Preoperative Imaging Diagnosis of Fish Bone Perforation of the Gastrointestinal Tract

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ABSTRACT

Accidental ingestion of a foreign body is a common occurrence. Most of these foreign bodies pass through the gastrointestinal (GI) tract uneventfully and rarely cause perforation. We present 2 cases of fish bone perforation: in the first case, the fish bone had perforated the stomach, and in the other case, it had perforated the jejunum. An 80-year-old woman experienced abdominal fullness, nausea, and chest tightness for 3 days. Another 78-year-old woman suffered from lower abdominal pain for 1 day. A series of imaging studies, including ultrasonography (US) and/or computed tomography (CT) was performed in the case of both the patients.

CASE REPORTS

Imaging modalities

US was performed with a C5-2 tightly curved array transducer of a M2540A EnVisor US system (Philips Medical Systems, Bothell, WA, USA), using a frequency of 5 MHz for abdominal examination. In case 1, abdominal CT was carried out using a 64-row multidetector CT (MDCT; Brilliance CT 64-channel by Philips Medical Systems, Netherlands). Axial, reformatted coronal and sagittal images with slice thickness of 5 mm were obtained in both the cases. Parasagittal image reformations was also performed in case 1. In both the cases, oral and intravenous contrast media were administered.

Case 1

An 80-year-old woman experienced abdominal fullness, nausea, and chest tightness for 3 days. Blood analysis showed that white blood cell count was 10120/μL and C-reactive protein level was 8.8mg/dL. The results of urinalysis were within the normal limits. The patient did not recollect ingestion of a foreign body. A series of imaging studies was performed (Fig. 1). Abdominal radiography (not shown) showed a normal bowel gas pattern and no identifiable abnormal radiopaque lesion or pneumoperitoneum in the abdomen. Abdominal US identified a linear
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Echogenic lesion, traversing the antral wall of the stomach. Abdominal CT showed a needle-shaped hyperdense lesion embedded in the posterior wall of the gastric antrum and traversing into the lesser sac. Pneumoperitoneum was not found. A foreign body, such as a fish bone, was diagnosed.

Owing to the presence of the fish bone, embedded in and migrating through the gastric wall, as noted on both US and CT, gastroendoscopy was not performed, and the patient was immediately sent for an operation. Surgical exploration confirmed the presence of a 2.5-cm long fish bone.

**Figure 1**

*a.* US performed in the middle, subcostal, and parasagittal planes shows a linear echogenic lesion (between cursors) traversing the hypoechoic gastric wall (between arrows) and extending into the perigastric region. *b.* Axial and *c.* reformatted parasagittal MDCT images, with slice thickness of 5 mm show the hyperdense bone-shaped foreign body (white arrow) penetrating the posterior wall of the gastric antrum and extending into the lesser sac. Note that the relatively hypodense oral contrast medium inside the stomach does not obscure the orientation of the foreign body. *d.* Surgical exploration clearly shows the fish bone perforating the stomach wall. *e.* The fish bone is 2.5 cm long.
that perforated the posterior wall of the gastric antrum, with the greater part of the bone migrating into the lesser sac. The fish bone was removed, and primary repair of the perforation site was performed. The patient was discharged 10 days later.

Case 2

A 78-year-old woman suffered from lower abdominal pain for 2 days, and this pain had aggravated since the noon of the hospitalization day. Blood sampling showed leukocytosis (white blood cell count: 14420/μL) and no elevation in

Figure 2

Figure 2. Case 2. Sequential, superior to inferior axial (a. from left to right), and reformatted anterior to posterior coronal (b. from left to right) MDCT images of 5 mm slice thickness show a linear hyperdense bone-shaped foreign body (shown as the white dot and white line appearance on the sequential images), penetrating the opposite wall of the jejunum.
the C-reactive protein level (0.73 mg/dL).

The patient did not recall ingestion of a foreign body. Abdominal radiography (not shown) showed a normal bowel gas pattern with no abnormal radiopaque lesion or pneumoperitoneum in the abdomen. CT identified a linear hyperdense object inside the lumen of the jejunum; this object was found to perforate the opposite wall of the jejunum (Fig. 2). Pneumoperitoneum was not identified. A foreign body, especially fish bone, was diagnosed. During a laparotomy, a 3.0-cm long fish bone penetrated the opposite wall of the jejunum. The fish bone was removed, and primary repair of the perforation sites was performed. The postoperative course of 7 days of hospitalization was uneventful.

**DISCUSSION**

Accidental foreign-body ingestion is common in clinical practice. Most of the ingested foreign bodies pass through the feces uneventfully within 1 week [1] whereas less than 1% of them perforate the GI tract [1-6]. The perforation can occur anywhere within the GI tract but tends to occur in areas of acute angulation or in narrow lumens such as the distal ileum, ileocecal junction, and rectosigmoid junction [2, 3, 5-6]. Perforation of the jejunum, as observed in case 2 reported here, is rather uncommon and has a reported incidence of 14% [1]. Sharp, pointed, and elongated foreign bodies, such as fish bones, toothpicks, chicken bones, needles and toothbrushes, can cause perforation [1-19].

Complications of foreign-body perforation include liver abscess [9, 10, 14, 15], contiguous organ (e.g., pancreas) injury [11], and fistula formation [9, 12]. On imaging, the perforated site may mimic a gastric submucosal tumor [13] and omental pseudotumor [17], and foreign-body perforation may be mistaken for diverticulitis and acute appendicitis [5-6].

The risk factors of foreign-body ingestion are old age, mental disorder, bulimia, alcoholism, prison incarceration, bowel fragility caused by inflammatory disease, and certain cultures wherein the consumption of unfilleted fish is considered a delicacy [1-3, 5]. Wearing of dentures eliminates the tactile sensation of the palatal surface and decreases the recognition of small intraoral objects, thus accounting for a high incidence of foreign-body ingestion [1, 2, 4].

The diagnosis of foreign-body perforation is difficult, because the ingestion is accidental and the patient may be unable to recall the incident [1-3, 5]. Therefore, as in our cases, a history of foreign-body ingestion is rarely obtained preoperatively. A definite diagnosis of foreign-body perforation of the GI tract is based on the clinical history [3, 8, 18] and findings of gastroendoscopy [8], colonoscopy [9], abdominal radiography [3], US [2, 19], CT [1, 3, 4, 6, 7, 10-12], and surgical exploration [3, 5, 13-17]. In a study by Goh et al. [3], foreign-body perforation of the GI tract was accurately diagnosed preoperatively only in 23% of the patients, through examination of the clinical history and abdominal radiography and/or CT examination. In addition, the broad spectrum of nonspecific (acute or chronic) clinical manifestations render the diagnosis of foreign-body perforation extremely difficult. Therefore, an accurate diagnosis is frequently delayed, and remains a clinical challenge.

Abdominal plain film is unreliable for the diagnosis of the fish bones [1-4], as was observed in our cases. The fish bones are only slightly radiopaque, and are rarely observed on radiography, especially when a superimposed inflammatory process or abscess occurs. An earlier prospective study revealed that plain radiography had a sensitivity of only 32% in the case of patients who had ingested fish bones [18]. Moreover, pneumoperitoneum is rarely observed on plain film [1-4] and not usually identified on CT [3]. Studies show that erect chest radiography and CT detect pneumoperitoneum in only 16% and 50% cases of patients, respectively, in whom the ingested foreign body causes hollow organ perforation [3, 4]. The low detection rate is due to the covering of the perforation sites by the adjacent bowel loop and omentum as well as accumulation of fibrin caused by progressive erosion of the intestinal wall by the impacted foreign body, thus limiting the passage of substantial intraluminal fluid and air into the peritoneal cavity [1-4].

Interestingly, although a previous study confirmed foreign-body ingestion and identified bowel perforations on surgical exploration, it did not detect foreign body on surgical and pathological examinations in 5% of cases [3]. This observation may be explained by the fact that after the foreign body has perforated the bowel wall, it may fall back into the lumen and pass through the GI tract uneventfully. A prospective study in 358 patients who had ingested fish bones showed that the yield of fish bone retrieval was inversely related to the duration of fish bone retention in the body [18]. It is postulated that most of the fish bones would be dislodged and passed. US facilitates the detection and identification of the location of foreign bodies, including non-radiopaque objects such as fish bones and toothpicks, based on the specific shape, echogenicity, and differences in acoustic shadowing [2, 19]. US has the advantages of portability, high flexibility, and low cost; moreover, it does not require a radiation dose [20]. Further, the operator can focus on the most symptomatic area of the patient’s abdomen with the real-time transducer. However, the drawback of US is the operator’s dependence, the patient’s obesity, and concomitant bowel gas, which may hinder imaging quality and decrease diagnostic accuracy.

CT, especially MDCT, is currently considered the imaging method of choice for examination of patients with acute abdomen. CT showed 100% sensitivity for the detection of intestinal fish bones and chicken bones in previous
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studies [1, 4], including a case study wherein a final positive result was obtained by a retrospective review of CT images after an initial misdiagnosis [1]. CT can detect not only the foreign body but also the perforation site [4]. The suggested CT findings at the region of perforation include a thickened bowel loop, regional fatty infiltration around the foreign body, localized pneumoperitoneum, associated bowel obstruction, and abscess formation. The high resolution, thin collimation, and multi-planar reconstructions of CT allow the whole GI tract to be surveyed in all projections, thereby enabling a high detection rate of foreign bodies [1, 4].

CT has potential limitations in the diagnosis of intra-abdominal fish bones. The fish bone on CT appears as a linear calcified lesion, which may mimic another structure such as a blood vessel, after intravenous contrast administration. Furthermore, oral contrast medium can obscure the intestinal fish bone, leading to a failure of its detection [1]. Oral contrast medium was also administered in both patients. However, it did not influence the final accurate diagnosis owing to the rather low density of the intestinal content and the penetration of fish bone through the bowel wall into the extra-luminal fat.

Scan thickness is another potential limitation of CT [1]. Thinner CT scans can differentiate a thin and short fish bone from the continuous course of a blood vessel. Without a high index of suspicion, a foreign body may be missed; further, in the presence of an accompanying inflammatory process in the adjacent region, the foreign body may mimic gastric submucosal or omental tumor [13, 17]. Therefore, a lack of observer awareness is a limitation of CT for the detection of a foreign body.

In conclusion, accidental ingestion of a foreign body may be unconscious, and a correct diagnosis is frequently delayed. A high index of suspicion, observer awareness about interpretation of CT findings, and special US technique and findings must be maintained for an accurate diagnosis of fish bone perforation.

REFERENCES

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