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# Emergency Removal of Ingested Foreign Bodies in 586 Adults at a Single Hospital in China According to the European Society of Gastrointestinal Endoscopy (ESGE) Recommendations: A 10-Year Retrospective Study

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Data Collection B  
Statistical Analysis C  
Data Interpretation D  
Manuscript Preparation E  
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**Background:** The 2016 European Society of Gastrointestinal Endoscopy (ESGE) guidelines recommend that ingested foreign bodies in the upper gastrointestinal (GI) tract are removed as an emergency within 6 hours, with an endoscopic approach that is individualized according to the type of foreign body identified. This retrospective study evaluated the 10-year experience of a single hospital in China performing emergency removal of ingested foreign bodies in 586 adults.


**Material/Methods:** Between 2011 and 2020, medical records of 642 adults with a diagnosis of foreign bodies ingestion were retrospectively screened. The timing of endoscopic intervention was classified according to ESGE recommendations. Uni- and multivariate analyses were performed.

**Results:** We included 586 patients. The median (range) diameter of foreign bodies was 2.5 (1-24) cm: for sharp ones it was 2.5 (1.5-4.0) cm and for long ones it was 16.9 (10-24) cm. The most common site of foreign body lodgment was the esophagus (n=481; 82.1%); 45.6% (n=252) received emergent removal within 6 hours, while 32.2% (n=178) underwent urgent removal within 24 hours. There were 583 (99.5%) foreign bodies removed successfully and the complication rate was 17.9%. Major complications occurred in 45 patients (7.7%). Female sex and non-emergent endoscopy after 6 hours were significantly associated with a higher overall complications rate. For major complications, older age, time interval >24 hours, and sharper objects were associated with major complications.

**Conclusions:** The findings from this retrospective study support the ESGE statement that endoscopic removal of ingested foreign bodies from the upper GI tract within 6 hours reduces complication rates for adults in the emergency setting.

**Keywords:** **Emergency Medical Services • Endoscopy, Gastrointestinal • Esophageal Perforation • Intraoperative Complications**

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## Background

Foreign body ingestion and food bolus impaction in the upper gastrointestinal (GI) tract are common problems in clinical practice worldwide [1,2]. Most ingested foreign bodies (80-90%) pass spontaneously [1,2]. McKechnie et al reported the first foreign body removal using a flexible endoscope in 1972 [3]. Since then, approximately 10-20% of foreign bodies require an endoscopic procedure for removal and <1% require surgery [1]. Although endoscopic treatment is minimally invasive, certain complications should not be ignored, such as laceration, bleeding, and perforation.

The reported complication rate in some studies was as high as 50% [4-7] and the major complication rate was about 7.3-25.8% [4,5,7-9]: laceration 9.1-16% [4,6,7,9]), perforation 1.5-8.1% [4-7,9]), and hemorrhage 3.4-5.0% [6,9]). The most frequently reported risk factors for complication were time interval between ingestion and endoscopic management, and the sharpness of the foreign body [7,10]. The rate of perforation caused by ingested sharp-pointed objects was 35% [11]. Therefore, efforts should be directed toward further reducing complication rates. Application of protective equipment, such as overtubes, protector hoods, and transparent caps, have already reduced the rate of mucosal injury during foreign body removal [12].

In addition, decision-making about the timing of an endoscopic intervention is still a problem, especially in the emergency setting. The European Society of Gastrointestinal Endoscopy (ESGE) recommended emergent endoscopic procedure within 6 hours for esophageal obstruction or sharp-pointed objects in the esophagus and urgent within 24 hours for other foreign bodies [1]. In fact, there are limited reports on the application of these recommendations in the management of ingested foreign bodies and food bolus in adults. Furthermore, supporting evidence from China is lacking. Therefore, this retrospective study evaluated the 10-year experience of a single hospital in China with emergency removal of ingested foreign bodies in 586 adults.

## Material and Methods

The research protocol was approved by the Institutional Review Board of Xijing Hospital. The present study only involved recording data from the medical records, and the requirement for informed consent was waived for this retrospective study.

We retrospectively reviewed the records of adults with a diagnosis of foreign body ingestion or food bolus impaction in the upper GI tract who were admitted to the emergency center at Xijing Hospital of Digestive Diseases, Air Force Medical University, Xi'an, China, between January 2011 and December

2020. Patients younger than 17 years and those with insufficient data for analysis were excluded, as were those who underwent a technique involving pushing the foreign bodies into the stomach without posterior removal.

## Data Collection

Patient demographic data that were analyzed included age, sex, accidental vs intentional ingestion, and symptoms at admission. Clinical features of foreign bodies included type, size, sharpness, number, and location. We sorted the ingested foreign bodies into 4 groups according to their nature: sharp-pointed objects (eg, jujube [also referred to as red date] pits, poultry bones, fish bones), long objects ( $\geq 6$  cm) (eg, pens, chopsticks), blunt objects (eg, plastic fragment), and food bolus, according to ESGE recommendations [1]. Endoscopic data that were analyzed included impaction time, endoscopic methods, accessory devices, associated GI tract diseases, and complications during the procedure.

## Timing of Endoscopic Removal

The 2016 ESGE guideline recommends emergent (preferably within 2 hours, but at the latest within 6 hours) therapeutic esophagogastroduodenoscopy to remove foreign bodies that obstruct the esophagus and for sharp objects or corrosive batteries that may perforate the esophagus. The guideline also recommends urgent (within 24 hours) therapeutic esophagogastroduodenoscopy for other esophageal foreign bodies without complete obstruction (recommendation 7). For foreign bodies in the stomach, ESGE recommends urgent (within 24 hours) therapeutic esophagogastroduodenoscopy for sharp-pointed objects, magnets, batteries, and large/long objects. ESGE also recommends nonurgent (within 72 hours) therapeutic esophagogastroduodenoscopy for medium-sized blunt foreign bodies in the stomach (recommendation 10).

In our institution, endoscopy was performed as early as possible in all cases according to the ESGE guideline, and the timing of endoscopic intervention was classified into 3 types: emergent within 6 hours, urgent within 24 hours, and nonurgent within 72 hours [1]. Emergent intervention is required for patients with high-grade esophageal obstruction and ingestion of disk batteries or long sharp-pointed objects. Urgent intervention is required for esophageal foreign objects that are not sharp-pointed, food impaction without complete obstruction, sharp-pointed objects in the stomach or duodenum, objects longer than 6 cm in length, and magnets within endoscopic reach.

## Endoscopic Procedures

All patients gave informed consent for the procedure. Before endoscopy, plain radiographs were routinely performed in the

initial investigation. Each patient underwent an upper endoscopy under local pharyngeal anesthesia. Intravenous sedation (usually propofol plus fentanyl) was employed if there were no contraindications; however, it might not have always been available during an emergency. Standard endoscopic video systems (EVIS LUCERA CV-260/CLV-260 and EVIS LUCERA ELITE CV-290/CLV-290SL; Olympus Medical System) were used for the removal of foreign bodies. Accessories used for foreign body removal were biopsy forceps, foreign body forceps, retrieval nets, snares, and retrieval baskets. For sharp foreign bodies, we used a transparent distal hood to store the foreign bodies to avoid mucosal injury [12]. Procedure success was considered as complete removal from the digestive tract, with subsequent confirmation of absence of foreign bodies on assessment of the digestive tract.

### Complications

After removal, diagnostic endoscopy was performed to determine the procedure-induced complications, such as minor mucosal injuries (abrasions or small erosions), deep laceration, perforation, or bleeding that required additional procedures to achieve hemostasis. Symptoms indicating perforation include fever, tachycardia, peritonitis, subcutaneous crepitus, and swelling of the neck or chest. Computed tomography (CT) is indicated if perforation is suspected based on the clinical or radiological findings. Surgical treatment was considered in cases of complications that could not be resolved endoscopically (eg, bleeding) or after unsuccessful attempts.

### Statistical Analysis

Continuous variables were expressed as medians and ranges and were compared using the independent sample *t* test or a one-way analysis of variance. Categorical variables were summarized as frequencies and were compared by using the  $\chi^2$  test or Fisher exact test. Two-tailed *P* values of less than .05 were considered significant. To summarize the independent predictive factors for overall complications and major complications, uni- and multivariate analyses were performed with a logistic regression analysis. The odds ratio (OR) and 95% confidence interval (CI) were calculated to assess the risk of related factors. All statistical analyses were performed using IBM SPSS software, version 24.0 (IBM Corp., Armonk, NY, United States).

## Results

### Patient Characteristics

A total of 586 out of 642 screened patients were included. A slight female predominance was noticed (55.3%) and the median (range) age was 57 (17-100) years. The most frequent presentation was a history of foreign body ingestion without any

associated manifestations (*n*=251, 42.8%). Dysphagia and a sense of a lump behind the sternum was the second common category (*n*=222, 37.9%), followed by chest pain (*n*=71, 12.1%), and others (*n*=42, 7.2%). Diagnosis of foreign body trapping was made using patient history, and witnesses of foreign body ingestion in most cases. A total of 16 patients (2.5%) had underlying gastrointestinal diseases. Esophageal stricture due to the previous corrosive injury was the most common pathology (*n*=11, 68.8%), followed by esophageal carcinoma/malignancy (*n*=4, 25.0%), and duodenum carcinoma (*n*=1, 6.3%).

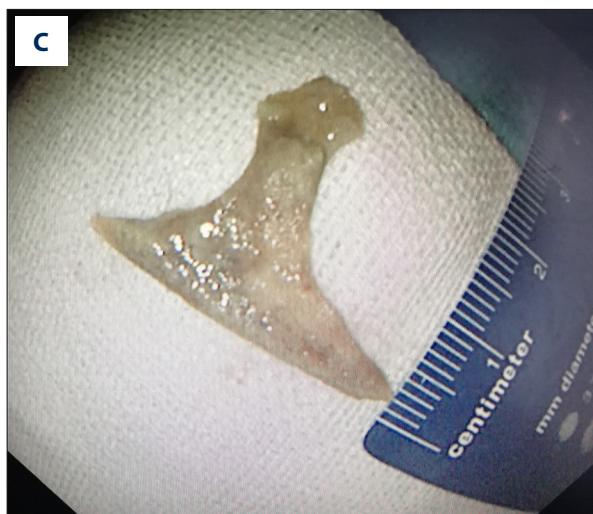
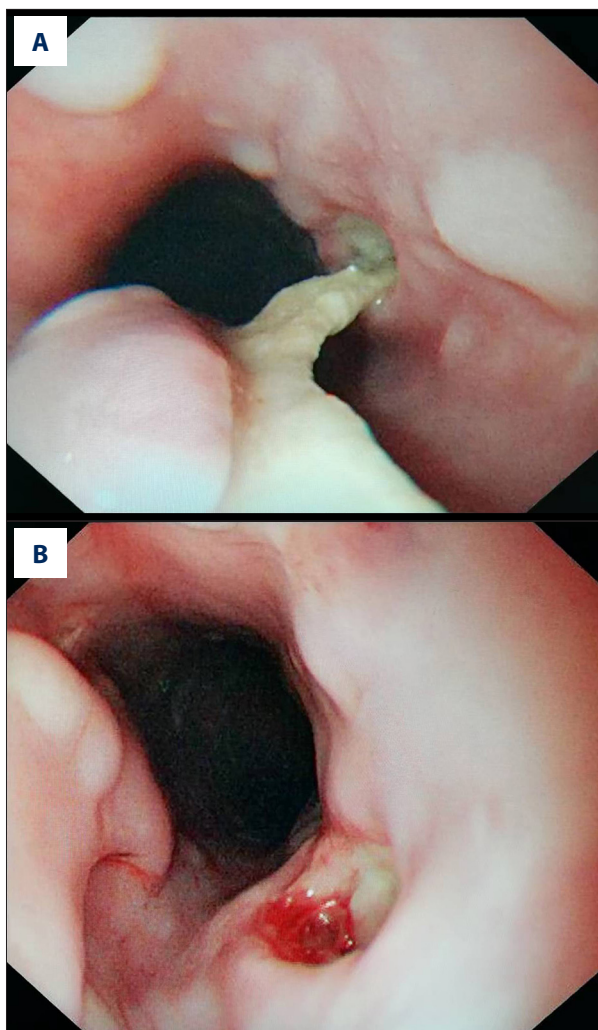
### Characteristics and Location of Foreign Bodies

Foreign body ingestion was incidental in 95% of cases; mostly food-related (*n*=488, 83.3%) and rarely non-alimentary (*n*=53, 9.0%). Foreign body ingestion sometimes occurs in psychiatric patients (*n*=10), drug abusers (*n*=6), and in prisoners (*n*=4). The major types of foreign bodies were jujube or red date pits (*n*=394, 67.2%), followed by poultry bones (*n*=54, 9.2%), food boluses (*n*=20; 3.4%), fish bones (*n*=20, 3.4%), and dentures (*n*=13; 2.2%). Other types of foreign bodies included metallic foreign bodies, medication foil, pens, lighter, chopsticks, toothbrush, and plastic fragment (Figures 1A-1C, 2A, 2B, 3A, 3B, 4A, 4B, 5A, 5B, 6A, 6B). Ten patients had 2 or more foreign bodies (Table 1).

The median (range) diameter was 2.5 (1-24) cm: 2.5 (1.5-4.0) cm for sharp ones and 16.9 (10-24) cm for long ones. The most common site of foreign body lodgment was the esophagus (*n*=481; 82.1%), with the upper esophagus (*n*=415; 70.8%) being the predominant site (Figures 1A-1C, 2A, 2B, 3A, 3B). Other lodgment sites were the stomach (*n*=89, 15.2%) and duodenum (*n*=16; 2.7%) (Figures 4A, 4B, 5A, 5B, 6A, 6B). There was a significant correlation between the type of foreign body and its location; 439 (87.8%) sharp-pointed foreign bodies were located in the esophagus, while 18 (78.3%) long foreign bodies were located in the stomach (Table 2).

### Timing and Devices

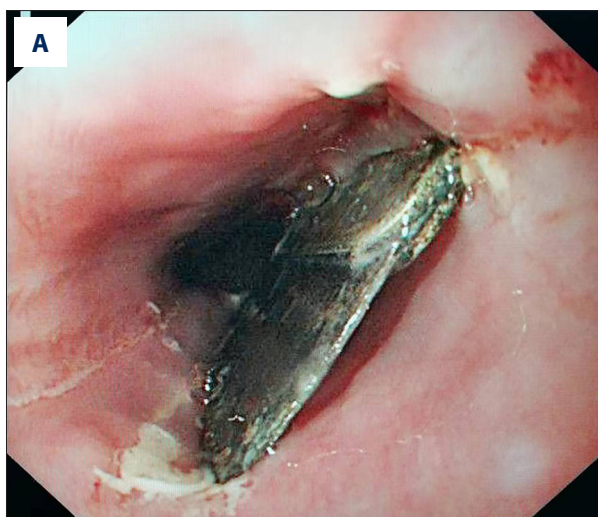
The time interval between ingestion and endoscopic examination could not be found in 34 patients. Among the remaining 552 patients, 45.6% (*n*=252) received emergent removal within 6 hours, while 32.2% (*n*=178) underwent urgent within 24 hours. The remaining 122 patients were referred from other centers and the time intervals were longer than 24 hours. Frequently-used devices for retrieval were retrieval forceps (*n*=529, 90.3%), snares (*n*=31, 5.3%), biopsy forceps (*n*=12, 2.0%), and endoscopic baskets (*n*=3, 0.5%). The remaining 10 patients used retrieval forceps and snares together. Snares were the most commonly used device for long foreign bodies (64.3%), while retrieval forceps were used most commonly for the remaining types (94.5%).



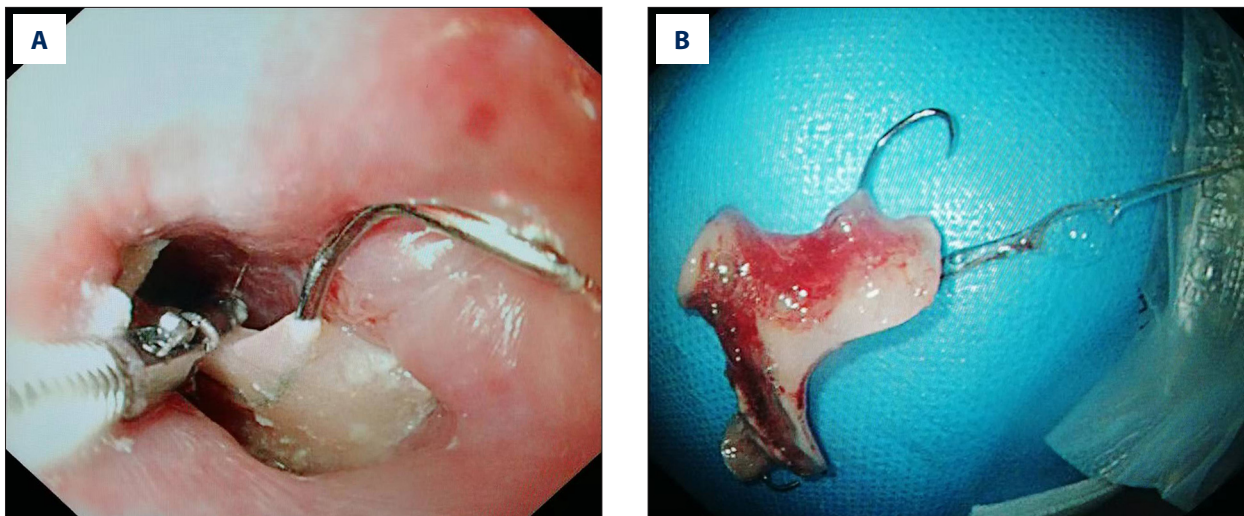
**Figure 1.** Sharp-pointed object (poultry bone) before and after endoscopic removal. (A) Poultry bone in the esophagus; (B) Esophageal ulcers after removal; (C) Removed poultry bone. Endoscopic images were recorded during procedures and edited via Microsoft PowerPoint (version 2016, Microsoft, USA).

**Success and Technical Complications**

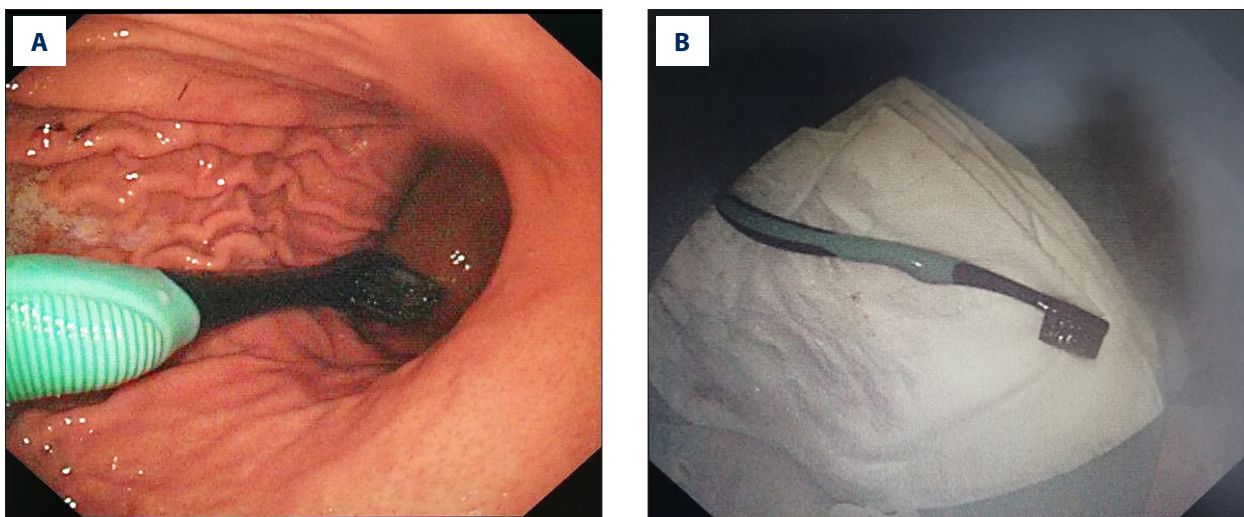
There were 583 (99.5%) successfully removed foreign bodies, and 3 removal attempts failed (2 dentures and 1 poultry bone). Complications were found in 105 patients (17.9%), including mucosal abrasion or erosion (n=60, 10.2%), laceration (n=8, 1.4%), deep ulceration (n=17, 2.9%), and perforation (n=20, 3.4%). Major complications, such as laceration, deep ulceration, and perforation, occurred in 45 patients (7.7%) (Figure 7A-7D).



**Figure 2.** Sharp-pointed object (single-edge razor blade) before and after endoscopic removal. (A) Single-edge blade in the esophagus; (B) Removed single-edge blade. Endoscopic images were recorded during procedures and edited via Microsoft PowerPoint (version 2016, Microsoft, USA).



**Figure 3.** Sharp-pointed object (denture) before and after endoscopic removal. (A) Denture in the esophagus; (B) Removed denture. Endoscopic images were recorded during procedures and edited via Microsoft PowerPoint (version 2016, Microsoft, USA).



**Figure 4.** Long object (toothbrush) before and after endoscopic removal. (A) Toothbrush in the stomach; (B) Removed toothbrush. Endoscopic images were recorded during procedures and edited via Microsoft PowerPoint (version 2016, Microsoft, USA).

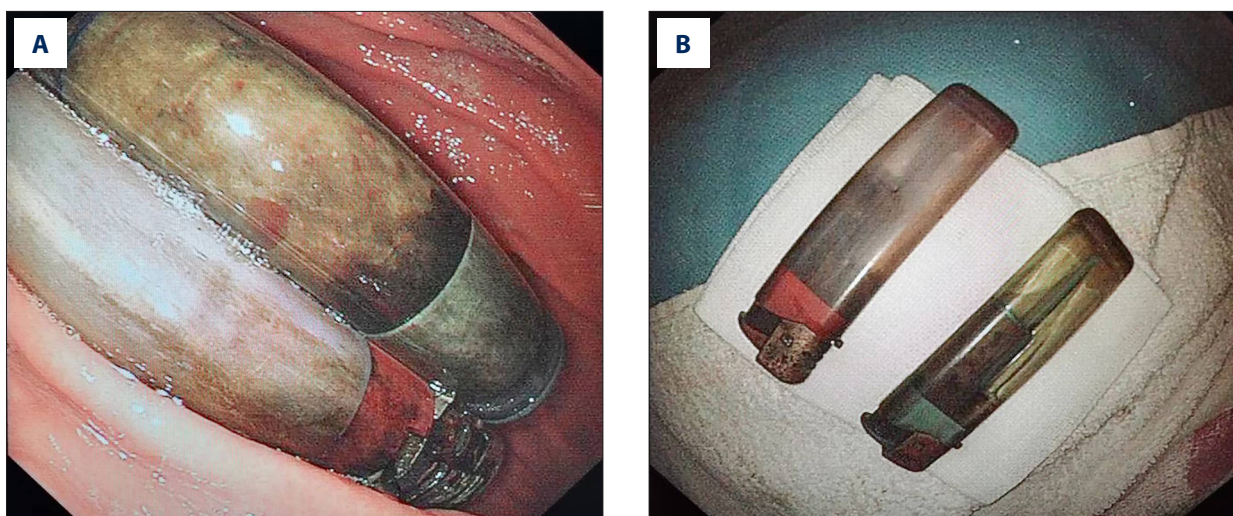
Among these 45 patients, 4 perforations needed surgery and the remaining patients were treated medically.

For all complications, female sex, older age, non-emergent endoscopy, and sharper objects were associated with higher complications in univariate analysis. Female sex and non-emergent endoscopy were significantly associated with higher complication rates according to multivariate analysis (**Table 3**). For major complications, older age, time interval >24 hours, and sharper objects were associated with major complications in both univariate and multivariate analyses. Notably, all major complications occurred in patients who ingested sharp objects. When adjusted for confounding factors, the odds ratios (95% CI) were 0.02 (0.003-0.20) for emergent endoscopy and 0.17 (0.05-0.57) for urgent endoscopy, respectively (**Table 3**).

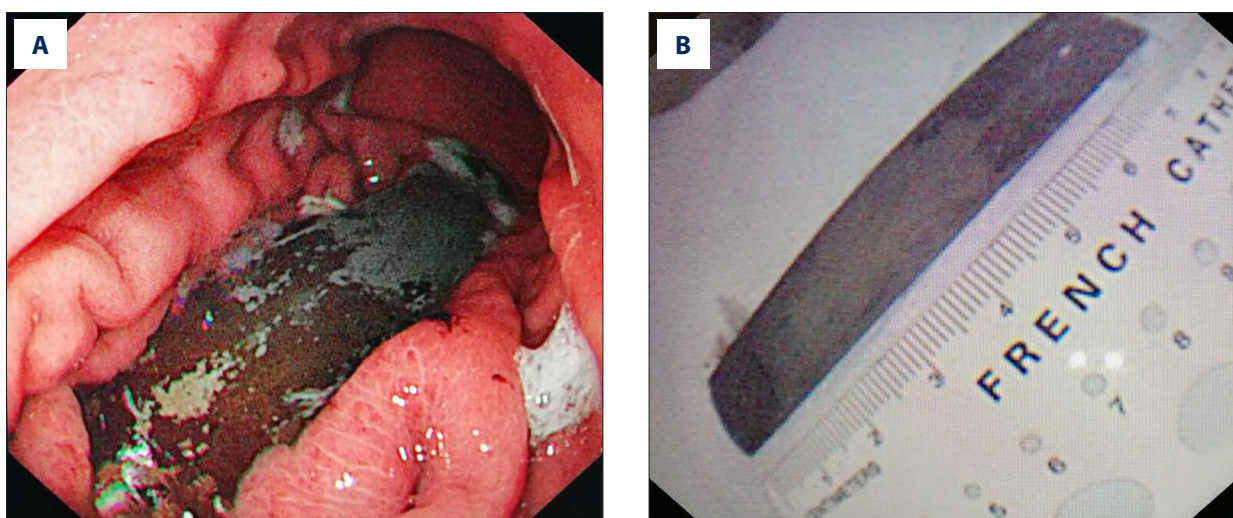
## Discussion

In the present study, sharp-pointed objects, such as jujube or red date pit, were the most common foreign bodies, and the upper esophagus was the most common site of foreign body lodgment in adults. The management of foreign bodies in our series corresponded closely to the 2016 ESGE guideline recommendations for foreign body ingestion. The removal success rate was nearly 100%. The rate of any complication during removal was 17.9% and that of major complications was 7.7%. We demonstrated that emergent endoscopy with 6 hours could reduce the risk of overall complications.

Foreign body types are correlated with geographical and cultural differences in dietary habits. The most common foreign



**Figure 5.** Long objects (lighters) before and after endoscopic removal. (A) Lighters in the stomach; (B) Removed lighters. Endoscopic images were recorded during procedures and edited via Microsoft PowerPoint (version 2016, Microsoft, USA).



**Figure 6.** Long object (steel plate) before and after endoscopic removal. (A) Steel plate in the stomach; (B) Removed steel plate. Endoscopic images were recorded during procedures and edited via Microsoft PowerPoint (version 2016, Microsoft, USA).

body in adults is food bolus in Western countries [13]. However, in Asian countries, sharp objects, including fish bones, chicken bones, fruit pits, and dentures are the most commonly ingested objects [4,7,14-16]. Fish bones are the most common foreign body in South China, while jujube pit is most common in northwest China [10,14-16]. Jujube is a dark red plum-like fruit of Old-World buckthorn trees, and jujube pits usually have 2 sharp points that can penetrate the wall of the GI tract (**Figure 7A-7C**) [10]. Our observation on jujube pits ingestion may be because of the high consumption of jujube in northwest China.

Our findings about long foreign bodies and food bolus were consistent with previous studies. Long foreign bodies occur more commonly in people with psychiatric disorders, alcohol

intoxication, and in incarcerated individuals looking for an opportunity to be sent to a medical facility. Generally, objects longer than 5-6 cm will not pass through the duodenal sweep, and most long foreign bodies were lodged in the stomach. Food bolus impaction was often combined with an underlying structural abnormality such as esophageal web, esophageal rings, or a benign or malignant esophageal stricture.

About 10-20% of foreign bodies cannot pass through the gastrointestinal tract spontaneously, and flexible endoscopy is the mainstay of foreign body removal [16-18]. In the last 10 years, the reported success rate of removal has gradually increased to 93-100% [7,9,18-21] due to improved equipment greater expertise. However, the high rate of technical success did not translate into lower rates of complications. The complication

**Table 1.** Baseline characteristics of 586 included patients.

Variables	No. of patients	Percentage (%)	Variables	No. of patients	Percentage (%)
<b>Sex</b>			Fish bones	20	3.4
Male	262	44.7	Dentures	13	2.2
Female	324	55.3	Metallic foreign bodies	13	2.2
<b>Age</b>			Medication foil	6	1.0
17-45	165	28.2	<b>Food bolus</b>	20	3.4
46-60	171	29.2	<b>Long objects</b>	23	
61-75	176	30.0	Pens	8	1.4
>75	74	12.6	Lighter	10	1.7
<b>Reasons for FB ingestion</b>			Chopsticks	3	0.5
Accidental	533	91.0	Toothbrush	2	0.3
Intentional	53	9.0	<b>Blunt objects</b>	43	
<b>Symptoms with FB ingestion</b>			Plastic fragment	7	1.2
None	251	42.8	Others	36	6.1
Dysphagia	222	37.9	<b>Multiple</b>	10	1.7
Chest pain	71	12.1	<b>Complications</b>		
Others	42	7.2	Mucosal erosion	60	10.2
<b>Type of foreign body</b>			Laceration	8	1.4
<b>Sharp-pointed</b>	500		Deep ulceration	17	2.9
Jujube pit	394	67.2	Perforation	20	3.4
Poultry bones	54	9.2			

FB – foreign body.

**Table 2.** Sites of foreign body lodgment according to foreign body (FB) type.

Type of FB	Esophagus			Stomach			Duodenum	Total
	Upper	Mid	Lower	Fundus	Corpus	Antrum		
Sharp-pointed	398	30	11	2	10	41	8	500
Food bolus	6	11	3	–	–	–	–	20
Long objects	1	1	–	1	16	1	3	23
Blunt objects	10	6	4	2	11	5	5	43
Total	415	48	18	5	37	47	16	586

rate has been reported to range from 0.5% to 50.0%, depending on what is considered as a complication (such as mucosal erosions in some series) [4-7,9,20-24]. Together with our study (success rate of 99.5% and complication rate of 18%), these paradoxical findings suggested that the high complication rate does not result from technical issues. Whether the sharpness of the foreign body is a risk factor for complications has been controversial. Sharp foreign bodies were identified as risk factors for complications in multiple studies [4,7,24]. When adjusted for other risk factors, sharp-pointed objects

were not associated with a higher overall complication rate, but were associated with a higher rate of major complications in the present study.

It is well recognized that complication rates increase with impaction time; however, few studies have explored the relationship between time interval between ingestion and endoscopic management and outcomes. The reported time intervals included 24 hours [8,24-26], 15 hours [27], 12 hours [7], and 6 hours [23]. The ESGE recommends emergent endoscopy within

**Table 3.** Univariate and multivariate analysis for overall complications and major complications.

Variables	Univariate			Multivariate		
	OR	95% CI	P value	OR	95% CI	P value
<b>All complications</b>						
Sex						
Male	1					
Female	1.79	1.15-2.79	0.01	2.47	1.18-5.16	0.016
Age (years)	1.03	1.02-1.04	0.00	1.01	0.99-1.03	0.183
Duration time (hours)						
>24	1					
≤24	0.96	0.45-2.05	0.92			
≤6	0.17	0.07-0.42	0.00	0.15	0.07-0.35	0.000
Length of FB (cm)	0.96	0.84-1.10	0.57			
Type of FB						
Non-sharp	1					
Sharp	5.19	1.86-14.50	0.002	3.36	0.92-12.22	0.067
<b>Major complications</b>						
Sex						
Male	1					
Female	1.74	0.86-3.54	0.125			
Age (years)	1.06	1.03-1.08	0.000	1.04	1.01-1.08	0.032
Duration time (hours)						
>24	1					
≤24	0.264	0.09-0.81	0.020	0.172	0.05-0.57	0.004
≤6	0.035	0.004-0.28	0.002	0.023	0.003-0.20	0.001
Length of FB (cm)	0.309	0.43-1.31	0.747			
Type of FB*						
Non-sharp	–					
Sharp			<0.001			<0.001

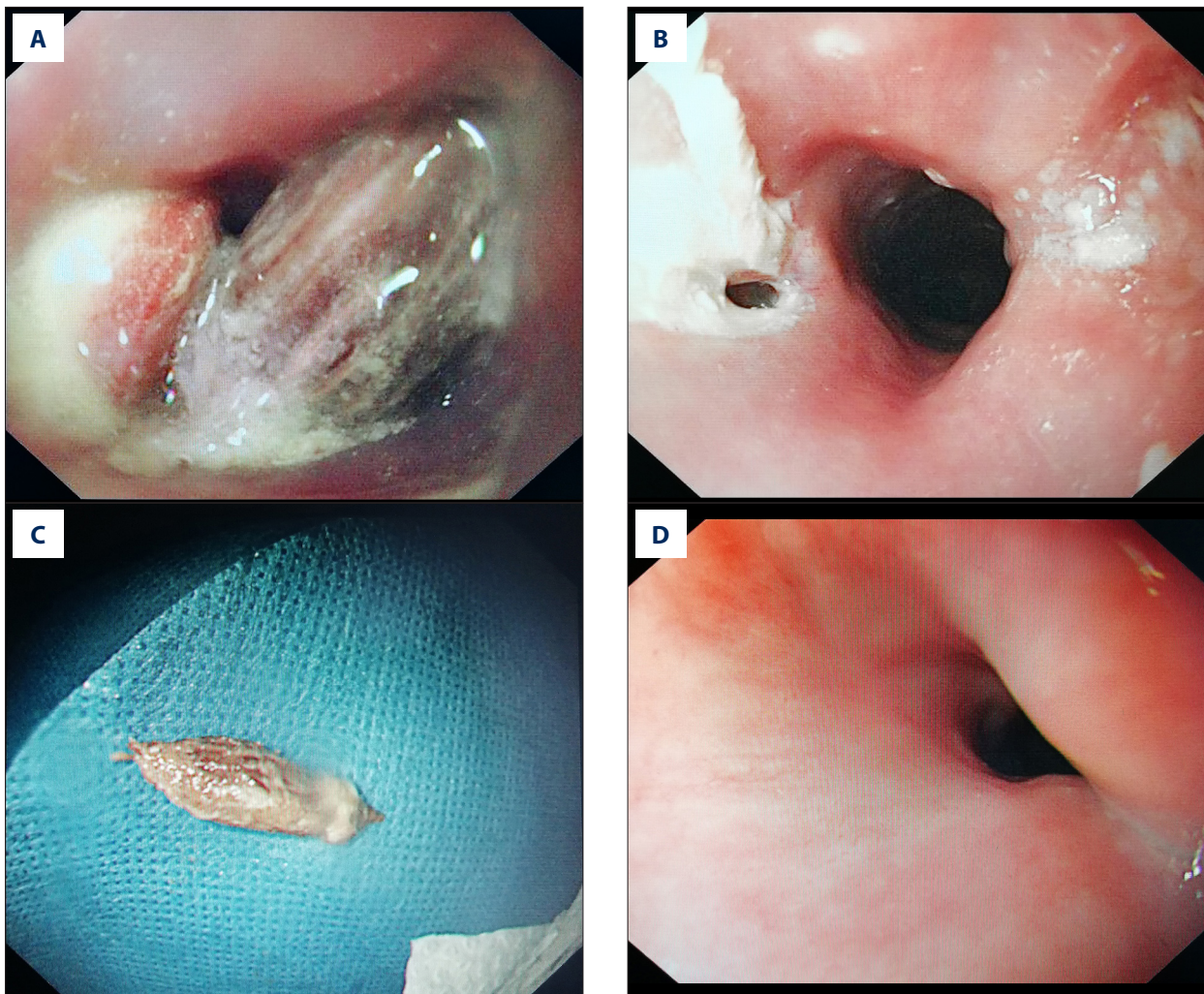
\* All major complications occurred in patients with sharp foreign bodies. FB – foreign body; OR – odds ratio; CI – confidence interval.

6 hours and urgent endoscopy within 24 hours for different kinds of objects. No previous study has evaluated the effectiveness of these recommendations. Our study demonstrated that time interval within 6 hours could reduce all complications, including major ones. Time interval between 6 and 24 hours could reduce major complications, but not overall complications. This may be explained by the wide use of safety measures, such as overtubes and transparent caps [12], which can widen the therapeutic window and reduce major complications.

Despite protective devices, mild complications were inevitable, and time is the true element of success.

The present study has some limitations. The study involved a retrospective analysis, data on some minor complications were not available, and the degree of mucosal damage was not objectively evaluated in all cases, so some potential bias might have been added. However, due to the relatively large numbers of cases with major complications, it was possible to investigate





**Figure 7.** Jujube pit ingestion with perforation before and after endoscopic removal. (A) Jujube pit in the esophagus; (B) Perforation after removal; (C) Removed jujube pit; (D) Healed perforation during follow-up. Endoscopic images were recorded during procedures and edited via Microsoft PowerPoint (version 2016, Microsoft, USA).

the risk factors. Second, psychiatric disease is a risk factor for foreign body lodgment, but the numbers were relatively small, and we did not analyze it. Finally, most foreign bodies were sharp-pointed objects in the present study, and caution should be used when extrapolating the results to other conditions.

## Conclusions

Flexible endoscopy is the mainstay of foreign body removal, with a success rate near 100%. The ESGE recommendations could significantly reduce the complication rates for adults in the emergency setting. Longer impaction time, older age, and

sharp-pointed objects were predictive factors for complications, especially major complications. The findings from this retrospective study supported the ESGE recommendations that endoscopic removal of ingested foreign bodies from the upper GI tract within 6 hours is needed to reduce complication rates for adults in the emergency setting. Further studies comparing patients with different dietary habits are needed.

## Declaration of Figures' Authenticity

All figures submitted have been created by the authors, who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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