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Case Report

Case Report of Negative Diagnostic Laparoscopy and EGD in a Patient with a Large Amount of Pneumoperitoneum

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Received: May 09, 2020; **Published:** July 09, 020

Abstract

We present the case of a 23-year-old male who presented with epigastrium and left upper quadrant pain. A computerized tomography (CT) scan of his abdomen and pelvis revealed a moderate amount of intraperitoneal free air; however, upon diagnostic laparoscopy and esophagogastroduodenoscopy no abnormalities were found.

The incidence of free air in the peritoneum is termed pneumoperitoneum. This is normally a result of perforation in the abdominal cavity. However, there are some rare cases as in the case of our patient in whom pneumoperitoneum is not due to perforation. Such cases are known as non-surgical or spontaneous pneumoperitoneum. Non-surgical pneumoperitoneum has a variety of causes including thoracic, abdominal, iatrogenic, gynecological, and traumatic causes. It is likely that our patient was a case of pseudopneumoperitoneum or of true idiopathic pneumoperitoneum.

To investigate the most common diagnostic methods for this rare disease we searched the PubMed database with the search term 'spontaneous pneumoperitoneum'. CT scan was seen to be the most commonly used diagnostic method. However, studies show that laparoscopy is more sensitive and more specific than CT when it comes to ruling out bowel perforation. Laparoscopy has also been proven to be a safer diagnostic method than laparotomy as the former poses less adverse effects.

In cases like that of our patient, we recommend the use of laparoscopy to rule out bowel perforation. Additionally, when there are no signs of peritonitis, fever is absent, and white blood cell count is normal, conservative management is highly recommended. By acquiring a working knowledge of the wide array of potential causes of pneumoperitoneum and their mechanisms, unnecessary surgical exploration and its associated morbidity can be avoided.

Keywords: *Computerized Tomography (CT); Emergency Department (ED); Nonsteroidal Anti-Inflammatory Drugs (NSAIDS)*

Introduction

The incidence of free air in the peritoneum is termed pneumoperitoneum. This is normally a result of perforation in the abdominal cavity. However, there are some rare cases in which pneumoperitoneum is not due to perforation.

Case Presentation

The patient was a 23-year old healthy male with a negative medical history presented to the emergency department (ED) with 4-day pain in his epigastrium and left upper quadrant. Onset of symptoms was abrupt with gradual worsening. He described the pain as sharp

and shooting, continuous and associated with dyspepsia, nausea, vomiting and lack of appetite. His symptoms were aggravated by eating. He denied previous use of any nonsteroidal anti-inflammatory drugs (NSAIDS) but did report drinking 2 - 3 alcoholic drinks per day. However, he denied any recent binge drinking. He did report use of marijuana for pain control. He denied any recent history of trauma. He was seen in the ED the previous day and only treated with a gastrointestinal (GI) cocktail, which is a mixture of liquid antacid, viscous lidocaine, and an anticholinergic medication. He refused any imaging at that time for financial concerns.

On physical exam, the patient had mild tenderness to palpation of the left upper quadrant, no guarding, no rigidity, no peritonitis. His vital signs were stable. His white blood cell count was 9.3 with no left shift of neutrophils. His lactate level was 0.7. A computerized tomography (CT) scan of his abdomen and pelvis without intravenous or per oral contrast revealed a moderate amount of intraperitoneal free air consistent with a perforated viscus (Figure 1). Based on the distribution of the free air, the radiologist favored a perforated gastric or duodenal ulcer.

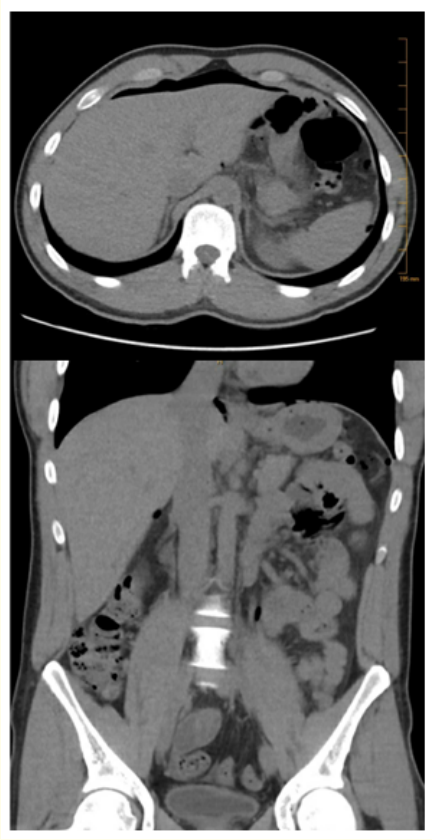

Figure 1: *CT scan of the abdomen and pelvis demonstrating moderate amount of free air in the peritoneum around the epigastric and left upper quadrant region.*

Procedure

The patient was taken to the operating room for a diagnostic laparoscopy, where he was positioned supine on the operating table. Sequential compression device (SCDs) were placed for DVT prophylaxis, and he received 5000 IU of subcutaneous heparin. He received

piperacillin and tazobactam for perioperative antibiotics prophylaxis. He underwent induction of general anesthesia and intubation without difficulty. A 5 mm incision was made two fingerbreadths below the left costal margin and a Veress needle was used to gain access to the peritoneum using OptiView technique. His abdomen was insufflated to 15 mmHg. Another 10 mm port was inserted under direct visualization above the umbilicus, as well. The abdomen was surveyed thoroughly. There were small air bubbles underneath the omentum in the area of the lesser sac. However, this may have been due to the placement of the trochar using OptiView technique.

There was clear fluid around the liver, consistent with benign ascites. No succus in the abdomen was found. The appendix and portions of the sigmoid colon was visualized with no evidence of inflammation. There was no fibrinous material nor thickened omentum anywhere in the abdomen. The abdomen was closely inspected the anterior portion of the stomach and identified no perforations there either. An intraoperative esophagogastroduodenoscopy was performed next. The esophagus had no abnormalities. The greater and lesser curvature was visualized, retroflexed to see the cardia and intubated the pylorus to view the first and second portions of the duodenum. There were no perforations or abnormalities identified, and all mucosa appeared healthy. There was no evidence of chronic gastritis in the stomach. An exploratory laparotomy was not elected to be pursued as the patient was hemodynamically stable and had minimal tenderness on his physical exam. A 15 French Blake drain was placed into the left upper quadrant anterior to the stomach. The umbilical port was closed with 0-vicryl suture in a figure-of-eight fashion. Skin was approximated with 4-0 Monocryl suture in a running subcuticular fashion.

Postoperative course

The patient was admitted postoperatively to the surgical floor unit. He was kept on perioperative antibiotics. He was allowed to have clear liquids on postoperative day 1 and was progressed to a regular diet by evening. He was discharged the following day. Prior to discharge his drain was removed. On follow up at two weeks, the patient was feeling well, the abdominal pain was gone and all incisions were well-healed.

Discussion

The incidence of free air in the peritoneum is termed pneumoperitoneum. This is normally a result of perforation in the abdominal cavity. However, there are some rare cases in which pneumoperitoneum is not due to perforation. Such cases are known as non-surgical or spontaneous pneumoperitoneum [1].

Non-surgical pneumoperitoneum can have varied causes. There are intrathoracic causes like pneumothorax or pneumomediastinum in which air can dissect its way down the esophagus and aorta into peritoneal tissue, eventually leading to peritoneal rupture and pneumoperitoneum [2]. Symptoms of pneumomediastinum include chest pain, dyspnea, neck pain, dysphagia and subcutaneous crepitus and a positive Hamman's sign (mediastinal crepitus) on examination. The absence of these symptoms in the patient makes it unlikely that pneumomediastinum was the cause of his pneumoperitoneum. Mechanical ventilation and cardiopulmonary resuscitation are also frequently cited thoracic causes of pneumoperitoneum, but again the patient's medical history do not support these.

Several abdominal causes of non-surgical pneumoperitoneum exist. Most of these are related to gastrointestinal procedures which rule this out in the case of our patient. One abdominal cause which is not procedure related is pneumatosis intestinalis. Pneumatosis intestinalis is a condition in which there is gas within the walls of the gastrointestinal tract leading to the formation of submucosal and subserosal cysts. Rupture of these cysts result in pneumoperitoneum [1]. The condition is generally asymptomatic and may resolve spontaneously though patients may present with diffuse abdominal pain, diarrhea, abdominal distension and tenesmus. Pneumatosis intestinalis can be diagnosed using imaging. On abdominal CT, findings would include circumferential collections of air adjacent to the lumen of the bowel that run in parallel with the wall of the bowel or linear collections without the air contrast or air fluid levels characteristically seen with intraluminal air [4]. The absence of these findings rules out pneumatosis intestinalis as the cause for the pneumoperitoneum seen in this patient.

Iatrogenic, gynecological and traumatic causes of pneumoperitoneum were also unlikely in this patient. It is possible that this could have been a case of pseudo pneumoperitoneum [5] in which there is an appearance of free intraperitoneal air on abdominal x-ray which fails to shift location when different positioning is used and in which there is a failure of radiolucency to collect in the most superior possible position. Frequently cited causes for pseudo-pneumoperitoneum include adventitial air shadows, overdistension of hollow viscera, undulant configuration of the diaphragm causing basal lung to appear to lie in the diaphragm, gas trapped in established wounds, basal pulmonary atelectasis simulating subphrenic air, subdiaphragmatic extraperitoneal fat, and interposition of the hepatic flexure of the colon between the right lobe of the liver and the diaphragm [2]. There is also a possibility that our patient could be a true case of idiopathic pneumoperitoneum. In these cases, there is intraperitoneal free air, yet no demonstrable risk factors present.

To investigate the most common diagnostic methods for this rare disease we searched the PubMed database with the search term 'spontaneous pneumoperitoneum'. Previously reported clinical features of spontaneous pneumoperitoneum patients are shown in table 1. CT examination was performed in thirteen of the sixteen patients, including our patient. In the three cases where CT was not performed, abdominal radiograph was used instead, as the imaging modality of choice. Endoscopy was performed in four out of the sixteen cases, being the only diagnostic method used in one of the cases. There was only one case utilizing colonoscopy. In six out of the sixteen cases, an exploratory laparotomy was performed. Ours was the only case in which laparoscopy was performed.

Reference	Year	Age (years)	Diagnostic Tools				
			CT	Endoscopy	Colonoscopy	Laparotomy	Laparoscopy
[7]	1996	68	-	+	-	-	-
[8]	1999	14	+	-	-	-	-
[9]	2005	49	+	-	-	-	-
[10]	2011	63	+	-	-	+	-
[11]	2011	69	-	-	-	+	-
[12]	2013	90	+	-	-	+	-
[13]	2013	72	+	-	-	+	-
[14]	2014	0.7	-	-	-	-	-
[15]	2015	77	+	+	-	-	-
[16]	2015	82	+	-	-	+	-
[17]	2016	85	+	-	-	-	-
[18]	2018	83	+	+	+	-	-
[19]	2018	72	+	-	-	-	-
[20]	2019	71	+	-	-	-	-
[21]	2020	77	+	-	-	+	-
Our case	2020	23	+	+	-	-	+

Table 1: *Tools used to diagnose spontaneous pneumoperitoneum.*

The diagnosis of spontaneous pneumoperitoneum poses a significant challenge. There has to be an intricate balance between the desire to accurately rule out bowel perforation and the desire to spare the patient from unnecessary surgical exploration. Although laparoscopy has not had very widespread use as a means of diagnosing spontaneous pneumoperitoneum, recent evidence shows that it may be the best tool for maintaining this intricate balance.

On the one hand, thorough investigation is very important. Bowel perforation is the most common cause of pneumoperitoneum and a delay in diagnosis can be life threatening due to the risk of developing infections such as peritonitis [6]. For some time, a CT scan has been the imaging modality of choice for diagnosing free air and localizing the site of organ perforation. This diagnosis has been based on direct CT findings such as bowel wall discontinuity and extraluminal air, and on indirect CT findings such as bowel wall thickening, abnormal bowel wall enhancement, and abscess and inflammatory mass adjacent to the bowel [7]. Direct visualization of the discontinuity of the bowel wall can specify the presence and site of GI tract perforation, which is marked by a low-attenuating cleft that usually runs perpendicular to the bowel wall on CT. However, this cleft has been reported to be observed less frequently than free air on CT and a cleft is usually seen in less than 50% of the patients with GI tract perforation. The relatively infrequent detection of this finding is partly due to the small size of the lesion [7]. In a recent retrospective study, the diagnostic role of laparoscopy for bowel perforation was analyzed. It was concluded that the laparoscopic method of diagnosis was both 100% specific and sensitive whereas, the sensitivity of CT was 83.3% and the specificity 22.2% [8]. Evidently, the diagnostic role of laparoscopy in diagnosing bowel perforation holds superiority to that of CT.

On the other hand it is also of paramount importance to avoid unnecessary surgical exploration and its associated morbidity. Adverse effects of exploratory laparotomy include hemorrhage, infection, organ damage, and adhesion formation. Although laparotomy was previously the gold standard for diagnosis of bowel perforation, the use of laparoscopy for this purpose has, in recent times, been widely accepted. A study shows that laparoscopic therapeutic interventions were performed in 6 patients of whom three were for perforated viscera. They found that patients who had a laparoscopic procedure were less severely injured leading to significantly lower numbers of intensive care units and hospital stays than patients who had laparotomy ($p < 0.005$). Therefore, laparoscopy serves as a diagnostic tool in abdominal trauma reducing the morbidity of a negative laparotomy [9-23].

Conclusion

In cases like that of our patient, we recommend the use of laparoscopy as a diagnostic method. Additionally, when there are no signs of peritonitis, fever is absent and white blood cell count is normal, conservative management is highly recommended. By acquiring a working knowledge of the wide array of potential causes of pneumoperitoneum and their mechanisms, unnecessary surgical exploration and its associated morbidity may frequently be avoided.

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Volume 3 Issue 8 July 2020