

The removal of foreign body ingestion in the upper gastrointestinal tract: a retrospective study of 1,182 adult cases

Xin Wang[#], Shuai Su[#], Yiming Chen, Zelan Wang, Ying Li, Junjie Hou, Weilong Zhong, Yuming Wang, Bangmao Wang

Department of Gastroenterology and Hepatology, General Hospital of Tianjin Medical University, Tianjin, China

Contributions: (I) Conception and design: X Wang, S Su; (II) Administrative support: Y Wang, B Wang; (III) Provision of study materials or patients: Y Chen, Z Wang; (IV) Collection and assembly of data: X Wang, Y Li, J Hou, W Zhong; (V) Data analysis and interpretation: X Wang; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

[#]These authors contributed equally to this work.

Correspondence to: Yuming Wang; Bangmao Wang. Department of Gastroenterology and Hepatology, General Hospital of Tianjin Medical University, Tianjin 300052, China. Email: yumingwangbest@163.com; mwang02@tmu.edu.cn.

Background: Foreign body (FB) ingestion in the gastrointestinal tract is a common and urgent problem observed in children and adults. However, there may be difficulty locating FB's and complications associated with their removal. This study aimed to identify risk factors and complications correlated to the presence and removal of FBs.

Methods: This 5-year retrospective study enrolled 1,311 patients between June 2014 and April 2019. Demographic and endoscopic data were collected, containing age, gender, types and location of FBs, duration of FB ingestion, accessory devices, endoscopic methods, and complications. Logistic regression analysis was applied to evaluate the predictive risk factors.

Results: Among 1,131 patients, FBs were found in 90.16% of cases. A major predictor for the presence of FB was a presentation of less than 24 hours (h). The types of FBs were jujube pits (36.72%) and fish bones (22.00%), and over 80% of the FBs were discovered in the esophagus. Complications were found in 239 cases (20.22%), of which hemorrhage (162/239, 67.78%) was the most frequent. Age ≥ 60 , duration ≥ 24 h, and FBs ingested in the esophagus were considered as risk factors for developing complications.

Conclusions: In conclusion, the longer duration, age ≥ 60 , and impaction in the esophagus were risk factors for developing complications following the ingestion of FBs. These factors should be considered when developing assessment and treatment plans in the management of FB ingestion.

Keywords: Foreign body ingestion; endoscopy; upper gastrointestinal tract; complication; risk factors

Submitted Jan 27, 2021. Accepted for publication Mar 16, 2021.

doi: 10.21037/atm-21-829

View this article at: <http://dx.doi.org/10.21037/atm-21-829>

1 Introduction

2 Foreign body (FB) ingestion is a common and urgent
3 problem presenting to gastroenterology (GI) departments
4 and is defined as swallowing anything purposely or
5 unintentionally, including food, medication, toys, coins or
6 other objects(1). An American survey reported the estimated
7 annual incidence of FBs ingestion was 120,000 cases (2). In
8 those patients, most ingestions were linked to dining, whilst
9 others were associated with psychiatric disorders, alcohol

dependence, drug abuse, digestive diseases (including 11
achalasia of the cardia), or other abnormal conditions (3-5). 12
The majority of ingested FBs (80–90%) pass through the 13
GI tract spontaneously and only 10–20% require endoscopic 14
intervention and <1% need surgery (6-9). Endoscopy 15
has become the preferred choice to remove FBs not only 16
because it avoids the need for surgery, but because it uses 17
conveniently accessible technical devices and advanced 18
visualization, may simultaneously diagnosis other diseases, 19

and is cost efficient in comparison to other methods (10-12). However, FBs may not be discovered in every procedure (13,14) and the detection rate may be as low as 75%. Older age and early presentation have been shown to be independent predictors for the presence of FBs (15,16), and occasionally, FB ingestion in the upper-GI tract may cause severe complications, such as perforation, internal bleeding or death (17). According to a previous study (18), an average of 1,500 people died from FBs ingestion each year in the United States. Moreover, most researchers agree that the types, sizes, and the duration of impaction were considered as risk factors linked with complications (12,19,20). This retrospective study aimed to identify factors correlated to the presence of FBs as well as complications associated with their presence and removal, such that timely and appropriate treatments may be applied for patients with FB ingestion. We present the following article in accordance with the STROBE reporting checklist (available at <http://dx.doi.org/10.21037/atm-21-829>).

Methods

Patients

This retrospective study was conducted in the Department of the Gastroenterology, Tianjin Medical University General Hospital. A total of 1438 patients presenting with suspected FBs between June 2014 and April 2019 were included. Patients with capsule endoscopies and stents, repeated endoscopies, and others whose FBs were extracted from the lower GI tract were excluded from the study. Eventually, the study enrolled 1,311 adult patients (781 women and 530 men) ranging from 18 to 89 years of age and with a mean age of 54.27 ± 3.03 years. This study was approved by the Institutional Review Board of Tianjin Medical University General Hospital (Ethical No. IRB2020-WZ-141). All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). Individual consent for this retrospective analysis was waived.

Endoscopic procedures

The vital signs, temperature, breathe, pulse and blood pressure should be recorded for every patients. And a physical examination focused on the patient's general condition and was to assess signs of any complications (21). Before the foreign-body extraction procedure, plain chest

radiography, or abdominal radiography if there was a suspicion of a gastric or duodenal foreign body. Upper GI endoscopy was performed in each patient under topical pharyngeal anesthesia using lidocaine, or general anesthesia using propofol or ketamine. Flexible endoscopes (mainly GIF-Q260 and GIF-Q290; Olympus Optical Co, Ltd, Tokyo, Japan) were adopted. Devices used included foreign body forceps, snare, rat-tooth forceps, basket, biopsy forceps, and alligator jaws forceps. A snare was used to extract irregular objects such as dental prostheses or metallic FBs and a latex protector hood or a transparent cap was utilized to avoid damage to the GI tract during endoscopic procedures.

Data collection

Demographic data including age, gender, clinical data containing history of other diseases, time from ingestion to presentation to the emergency department, and endoscopic data recording types, location of FBs, duration of FBs ingestion, endoscopic devices, the methods of anesthesia, and complications were collected for analysis.

Statistical analysis

T tests were used to compare the mean and standard deviation, Chi-square tests were to contrast proportions, and logistic regression analyses were to assess the risk factors of FBs presence and complications. All tests were two-tailed and $P < 0.05$ was defined as statistically significant. SPSS statistical software (ver. 13.0; SPSS Inc., Chicago, IL, USA) was applied to complete the statistical analyses.

Results

Characteristics and risk factors of patients with foreign body ingestion

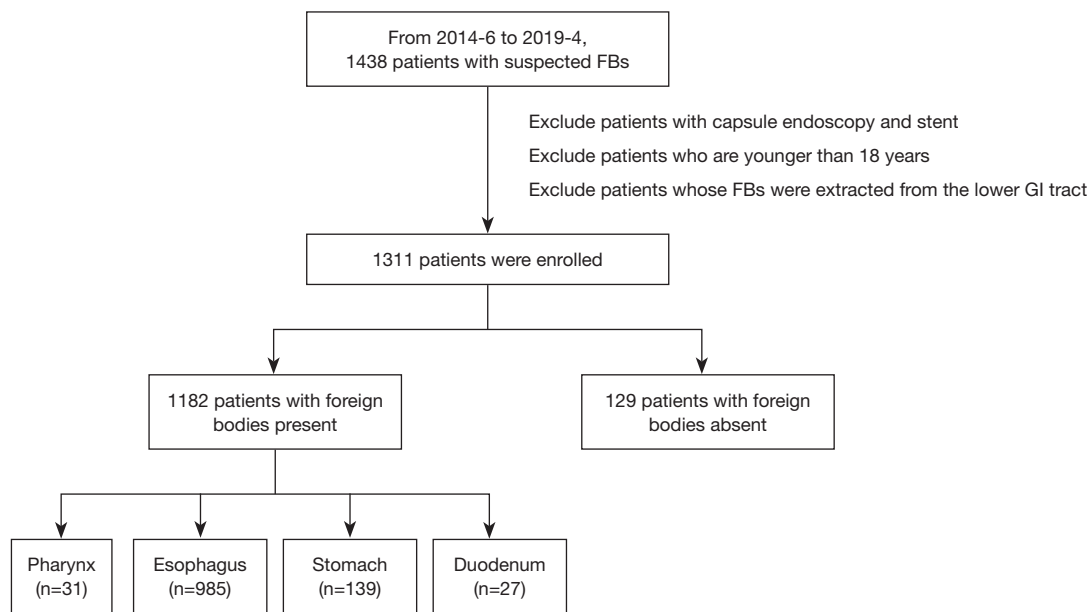
A total of 1,311 patients with suspected FBs ingestion underwent endoscopic management and FBs were found in 1,182 (90.16%) individuals. Compared to patients without FB, those with FB present were of older age (55.09 ± 15.72 vs. 46.70 ± 16.22 years, $P < 0.0001$), more frequently female (61.17% vs. 44.96%, $P < 0.0001$), and of shorter ingestion duration (23.78 ± 2.12 vs. 41.24 ± 7.46 hours, $P = 0.014$).

Significant variables that estimated the presence of FBs based on Pearson's Chi-square tests included gender, age, and duration of FB ingestion ($P < 0.05$). The risk factor of FBs

Table 1 Characteristics and risk factors of patients with foreign body ingestion

Characteristics/Items	Foreign bodies present, n=1,182 (%)	Foreign bodies absent, n=129 (%)	P value ^a	P value ^b (logistic)	OR	95% CI
Age, mean ± SD (years)	55.09±15.72	46.70±16.22	<0.0001	0.429	–	–
Female: male	723: 459	58:71	<0.0001	0.543	–	–
Impaction time	23.78±2.12	41.24±7.46	0.014	–	–	–
<24 vs. 24 h	–	–	–	<0.0001	3.67	2.05–6.64

P value^a: Pearson's Chi-square test or *t* test; P value^b: logistic regression analysis; SD, standard deviation; OR, odds ratio; CI, confidence interval.

**Figure 1** Gastroenterology Department flow sheet of patient with foreign body ingestion.

116 presence was the duration less than 24 h (OR 3.67; 95% CI:
117 2.05–6.64) via the logistic regression analysis (Table 1).

118

119 *The type and location of FB*

120
121 Various types of FBs were detected in the upper GI tract,
122 consisting of jujube pits (36.72%), fish bones (22.00%),
123 dental prostheses (6.60%), other bones such as chicken
124 or duck bones (10.49%), and small metallic FBs (5.24%)
125 such as needles, spoons, rings, and coins, and medicine
126 or its packaging (3.64%). Other objects included lighters,
127 technological products, chopsticks, plastics, nuts, shears,
128 pens, chinaware fragments, and plastic knives (Table S1).
129 Anatomically, most FBs were detected in the esophagus
130 (n=985, 83.33%), with the stomach (n=139, 11.76%),

pharynx (n=31, 2.62%), and duodenum (n=27, 2.28%)
following (Figure 1).

131

132

133

134

135 *Types of accessory device*

136 The selection of tools to remove FBs mainly depends on the
137 type and location of the FB (21,22). The most frequently
138 used devices were foreign body forceps (70.55%), snare
139 (8.63%), and rat-tooth forceps (6.77%). Others, such as
140 biopsy forceps (0.85%), alligator jaws forceps (0.34%), and
141 retrieval basket (0.34%) were rarely adopted. Foreign body
142 forceps (forceps) were more frequently applied in managing
143 routine types of FBs like jujube pits (OR 5.87; 95% CI:
144 3.09–11.13) or fish bones (OR 31.65; 95% CI: 4.39–228.35).
145 The most successful method for removing FBs was forceps

Table 2 Type of accessory devices

Accessory devices (No./%)	Success rate (No./%)	P value	Location of foreign bodies ingestion/number	P value
Foreign body forceps (only) (834/70.55)	796/95.44	0.147	Pharynx/20	
			Esophagus/734	
			Stomach and duodenum/77	
Snare (only) (102/8.63)	94/92.15	0.634	Pharynx/2	
			Esophagus/55	¹ <0.0001
			Stomach and duodenum/44	¹ <0.0001
Rat-tooth forceps (88/7.38)	83/94.32	0.625	Pharynx/6	
			Esophagus/76	¹ 0.653
			Stomach and duodenum/6	
Alligator jaws forceps (5/0.42)	5/100	0.415	Pharynx/0	
			Esophagus/4	¹ 0.474
			Stomach and duodenum/1	
Biopsy forceps (10/0.85)	9/90.0	0.053	Esophagus/5	¹ 0.004
			Stomach and duodenum/5	
			Pharynx/0	
Retrieval basket (4/0.34)	3/75.0	0.155	Esophagus/3	¹ 0.402
			Stomach and duodenum/1	
			Pharynx/0	
Use at least 2 tools (118/9.38)	109/92.37	0.138, ² <0.0001	Esophagus/98	¹ 0.138, ² <0.0001
			Stomach and duodenum/20	² <0.0001

¹means compared to foreign body forceps; ² means compared to snare.

146 (796/834, 95.44%), the application of which was higher
 147 in the esophagus compared to snare (88.01% vs. 53.92%).
 148 Snare was used in 102 patients with 44 (43.14%) cases in
 149 the stomach where their utilization was more effective than
 150 that of forceps (43.14% vs. 9.23%) in extracting metallic
 151 objects (OR 4.51; 95% CI: 2.67–7.64) and dental prosthesis
 152 (OR 6.35; 95% CI: 3.42–11.83) (Tables 2,3).

153

154 *Endoscopy method*

155

156 All patients underwent endoscopy via topical pharyngeal
 157 anesthesia (n=1,100) or general anesthesia (n=82). Patients
 158 who experienced the former had a higher average age
 159 (55.64±0.47 vs. 47.84±1.80, P<0.0001). Compared with
 160 topical approaches, removal using general endoscopy
 161 on the successful rate was higher (96.34% vs. 92.73%,
 162 P=0.225) and exhibited a lower complication rate (20.55%

vs. 15.85%, P=0.308) (Table 4). Unfortunately, these given
 data seem to disagree that endoscopic process with general
 anesthesia has evident superiorities.

163

164

165

166

167

168

Complications of FB

While there were no deaths, 239 patients (20.22%)
 developed complications when endoscopy was used.
 The most frequent of these were hemorrhage (n=162,
 67.78%) and perforation (n=65, 27.20%) as shown in Table
 S2. However other serious complications such as neck
 subcutaneous emphysema or mediastinum emphysema,
 esophagitis and cervical space infection or mediastinitis,
 rupture of large blood vessels, or esophagotracheal fistula
 observed in previous studies (23), were not seen in ours.

169

170

171

172

173

174

175

176

177

There were no differences in gender and anesthetic
 methods between patients with complication and without

178

179

Table 3 Comparison of two tools for removing foreign bodies

Items	Foreign body forceps (only), n=834/70.55%	Snare (only), n=102/8.63%	P value ^a	P value ^b (logistics)	OR; 95% CI
Success rate	796/95.44%	94/92.15%	0.147	–	–
Location					
Pharynx	20/2.40%	2/1.96%	1.0		
Esophagus	734/88.01%	55/53.92%	<0.0001		
Stomach and duodenum	77/9.23%	44/43.14%	<0.0001		
The type of foreign bodies					
Jujube pits	346/41.49%	11/10.78%	<0.0001	<0.0001	5.87; 3.09–11.13
Fish bone	199/23.86%	1/0.98%	<0.0001	<0.0001	31.65; 4.39–228.35
Metallic foreign bodies	56/6.71%	25/24.51%	<0.0001	<0.0001	4.51; 2.67–7.64
Dental prosthesis	29/3.48%	19/18.63%	<0.0001	<0.0001	6.35; 3.42–11.83

P value^a: Pearson's Chi-square test; P value^b: logistic regression analysis. OR, odds ratio; CI, confidence interval.

Table 4 The method of endoscopy

Parameters	Topical pharyngeal anesthesia (n=1,100)	General anesthesia (n=82)	P value
Male	410/37.27%	49/59.76%	<0.0001
Mean age (years)	55.64±0.47	47.84±1.80	<0.0001
Successful endoscopic removal	1020/92.73%	79/96.34%	0.225
Complications	226/20.55%	13/15.85%	0.308
Mean of duration of impaction (h)	29.24	41.60	0.331

180 complication (P=0.265 and 0.392). However, patients who
 181 experienced complications were older than those who
 182 did not (58.71±1.43 *vs.* 54.19±2.98, P<0.0001), and the
 183 duration of FB presence prior to removal was significantly
 184 longer in the former (36.43±4.22 *vs.* 18.00±1.37, P<0.0001).
 185 Interestingly, FBs were more likely to be found in the
 186 esophagus in patients with complications (P=0.028).
 187 Consistently, the consequence of logistics analysis showed
 188 that the independent risk factors of complications were age
 189 ≥60 (OR 1.54; 95% CI: 1.07–2.20), the presence of FBs
 190 beyond 24 h (OR 2.67; 95% CI: 2.00–3.57), and esophageal
 191 FBs (OR 2.07; 95% CI: 1.22–3.53) (Table 5).

193 Discussion

194
 195 FB ingestion is a universal clinical problem. Of the
 196 1,131 patients involved in this study FBs were found in
 197 90.16% patients via endoscopic procedures. Complications

were observed in 239 cases (20.22%), of which hemorrhage
 (162/239, 67.78%) was the most frequent. Risk factors of
 complications included age ≥60, duration of FB ingestion
 ≥24 h and esophageal FBs.

Although patients with FBs suffer symptoms such as throat
 discomfort, epigastric pain, vomiting, and dysphagia (14),
 some FBs produce no symptoms. In addition, a duration of
 less than 24 h was a possible factor indicating the presence
 of FBs in this study, which is consistent with previous
 findings that early presentation is one of the independent
 predictors of the presence of FBs (15,16). A duration of
 less than 24 h increased the risk of the presence of FBs by a
 3.67-fold.

In our study, nearly 59% of FBs were fish bones and
 jujube pits, which is similar to previous findings indicating
 that most FB ingestions were accidental food and bone
 impactions (24–26). Moreover, a great majority of FBs were
 esophageal as also previously published (1,17). Foreign

Table 5 Risk factors for complications of foreign bodies

Possible factors	Non-complication (n=943)	Complication (n=239)	P value ^a	P value ^b (logistic)	OR	95% CI
Mean age ± SD (years)	54.19±2.98	58.71±1.43	<0.0001			
Age ≥60 vs. <60				0.019	1.54	1.07–2.20
Female: male	569:374	154:85	0.265	-		
Impaction time (h)	18.00±1.37	36.43±4.22	<0.0001			
≥24 vs. <24 h				<0.0001	2.67	2.00–3.57
Location			0.028			
Esophagus	774	221		0.007	2.07	1.22–3.53
Stomach	141	17				
Type of foreign body ingested			<0.0001			
Jujube pits	304	129		0.992	-	-
Fish bone	218	43		0.298	-	-
Others	421	67				
Anesthetic methods			0.392			
Topical pharyngeal anesthesia	874	226		-		
General anesthesia	69	13				

P value^a: Pearson's Chi-square test or *t* test; P value^b: logistic regression analysis. SD, standard deviation; OR, odds ratio; CI, confidence interval.

216 bodies forceps successfully removed generous esophageal
 217 FBs including jujube pits, while snare was the best choice
 218 to remove FBs ingested in the stomach, such as dental
 219 prostheses. While our findings were largely consistent with
 220 those of Geng [2017] (17) who found no distinct differences
 221 in the success rates between general and topical pharyngeal
 222 anesthesia, our data conveyed a trend towards a lower
 223 complication rate (15.85% vs. 20.55%) and higher removal
 224 rate (96.34% vs. 92.73%) under general anesthesia. More
 225 research is required to determine whether these benefits of
 226 general anesthesia are more broadly apparent.

227 The complication rate after removal of FB ingestion was
 228 around 20% in our patients, although this has ranged from
 229 fewer than 5% to nearly 50% in other studies (20,27,28).
 230 A possible reason for the high complication rate seen in
 231 some studies may be that mucosal injury and hematoma are
 232 classified as mild complications, appearing in up to 29.5%
 233 in one study (17). Additionally, fever (≤ 38 °C), abrasions,
 234 small erosions, abscesses, ulcers, and mucosal laceration
 235 have also been listed as complications (27). Agreement on
 236 the criteria by which complications are classified and their
 237 reporting would greatly improve the validity and accuracy
 238 of findings.

Risk factors for FBs ingestion leading to complications 239
 have been previously observed in relation to the types 240
 and size of FBs, duration of FBs impaction and delay in 241
 endoscopic management (1,13,15,20). In our paper we also 242
 identified age ≥ 60 and esophageal FBs as additional risk 243
 factors. A longer duration of FB ingestion is associated with 244
 a greater risk of harm. The danger of complications in cases 245
 with a duration of over 24 h was 2.67-fold higher than those 246
 with a duration of less than 24 h. Furthermore, the frequency 247
 of complications increases with age. This might be due 248
 to several factors: Firstly, the swallowing function and 249
 sensation are less sensitive in the elderly than in younger 250
 adults; secondly, most patients wearing dentures are elderly; 251
 thirdly, the overall physical condition of elderly patients is 252
 weaker and less able to tolerate trauma than those younger. 253
 Esophageal FBs carried a higher risk of complications in 254
 comparison to the stomach because of the narrower lumen 255
 and thinner muscular layer. 256

257 FBs ingestion can be treated successfully and safely in
 258 more than 92% of cases in this study, which was similar to
 259 most researches (16). The factors related to a successful
 260 procedure include the compliance of patients, appropriate
 261 extraction devices, experienced endoscopists, the

262 radiological evaluation, the degree of cooperation between
263 endoscopists and nurses, and so on.

264 The chief limitations to this study are its retrospective
265 nature and the uneven number of patients in the general
266 anesthesia and endoscopy groups. Although retrospective
267 research might increase the deviations of research results,
268 we collected the associated data of patients with foreign
269 bodies ingested from June 2014 and April 2019 to expand
270 the sample size and avoid the condition. The latter result
271 in the distribution of adverse outcomes towards the
272 general anesthesia group. Further investigation into the
273 benefits of general anesthesia in removing FBs is strongly
274 recommended.

275 In conclusion, the duration of ingestion before removal
276 was the common factor affecting the presence of FBs and
277 its complications, while age ≥ 60 and esophageal FBs were
278 other risk factors contributing to complications. Taking
279 these possible risk factors into consideration, appropriate
280 endoscopic interventions could be executed to treat patients
281 with FB ingestion.

282

283 Acknowledgments

284 We appreciate the efforts all of our colleagues have made
285 towards in this study.

287 *Funding:* This study was supported by a grant from the
288 National Natural Science Foundation of China (No.
289 81570489).

290

291 Footnote

292 *Reporting Checklist:* The authors have completed the
293 STROBE reporting checklist. Available at [http://dx.doi.](http://dx.doi.org/10.21037/atm-21-829)
294 [org/10.21037/atm-21-829](http://dx.doi.org/10.21037/atm-21-829)

296

297 *Data Sharing Statement:* Available at [http://dx.doi.](http://dx.doi.org/10.21037/atm-21-829)
298 [org/10.21037/atm-21-829](http://dx.doi.org/10.21037/atm-21-829)

299

300 *Conflicts of Interest:* All authors have completed the ICMJE
301 uniform disclosure form (available at [http://dx.doi.](http://dx.doi.org/10.21037/atm-21-829)
302 [org/10.21037/atm-21-829](http://dx.doi.org/10.21037/atm-21-829)). The authors have no conflicts
303 of interest to declare.

304

305 *Ethical Statement:* The authors are accountable for all
306 aspects of the work in ensuring that questions related
307 to the accuracy or integrity of any part of the work are
308 appropriately investigated and resolved. This study was
309 approved by the Institutional Review Board of Tianjin

Medical University General Hospital (Ethical No. 310
IRB2020-WZ-141). All procedures performed in this study 311
involving human participants were in accordance with the 312
Declaration of Helsinki (as revised in 2013). Individual 313
consent for this retrospective analysis was waived. 314

315

Open Access Statement: This is an Open Access article 316
distributed in accordance with the Creative Commons 317
Attribution-NonCommercial-NoDerivs 4.0 International 318
License (CC BY-NC-ND 4.0), which permits the non- 319
commercial replication and distribution of the article with 320
the strict proviso that no changes or edits are made and the 321
original work is properly cited (including links to both the 322
formal publication through the relevant DOI and the license). 323
See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>. 324

325

326 References

- 327 1. Hong KH, Kim YJ, Kim JH, et al. Risk factors for 328
complications associated with upper gastrointestinal 329
foreign bodies. *World J Gastroenterol* 2015;21:8125-31. 330
- 331 2. Mowry JB, Spyker DA, Cantilena LR, et al. 2013 Annual 332
Report of the American Association of Poison Control 333
Centers' National Poison Data System (NPDS):31st 334
Annual Report. *Clin Toxicol (Phila)* 2014;52:1032-283. 335
- 336 3. Long B, Koyfman A, Gottlieb M. Esophageal Foreign 337
Bodies and Obstruction in the Emergency Department 338
Setting: An Evidence-Based Review. *J Emerg Med* 339
2019;56:499-511. 340
- 341 4. Geraci G, Sciume' C, Di Carlo G, et al. Retrospective 342
analysis of management of ingested foreign bodies and 343
food impactions in emergency endoscopic setting in adults. 344
BMC Emerg Med 2016;16:42. 345
- 346 5. Bekkerman M, Sachdev AH, Andrade J, et al. Endoscopic 347
Management of Foreign Bodies in the Gastrointestinal 348
Tract: A Review of the Literature. *Gastroenterol Res Pract* 349
2016;2016:8520767. 350
- 351 6. Smith MT, Wong RK. Esophageal foreign bodies: 352
types and techniques for removal. *Curr Treat Options* 353
Gastroenterol 2006;9:75-84. 354
- 355 7. Birk M, Bauerfeind P, Deprez PH, et al. Removal of 356
foreign bodies in the upper gastrointestinal tract in adults: 357
European Society of Gastrointestinal Endoscopy (ESGE) 358
Clinical Guideline. *Endoscopy* 2016;48:489-96. 359
- 360 8. Eisen GM, Baron TH, Dominitz JA, et al. Guideline for 361
the management of ingested foreign bodies. *Gastrointest* 362
Endosc 2002;55:802-6. 363
- 364 9. Ginsberg GG. Management of ingested foreign objects 365

- 358 and food bolus impactions. *Gastrointest Endosc* 1995;41:33-8. 391
- 359 1088 cases in China. *Gastrointest Endosc* 2006;64:485-92. 392
- 360 10. Li ZS, Sun ZX, Zou DW, et al. Endoscopic management 20. Sung SH, Jeon SW, Son HS, et al. Factors predictive of 393
- 361 of foreign bodies in the upper-GI tract: experience with risk for complications in patients with oesophageal foreign 394
- 362 1088 cases in China. *Gastrointest Endosc* 2006;64:485-92. 395
- 363 11. McKechnie JC. Gastroscopic removal of a phytobezoar. 21. Birk M, Bauerfeind P, Deprez PH, et al. Removal of 396
- 364 Gastroenterology 1972;62:1047-51. foreign bodies in the upper gastrointestinal tract in adults: 397
- 365 12. Chen Q, Chu H, Tong T, et al. Predictive factors for European Society of Gastrointestinal Endoscopy (ESGE) 398
- 366 complications associated with penetrated fish bones Clinical Guideline. *Endoscopy* 2016;48:489-96. 399
- 367 outside the upper gastrointestinal tract. *Eur Arch* 22. Wu WT, Chiu CT, Kuo CJ, et al. Endoscopic management 400
- 368 Otorhinolaryngol 2019;276:185-91. of suspected esophageal foreign body in adults. *Dis* 401
- 369 13. Yao CC, Wu IT, Lu LS, et al. Endoscopic Management Esophagus 2011;24:131-7. 402
- 370 of Foreign Bodies in the Upper Gastrointestinal Tract of 23. Chirica M, Champault A, Dray X, et al. Esophageal 403
- 371 Adults. *Biomed Res Int* 2015;2015:658602. perforations. *J Visc Surg* 2010;147:e117-28. 404
- 372 14. Zhang S, Cui Y, Gong X, et al. Endoscopic management 24. Zhang X, Zhang X, Tu C, et al. Analysis of the 405
- 373 of foreign bodies in the upper gastrointestinal tract in management and risk factors for complications of 406
- 374 South China: a retrospective study of 561 cases. *Dig Dis* esophageal foreign body impaction of jujube pits in adults. 407
- 375 *Sci* 2010;55:1305-12. *Wideochir Inne Tech Maloinwazyjne* 2018;13:250-6. 408
- 376 15. Saltiel J, Molinsky R, Leibold B. Predictors of Outcomes 25. Gretarsdottir HM, Jonasson JG, Björnsson ES. Etiology 409
- 377 in Endoscopies for Foreign Body Ingestion: A Cross- and management of esophageal food impaction: 410
- 378 Sectional Study. *Dig Dis Sci* 2020;65:2637-43. a population based study. *Scand J Gastroenterol* 411
- 379 16. Libânio D, Garrido M, Jácome F, et al. Foreign body 2015;50:513-8. 412
- 380 ingestion and food impaction in adults: better to 26. Zhong Q, Jiang R, Zheng X, et al. Esophageal foreign 413
- 381 scope than to wait. *United European Gastroenterol J* body ingestion in adults on weekdays and holidays: A 414
- 382 2018;6:974-80. retrospective study of 1058 patients. *Medicine (Baltimore)* 415
- 383 17. Geng C, Li X, Luo R, et al. Endoscopic management 2017;96:e8409. 416
- 384 of foreign bodies in the upper gastrointestinal tract: a 27. Weiland ST, Schurr MJ. Conservative management of 417
- 385 retrospective study of 1294 cases. *Scand J Gastroenterol* ingested foreign bodies. *J Gastrointest Surg* 2002;6:496-500. 418
- 386 2017;52:1286-91. 28. Kim JE, Ryoo SM, Kim YJ, et al. Incidence and Clinical 419
- 387 18. Lyons MF 2nd, Tsuchida AM. Foreign bodies of Features of Esophageal Perforation Caused by Ingested 420
- 388 the gastrointestinal tract. *Med Clin North Am* Foreign Body. *Korean J Gastroenterol* 2015;66:255-60. 421
- 389 1993;77:1101-14. 422
- 390 19. Hung CW, Hung SC, Lee CJ, et al. Risk factors for (English Language Editor: B. Draper) 423
- complications after a foreign body is retained in the

Cite this article as: Wang X, Su S, Chen Y, Wang Z, Li Y, Hou J, Zhong W, Wang Y, Wang B. The removal of foreign body ingestion in the upper gastrointestinal tract: a retrospective study of 1,182 adult cases. *Ann Transl Med* 2021. doi: 10.21037/atm-21-829

Supplementary

Table S1 The type of foreign bodies

Type	Number	Percentage (%)
Jujube pits	434	36.72
Fish bone	260	22.00
Other bone	124	10.49
Dental prosthesis	78	6.60
Metallic	62	5.24
Medicine or its packaging	43	3.64
Others	181	15.31
Total	1182	100

Table S2 The type of complications

Type of complications	Number	Percent (%)
Hemorrhage	162	67.78
Perforation	65	27.20
Perforation with bleeding	12	5.02
Total	239	100