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Emergency care of esophageal foreign body impactions: timing, treatment modalities, and resource utilization

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Abstract

Esophageal foreign body impaction (EFBI) often requires urgent evaluation and treatment, but characteristics of ED care such as timing of presentation and therapeutic procedures and costs of care are unknown. We aimed to study healthcare utilization for patients with EFBI presenting to the Emergency Department (ED). Cases of EFBI from 2002 to 2009 were identified by querying three different databases from the University of North Carolina Hospitals for all records with ICD-9 CM code 935.1: "foreign body in the esophagus." Charts were reviewed to confirm EFBI and extract pertinent data related to the ED visit, including time of presentation, length of ED stay, medications administered, type of procedure performed and characteristics of procedures, and time to therapeutic procedure. Hospital charges for EFBI encounters and consult fees were determined from the Physicians' Fee Reference 2010, and were compiled to estimate costs. Of the 548 cases of EFBI identified, 351 subjects (64%) presented to the ED. A total of 118 (34%) patients received a medication to treat EFBI, which was only effective in 8% of those patients. 290 (83%) subjects underwent a procedure including EGD (65%) or ENT-performed laryngoscopy/esophagoscopy (40%). Admission to the hospital occurred in 162 (46%) of cases. There was no relationship between ED arrival time and time-to-procedure or total time in ED. There was also no significant relationship between delivery of ED medications and likelihood of undergoing a procedure, or between ED arrival time and delivery of medications. The charges associated with a typical EFBI episode ranged from $2,284–6,218. In conclusion, the majority of patients with EFBI at our institution present to the ED. Medical management was largely ineffective. A therapeutic procedure was required to clear the EFBI in most patients. Time of ED arrival made no difference in time-to-procedure, indicating that GI and ENT specialists recognize the urgency of treating EFBI regardless of time of day.

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Keywords

Foreign bodies (MeSH); Esophageal Diseases (MeSH); Endoscopy; Gastrointestinal (MeSH); Emergency service; Hospital (MeSH); Healthcare costs (MeSH)

Introduction

Esophageal foreign body impaction (EFBI) is a gastroenterological emergency with an estimated annual incidence in the US of 11 per 100,000 person years[1], and resulting in up to 1,500 deaths per year.[2] Patients typically present to an emergency department (ED) with chest or throat discomfort, dysphagia or odynophagia, and difficulty managing oral secretions.[3] Esophageal foreign body impactions can be associated with serious consequences such as caustic injury[4], esophageal perforation[5], and aortoesophageal fistula formation.[6]

Food bolus is the most common impacted foreign body, particularly in adults, but other objects such as coins, toys, bones, batteries can also present in this fashion.[1] Certain medical therapies are available such as glucagon[7–9] and nitroglycerin, but results are mixed. Because urgent endoscopic evaluation and disimpaction are recommended in the case of complete esophageal obstruction or impaction of hazardous objects[10], patients with EFBI frequently require after-hours and/or bedside endoscopy. Various endoscopic techniques have been reported including pushing the bolus or object into the stomach with the endoscope, removal with a net, and morcellation or piecemeal removal with forceps.[10] This disorder is also treated by otolaryngologists using laryngoscopy and rigid esophagoscopy, particularly for proximal impactions, pediatric cases, and those who fail intervention via flexible upper endoscopy.[11, 12]

Because EFBI results in both ED visits and interventional procedures, it would be expected to be associated with relatively high healthcare costs. However, characteristics of ED service utilization, treatment choices and related time trends for EFBI patients are not well described. We aimed to assess ED utilization and healthcare costs for patients with EFBI, with a focus on time of presentation, type of impaction, efficacy and timing of medical therapy, and time to therapeutic procedure.

Materials and Methods

Study design and case identification

This was a retrospective study of all patients presenting with EFBI at University of North Carolina (UNC) Hospitals from June, 2002 through December, 2009. Potential cases of EFBI were identified by querying three different electronic databases for all records with the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code 935.1:“foreign body in the esophagus.” The three sources were: 1) the UNC Hospital billing database (Siemens Decision Support Solutions, available 2002–2009), 2) the Carolina Data Warehouse for Health (including data from the UNC electronic health record system, available 2006–2009), and 3) the UNC endoscopy database (Provation MD, Wolters Kluwer, Minneapolis, MN, available 2002–2009).

Data abstraction

Charts of subjects associated with ICD-9 CM 935.1 were individually reviewed to confirm EFBI status. In this study, EFBI was defined as: 1) ingestion of food or a potentially obstructing foreign body; 2) presentation with symptoms of esophageal bolus impaction (e.g. acute dysphagia, chest pain, foreign body sensation, inability to control secretions);

and, 3) either a procedure (i.e. upper endoscopy or rigid esophagoscopy) which demonstrated bolus impaction, a response to medical therapy (e.g. glucagon) that resulted in witnessed clearing of the obstructing bolus either via vomiting or swallowing, or witnessed resolution of the impaction in the ED prior to undergoing a procedure. Patients were excluded if the ICD-9-CM code 935.1 could not be linked to an acute care visit or a procedure with the features above. Pertinent data from first-time EFBI cases were extracted and included: date of EFBI, age, gender, race, impacted item, procedure(s) performed, procedure complications, endoscopic or surgical techniques used to clear the impacted bolus, whether esophageal biopsy or esophageal dilation was performed, GI comorbidities, and prior or subsequent episodes of EFBI. Patients with more than one occurrence of EFBI during this time period, either at our institution or reported by history, were categorized as having recurrent EFBI. Cases of GERD were defined by the diagnosis in the medical record. Cases of EoE were defined per 2007 consensus guidelines[13], and full details about the role of EoE in this population have previously been reported.[14]

Charges and cost calculations

To estimate costs we used the University of North Carolina Hospitals billings database and the Physicians Fee Reference, 2010 (Wasserman Medical Publishers). We selected subjects who received a range of treatments and services related to their EFBI and obtained the hospital charges associated with each of these EFBI incidents at our center. The Physicians Fee Reference was used to obtain the best estimate for zip code-adjusted median GI and ENT consultation costs. Total costs were estimated from a compilation of the total hospital charges and, when applicable, consult charges.

Statistical analysis

Descriptive statistics were used to summarize the findings. For bivariate analysis, means were compared with t-test and proportions were compared with chi-squared tests. For variables where there were not normal distributions, medians were compared using the Wilcoxon Rank-sum test. Two tailed p values of <0.05 were considered statistically significant. All statistical analyses were performed using STATA, version 10.1 (College Station, TX, USA). This study was approved by the UNC Institutional Review Board.

Results

Case characteristics

A total of 548 cases of EFBI were identified. Of these, 351 subjects (64%) presented to the ED. Of the 197 cases that were not associated with an ED visit, the majority (192; 97.5%) were associated with either an EGD or ENT procedure. Focusing on the ED cases only, the majority of cases were males (57%) and white (68%) (Table 1). The mean age was 34.7 (range 4 months – 99 years), with a bimodal distribution, with peaks in children (age 2–5) and older adults (age 41–80) (Figure 1). A majority of patients with EFBI were white (68%). Among all EFBI cases treated in the ED, a majority were due to esophageal food impaction (EFI, n=187, 53%), though coin impactions were also common, accounting for 27% of cases, all in children. The most common GI diagnoses associated with EFBI were GERD and/or esophagitis (14%), esophageal strictures (12%), hiatal hernia (11%), eosinophilic esophagitis (8%), and rings (Schatzki's or other, 8%). These comorbidities were expectedly more common in adults. The number of EFBIs presenting to the ED rose over time, with 15 in 2003 and 70 in 2009 (Table 2). A total of 162 (46%) patients were admitted to the hospital. Children with EFBI were more likely to get admitted compared to adults (78% vs. 23%, $p<0.001$).

EFBI treatment

A total of 118 (34%) patients received a medication to treat EFBI. Medication use was significantly more common in adults vs. children (55% vs. 4%, p<0.001). The most common medications used were glucagon and nitroglycerin (72% and 54% of all medications, respectively) (Table 2). Medications alone led to resolution of symptoms in only 10 patients (8% of all those receiving EFBI medications).

A total of 290 subjects (83%) underwent a procedure. Of the 61 patients who did not undergo a procedure, 10 had resolution of symptoms attributed to medications as above, 11 had spontaneous resolution or improvement of symptoms, and details were unavailable or could not be determined from available data in the remaining 40 cases. Procedures included EGD (65%) and ENT-performed laryngoscopy or esophagoscopy (34%). Seventeen patients underwent both an EGD and an ENT procedure, and all but 1 of these patients had a food impaction. Compared to children with EFBI, adults were significantly more likely to undergo an EGD, and significantly less likely to undergo an ENT procedure (p<0.001 for both comparisons). Among those who underwent procedures, bolus extraction (e.g. using a Roth net or via piecemeal removal with forceps) was performed in 56% of cases. The impacted item was pushed into the stomach in 66 cases (23%). The most commonly used endoscopic tools were forceps (90 cases, 33%) and Roth nets (31 cases, 11%). After EFBI clearance, dilation was performed in 32 cases (11%). Complications were uncommon, occurring in 3% of cases. The most common complication was an unsuccessful EGD (i.e. inability to relieve impaction or remove object) requiring further intervention (including rigid esophagoscopy, n=5). The other complications included mucosal tears or erosions (n=3), atrial fibrillation (n=1) and bronchospasm (n=1). Persons who received EFBI medications in the ED were not more or less likely to undergo a subsequent procedure (p = 0.3).

Time of presentation and timing of procedures

Presentation to the ED with EFBI was slightly more common in the afternoon and evening hours (Table 2). On average, the length of time between ED arrival and undergoing the procedure was 9.5 hours (Table 3). Time to procedure was significantly shorter for adults vs. children (7.3 hours vs. 12.1 hours, p<0.001). Procedures were most common during normal working hours, but occurred between 4pm and 8am not infrequently (Figure 2). There was no relationship between ED arrival time and time-to-procedure, between ED arrival time and total time in ED (Figure 3), or ED arrival time and whether or not patients received EFBI medications. The time-to-procedure was actually shorter in patients who received EFBI medications compared to those who did not (7.9 hours vs. 10.4 hours; p=0.04). Patients with food impactions were no more likely to undergo a procedure than those with non-food impactions (84% vs. 85%; p=0.7). However, the time-to-procedure was generally shorter for food impactions compared to non-food impactions (7.7 hours vs. 11.7 hours respectively, p=0.0005). The time-to-procedure was even shorter for those with meat impactions (6.2 hours vs. 11.4 hours for non-meat impaction, p<0.0001).

Charges and Costs

The charges for treatment for an average adult patient with EFBI seen in the ED ranged between $2,284 and $3,577. This incorporates the ED visit and physician fees, as well as the gastroenterology (or ENT) consultation and procedure, typically without the use of anesthesia support. The cost for an average child with EFBI was higher, between $3,728 and $6,218, and typically also included operating room charges and anesthesiologist fees. As would be expected, costs were highest in patients who underwent procedures, especially those undergoing multiple procedures (Table 4).

Discussion

In this single-center study of esophageal foreign body impaction over an 8 year time period, we found that the large majority of patients with EFBI presented to the ED. Medical management was typically ineffective in relieving the impaction, and a costly therapeutic procedure was required to clear the EFBI in most patients. Contrary to our initial hypothesis, time of ED arrival made no difference in time-to-procedure, indicating that GI and ENT specialists recognize and address the urgency of treating EFBI regardless of time of day. Children with EFBI were more likely to undergo ENT procedures vs. EGDs, had significantly longer time-to-procedure, and were more likely to be admitted to the hospital compared to adults. To our knowledge, ours is the largest U.S. series in the literature, and the only one to examine factors such as ED utilization, timing of procedures, and cost with respect to this disorder.

Our study contributes to previously published literature on this topic. Kirchner et al performed a retrospective study of 54 cases of EFBI from Germany, and found that meat impaction was the most common cause of esophageal obstruction, which is similar to our findings.[15] Wu et al performed a retrospective review of 326 cases of EFBI in Taiwan.[16] In contrast to our findings, this study found that patients with food bolus impaction had significantly delayed endoscopic intervention compared to those with other foreign body impactions, but this may have to do with the relatively high incidence of fish bone (34%) and chicken bone (11%) impactions in this series, which were not classified as food impactions and were treated more emergently. Of the 172 of the patients in their study who underwent EGD, a 16% failure rate was reported, which was higher than the rate observed in our study (2%). Mosca et al reported a series of 414 patients with suspected foreign body ingestion from Italy, all of whom underwent endoscopic intervention within 6 hours.[17] The failure rate of endoscopic therapy in this study was 1.1%, similar to our results. Another recent American study of foreign body ingestions by Palta et al reported 16 cases of EFBI, all of which were managed endoscopically. Most (93%) of EFBI patients had an intervention within 24 hours which is similar to our findings.[18] Overall, our results support and are consistent with a recently published guideline on the management of EFBI.[10]

In this study, the use of medications to relieve esophageal food bolus impaction was fairly common, occurring in about a third of patients, but only rarely led to resolution. A procedure was performed in most cases of food impaction, and was successful a majority of the time. These findings would suggest that the role of medications to relieve EFBI is limited, and one could argue that they shouldn't be tried at all since they are not without side effects.

There are few other studies addressing costs or resource utilization associated with EFBI in the literature.[19] The direct charges that we report here, ranging on average from $2000–$6000, are substantial for a single health care encounter, particularly one potentially resulting from a single bite of food. While these costs may be specific to our center or region, we attempted to select representative direct costs and reimbursements from a national reference guide. It is likely that our cost estimates are conservative, as we did not include discharge medications, repeat endoscopic procedures (i.e. for stricture dilation), follow-up physician visits, or missed time from work. When this is considered in sum, the costs of EFBI presenting to the ED are substantial.

It is important to acknowledge the strengths and limitations of this study. We performed a thorough review of multiple electronic resources in order to maximize the sensitivity of our case finding strategy, and believe that we were able identify all of the EFBI cases seen at our institution during the time frame of this study. Furthermore, we reviewed all the medical

records of cases identified in this study, optimizing the specificity of case identification and making any misclassification of EFBI cases very unlikely. We included both adult and pediatric cases, and captured patients regardless of whether they were evaluated by a gastroenterologist. Our study comprised a relatively large sample. Though multiple data sources were used to identify cases of EFBI, because billing code was used to identify cases, it is possible that some cases presenting to UNC during the time frame of this study were missed. However, since most patients were coded multiple times, we would expect that miscoding (or lack of coding) would be rare. Because this was a retrospective study, we used hospital charges to estimate episode costs. While this is an imperfect measure of the true costs associated with EFBI, we feel it is a reasonable approximation in this situation.

In conclusion, the majority of patients with EFBI at our institution between 2002 and 2009 presented to the ED. Medical management was largely ineffective, and a therapeutic procedure was required to clear the EFBI in most patients, which was associated with high per-episode charges. Time of ED arrival made no difference in time-to-procedure, indicating that GI and ENT specialists appropriately recognize and address the urgency of treating EFBI regardless of time of day.

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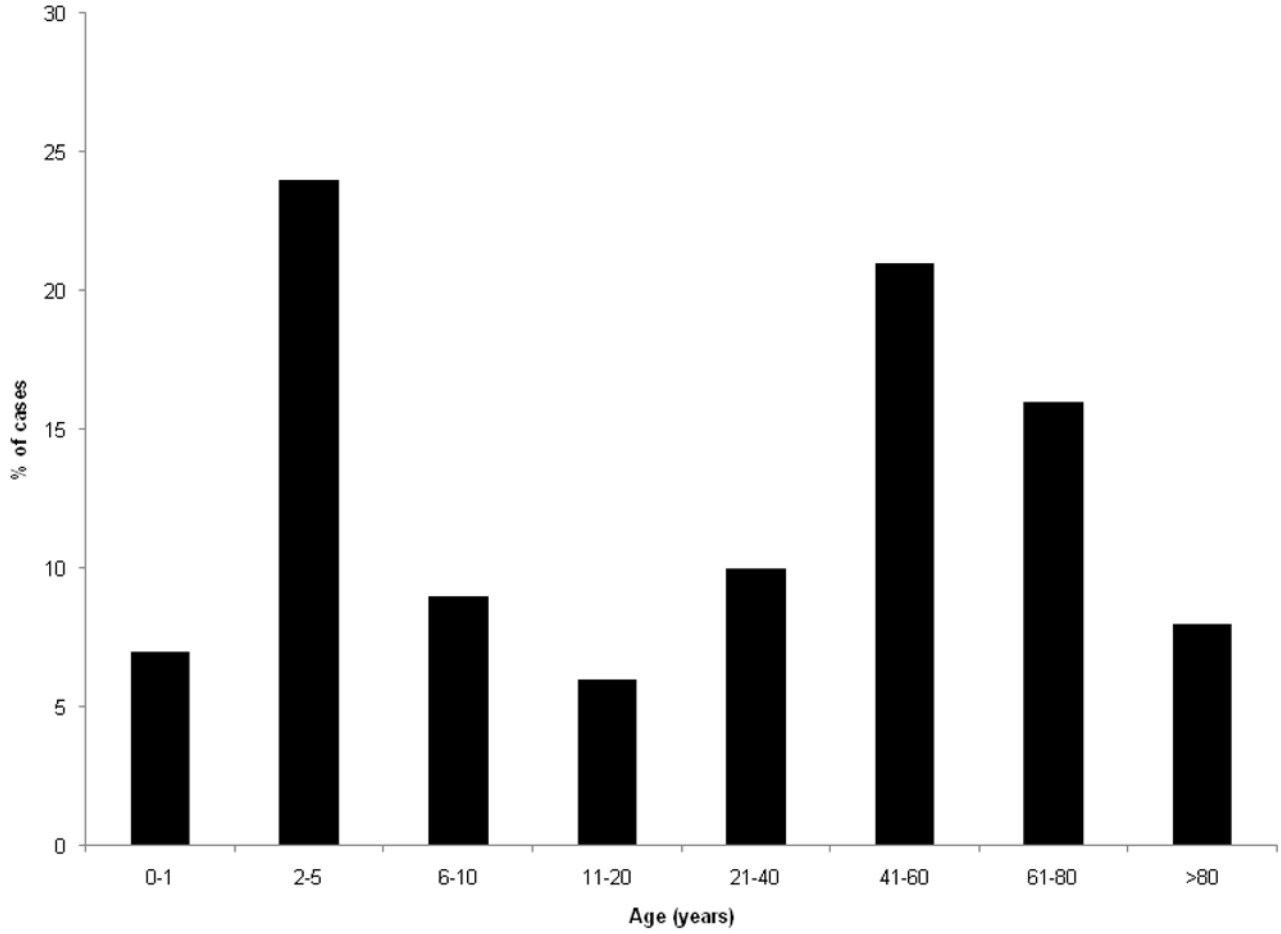


Figure 1.
Histogram of age at presentation of 351 cases of esophageal foreign body impactions seen in the Emergency Department at a single center from 2002–2009, showing bimodal distribution of cases.

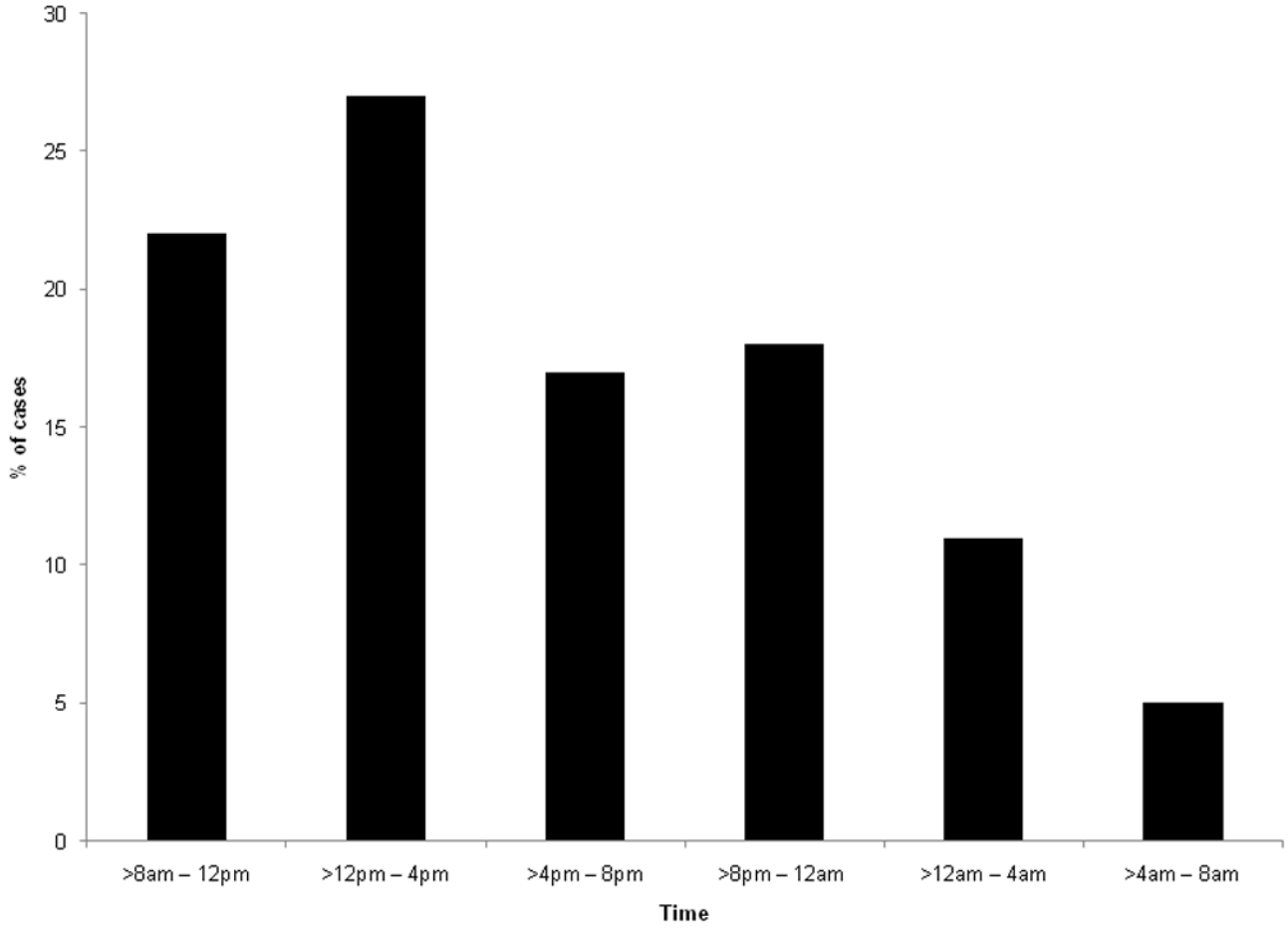
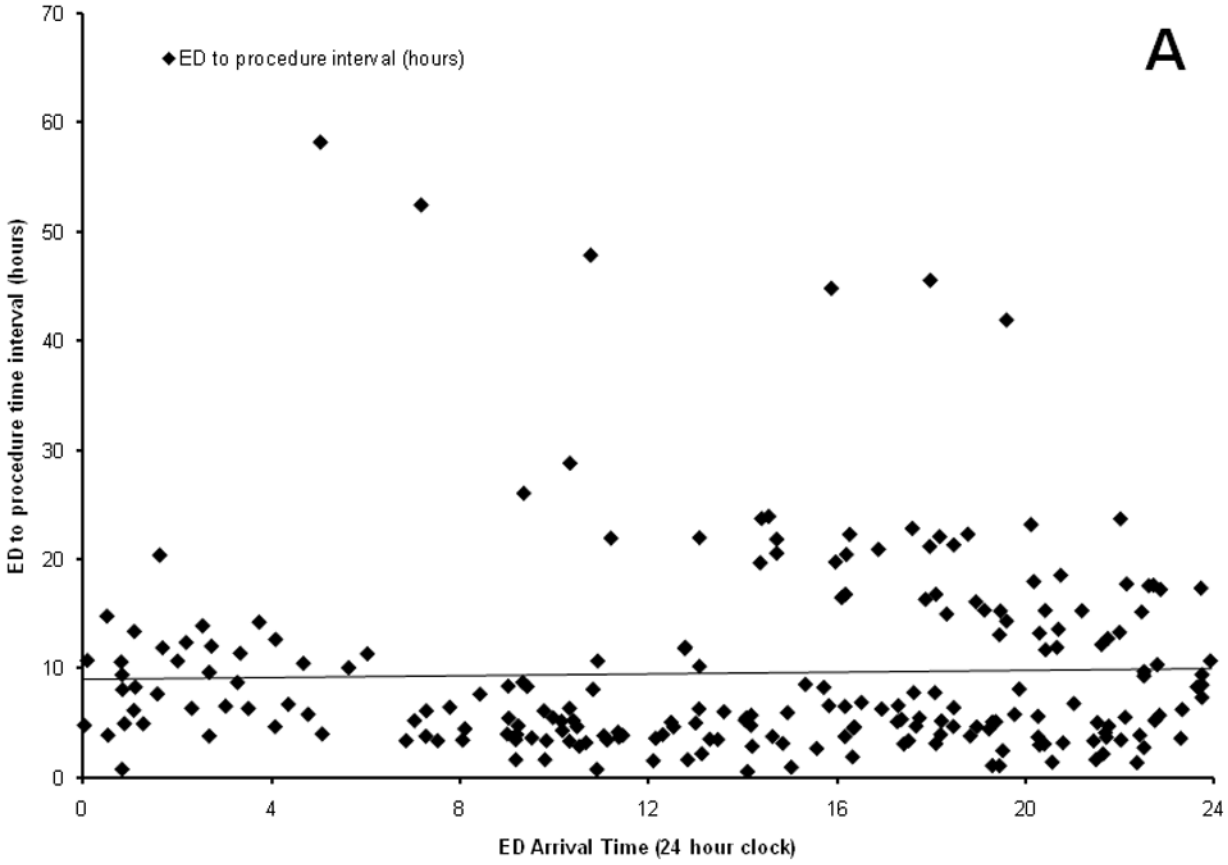


Figure 2.
Distribution of procedure start times, presented as percentage of patients with esophageal food impaction seen in the Emergency Department.



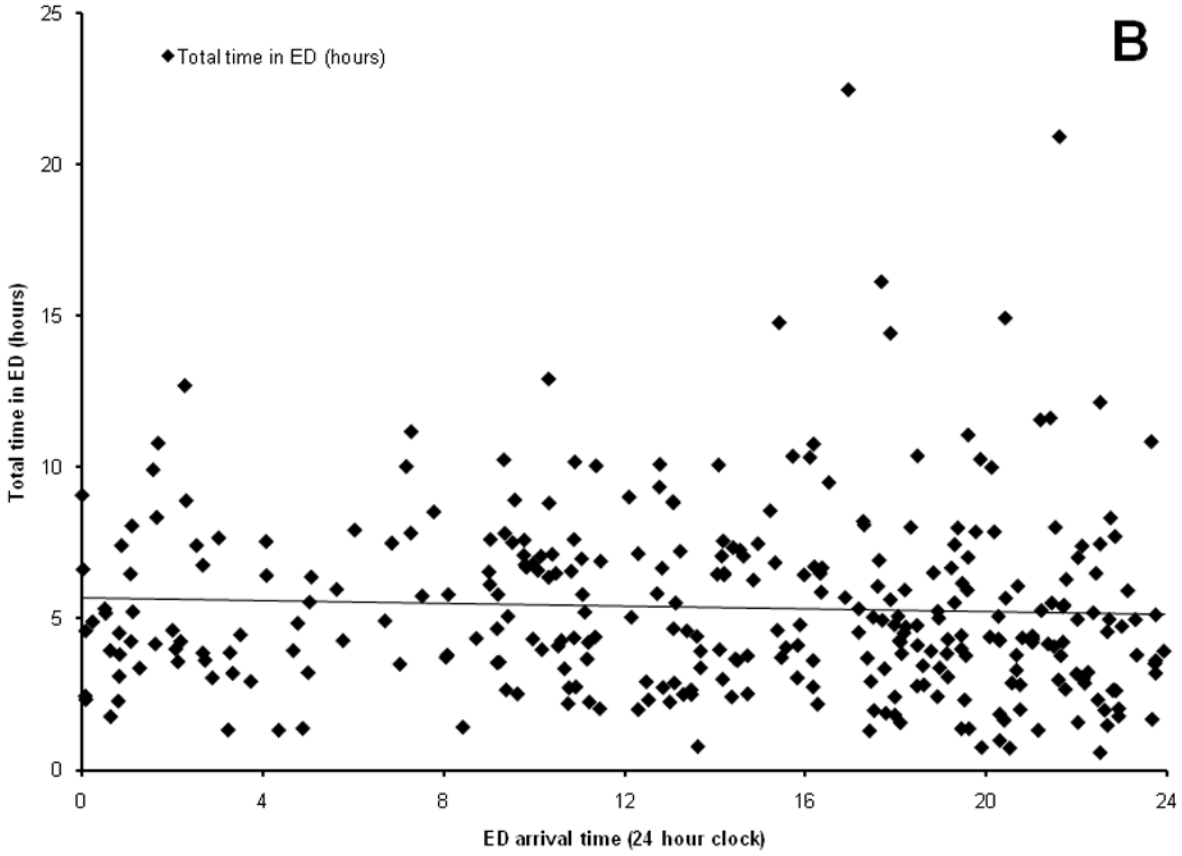


Figure 3.
Plot of ED arrival time vs. time-to-procedure (A) and total time in ED (B). Lines represent linear average. Graphs show that time-to-procedure and total time in ED did not correlate with ED arrival time. r = NS for both.

Table 1

Characteristics of patients presenting with esophageal foreign body impaction to the Emergency Room from 2002–2009, overall and stratified by age at presentation

Characteristic	Total n=351	Pediatric* n=149	Adult n=202
Gender, n (%)			
Female	150 (43)	66 (44)	84 (42)
Male	201 (57)	83 (56)	118 (58)
Age (years)			
Mean ± SD	34.7 ± 30.4	4.2 ± 3.8	57.1 ± 20.1
Median (IQR)	31.6 (3.7, 59.6)	3.0 (1.3, 5.6)	56.7 (42.6, 72.0)
Race, n (%)			
White	240 (68)	79 (53)	161 (80)
Black	66 (19)	36 (24)	30 (15)
Hispanic	22 (6)	17 (11)	5 (2)
Asian	4 (1)	2 (1)	2 (1)
Other	19 (6)	15 (10)	4 (2)
Food impaction history, n (%)			
Prior food impaction	56 (16)	5 (3)	51 (25)
Subsequent food impaction	20 (6)	3 (2)	17 (8)
Associated GI diagnoses†, n (%)			
GERD/esophagitis	49 (14)	8 (5)	41 (20)
stricture/stenosis	44 (13)	3 (2)	41 (20)
Hiatal hernia	39 (11)	0 (0)	39 (19)
Eosinophilic esophagitis	29 (8)	5 (3)	24 (12)
Schatzki ring	29 (8)	0 (0)	29 (14)
Achalasia	6 (2)	0 (0)	6 (3)
Prior anti-reflux surgery	6 (2)	2 (1)	4 (2)
Web	5 (1)	0 (0)	5 (2)
Cancer‡	2 (1)	0 (0)	2 (1)
Other§	30 (9)	6 (4)	24 (12)
None	209 (60)	132 (89)	77 (38)
Impacted item, n (%)			
Meat	122 (35)	13 (9)	109 (54)
Other food¶	65 (19)	11 (7)	54 (27)
Coin	93 (27)	93 (62)	0 (0)
Bone	20 (6)	6 (4)	14 (7)
Pill	11 (3)	0 (0)	11 (5)
Battery	3 (1)	3 (2)	0 (0)
Toy††	5 (1)	5 (3)	0 (0)
Other‡‡	21 (6)	17(11)	4 (2)
Unknown	11 (3)	1 (1)	10 (5)

[*] pediatric cases defined as age at presentation <18 years

[†] Percentages do not add up to 100 due to overlap of conditions.

[‡] includes esophageal cancer and extrinsic compression from tumor

[§] other GI diagnoses include: esophageal ulcer, Barrett's esophagus, prior esophageal atresia surgery, Zenker's diverticulum, esophageal dysmotility.

Impacted item as reported by patient or family description or by procedure report

[¶] examples of other food include: beans, fruit, vegetable

[††] examples of toys include Legos or "Lite Brite" pieces

[‡‡] other impacted items include: bottle cap, toothpick, blister pack of pills, pebble

GERD: gastroesophageal reflux disease; SD: standard deviation; IQR: interquartile range

Table 2

ED utilization and visit characteristics (N=351)

Visit characteristic	Total n=351	Pediatric* n=149	Adult n=202	p
Year of presentation, n (%)				0.001
2003†	15 (4)	0 (0)	15 (7)	
2004	18 (5)	3 (2)	15 (7)	
2005	47 (13)	18 (12)	29 (14)	
2006	75 (21)	29 (19)	46 (23)	
2007	57 (16)	25 (17)	32 (16)	
2008	69 (20)	35 (23)	34 (17)	
2009	70 (20)	39 (26)	31 (15)	
Time of ED arrival‡, n (%)				0.13
12am – 4am	41 (12)	23 (15)	18 (9)	
>4am – 8am	20 (6)	10 (7)	10 (5)	
>8am – 12pm	53 (15)	16 (11)	37 (18)	
>12pm – 4pm	57 (16)	30 (20)	27 (13)	
>4pm – 8pm	73 (21)	35 (23)	38 (19)	
>8pm – 12am	76 (22)	33 (22)	43 (21)	
not available	31 (9)	2 (1)	29 (14)	
Length of stay in ED (hours)				
Mean ± SD	5.4 ± 3.0	4.3 ± 2.4	6.2 ± 3.2	<0.001
Median (IQR)	4.7 (3.3, 6.9)	3.9 (2.8, 5.1)	5.9 (4.1, 7.6)	
EFI medication given in ED, n (%)	118 (34)	6 (4)	112 (55)	<0.001
Type of EFI medication(s) given, n (%)				
Glucagon	85 (24)	5 (3)	80 (40)	<0.001
Nitroglycerin	64 (18)	1 (1)	63 (31)	<0.001
GI cocktail/viscous lidocaine	11 (3)	0 (0)	11 (5)	0.003
Benzodiazepines	9 (3)	1 (1)	8 (4)	0.05
Other	8 (2)	0 (0)	8 (4)	0.012
Admission to hospital from ED, n (%)	162 (46)	116 (78)	46 (23)	<0.001

† 2003 was the first whole year of the study

‡ ED arrival time not available for years 2003–2004

ED: Emergency Department; SD: standard deviation; EFI: esophageal food impaction; IQR: interquartile range

Table 3

Characteristics of procedures performed on patients with esophageal foreign body impactions presenting to the Emergency Department.

Procedure Characteristics	Total n=351	Pediatric* n=149	Adult n=202	p
Procedure performed†	290 (84)	126 (85)	164 (81)	0.3
Time from ED arrival to procedure (hours)				
Mean ± SD	9.5 ± 8.9	12.1 ± 8.9	7.3 ± 8.2	<0.001
Median (IQR)	6.3 (3.8, 12.7)	10.6 (5.7, 16.4)	4.7 (3.4, 7.6)	
Procedure type‡				
EGD	189 (65)	46 (31)	143 (71)	<0.001
ENT laryngoscopy/esophagoscopy	121 (34)	86 (58)	35 (17)	<0.001
Dual procedure	17 (5)	4 (3)	13 (6)	0.1
Technique				
Extraction or removal	162 (56)	109 (87)	53 (32)	<0.001
Pushed with scope	66 (23)	4 (3)	62 (38)	<0.001
No obstruction seen	31 (11)	5 (4)	26 (16)	0.001
Other technique	2 (1)	0 (0)	2 (1)	0.5
None or not specified	28 (10)	9 (7)	19 (12)	0.2
Tools used				
Forceps	90 (33)	71 (56)	19 (12)	<0.001
Roth net	31 (11)	6 (5)	25 (15)	0.005
Snare	11 (4)	1 (1)	10 (6)	0.03
Coin grasper	21 (7)	21 (17)	0 (0)	<0.001
Cap	11 (4)	0 (0)	11 (7)	0.003
No tools or not specified	108 (37)	18 (14)	90 (55)	<0.001
Dilation performed	32 (11)	4 (3)	28 (17)	0.001
Complication during procedure§	10 (3)	3 (2)	7 (4)	0.5

† Procedures include EGD performed by GI, ENT or surgical services; laryngoscopy/esophagoscopy performed by ENT and surgical procedures

‡ Totals to > 100% because some patients had two procedures

§ Complications included unsuccessful EGD, superficial mucosal tear/abrasion, atrial fibrillation and bronchospasm

EGD: esophagogastroduodenoscopy; SD: standard deviation; IQR: interquartile range

Table 4

Hospital charges related to food impactions[†]

Charges	USD
Actual charges for EFBI related visits for 7 representative patients	
Adult: ED visit with spontaneous clearance of EFBI	$795
Adult: ED visit, GI consult, medication, clearance of EFBI without procedure	$1046
Adult: ED visit, GI consult, medications, EGD	$2431
Adult: ED visit, GI & ENT consults, , medications, EGD	$2653
Adult: ED visit, GI & ENT consults, medications, EGD, admission	$3678
Child: ED visit, ENT consult, laryngoscopy in OR, anesthesia services	$3733
Child: ED visit, GI & ENT consults, EGD in OR, anesthesia services, admission	$7457
Range of potential charges for 2 typical patients with EFBI	
Adult: ED visit, administration of EFI related medication, GI consult, EGD	$2284–3577
Child: ED visit, X-ray, GI or ENT consult, EGD or ENT procedure in OR, anesthesia services, PACU	$3728–6218

[†]charges taken from a sample of study subjects billing records in 2008 and 2009. Consult fees obtained from Physician's Fee Reference, 2010; reported is PFR 50%

EGD: esophagogastroduodenoscopy; ENT: ear nose, and throat surgery; ED: emergency department; GI: gastroenterology; OR: operating room; PACU: post-anesthesia care unit; USD: US dollars