New Advances in Mangement of Diaphragmatic Rupture

Essay

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بِسْمِ اللّهِ الرّحمَنِ الرّحيمِ

[...رَبِّ أَوزِعنِي أَن أَشكُرَ نِعمَتَكَ
الّتِي أَنْعَمْتَ عَلَيَّ وعَلى والِدَيَّ
وأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ
وأَدْخِلْنِي بِرَحْمَتِكَ فِي
عِبَادِكَ الصَّالِحِينَ]

صدق الله العظيم

النمل.. اية رقم ١٩

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Amr Seif ElDeen Mahmoud

Contents

List of Abbreviations

AIS ..... Abbreviated injury score.
C2 ..... Cervical-2.
CDH ..... Congenital diaphragmatic hernia.
Cm ..... Centemeter.
Cm H_2O ..... Centemeter water.
COPD ..... Chronic obstructive pulmonary disease.
CT ..... Computerized tomography.
DH ..... Diaphragmatic rupture.
DI ..... Diaphragmatic injury.
DR ..... Diaphragmatic rupture.
ECG ..... Electro cardiography.
ER ..... Emergency room.
FAST ..... Focused abdominal sonography for trauma.
H_2O ..... Water.
ICD ..... Intercostal drain.
ISS ..... Injury severity score.
IVC ..... Inferior vena cava.
LT ..... Left.
Ml ..... Milliliter.
MRI ..... Magnetic resonance imaging.
Mv^2 ..... Mass and velocity.
MVA ..... Motor vehicle crashes.
MVCs ..... Motor vehicle crashes.
PEG ..... Percutaneous endoscopic gastrostomy.
PTFE ..... Polytetrafluoroethylene.
Rt ..... Right.
T5 ..... Thoracic-5.
T9 ..... Thoracic-9.
TDI ..... Traumatic diaphragmatic injury.
TDR ..... Trumatic diaphragmatic rupture.
UGI ..... Upper gastrointestinal.
US ..... Ultrasonography.
VATS ..... Video assisted thoracoscopic surgery.

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Introduction

The diaphragm is a musculomembranous entity separating the thorax from the abdomen. The muscular part originates anteriorly from the xiphoid process, laterally from the inner surface of the six lower cartilages, and posteriorly from the medial and lateral lumbosacral arches, the median arcuate ligament, and the bodies of the three upper lumbar vertebrae. The muscular part inserts on the central tendon ***(Skandalakis et al., 2007).***

Sennertus in 1541 was the first to report a diaphragmatic injury, in a postmortem examination. In 1579, Paré described the consequences of diaphragmatic herniation in blunt and penetrating injuries. In 1853, Bowditch became the first physician to diagnose a posttraumatic diaphragmatic hernia in vivo. In 1886, Riolfi performed the first repair of a diaphragmatic herniation after a stab wound, while Walker in 1900 was the first surgeon to repair a diaphragmatic hernia after blunt trauma ***(Susmallian and Charuzi, 2003).***

Traumatic diaphragmatic hernias are classified into three phases. The acute phase extends from the time of original trauma to the apparent recovery from the primary injuries. The latent phase begins as the intraabdominal viscera occupy the defect and variously herniate into the thoracic cavity. The obstructive phase begins with the signs of visceral obstruction or ischemia as in other hernias ***(Karnak et al., 2001).***

Diaphragmatic herniation can occur in two places, Intra thoracic herniation where the defect through the muscular portion of the diaphragm. Intrapericadial herniation where the defect through the central tendon of the diaphragm. It is a very rare injury. Crawshaw described the first case of traumatic tear of the diaphragm and pericardium in 1952. Less than 100 cases have been reported in the literature to date ***(Cipe et al., 2012).***

TDR may be caused by blunt trauma or penetrating injuries, representing 80–85% and 15–20% of traumatic causes, respectively. Diaphragmatic lesions originating from blunt trauma, most often resulting from motor vehicle collisions and/or high kinetic energy traumas, are less frequent and found in 0.5–8.0% of patients undergoing emergency exploratory laparotomy. Penetrating trauma is reported to be the most common cause of diaphragmatic injuries. In a few cases, TDR may be classified as due to iatrogenic causes ***(Bocchiniet al., 2012).***

The size of TDR is smaller in penetrating trauma than in blunt trauma. Small ruptures are potentially more dangerous because of a tendency to overlook the wound, the progression of diaphragm herniation, and strangulation in the late phase. However, large ruptures have high probability for herniation of intra-abdominal organs into thorax in the acute phase. The

stomach was the most herniated organ into thorax through TDR in the acute phase ***(Dirican et al., 2011).***

Although autopsy studies have revealed equal incidence of right and left diaphragmatic ruptures, antemortum study reports suggest 88–95% of diaphragmatic ruptures occurred on the left side. Right sided ruptures are associated with high mortality and morbidity and thus the under diagnosis of right sided injuries may be due to greater pre hospital mortality. Right sided tears are significantly less likely than left sided tears because of the protective effect of the liver. This could also be explained by better visualisation of the left diaphragm, on diagnostic laparoscopy, but restricted visualisation of the right diaphragm ***(Rashid et al., 2009).***

Traumatic diaphragmatic rupture as a result of blunt trauma is produced by sudden increase in the pleuroperitoneal pressure gradient that occurs at areas of potential weakness along the embryological point of fusion. and majority of the time it involves the left hemidiaphragm. Any penetrating injury below the 5^{th} intercostal space should be suspected of having diaphragmatic and thoracoabdominal injuries ***(Chandra et al., 2007).***

The most frequent acute symptoms of DR are chest, scapular, and abdominal pain. Unfortunately, the clinical diagnosis of DR is difficult and is missed in 7 to 66%

ofpatients. Dyspnea, due to lung compression by the intra-abdominal visceral herniation can be present. Additionally, 75% of patients with DR have an associated intraabdominal injury. If the symptoms are not conspicuous and the diagnosis of DR is delayed, the traumatic visceral herniation may become complicated with incarceration and strangulation ***(Sangster et al., 2007).***

The pathophysiological sequelae of a ruptured diaphragm affect both the circulation and respiratory systems due to the reduced function of the diaphragm, lung compression, mediastinal shift, and therefore impaired venous return to the heart. Physical findings can be either thoracic or abdominal. Thoracic signs include decreased breath sounds, fractured ribs, flail chest, and signs of hemothorax or pneumothorax. Auscultation of bowel sounds in the chest is pathognomonic of diaphragmatic rupture, occurring due to herniation of bowel contents. Abdominal signs include abdominal pain, guarding, absence of bowel sounds, and abdominal swelling, depending on the extent of injuries. Occasionally physical examination can be relatively normal ***(Nain et al., 2012).***

Missed diaphragmatic injury following initial trauma have been reported in between 9.5% and 61% of cases The detection of these injuries is often difficult because of nonspecific clinical signs, the presence of additional intra

abdominal injuries and other injuries that may demand urgent treatment and distract attention, and at times, due to a lack of awareness of this clinical entity. This leads to progressive herniation of the abdominal organs into the thorax over time. Clinical presentation of a late diagnosed DH, which is encountered only rarely on the right side, requires diagnostic and therapeutic approaches different from those associated with acute DR. Therefore, a diagnosis of DH should be considered in patients with a history of high-energy trauma ***(Guner et al., 2012).***

The increasing popularity of conservative management for solid organ injury after blunt trauma increases the risk of missing DI. Reiff et al.17 discussed this issue. Splenic injury, pelvic fracture, occupant compartment intrusion >30 cm, and a velocity change >40 km/h have a sensitivity higher than 85% for DI. Thus, all appropriate diagnostic modalities should be performed to rule out DI in these patients ***(Özgüç et al., 2007).***