Acta Radiologica
2014, Vol. 55(1) 8–13

DOI: 10.1177/0284185113493087
acr.sagepub.com

Fish bone foreign bodies in the pharynx and upper esophagus: evaluation with 64-slice MDCT

Soyeon Park[1], Dae Seob Choi[1,2], Hwa Seon Shin[1], Jae Min Cho[1], Kyung Nyeo Jeon[1], Kyung-Soo Bae[1], Eun Ha Koh[2] and Jung Je Park[2]

Abstract

Background: Fish bone (FB) is one of the common causes of foreign body impaction in the pharynx and esophagus.
Purpose: To investigate the efficacy of 64-slice multidetector computed tomography (MDCT) for the evaluation of pharynx and upper esophageal FB foreign bodies.
Material and Methods: Sixty-six patients with suspected FB foreign body ingestion were examined by plain radiography ($n = 40$) and unenhanced MDCT ($n = 66$). We analyzed the presence, location, size, shape, and lying position of the foreign bodies.
Results: On MDCT, 46 foreign bodies were detected. Among them, 45 were confirmed by endoscopy. The sensitivity of MDCT for the detection of foreign bodies was 100%, which was superior to that of the plain radiography (51.7%). The location of the foreign bodies was most common in the upper esophagus ($n = 22$, 47.8%), followed by pharyngoesophageal junction ($n = 10$, 21.7%), transjunctional ($n = 7$, 15.2%), hypopharynx ($n = 5$, 10.9%), and oropharynx ($n = 2$, 4.3%). Their longest length was 5.3–40.1 mm (mean, 21.3 mm). Thirty-three FBs (71.7%) were linear and 13 (28.3%) were flat in shape. They showed transverse ($n = 23$, 50.0%), parallel ($n = 13$, 28.3%), and oblique positions ($n = 10$, 21.7%) to the long axis of the pharynx and esophagus, respectively.
Conclusion: MDCT is useful for the evaluation of the pharynx and upper esophageal FB foreign bodies.

Keywords
Foreign body, fish bone, multidetector computed tomography, pharynx, esophagus

Date received: 9 March 2013; accepted: 9 May 2013

Introduction

Fish bone (FB) impaction in the pharynx and upper esophagus is a common ear-nose-throat (ENT) emergency in East Asian countries where large amounts of fish are consumed (1). Most of the ingested foreign bodies and food bolus spontaneously reach to the gastrointestinal tract. In 10–20% of the cases, endoscopic intervention is required. Surgical procedures can be required in <1% (2). The patients, who have history of foreign body ingestion, feel continuous dysphasia or foreign body sensation. At the hospital, they usually take plain radiography and physical examinations. The palatine tonsil, tongue base, vallecula, and pyriform sinus are known as common impaction sites, where it is relatively easy for ENT specialists to see and remove the foreign bodies (3). However, if the foreign body is embedded in the pharyngeal wall or located in the postcricoid region of the hypopharynx or the esophagus, it is not easy to identify and remove.

[1]Department of Radiology, Gyeongsang National University School of Medicine, Jinju, Republic of Korea
[2]Gyeongsang Institute of Health Science, Gyeongsang National University School of Medicine, Jinju, Republic of Korea

Corresponding author:
Dae Seob Choi, Department of Radiology, Gyeongsang National University Hospital, Gyeongsang National University School of Medicine, 90 Chilam-dong, Jinju 660-702, Republic of Korea.
Email: choids@gnu.ac.kr

If the diagnosis and treatment get delayed, serious complications such as esophageal perforation, deep neck infection, or mediastinitis can be caused (4).

Plain radiography of the lateral upper airway is commonly examined for foreign body evaluation, however, according to a report from Singh et al. (5), 48% of FBs are radiolucent and diagnostic accuracy is doubtful because of the obstacles such as varying radio-opacity of the bones and calcifications of the thyroid, cricoid, and triticeous cartilages (6). There have been several reports that computed tomography (CT) could detect foreign bodies with a high sensitivity compared to plain radiography. However, most of the studies were used with conventional or single detector spiral CT and included not only the FB, but also various kinds of foreign bodies (7–9).

With multidetector CT (MDCT) technology, volume data of the neck and thorax can be obtained within several seconds. From the volumetric data, coronal or sagittal reformation images with high z-axis resolution can be reconstructed and it can be a potential advantage of MDCT for the evaluation of pharyngoesophageal foreign bodies compared to the conventional CT (10). The purpose of this study was to investigate the diagnostic value of 64-slice MDCT for the evaluation of FB foreign bodies in the pharynx and upper esophagus and to describe their MDCT findings.

Material and Methods

Patients and diagnosis algorithm of FB impaction

This retrospective study was approved by our institutional review board. Informed consent was waived. From December 2010 to August 2011, 66 patients, who had dysphasia or foreign body sensation after the ingestion of raw or cooked fish, were evaluated with 64-slice MDCT. They were 34 boys/men and 32 girls/women, aged 6–72 years (mean, 48.7 years). CT scans were performed in all patients and cervical plain radiography was taken in 40 of the patients. In the cases ($n = 46$) of which foreign body was visible on CT or plain radiography, endoscopic examinations were performed and endoscopic removal of the foreign body was attempted. When cervical plain radiography and CT scans appeared normal ($n = 20$), the patients were observed and clinical follow-up was done.

Image study

Cervical plain radiography was taken with standard projections (anterior-posterior and lateral projections). CT examinations were performed using a 64-slice MDCT system (LightSpeed VCT; GE Healthcare, Milwaukee, WI, USA). Without contrast material administration, CT examinations were performed with spiral mode and the scan range included the skull base to the carina. Parameters for the CT acquisition were: field of view, 140 mm; detector collimation, 64×0.625 mm; table speed, 48 mm/rotation; gantry rotation speed, 0.75 s/rotation; 120 kVp; and 200 mAs. Continuous axial and coronal images were reconstructed with 2.5-mm slice thickness and interval.

Image analysis

Two investigators independently reviewed each plain radiography and CT images in a separate session without knowledge of the clinical and other imaging findings. In the cases of disagreement, the final assessment was made by consensus. The presence and location of the foreign body were assessed. The locations were categorized as one of the five sites, which were the oropharynx, hypopharynx, pharyngoesophageal junction, transjuctional, and upper esophagus, respectively. In the cases of which the foreign bodies were detected, we also evaluated their shape and lying position. The shape was categorized as linear or flat and the lying position was categorized as parallel, transverse, or oblique to the long axis of the pharynx and esophagus (Fig. 1). The longest length of the foreign body was also measured.

Results

In 46 of 66 patients, FB foreign bodies were detected on MDCT. The most common impaction site was the upper esophagus ($n = 22$, 47.8%), followed by the pharyngoesophageal junction ($n = 10$, 21.7%), transjunctional position ($n = 7$, 15.2%), hypopharynx ($n = 5$, 10.9%), and oropharynx ($n = 2$, 4.3%), respectively. Thirty-three FBs (71.7%) were linear and 13 (28.3%) were flat in their shape (Figs. 1–4). The lying position of the foreign body was transverse in 23 (50.0%), parallel in 13 (28.3%), and oblique in 10 (21.7%) to the long axis of the pharynx and esophagus, respectively (Figs. 1–4). Their longest length was 5.3–40.1 mm (mean, 21.3 mm).

Except for one case, all of the foreign bodies which were detected on MDCT were confirmed by endoscopic examinations. Among 45 FBs detected on endoscopic examinations, 40 were successfully removed by endoscopic intervention under local or general anesthesia and the remaining five passed into the stomach during the endoscopic procedures. The 20 patients in whom MDCT was negative were followed up in the outpatient clinic after 1 week and all were asymptomatic, suggesting that no foreign body was present in the pharynx or esophagus. For the detection of the FB foreign body, the sensitivity of MDCT was 100% (45/45) (Table 1).

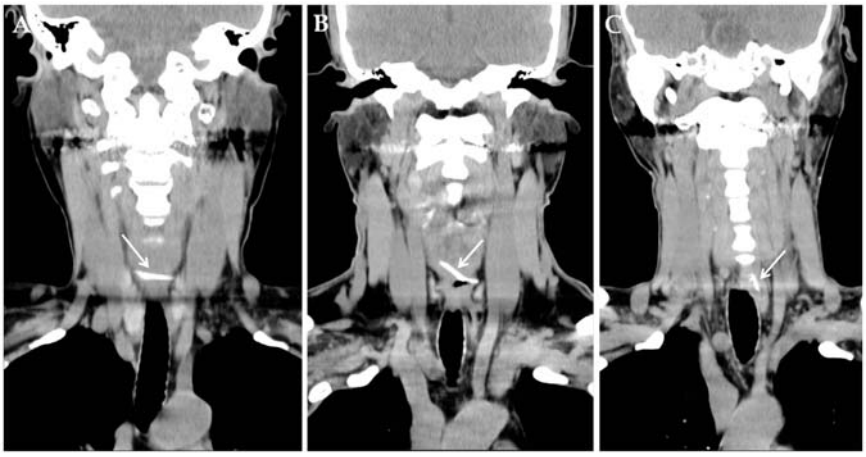

Fig. 1. Lying positions of foreign bodies. Transverse (A), oblique (B), and parallel (C) lying positions.

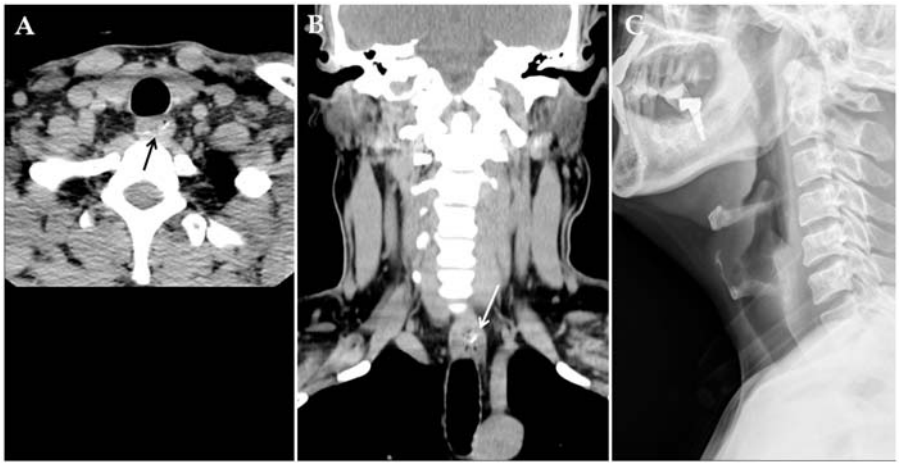

Fig. 2. A 48-year-old man with odynophagia. Axial (A) and coronal (B) CT scans reveal a high density foreign body positioned transversely in the cervical esophagus (arrow). There is no remarkable finding on the lateral projection of cervical radiography (C). Flexible esophagoscopy confirmed the foreign body in the cervical esophagus.

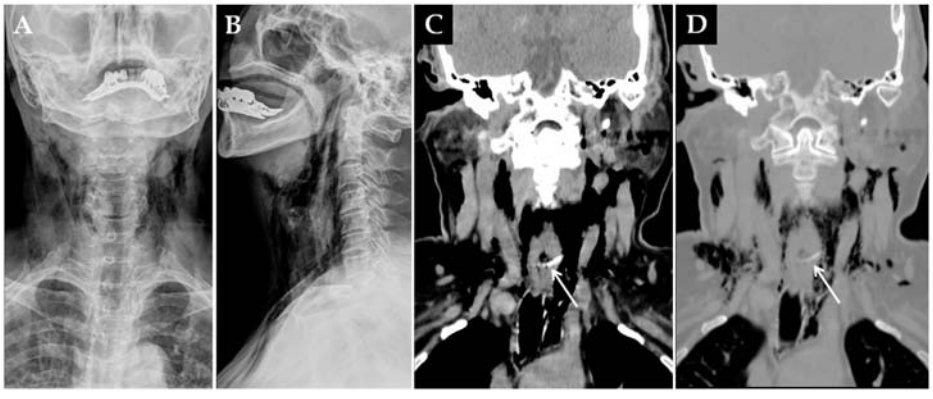

Fig. 3. A 72-year-old woman with throat pain. AP (A) and lateral (B) projections of cervical radiography reveal diffuse emphysema in the neck and anterior chest wall, but there is no visible foreign body. Coronal CT scans of soft tissue (C) and bone window (D) setting demonstrate a linear hyperdense foreign body at the pharyngo-esophageal junction (arrow).

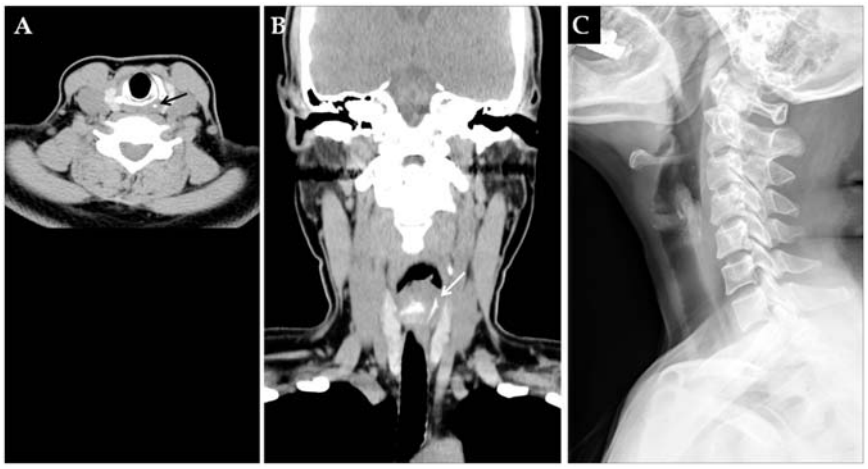

Fig. 4. A 50-year-old woman with throat pain. Axial (A) and coronal (B) CT scans demonstrate a linear foreign body in the hypopharynx to the upper esophagus (arrow). There is no evidence of radio-opaque foreign body on lateral cervical radiography (C). She took an esophagoscope examination, but there was no visible foreign body.

Table 1. MDCT for the detection of fish bone foreign bodies.

	MDCT (+)	MDCT (–)	Total
Endoscopy or F/U (+)	45	0	45
Endoscopy or F/U (–)	1	20	21
Total	46	20	66

Table 2. Plain radiography for the detection of fish bone foreign bodies.

	Plain radiography (+)	Plain radiography (–)	Total
Endoscopy or F/U (+)	15	14	29
Endoscopy or F/U (–)	0	11	11
Total	15	25	40

Among the 40 patients where plain radiography was performed, foreign bodies were detected in 15 and all were confirmed by endoscopic examination. For 14 of 25 patients whose foreign body was not observed by plain radiography, foreign bodies were detected on MDCT and were confirmed by endoscopic examinations (Figs. 2 and 3). In the remaining 11 patients, foreign bodies were not detected by MDCT either. Therefore, the sensitivity of plain radiography for the detection of foreign bodies was 51.7% (15/29) (Table 2).

Discussion

In East Asian countries, FB is the most common cause of foreign body impaction in the pharynx and esophagus (1). Patients who are suspected of foreign body impaction usually take a physical examination and an indirect laryngoscopic examination. Although the pharyngeal foreign bodies are easily detected by physical and laryngoscopic examinations, sometimes it can be difficult to detect the FB foreign bodies because they are usually sharp and pointed and may invade into the deep portion of the pharyngeal wall. Furthermore, the foreign bodies located in the esophagus level are not possible to diagnose with laryngoscopic examinations.

Plain radiography is preferentially taken as an imaging modality for the evaluation of the pharyngoesophageal foreign bodies. However, it has been reported that plain radiography is not sensitive for the detection of the FB foreign body. According to previous studies, the sensitivity of plain radiography was 23.5–54.8% (1, 3, 11). In our study, plain radiography had a 51.7% sensitivity, which is similar to previous reports. The radiological visualization of a foreign body depends on its radio-opacity. Small or thin FBs are usually radiolucent (1).

It has been reported that CT is a useful imaging modality for the evaluation of FB impaction in the pharynx and esophagus. The reported sensitivity and specificity of the CT were 90.9–100% and 91–100%, respectively (1,8,9,11). In our series of 66 cases, the sensitivity and specificity were 100% and 95.2%, respectively. There was one false-positive case, in which CT showed a linear FB in the hypopharynx to the upper esophagus. However, the FB was not found by

endoscopic examination. In this case, the foreign body might have spontaneously passed into the stomach prior to the endoscopic examination (Fig. 4).

For the evaluation of the pharyngoesophageal foreign bodies, not only their presence, but their location, size, shape, lying position, and relationship to other vital structures are also important. MDCT has been found useful for the evaluation of patients with suspected pharyngoesophageal foreign bodies because it offers short examination time and the ability to obtain diagnostically useful coronal and sagittal reconstruction images (10). In the present study, MDCT was useful for the evaluation of the location, size, shape, and lying position of the FB foreign bodies and their relationship to the neighboring structures. There were two cases with complications. One had a retropharyngeal abscess and the other had soft tissue emphysema in the neck and anterior chest wall. On MDCT, the foreign bodies were found in the lumen of the hypopharynx and esophagus (Fig. 3). Under general anesthesia, endoscopic intervention was attempted and they were successfully removed. After conservative management with antibiotics, the clinical condition improved and the radiological findings disappeared on follow-up studies.

In our study, the most common location of the FB impaction was the upper esophagus (47.8%), followed by the pharyngoesophageal junction (21.7%), and transjunctional (15.2%), which is consistent with previous studies (12,13). The cricopharyngeal sphincter is the narrowest point in the gastrointestinal tract, approximately 14 mm in diameter and the relatively weak peristalsis in the upper esophagus makes this site especially vulnerable (13,14).

Most of the previous studies for the evaluation of FB foreign bodies were focused on the detectability of CT and the CT findings were hardly described. The size, shape, and lying position of the impacted FB are also important for appropriate treatment planning. The larger the foreign body is in its size, the more difficult it is to remove with endoscopic procedures. The foreign bodies with a sharp or pointed end and transverse lying position are prone to perforate the pharynx and esophageal walls (Fig. 3) (15,16). In our study, from the axial and coronal reconstruction images, we could easily assess the size, shape, and lying position of the FBs. The majority of the FBs (71.7%) were linear in shape. For the assessment of the lying position, the FBs showed transverse (50.0%), parallel (28.3%), and oblique positions (21.7%) to the long axis of the pharynx and esophagus, respectively.

This study has some limitations. First, it was a retrospective study. Before the radiological evaluation, patients underwent a physical and indirect laryngoscopic examination. When a FB foreign body was detected on the examination, it was immediately removed. In cases which were equivocal on the initial examination or difficult in direct removal of the foreign body, the patients were evaluated with MDCT and/or plain radiography, which can cause a selection bias. Second, endoscopic examinations were not performed in patients whose FB foreign body was not detected on MDCT. However, an endoscopic procedure is invasive with a potential risk. An embedded FB in deep layer of the pharynx and esophagus can usually not be found by endoscopy. If the FB is located out of the pharynx and esophagus, its presence cannot be confirmed by endoscopy either (17).

In conclusion, 64-slice MDCT is highly sensitive in the detection of FB foreign bodies in the pharynx and upper esophagus. MDCT is useful for the evaluation of the pharynx and upper esophageal FB foreign bodies.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. Watanabe K, Kikuchi T, Katori Y, et al. The usefulness of computed tomography in the diagnosis of impacted fish bones in the oesophagus. J Laryngol Otol 1998;112:360–364.
2. Eisen GM, Baron TH, Dominitz JA, et al. Guideline for the management of ingested foreign bodies. Gastrointes Edosc 2002;55:802–806.
3. Evans MR, Ahuja A, Rhys Williams S, et al. The lateral neck radiograph in suspected impacted fish bones: does it have a role? Clin Radiol 1992;46:121–123.
4. Nandi P, Ong GB. Foreign bodies in the oesophagus: reviews of 2394 cases. Br J Surg 1978;65:5–9.
5. Singh B, Kanto M, Har-El G, et al. Complications associated with 357 foreign bodies of the pharynx, larynx, and esophagus. Ann Otol Rhinol Laryngol 1997;106:301–304.
6. Talmi YP, Bedrin L, Ofer A, et al. Prevertebral calcification masquerading fish bone ingestion. Ann Otol Rhinol Laryngol 1997;106:435–436.
7. Braverman I, Gomori JM, Polv O, et al. The role of CT imaging in the evaluation of cervicalesophageal foreign bodies. J Otolaryngol 1993;22:311–314.
8. Eliashar R, Dano I, Dangoor E, et al. Computed tomography diagnosis of esophageal bone impaction: a prospective study. Ann Otol Rhinol Laryngol 1999;108:708–710.
9. Marco De Lucas E, Sádaba P, Lastra García-Barón P, et al. Value of helical computed tomography in the management of upper esophageal foreign bodies. Acta Radiol 2004;45:369–374.
10. Pinto A, Muzj C, Gagliardi N, et al. Role of imaging in the assessment of impacted foreign bodies in the hypopharynx and cervical esophagus. Semin Ultrasound CT MR 2012;33:463–470.

11. Hirasaki S, Inoue A, Kubo M, et al. Esophageal large fish bone (Sea bream jawbone) impaction successfully managed with endoscopy and safely excreted through the intestinal tract. Inter Med 2010;49:995–999.
12. Morales-Angulo C, Rodríguez Iglesias J, Mazón Gutiérrez A, et al. Foreign bodies of the esophagus. Acta Otorrinolaring Esp 1998;49:644–646.
13. Kamath P, Bhojwani KM, Prasannaraj T, et al. Foreign bodies in the aerodigestive tract-a clinical study of cases in the coastal belt of South India. Am J Otolaryngol 2006;27:373–377.
14. Smith MT, Wong RK. Foreign bodies. Gastrointest Endosc Clin N Am 2007;17:361–382.
15. Poluri A, Singh B, Sperling N, et al. Retropharyngeal abscess secondary to penetrating foreign bodies. J Craniomaxillofac Surg 2000;28:243–246.
16. Chee LW, Sethi DS. Diagnostic and therapeutic approach to migrating foreign bodies. Ann Otol Rhinol Laryngol 1999;108:177–180.
17. Mosca S, Manes G, Martino R, et al. Endoscopic management of foreign bodies in the upper gastrointestinal tract: report on a series of 414 adult patients. Endoscopy 2001;33:692–696.