Bougienage Versus Endoscopy for Esophageal Coin Removal in Children

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Background: Foreign body ingestion is a common pediatric problem. Coins are by far the most common ingested foreign bodies. When ingested coins become lodged in the esophagus, they may cause serious complications if they are not removed in a timely manner. Endoscopic removal is the preferred treatment in many pediatric centers as its safety and effectiveness are well established.

Objectives: We performed this study to evaluate safety and effectiveness of an alternative method of managing esophageal coins, using bougienage technique.

Methods: Previously healthy children presenting to the local emergency room with uncomplicated, witnessed coin ingestion of less than 24 hours duration were prospectively recruited with an intent-to-treat analysis. A single oral passage of a Hurst bougie dilator was performed by a gastroenterologist to dislodge the esophageal coin into the stomach. If bougienage was successful (x-ray showing coin in the stomach), patients were discharged and instructions were given for monitoring stools until passage of the coin through anus was confirmed. If bougienage was unsuccessful, the child developed symptoms at any time or if a coin remained intragastric for 4 weeks, endoscopic removal was planned. Children whose parents declined to participate in the bougienage treatment received the standard endoscopic removal and their hospital records were used as controls.

Results: A total of 10 children were enrolled in this study, with a mean age of 3.2 years (11 mo to 10 y), 6 boys and 4 girls. All received little or no sedation. Nine children (90%) were successfully treated using bougienage, all of whom spontaneously passed the ingested coins, with a mean duration of 2.6 days (1 to 7 d) without subsequent intervention. A single case failed bougienage and underwent endoscopic removal. Three children declined bougienage treatment and underwent endoscopic removal. There were no reported minor or major adverse events with any of our cases. The mean health care cost for the hospital visit for bougienage treatment was $1210, compared with $3100 for the endoscopic removal ($P < 0.001$). Furthermore, the mean time spent in the hospital from diagnosis to discharge was 2 hours for bougienage-treated patients compared with 8 hours for endoscopic treatment ($P < 0.001$).

Conclusions: Bougienage of impacted esophageal coins is an effective, safe, and more economic treatment modality for selected pediatric patients with uncomplicated coin ingestion. This simple technique may provide a valuable tool to emergency room physicians or primary care doctors especially when endoscopy is not readily available.

Key Words: bougienage, endoscopy, ingested coin, children

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Foreign body ingestion is a common problem in children.[1,2] Coins are by far the most common foreign bodies ingested by children, composing up to 60% of all ingested solid foreign bodies in one study.[3] Around two-thirds of the ingested coins will be located in the stomach at the time of radiologic evaluation.[4] Most of the coins that are in the stomach will pass uneventfully in the stool over 5 to 14 days. Because of their smooth edges and nontoxic nature, ingested coins that are located in the stomach are routinely observed for up to 4 weeks, with endoscopic removal only for those coins that fail to pass spontaneously. A smaller percentage of the ingested coins will be lodged in the esophagus and can cause serious complications or even be aspirated if they are not removed promptly. This can be achieved by endoscopic removal or by dislodging the coin to the stomach using bougienage.[5–7] Esophageal bougienage is a well-established technique for dilatation of benign esophageal stricture and achalasia of the cardia.[8,9] This approach is not universally accepted and a prospective cost analysis of the 2 procedures has not been previously published.

METHODS

We performed this study to determine the efficacy, safety, and cost-effectiveness of esophageal bougienage for treatment of uncomplicated recently ingested coins located in the esophagus in children, with an intent-to-treat analysis to compare it to the current standard of endoscopic removal. The study protocol was approved by the institutional review board at the Oklahoma University and at Saint Francis hospital in Tulsa, OK.

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Inclusion Criteria

All patients between 6 months to 12 years of age with witnessed or documented recent coin ingestion within 24 hours, lodged in the esophagus as confirmed by radiologic evaluation with absence of any of the exclusion criteria were eligible to participate.

Exclusion Criteria

1. History of multiple coin ingestion or ingestion of foreign bodies other than coins.
2. Longer duration of ingestion or uncertain duration.
3. History of previous esophageal disease, esophageal or gastrointestinal surgery.
4. History of previous caustic injury to esophagus or foreign body ingestion.
5. Presence of respiratory compromise on examination.

End Point

End points of the study were the successful dislodging of the esophageal coin after bougienage, and subsequent passage and discovery of the coin in the child's stool, or failure of the coin to be dislodged into the stomach or to pass through the gastrointestinal tract with subsequent endoscopic and/or surgical removal of the ingested coin as necessary.

Design

Prospective enrollment of all eligible patients meeting the inclusion criteria consecutively presenting to the emergency room with ingested coins in the esophagus was done, after obtaining informed consent. Patients were treated by a single passage of a Hurst bougie dilator, from the mouth to the stomach while sitting upright, by one of the 2 investigators. Sedation was used based on the child's co-operation, parents' preference, and the investigator's judgment. When chosen, sedation was done with oral chloral hydrate or oral/intravenous versed in a single weight-appropriate dose. The bougie dilator used was one of 2 sizes: 26 French, for children 6 months to 4 years; or 36 French for children between 4 and 12 years of age. These sizes were chosen to match the outer diameter of the pediatric endoscopes used for these age groups.

Following the procedure, a repeat x-ray was done and if the coin was not dislodged into the stomach, the child underwent endoscopic removal of the coin. If bougienage was successful, (x-ray showing coin in the stomach), the patient was discharged and instructions were given to the family for monitoring stools until passage of the coin through anus was confirmed. If a child developed any symptoms, a repeat x-ray was obtained and if the coin was intragastric, endoscopic removal was planned. Follow-up abdominal x-rays of the patients were requested after 4 weeks if the coin did not pass through anus and endoscopic removal of the retained gastric coin would be arranged.

Children whose parents declined bougienage treatment, underwent standard endoscopic removal and their hospital records were reviewed as a control group.

Adverse events were monitored by the investigators both at the time of the procedure and subsequently checked on follow-up calls until passage of the coin was confirmed. Financial statements for the hospital charges were reviewed and the duration of time in the hospital until discharge was recorded. Outcome information of each treatment including any adverse events was collected for all participating patients. This included the immediate postprocedure period and throughout the follow-up period.

Data Analysis

Data were analyzed with SPSS 14.0 (SPSS, Inc, Chicago, IL) and an IBM compatible computer. Student *t* test was used to compare the means of the bougienage-treated cases and the standard endoscopic-treated cases.

RESULTS

A total of 10 children were enrolled in our study, mean age 3 years (range 11 mo to 10 y), 6 boys and 4 girls, 8 white and 2 African American children. Three more children (2 girls and 1 boy), mean age 2.5 years, declined to have bougienage treatment when recruited and had standard endoscopic removal of the ingested coins.

The coins were lodged in the proximal esophagus, above the level of the carina, in 9 children and in the mid-esophagus in the remaining patient. Nine of the 10 children were successfully treated using the bougienage method, all of whom spontaneously passed the ingested coins within a mean duration of 2.6 days (range 1 to 7 d) without subsequent intervention or need for a repeat x-ray. The one case of failed bougienage treatment underwent endoscopic removal of the ingested coin at that visit. Interestingly, upon removal it was found that he had ingested 2 coins stuck side-by-side, giving the appearance of a single coin on x-ray. His records and those of the 3 children who declined bougienage treatment served as a control group for comparing the endoscopic treatment to bougienage cases. There were no reported minor or major adverse events or complications with any of the bougienage cases or endoscopy cases. The mean healthcare cost for the hospital visit for bougienage cases was \$1210 (range \$950 to \$1600), compared with \$3100 for the endoscopy removal ($P < 0.001$). Furthermore, mean time spent in the hospital from diagnosis to discharge was 2 hours (range 1.5 to 3 h) for bougienage-treated patients compared with 8 hours (range 4 to 12 h) for endoscopy treatment ($P < 0.001$), reflecting time to call endoscopy team after hours, use of sedation/anesthesia and observation during recovery.

DISCUSSION

Coin ingestion is most common in infants and toddlers; with older children only occasionally ingesting coins. Bougienage treatment for esophageal coins has been reported[7,10] but has not received broad acceptance yet. Some controversy persists, which is addressed prospectively by findings in our research. Endoscopic

removal of esophageal foreign bodies is the usual treatment in many pediatric centers. Its safety and effectiveness are well demonstrated.[3,4,11–13] However, endoscopy is a more costly procedure that requires the presence of a skilled pediatric endoscopist and is usually done under sedation or general anesthesia, with the need for subsequent observation/hospitalization. Therefore, it is relatively expensive and may not be readily available in smaller community hospitals. These limitations are not present with bougienage treatment, which may be performed without sedation and could be performed by general pediatricians or emergency room physicians. All of our bougienage procedures were performed in the emergency room obviating the need for hospital admission overnight for observation that is sometimes used with endoscopic removal for nonsymptomatic children.

With an average hospital stay of 2 hours, compared with 8 hours for endoscopic removal, this intervention promises to reduce both the total healthcare cost and the disruption to the patient and family. This technique may be especially useful for physicians working at smaller community hospitals or rural clinics where transfer of the patient to a tertiary care center would be necessary for endoscopic treatment to be performed. Such transfers would likely add significantly to the cost and time of the endoscopic treatment more than that reflected in our study. The finding of superior cost efficacy of bougienage versus endoscopy in treating esophageal coins was proposed on a hypothetical basis previously[14] and is now demonstrated in our study.

There are advantages to endoscopic removal of esophageal coins over simple bougienage treatment. Direct visualization offers an opportunity to evaluate the surrounding esophageal mucosa and lumen or remove unsuspected radiolucent objects if swallowed simultaneously.

The fact that one case had failed the bougienage treatment points out 2 important issues. First bougienage is not going to be successful in all patients, so endoscopic removal will continue to have a role to play for selected cases. Second, the safety of the procedure depends in part on the ingested foreign body being a coin, rather than some other object such as a disc battery. Therefore, an observed ingestion or careful radiologic confirmation is mandatory.

CONCLUSIONS

Bougienage of impacted esophageal coins is an effective, safe, and more economic treatment modality for selected pediatric patients with uncomplicated coin ingestion. Spontaneous passage followed in this study after successfully advancing the coin to the stomach within a short period in all cases. This simple technique may provide a valuable tool to emergency room physicians or primary care doctors especially when endoscopy is not readily available.

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