

An anatomical illustration of the human esophagus. A yellow rubber duck is shown as a foreign body lodged in the lower part of the esophagus. A white, circular endoscopic view is shown, with the duck appearing to be floating in a pool of water within the lumen of the esophagus. The surrounding tissue is pinkish-red, and the background is a dark blue gradient.

# Esophageal Foreign Bodies

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- 100,000 cases reported each year in the United States, 80 percent occur in children.
  - between 6 months and 3 years
  - Most pass spontaneously
  - 10% - 20 % : endoscopic removal
  - < 1 % : surgical intervention

Table 2: Types of FB recovered from the digestive tract

Type of FB	Number	Percentage
Coins	69	71.1
Buttons	6	6.1
Batteries	4	4.1
Needles	4	4.1
Screws	4	4.1
Safety pin	3	3.0
Hair pin	2	2.0
Locket	2	2.0
Nose ring	1	1.0
Metal plate	1	1.0
Locket	1	1.0
<b>Total</b>	<b>97</b>	<b>100</b>

FB = Foreign bodies



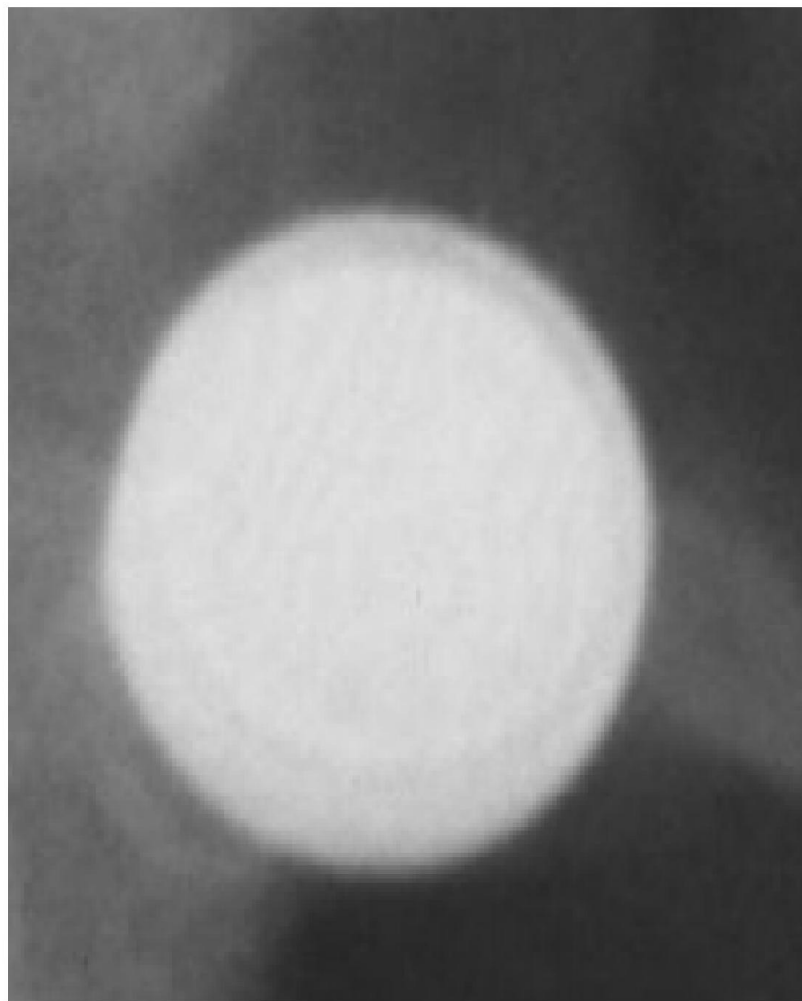
# Coin Ingestion



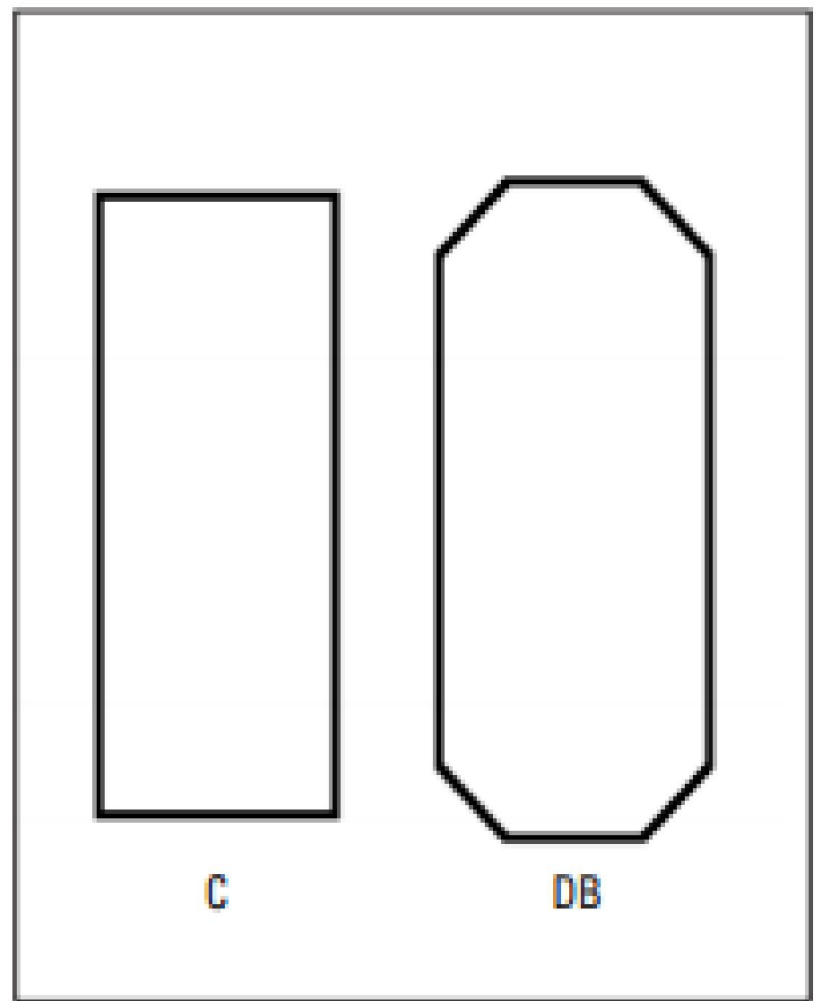
***Glenn Elert, 2002:***

- Coin:  $d = 24 \text{ mm}$
- Before 1982 pennies (3.1g) were 95 % copper & 5 % zinc
- Since 1982 pennies (2.5g) are 97.5 % zinc & 2.5 % copper
- ❖ **Zinc** is more corrosive than copper
- Esophagus is 17 x 23 mm. in size 2 cm in the anterior-posterior dimension and up to 3 cm laterally
- Coins → coronal plane (esophagus), sagittal (trachea)
- 30 % esophagus : asymptomatic

Mệnh giá	Thông số kỹ thuật				Vành
	Đường kính	Độ dày mép	Khối lượng	Vật liệu	
200 đ	20,00 mm	1,45 mm	3,2 g	Thép mạ nikel	Tron
500 đ	22,00 mm	1,75 mm	4,50 g	Thép mạ nikel	Khía răng cưa ngắt quãng 6 đoạn
1000 đ	19,00 mm	1,95 mm	3,80 g	Thép mạ đồng thau	Khía răng cưa liên tục
2000 đ	23,50 mm	1,80 mm	5,10 g	Thép mạ đồng thau	Khía răng cưa ngắt quãng 12 đoạn
5000 đ	25,50 mm	2,20 mm	7,70 g	Hợp kim $CuAl_6Ni_2$	Khía vô sò

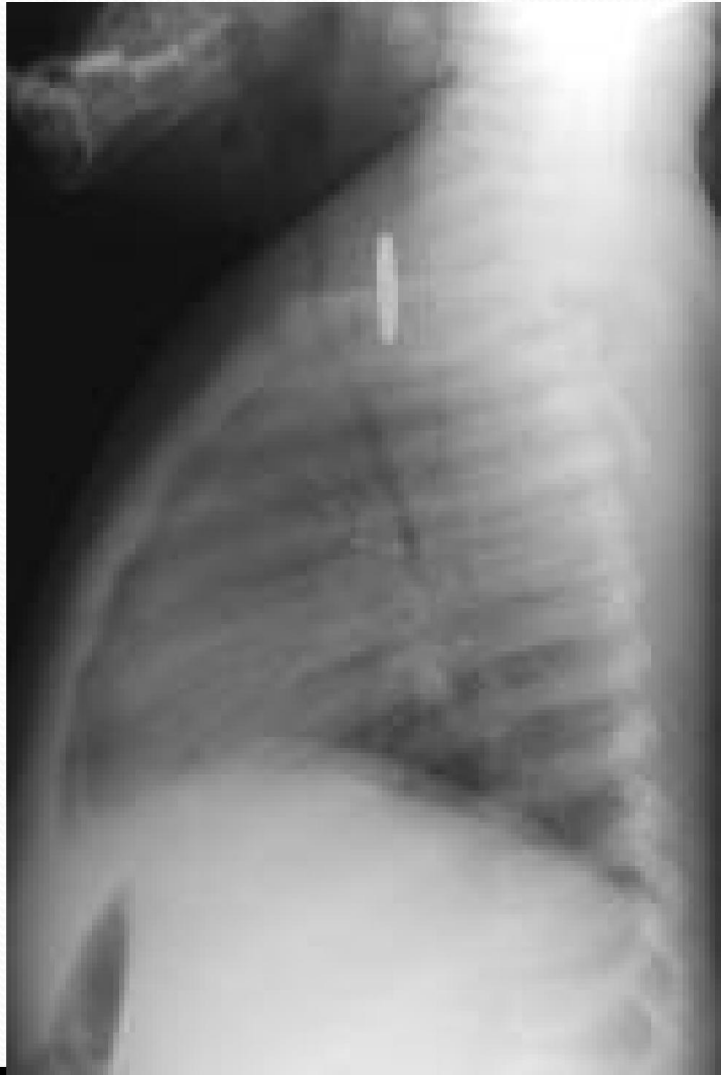


**Figure 3.** Note the double contour appearance of a disc battery on a foreign body radiograph.



**Figure 4.** Note the lateral appearance of a coin (C) versus that of a disc battery (DB) in this schematic presentation.









*Ingestion of Cylindrical and Button Batteries: An Analysis of 2382 Cases* Toby Litovitz, MD, and Barbara F. Schmitz, RN, CSPI:

- 7-year period, 2382 cases :Button cells (2320), cylindrical cells (62).
- Lodged and caused esophageal injury (20 to 23 mm).
- No clinical evidence of mercury toxicity.
- Most cases (benign)
- 0.08% (major effect) → esophagus

**TABLE 6. Relationship of Battery Type (Chemical System) and Outcome**

Chemical System	Outcome, Row %*			No.	
	No Effect	Minor	Moderate Major		
<b>Nonesophageal</b>					
Silver oxide	94.4	2.8	2.8	250	
Mercuric oxide	87.6	5.9	6.5	370	
Lithium	100.0			3	
Manganese dioxide	90.8	6.2	3.1	455	
Standard (AA, AAA, C, N)	81.8	9.1	9.1	44	
Zinc/air	94.7	4.6	.7	415	
<b>Esophageal†</b>					
Mercuric oxide		50.0	50.0	2	
Lithium			66.7	33.3	3
Manganese dioxide	75.0			25.0	4
Zinc/air	66.7	33.3		3	

**TABLE 5. Correlation of Battery Diameter and Patient Outcome Following Battery Ingestion**

Diameter, mm	No Effect		Minor Effect		Moderate Effect		Major Effect	
	No.	Size, %	No.	Size, %*	No.	Size, %*	No.	Size, %*
6.8–11.9	1381	91.9	75	5.0	46	3.1	0	0.0
15.0–23.0	29	64.4	5	11.1	9	20.0	2	4.4

\* Row percent for 1547 cases with known outcome and known battery diameter.


# Major outcome

- Esophageal perforation
- Tracheoesophageal fistula
- Esophageal scarring requiring repeated dilations or surgery
- Death following *battery bodgment* in the esophagus

## ***Toby Litovitz, 1992:***

- 20 mm to 23 mm diameter cells
- Ages 4 months - 11 months

- 1 hour : mucosa damaged
- 4 hours : erosion through the muscular wall (leakage of caustic battery contents)
- > 6 hours : perforation leading to mediastinitis, tracheoesophageal fistula, or death may occur.
- ***Maves JD, Carither JS, 1984: “esophageal retention of a disk battery for greater than 2 h can cause a transmural injury”***



**Yardeni D, Coran AG.** *Severe esophageal damage due to button battery ingestion: can it be prevented?*  
Pediatr Surg Int. 2004:

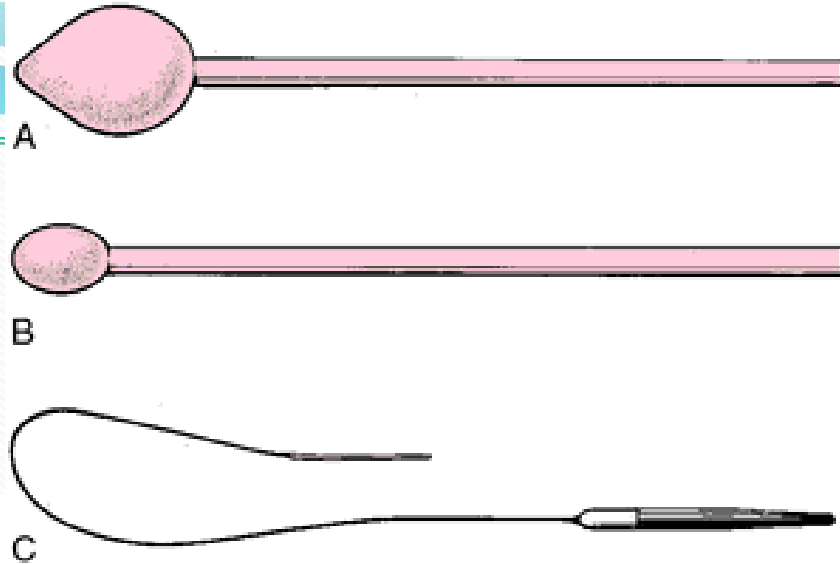
- The larger the battery, the greater the probability of retention
- The longer the retention the greater the risk of injury



**Hawkins DB**, Removal of blunt foreign bodies from the esophagus. *Ann Otol Rhinol Laryngol* 1990:

- Multiple esophageal foreign body impactions, 80% have an esophageal anomaly on further evaluation
- Recurrent esophageal foreign bodies, 19% have esophageal anomalies that previously required surgical repair.

# Bougienage



*Am J Emerg Med.* 2014 Oct;32(10):1263-9. doi: 10.1016/j.ajem.2014.08.007. Epub 2014 Aug 7.

## Clinical effectiveness of bougienage for esophageal coins in a pediatric ED.

Allie EH<sup>1</sup>, Blackshaw AM<sup>2</sup>, Losek JD<sup>3</sup>, Tuuri RE<sup>4</sup>.

### ⊕ Author information

#### Abstract

**OBJECTIVE:** To describe a tertiary care pediatric emergency department (PED) experience with bougienage for esophageal coins.

**METHODS:** This was a large retrospective case series of children with esophageal coins presenting to a tertiary PED from January 2004 to October 2012. Bougienage eligibility criteria were medically stable, no prior gastro-esophageal surgery or disease, single coin, and witnessed ingestion within 24 hours. Abstracted data were age, signs and symptoms, coin type, management, efficacy, complications, returns, length of stay (LOS), and hospital charges. Main outcomes included procedural success and complications. Secondary outcomes included LOS and hospital charges.

**RESULTS:** There were 245 patients with esophageal coins with 136/145 (94%) successful bougienage procedures and 109/109 (100%) successful surgical retrievals. There were 18 minor complications and 5 return visits for patients with bougienage. There were 10 minor and 2 major complications with surgical retrieval. Patients undergoing bougienage were 4 years (SD 2) vs 3 years (SD 3) for surgical retrieval ( $P < 0.001$ ). Mean LOS for successful bougienage was 137 minutes (SD 54) vs 769 (SD 535) for surgical retrieval. The difference in the means was 632, 95% CI for the difference in means of -723 to -541 ( $P < .001$ ). Mean charges for successful bougienage were \$984 (SD \$576) vs. \$7022 (SD \$3132) for surgical retrieval. The difference in means was \$6038, 95% CI -\$6,580 to -\$5,496 ( $P < .001$ ).

**CONCLUSIONS:** Esophageal bougienage is safe and highly effective. It is also more time and cost efficient than other treatment options.



ISRN Otolaryngol. 2014; 2014: 679378.

PMCID: PMC3929373

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## Value and Efficacy of Foley Catheter Removal of Blunt Pediatric Esophageal Foreign Bodies

[Yasin Abdurehim](#), [Yalkun Yasin](#), [Qu Yaming](#), and [Zhang Hua](#)\*

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- 98%, safe, rapid cost-effective procedure.
- Applicable for blunt, flat foreign bodies impacted in the esophagus.
- Do not recommend blind retrieval of batteries

# Rigid vs flexible endoscopy

Pediatr Surg Int. 2014 Apr;30(4):417-22. doi: 10.1007/s00383-014-3481-2. Epub 2014 Feb 19.

## **Extraction of esophageal foreign bodies in children: rigid versus flexible endoscopy.**

Russell R<sup>1</sup>, Lucas A, Johnson J, Yannam G, Griffin R, Beierle E, Anderson S, Chen M, Harmon C.

### **⊕ Author information**

#### **Abstract**

**PURPOSE:** Foreign body (FB) ingestion is a common and potentially serious problem in children. Both rigid (RE) and flexible (FE) endoscopic techniques are used for removal of esophageal FBs; however, there is no consensus amongst pediatric surgeons regarding the best method. This study reviewed our experience managing esophageal FBs using both techniques.

**METHODS:** A 12-year retrospective review of children admitted with an esophageal FB between 1999 and 2012 was undertaken. Clinical data, management techniques, and complications were abstracted. Differences between these two groups were compared with standard statistical methods.

**RESULTS:** 657 children were treated for esophageal FB ingestion, of which 366 (56%) were treated with FE. The most frequently ingested item was a coin (84%), and FBs were most commonly lodged in the upper third of the esophagus (78%). There was a slightly younger population in the FE group (4.0 vs. 3.3 years,  $p < 0.01$ ), but otherwise no significant differences were found between the groups. The FB was successfully removed with the initially chosen technique in 97% of patients.

**CONCLUSIONS:** Esophageal FBs may be successfully removed with either RE or FE. Since treatment failures were managed with conversion to the other technique, both procedures should be included in the training curriculum.

## Timing of endoscopy for ingested foreign bodies

### Emergent endoscopy

Patients with esophageal obstruction (ie, unable to manage secretions)

Disk batteries in the esophagus

Sharp-pointed objects in the esophagus

### Urgent endoscopy

Esophageal foreign objects that are not sharp-pointed

Esophageal food impaction in patients without complete obstruction

Sharp-pointed objects in the stomach or duodenum

Objects >6 cm in length at or above the proximal duodenum

Magnets within endoscopic reach

### Non-urgent endoscopy

Coins in the esophagus may be observed for 12-24 hours before endoscopic removal in an asymptomatic patient

Objects in the stomach with diameter >2.5 cm

Disk batteries and cylindrical batteries that are in the stomach of patients without signs of GI injury may be observed for as long as 48 hours; batteries remaining in the stomach longer than 48 hours should be removed

*Reproduced from: ASGE Standards of Practice Committee. Management of ingested foreign bodies and food impactions. Gastrointest Endosc 2011; 73:1085. Table used with the permission of Elsevier Inc. All rights reserved.*



Mercury chloride,  
possibly mercury(I) chloride



Mercury(II) oxide

Thank  
you!



Cinnabar, mercury(II) sulfide



Mercury(I) chloride as a mineral