The Spontaneous Passage of Esophageal Coins in Children

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Objectives: To determine the likelihood of spontaneous passage of esophageal coins to the stomach in children and to determine the effect of initial coin location on spontaneous passage.

Design: Retrospective review of medical records and radiographs.

Subjects: Consecutive patients 18 years or younger presenting during a 24-month period (October 1995 to September 1997) whose evaluation revealed an esophageal coin.

Setting: The emergency department of a large, urban academic children’s hospital.

Main Outcome Measures: Independent measures were time between ingestion and radiographs, initial location of the coin, and categorization of case as “simple” (patients without a history of esophageal disease or surgery, with a single esophageal coin lodged less than 24 hours, and with no respiratory compromise on presentation) or “complex.” Dependent measures were spontaneous passage of the coin to the stomach and the time to passage.

Results: A total of 116 cases were included in the analysis, of which 84 were simple and 32 complex. Among the 84 simple cases, the coin was initially located in the proximal third of the esophagus in 54 (64%), the middle third in 7 (8%), and the distal third in 22 (26%). For the 32 complex cases, the initial location of the coin was the proximal third of the esophagus in 27 (84%) and the middle third in 5 (16%). Subsequent radiographs were obtained in the emergency department in 58 (69%) of the simple cases. Among these cases, spontaneous passage of the coin to the stomach occurred in 16 (28% [95% confidence interval, 21%-41%]). By initial coin location, spontaneous passage in this group occurred in 22% (7/32) of proximal, 33% (2/6) of middle, and 37% (7/19) of distal esophageal coins (P < .05). Subsequent radiographs were obtained in 14 (44%) of the complex cases; no coin had passed spontaneously to the stomach in these patients (0% [95% confidence interval, 0%-20%]).

Conclusions: Children with a single esophageal coin seen within 24 hours of ingestion, who have no history of esophageal disease and no respiratory compromise on presentation, have a 28% chance of spontaneous passage of the coin to the stomach. Coins in the upper as well as the lower esophagus pass spontaneously. Observing these children for 12 to 24 hours prior to invasive procedures will reduce complications and costs.

SUBJECTS AND METHODS

DESIGN AND SUBJECTS

We performed a retrospective review of consecutive cases in which radiographic evaluation revealed an esophageal coin in children and adolescents 18 years old or younger. The study was conducted in the emergency department (ED) of a large urban, academic children’s hospital during the 24-month period October 1, 1995, through September 30, 1997. Included in the study were some patients referred to the ED from another health care facility with the diagnosis of an esophageal coin. We identified cases by searching (1) the ED computerized medical record database by key words coin, quarter, dime, nickel, penny, and esophagus; and (2) the hospital database for International Classification of Diseases, Ninth Revision (ICD-9) codes 935.1 and 935.2, foreign body in esophagus and stomach, respectively, and 938, foreign body in digestive system, unspecified.

MEASURES

Emergency department and hospital records were reviewed for demographic information, date and time of ingestion and presentation to the ED, symptoms and physical examination findings, time radiographs were taken, coin location, procedures to remove coins, and adverse outcomes. Radiographs were reviewed to confirm the time of the study and the location of coins. Coin location in the esophagus was defined as being in the proximal third if between the cricopharyngeus muscle and the jugular notch, the middle third if in the region of the aortic arch, and the distal third if between the tracheal bifurcation and the gastroesophageal junction. A priori, cases were categorized as “simple” or “complex.” We defined simple cases as those involving patients with no history of esophageal disease or surgery, with a single esophageal coin lodged less than 24 hours and with no respiratory compromise on presentation to the ED. Cases in which the patient did not meet these criteria were categorized as complex. The diagnosis of respiratory compromise was determined by abnormal findings on physical examination (stridor, retractions, difficulty breathing, apnea, or hypoxemia) noted in the ED records.

The main dependent measures were (1) spontaneous passage of the coin, defined as the movement of the coin through the gastroesophageal junction to the stomach or intestines as seen on subsequent radiographic evaluation; and (2) the time to passage of the coin from the esophagus, calculated as the interval between coin ingestion and the radiograph showing spontaneous passage.

ANALYSIS

Data were analyzed with SPSS for Windows, Version 7.5.2 software (SPSS Inc, Chicago, Ill). Significance was assessed using the χ² statistic with a cutoff of P≤.05.

RESULTS

DEMOGRAPHICS

There were 118 cases of esophageal coins during the study period. The medical record of 1 patient was not available for review. Another patient with a proximally located coin vomited the coin on arrival to the ED and had an incomplete medical record, and thus was excluded from the analysis. The remaining 116 cases, including 58 males and 58 females, were included in the analysis. The mean age was 42.4 months (SD, 30.9; range, 7-153 months). Ninety patients (78%) were referred from an outside facility.

There were 84 simple cases, of which 43 patients were male and 41 female. The mean age of the patients in this group was 48.2 months (SD, 30.9; range, 8-133 months). The average time of presentation to the ED after the coin ingestion was 3.8 hours (SD, 2.66; range, 0.25-14 hours) (Table 1). There were 32 complex cases, of which 15 patients were male and 17 female. The patients with complex presentation were significantly younger, with a mean age of 27.3 months (SD, 27.1; range, 7-115 months; P = .001). These cases included 1 patient with a history of a repaired tracheoesophageal fistula and esophageal strictures who presented on 2 separate occasions with an esophageal coin. Another patient had a 5-year history of gastroesophageal reflux and esophagi-
There were no adverse events noted during the observation periods between radiographs in any of the patients while in the ED (0% [95% confidence interval, 0%-2.5%]). Adverse events were noted during or shortly after endoscopy in 6 of the 100 patients who underwent the procedure (6% [95% confidence interval, 3.8%-13.1%]). These included 1 patient with pharyngeal bleeding, 1 who developed bronchospasm, 3 who were inadvertently extubated during the procedure, and 1 patient with stridor and hypoxia, as measured by pulse oximetry, who required admission to the intensive care unit. Two of the adverse events occurred in patients with simple cases.

**Comment**

Many coins lodged in the esophagus will spontaneously pass to the stomach. Our results show that children most likely to have spontaneous passage of an esophageal coin are those who have a single coin lodged less than 24 hours, and who have no history of esophageal disease. Patients not meeting these criteria are unlikely to have spontaneous passage of an esophageal coin. The initial location of the coin in the esophagus did not determine the likelihood of spontaneous passage of the coin in our series. Although patients with complex presentations tended to be younger than those with simple presentations, age was not an independent factor in determining the likelihood of spontaneous passage in our series.

Several previous studies have described the spontaneous passage of esophageal coins in children; however, none has fully determined the factors associated with spontaneous passage. Hodge et al found that 40% of 25 patients with esophageal coins had spontaneous passage to the stomach during a 1- to 5-hour observation period; all of these patients had presented within 24 hours of ingestion. Stringer and Capps found a 33% spontaneous passage rate within 12 hours in 15 patients. Schunk et al showed prospectively that all of 3 patients allowed up to a 24-hour observation period had spontaneous passage of their esophageal coin. None of these studies included the initial location of the coins in their analyses. In another prospective study, Caravati and coworkers found a 77% spontaneous passage rate in 13 patients referred to an ED after a coin ingestion, but neither the initial coin location nor the time to passage was noted in this study.

Conners et al found a 60% spontaneous passage rate for distal esophageal coins, with a median time to passage of 5 hours. They showed that none of the 48% of patients with proximal or middle esophageal coins who underwent subsequent radiographs had spontaneous passage of the coin. Included in this group, however, were patients with coins lodged as long as 2 months. Based on our criteria, these cases would have been considered complex, and thus the coins would have been unlikely to spontaneously pass. In another study, Conners et al showed prospectively that all of 4 patients with distal esophageal coins who were observed for up to 24 hours had spontaneous passage of the coin to the stomach. The

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### Table 1. Comparison of Simple and Complex Cases

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Simple Cases (n = 84)</th>
<th>Complex Cases (n = 32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female, No. (%)</td>
<td>41 (49)</td>
<td>17 (53)</td>
</tr>
<tr>
<td>Mean age, mo</td>
<td>48.2</td>
<td>27.3</td>
</tr>
<tr>
<td>Coin location in esophagus, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal</td>
<td>54 (64)</td>
<td>27 (84)</td>
</tr>
<tr>
<td>Middle</td>
<td>7 (8)</td>
<td>5 (16)</td>
</tr>
<tr>
<td>Distal</td>
<td>22 (26)</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (1)</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 2. Spontaneous Passage Rate by Initial Location of Coin in Esophagus

<table>
<thead>
<tr>
<th>Subsequent Radiograph, No. (%)</th>
<th>Spontaneous Passage, No. (%)</th>
<th>Mean Time to Passage (Range), h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal</td>
<td>32 (59)</td>
<td>7 (22)</td>
</tr>
<tr>
<td>Middle</td>
<td>6 (86)</td>
<td>2 (33)</td>
</tr>
<tr>
<td>Distal</td>
<td>19 (86)</td>
<td>7 (37)</td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (100)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>58 (69)</td>
<td>16 (28)</td>
</tr>
<tr>
<td>Complex cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal</td>
<td>13 (48)</td>
<td>0</td>
</tr>
<tr>
<td>Middle</td>
<td>1 (20)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>14 (44)</td>
<td>0</td>
</tr>
</tbody>
</table>

*NA indicates not applicable.

Spontaneous passage in this group occurred in 22% (7/32) of proximal, 33% (2/6) of middle, and (37% (7/19) of distal coins. There was no statistically significant difference among these rates. The mean age of patients with spontaneous passage was 56.8 months, compared with 46.1 months for those who did not have spontaneous passage (P = .21). The mean time to spontaneous passage was 4.8 hours (SD, 2.47; range, 2.3-12 hours) (Table 2). For patients who did not have spontaneous coin passage, the mean time between ingestion and a subsequent radiograph was 7.9 hours (SD, 4.65; range, 1.25-20.5 hours).

Subsequent radiographs were obtained in 14 (44%) of the complex cases. No coin had passed spontaneously to the stomach in these patients (0% [99% confidence interval, 0%-20%]) (Table 2).

**COIN REMOVAL**

Endoscopic coin removal under general anesthesia was performed in 68 (81%) of the simple cases and 32 (100%) of the complex cases. No other invasive procedures were performed on the patients in this study. In 6 (9%) of the simple cases, the coin was found in the patient’s stomach at the time of endoscopy. For these patients, endoscopy was performed at a mean of 3.9 hours (range, 3.3-11.5 hours) after coin ingestion. None of the patients in the complex group had a coin noted in an unexpected location at the time of endoscopy (95% confidence interval, 0%-9%).

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results of this study led the authors to recommend a 12- to 24-hour observation period for children with coins lodged in the distal esophagus only.

Our finding that all of the coins that passed spontaneously did so in the 12 hours after ingestion is in agreement with the findings of Hodge et al., Stringer and Capps, and Conners et al., who found spontaneous passage within 5, 12, and 24 hours, respectively, in their patients. In addition, the 6 patients in our study who had coins found in the stomach at the time of endoscopy had the procedure performed at a mean of 5.9 hours after coin ingestion. Had these patients had another radiograph performed, some might have been able to avoid endoscopy.

Many other investigators have expressed concern over the potential complications of esophageal coins in children, including esophageal perforation, tracheoesophageal fistula, and fatal aortoeresophageal fistula. These serious complications, however, are extremely rare events and have been described only in patients who presented more than 1 week after a coin ingestion. To our knowledge, there are no reports of serious complications from the presence of a coin in the esophagus for less than 24 hours. Furthermore, in a study by Bonadio et al of 50 children undergoing endoscopic removal of coins lodged in the esophagus less than 24 hours, only 16% had any mucosal injury seen on endoscopy, and none had more than a minimal abrasion. In addition, we know of no reports of stable patients who spontaneously aspirated a coin previously located in the esophagus.

There are, however, potential complications of the procedures used to remove esophageal coins in children. Balloon-tipped catheter removal has been associated with complication rates as high as 3%, including esophageal laceration with mediastinitis and airway compromise. Likewise, Hawkins reported a 9% complication rate in 196 children undergoing endoscopic removal of esophageal coins. These complications included stridor, exacerbation of preexisting lung disease, laryngospasm, and inadvertent extubation. Avoiding invasive removal procedures by allowing time for spontaneous coin passage would decrease the rate of adverse events.

This was a retrospective review; hence, there was a wide approach to the management of the patients in the study. Many patients were not evaluated with a subsequent radiograph and were not observed for 12 to 24 hours after their coin ingestion. The rate of spontaneous coin passage we report may therefore be underestimated. In addition, since the time of coin passage from the esophagus was estimated as the time between ingestion and the radiograph showing coin passage, the actual time to spontaneous passage is likely to be even less than that reported. A prospective study with subsequent radiographic evaluation at the end of a standardized observation period would be required to more closely determine the true spontaneous passage rate in these patients.

## CONCLUSIONS

Serious complications of esophageal coins are rare and occur only after a coin has been lodged more than 24 hours. We therefore recommend that children with simple presentations of esophageal coins (a single coin lodged less than 24 hours, no history of esophageal disease or surgery, and no respiratory compromise on presentation in the ED) undergo an observation period for 12 to 24 hours before performing an invasive procedure to remove the coin. We recommend that during this period they should not receive food or fluids by mouth in the event that an invasive procedure becomes necessary. Further study is needed to evaluate whether food or fluids may facilitate coin passage from the esophagus. Since spontaneous passage occurs for coins located in all segments of the esophagus, patients with coins in the proximal and middle portions of the esophagus should be included in this protocol. This approach will reduce the complications and costs associated with esophageal coins in children.

## REFERENCES


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