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Rupture diaphragm: Early diagnosis and management

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ABSTRACT

Background: This kind of pathology is uncommon and even may pass unnoticed in casualty patients or iatrogenic after major abdominal surgeries. The repair of such pathology is simple in most cases.

Methods: Over 10 years in Saudi German Hospital in Madinah, KSA; we reviewed retrospectively 39 cases of diagnosed diaphragmatic tears due to many causes. The cases were reviewed regarding preoperative, operative and postoperative variables.

Results: The outcome of the repair of the diaphragm was good relieving the symptoms with no complications related to the repair of the diaphragm. The morbidity and mortality were due to the associated injuries.

Conclusions: Early diagnosis and avoiding misdiagnosis as pneumothorax are crucial in the management. Plain CXR and even CT chest without contrast are mandatory in cases of blunt trauma with other multiple system injuries even to the abdomen alone.

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1. Introduction

This pathology was first presented by Sennertus who first described such pathology in 1541. Later on, it was described in 1886 by Riolfi and first published in 1951 by Carter and his colleagues [1]. Diaphragmatic injury is mostly caused by blunt or penetrating traumas. It is uncommon, but it might carry the risk of being misdiagnosed as pneumothorax, or delayed diagnosis, in the OR, or even after hospital discharge. By far the most common etiology is the blunt trauma mainly road traffic accidents (RTAs). This pathology may be present in 2% or less of all trauma cases. Rarely it is an isolated pathology but more commonly associated with major organ injuries [2].

The main causes of diaphragmatic injuries are blunt trauma in RTAs, fall from height, stabs, gun shots missile injuries or iatrogenic during chest or abdominal surgeries [3]. In some series the injury of the diaphragm may be present in 8% of all chest trauma cases [4]. The exact mechanism leading to rupture is not well known but there are hypotheses which might explain

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how it happens. The most accepted one is the increased intra-abdominal pressure in blunt traumas creating pressure gradient between the chest and the abdomen leading to rupture and subsequent visceral herniation into the thoracic cavity [5,6]. The most common site of injury is the left side and the most common organ to be herniated is the stomach then the spleen or both. The side trauma is the commonest mode of trauma leading to such pathology while the front or back traumas have lesser incidence [7,8].

The early diagnosis may be missed in the initial clinical assessment or the plain CXR. Yet, there are clues in the plain CXR; such as raised diaphragm, interrupted contour or gas bubble in the thorax [9]. The CT chest is the most accurate tool of detecting early cases. In spite of that, the CXR and CT chest may not provide early diagnosis of such injury, moreover; laparotomies may also overlook it in 15% of cases [6,10]. In trauma cases, we must focus on the left copula as left diaphragmatic rupture represents 50–80% of cases of ruptured diaphragm in blunt chest trauma [11].

Despite the simple technique of repair, mortality is high in such cases due to other associated major injuries.

Another cause of diaphragmatic injury is iatrogenic, mainly due to major abdominal or thoracic surgeries.

2. Patients and methods

The reviewed cases of repair of the diaphragm were performed between January 2006 and December 2016 in Saudi German Hospital in Madinah; KSA. They were 39 cases. 36 cases presented in the ER room in major RTAs, and they were diagnosed primarily as ruptured diaphragm.

The other 3 cases presented late; two of them were submitted for major abdominal surgeries (one year before admission) and the diaphragm was injured during the surgeries. The third patient had a history of trauma due to RTA 3 years before he was admitted for coronary artery bypass grafting (CABG). The injury was discovered accidentally during left internal mammary artery (LIMA) harvesting.

2.1. Diagnosis

Plain CXR was done in all cases and it was not conclusive in 23 patients (59%). It showed in the remaining patients loss of diaphragmatic contour, elevated left diaphragm than the right, small or large bowel in chest, gas bubbles in the chest, seen nasogastric tube in the chest, and pleural collection with obliteration of the costophrenic angle. In some cases that had large herniation, the mediastinum was pushed to the contra-lateral side. Pneumothorax, hemopneumothorax, loss of gastric bubble under left cupola and/or pneumoperitonum may also be detected.

2.2. CT chest without contrast

CT chest without contrast was done pre-operatively for 37 patients (one case was not submitted for CT chest and was diagnosed accidentally intra-operative as right side injury-after liver donation and another was the case discovered accidentally during LIMA harvesting for CABG) confirming the same findings like in the plain CXR. CT chest gave a highly positive yield (100%) in the diagnosis of diaphragmatic injuries. The important sign was discontinuity of the diaphragm. Some cases showed hour glass sign (Collar sign). Focal diaphragmatic thickening might be demonstrated Figs. 3 and 4.

We did not need to proceed for the MRI. Abdominal ultra-Sonography was done in all cases and it was not conclusive and its main role was in the primary assessment of poly-trauma cases.

We used the naso-gastric test in some patients in the ER room for primary diagnosis of the ruptured diaphragm. Blowing gently in the naso-gastric tube with synchronous auscultation of the chest revealed air sounds; despite it was not the tool we counted upon, it was positive in 100% of cases.

2.3. Operative procedures

The planned procedures were in cases that had a settled diagnosis of diaphragmatic injury before admission to the OR. The unplanned procedures were in those patients with encountered diaphragmatic injury during abdominal or chest surgeries. The plan was set according to the associated injuries. All cases were submitted for open surgical repair (abdominal or thoracic) under general anesthesia. 36 cases were acutely presented in RTAs. The remaining 3 cases were chronic; two of them did not have a pre-operative plan for repair of the torn diaphragm as they were accidentally discovered intra-operatively, the third case was planned for transthoracic repair (post-gastric pull-up surgery).

2.3.1. Planned procedures: Used in 37 patients

The abdominal approaches were the most commonly used in planned procedures (27 cases; 69.23%). These cases had associated abdominal organs injured.

2.3.1.1. Abdominal approach: Used in 27 patients. The abdominal approach for the rupture diaphragm was performed in the acute early cases.

Under general anesthesia in the supine position; median skin incisions were performed in all cases.

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