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# Therapeutic Effect of Esophageal Foreign Body Extraction Management: Flexible versus Rigid Endoscopy in 216 Adults of Beijing

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**Background:** The aim of this study was to assess the effectiveness and complications of rigid endoscopy (RE) and flexible endoscopy (FE) for the extraction of esophageal foreign bodies (FB) in adults.

**Material/Methods:** A retrospective analysis was conducted on the medical records of 216 adult patients with esophageal FB impaction treated at Peking University Third Hospital, Beijing, China, between January 2008 and December 2012.

**Results:** The success rate of FB extraction was 100% (142/142) in patients treated with RE compared to 97.3% (72/74) in those treated with FE ( $P=0.045$ ). The total incidence of complications in RE-treated patients was lower than that in FE-treated patients (28.2% vs. 45.9%,  $P=0.009$ ), but the perforation rate was higher (5.6% vs. 1.4%,  $P=0.135$ ). The incidences of total complications and perforation were associated with the duration of FB impaction in patients who underwent RE (both  $P<0.05$ ) but not in patients who underwent FE. RE was more frequently used in extraction of FBs located in the upper esophagus (88.7%, 126/142) compared to FE (60.8%, 45/74) ( $P<0.05$ ). The size of extracted FB was significantly larger in patients treated with FE compared to those treated with RE ( $P<0.05$ ).

**Conclusions:** Both RE and FE were effective in the extraction of esophageal FB. However, the perforation rate and the need for general anesthesia were higher in RE-associated extraction. FE may be the preferred endoscopic treatment for the extraction of esophageal FB, except possibly for those impacted in the upper esophagus. FB extraction may produce better outcomes if endoscopy is employed early.

**Keywords:** **esophagus • foreign body • flexible endoscopy • rigid endoscopy • adult**

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## Background

A foreign body (FB) or food bolus lodged in the esophagus because it was swallowed by mistake, because of narrowing of the esophagus, or because of a psychiatric disorder is a common problem [1,2]. The majority of FB ingestions occur in children younger than 6 years of age, and coins and toys are the most common FB they ingest; among adults, the most commonly impacted objects are dentures, fish bones, and meat [3–5]. Although 80% to 90% of impacted FB in the esophagus pass spontaneously, the remainder require removal by endoscopy (10% to 20%) or surgery (about 1%) [6]. When esophageal FBs are impacted for longer than 24 h, complications occur, including tracheoesophageal fistula, acute mediastinal infection, esophageal mucosa denudation, upper digestive tract hemorrhage, esophageal stenosis, airway obstruction, esophageal perforation, and, in severe cases, death [7–13].

In recent years, endoscopy, either with flexible endoscopes (flexible endoscopy; FE) or rigid scopes (rigid endoscopy; RE) has been the most common approach for removal of impacted esophageal FBs [14]. FE most often can be performed under local anesthesia, usually in the outpatient setting, and patients recover rapidly; thus the expense of hospitalization is avoided. However, RE performed under general anesthesia may be more comfortable for patients and is better tolerated. Whether FE or RE should be the preferred approach for extraction of esophageal FBs is not clearly established [15]. Most clinical trials comparing RE and FE and have suggested that FB extraction rates of the 2 methods are similar [16,17]. Some reports have recommended that FE be the “first line” approach because it does not require general anesthesia, has shorter operation time, and permits biopsy of the esophageal mucosa [18].

FB ingestion is a commonly encountered clinical problem in China; however, studies reporting the incidence and management of the condition in Chinese patients are limited [18]. In this study, we retrospectively analyzed the medical records of patients who had undergone endoscopic extraction of esophageal FB in Peking University Third Hospital, Beijing, China. The effectiveness and the complications of RE and FE were compared.

## Material and Methods

### Patients

A consecutive series of 216 patients had FB extraction from the esophagus at Peking University Third Hospital, Beijing, China, between January 2008 and December 2012. The patients' records were reviewed for demographics, clinical manifestations, characteristics and location of FB, duration of FB impaction

(from impaction to the time of endoscopic treatment), success rate, and complications after endoscopic treatment.

The endoscopic approach performed depended on the department of initial admission. There were 142 patients admitted to the Department of Otorhinolaryngology and who underwent RE; 74 patients were admitted to the Department of Gastroenterology and underwent FE. After comprehensive preoperative examinations, RE was performed on patients under general anesthesia in the operating room. For FE, patients received pharyngeal local anesthesia with lidocaine gel in the Gastrointestinal Endoscopy Center after fasting for at least 4 h. The endoscopes were types GIF-Q260, GIF-130, and GIF-140 from Olympus (Tokyo, Japan) and types EG-450 and EG-410 from Fuji (Tokyo, Japan). Instruments included rat-tooth forceps (44.6%, 33/74), biopsy forceps (6.8%, 5/74), snare (9.5%, 7/74), combined instruments, which included the use of at least 2 or 3 of the above (18.9%, 14/74), and net bucket (2.7%, 2/74). In 6 FE patients, FBs were removed using rat-tooth forceps or snare introduced through an overtube; in 4 FE patients (5.4%, 4/74), FBs were pushed into the stomach using biopsy forceps or rat-tooth forceps. In 9 patients (12.2%, 9/74), instruments were not required because severe vomiting dislodged the FB, or no FB was visualized during the endoscopy process.

### Statistical analysis

SPSS version 17.0 (SPSS Inc., Chicago, IL) was used. If the data were normally distributed, independent samples *t*-test was used for comparisons of data between 2 groups. Otherwise, Mann-Whitney rank analysis was used for measurement of data with abnormal distribution. Chi-square test was used for detecting significant differences in the percentages of categorical data.  $P < 0.05$  was considered statistically significant.

## Results

### Baseline information

The demographics and clinical manifestations of the patients are shown in Table 1. The ages of patients in the RE and FE groups were similar ( $P = 0.875$ ), but the male: female ratio was 1:1.5 in the RE group and 1.2: 1 in the FE group ( $P = 0.025$ ). Odynophagia (116/142, 81.7%) was more frequent in the RE group, whereas odynophagia (22/74, 29.7%) and chest pain (23/74, 31.1%) were more common in the FE group (Table 1).

Esophageal strictures were encountered in none of the patients who had RE, but in 14 of 74 who had FE (Table 1). The cause of the strictures, when it could be determined, was malignancy in 3 patients, postoperative anastomotic stricture in 5, and indeterminate in 6.

**Table 1.** Demographics and baseline information of patients who underwent rigid endoscopy (RE) and flexible endoscopy (FE).

	RE	FE	P
Gender (Male: Female)	56:86	41:33	0.025
Age (years)	50.8±19.0	50.3±21.7	0.875
Clinical manifestations			<0.001
Odynophagia	116	22	
Paraesthesia pharynges	6	12	
Dysphagia	5	15	
Chest pain	8	23	
Neck pain	1	0	
Nausea	0	2	
Combined	6	0	
Impaction duration (hours)	26.2±28.3	14.4±13.0	0.001
≤24 hours	99	64	
24~48 hours	24	9	0.008
≥48 hours	19	1	
Location of FB			
Upper: middle: lower	126: 13: 3	45: 21: 8	<0.001
Type of foreign body			<0.001
Food bolus	5	22	
Ring	0	1	
Shrimp skin	1	0	
Crab bone	2	0	
Fish bone	40	21	
Chicken or duck bone	33	11	
Coin	1	0	
Denture	9	6	
jujube pit	51	6	
Foil covered pill	0	3	
Plastic wrap	0	1	
No obvious FB	0	2	
Key	0	1	
Size of impaction			
Major diameter (cm)	2.22±0.72	2.50±0.99	0.021
Minor diameter (cm)	1.06±0.72	1.40±1.10	0.005
Penetration into esophageal wall			<0.001
One side of wall	22	12	
Two sides of wall	76	11	
No penetration	44	51	
Esophageal stricture	0/142	14/74	<0.001
The positive rate of Contrast esophagography	132/134	17/18	0.245
The positive rate of chest or abdominal radiography	32/134	5/22	0.641

**Table 2.** Success rate and complications after RE and FE treatments.

	RE	FE	P
FB removal success rate	142/142	72/74	0.045
Complications (No: Yes)	102: 40	40: 34	0.009
Erosion	9	13	
Ulcer	2	9	
Infection	1	1	
Perforation	8	1	
Edema	13	5	
Hemorrhage	6	3	
Mucosa denudation	1	2	
Perforation (No: Yes)	134: 8	73: 1	0.135

**Table 3.** Medical information of patients with esophageal foreign body impaction and esophageal perforation.

Serial number	Gender	Age	Clinical manifestation	foreign body impaction duration (hour)	Location of impaction	Type of foreign body	Esophageal stricture	Therapeutic approach	Perforation management
1	Female	71	Dysphagia	4	Upper segment	Jujube pit	No	FR	Conservative
2	Female	79	Odynophagia	144	Upper segment	Jujube pit	No	RE	Conservative
3	Female	70	Odynophagia	21	Upper segment	Fish bone	No	RE	Conservative
4	Female	56	Odynophagia + dysphagia	35	Upper segment	Crab bone	No	RE	Conservative
5	Female	83	Odynophagia	53	Upper segment	Jujube pit	No	RE	Conservative
6	Male	43	Odynophagia	148	Upper segment	Jujube pit	No	RE	Conservative
7	Female	56	Odynophagia + chest pain	15	Upper segment	Denture	No	RE	Conservative
8	Female	37	Odynophagia	14	Upper segment	Fish bone	No	RE	Conservative
9	Female	76	Odynophagia	73	Upper segment	Jujube pit	No	RE	Conservative

### Therapeutic efficacy

The success rates of RE and FE in removing FB were 100% (142/142) and 97.3% (72/74), respectively (Table 2). In 2 cases, management with FE failed, and RE was subsequently employed for successful FB removal.

The total incidence of complications was 28.2% (40/142) in RE-treated patients compared with 45.9% (34/74) in the FE-treated

patients ( $P=0.009$ ). The perforation rate was 5.6% (8/142) in RE-treated patients compared with 1.4% (1/74) in those treated with FE, a difference that did not reach statistical significance ( $P=0.135$ ) (Table 2). All patients in whom perforation occurred recovered with conservative treatment, and without surgical intervention. The types of FB in the 9 patients who had perforations are listed in Table 3. All perforations occurred in the upper segment of the esophagus. Additional complications included mucosa erosion, ulcer, infection, local mucosa

**Table 4.** The incidence of total complications and perforation according to the duration of time between impaction and RE or FE treatments.

Impaction duration	Complication (%)			Perforation (%)		
	RE	FE	<i>P</i> *	RE	FE	<i>P</i> *
≤24 hours	22/99 (22.2)	31/64 (48.4)	0.001	3/99 (3.0)	1/64 (1.6)	1.000
24~48 hours	6/24 (25.0)	2/9 (22.2)	0.868	1/24 (4.2)	0/9 (0%)	1.000
≥48 hours	12/19 (63.2)	1/1 (100.0)	0.452	4/19 (21.1)	0/1 (0%)	1.000
<i>P</i> #	0.001	0.118		0.021	1.000	

\* RE treatment vs. FE treatment; # ≤24 hours vs. 24~48 hours vs. ≥48 hours (Chi-square test).

edema, litter hemorrhage in mucosa, hematoma formation, and esophageal mucosa denudation [19] (Table 2).

### Duration of FB impaction

The duration of impaction before endoscopic treatment differed between the treatment groups ( $P=0.001$ ), being nearly twice as long in the patients with RE as those with FE. Ninety-nine patients (69.7%) and 19 patients (13.4%) underwent RE within 24 h and after 48 h of FB impaction, respectively, whereas 86.5% patients underwent FE within 24 h of FB impaction, and 1 patient after 48 h (this patient was admitted to hospital 96 h after FB impaction) (Table 1).

The incidence of total complications and perforation according to the duration of time between impaction and treatment is shown in Table 4. The incidences of total complications and perforation were associated with the duration of FB impaction in patients who underwent RE (both  $P<0.05$ ) but not in patients who underwent FE. Five perforations were associated with FB impaction duration of longer than 24 h (Table 3).

### FB location in the esophagus

The location of the impaction differed between the 2 groups ( $P<0.001$ ) (Table 1); it was in the upper esophagus in 88.7% (126/142) of patients who had RE, compared with 60.8% (45/74) of patients who had FE. Only 2.1% and 10.8% patients in the RE and FE groups, respectively, had FB in the lower esophagus. One or both ends of the FB had penetrated the esophageal wall in 69.0% (98/142) of RE cases compared to 31.1% (23/74) of FE cases ( $P<0.001$ ).

### Characteristics of FB

The most common FBs extracted by either FE or RE were food-related objects (including food bolus, shrimp skin, crab bone, fish bone, chicken or duck bone, and jujube pit); overall, the food-related objects accounted for 93.0% (132/142) and 81.1% (60/74) of the FB in the RE and FE groups, respectively. The

major diameter ( $P=0.021$ ) or minor diameter ( $P=0.005$ ) of the extracted FB was significantly larger in patients treated with FE compared to those treated with RE (Table 1).

### Adjuvant diagnostic method

The positive diagnostic rate of upper gastrointestinal sodium diatrizoate esophagography was 98.5% (132/134) and 94.4% (17/18) for patients who underwent RE and FE, respectively. The positive diagnostic rate of chest or abdominal radiography was 23.9% (32/134) and 22.7% (5/22) for patients who underwent RE and FE, respectively (Table 1).

## Discussion

In the present study, we compared the effectiveness of RE and FE in the management of FB esophageal impactions in adults. We showed that FE and RE were equally effective in the removal of FB impacted in the esophagus. The total incidence of complications in RE-treated patients was lower than that in FE-treated patients, but RE was associated with a higher frequency of esophageal perforation. RE was more frequently used in extraction of FBs located in the upper esophagus compared to FE. Food-related objects were the most common FB. The size of the extracted FB was significantly larger in patients treated with FE compared to those treated with RE.

We reported success rates of 100% and 97.3% for the removal of FB using RE and FE, respectively, and incidences of complications at 28.2% by RE and 45.9% by FE. These data are in accordance with previous studies in adults that show an esophageal FB extraction rate of 91.4% by FE in adults [20], and reports of incidences of complications associated with endoscopic treatment of esophageal impaction ranging from 15% to 42% [21–23]. We observed a slightly higher rate of complications, possibly because we frequently (80%) found that the impacted objects in our patients were sharp FBs, such as bones, dentures, jujube pits, and pills covered by foil packages. These objects penetrated into the esophageal wall in 69% and 31.1% of RE and FE cases, respectively.

While we saw no statistically significant difference between RE and FE in success rate of extraction, there was a higher rate of esophageal perforation associated with RE. Although this difference did not reach statistical significance, it is clinically relevant because 8 patients in the RE group compared with 1 in the FE group experienced perforation. The explanation for the relatively high perforation rate in the patients who had RE is not entirely clear. Factors that may have been involved are the nature of the FB impacted, differences in endoscopic technique or expertise, and a longer duration between impaction and endoscopy in the RE group.

We suspect that the relatively long interval between impaction and endoscopy may have been a factor in the relatively high rate of perforation in the RE patient group. Evidence suggests that the incidence of complications due to FB impaction increases from 3.2% to 7.2% within 24 h and from 21.1% to 23.5% within 48 h after impaction occurs [20,24]. Regardless of the type of FB, the risk of complication increases after 24 h [19], although early perforation associated with an impacted food bolus has been reported [25]. In our study, the incidence of complications was positively correlated with the duration of impaction in the patients who underwent RE but not in those who underwent FE. Nineteen (13.4%) of our patients who underwent RE and 1 (1.4%) who underwent FE were treated after 48 h of FB impaction. Previous reports indicate that 70% of patients are admitted to hospital and undergo endoscopic therapy within 24 h of FB [20]; our corresponding figure was 75%.

The diagnosis of esophageal FB impaction is usually made on the basis of medical history and clinical manifestations. Imaging studies may also be useful [26], but the diagnosis rate by chest or abdominal X-ray examination has been reported at only 26% [20]. Fish and chicken bones, which are common causes of impaction, have a density similar to that of human vertebrae, which can make their visualization radiographically difficult. We found the diagnostic rate of FB esophageal impaction by upper gastrointestinal barium contrast X-ray was 98.5% and 94.4% for patients who underwent RE and FE, respectively; the diagnosis rate by chest or abdominal X-ray examination was 23.9% and 22.7%, respectively. Therefore, we recommend that the first-line imaging examination be contrast esophagogram instead of conventional chest

or abdominal X-ray examination if bone-related esophageal impaction is suspected; a water-soluble contrast agent may be preferable to barium because of its lower risk of causing chemical pneumonia if aspirated, a concern especially in children and elderly patients.

Fourteen of our patients (18.9%) who underwent FE had esophageal strictures, but no complications associated with the strictures were identified. This frequency of stricture is similar to that reported by others [20]. Sperry et al. [27] observed that eosinophilic esophagitis was present in 9% of 548 patients with esophageal FB impaction; it is unclear if that condition was present in any of our patients. Esophageal FB impaction has been reported to be common (13–50%) in patients after broncho-esophageal fistula surgery [28].

Our study had several limitations. First, we collected retrospective data from a single medical care unit. Therefore, our data may not be generalizable to other healthcare settings. Second, there was no randomization of treatment method. Choice of the endoscopic procedure was based on department of admission: patients admitted to the Department of Gastroenterology underwent FE, whereas patients admitted to the Department of Otorhinolaryngology underwent RE.

## Conclusions

In conclusion, FE and RE were equally effective in the removal of FB impacted in the esophagus. RE was associated with a higher frequency of esophageal perforation, but whether this was due to endoscopy itself, or to factors such the nature of the FB or FB impaction duration is not known. Since FE may have a lower rate of esophageal perforation than RE and does not require general anesthesia, it may be preferred over RE as the initial endoscopic approach in the management of esophageal FB impaction. RE may be reserved for patients with FB located in the upper esophagus, or who have failed attempts with FE. FB extraction may produce better outcomes if endoscopy is employed early.

## Conflict of interest

The authors declare that they have no conflict of interest.

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