Anterior-Commissure Laryngoscope Extraction of Esophageal Coins in Children Using an Apnea Technique

Luis A. Tarrats, MD-JD 1, Marinell Rivera-Rodríguez, MD 2, Lorena González, MS 3, Susana Vargas-Pinto, MD 4, Miguel Garratón, MD 1, Elisa Quintero, MD 2, and Antonio Riera-March, MD 1

Abstract
This is a case series with chart review of 59 consecutive pediatric patients with a diagnosis of cervical esophageal coin who underwent anterior-commissure laryngoscope (ACLA) extraction during apnea. The purpose of this study was (1) to evaluate the efficacy and safety of coin extraction and (2) to analyze foreign body features and intraoperative physiological parameters (apnea time, O 2 saturation and end-tidal CO 2 (ETCO 2 ) of apnea, minimum O 2 during procedure, and heart rate). The technique was completed in 94.9% of the sample. The mean of the length of apnea was 57.7 ± 25.2 seconds. The median minimum O 2 saturation was 99.5% (minimum = 93, maximum = 100), and the median of the ETCO 2 at the end of the procedure was 35.7 ± 4.8 mm Hg. Heart rates remained at baseline values during the procedure (P < .001). This technique represents an efficient and secure modality for treatment. If successful, the patient can be safely discharged after clearance from anesthesia and a swallowing trial.

Keywords
esophageal coins, apnea

This article presents our results with the anterior-commissure laryngoscope apnea technique (ACLA) for extraction of esophageal coins in children. Few studies establish the anesthetic considerations of foreign body removal during a safe apneic period. Albeit not representing a novel technique, data are necessary regarding its performance and safety.

Methods
The Institutional Review Board of the University of Puerto Rico approved this study. We are the only institution in Puerto Rico providing removal of esophageal foreign bodies at the level of the cervical esophagus. In this case series with chart review, 59 consecutive children who underwent the ACLA technique were assessed. Patients with respiratory distress, neck deformities, signs of perforation, more than 72 hours' ingestion, cardiopulmonary disease, and history of esophageal pathology were excluded. Due to the instrument’s length limitation, children older than 10 years and coins visualized 2 cm below the clavicles on chest X-ray were not candidates. Five cases were excluded due to the above criteria.

ACLA Technique
An anterior commissure laryngoscope (170 mm length) was introduced under direct visualization without significant force, following the path of the posterior pharynx into the esophageal inlet (Figure 1). The laryngoscope distal opening showed the coin in the horizontal plane, and then with a 28-cm duckbill grasping forceps, the coin was securely clenched, and both instruments were simultaneously retrieved. For training purposes, the first 5 cases were performed with an endotracheal tube. A secondary inspection was performed to rule out another object and assess the esophageal mucosa.

Patients were preoxygenated via mask with 100% oxygen using 5 L/min of gas flow for 5 minutes. Anesthesia

1 Department of Otolaryngology Head and Neck Surgery, School of Medicine, Medical Sciences Campus, University of Puerto Rico, San Juan, Puerto Rico, USA
2 Department of Anesthesiology, School of Medicine, Medical Sciences Campus, University of Puerto Rico, San Juan, Puerto Rico, USA
3 Research Design, Biostatistics, and Clinical Research Ethics, Puerto Rico Clinical and Translational Research Consortium, Medical Sciences Campus, University of Puerto Rico, San Juan, Puerto Rico, USA
4 Department of Surgery, Saint Luke’s Episcopal Hospital, Ponce School of Medicine, Ponce, Puerto Rico, USA

This article was presented as a poster at the 2014 AAO-HNSF Annual Meeting & OTO EXPO; September 21-24, 2014; Orlando, Florida.

Corresponding Author:
Luis A. Tarrats, MD-JD, Department of Otolaryngology, University of Puerto Rico School of Medicine, Suite A-972, San Juan, Puerto Rico 00936, USA.
Email: luisamtarrats@gmail.com
was induced with 5% sevoflurane/oxygen, and intravenous (IV) propofol 4-mg/kg bolus was injected before the procedure. Glycopyrolate and IV dexamethasone were administered prophylactically.

Descriptive statistics were used to characterize the study sample sociodemographics and coin removal procedure (ie, efficacy outcomes) variable. Physiological parameters (ie, safety outcomes) were also characterized using measures of central tendency. Procedure time was chronometrically recorded on 12 cases. The Fisher exact and Kruskal-Wallis tests were used to assess differences between age groups for categorical and continuous variables, respectively. Unsuccessful cases (n = 3 of 59) were excluded. Statistical analysis was performed using Stata (Version12.0; StataCorp LP, College Station, Texas).

**Results**

Of the 59 patients who qualified for the ACLA technique, 56 (94.9%) were successfully treated and discharged home on the same day. Unplanned readmissions did not occur.

**Demographics and Complications**

Successful treatment was high across the age spectrum. The coin was removed on the first attempt in 54 (96.4%) cases. There were no procedure-related complications, loss of coin upon extraction, failure to identify a second object, or an undiagnosed pathological injury. Most cases showed a normal healthy esophageal mucosa (51 [91.1%]) (Table 1).

**Anatomical Area and Cardiac Rhythm**

All coins were US currency. The most common was the penny (39 [69.6%]). Children aged ≤1 year were more likely to ingest pennies (100%), whereas children aged ≥5 years more likely ingested quarters (50%) (P = .01). Two patients were found with two 1-cent coins.

Most of our coins were found at the level of the cricopharyngeous muscle (50 [89.3%]). Coin type did not correlate with anatomical site. Cardiac rhythm remained close to baseline, and no arrhythmia was recorded (Table 2).

**Procedure Time and Oxygenation Parameters**

The median procedure time was 52 seconds (minimum 21, maximum 96). The minimum oxygen saturation (SpO2) was kept at safe levels (99.5%; minimum 93%, maximum 100%) (Table 3).

**Discussion**

In older children, observation is an acceptable option that allows for spontaneous passage of esophageal coins distally located.1 Nonetheless, most coins are ingested by younger children and are predominantly lodged at the upper esophagus.2 In this scenario, rigid videoesophagoscopy under general anesthesia is the treatment of choice.3

In our institution, the ACLA technique has become the first choice for removal of coins lodged above the thoracic inlet in healthy children younger than 10 years with documented coin ingestion within the previous 72 hours. The potential risks include dental damage, pharyngeal laceration, esophageal perforation, and airway occlusion. Although there is a legitimate concern of retrieving a foreign body in a nonsecure airway, it is unlikely that the object will migrate anterosuperiorly into the glottis. If the coin falls from the forceps during the extraction, it would most likely fall into the posterior pharynx on an extended neck. Eligible patients can safely undergo this procedure in apnea if preoxygenated with 100% oxygen, achieving a fraction of inspired oxygen (FI\textsubscript{O}2) >90% and a threshold of SpO\textsubscript{2} of 91% to avoid further decrease. This will prolong the time to achieve critical hypoxia in an open airway.

<table>
<thead>
<tr>
<th>Table 1. Description of Study Sample (N = 56).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics and Complications</td>
</tr>
<tr>
<td>Value</td>
</tr>
<tr>
<td>Sex, No. (%)</td>
</tr>
<tr>
<td>Male 24 (42.9)</td>
</tr>
<tr>
<td>Female 32 (57.1)</td>
</tr>
<tr>
<td>Age, y</td>
</tr>
<tr>
<td>Mean ± SD 3.2 ± 2.4</td>
</tr>
<tr>
<td>Median (IQR) 2.6 (3.8)</td>
</tr>
<tr>
<td>Age groups, y, No. (%)</td>
</tr>
<tr>
<td>≤1 13 (23.2)</td>
</tr>
<tr>
<td>&gt;1 and &lt;5 27 (48.2)</td>
</tr>
<tr>
<td>≥5 16 (28.6)</td>
</tr>
<tr>
<td>Coin removal procedure, No. (%)</td>
</tr>
<tr>
<td>No. of attempts</td>
</tr>
<tr>
<td>1 54 (96.4)</td>
</tr>
<tr>
<td>2 2 (3.6)</td>
</tr>
<tr>
<td>Findings after second look</td>
</tr>
<tr>
<td>Normal 51 (91.1)</td>
</tr>
<tr>
<td>Swelling 1 (1.8)</td>
</tr>
<tr>
<td>Abrasion 4 (7.1)</td>
</tr>
</tbody>
</table>

Abbreviation: IQR, interquartile range.
Since the approximate time for coin removal was less than 2 minutes, this technique is within the safe apneic period.4

The coin (all pennies) could not be retrieved by ACLA technique in 3 patients: in 1 patient, the coin migrated distally during anesthesia relaxation; another presented an esophageal web; and another had significant resistance in the upper esophageal sphincter. As part of our protocol, since the coin was not retrieved after 3 ACLA attempts, the patients were intubated and successfully treated by rigid videoesophagoscopy.5

Limitations
This is a retrospective study from a single institution, limited to a single class of foreign objects. The technique was not compared with rigid videoesophagoscopy.

Conclusion
The ACLA technique for removal of esophageal coins in children is a safe and effective technique in a properly selected patient population. After the procedure, the patient can be discharged home.

Acknowledgments
We thank Amy Irizarry for all the work with the illustrations.

Author Contributions
Luis A. Tarrats, conception, design, analysis, data interpretation, drafting, final approval, agreement to be accountable for all aspects of the work; Marinell Rivera-Rodríguez, acquisition, data interpretation, drafting, final approval, agreement to be accountable for all aspects of the work; Lorena González, data interpretation,
drafting, final approval, agreement to be accountable for all aspects of the work; Susana Vargas-Pinto, acquisition, data interpretation, drafting, final approval, agreement to be accountable for all aspects of the work; Miguel Garratón, analysis, critical revision, final approval, agreement to be accountable for all aspects of the work; Elisa Quintero, analysis, critical revision, final approval, agreement to be accountable for all aspects of the work; Antonio Riera-March, analysis, critical revision, final approval, agreement to be accountable for all aspects of the work.

Disclosures

Competing interests: None.
Sponsorships: None.
Funding source: None.

References