

Use of 3-Dimensional Computed Tomography to Detect a Barium-Masked Fish Bone Causing Esophageal Perforation

Atsushi Tsukiyama, Takashi Tagami, Shiei Kim and Hiroyuki Yokota

Department of Emergency and Critical Care Medicine, Nippon Medical School Hospital

Abstract

Computed tomography (CT) is useful for evaluating esophageal foreign bodies and detecting perforation. However, when evaluation is difficult owing to the previous use of barium as a contrast medium, 3-dimensional CT may facilitate accurate diagnosis. A 49-year-old man was transferred to our hospital with the diagnosis of esophageal perforation. Because barium had been used as a contrast medium for an esophagram performed at a previous hospital, horizontal CT and esophageal endoscopy could not be able to identify the foreign body or characterize the lesion. However, 3-dimensional CT clearly revealed an L-shaped foreign body and its anatomical relationships in the mediastinum. Accordingly, we removed the foreign body using an upper gastrointestinal endoscope. The foreign body was the premaxillary bone of a sea bream. The patient was discharged without complications.

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Key words: barium contrast, fish bone, foreign body perforation, esophagus, 3-dimensional computed tomography

Introduction

Esophageal perforation is a life-threatening condition that is fatal in 10% to 20% of patients¹². Moreover, perforation by a sharp foreign body can have additional effects because the esophagus is adjacent to vital structures, such as the heart and great vessels. In this way, esophageal perforation can lead to cardiac tamponade, subclavian arterioesophageal fistula, aortoesophageal fistula, tracheoesophageal fistula, and to the death of the patient³⁻⁸. Thus, immediate and accurate identification of the foreign body, the cause of the injury, and associated complications is essential⁹.

When a patient presents with esophageal perforation due to accidental ingestion of a foreign body, computed tomography (CT) is generally useful for detecting and evaluating the lesion^{9,10}. However, when barium has been used as the esophagographic contrast medium, even CT cannot reveal sufficient details about the lesion. We report a case in which we were unable to detect the foreign body with horizontal CT but subsequently detected the object—a fish bone—with 3-dimensional (3D) CT.

Case Report

A previously healthy 49-year-old man with no history of psychiatric disorder was transferred to

Correspondence to Takashi Tagami, MD, PhD, Department of Emergency and Critical Care Medicine, Nippon Medical School Hospital, 1-1-5 Sendagi, Bunkyo-ku, Tokyo 113-8603, Japan

E-mail: t-tagami@nms.ac.jp

Journal Website (<http://www.nms.ac.jp/jnms/>)



Fig. 1 Transverse-plane computed tomographic image of the chest.

our university hospital after a previous physician had diagnosed esophageal perforation by means of an upper gastrointestinal series with barium as the contrast medium. The patient was 176 cm tall and weighed 90 kg. The only complaint was a dull and continuous chest pain that had started immediately after a meal eaten approximately 8 hours earlier. The previous physician had not observed a foreign body on CT. The vital signs were as follows: body temperature, 37.8°C; blood pressure, 160/99 mmHg; radial pulse, 80 beats/minute and regular; and respiratory rate, 16 breaths/minute. Physical examination showed no other abnormalities. The only remarkable laboratory findings were leukocytosis (15,300 cells/ μ L) and a slightly high C-reactive protein level (0.68 mg/dL).

A CT scan performed in our department revealed a high-density area extending from the esophageal lumen into the mediastinal cavity, due mainly to the barium used for esophagography at the previous hospital (**Fig. 1**). No sign of pneumomediastinum, mediastinal abscess, or major vessel injury was present. Because of the large amount of adherent barium contrast medium, upper gastrointestinal endoscopy did not show the details of the site of perforation. Although we could not reach a definite diagnosis, we made a tentative diagnosis of esophageal perforation of unknown origin or spontaneous esophageal perforation because the patient did not provide a history of foreign body ingestion. In addition, CT performed on arrival showed minimal barium leakage into the

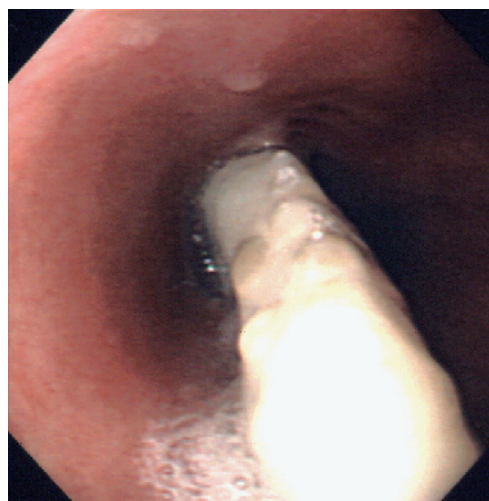


Fig. 2 Endoscopic image of an L-shaped foreign body penetrating the esophageal wall.

mediastinum; therefore, the patient did not undergo mediastinal irrigation and was treated conservatively with parenteral nutrition and broad-spectrum intravenous antibiotics.

On subsequent day, a 3D CT image unexpectedly revealed an L-shaped foreign body penetrating the posterior esophageal wall (**Fig. 2**). Therefore, we were able to definitively diagnose esophageal perforation caused by this L-shaped foreign body; subsequently, we dislodged the foreign body by using an upper gastrointestinal endoscope (**Fig. 2**). The 30×30-mm foreign body was identified as the premaxillary bone of a sea bream (**Fig. 3**). The hiatus remaining after removal of the foreign body was not large or bleeding actively; therefore, we did not repair the site of perforation. Follow-up endoscopy 1 week later showed that the hiatus had healed well (**Fig. 4**). Subsequent magnetic resonance imaging revealed no residual bone within the remaining high-density area in the mediastinum. The patient was discharged from our hospital without complications and showed no sign of recurrent pathology upon a 6-month follow-up examination.

Discussion

This case suggests that 3D CT is effective for establishing a diagnosis involving a foreign body by providing a clear image of the object despite the

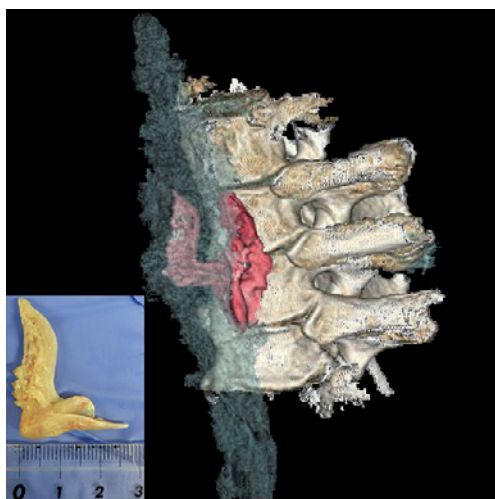


Fig. 3 Three-dimensional computed tomography reveals an L-shaped foreign body (the premaxillary bone of a sea bream [inset]) that had pierced the left posterior esophageal wall.

presence of an obscuring area of high density involving both the foreign body and barium contrast medium.

In patients suspected of having esophageal perforation on the basis of clinical presentation and the results of chest radiography, a CT scan or esophagram should be promptly obtained^{11,12}. In general, the diagnosis of esophageal perforation can also be confirmed with a water-soluble contrast esophagram (e.g., Gastrografin: a mixture of sodium amidotrizoate and meglumine amidotrizoate) that reveals the location and extent of contrast material extravasation. However, with this approach, false-negative results occur in as many as 10% of the cases of esophageal perforation¹³. Therefore, if the results of the water-soluble contrast study are negative, a barium study should be performed for more accurate diagnosis. Although barium is better able to show small perforations, it causes an inflammatory response in the mediastinal and pleural cavities and, therefore, should not be used in the primary diagnostic study¹⁴. Moreover, a contrast examination, especially using barium, should not be performed before an ingested foreign body is removed, because the contrast medium will make the subsequent procedures (e.g., esophagoscopy) technically difficult^{9,15}, as described in the present case.

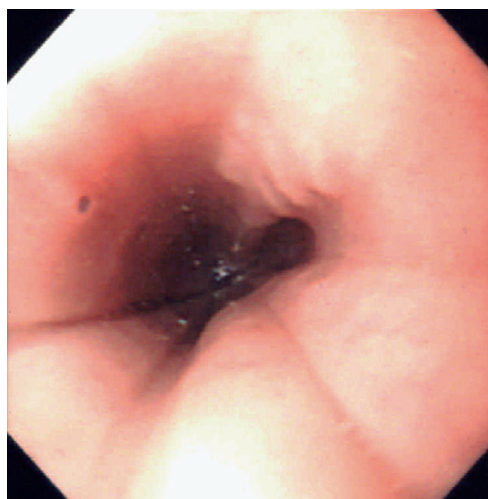


Fig. 4 Follow-up endoscopy after removal of the foreign body.

Zhang et al.⁴ have reported that 3D CT is effective for rapid identification of potentially lethal complications, such as aorto-esophageal fistula, caused by an esophageal foreign body. Therefore, a 3D CT scan may be advantageous not only for diagnosis but also for assessment of complications. In the present case, a horizontal CT scan could not be able to evaluate the perforation lesion enough, because of the residual barium contrast medium. The CT values of barium and bone are too similar to differentiate, even via retrospective re-evaluation by experts. Therefore, 3D CT is recommended in cases involving esophageal perforation of unknown etiology, as this technology can visualize the complete shape of a foreign object with the least interference by previously administered contrast medium.

Esophageal perforation should be diagnosed and treated as soon as possible, because the mortality rate associated with delayed diagnosis is higher than that associated with diagnosis within 24 hours¹⁶. A worsening complication increases the mortality rate. Physician should ensure that the foreign body is completely removed and should aim to prevent subsequent exacerbation of mediastinitis. Treatment with broad-spectrum intravenous antibiotics is essential to avoid secondary mediastinal infection from the perforation, whereas total parenteral nutrition ensures that the patient receives sufficient nutrition for recovery. Regular CT and magnetic

resonance examinations are also essential to monitor possible complications and the healing of the perforation. Unfortunately, in the present case, we did not perform fluoroscopy with a water-soluble contrast medium, as recommended by a previous study¹⁷.

In conclusion, 3D CT is recommended for visualization of suspected esophageal perforation in cases in which contrast medium has been previously administered. By revealing the complete shape of a foreign body, even if it is obscured by a barium contrast medium, 3D CT can facilitate definitive diagnosis and may reveal severe complications early.

Conflict of Interest: All the authors in this paper declare no conflict of interest.

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