

Endoscopic Management of Esophageal Foreign Bodies: A Retrospective Study in China

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1. Abstract

Esophageal Foreign Bodies (FBs) are the common clinical emergency, accounting for 4% of emergency endoscopic diagnosis and therapeutic approach. Approaches to handle these cases are evolved continuously and offered better treatment with less cost, reduced surgery, improved visualization with high success rate. Clinically data are lacking to choose the better method and whether to use auxiliary devices or not, for safe, quickly, and efficiently with reduced complications to remove the esophageal FBs. In China only 20,000 cases of adult esophageal FBs have been reported yet in the past five years. However, up to date no retrospective studies have been evaluated the safe and effective endoscopic management of esophageal FBs in China.

1.1. Purpose: To evaluate the safety and effectiveness of endoscopy approach alone or with auxiliary equipment's for the removal of esophageal FBs.

1.2. Methods: A total of 509 patients were diagnosed with esophageal FBs and managed with endoscopy in First Affiliated Hospital of the University of Science and Technology of China (Anhui Provincial Hospital) from December 2017 to December 2020. The data and details related to endoscopy were collected from the reporting system of the endoscopy center. The patients treated with gastroscopy approach were considered only. Data on patient's gender, age,

hospitalization, outpatient service, awake state, anesthesia state, type of foreign bodies, location of foreign bodies, endoscopic auxiliary equipment used, operation time, success rate of removal and complications were reviewed and analyzed retrospectively.

1.3. Results: Among the managed 509 cases of esophageal FBs, the incidence of men and women was equal (254 males and 255 females). 301 cases (59.1%) occurred in youth and adults (15-60 years old), followed by 197 cases (38.7%) in elderly (> 60 years old) and 11 cases (2.2%) in children (<15 years old). 472 cases (92.7%) were outpatients while 37 cases (7.3%) were hospitalized patients. 484 cases (95.1%) were treated by ordinary gastroscopy (patients in waking state) and 464 cases (95.87%) were successful with the average removal time 15.02 ± 7.61 minutes. While 25 cases (4.9%) were undergone for anesthesia gastroscopy (patients under general anesthesia) and 23 cases (92%) were successful with average operation time 13.64 ± 5.67 minutes. Poultry bones were the most common type of esophageal FB in 209 cases (41.1%), followed by fish bones in 166 cases (32.6%) and the rest were eggshells, nuts, date pits, energy stones or clumps of food in 134 cases (26.3%). In 372 (73.1%) esophageal FBs cases were incarcerated in the upper esophagus, followed by 98 cases (19.3%) at middle segment and in 39 cases (7.6%) were in the lower esophagus. For the endoscopic auxiliary equipment used, mostly used devices were the foreign body forceps in 460 cases (90.4%), followed by net

baskets alone and baskets combined with other devices used in 49 cases (9.6%), and among the 49 cases, alone net basket was used in 39 cases, foreign body forceps in combination with net baskets were used in 9 cases and combination of net basket, snare with foreign body forceps was used in 1 case. In 346 esophageal FBs cases by using transparent cap, 330 cases (95.3%) were taken out successfully with average operation time 14.90 ± 7.53 minutes while in 163 esophageal FBs cases without any use of transparent cap, 157 cases (96.3%) were taken out with average operation time 15.05 ± 7.54 minutes. Among 509 cases, 487 (95.6%) were treated successfully while in 22 (4.4%) cases the foreign body was not removed successfully. Among the 22 cases, 17 cases were reported with too large size of foreign body (>2.5 cm) or embedded deeply and 5 cases could not tolerate the ordinary gastroscopy, 2 (0.3%) cases had complications.

1.4. Conclusions: Poultry bones are the most common type of esophageal FBs in upper gastrointestinal track in Chinese population. Endoscopic management of esophageal FBs is a safe and effective approach for the removal of FBs. Use of transparent cap can provide clear field view and reduce the damage to the mucous membrane of the digestive tract caused by FBs during the operation. These findings of the retrospective study can provide the future decision guideline to clinicians to determine first-line approach for the removal of esophageal FBs.

1.5. Core Tip: Esophageal foreign bodies (FBs) are the common clinical emergency. Approaches to handle these cases are evolved continuously and offered better treatment with less cost, reduced surgery, improved visualization with high success rate. However, up to date no retrospective studies have been evaluated the safe and effective endoscopic management of esophageal FBs in China. Here, we made a retrospective study, this study can provide effective treatment strategies for front-line doctors to remove esophageal foreign bodies quickly and efficiently. This can not only reduce the pain of patients but also reduce the occurrence of complications of foreign body incarceration, reduce the cost of patients and provide better services for patients.

2. Introduction

The impact of esophageal Foreign Bodies (FBs) is an urgent situation that requires clinical interventions thus; representing the second most endoscopy emergency after bleeding [1]. In United States, more than 100,000 cases of esophageal FBs are reported each year [2]. But the incident data are lacking in China and management is also controversial. However; according to incomplete statistics from domestic and foreign literature databases, more than 20,000 adult cases with esophageal FBs were reported in last past 5 years in China [3]. As esophagus is in the posterior mediastinum and it is adjacent to many important tissue structures such as the aorta, trachea and heart, so impacted esophageal FBs can cause severe complications and can even endanger the life of patients if they are not handled properly and timely [4]. Usually, the most of esophageal FBs can pass spontaneously, harmlessly and don't require any treatment. However,

10-20% are removed by endoscopy interventions while less than 1% require surgery [5]. Several management methods have been devised for the treatment of esophageal FBs and these methods continue to evolve owing to the various advantages such as avoidance to surgery, less cost burden, save time and efforts, improved visualization, high success rate, less complication and reduced morbidity as well as diagnosis of other diseases [6]. The choice of treatment and method is based upon the location of esophageal FBs, complications and interval between the ingestion and treatment [7]. Thus, the optimal method of treatment should be opted to benefit the patient maximally with minimum invasive and least financial burden. At present, up to our best knowledge the retrospective studies related to endoscopy management with various modifications for the handling of esophageal FBs are not reported in China. This retrospective study is from a single medical center "First affiliated provisional hospital of university of science and technology of China Hefei at the "department of Digestive Diseases" during the period of December 2017 to December 2020. The aim of this study is to report our experience and outcome of endoscopy management of 509 cases for the optical treatment and removal of esophageal FBs and to further evaluate the safety and effectiveness of endoscopic management for the physicians to determine the first-line decision to serve the patients better.

3. Materials and Methods

3.1. Study design and patient's data

This retrospective study was conducted at the First Affiliated Hospital of the University of Science and Technology of China (Anhui Provincial Hospital). This study was approved by Ethics Committee of our institute and was conducted in principles of declaration of Anhui government. Before the operation, all patients signed a consent form for endoscopic treatment after detailed explanation of procedure to the patient's family. The cohort of this retrospective case control study includes the 509 patients with esophageal FBs confirmed by CT or Barium swallowed cotton batting examination and were treated in our hospital by gastroscopy (CV-290, Olympus) from December 2017 to December 2020. Data were collected from medical record while endoscopy data were taken from the Endoscopy Reporting System (Tianzhu) endoscopy center. Patients who had FBs other than esophagus, FBs falling off or coughing up or those who underwent to surgical interventions were excluded from this study. Only the patients who underwent gastroscopy or with gastroscopy and modification devices for the removal of esophageal FBs were included in this study. The following patient data were extracted: 1) Gender, 2) Age, 3) Outpatient or inpatient, 4) FBs type, 5) Anesthetized or waking state, 6) FBs location (upper esophagus, middle esophagus, lower esophagus, here we clarify the definition of the various esophageal segments by according to anatomical position of the esophagus, the upper esophagus segment refers to cervical esophagus, the middle esophagus segment refers to upper and middle segments of thoracic esophagus and the lower esophagus segment refers to lower segment of thoracic esophagus, as every patient

with foreign body was routinely treated in the ENT department and the patient who had no foreign body in the hypopharynx will be treated in our department, so the hypopharynx was not included), 7) Procedure time, 8) Procedure type and extraction devices type, 9) Success rate and complications. According to age, patients were divided into following groups: children (<15 years old), youth and adults (15-59 years old), elderly (>60 years old). Non frequent FBs were categorized as "others" (eggshells, coins, energy stones). Operation time was considered as a time required for the complete removal of esophageal FBs including resolution of complications. For the extraction devices, we considered all devices like auxiliary devices, single-use or combination use for the removal of esophageal FBs and as well as for the protection of digestive track. Complications were considered as complication involving the perforation, lacerations and bleeding that need additional procedures to procure the hemostasis. Bleeding due to minor mucosal damage that can heal naturally were not considered. The success rate of operation was considered as a complete removal of esophageal FBs from esophagus with subsequent confirmation of absence of foreign bodies on assessment of esophagus.

Table 1: Patient background

Gender	Number of cases (%)	Age group(yr)	Number of cases (%)	Patient source	Number of cases (%)
Male	254(49.90)	<15	11(2.20)	Outpatients	472(92.70)
		15-60	301(59.10)		
Female	255(50.10)	>60	197(38.70)	Inpatients	37(7.30)

5.2. Type and Location of Foreign Body

Data on the types and the location of esophageal FBs incarceration are presented in table 2. The most common type of esophageal FBs was poultry bone in 209 (41.1%) cases, fish bones in 166 (32.6%) cases and the rest were clumps of food, eggshells, coins, energy stones

Table 2: Foreign body type and retrieved location

Foreign body types	Number of cases (%)	Retrieved location	Number of cases (%)
poultry bones	209(41.10)	Upper esophagus	372(73.10)
fish bones	166(32.60)	Middle esophagus	98(19.30)
Others	134(26.30)	Lower esophagus	39(7.60)

5.3. Operation Type and Time

As shown in table 3, usually the patients were treated with ordinary gastroscopy in 484 (95.1%) cases and the success rate for the complete removal of esophageal FBs was in 464 (95.87%) cases with the average removal time 15.02±7.61 minutes. While 25 (4.9%) cas-

Table 3: Procedure type and time

Group	Ordinary gastroscopy (n=484)	Anesthesia gastroscopy (n=25)	χ^2/t value	P value
Successfully removed (Number of cases (%))			0.179	0.672*
Yes	464(95.87)	23(92.00)		
No	20(4.13)	2(8.00)		
Operation time (min, x±s)	15.02±7.61	13.64±5.67	0.892	0.373*

* P≤0.05 is statistically significant.

4. Statistical Analysis

Categorically data were presented as number and percentage (%) for comparison of different types. Chi-square was performed for comparison of differences in different groups. The operation duration was calculated as mean± Standard Deviation (SD) expressed in minutes. The independent Student's t-test was used for non-categorical variables. All the statistical analyses were performed by using IBM SPSS software, version 20.0 (IBM Corp., Armonk, NY, United States). A P value of <0.05 was considered as statistically significant.

5. Results

5.1. Clinical Data of Patients

A total of 509 patients were underwent with gastroscopy to remove esophageal FBs after examination by CT or barium swallow cotton batting in our hospital between December 2017 to December 2020. Patients clinical and background data included for analysis are presented in table 1. Of 509 patients with esophageal FBs included for analysis, 254 were males and 255 were females. Regarding age, 11 (2.2%) cases were in children (<15 years old), 301(59.1 %) cases were in youth and adults (15-60 years old), and 197 (38.7%) were elderly cases (>60 years old). Additionally, 472 (92.7%) cases were outpatients and 37 (7.3%) were in patients.

in 134 (26.3%) cases. While on the other hand, the most common location of esophageal FBs was upper esophagus in 372 (73.1%) cases, followed by the middle esophagus in 98 (19.3%) cases and rest were incarcerated in the lower esophagus in 39 (7.6%) cases.

es were treated with anesthesia gastroscopy and successful rate in 23 (92%) cases with average operation time 13.64±5.67 minutes for complete removal of esophageal FBs. The percentage of successful removal and operation time has no correlation (P>0.05) with the condition of the patient who underwent gastroscopy.

5.4. Devices or Modification Used for Removal of Esophageal FBs

Data for the most used devices or modifications performed for the complete removal of the esophageal FBs is shown in table 4. Different kind of auxiliary devices either alone or in combination were used. Most used device was the foreign body forceps in 460 (90.4%)

Table 4: Devices most used for extraction

Auxiliary devices	Number of cases (%)	Others	Number of cases(n)	Transparent	Number of cases (%)
Foreign body forceps	460 (90.40)	Foreign body forcep and net basket	9	Yes	346 (67.90)
		Net basket only	39		
Others	49 (9.60)	Foreign body forcep, net basket and snare	1	No	163 (32.10)

5.5. Success and Complications

Among 509 patients, 487 (95.6%) cases were treated successfully while in 22 (4.4%) cases the foreign body was not removed successfully. Among the 22 cases, 17 cases were reported with too large size of foreign body (>2.5cm) or embedded deeply and 5 cases could not tolerate the ordinary gastroscopy; 2 (0.3%) cases had complications as demonstrated in table 5, the complications involved were the deep laceration which led to perforation due to longer time of

patients, followed by alone net baskets and baskets combined with other devices used in 49 (9.6%) cases, and among the 49 cases, alone net basket was used in 39 cases, foreign body forceps in combination with net baskets were used in 9 cases and combination of net basket, snare with foreign body forceps was used in 1 case. Transparent caps were used in 346 (67.9%) cases and in 163 (32.1%) cases no transparent caps were used.

FBs incarceration. In 346 cases esophageal FBs were removed by using transparent caps and the success rate of complete removal was in 330 (95.3%) cases with average operation time 14.90 ± 7.53 minutes. In 163 cases esophageal FBs were removed without any use of transparent caps and the success rate of complete removal was in 157 (96.3%) cases with average operation time 15.05 ± 7.54 minutes as demonstrated in table 6. The use of transparent caps neither improves the success rate of operation nor it shorten the operation time ($P > 0.05$).

Table 5: Successful rate and complications

Successfully removed (Number of cases (%))	Number of cases (%)	Complications	Number of cases (%)
Yes	487(95.60)	No	507(99.70)
No	22(4.40)	Yes	2(0.30)

Table 6: Successful rate with transparent caps

Group	With transparent caps(n=346)	Without transparent caps(n=163)	χ^2/t value	P value
Successfully removed (Number of cases (%))			0.238	0.625*
Yes	330(95.3)	157(96.3)		
No	16(4.7)	6(3.7)		
Operation time(min, $\bar{x} \pm s$)	14.90 \pm 7.53	15.05 \pm 7.54	0.203	0.839*

6. Discussion

Incarceration of FBs in the esophagus is related to three physiological stenoses. At the beginning of the esophagus (approximately 15 cm from the central incisor), the intersection of the esophagus and the left main bronchus (approximately 25 cm from the central incisor) and the esophageal hiatus where the esophagus passes through the diaphragm (approximately 40 cm from the central incisor) [8]. Most esophageal FBs impact at the upper and middle esophagus regardless of their sizes. Therefore, more than 60% of adult esophageal FBs are retained in the upper esophagus (neck), about 25% of FBs are retained in the middle of the esophagus (chest), and less than 10% of FBs are retained in the lower esophagus [9]. However, the clinical risk factors for esophageal FBs incarceration are not only caused by physiological esophagus stenosis but also related to basic esophageal diseases, such as gastroesophageal reflux disease, esophageal steno-

sis, esophageal hiatus hernia, cardia retardation, eosinophilic esophagitis, esophageal cancer, or all kinds of esophageal surgery. In such conditions, it's difficult to swallow food smoothly and FBs are more likely to be incarcerated [10-12]. Beside this, the risk of incarceration is also related to length and sharpness of FBs. The average length of incarcerated FBs is about 22 ~ 26 mm. Sharp objects are more prone to incarcerate [13]. In our present retrospective study, among 509 cases of FBs in the esophagus, 372 cases (73.1%) were incarcerated in the upper of the esophagus, followed by the middle about 98 cases (19.3%) and the remaining 39 cases (7.6%) were in the lower of the esophagus. The most common esophageal FBs were the poultry bones and were sharp objects with average length of 2 cm while the rest were clumps of food, eggshells, coins, and energy stones with average diameter similar to the esophagus. This data was consistent with the previous reported literature.



Figure 1: Gastroscopy for esophageal foreign bodies (FBs). A. Without transparent. B. With short front end transparent. C. With longer front end transparent.



Figure 2: Gastroscopy with different length of transparent front end and foreign bodies (FBs). 1A and 1B. Gastroscopy with short front end transparent and the FB is exposed. 2A and 2B. Gastroscopy with longer front end transparent and the FB is inside.

Since the esophagus is in the posterior mediastinum, adjacent to many important tissue structures such as the aorta, trachea, and heart. If the FBs are not handled properly on time, they might cause esophageal mucosal erosion, hemorrhage, and perforation. The serious complications are mainly secondary to perforated neck abscess [14], mediastinal abscess (inflammation), esophageal aortic fistula or pseudoaneurysm related fatal hemorrhage [15], esophagotracheal fistula related breathing disorder and even pericardial effusion [14, 16]. Besides the anatomical structures, these complications are also related to type, size, sharpness, hardness, and residence time of FBs. Hard and sharp FBs cause more complications than soft and blunt FBs accounting 90% of sharp FBs cause perforation of esophagus [17]. The incidence of complications is higher in the patients with retention time of FBs longer than 24 hrs [18]. The success of the endoscopic treatment is decreased when the retention time of esophageal FBs is increased more than 24 or 72hrs and the risk of complications is also increased by 2 to 7 times [19-22]. Thus, the severity of complications and prognosis of patients can be improved by timely and smooth removal of esophageal FBs [23]. The degree of comfort and successful removal rate of FBs have been increased while the complications have been decreased with the rapid development of endoscopy and its accessories [24, 25]. Usually, the esopha-

geal FBs required urgent treatment to avoid the complications. Most of gastroscopy are done in waking state but if the patient is unable to cooperate and the foreign body is too large or embedded deeply, then gastroscopy is done under general anesthesia or esophagoscopy under general anesthesia with endotracheal intubation. In our study, among 509 patients, 484 cases (95.1%) were operated by ordinary gastroscopy and successful rate was 95.87% (464 cases) with average removal time 15.02 ± 7.61 minutes, 25 cases (4.9%) were operated by anesthesia gastroscopy and successful rate was 92% (23cases) with average operation time 13.64 ± 5.67 minutes; 472 cases (92.7%) were outpatients reported with esophageal FBs while 37 cases (7.3%) were inpatients; 487 (95.6%) cases were treated successfully while in 22 (4.4%) cases the foreign body was not removed successfully. Among the 22 cases, 17 cases were reported with too large size of foreign body ($>2.5\text{cm}$) or embedded deeply, which were under general anesthesia with endotracheal intubation by esophagoscopy S3009 (11.5mm*15mm*300mm, Huida, China) in Ear-Nose-Throat (ENT) department, and 5 cases could not tolerate the ordinary gastroscopy, among which 3 cases were under general anesthesia with endotracheal intubation by esophagoscopy in Ear-Nose-Throat (ENT) department that night, 2 cases were under general anesthesia by gastroscopy the next day; 2 (0.3%) cases had complications,

the complications involved were the deep laceration which led to perforation due to longer time of FBs incarceration. By further analyzing the characteristics of foreign body incarceration in these cases, we found that the reason of the failure of endoscopic removal was that the foreign body was too large (>2.5cm), the shape of the foreign body was irregular (V type or triangle type), the foreign body was deeply embedded or the patient cannot cooperate. Therefore, according to our current retrospective study, we suggest that for the esophageal foreign body that cannot be removed by ordinary gastroscopy, if the foreign body is small and the shape is more regular, gastroscopy under general anesthesia can be tried. If the foreign body is too large, irregular in shape or embedded deeply, it is recommended to select esophagoscopy under general anesthesia with endotracheal intubation in ENT department. Thus, gastroscopy is a safe and effective method for the removal of esophageal FBs. There was no statistical significance in successful rate and operation time between patient in waking state or under general anesthesia. Therefore, it is recommended to use ordinary gastroscopy for the removal of esophagus FBs promptly. If the patient is uncomfortable or the foreign body is too large, with irregular shape, embedded deeply or caused complications such as perforations or bleeding, gastroscopy under general anesthesia or esophagoscopy under general anesthesia with endotracheal intubation is preferred.

Different endoscopic auxiliary equipment's such as grasping forceps, polypectomy snares, Dormer-type stone retrieval baskets, retrieval snare net, transparent cap-fitting device (used for endoscopic mucosal resection) [26], overtube (to protect airways) [27, 28] and retractable latex-rubber condom-typed hood [29] are used for safe removal of FBs. The choice of the use of the accessories is based upon the type of foreign bodies. For food bolus impaction, blunt object, button or small disk batteries, sharp and long objects, dormer-type stone retrieval baskets, a retrieval snare net, stone retrieval basket, transparent cap an overtube or a retractable latex-rubber condom-type hood and polypectomy snare are used respectively. In our retrospective study, different auxiliary devices were used according to the type of esophageal FBs. Some of the devices were used alone and some of the devices were used in combination. Foreign body forceps were the most used endoscopic auxiliary equipment in 460 cases (90.4%), followed by net baskets alone and baskets combined with other devices used in 49 cases (9.6%) and foreign body forceps combined with net baskets were used in 9 cases. In 39 cases, alone net basket was used and in only 1 case multiple equipment like foreign body forceps, net baskets and snares were used simultaneously. In addition, 346 cases (67.9%) used transparent caps while in 163 cases (32.1%) transparent caps were not used. As an auxiliary tool under endoscopy, transparent caps are widely used in the diagnosis and treatment of various diseases under endoscopy. In our present retrospective study, the use of transparent caps provides the clear view of the field and reduces the damage to the mucous membrane of the digestive tract caused by FBs during the operation. Here the damage to the mucous membrane of the digestive tract referred to was not caused by the incar-

ceration of the foreign body itself, but was caused by the lack of the protection of the transparent cap during the operation. In our study, 163 cases did not use the transparent cap and all of them had secondary damage to the esophageal mucosa while the use of transparent caps could reduce the secondary damage to the esophageal mucosa, moreover, the protection of digestion track mucosa is better with the use of the longer front end of transparent caps as shown in figure 1. Gastroscopy with longer transparent front end could provide better protection to the mucosa of the digestion track as the FBs could be pull into the front end of the transparent as showed in figure 2.

Different kind of foreign bodies have been observed in different age group people. Esophageal FBs like batteries, coins, toys and pins are commonly found in children [30] and animal bones (poultry bones, fish bones, etc.), nut nuclei, dentures and food are found in Chinese adult with age more than 50 years [31]. While FBs such as drugs and blades are found in mentally abnormal people and criminals [32]. In our present study of 509 patients, the incidence of esophageal FBs was almost equal in male and females (254 males and 255 females). 301 cases (59.1%) occurred in youth and adults (15-60 years old), followed by 197 cases (38.7%) in elderly (>60 years old) and 11 cases (2.2%) in children (<15 years old). The most common type of esophageal FBs were the poultry bones in 209 cases (41.1%), followed by fish bones in 166 patients (32.6%) and rest were glutinous rice, clumps of food, eggshells, coins, and energy stones were found in 134 cases (26.3%). It was because of different eating habits in Chinese population as in China, meat is more likely to be cooked with bones. While food boluses are more common in western population as in west the meat is cooked or eaten off the bones. Among the 134 cases, 67 cases were clumps of food, which were because of presence of anastomotic strictures (51 cases) and esophageal cancer (16 cases), of which 15 cases were squamous cell carcinoma and 1 case was cardia adenocarcinoma involving the terminal esophagus. By further investigation on the 134 cases, we found that patients with esophageal diseases or operation will cause recurrent foreign body incarceration because of esophageal stricture or anastomotic stenosis. And by further comparing the characteristics of age-related foreign bodies in the three groups, we found that in the three groups, the foreign body incarcerated in children, youth and adults were mainly bony foreign bodies, while in the elderly patients, bony foreign bodies, clumps of food and jujube cores were the main types. It may be related to the eating characteristics of elderly patients and elderly patients were more prone with esophageal diseases.

Endoscopy is a safe and efficient diagnostic and therapeutic approach. In China, the most common type of esophageal FBs are the hard bones and fruit pits, that's why the proportion of endoscopic treatment is higher than that in western countries. It has been already reported that the longer FBs cannot passed through the esophagus and cause more complications. As esophagus is located in the posterior mediastinum and it is adjacent to the aorta, trachea, heart and other important tissue structures, if the foreign body is not handled

in time or in an improper manner, it may cause serious complications, even endanger the patient's life, especially when the foreign body is incarcerated for more than 24 hours and then the risk of complications such as perforation and bleeding is greater. Therefore, esophageal FBs should be removed within 24 hours and early removal of FBs can improve the prognosis of the patients. By a retrospective study of 509 patients with esophageal foreign bodies in the past 3 years, we found that emergency ordinary gastroscopy in waking state is a safe and effective method, the success rate of foreign body removal can reach more than 95%, especially for patients with small or regular shapes foreign bodies, while for patients with larger, irregular shapes, longer incarcerated and deeply embedded foreign bodies, it is recommended to try esophagoscopy under general anesthesia with endotracheal intubation. At the same time, different foreign bodies can choose different endoscopic auxiliary instruments. For lumpy foreign bodies, it is recommended to use a net basket or a snare. For hard foreign bodies, it is recommended to choose foreign body forceps, especially for bony foreign bodies, and the addition of a longer front end transparent cap can provide clear view of the field and reduce secondary damage to the esophageal mucosa caused by foreign bodies during the operation. Our experience with the esophageal FBs emphasizes the endoscopic approach for the safe, simple, and secure removal under the waking state in most of the cases. Lower incidence of complications, less need of surgery, higher success rate and reduced hospitalization rate are the robustness of endoscopy approach. Auxiliary equipment's should be selected to assist the endoscopy for the safe removal and protection of mucosa of the esophageal wall. This study can provide effective treatment strategies for front-line doctors to remove esophageal foreign bodies quickly and efficiently. This can not only reduce the pain of patients but also reduce the occurrence of complications of foreign body incarceration, reduce the cost of patients and provide better services for patients.

Also, there are some limitations of this study. Firstly, in our study, most of the patients with esophageal FBs were operated by emergency ordinary gastroscopy in waking state, and gastroscopy under general anesthesia was limited, so there may be some deviation in the study and a large sample of gastroscopy under general anesthesia data is needed to make up for the limitations of this study to evaluate the efficacy and safety between ordinary gastroscopy in waking state and gastroscopy under general anesthesia. Secondly, since we are not children's hospital, the incidence of foreign body in adults is much higher than that in children. If a similar study is conducted in a children's hospital, more meaningful data may be obtained.

In conclusion, endoscopic management of esophageal FBs is safe and extremely effective as compared to surgical operation. It is less traumatic, low cost and fewer iatrogenic complications, so it can be used as the first choice of treatment to manage the esophageal

FBs. The devices required for extraction depends upon the type of esophageal FBs. As in our study most common esophageal FBs were poultry bones or fish bones so it is recommended to install the transparent cap before the lens, which will provide clear vision and protection and reduce the damage to the mucosa of esophageal wall.

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