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Case Report

A case of liver abscesses and porto-enteric fistula caused by an ingested toothpick: A review of the distinctive clinical and imaging features

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ABSTRACT

Though foreign body (FB) ingestions are a relatively common occurrence in the bustling emergency department, particularly among children, the vast majority of FBs either pass uneventfully or can be retrieved endoscopically. Only a small percentage of patients will experience complications such as bowel obstruction, ischemia, or perforation that may progress to abscess, septic thrombophlebitis, peritonitis, or shock. Depending on their composition, small FBs can be very difficult to detect on computed tomography (CT). However, a delay in definitive treatment resulting from the failure to clinically or radiologically recognize that a FB may be responsible for the acute presentation can lead to substantial morbidity and mortality. We present a case of unresolving hepatic abscess and recurrent sepsis caused by a toothpick-induced porto-enteric fistula in which the FB was not initially identified, thereby leading to multiple treatment failures and readmissions. This is followed by a literature review with comprehensive discussion of the distinctive clinical and imaging features of migrated FB-induced liver abscesses.

Case report

A 72-year-old male with past medical history of type-2 diabetes presented to the emergency department with fevers and rigors preceded by three weeks of fatigue, diarrhea, and right upper abdominal pain. Pertinent initial vital signs were as follows: temperature 40.4°C, heart rate 138 beats per minute, and blood pressure 115/46 mmHg. However, he became progressively hypotensive (80s/50s mmHg) prompting initiation of volume resuscitation, pressor support, and broad-spectrum antibiotics. Laboratory values were notable for a white blood cell count of 13.3 × 10^9/L, total bilirubin 1.7 mg/dL, aspartate aminotransferase 141 U/L, alanine aminotransferase 178 U/L,

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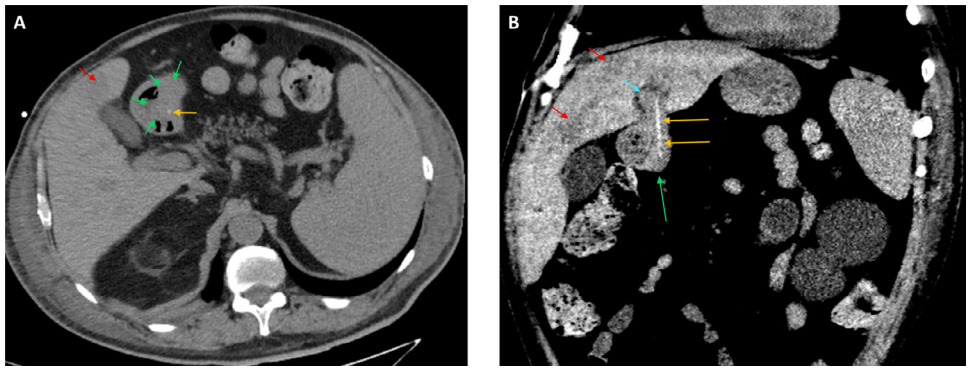

Fig. 1 – Noncontrast CT abdomen/pelvis. a. Axial image with standard windowing (C:35.0, W:350) at the level of the pyloroduodenal junction demonstrates a punctate hyperdense foreign body (yellow arrow) within the posterior pyloric wall. Note the reactive eccentric gastric wall thickening surrounding the foreign body (green arrows), which had increased compared to initial the CT 1 month prior (not shown). b. Coronal image with narrow windows (C:35, W:100) demonstrates a 4.6 cm linear hyperdense foreign body (yellow arrows) extending from the pyloroduodenal junction (green arrow) directly into the distal left portal vein (blue arrow). a. & b. Low attenuation areas in the liver parenchyma represent incompletely resolved abscess cavities (red arrow). (Color version of figure is available online.)

alkaline phosphatase 256 U/L, and lactate 2.4 mmol/L. Blood cultures returned positive for *Streptococcus Viridans*.

Initial noncontrast CT abdomen/pelvis demonstrated several hypoattenuating hepatic masses in segment IV and VIII with the largest measuring 7.6 × 6.6 cm. Magnetic resonance (MR) imaging showed multiple heterogeneous lesions that were hyperintense on T2-weighted images, hypointense on T1-weighted images, and demonstrated diffusion restriction consistent with liver abscesses. Ultrasound (US)-guided pigtail catheter placement into the largest abscess immediately drained 30 mL of pus. Cultures grew *Actinomyces odontolyticus*; therefore, a dental source was postulated. After his clinical status improved and follow-up CT showed diminished size of hepatic abscesses, the patient was discharged on ertapenem/vancomycin. However, the patient returned two days later with new fevers and increased catheter drainage despite no change in collection size on 2 CTs obtained over the 5 day admission. Antibiotics were switched to clindamycin and the patient was soon discharged in stable condition.

Six days later, the patient presented for a third time with worsening fevers. Noncontrast CT abdomen/pelvis (notably, the patient's *fifth* cross-sectional in the past month) showed minimally smaller hepatic abscesses. However, the reader raised concern for a FB by astutely noting a punctate 4.6 cm linear hyperdensity extending from the posterior pyloric wall into the left portal vein associated with focal gastric wall thickening (Fig. 1). In retrospect, this density could be appreciated on *all* prior CT studies. US confirmed an echogenic linear FB and left portal vein thrombosis (Fig. 2). The patient underwent exploratory laparotomy utilizing intraoperative US during which a 4.5 cm-long toothpick was retrieved, followed by repair of the porto-enteric fistula (Fig. 3). The patient, who had no recollection of ingesting a FB, tolerated the procedure well and was discharged in stable condition without any readmissions to date.

Discussion

Overview

Pyogenic hepatic abscesses are rarely, if ever, truly idiopathic, even in the presence of risk factors (ie, diabetes, cirrhosis, immunocompromised, advanced age) [1,2]. Rather, hepatic abscesses invariably occur as a secondary consequence of underlying pathology that usually falls within one of five main categories: (1) Portomesenteric bacterial seeding from an inflammatory or malignant bowel process (eg, colorectal cancer, colitis, diverticulitis, appendicitis, FB-induced intestinal perforation); (2) Hepatic arterial seeding from distant infection (eg, endocarditis, osteomyelitis); (3) Ascending cholangitis (eg, choledocholithiasis, biliary instrumentation); (4) Contiguous extension (eg, cholecystitis, perforated gastroduodenal ulcer, severe pyelonephritis); and (5) Penetrating trauma/iatrogenic [1,3]. Hepatic abscess caused by direct intraparenchymal extension of toothpick-induced gastric perforation has been described, as has traumatic main portal vein thrombosis without liver abscess due to fish bone-induced duodenal perforation [2,4,5]. However, this is the first reported case of migrated FB-induced liver abscess secondary to *traumatic pylephlebitis* and porto-enteric fistula caused by transmural gastric perforation involving a toothpick.

Migrated foreign body-induced liver abscess: Distinctive features

The simultaneous presence of certain clinical and radiological features should prompt strong consideration of a migrated FB-induced liver abscess. These include: left lobe location (65.9%), single abscess site (91.7%), absence of predisposing factors, ie, "cryptogenic" (94.1%), and multiple

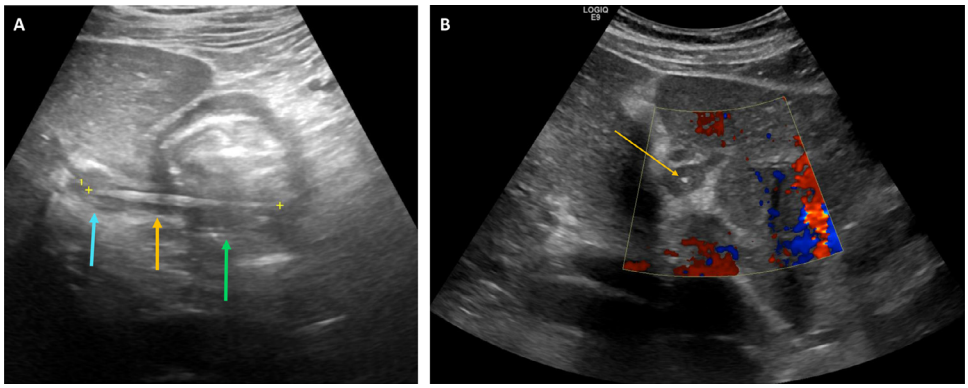

Fig. 2 – Hepatic Doppler ultrasound with targeted assessment of foreign body. a. Sagittal oblique sonographic image at the level of the pyloroduodenal junction (green arrow) showing long-axis view of a linear hyperechoic foreign body (yellow arrow) that penetrates the full thickness of the gastric wall and extents directly into the left portal vein (blue arrow). b. Transaxial color Doppler sonographic image at the level of the left portal vein shows short-axis view of the foreign body (yellow arrow) within the lumen of the left portal vein and absent intraluminal color Doppler signal consistent with thrombosis. (Color version of figure is available online.)

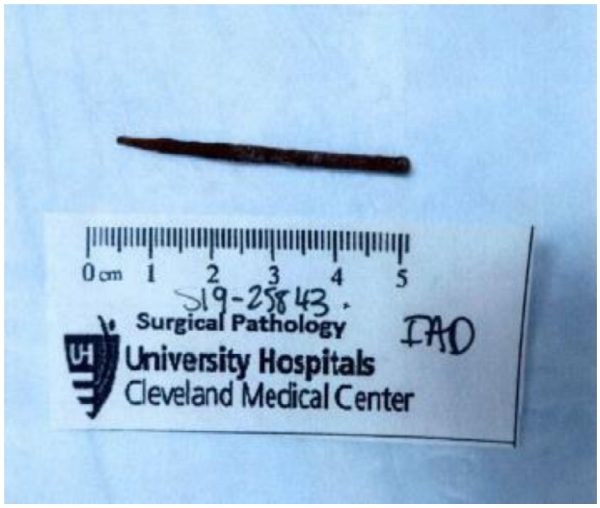

Fig. 3 – Surgical specimen. A 4.5 cm long wooden toothpick retrieved from exploratory laparotomy, corresponding to foreign body seen on preoperative US and CT.

treatment failures (90.4%) [2,6]. Given that the treatment standard of image-guided drainage plus intravenous antibiotics boasts a 90%-100% success rate in patients with hepatic abscesses from other causes, this last factor is arguably the most specific for FB-induced liver abscess because the underlying source is not addressed [4].

Hepatic abscess predominates in the right lobe (55%-80%) when caused by portal venous bacteremia as a consequence of preferential portal flow [2,6,7]. Left lobe predominance in migrated FB-induced liver abscess, however, is explained by (a) The close anatomic proximity of the gastroduodenal region to the hepatic capsule, and (b) The pyloric sphincter serving as a point of structural and functional narrowing. Hence the observation by Leggiere et al that the most common site of transgastric perforation was prepyloric in left lobe abscesses, while the perforation site in right lobe abscesses was more variable (1st-2nd duodenal segments or near the hepatic flexure of the colon) [2]. Additionally, isolation of unusual organisms from the liver abscess—as opposed to Escherichia coli (most common), followed by Klebsiella, Streptococcus, and Bacteroides—may hint at an unconventional source [4].

Even in the presence of suggestive features, the low diagnostic yield of imaging in the setting of migrated FB-induced liver abscess is multifactorial and usually begins on the clinical front with poor patient recollection or clinical suspicion of FB ingestion. Initial presenting symptoms and laboratory values are usually identical to that seen with hepatic abscess from other etiologies (fever, elevated ESR/CRP and WBC count, upper abdominal pain). Therefore, knowledge of an established psychiatric illness, a track-record of repeated FB ingestions, or a triad of preceding epigastric pain, hematemesis, and hepatic abscess may prove particularly helpful.

Fish bones (44%) and toothpicks (29%) were the most commonly implicated FBs, yet are far more elusive on imaging compared to their less frequent metallic counterparts [2]. In a case series of migrated FB-induced liver abscesses that included both metallic and nonmetallic FBs, only 19/40 (47%) were directly visualized on CT and/or US preoperatively while the remaining cases resorted to invasive (surgical or endoscopic) diagnosis [2]. Although CT outperformed US in this series (55% vs 27%), Li and Ender found a significantly lower yield for CT (15%) compared to US (29%) in their review that exclusively examined 57 toothpick-related internal injuries [2,8].

These data underscore the importance of identifying and correctly interpreting secondary reactive changes to aid in the diagnosis of migrated FB-induced liver abscess. These include: thickened viscus wall inseparable from the hepatic capsule; soft tissue tract or fistula extending from viscus wall to liver; and infiltrative soft tissue interposed between the viscus and liver that correlates with adhesions encountered in 89% of surgical cases [2,4,6]. These findings are highly suspect for underlying FB even if not directly visualized, particularly

when the hepatic abscess is adjacent to the aforementioned reactive changes.

Imaging of foreign bodies: Essentials for the radiologist

Having a solid knowledge of modality-specific advantages and limitations for FB visualization will also optimize the chances of detection. Metal, graphite, and stone are significantly denser than soft tissues and are usually detectable on radiographs, while organic objects (eg, wood) and most other materials are either radiolucent or similar in density to surrounding soft tissue [9]. Contrary to popular lore, all types of glass (not only lead-containing glass) should be detectable on radiographs due to its higher density than soft tissue [9].

CT has been shown to consistently detect metal, teeth, stone, glass, and graphite fragments as small as 0.5 mm and plastic fragments as small as 1 mm embedded within soft tissues [10]. Wood can have a variable appearance on CT depending on length of incubation. A recently inoculated wood fragment will exhibit air density on CT because dry wood contains air within its interstices [9]. Over time, the wood absorbs serosanguinous fluid, giving it a slightly hyperdense appearance [9]. This same process may result in increased T1 and T2 relaxation times on MRI; however, the majority of FBs on MRI will appear as a signal void or hypointense on all sequence with variable susceptibility [9]. The utility of MRI in the work-up for FB lies not with detection/identification of the FB itself, but rather in evaluating for the presence and extent of associated infection or granulomatous reaction.

US can detect the smallest and widest range of FBs more effectively than any other imaging modality. This is largely attributed to its superior in-plane spatial resolution (150 μm) and because all FBs are either distinctively hyperechoic specular reflectors and/or they produce conspicuous posterior acoustic shadowing [11]. However, in addition to overcoming case-specific technical limitations, the success of US ultimately requires both a pretest suspicion for the presence of FB and knowledge of its anatomic location, both of which are usually absent in the early work-up of hepatic abscess. Thus, US is best reserved for detailed localization and assessment of structural involvement by a FB after the diagnosis is already suspected.

Conclusion

We report a case of pyogenic hepatic abscess caused by the transgastric perforation of an ingested FB with porto-enteric fistula that was not initially recognized, leading to multiple treatment failures and recurrent sepsis. The diagnosis of migrated FB-induced liver abscess is, and will likely always remain, a significant clinical and radiological challenge. A single-site abscess occurring in the left hepatic lobe of an otherwise healthy patient associated with a thickened viscus wall inseparable from the hepatic capsule should be regarded with high suspicion. The diligent radiologist familiar with these unique imaging and clinical characteristics is well-positioned to initially suggest the diagnosis, thereby facilitating earlier treatment and ultimately the best patient outcome.

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