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Case Report



Indirect Radiological Signs of Hollow Organ Perforation

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Hollow organ perforation is a serious and common abdominal emergency. The diagnosis depends on history taking, physical examination, and radiological findings. We reported a hollow organ perforation patient with only indirect radiological signs of the heterogenous enhanced lesion between the stomach, duodenum, and liver over initial abdominal computed tomography. Pneumoperitoneum occurred in follow-up chest X-ray 5 hours after the emergency department visit. The reason for the delayed occurrence of pneumoperitoneum, direct/indirect radiological signs of hollow organ perforation, and ways to avoid this pitfall are discussed.

Key words: hollow organ perforation, acute abdomen, pneumoperitoneum, peritonitis

Introduction

Hollow organ perforation is diagnosed preoperatively according to history, physical examination, and radiological signs.^{1,2} Pneumoperitoneum, a direct radiological sign of perforation, is the hallmark of hollow organ perforation. It refers to the presence of extraluminal free air within the peritoneal cavity which usually occurs immediately after hollow organ perforation and leakage of intraluminal air. In the circumstance that there is only fluid content and no intraluminal air around the perforation site, indirect radiological signs, abscess, inflammatory mass, or phlegmon will be the only image findings.^{3,4} Hollow organ perforation without pneumoperitoneum is a diagnostic challenge and seldomly discussed in previous literature. We reported a patient of hollow organ perforation without pneumoperitoneum in the initial abdominal computed tomography (CT) and subphrenic free air was noted in follow-up chest X-ray.

Case Report

A 32-year-old male presented to the emergency department (ED) because of gradual onset, persistent

diffuse dull abdominal pain for 2 hours. There was no associated vomiting, diarrhea, or constipation. The physical examination showed a body temperature of 36.7°C, a soft abdomen, normal active bowel sounds, and diffuse tenderness without rebound pain. The laboratory evaluation disclosed a white blood cell (WBC) count of 11,200/mm³ with 77% segmented neutrophils. The serum lipase, aspartate aminotransferase, total bilirubin, and alkaline phosphatase were all within normal limits. A standing chest X-ray (Fig. 1) and left lateral decubitus abdomen plain film (Fig. 2) showed no extraluminal free air. Under the clinical impression of peritonitis, abdominal CT was arranged because no specific cause was found according to current blood exam and image studies. The CT disclosed no pneumoperitoneum and instead a heterogenous enhanced lesion in the hepatic hilum, between the stomach, duodenum, and liver (Fig. 3). Diffuse bowel wall swelling and pelvic ascites were also found which were compatible with peritonitis resulted from duodenal diverticulitis or heal-off perforated peptic ulcer (Fig. 4). The abdominal pain was relieved after an intramuscular injection of 30 mg of Ketorolac. The general surgeon was consulted and suggested conservative treatment with intravenous antibiotics, close

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Fig. 1. Standing chest X-ray.



Fig. 2. Left decubitus abdomen plain film.

monitor clinical symptoms, follow-up WBC, and differential counts. Five hours after the ED visit, the abdominal pain recurred and a repeat standing chest X-ray showed subphrenic free air (Fig. 5). An exploratory laparotomy found a duodenal perforation. The patient was discharged uneventfully 1 week later.

Discussion

Air and fluid leakage from hollow organ perforation lead to direct and indirect radiological signs. If pneumoperitoneum does not occur immediately after perforation and the clinical symptoms are ambiguous in the early stage, the diagnosis of hollow organ per-

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Fig. 3. Computed tomography of the abdomen shows a heterogenous enhanced lesion (black arrow).



Fig. 4. Coronal view of computed tomography shows a heterogenous enhanced lesion (solid black arrows), diffuse bowel wall swelling (dashed black arrows), and pelvic ascites (solid white arrows).

foration may be delayed. In this case, the patient visited ED 2 hours after the onset of symptoms and pneumoperitoneum was absent in all image studies. The absence of pneumoperitoneum can be rationalized that there was only intraluminal fluid leakage in the early stage of perforation. As the disease progressed,



Fig. 5. The repeat standing chest X-ray shows subphrenic free air (black arrows).

more intraluminal air and fluid leakage induced obvious peritoneal signs and pneumoperitoneum was evident.

How to avoid this pitfall in diagnosing an acute abdomen patient needs further discussion. A focused history and physical examination are essential in the diagnosis of hollow organ perforation. The improvement in imaging studies in recent decades has increased the accuracy of diagnosis significantly. The diagnosis of hollow organ perforation by a plain X-ray is based on the presence of pneumoperitoneum, which is usually identified as subphrenic air collection in a standing chest radiograph or left lateral decubitus view of the abdomen.^{3,4} An upright chest X-ray can detect as little as 1 mL of extraluminal air, while the left lateral decubitus abdomen plain film can detect 5–10 mL of extraluminal air.⁵ The sensitivity of detecting pneumoperitoneum with a plain film is 50–70%.³ Selective use of CT increases the diagnostic accuracy and sensitivity in patients with acute abdomen pain.^{6,7} In CT images, the direct sign of perforation is pneumoperitoneum and indirect signs are an abscess, inflammatory mass, or phlegmon related to the bowel.⁴ Physicians diagnose hollow organ perforation preoperatively based mostly on the presence of pneumoperitoneum. In a patient with acute abdominal pain, if the indirect signs of perforation are the only finding in image study, the diagnosis of hollow organ perforation is not straightforward since the differential

diagnosis are broad. The time lag between the onset of perforation and the presence of pneumoperitoneum varied with the intraluminal content around the perforation site and has not been studied thoroughly. In our case, the presence of pneumoperitoneum can be delayed for at least 2 hours after the onset of abdominal pain. The sooner the patient visits the hospital after the onset of abdominal pain, the greater the possibility that an imaging study will be done within this time window. Diagnosing hollow organ perforation solely on the presence of pneumoperitoneum, not considering the timing and indirect signs of image studies, may lead to a delayed or missed diagnosis. Serial examinations and close monitoring of symptoms are essential to avoid this pitfall. Physicians must be aware that an inflammatory mass, abscess, or phlegmon without pneumoperitoneum may indicate an early or sealed-off hollow organ perforation.

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None.

Conflicts of Interest Statement

No conflict of interest to declare.

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