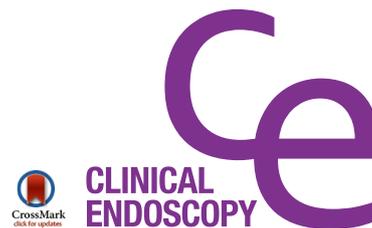


REVIEW

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Oroesophageal Fish Bone Foreign Body

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Fish bone foreign body (FFB) is the most frequent food-associated foreign body (FB) in adults, especially in Asia, versus meat in Western countries. The esophageal sphincter is the most common lodging site. Esophageal FB disease tends to occur more frequently in men than in women. The first diagnostic method is laryngoscopic examination. Because simple radiography of the neck has low sensitivity, if perforation or severe complications requiring surgery are expected, computed tomography should be used. The risk factors associated with poor prognosis are long time lapse after FB involvement, bone type, and longer FB (>3 cm). Bleeding and perforation are more common in FFB disease than in other FB diseases. Esophageal FB disease requires urgent treatment within 24 hours. However, FFB disease needs emergent treatment, preferably within 2 hours, and definitely within 6 hours. Esophageal FFB disease usually occurs at the physiological stricture of the esophagus. The aortic arch eminence is the second physiological stricture. If the FB penetrates the esophageal wall, a life-threatening aortoesophageal fistula can develop. Therefore, it is better to consult a thoracic surgeon prior to endoscopic removal. **Clin Endosc 2016;49:318-326**

Key Words: Seafood; Bone and bones; Foreign bodies; Esophagus; Pharynx

INTRODUCTION

Aeroesophageal foreign body (FB) disease can be divided according to the involved organ: tracheobronchial tree, oropharynx, and esophageal or other gastrointestinal tract. In one study showing the distribution of aeroesophageal FB, 90% of patients had a retained FB, while it passed in the other 10%. Among the retained FB cases, it was found in the pharyngo-esophagus in 86.2% of cases and in the tracheobronchial tree in 13.7% of cases.¹ With rapid development of diagnostic and therapeutic gastrointestinal endoscopy, all pharyngeal and esophageal FB diseases, except for tracheobronchial, are considered gastroenterological. The fish bone is a very common cause of FB disease in areas in which the people frequently

eat fish. The esophageal fish bone foreign body (FFB) diseases have a wide spectrum of clinical manifestations from minor disease that can resolve spontaneously to severe fatal diseases. This article addresses the esophageal FFB diseases including pharyngeal FB because their symptom manifestations are similar from the patient perspective.

FISH BONE FOREIGN BODY IN THE ESOPHAGUS AND PHARYNX

General aspect

The major causes of FB disease differ between children and adults. FB diseases due to nonfood objects are more common in children than in adults, especially those 6 months to 6 years of age.²⁻⁶ Coins are most common in children.⁷ Adult true FB diseases are common in individuals who are elderly, have psychiatric conditions, have developmental disabilities, are inebriated, or are prisoners seeking a secondary gain.^{5,8-10} The main causes of foodborne FB diseases also vary among geographic regions and cultures. The most common esophageal FB diseases in adults in the Western world are due to impacted meat or other food,⁵ with an estimated annual incidence of

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13/100,000 people.¹¹ However, in the Asian culture or coastal areas, fish bone is the most common cause.¹²⁻¹⁴ Approximately 80% to 90% of ingested FBs are passed spontaneously without complications,¹⁵⁻¹⁸ while 10% to 20% of FBs in the alimentary tract require endoscopic removal and approximately 1% require surgical intervention.¹⁵⁻¹⁸ However, intentionally ingested FBs much more commonly require endoscopic treatment (63% to 76%) and surgery (12% to 16%).^{19,20} Mortality is not uncommon in FB diseases. In the 1970s, approximately 1,500 people in the United States died annually of FB diseases.²¹ Therefore, clinicians should remember that FB diseases can be serious or even fatal.

Epidemiology

Contrary to Western countries where the food bolus impaction is more common,⁵ FFB are most common in Asia.¹²⁻¹⁴ In South China, fish bone ingestion is most common (60%) among the FB diseases and becomes more prevalent with time.²² In Korea, FFB is most common (46% to 72.3%) in upper gastrointestinal FB disease.²³⁻²⁶ Sex distributions varied among centers. Many institutes have shown a male predominance.^{2-4,23-25,27,28} However, other institutes have shown a female predominance.^{26,29} Mean ages differed by study design; however, in two studies of adult FFB, the mean female age was somewhat higher than the mean male age.^{23,26}

There are no well-controlled epidemiologic data of the incidence of FFB diseases in Korea. The results reported to date differed among institutes and the main treating department. Two studies of treatment in the ear-nose-throat department (ENT) setting are available. In the consortium of Seoul National University Hospital, Seoul National University Boramae Medical Center, and Seoul National University Bundang Hospital (midwestern coastal region in Korea), 270 patients were diagnosed with FFB in the oropharynx over 61 months.³⁰ The other study reported treatment in the ENT department of Gyeongsang National University Hospital (southern coastal region in Korea) of a total of 198 cases of FFB disease over 21 months, of which approximately 37.9% of patients were <20 years of age.²⁹

Several epidemiologic data have been reported in the gastroenterology setting. In Gyeongsang National University Hospital, 188 cases of esophageal FFB disease were diagnosed over 71 months (January 1998 to November 2003);²⁴ in Asan Medical Center (midwestern coastal region in Korea), 196 cases of esophageal FFB disease were diagnosed including 13 cases of esophageal perforation over 91 months (January 2000 to July 2008);³¹ in Jeju National University Hospital (southern island in Korea), 77 cases of pharyngoesophageal FFB diseases were diagnosed over 89 months (March 2004 to March 2011);²⁶ and in Dankook University Hospital (central inland in

Korea), 113 cases of esophageal FFB diseases including three child patients were diagnosed over 168 months (January 2001 to December 2014).²³

Lodging site

One study reported that in the ENT setting, oropharyngeal FFBs are more common in young patients, while esophageal FFB is primarily observed in patients >40 years of age.²⁹ They suspected the reason for the rapid increase in FFB in the esophagus in people >40 years is related to deterioration of the swallowing movement and esophageal physiological characteristics that develop with age.^{29,32} However, in the gastroenterology setting, esophageal FFB is more common than oropharyngeal FFB.^{23,25,26}

Frequent lodging sites in the oropharynx are the tonsils, tongue base, valleculae, and pyriform recesses, the tonsils being the most common site.^{29,30,32,33} Some authors suggested inspecting the tonsils first prior to evaluating another pharyngeal regions.³⁴ Major complications of FB such as impaction, perforation, or obstruction usually occur in areas of gastrointestinal angulation or narrowing.³⁵ It is well known that the esophagus has three areas of physiological narrowing: the upper esophageal sphincter, eminence of the aortic arch or the left main bronchus, and the lower esophageal sphincter. In addition, an anatomical pathology, such as stenosis, will create another site. The upper esophageal sphincter is the most common lodging site of FFB.^{7,12,23,24,26,36} It is very important to know, at least in cases of sharp-pointed FB objects, that the aortic eminence is a physiological stricture. A sharp FFB lodged within the second physiological stricture that penetrates the esophageal wall can cause a fatal aortoesophageal fistula (AEF).

FFB shape also influences the lodging site. In one study, flat or polygonal FFBs tended to involve the esophagus, whereas linear bones more commonly became lodged in the pharynx.²⁶

Causative fish species as origin of FFB

Many patients with FFB could not recall what kind of fish they ate. Causative fishes differ among regions and cultures. In Jeju, the most common FFB fish is the damselfish (*Chromis notata*), followed by armorclad rockfish and houttuyn.²⁶ Contrary to Jeju, the three most common species were groaker, turbot, and rockfish in Jinju province.²⁹ In the Seoul-Gyeonggi region, mackerel, yellow corbina, and cutlass fish were common, although incidences varied among institutes.³⁰

Fish recipes may influence FFB disease. In one study, fish stew caused the highest number of cases of esophageal FB disease, followed by baked fish, steamed fish, and raw fish.²⁹ Another study showed soup recipes, including stew, were

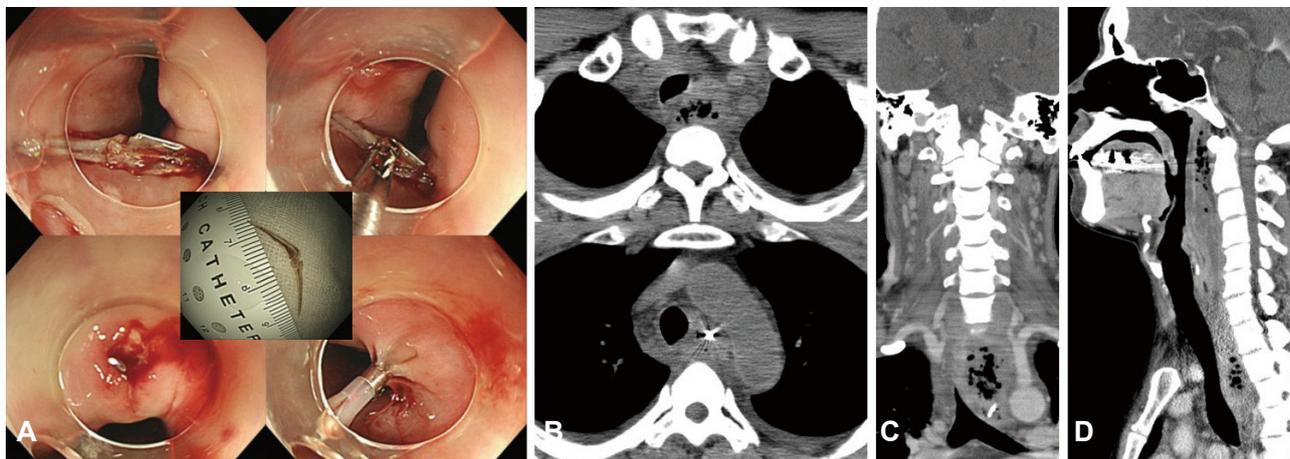


Fig. 1. Complicated case of esophageal fish bone foreign body (FFB) of a 43-year-old man who had alcoholic liver cirrhosis and chronic pancreatitis and had complained of back pain since 3 days before. (A) Endoscopic photography shows a typical damselfish (“Jari” in Korean) FFB near the aortic arch eminence. There was no evidence of an aortic arch injury on the first computed tomography (CT). During endoscopy, the FFB impacting one side of the esophageal wall was removed using foreign body forceps and the penetrated hole was sutured using a hemoclip. Approximately a 2.5-cm length of typical “anal fin spine-pterygiophore complex” FFB was removed successfully. On the second hospital day, fever and dyspnea were aggravated. On the follow-up CT, pneumomediastinitis with abscess formation was seen (B, cross-section; C, coronal section; D, sagittal section). Note that free air and inflammatory material extended up to the retronasopharyngeal space. The patient transferred to the surgical ward and underwent surgery on hospital day 3. The postoperative course was uneventful and the patient was discharged on hospital day 30.

the most common culprits.²⁶ However, this can depend on fish type.²⁶ In Jeju province, the most common FFB disease is caused by damselfish bones, especially by the anal fin spine-pterygiophore complex, which causes more serious complications due to its peculiar shape (Fig. 1).²⁶ Esophageal linear slender FFBs can be passed to stomach. However the sharp pointed linear FFB could be remained in the esophagus because it can penetrate the mucosa and anchored in the esophagus.

Symptoms

The diagnosis of FFB is based on the patient’s diet history and symptoms. A physical examination should evaluate the patient’s general condition and assess signs of any complications.¹⁸ The symptoms of esophageal FB diseases are FB sensation, sore throat, dysphagia, odynophagia, retrosternal pain, retching, and vomiting.^{16,17,37,38} FB sensation and localized pain could be the main complaints in the early period of FFB disease. Later, localized inflammatory or systemic symptoms by the progression of complications may become evident. Patients can generally identify the ingestion and localize the discomfort. However, the area of discomfort often does not correlate with the site of impaction.³⁹ Patients could identify the correct location if the FB is lodged in the upper esophagus or above. However, below this region, the symptoms became vague, making localization of the impact site difficult. Severe and systemic symptoms such as swelling and crepitus on the neck, hematemesis, dysphagia, dyspnea, fever, and chest and back pain can be reported after complications develop.

Esophageal abrasions secondary to ingested FB can often mimic impaction. FB sensations can persist for several hours even after the FB has passed the esophagus or has been removed endoscopically.¹⁸ It is very embarrassing for patients and physicians when no FB is found endoscopically for patients who complain of FB sensations. In such cases, computed tomography (CT) can be a good alternative. If there is no detected FB on the CT of the patient who complains of an FB sensation, the doctor can state “no FB” with high confidence because CT has a high negative predictive value (up to 97%).⁴⁰

Radiologic evaluation

Radiographic study of the neck, chest, and abdomen is needed to assess the presence, location, size, configuration, and number of ingested objects. It also helps to detect FB-induced complications.^{18,41,42} Contrary to nonfood objects and large animal bones that can mostly be identified on radiography, fish bones are difficult to be identified on radiography.¹⁸ The detection rate of plain radiography is dependent on bony calcification or fish type.⁴³ Although plain radiography is recommended as the initial screening method, its sensitivity for detecting FFB is only 32%⁴⁴ and false-negative rate is reportedly as high as 47%.²⁷ Biplane radiography helps detect FB that is not detectable on plain radiography (Fig. 2).¹⁸ Imaging both the anteroposterior and lateral views increases the detection rates of FB and free mediastinal or peritoneal air.⁴² Because the anteroposterior view of the neck rarely detects FFB, the lateral view is better for detecting oropharyngeal and upper esophageal FFB (Fig. 3A, B).⁴⁵

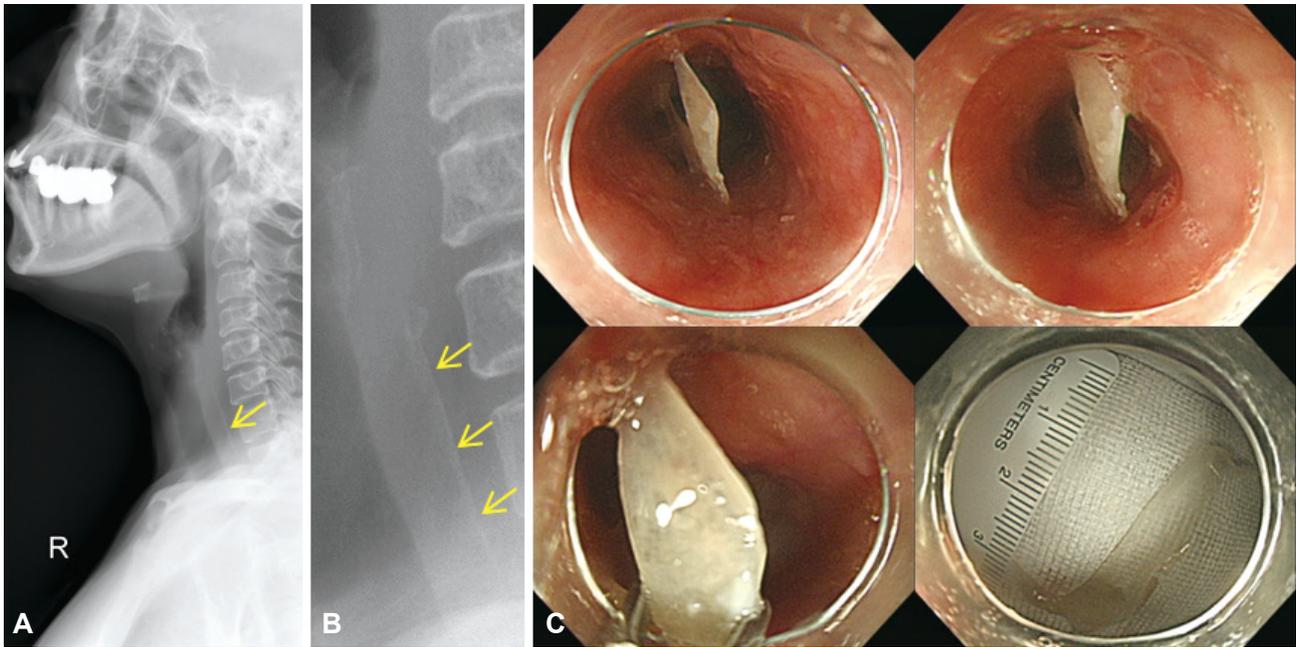


Fig. 2. A typical case of upper esophageal fish bone foreign body (FFB) disease in a 62-year-old woman complaining odynophagia after eating a fish (*Lateolabrax japonicus*) 1 day before. (A) On the neck lateral X-ray (NLX) and (B) its magnified view, about 3 cm of linear opacity was seen. (C) The FFB was removed using cap-fitted endoscopy. In cases of upper esophageal FFB above the thoracic inlet, a simple NLX is a useful single modality to diagnose the FFB disease prior to do endoscopic examination without need to check computed tomography. Arrows denote FFB.

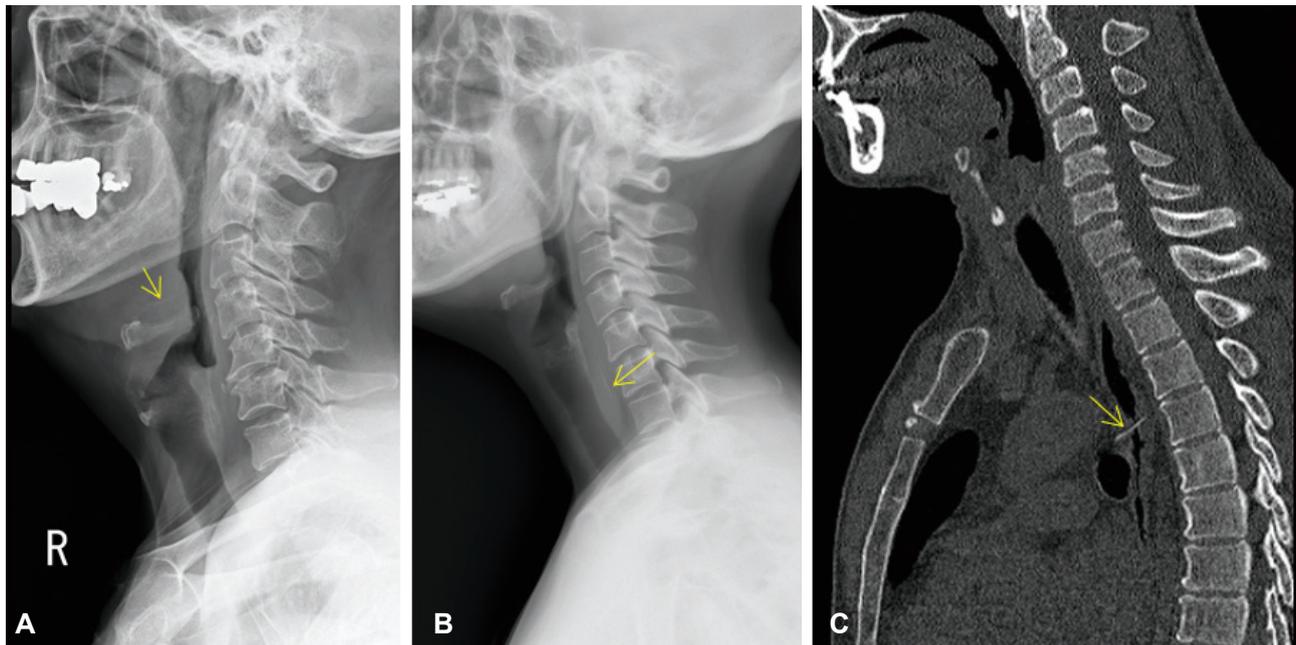


Fig. 3. Neck lateral X-ray (NLX) and computed tomography (CT) to identify fish bone foreign bodies (FFBs). (A) Hypopharyngeal FFB. (B) Cervical esophageal FFB. (C) Thoracic esophageal FFB. The hypopharyngeal and cervical esophageal FFB are well detected on the NLX. However, below the thoracic inlet, only CT can detect the FFBs. Arrows denote FFBs.

The FB lodged below the thoracic inlet could not be detected with plain radiography, even in the lateral view. CT is superior to plain radiography for localizing and identifying FB and is highly reliable for localizing FB in the esophagus (Fig. 3C).⁴⁶ CT has high sensitivity (90% to 100%) and specificity (93.7%

to 100%).⁴⁷⁻⁵⁰ CT sensitivity may increase with three-dimensional reconstruction, i.e., coronal or sagittal views.⁵¹ Positive and negative prospective values of CT are 75% and 97%, respectively.⁴⁰ CT is a very useful method in cases of imbedded FB that require focused diagnosis and treatment as well

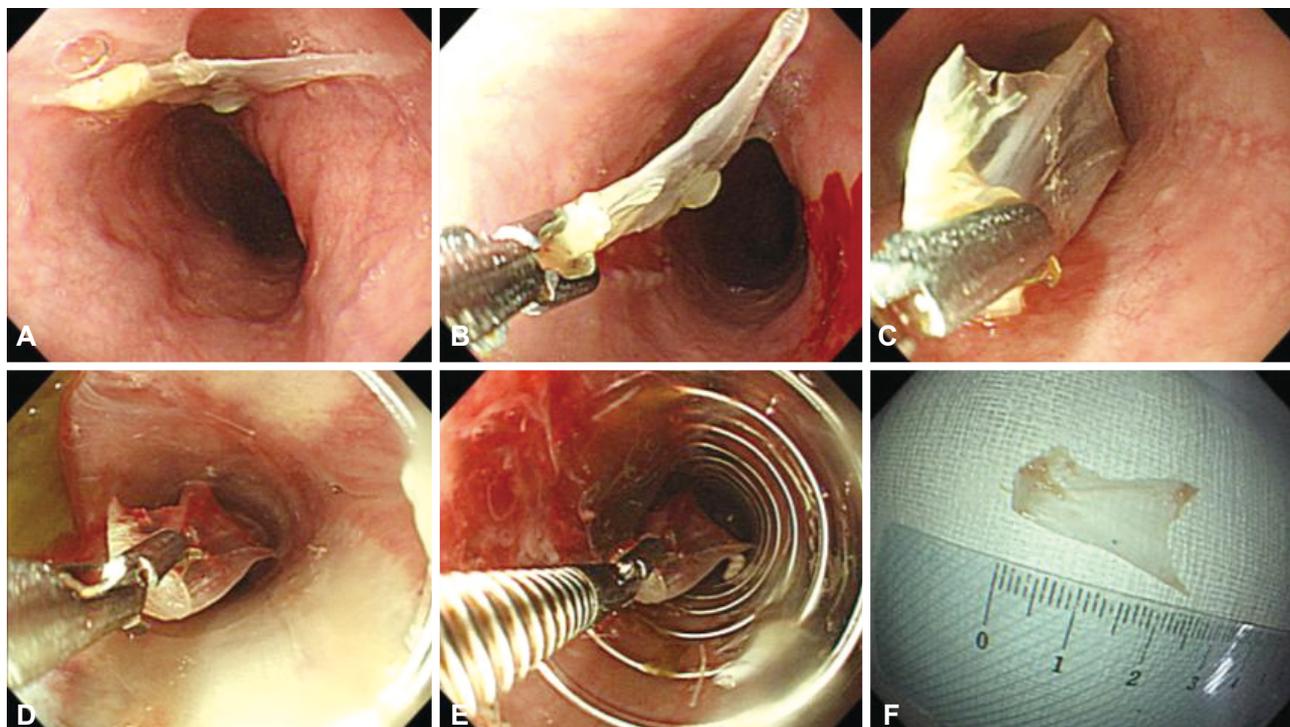


Fig. 4. (A-F) Serial endoscopic photos of removal of the esophageal flat fish bone foreign body (FFB) using an overtube. Many esophageal FFB are flat, large, and have a sharp polygonal edge. For this reason, esophageal laceration can be evoked during FFB retrieval, especially upper esophageal sphincter. Using an overtube not only protects the upper esophageal mucosa from laceration but also helps protect the airway from aspiration.

as in cases of passed FB with remaining FB sensation. CT is an essential diagnostic modality for detecting and predicting FB-related current or impending complications.

Contrast esophagography is not recommended as an initial diagnostic modality because of the related high risk of aspiration and interference with the subsequent endoscopic visualization.^{18,42} However, for making the diagnosis of esophageal perforation, esophagography remains the standard. The use of a water-soluble contrast agent is the first choice because it can be absorbed rapidly despite a low detection rate (50% of cervical and 75% to 80% of thoracic perforation cases), while the barium contrast exam is used as a rescue method.⁵² The overall false-negative rate of esophagography for detecting perforations is 10%. However, clinicians should remember that aspiration of the hypertonic water-soluble contrast solution leads to pulmonary edema.³⁸

Initial evaluation and timing for treatment

Initial management includes assessing the airway and respiratory status to identify patients who are at high risk of aspiration.⁴² Although >80% of FB may pass without intervention,¹⁵ esophageal FB should be treated more urgently than gastric FB since it is more likely to become obstructed and aspirated since the esophagus features a narrow lumen and thin wall that is vulnerable to pressure or perforating force, is

located at the center of major organ, and is more easily accessible with endoscopy than the stomach. Many authors have reported that esophageal FB and food impactions should be removed within 24 hours because treatment delay decreases the possibility of successful removal and increases the risk of complications.^{2,53} FFB disease has a higher risk of severe complications if the treatment is delayed beyond 24 hours⁵⁴ and a high frequency of bleeding compared to other FB diseases.²⁸ Some authors recently recommended a more aggressive treatment for patients with high-risk status, including FB inducing complete esophageal obstruction and the ingestion of a sharp object or battery into the esophagus.¹⁸ They recommended emergent (preferably within 2 hours, but within 6 hours at the most) therapeutic esophagogastroduodenoscopy (EGD) for patients with high-risk esophageal FB as well as urgent (within 24 hours) EGD for other esophageal FB.¹⁸ Most FFB are sharp objects, so FFB should be treated emergently.

Treatment modality

The initial assessment of the patient complaining of an FB sensation in the neck consists of an oral cavity examination with a tongue depressor and a pen light. The next step is direct laryngoscopic examination, followed by flexible or rigid endoscopy.⁴² Although flexible endoscopy of ENT has a lower risk of perforation and a high success rate,¹⁸ rigid endoscopy

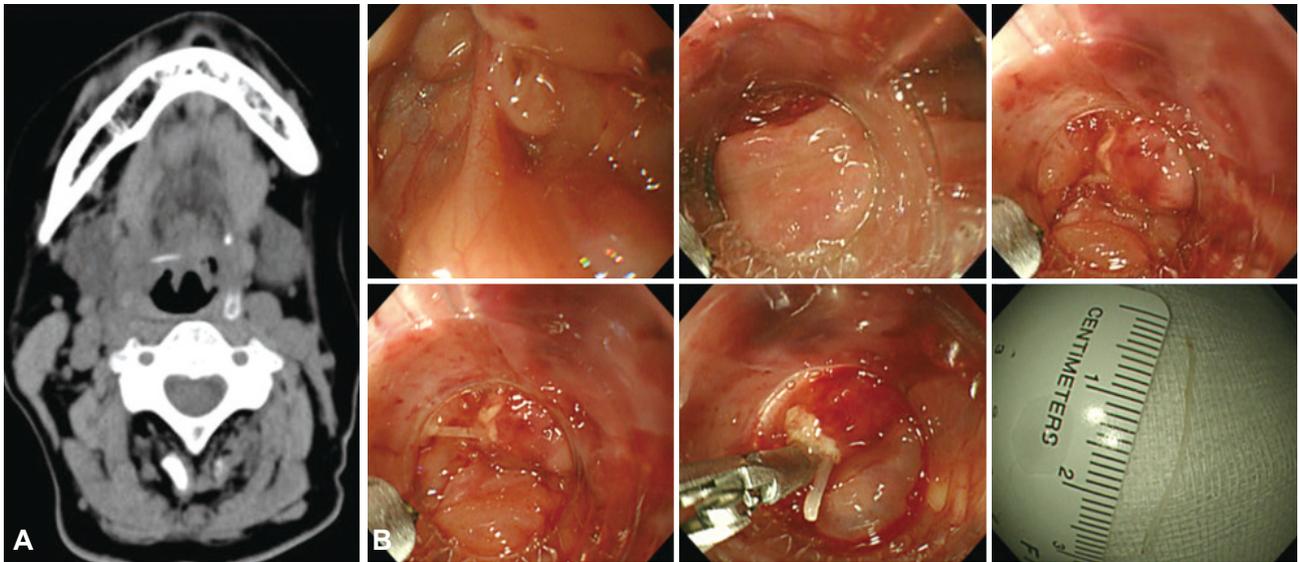


Fig. 5. Usefulness of cap-fitted endoscopy in the collapsed pharyngeal space. A linear fish bone foreign body (FFB) is totally imbedded in the right vallecula on computed tomography (A). Serial photos to find, expose, and remove the imbedded FFB (B). The naked endoscopic tip cannot approach and visualize the collapsed space. The cap-fitted endoscopy is useful not only visualize the collapsed mucosa but also detect and expose the imbedded FFB by sweeping mucosa with the edge of the cap. Cap also makes the sufficient space to operate the forcep to remove the FFB in the collapsed space.

has some advantages for FB impacted in the upper esophageal sphincter or hypopharyngeal region.⁵⁵

Since EGD is a widespread and rapidly developed therapeutic technique, it has recently become the first therapeutic modality for the pharyngoesophageal FFB disease in Korea. Because CT is an expensive diagnostic modality, simple radiology only could be used prior to EGD in many institutions since it allows the examination of both the pharynx and upper esophagus in patients complaining of only a “neck” FB sensation. Therefore, the endoscopist should meticulously evaluate the oropharyngeal mucosa prior to entering the upper esophageal sphincter.

In cases of non-sealed perforation, abscess formation, complete object imbedding beyond the lumen, uncontrolled bleeding and infection, and adjacent organ injury, surgical treatment may be indicated. Minimal invasive surgeries were recently introduced.⁵⁶

An FFB is a sharp FB that can penetrate the mucosa and wall of the digestive tract. Although the esophageal wall is totally penetrated by a small linear FFB, significant air and liquid leakage rarely occur in the early phase because the penetrated hole may be sealed by the FFB itself. In this case, short-term antibiotics can be used prophylactically. However, in cases of gross perforation, laceration, and pus discharge, it should be managed as mediastinitis. In one study, the FFB tended to become impacted in a transverse position rather than a parallel or oblique position in the pharynx and esophagus. This tendency enables the FFB to more easily penetrate the esophageal wall, particularly linear and sharp objects. As

such, if the FFB has two pointed ends, it can penetrate both esophageal walls, which would decrease the luminal stretching power and create an FB sensation in the early phase that may delay hospitalization.

Protect and retrieval devices

Protective devices are needed to avoid mucosal damage and aspiration during endoscopic FB removal, and endotracheal intubation should be considered in cases with a high risk of aspiration.¹⁸ An overtube is useful to protect mucosal damage during FB retrieval and create additional airway protection (Fig. 4).^{37,38,57} A transparent cap is also useful for protecting the mucosa during FB retrieval and providing a clear visual field within the collapsed lumen during endoscopy (Fig. 2). It is a safe and effective method for removing upper esophageal FB and shortening operative time.⁵⁸ The transparent cap is also useful for pharyngeal FB (Fig. 5).⁵⁹ A rubber hood can be used to protect the esophageal mucosa during retrieval of sharp objects.¹⁸

The choice of retrieval device is determined by the FB and endoscopy characteristics as well as the endoscopist's preference. Appropriated retrieval devices to remove sharp-pointed objects include grasping forceps, polypectomy snare, basket, retrieval net, transparent cap, and latex rubber hood.¹⁸ Rat tooth and alligator forceps are the main grasping forceps used to retrieve the FFB. The difference of these two forceps is the grasping surface: The former can grasp FB with its tooth-like tip (Fig. 4B), whereas the latter grasps it using its entire jaw. Conventional standard biopsy forceps may not be recom-

mended except for small linear FFB due to its small opening width, which decreases the success rate.¹⁶ In cases of flat FFB, the polypectomy snare, basket, and retrieval net also can be used.

Complications

Serious complications are more frequent in adults than in children. Aspiration, asphyxia, and obstruction would be most serious complications in cases of food bolus impaction. However, in FFB disease, the primary insults of FFB inducing complications are initiated by penetration/perforation and laceration of the pharyngoesophageal wall. Esophageal perforations due to FB ingestion account for 1% to 4% of the total reported cases.⁶⁰ However, in FFB, esophageal penetration or perforation reportedly occur in >50% of cases.²⁶ After the insult, infection and adjacent organ damage can develop.

In one study, esophageal perforation was present in 18 of 196 patients with esophageal FB. Among the 18 cases of perforation, 13 were FFB diseases. Of the 13 cases of perforated FFB disease, six underwent surgical operation; primary closure and drainage, esophageal resection, and colon interposition, open thoracotomy after neck incision and drainage (I&D), empyectomy, thoracoscopic drainage, and I&D.³¹

The risk of complications was increased with a longer duration of impaction (>24 hours),⁵⁴ bone type,²⁶ and longer bone length (>3 cm).⁶¹ FFB more frequently features bleeding than other kinds of FB.²⁸ In pharyngeal FFB, deep neck infection, neck abscess, epidural abscess,⁶² and retropharyngeal hematoma⁶³ are the main complications, and the FFB can migrate through the soft tissue of the neck to the skin.⁶⁴ If the FFB erodes the esophageal mucosa, esophageal dissection and intramural hematoma^{65,66} or abscess formation could be possible.⁶⁷ When the FFB penetrates the entire esophageal wall to the airway, tracheoesophageal fistula,^{68,69} recurrent pneumonia,⁷⁰ lung abscess,⁷¹ empyema,⁷² or pneumothorax can develop. Mediastinitis⁷³ and abscess formation is the most common complication when the FFB penetrates the entire esophageal wall (Fig. 1). If the FFB advances to the heart, pericarditis,⁷⁴ cardiac tamponade, infectious endocarditis,⁷⁵ and systemic air embolism⁷⁶ may occur.

The major concern is penetration of a major vascular structure, especially the aorta and aortic arch. It is well known that the aortic arch eminence is the second physiological stricture of the esophagus. If a sharp FFB becomes lodged and penetrates the aortic arch eminence, a pseudoaneurysm⁷⁷ or AEF^{78,79} can develop. AEF is the most serious complication of FFB disease in the esophagus. If an endoscopist accidentally detects an FFB impacting the aortic eminence, it is better to stop the endoscopic procedure immediately and switch to CT. Once the FFB has been observed to have caused an aortic

injury on CT, the physician should consult thoracic surgery prior to starting endoscopy.

Difficult case

Once an FB enters the stomach, it can pass uneventfully, even if sharp.^{5,15,19} In the case of food bolus impaction, the push technique is the primary treatment method.¹¹ A food bolus is a blunt material that does not injure the mucosa and can be digested by enzymes in the stomach and small bowel. An endoscopist may push the FFB into the stomach to reposition and grasp the FFB more safely. Although the majority of sharp objects in the stomach will pass without incident, the risk of complications is as high as 35%.^{37,42} Therefore, it is recommended that clinicians not push the FFB into the stomach and retrieve a sharp FFB from the stomach or proximal duodenum endoscopically whenever possible. If the FFB cannot be retrieved endoscopically, inpatient treatment and close clinical observation may be needed.¹⁸ Daily radiographs are recommended for sharp objects such as FFB. Surgery must be considered considering the possibility of perforation or the failure to progress within 3 days after ingestion.¹⁸ A bowel-perforating FFB can cause an insidious course of actinomycosis.^{80,81}

As time lapses after a whole FFB penetrates the pharyngeal or esophageal wall, the FFB may migrate deeper and the overlying epithelium heal. In that case, there will be lack of clues on endoscopy and barium esophagography.⁶¹ Finger sweeping could be helpful for an oropharyngeally imbedded FFB.²⁷ However, CT is the only technique that is able to detect FFB in the esophagus below the thoracic inlet. If FFB is totally imbedded through a pharyngoesophageal wall, a case-by-case approach depending on the FB size and patient's clinical condition is suggested. Most completely imbedded FBs require surgical treatment. However, because the FFB itself is a kind of bony fragment, a small and slender FFB might be absorbed gradually over time.^{73,82}

CONCLUSIONS

The FFB is the most frequent esophageal FB in adults in Asia. The upper esophageal sphincter is most frequently involved. An FFB should be removed as soon as possible (≤ 24 hours). A long time lapse is associated with a high risk of complications. Because the sensitivity of simple radiography is low, CT is considered if complications are suspected. To avoid aspiration and mucosal laceration, the use of an overtube and a transparent hood is recommended during EGD.³⁴ FFB disease can cause severe fatal conditions, especially AEF. In the case of suspected AEF, the clinician should consult the thoracic

ic surgeon prior to removing the FB by EGD. In failed cases of FB removal, patients should be managed with a case-by-case approach depending on the clinical condition.

Conflicts of Interest

The author has no financial conflicts of interest.

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