European Archives of Oto-Rhino-Laryngology
https://doi.org/10.1007/s00405-024-08625-w

HEAD AND NECK

Ensuring that ingested fishbones that migrate to the neck are located, diagnosed, and removed early

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Received: 15 February 2024 / Accepted: 17 March 2024

Abstract

Objectives The aim of this retrospective study was to explore the clinical characteristics of and diagnostic and therapeutic strategies for the removal of fish bones that migrate to the neck.

Methods We reviewed the clinical data of 30 patients over the past 12 years who underwent neck surgery in our otorhinolaryngology department for the migration of fish bones from the throat. The location of fish bones and the positivity rate of different examination methods (neck CT and B-ultrasound) were evaluated statistically. The diagnosis and treatment strategy for fish bone migration to the neck was also summarized.

Results A total of 24 patients had a history of foreign body ingestion. The duration from foreign body ingestion to the appearance of symptoms in the neck ranged from 26 to 151 days, with a median of 50 days (interquartile range, 32–86 days). Among the 24 patients with fish bones located in the front or side of the neck, 50% (12/24) and 100% (24/24) of whom had positive neck CT and B-ultrasound results, respectively. Additionally, for 6 patients with fish bones in the retropharyngeal space, the positive rate for neck CT was 100%, whereas neck B-ultrasound showed negative results due to the air and depth in the trachea and esophagus. A strong correlation was observed between the length of fish bones detected by B-ultrasound and CT and the actual length. Indeed, no significant difference was observed between the length of fish bone determined by B-ultrasound and the actual length. In patients with fish bones located in the anterior and lateral neck regions, the foreign bodies were successfully removed by a lateral cervical approach operation (23/24). For the 6 cases with fish bones located in the retropharyngeal space, all (6/6) were removed by incising the posterior pharyngeal wall with assistance from transoral endoscopy.

Conclusions The techniques of B-ultrasound and CT have advantages for the diagnosis of migratory foreign bodies in the neck. Although B-ultrasound is more accurate for estimating the length of migratory fish bones in the neck, a combination of both methods can improve the preoperative positive rate of diagnosis. Therefore, a variety of surgical approaches should be employed to manage the different locations of cervical foreign bodies.

Keywords B-ultrasound · CT · Fish bone · Migratory foreign body

Introduction

Fish bones are the most common foreign bodies in the throat and are frequently encountered in the emergency department of otorhinolaryngology clinics. A majority can be eliminated by routine examination and timely treatment. However, a lack of timely medical treatment can sometimes result in the fish bone becoming embedded in the base of the tongue, epiglottic valley, piriform fossa, posterior hypopharyngeal wall, and post-cricoid/cervical esophagus. With repeated swallowing, fish bones can gradually penetrate the upper digestive tract and move into the peripharyngeal space [1]. After entering this space, the fish bones migrate even further to other spaces in the neck where they are referred to as cervical migratory foreign bodies [2]. This can lead to infection of the surrounding tissues and more serious complications, such as damage to important nerves and blood vessels in the neck. The symptoms from cervical migratory fish bones can appear months or even years later, making the diagnosis of such patients

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Published online: 16 April 2024

challenging. Almost all affected patients complain of throat pain due to mucosal aberrations produced by the sharp fish bones, which can therefore be easily overlooked [1]. Many of the previous studies in this area have relied mainly on laryngoscopes, cervical CT, or X-rays, but the results are controversial [3]. In the present study, we found that B-ultrasound gives accurate diagnosis of cervical migratory fish bone cases in comparison to clinical CT. However, determining the precise location of the fish bone, as well as timely diagnosis and treatment, are extremely important. Therefore, we conducted a retrospective study of patients undergoing neck surgery over the past 12 years because of the migration of fish bones from the throat.

Materials and methods

Study participants and data

We retrospectively analyzed the clinical data from 30 patients with migratory fish bones in the neck who were hospitalized at the First Affiliated Hospital, Ningbo University, from October 2010 to October 2022. These patients comprised 17 males and 13 females. All patients underwent laryngoscopy, neck CT, and neck B-ultrasound investigations prior to surgery. A total of 24 cases were located in the anterior or lateral neck, and 6 cases in the retropharyngeal space. In 23 cases with fish bones located in the front and side of the neck, the foreign bodies were successfully removed through the lateral cervical approach. In the remaining patient, although B-ultrasound indicated a suspected foreign body, surgical exploration through the external cervical approach removed mucopurulent secretions as well as inflammatory and hyperplastic surrounding tissues. However, no obvious foreign bodies were identified, with intraoperative and postoperative B-ultrasound showing no obvious foreign bodies. Furthermore, the patient felt no discomfort at 1 year of postoperative follow-up. For the removal of fish bones from the retropharyngeal space in 6 patients, the posterior pharyngeal wall was incised, with assistance from transoral endoscopy. All patients were followed up for 1 year, at which time none felt discomfort. Moreover, the inflammatory swelling of soft tissue caused by the foreign body in the lateral neck or retropharyngeal space had also gradually subsided.

Study methodology

Patient clinical data were retrieved and analyzed, including age, length of the foreign body, time from ingestion of the foreign body to the onset of symptoms, and the duration of operation. Subsequently, all investigations and surgical approaches were compared, and the clinical characteristics, diagnosis, and relevant treatment strategies were summarized.

Results

The age of the 30 patients in this study ranged from 22 to 70 years, with a median (interquartile range, IQR) of 51 years (40–60 years). Twenty-four patients had a history of foreign body ingestion. The duration of illness from the time of foreign body ingestion to the appearance of symptoms in the neck ranged from 26 to 151 days, with a median of 50 days (32–86 days). The remaining six patients had an ambiguous history of foreign body ingestion and had complained of neck discomfort. The duration of surgery ranged from 30 to 240 min, with a median of 107 min (79–140 min). In 29 cases of foreign body removal, the length of the foreign body ranged from 7 to 31 mm, with a median of 15 mm (11–20 mm). In 6 cases, the fish bones were removed together with giant cell granulomas that had formed due to the inflammatory reaction caused by the foreign body. In nine cases, the fish bones were extracted with the help of intraoperative B-ultrasound localization. Moreover, the fish bones were initially broken into two or three segments during the visualization process. All were removed thoroughly according to the length indicated by preoperative B-ultrasound or CT in the subsequent 7 cases. Table 1 displays the general characteristics of the patients in this study.

Of the 29 patients who underwent surgical removal of cervical migratory fish bones, 9 fish bones were located at the floor of the mouth and submandibular area, and 4 between the superficial cervical fascia and the superficial layer of the deep cervical fascia. Another 6 fish bones were located in the deep cervical fascia space (thyroid, trachea-esophagus, cervical sheath, and near the thyroid), 4 were located in the strap muscles of the neck and the surrounding space, and 6 were located in the retropharyngeal space.

Table 1 General characteristics of the study patients

	N	Range	Median(IQR)
Age (years)	30	22–70	51 (40–60)
Duration of illness (days)	24	26–151	50 (32–86)
Duration of surgery (minutes)	30	30–240	107 (79–140)
Length of foreign body (mm)	29	7–31	15 (11–20)

Table 2 Comparison of the length of fish bones detected by different methods (paired *t* test)

Groups		*N*	Mean ± SD(mm)	Correlation	t	df	*P* value
Paired Comparison 1	Actual length	23	15.96 ± 6.70	0.99 ($P<0.01$)	0.89	22	0.383
	Length of the B-ultrasound display		15.78 ± 6.69				
Paired Comparison 2	Actual length	18	17.11 ± 6.06	0.97 ($P<0.01$)	10.03	17	0.000
	Length of the CT display		13.56 ± 5.67				
Paired Comparison 3	Length of the B-ultrasound display	12	16.00 ± 5.91	0.96 ($P<0.01$)	6.92	11	0.000
	Length of the CT display		12.83 ± 5.72				

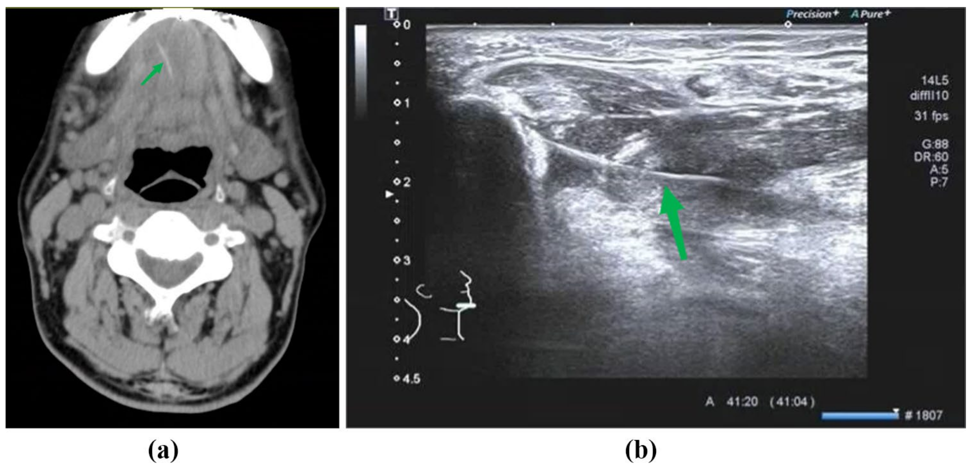


Fig. 1 **a** A high signal foreign body with a length of approximately 25 mm was observed in the submental muscle layer. **b** A 26 × 0.6 mm of the strip hyperechoic area was observed in the submental muscle layer, and a 14 × 8 mm hypoechoic area was observed around it

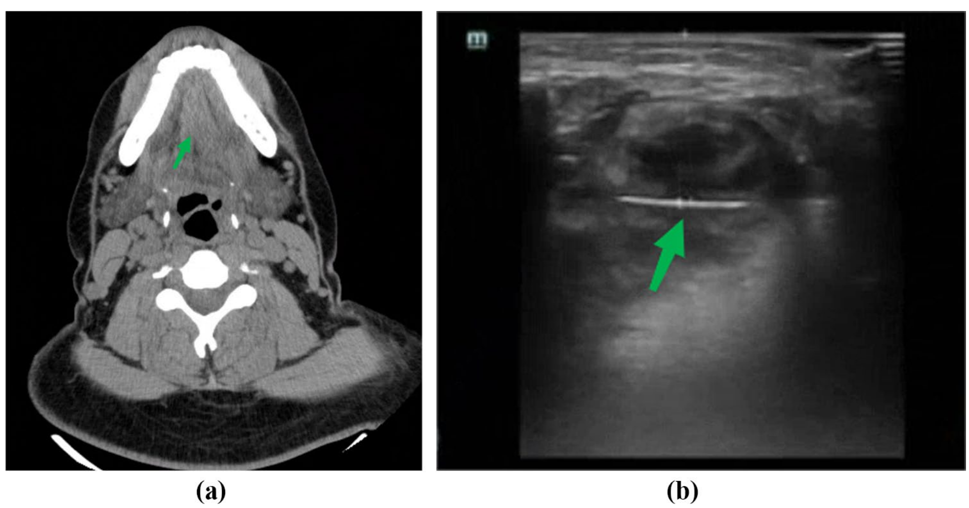
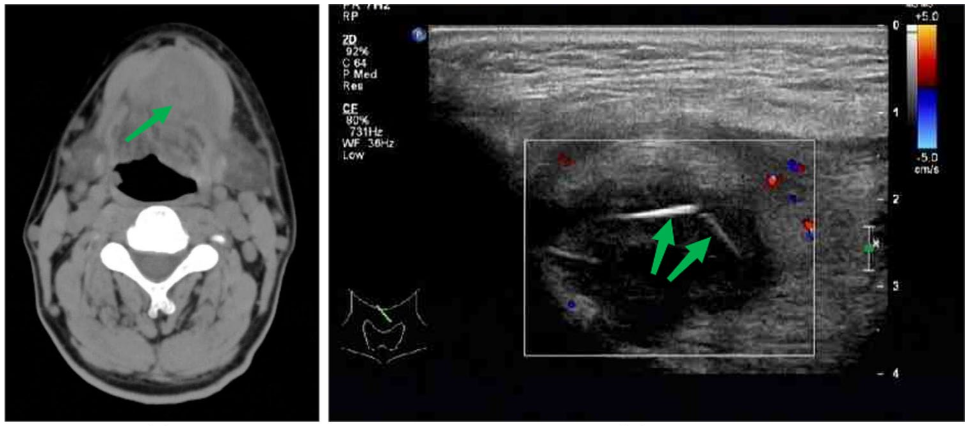


Fig. 2 **a** No obvious abnormal signals were found under the jaw or under the chin. **b** A strip-shaped hyperecho (18 mm in length, 24 mm from the skin layer) was found under the neck and the surrounding soft tissue was hypoechoic



(a) (b)

Fig. 3 **a** A mass of soft tissue density shadow (45 × 33 mm) with unclear boundaries was found in the submental region. **b** In the deep submental muscle layer, mixed echoes approximately 29 × 21 × 27 mm in size were observed, with two strips of hyperechoic shadows approximately 10 mm and 6 mm in length and a clear boundary

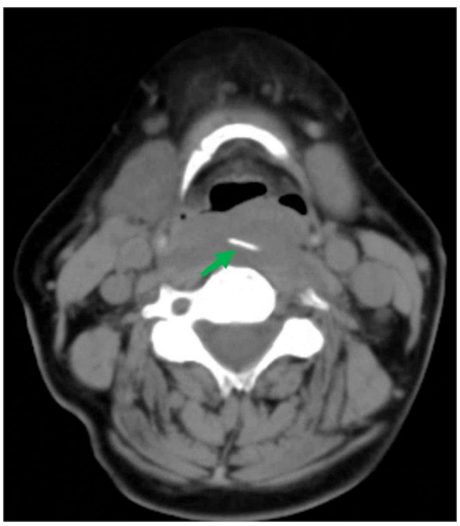


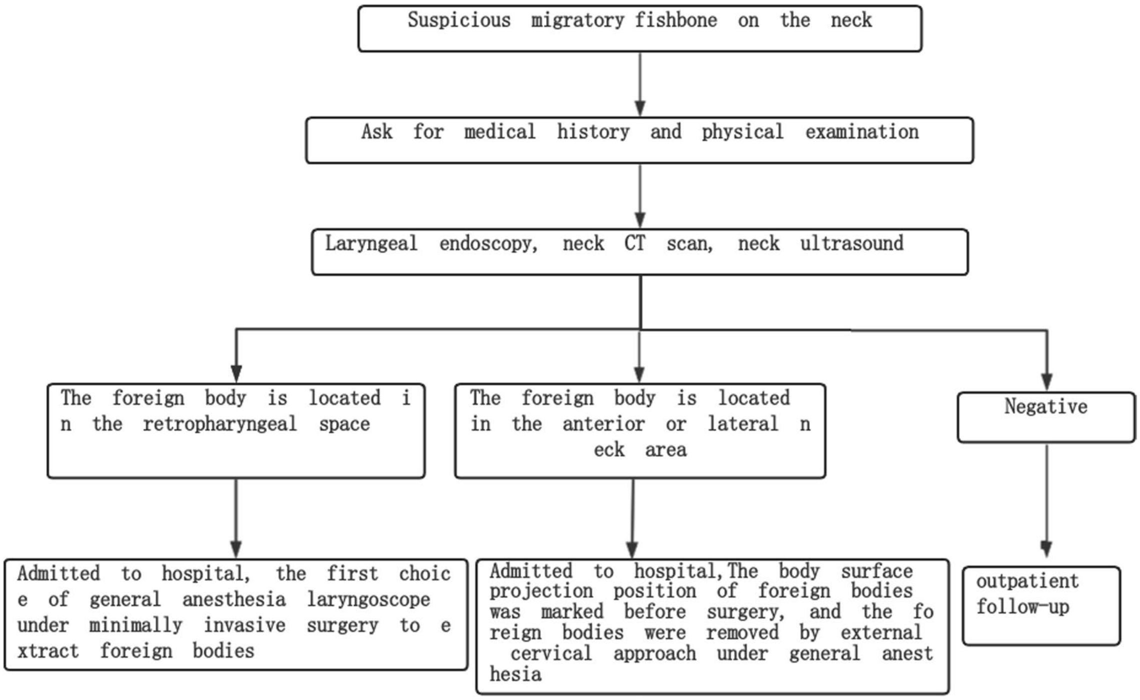
Fig. 4 **a** From the epiglottis to the upper glottis, the posterior wall of the laryngopharynx and the prevertebral soft tissue are significantly thickened and lumpy, with unclear boundaries (equivalent to the C5 level), and transverse high-density thin shadows (approximately18 mm in length) are visible

Laryngoscopy revealed a local uplift of the posterior pharyngeal wall in three of the 6 patients with fish bones in the retropharyngeal space, but no significant abnormalities were observed in the other patients. In 18 patients (18/24), a neck CT scan directly indicated fish bones accompanied by local infectious lesions, including 12 fish bones located at the anterior and lateral positions of the neck, and 6 in the retropharyngeal space. B-ultrasound detected fish bones located in the anterior and lateral neck, with all 24 cases showing positive results (24/24). However, B-ultrasound failed to detect fish bones in the retropharyngeal space due to their deep location and the presence of gas in the trachea and oropharynx.

Among the 29 patients with cervical migratory fish bones, B-ultrasound yielded positive results in 23 cases, CT scans were positive in 18 cases, and both B-ultrasound and CT scans showed positive results in 12 cases. A strong correlation was observed between the length of the fish bone detected by B-ultrasound and CT, and its actual length. There was no statistically significant difference between the length of fish bone detected by B-ultrasound and its actual length ($P = 0.383$). Table 2 displays the comparison of fish bone lengths as assessed by the different examination methods (paired *t* test).

In the 29 cases where the foreign body was removed, both B-ultrasound and CT scans were positive in 12 cases, with typical images displayed in Fig. 1. For the 12 cases where CT scans were negative but B-ultrasound results were positive, typical images are presented in Figs. 2 and 3. Typical images for the 6 cases with positive CT scans but negative B-ultrasound results are shown in Fig. 4. In all Figs. (a) illustrates the neck CT images, while (b) shows the neck B-ultrasound images.

Based on our clinical experience, we have summarized the diagnosis and treatment process for patients with suspected pharyngeal fish bones migrating to the neck in the flow chart shown below.



Discussion

The pharynx is a muscular tube extending from the base of the skull to the level of the cricoid cartilage. It plays a crucial role in life processes such as breathing, swallowing, and speech. The pharynx is surrounded by a multi-layered wall composed of mucosa, pharyngobasilar fascia, the muscle layer with upper and lower constrictors, and buccopharyngeal fascia [4]. The pharynx is funnel-shaped, flat at the front and back, wide in the upper area, and narrow in the lower region. Since fish bones are slender and sharp, they can easily enter the hypopharynx or esophagus together with the food mass while eating [5]. Once sharp fish bones become embedded into the base of the tongue, the piriform fossa, the posterior hypopharyngeal wall, and other nearby areas, they are able to penetrate the upper digestive tract and enter the peripharyngeal space if left treated [4]. After entering the peripharyngeal space, the fish bones can move into various spaces in the neck due to swallowing, esophageal peristalsis, vascular pulsation, or neck muscle activity, thereby forming cervical migratory foreign bodies [6]. Migratory fish bones are heterologous, which predisposes them to abscess formation. Severe cases can cause serious complications or mortality due to injury to neurovascular structures [6–8]. This is worthy of serious attention by clinicians, especially for otolaryngologists who work in areas with high seafood consumption.

The key to successful removal of a foreign body in the neck is to clearly identify the location of the foreign body before and during the operation. Laryngoscopy, lateral neck X-ray, and neck CT scans are commonly used for diagnosing migratory foreign bodies in the neck [9, 10]. In a few studies, B-ultrasound has been used to guide foreign body removal [11, 12]. Neck CT imaging is better at detecting recently embedded short fish bones, and for large and hard bones. However, it is not effective in detecting small fish bones embedded for a long time. After obtaining a detailed history, patients who presented in our department with a high suspicion of migratory foreign bodies underwent a combination of laryngoscopy, neck B-ultrasound, and neck CT three-dimensional reconstruction [13]. For migratory fish bones in the oropharynx (such as the retropharyngeal space), the bulging, red, or swollen posterior pharyngeal wall is easily detected by laryngoscopy. However, the positive rate for laryngoscopy is low because there are no obvious abnormalities in the migrated foreign bodies. Neck B-ultrasound is easy to perform, inexpensive, avoids radiation exposure, is appropriate for both radiolucent and radiopaque foreign bodies, and allows foreign bodies in the neck to be located precisely. It can also determine the distance between the foreign body and the skin surface, as well as its relationship with adjacent blood vessels. The present study demonstrates that B-ultrasound is highly effective at diagnosing cervical migrating fish bones. However, its diagnostic capability around the throat and trachea is limited due to the presence of air-filled spaces such as the trachea and esophagus. Thin-slice CT scans and three-dimensional reconstruction provide a comprehensive view of foreign bodies in the neck from various angles. Moreover, they can accurately depict their shape, size, position, and relationship to neighboring structures. This method is also able to assess the nature of the foreign body and the presence of vascular damage. A review of the literature indicates that CT scans exhibit high specificity but low sensitivity for the diagnosis of migrating fish bones [3, 11, 14, 15]. The current study found that the success rate of CT scans (18/30) was not as high as that of B-ultrasound, in line with the findings of Chen et al. [2] Likely reasons for the lower detection rate of CT scans include: (1) most elongated fish bones are not visible on X-rays, making CT detection challenging; (2) the delay between fish bone ingestion and the onset of symptoms allows time for inflammation, partial absorption, organization, and decalcification of the fish bones, thus reducing the success rate of CT scans in the neck; and (3) the thickness of CT slices is often greater than the diameter of the fish bone, leading to possible misdiagnosis even with three-dimensional CT reconstruction [3]. Therefore, B-ultrasound and CT scans each have advantages for diagnosing migratory fish bones in the neck. B-ultrasound is more sensitive for foreign bodies located at the front and sides of the neck, whereas cervical CT scans are better for detecting fish bones in the retropharyngeal space [3]. Combining B-ultrasound with CT scans significantly increases the diagnostic accuracy for migratory fish bones in the neck and reduces the risk of a missed diagnosis [2]. Based on our clinical experience, we therefore propose a diagnostic and treatment strategy for cervical migratory fish bones that emphasizes the critical role of B-ultrasound, in contrast to previously reported strategies in the literature [10, 14, 16].

The fish bone is a heterologous foreign body in the neck that may induce local inflammation upon entering soft tissues, leading to infections in soft tissue spaces and potentially severe complications. Hence, timely removal of the foreign body after a definitive diagnosis is imperative. In the present study, the time elapsed from the moment of foreign body ingestion to the onset of neck symptoms ranged from 26 to 151 days, with an average of 61.7 ± 35.2 days. This concurs with the findings of other researchers [2, 17].

Removal of the foreign body was conducted using external cervical approaches and transoral endoscopic surgery. The external cervical incision approach targets lateral, anterior, and submandibular foreign bodies, with preoperative B-ultrasound marking the surface projection. During the procedure, the surrounding vital nerves and vessels were carefully protected while searching for foreign bodies in the inflamed area. If a local foreign body granuloma had formed, this was completely excised and the tissue examined for fish bones. In the 6 cases where the fish bone was located in the retropharyngeal space, these were removed via transoral endoscopic surgery guided by high-definition endoscopy. Based on the location of the foreign body, its proximity to surrounding tissues (epiglottis and tonsil), and the observation of local swelling on the posterior pharyngeal wall under high-definition endoscopy, a vertical incision was made on the mucosa of the posterior pharyngeal wall. Complete hemostasis ensured a clear surgical field, allowing the foreign body to be meticulously separated with laryngeal forceps under high-definition endoscopy and then removed. The use of high-definition endoscopy resulted in less trauma and avoided neck scarring, thereby adhering to the principles of minimally invasive surgery and aesthetic considerations [18]. During the procedure, it was important to compare the length of the foreign body to the preoperative assessment, to verify the completeness of the foreign body, and to check for new sections at its ends. If discrepancies in length or new sections were noted, a thorough inspection of the area around the foreign body was conducted until all foreign bodies were identified and removed.

Intraoperative B-ultrasound may be utilized for dynamic exploration if it proves challenging to locate the foreign body during surgery. The relationship between the foreign body and the hyoid bone, neck sheath, thyroid cartilage, and other fixed anatomical structures should be explored during the operation. The vascular clamp tip can be positioned to locate the foreign body according to the adjacent relationship [2, 7]. Hence, in 9 patients we successfully identified the direction and position of fish bones and removed these with the help of intraoperative B-ultrasound.

Conclusions

Cervical migratory fish bones are difficult to identify and remove because of the complex anatomical structure of the neck and many adjacent cavities. Moreover, the extrusion and muscle traction that occurs during surgery may cause foreign body migration, while preoperative local inflammation and intraoperative bleeding can obscure the operating vision. For a successful operation, it is important to precisely locate the foreign body preoperatively, employ the correct surgical approach, and have an experienced operator with a high level of surgical skill.

Funding This work was supported by Medical Health Science and Technology Project of Zhejiang Provincial Health Commission (Grant No. 2019KY582).

Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

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