stomach is recommended [4,5,14]. If this maneuver fails too we recommend chest-tube insertion.In two of our patients this maneuver improved the clinical situations. Positive pressure ventilation allows immediate re-expansion of the lung and forces intraperitoneal contents back into the abdomen (14) we did this maneuver in one of our patients but did not improve clinical state of

patient.Instant clinical improvement should occur after stomach decompression [10,11]. If deflation of the stomach does not occur, the mediastinal shift can impair venous return and lead to cardiac arrest [4,5,12,14].

Definitive management after initial resuscitation in this emergency conditions, With thoracotomy orLaparotomy is the access of choice, but we do thoacotomy and thoraco-abdominal approach in our patients. Tension colothorax causingsever shifting of mediastinum, collapse of the underlying lung and cardia compression. It is a surgical emergency. It is more common on the left side and the colon is most likely to herniate[21]. It can be asymptomatic or present with abdominal pain, intestinal obstruction and cardio-respiratory distress[21]. One of our patients was presented with tension gasterocolothorax.

Right-sided diaphragmatic ruptures are rare and difficult to diagnose, as chest radiography often does not show any specific signsand may show only elevation of the right diaphragmatic border. Right sided ruptures are associated with high mortality and morbidity [16, 8, 6]. Right-sided diaphragmatic rupture and subsequent herniation of viscera is uncommon, and is associated with a higher morbidity and mortality than left-sided hernias. There are three phases used to describe the presentation of traumatic diaphragm rupture: acute, latent, and obstructive phases [13]. The acute phase occurs during the recovery time from the initial injury. These diaphragmatic injuries are missed, often due to masking from other sever, co-existing injuries [1,2,6, 16]. The diagnosis may also be delayed in patients. The latent phase refers to an asymptomatic period, where herniations are found incidentally on radiologic imaging performed for other reasons. During the obstructive phase, patients are symptomatic often from GI obstruction or perforation and cardiovascular compression secondary to herniation of abdominal contents into the thorax due to sever physical activity [3,6, 7,15]. Two of our patients presented with sever dyspnea, chest wall and abdominal pain after physical activity with herniation of colon and liver and were presented 4 to 8 years after the initial trauma. Accordingly, delayed diagnosis is common in right-sided ruptures, often resulting in severe complications,such as strangulationand intrathoracic herniation of the hollow organs (stomach, colon, and small bowel)[17, 18]. Cases of right diaphragmatic rupture with hepatothorax may result in severe atelectasis of the right lung or tension mediastinum, thereby severely impeding respiration and circulation [3,6, 16].As our cases with colon and hepatothorax. In these kind of conditions an abdominal and chest CT should be performed quickly, and surgical repair via a trans-thoracic or trans-abdominal approach should be considered immediately following radiographic confirmation [3,11,16,17,18].

We used thoracotomy approach. Because the size of the rupture is often too large a primary repair not possible, and prosthetic mesh may be necessary [19, 20]. As in two of our cases defect was very large and we used total prolene mesh for repair of total defect of diaphragm without complications. Primary closure of the diaphragm in emergency is not always possible, and is challenging issues. Because Autologous or local tissues such as the pericardium is not available[22, 23].

Defects in the diaphragm should be closed or reconstructed with the same principle as repairing or reconstruction of abdominal and chest wall defects [24]. Primary closure of the diaphragm is not always possible [10]. Synthetic meshes are used because it is available in all conditions even in emergency patients.The limitations of synthetic meshes are in the compromised or infected wounds cases, bioprostheses or bioartificial materials are used in some elective surgerieswith some challenging issues about their cost and mechanical instability and are not available in emergency conditions [23,24,25]. We used synthetic meshes in five cases and one of them had infected pleural space but outcome was good.The only limitation of this case study is a small number of cases.

Conclusion

Diagnosis of diaphragmatic rupture is difficult and have a clinical suspicion in high risk patients and using of radiologic modalities for diagnosis and treatment. Moreover, delayed diaphragmatic rupture and diaphragmatic hernia should be considered in patients with recent blunt trauma and gastrointestinal or respiratory complaints.In emergency conditions,synthetic meshes are an available material can use for large defect of diaphragms partially or totally.

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