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Outcomes variability in non-emergent esophageal foreign body removal: Is daytime removal better?

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ABSTRACT

Objective: The objective of this study is to investigate differences between esophageal foreign body removal performed during standard operating room hours and those performed after-hours in asymptomatic patients.
Methods: A retrospective chart review at a tertiary children's hospital identified 264 cases of patients with non-emergent esophageal foreign bodies between 2006 and 2011. Variables pertaining to procedure and recovery times, hospital charges, complications, length of stay, American Society of Anesthesiology (ASA) classification, and presence of mucosal injury were summarized and compared between cases performed during standard operating hours and those performed after-hours.
Results: Cases performed during standard hours had significantly longer average wait times compared with after-hours cases (13.1 h versus 9.0 h, $p < 0.001$). No other clinical characteristics or outcomes were significantly different between groups. Longer wait times are not associated with mucosal injury or postoperative complications.
Conclusion: There were no significant differences in procedure time, charges, or safety in after-hours removal of non-emergent esophageal foreign bodies compared to removal during standard operating hours. OR wait time was about 4 h longer during standard hours compared with after-hours. This study could not assess the factors to determine the impact in differences in hospital resource utilization or work force, which may be significant between these two groups.

1. Introduction

To control expenditures in health care, we must identify ways to deliver the best quality care at the lowest expense. This is particularly cogent since it has become evident that increased expenses do not necessarily translate into better outcomes. Value-add in the surgical field of pediatric otolaryngology means efficient and safe surgical intervention that does not disrupt already scarce resources or increase costs unnecessarily.

A common diagnosis treated in pediatric otolaryngology is esophageal foreign body ingestion. Foreign body ingestion occurs with annual incidence in the United States of 11 per 100,000 person-years and mortality of up to 1500 deaths per year [1]. Cases often exhibit a bimodal distribution with peaks in children and older adults. The American Association of Poison Control Centers reported 96,806 such cases in children 5 years old and under in 2008 [2]. Over half of the cases which required removal in the operating room were secondary to coin ingestion.

Children with esophageal foreign bodies may present with drooling, dysphagia, odynophagia, cough, difficulty breathing, or even chest pain. However, they may also be asymptomatic. Current management consists of immediate removal in symptomatic cases and in those where caustic substances, such as batteries, are suspected. Often, stable, non-emergent patients are admitted and managed with removal the following day. Some surgeons opt for immediate removal even in asymptomatic patients. The temporal relationship of certain surgical procedures has been shown to significantly impact outcomes, with an increased rate of adverse events in procedures completed after-hours. Furthermore, increasing stressors on operating room resources and hospital-wide cost efficiency force us to re-evaluate the cost and outcome differences of when non-emergent esophageal foreign body removal is conducted. The objective of this study is to analyze differences

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between esophageal foreign body removals performed during standard operating room hours and those performed after-hours.

The hypothesis that daytime removal of non-emergent esophageal foreign bodies during standard hours may be more efficient and have fewer complications than nighttime, off-hour removal prompted this study.

2. Methods

2.1. Study design

At Texas Children's Hospital, a tertiary care center, esophageal foreign body retrieval is performed by three services: otolaryngology, general surgery, and gastroenterology. We conducted a retrospective chart review of a total of 522 esophageal foreign body removals by the pediatric otolaryngology service from 2006 to 2011, identified by CPT code 39215. Cases that required emergent removal (i.e., batteries, sharp objects, and airway compromise) or performed by general surgery or gastroenterology were excluded from the study. This project was reviewed and approved by the Baylor College of Medicine institutional review board.

2.2. Data collection

We identified 264 cases of patients with non-emergent esophageal foreign bodies from the years 2006 to 2011, managed by the otolaryngology service. Excluding those with incomplete chart information and those with airway components, there were 196 cases (74%) for analysis. Variables from operative as well as anesthesia records and hospital chart were obtained including age, whether patient was transferred from an outside hospital, hospital charges, operating and anesthesia time, postoperative complications, length of stay, type of foreign body, ASA classification, time in PACU, and presence of mucosal injury. We then compared the data between standard daytime (7 AM–3 PM) and after-hour procedures (3 PM–7 AM). Since the documentation of actual foreign body ingestion time is poorly documented and often unwitnessed, a surrogate for the time to surgical intervention is measured by the time from the ER to the OR.

2.3. Statistical analysis

The characteristics of the study population are summarized by means with standard deviations or frequencies with percentages. Summary statistics are stratified by surgeries performed during normal hours and after-hours. p-values are provided using chi-squared test, Fisher's exact test, t-test and Wilcoxon rank sum test as appropriate. Procedure time and time in PACU were log transformed to attain approximate normality. Linear regression was used to estimate the univariate and multivariable covariate effects on log-transformed procedure time and time in PACU. Logistic regression was used to estimate the univariate and multivariable covariate effects on length of stay and complications.

2.4. Patient evaluation and operating technique

Currently, the practice at our hospital involves patients being evaluated in the emergency room (ER) by trained pediatric faculty who then contact otolaryngology once an esophageal foreign body has been confirmed by either recent outside X-rays or X-rays obtained after patient's arrival to the ER. The majority of patients (84%) are admitted for observation and scheduled for removal the following morning if the patient arrive after-hours and are both asymptomatic and non-emergent (i.e., no significant drooling, respiratory distress, or concern for battery ingestion). Given the nature of un-witnessed events and the median age of patients (1.75 years), the actual time of initial foreign body ingestion is not often known. Additionally, over half of patients (62%) are transferred from outlying facility for higher level of care. Therefore, the time elapse of the transfer process was not easily captured in this study.

Objects in all cases are located at the level of the cricopharyngeus muscle above the thoracic inlet, which were confirmed by preoperative X-ray prior to removal. Removal is conducted under general anesthesia by rigid esophagoscopy. Once the object is removed, a second look is conducted to confirm any mucosal injury or the presence of additional objects. Mucosal grade is classified from 0 to 4 (0 = normal, 1 = mild erythema and edema, 2 = superficial abrasion or ulcer, 3 = through muscle or eschar, 4 = perforation). Patients are PO challenged and those who successfully tolerate liquids by mouth are discharged directly from the PACU.

3. Results

Patient characteristics and outcomes are summarized in Table 1. Patients who underwent removal during standard hours had a significantly longer wait time for surgery than those who underwent removal after-hours (see Fig. 1). Average time from ER to OR is decreased by 4 h for after-hours surgery compared to normal hours ($p < 0.001$). Being transferred also significantly reduces the ER to OR time ($p = 0.041$). After adjusting for age, ASA, mucosa grade, transfer status, and weekend procedures the average time from ER to OR is 4 h shorter for after-hours surgery compared to normal hours ($p < 0.001$). This could reflect a confounding effect from after-hour admissions that were carried over into the standard hours the following day. However, even after additionally adjusting for preoperative admissions, the average time from ER to OR is 2.3 h shorter for after-hours surgery compared to normal hours ($p = 0.032$).

Slightly more cases of mucosal injury were encountered during after-hours procedures (31% versus 25%). Majority of patients in both standard and after-hours groups had an ASA classification of 1 or 2. Twenty percent of patients had a length of stay greater than 24 h. The median procedure time was 10 min during normal hours and 11 min performed after-hours, and the median hospital charge was $7761 for procedures performed during normal hours and $7847 for procedures completed after-hours. The difference of $86 in hospital charges was not significant.

Further analysis using logistic regression examined whether longer wait times from the ER to the OR was associated with any higher mucosal grade or postoperative complications. Increased wait time in the ER was not significantly associated with mucosal injury ($p = 0.594$) or postoperative complications ($p = 0.113$).

Overall, postoperative complication rate was 5%. Postoperative complications were defined as fever or cardiopulmonary events such as increased oxygen requirement, tachycardia, and aspiration pneumonia. There was one case of delayed diagnosis of superimposed battery ingestion complicated by slow peristalsis. There were no significant intraoperative complications such as esophageal perforation.

Postoperative complications were not significantly associated with timing of removal ($p = 0.28$). Mucosa Grades 1, 2, and 3 have an increased odds of complications compared to mucosa grade 0 ($p = 0.003$). Of the nine patients who had postoperative complications, only one had removal after-hours and seven of them had ASA 2 or 3. Fifty-six percent were transferred, 44% had removal over the weekend, and the median length of stay was 2 days (range of 1–7 days). The median procedure time is 13 and 86 min in PACU. Twenty-two percent had no mucosal change, 33% grade 1, 33% grade 2, and 11% grade 3. All patients with postoperative complications presented with coin ingestion, except one who