

# POINT-OF-CARE ULTRASOUND IDENTIFICATION OF PNEUMOPERITONEUM AND PERFORATED VISCUS: A CASE REPORT

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## Introduction

Pneumoperitoneum is one of the causes of an acute abdomen. Although a rare cause of abdominal pain, pneumoperitoneum has a high mortality burden. Non-postoperative scenarios not limited to this differential include ruptured viscus, peritonitis with gas forming organisms, intra-abdominal abscess rupture, or bowel obstruction with permeation of gas through the bowel wall (1). Focused physical abdominal examination may be relatively normal or reveal focal tenderness. Abdominal distention, however, is common in patients with perforation and can lead to typical signs of focal or diffuse peritonitis. Typical diagnostic studies include upright radiography of the chest and abdomen, but plain films cannot rule out a perforated viscus. Bedside point-of-care ultrasonography (US) can allow for the rapid identification of pneumoperitoneum and atraumatic perforated viscus.

## Case Report

A 55-year-old year old female with unknown past medical history presented to the emergency department (ED) via ambulance for complaint of abdominal pain. Patient reported associated distention, nausea, and multiple episodes of vomiting. She denied previous history of abdominal surgeries, and was in severe distress to provide further history. As per EMS, patient was reportedly found down on the floor at home by her neighbors who then called for help.

Upon arrival to the emergency department, patient's vital signs were the following: T 36.3C, BP 123/78, HR 130, RR 30, 98% O<sub>2</sub> on RA. She appeared frail, pale, and in obvious pain. Abdominal exam was positive for distention and diffuse tenderness consistent with acute abdomen. Peripheral intravenous lines were established with subsequent administration of intravenous fluid resuscitation. Emergency physician-performed bedside US demonstrated free fluid in the right upper quadrant, pneumoperitoneum, and large distended bowel loops with appearance of stool contents outside of bowel walls. On-call general surgery was then emergently notified based upon these ultrasound findings. Further imaging and laboratory studies were ordered. Abdominal films demonstrated distended air-filled bowel loops without exclusion of free air and distal bowel obstruction. Follow up CT abdomen and pelvis confirmed pneumoperitoneum with likely perforated sigmoid colon and extensive ascites. Labs showed an elevated lactic acid level of 5.6, procalcitonin level 436.25, and creatinine of 2.46 consistent with acute kidney injury. Concurrent with IVF resuscitation, blood cultures were obtained and piperacillin/tazobactam, anti-emetics, and hydromorphone were administered. The patient was evaluated by general surgery in the ED who transferred her to operating room for emergent exploratory laparotomy. The final surgical diagnosis was pneumoperitoneum and feculent peritonitis secondary to a perforated large stercoral ulcer in the sigmoid colon.

## Point-of-Care Ultrasound Images

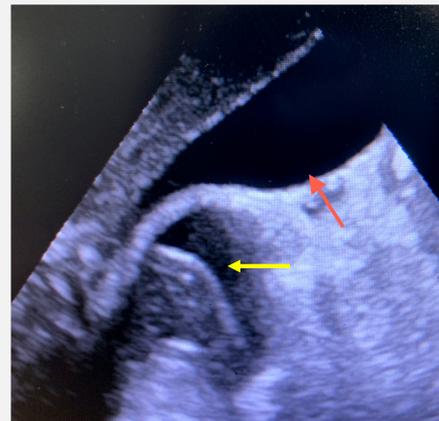


Figure 1:  
Ultrasound findings of intra-abdominal free fluid. Peri-hepatic free fluid (red arrow) and peri-nephric free fluid (yellow arrow).

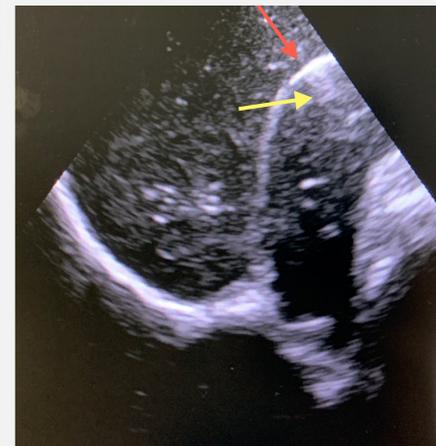


Figure 2:  
Ultrasound findings of pneumoperitoneum. Hyperechoic foci (red arrow) with ringed down artifact (yellow arrow) in the hepato-renal space.

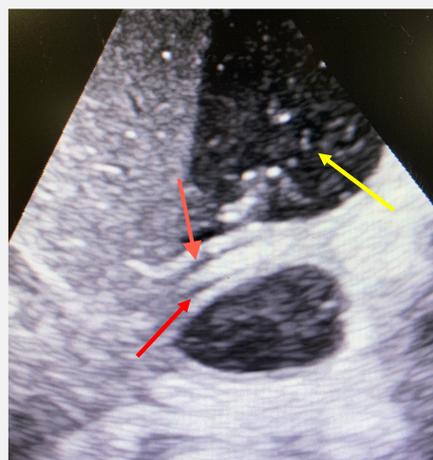


Figure 3:  
Ultrasound findings suggestive of bowel obstruction. Hypokinetic dilated bowel loop (yellow arrow) with extraluminal free fluid (red arrows).

## Discussion

Pneumoperitoneum is one of the few causes of acute abdomen with a high mortality. Chest and abdominal radiography are typically helpful with a patient having chest or abdominal pain, but plain films cannot rule out perforation. They are found to have 50-70% sensitivity for detecting extraluminal air on plain film (2).

Ultrasonography has been demonstrating excellent potential for identifying pneumoperitoneum with a sensitivity of 92% and specificity of 53%, and overall accuracy of 88% (3,4,5). Although it cannot establish the cause and location of the perforation, US is useful in identifying patients that need emergent surgical management. US also has the advantage of conveying dynamic information about bowel function, and is easily accessible in the emergency department. Compared to CT, US also has lower cost, lacks radiation exposure, and, most importantly, can be obtained rapidly at the bedside of a hemodynamically unstable patient.

Based on our patient case, US demonstrated a pivotal role in establishing a rapid diagnosis for the patient and conveying the findings to a surgeon expeditiously.

## Conclusion

US has a higher sensitivity in detection of bowel perforation compared to plain film, and can identify patients that might require surgical approach expeditiously as opposed to CT. US is a diagnostic modality which should be considered early if there is high clinical suspicion for pneumoperitoneum.

## References

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