Pneumobilia, pneumoperitoneum and pneumowirsung of traumatic etiology: Case report and review of the literature

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ABSTRACT

Pneumobilia is a phenomenon associated with the presence of a biliary-enteric fistula or manipulation of the bile duct during procedures or surgical interventions that cause dysfunction of the sphincter of Oddi. A known, but infrequently reported event, is the increase in intraabdominal pressure after closed abdominal trauma, which causes pneumobilia due to a mechanism of retrograde air leakage towards the bile duct. Depending on the general compromise of each patient, the prognosis can vary from a benign condition that only requires conservative management, to being life threatening. We present the case of a 75-year-old male patient who, after suffering a closed thoraco-abdominal trauma, presented with rib fracture and, in addition, gallbladder wall rupture, pneumoperitoneum, pneumobilia, and pneumowirsung, having a favorable clinical course after receiving conservative management.

Keywords: Biliary fistula; Sphincter of Oddi; Pneumoperitoneum (source: MeSH NLM).

INTRODUCTION

Pneumobilia is the presence of gas in the biliary tree. In most cases, it is related to cholecystoenteric fistulas of biliary origin, emphysematous cholecystitis, surgically created anastomosis between the intestine and the extrahepatic biliary tract, endoscopic interventions, and dysfunction of the sphincter of Oddi. Traumatic etiology has been associated with pneumobilia and there are few reported cases related to closed thoraco-abdominal trauma. It is usually a benign condition; however, it can be life threatening when it is due to an emphysematous infectious process, or in relation to the compromise of other organs injured in the trauma. We present the case of a patient who, after a closed thoraco-abdominal trauma, presented rib fractures, concomitantly with pneumoperitoneum, pneumobilia and pneumowirsung, receiving conservative management. He had a favorable clinical course.
During his clinical evolution, the patient presented oxygen desaturation, for which he was started on binasal cannula oxygen therapy. He received respiratory physiotherapy and continued with the established antibiotic treatment. Surgical expectant management was chosen.

On the 6th day of hospitalization, there was a decrease in thoracic and abdominal pain; likewise, the patient required less oxygen supply, starting oxygen weaning. Abdominal CT scan on the 10th day of hospitalization showed resolution of the pneumoperitoneum, but persistence of pneumobilia (Figure 7), and air was also found in the pancreatic duct of Wirsung (neumowirsung). (Figure 8)

A decision was made to keep the patient under observation and continue to provide conservative management, in conjunction with general surgery. On the 16th day of hospitalization, the patient did not present abdominal or chest pain. In addition, he was weaned off oxygen with good tolerance. His hospital course was uneventful, and he was discharged without complications.

DISCUSSION

Pneumobilia is defined as the presence of air in the biliary tree and implies an abnormal connection between the gastrointestinal and biliary tracts. (3) The most common cause includes the presence of gallstones and consequently biliary-enteric fistula. (1) Of these patients, up to 50% may present with pneumobilia. (7) It can also occur after a biliary-enteric anastomosis or manipulation of the bile duct in endoscopic procedures, such as ERCP, especially in cases in which sphincterotomy is performed, (1),(7),(8) a procedure creating incompetence of the sphincter of Oddi. (4) Other less common causes include malignant processes such as lymphoma of the duodenal papilla. (9)

The presence of pneumobilia without any intervention or procedure suggests an infectious process, such as emphysematous cholecystitis, pyogenic cholangitis, or an abnormal biliary-enteric connection that requires surgical management. (7) In the case presented, the patient had no
history of manipulation of the bile duct, either surgically or endoscopically, nor a history of gallstones. In addition, the abdominal ultrasound and abdominal tomography did not show cholelithiasis that could lead to a biliary-enteric fistula.

Some other etiologies for the development of pneumobilia are considered, especially trauma related. The development of pneumobilia is extremely rare after closed abdominal trauma (7,8), with a few cases reported to date. The patient we report fell while taking a bath. It is worth mentioning that most of the reported cases presenting with pneumobilia were the result of a high-impact abdominal trauma after a traffic accident, with multiple organic compromise.

It is known that the sphincter of Oddi can support a pressure of up to 60 cm H2O, thus preventing the passage of air into the biliary system. (2)(10) From a pathophysiological standpoint, post-trauma pneumobilia is the result of retrograde passage of air from the proximal intestinal lumen to the sphincter of Oddi and the biliary system, due to increased intra-abdominal pressure. (3)(7)(11) The same pathophysiological mechanism has been described in a reported case of pneumobilia after cardiopulmonary resuscitation. (12) We agree that this mechanism explains the presence of pneumobilia in the case presented, having closed thoracic-abdominal trauma as the sole associated factor. Unlike the cases reported to date, our patient also presented pneumowirsung (Figure 4), which supports the theory of retrograde air flow through the sphincter of Oddi, not only to the biliary system but also to the pancreas. In the literature, the presence of pneumowirsung has only been reported in association with postoperative patients, (13) but not as a result of thoraco-abdominal trauma.

Pneumoperitoneum in blunt abdominal trauma is usually associated with hollow viscus perforation. (8) In the case reported, in addition to pneumobilia, the patient had pneumoperitoneum. Despite the presence of rib fractures, no pneumothorax is evident. One possible mechanism to explain pneumoperitoneum could be related to the rupture of the gallbladder wall that was in contact with the area of the rib fracture. In the case reported by Howley et al. (8), pneumobilia plus pneumoperitoneum is reported, and it is considered that the intensity of the abdominal trauma caused retrograde passage of air through the sphincter of Oddi and was strong enough to cause rupture of the hepatic capsule, causing leak into the peritoneal cavity. The patient, they reported, later developed hepatic abscess formation, which supported this theory.
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Prompt diagnosis and early management of traumatic pneumobilia are necessary to minimize morbidity and mortality associated with causes requiring surgical treatment. Of the eleven cases reported to date, only one had a fatal outcome. The other cases had some sequelae, but these were due to complications more related to great impact traffic accidents than to pneumobilia itself.

Table 1. Reported cases of pneumobilia of traumatic etiology.

<table>
<thead>
<tr>
<th>Author</th>
<th>Age</th>
<th>Sex</th>
<th>Symptoms</th>
<th>Temp</th>
<th>Management</th>
<th>Complications</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gering, 2001</td>
<td>89</td>
<td>F</td>
<td>Hypotension, abdominal pain, chest pain</td>
<td>Humerus fracture, multiple rib fractures, hemotorax, intracerebral hemorrhage, massive pneumobilia, scant pneumoperitoneum, free fluid in pelvic cavity</td>
<td>Exploratory laparotomy</td>
<td>ARDS, hypovolemic shock</td>
<td>Passed away</td>
</tr>
<tr>
<td>Ladurner, 2005</td>
<td>50</td>
<td>M</td>
<td>ECG: 3, hypotension</td>
<td>Skull fracture, C3-C4 fracture, multiple rib fractures, right pneumothorax, Pneumobilia in control TEM after CPR</td>
<td>Chest tube drainage, C3-C4 fracture stabilization, right upper extremity total amputation</td>
<td>Cardio respiratory arrest requiring CPR</td>
<td>Resolution of pneumobilia at day 4</td>
</tr>
<tr>
<td>Barnes, 2006</td>
<td>47</td>
<td>M</td>
<td>Chest pain, abdominal pain</td>
<td>Left olecranon fracture, hemotorax, rib fracture, pneumobilia, splenic laceration</td>
<td>Chest tube drainage, exploratory laparotomy</td>
<td>None</td>
<td>Favorable</td>
</tr>
<tr>
<td>Barnes, 2006</td>
<td>34</td>
<td>M</td>
<td>Abdominal distention, abdominal pain</td>
<td>Hepatic laceration, pneumobilia</td>
<td>Conservative</td>
<td>None</td>
<td>Favorable</td>
</tr>
<tr>
<td>Barnes, 2006</td>
<td>45</td>
<td>F</td>
<td>Neurological dysfunction</td>
<td>Multiple rib fracture, right pneumothorax, sacral fracture, pneumobilia</td>
<td>Chest tube drainage, laparotomy, and thoracic aortic rupture repair</td>
<td>None</td>
<td>Favorable</td>
</tr>
<tr>
<td>Thompson, 2007</td>
<td>19</td>
<td>F</td>
<td>Absence of air-fluid sounds, ECG: 6</td>
<td>Extradural hematoma, multiple rib fractures, left pneumothorax, right hemotorax, sacral fracture, splenic laceration, pneumobilia</td>
<td>Conservative, evacuation of extradural hematoma</td>
<td>Neurological dysfunction</td>
<td>Resolution of pneumobilia at day 7</td>
</tr>
<tr>
<td>Howley, 2010</td>
<td>65</td>
<td>F</td>
<td>Right hypochondrium pain</td>
<td>Pneumobilia, pneumoperitoneum, peripheric free fluid</td>
<td>Exploratory laparotomy (hepatic laceration)</td>
<td>Liver abscesses</td>
<td>None</td>
</tr>
<tr>
<td>Yildiz, 2011</td>
<td>61</td>
<td>M</td>
<td>Right hypochondrium pain</td>
<td>Pneumobilia</td>
<td>Rest, broad-spectrum antibiotic therapy</td>
<td>None</td>
<td>Favorable</td>
</tr>
<tr>
<td>Sandhu, 2013</td>
<td>25</td>
<td>M</td>
<td>Abdominal pain</td>
<td>Pneumobilia, pneumoperitoneum, and ascites</td>
<td>Exploratory laparotomy (gastric perforation)</td>
<td>None</td>
<td>Favorable</td>
</tr>
<tr>
<td>Okan, 2015</td>
<td>18</td>
<td>M</td>
<td>Suprapubic pain</td>
<td>Pneumobilia, fracture in the sacrum and right acetabulum</td>
<td>Orthopedic surgery</td>
<td>None</td>
<td>Favorable</td>
</tr>
<tr>
<td>Fourneau, 2019</td>
<td>70</td>
<td>M</td>
<td>Neurological disorder, abdominal pain, hypotension</td>
<td>Hepatic laceration, hepatic subcapsular hematoma, hemotorax, rib fracture, pneumobilia</td>
<td>Conservative</td>
<td>None</td>
<td>Favorable</td>
</tr>
<tr>
<td>Chávez, 2023</td>
<td>75</td>
<td>M</td>
<td>Abdominal pain, chest pain</td>
<td>Rib fracture, pneumoperitoneum, pneumobilia</td>
<td>Conservative</td>
<td>None</td>
<td>Favorable</td>
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explains the good clinical evolution of the patient without the need surgical intervention. Therefore, pneumobilia of traumatic etiology would not be an indication for surgical management per se.

CONCLUSIONS

Closed thoracic-abdominal trauma can cause pneumobilia, pneumoperitoneum, and pneumowirsung. These diagnostic possibilities should be considered in the absence of pathological history or previous procedures. In addition, surgical management will not always be required, as long as the patient is kept under permanent observation and the pertinent control imaging study is performed.

Conflicts of interest: The authors declare that they have no conflicts of interest.

REFERENCES


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