Blunt traumatic rupture of the diaphragm: Study of 33 cases

Firas M. Al-Chalabi, Haytham H. Al-Najafi

Department of Surgery, College of Medicine, University of Mosul

Received 18th Jan, 2005; Accepted 10th May, 2006

ABSTRACT

Objective: To assess the role of clinical manifestations and radiological findings in the early recognition and diagnosis of blunt diaphragmatic rupture, with determination of the operative findings during surgical intervention.

Design: A prospective case series study.

Setting: Al-Jamhori Teaching Hospital in Mosul, during the period July 1999-June 2004.

Participants: Thirty Three (33) patients with blunt traumatic rupture of the diaphragm proved by surgery.

Results: Three quarters of the blunt diaphragmatic rupture were caused by motor vehicle accidents, 91% of the patients had respiratory embarrassment. Only 27.2% of the patients were diagnosed by chest x-ray, the remaining 72.8% were discovered during laparotomy. The left dome of the diaphragm was ruptured in 75.8%, whereas herniation of the abdominal viscera into the chest was found in 45.8%. Concomitant intra-abdominal injury was found in 84.8% of the patients. The mortality is sharply increased when the right dome of the diaphragm is ruptured.

Conclusion: The clinical features may be masked by other chest or abdominal injuries. Chest x-ray is a reliable test to diagnose diaphragmatic rupture. The left hemi-diaphragm is more commonly injured, in addition concomitant intra-abdominal injuries are very common. A meticulous inspection of the diaphragm should be undertaken during all exploratory laparotomies for trauma.

© 2006 Mosul College of Medicine
Bunt rupture of the diaphragm is no longer uncommon, and its incidence has risen sharply, with the increase in high-speed accidents from motor vehicle collisions. However, the mechanism for diaphragmatic rupture (DR) is high speed blunt abdominal trauma with a closed gutter.

Clinically, the patient may present with vague symptoms, as dyspnea, chest pain, and cyanosis. The diagnosis of acute DR is difficult to establish in the immediate posttraumatic period due to obscuration caused by overlying hematothorax or displacement of abdominal organs.

In addition, the fact that most patients with DR usually have sustained additional multiple traumatic injuries elsewhere in the body, does also play a role in diverting attention in more than one site as to allow more likely for missing DR.

In fact, it has been stated that DR should be suspected in all patients with radiological abnormalities of the diaphragm, lower lung field haziness, hemothorax, or displacement of abdominal organs. DR should be considered in the differential diagnosis of thoracic trauma and intra-abdominal injuries.

However, chest x-ray remains the closer beneficial test for diagnosing DR. All cases of DR, weather diagnosed pre-operatively or intra-operatively, must be repaired surgically in order to avoid long term sequel.

The presence of DR should be excluded before the termination of an exploratory laparotomy in such circumstances. Delay in the recognition of DR can be life threatening since it can lead to hemothorax or intrathoracic injuries into the thorax with possible strangulation or respiratory embarrassment.

This study aims to assist the clinical and radiological features that contribute to the early recognition and diagnosis of DR, on evaluating patients suspected to blunt abdominal trauma. It also aims to determine the method of treatment, the exploratory findings, and the concomitant intra-abdominal injuries.

Patients and methods

Over a five-year period (July 1999- June 2004), all patients diagnosed and surgically treated for blunt diaphragmatic rupture (DR) who were admitted to the three surgical units at Al-Jamhuri Teaching Hospital in Mosul, were studied. Concerning, clinical manifestations, radiological studies, surgical findings, mortality, and morbidity.

On admission, all these trauma patients were assessed clinically for signs of acute abdomen (pain, tenderness, guarding, rigidity), and examined for any injury to other parts of the body, to exclude head injury, pelvic injury, or fractures and wounds. In addition, most of the patients that undergone chest film examination to exclude thoracic injury. All patients radiologically proved to have DR were evaluated for the presence of chest pain, shinness of breath, and respiratory distress. Whereas patients surgically proved to have DR were interrogated postoperatively for chest pain, shortness of breath, and respiratory distress.

According to the clinical and radiological assessment, the patients were either subjected to emergency laparotomy or kept on conservative management. All patients who were kept initially on conservative therapy (the delayed group) were all operated on within 48 hours after admission to the hospital because of either developing signs of peritonitis or radiological evidence of visceral herniation into the chest.

Verification of the diagnosis of DR in all patients was performed after surgical intervention. All surgical findings regarding the diaphragmatic tear, the herniated viscera, and other associated intra-abdominal injuries were recorded. All
Results
Thirty five patients with blunt trauma, had undergone surgical repair of the diaphragm during exploratory laparotomy. Thirty seven (72.1%) patients had sustained motor vehicle accidents, 5 (15.2%) patients were due to direct violence to the abdomen, the remaining 3 (9%) had fallen from height.
On admission, 30 (91%) patients had respiratory symptoms as chest pain, dyspnoea, or respiratory distress, whereas 21 (63.6%) patients had signs and symptoms of acute abdomen. In addition, all patients had associated extra-abdominal injuries as shown in table (1).
Twenty nine patients underwent chest-x ray on admission, five (17.2%) of these were diagnosed as DR, because they had radiological evidence of visceral herniation into the chest; 11 (38%) patients had no detectable radiological abnormality, in the remaining 13 (44.8%) patients non-specific radiological abnormalities such as haziness, hemothorax or elevated diaphragmatic arcs were encountered.
Twenty six (78.8%) patients were subjected to emergency laparotomy within six hours of admission, because of signs of acute abdomen in 21 patients, and radiological evidence of DR in 5 patients. The symptom (72.1%; 21/29) pathologic delayed group were submitted to a second chest-x ray while maintained on conservative management, 4 of them had shown radiological evidence of herniated abdominal visera into the chest, the remaining three patients developed signs of peritoneal two of them within 24 hours, and within 36 hours in one patient.

Table (1): The extra- abdominal associated injuries.

<table>
<thead>
<tr>
<th>Organs injured</th>
<th>Wound injury</th>
<th>Thoracic injury</th>
<th>Pelvic injury</th>
<th>Wounds</th>
<th>Fractures</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>18</td>
<td>24</td>
<td>9</td>
<td>27</td>
<td>3</td>
</tr>
</tbody>
</table>

Only nine (27.2%) patients were diagnosed as DR on radiological passes pre-operatively, the rest, 26 (72.8%) patients were found to have DR incidentally on exploration for acute abdomen.
During surgery, 25 (75.8%) patients were found to have left sided DR. 6 patients had right sided DR, the remaining two had bilateral rupture of the diaphragm.
Herniation of abdominal viscerota into the thoracic cavity was encountered in 15 (45.4%) patients, in 14 of them was on the left side, the stomach being the most common herniated organ as in table (2).
Only one patient had a herniated liver into the right thoracic cavity. In 26 (78.8%) patients, a radial tear in the dome of the diaphragm was found. Whereas, in 1 (21.2%) cases the diaphragm was nearly avulsed from the thoracic cage with remnant of about 1 centimeter, in 5 (15.2%) patients it was stippled posterolaterally, and in 2 (6%) cases it was antrioperatively.
Twenty eight (84%) patients were found to have concomitant intra-abdominal injuries as shown in table (2) in the remaining 5 (15.2%) patients, no other intra-abdominal injury was encountered apart from the diaphragmatic rupture.
Six (18%) patients died within 1-5 days after surgery, two of them had bilateral DR with severe hepatic injuries and other associated abdominal or thoracic injuries.
Three patients out of the six with right DR died for the same reason, but, only one patient with left sided DR died due to sepsisemia with subsequent uremia.
In other words, the mortality rate was 100% for patients with bilateral DR, 50% for right, and 4% among those with left sided DR.

Table (2): The number of organs herniated and the concomitant intra- abdominal injuries.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Stomach</th>
<th>spleen</th>
<th>colon</th>
<th>omentum</th>
<th>liver</th>
<th>mesentery</th>
<th>kidney</th>
<th>resectional</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of herniations</td>
<td>12</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No. of injuries</td>
<td>2</td>
<td>17</td>
<td>-</td>
<td>9</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>-</td>
</tr>
</tbody>
</table>
Discussion
In this study, motor vehicle accidents (MVA) stood as the commonest cause (75.6%) of blunt diaphragmatic rupture in conformity with the report of Voelter et al.11, and Harmas et al.12, where (MVA) was the main cause in 90% and 77% respectively. This is ascribed to the increase in the high speed accidents from motor vehicle collision13.

Thirty (91%) of our DR patients had respiratory manifestations, in the form of chest pain, dyspnea, and respiratory distress, which stand as an important pointer to the possibility of DR. However, Rodrigues et al.12, stated that 52% of his patients with DR had respiratory manifestations. This may be attributed to the 21 (63.6%) patients with a positive respiratory manifestation who were postoperatively interrogated. Likewise, respiratory manifestations of DR are variable and unpredictable specially in massively traumatized patients.10,11 However, the diagnosis is frequently missed in the acute phase. because of the presence of shock, respiratory insufficiency, visceral injury, or coma.11

In our study, we did not recognize respiratory embarrassment as diagnosis for DR, unless it was supported by chest x-ray, because it may be easier to direct trauma to the chest, shock state, or referred pain from the abdomen. But when respiratory manifestations develop after a severe blow to the abdomen without clinically evident trauma to the chest, the diagnosis of DR has to be contemplated13, and should be sought radiologically or surgically.

In our study, the pre-operative diagnosis by chest-x-ray was achieved in 9 (27.2%) patients, in other studies it ranges between (24-62%)13.14,15,16,17,12,14,15,16. However, DR can be diagnosed radiologically only if herniated stomach or bowel is constructed as it transits the torn diaphragm.20

Although non-specific radiological findings were encountered in 13(44.8%) of the 29 patients who underwent initial chest-x-ray on admission, they were either unpredictable or misinterpreted; such findings justify repeating the chest-x-ray rather than ignoring it. This will demonstrate the potential pitfalls of misinterpreting the chest radiograph, and the value of repeating it.11 However, a prompt recognition of this potentially life threatening injury is difficult when the initial chest-x-ray is unrevealing, and immediate or early operation is not done.17

In our study, we found that 24 (72.8%) of DR patients, were discovered during abdominal exploration for acute abdomen, but in their reports, Guth et al.19 stated that (42%) of the patients with DR were discovered at time of laparotomy.

Isolated affectation of only the left dome of the diaphragm with blunt injury is clearly more common than that of the right dome, which was reported as (75%) in two reports13,16, which is very similar to the present series (76%); one single report stated it as (56%)19, but most reports stated that left sided rupture was (57-87%).19 The high prevalence of left dome injury suggests that blunt trauma that
increase the incidence of the mortality rate.

In conclusion: diaphragmatic rupture represents a challenge to the surgeon, although it is not uncommon after blunt trauma. The presence of respiratory failures with suspicious chest X-ray remains the best diagnostic index, therefore chest X-ray is advisable for every patient with blunt trauma.

The left diaphragmatic rupture is more common, and had better prognosis than the right one, in addition associated extra-abdominal and intra-abdominal injuries are extremely common.

Acknowledgement: we are grateful to all colleagues in the three general surgical units of al-Jannah teaching hospital, for including in our study patients who were under their care.

References