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Esophageal foreign-body impactions: epidemiology, time trends, and the impact of the increasing prevalence of eosinophilic esophagitis

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Abstract

Background—The epidemiology of esophageal foreign-body impaction (EFBI) is poorly described, and the impact of the increasing prevalence of eosinophilic esophagitis (EoE) on this is unknown.

Objective—To assess the characteristics of patients with EFBI, to determine whether EFBI cases increased in proportion to EoE cases, and to identify predictors of EFBI.

Design—Retrospective study.

Setting—Tertiary care center.

Patients—Cases of EFBI from 2002 to 2009 were identified by querying billing, clinical, and endoscopy databases for the International Classification of Diseases, 9th Revision, Clinical Modification code 935.1, “foreign body in the esophagus.” Charts were reviewed to confirm EFBI and to extract pertinent data. Cases of EoE were defined per guidelines.

Results—Of 548 patients with EFBI (59% male, 68% white, bimodal age distribution), 482 (88%) required a procedure, 347 (63%) had food impactions, and 51 (9%) had EoE. EFBI increased over the study time frame, and the number of EGDs performed for EFBI nearly quadrupled. Increasing diagnosis of EoE did not fully account for this trend, but only 27% of patients who underwent EGD had esophageal biopsies. Of patients who underwent biopsy, 46% had EoE. EoE was the strongest predictor of multiple EFBI (odds ratio 3.5; 95% CI, 1.8–7.0).

Limitations—Retrospective, single-center study.

Conclusions—The number of EGDs performed for EFBI has increased dramatically at our center, but increasing EoE prevalence only partially explains this trend. Because only a minority of EFBI patients underwent biopsies and because nearly half of those who did undergo biopsy had

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EoE, the incidence of EoE may be substantially underestimated. Physician education is needed to increase the proportion of subjects with EFBI who undergo biopsies.

Esophageal foreign-body impaction (EFBI) is a GI emergency, often requiring presentation to an emergency department (ED) for urgent evaluation and treatment.¹ The etiologies are numerous and include inadvertent swallowing of coins in children, complications of reflux disease such as peptic strictures, Schatzki's rings, motility disorders such as achalasia, and malignancy.¹⁻³

In recent years, EFBI has also been recognized as a major presenting feature of eosinophilic esophagitis (EoE), particularly in adults. Several studies suggest that EoE is now the leading cause of food impaction in patients presenting to an ED, accounting for more than 50% of episodes.^{4,5} The incidence and prevalence of EoE have increased significantly over the past decade in both children and adults,⁶⁻¹⁰ but the impact of EoE on the epidemiology of EFBI is not well understood.

The purposes of this study were to assess the characteristics of patients presenting to a tertiary care center with EFBI, to determine whether the number of EFBI cases has increased with the increasing prevalence of EoE, and to identify predictors of EFBI. We hypothesized that the incidence of EFBI increased in proportion to the incidence of EoE and that a substantial proportion of EFBI would occur in association with EoE.

METHODS

We conducted a retrospective study of all patients presenting with EFBI to University of North Carolina (UNC) Hospital from June 2002 through December 2009. All data were collected from the single UNC Hospital location in Chapel Hill, North Carolina. To improve the sensitivity of our case-finding strategy, potential cases of EFBI were identified by querying 3 separate 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 3 sources were (1) the UNC Hospital billing database (available 2002–2009), (2) the UNC comprehensive clinical data warehouse (available 2006–2009), and (3) the UNC endoscopy database (2002–2009; Provation Md, Wolters-Kluwer, Minneapolis, Minn). This ICD-9 code was constant over the study time frame, and there were no changes in billing practice or the endoscopy reporting system during this time period.

Charts were then reviewed to confirm EFBI status, defined as ingestion of food or a potentially obstructing foreign body, presentation with symptoms of esophageal bolus impaction (eg, acute dysphagia, chest pain, foreign-body sensation, inability to control secretions), and one of the following: either a procedure (ie, upper endoscopy or rigid esophagoscopy) that demonstrated bolus impaction, a response to medical therapy (eg, glucagon) that resulted in witnessed clearing of the obstructing bolus either by vomiting or swallowing, or a witnessed resolution of the impaction in the ED before 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 listed. Pertinent data from first-time EFBI cases were extracted and included date of EFBI, age, sex, race, impacted item, procedure(s) performed, procedure complications (unsuccessful endoscopy, respiratory compromise, cardiac arrhythmia, hypotension, mucosal injury, perforation, death), endoscopic or surgical techniques used to clear the impacted bolus, esophageal biopsy sample procurement (if performed), esophageal dilation (if performed), GI comorbidities, and previous or subsequent episodes of EFBI. Patients with more than 1 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.¹⁰

Specifically, subjects had clinical symptoms of esophageal dysfunction, 15 or more eosinophils in at least 1 high-power field (eos/hpf), and either a lack of histologic response to 6 to 8 weeks of treatment with a high-dose proton pump inhibitor (PPI), or a normal pH monitoring study of the distal esophagus. Cases of EoE were reconfirmed by cross-referencing our EoE patient database, which is a comprehensive registry of all EoE patients seen at UNC from 2000 to the present.

Descriptive statistics were used to summarize the findings. Because of the heterogeneity of presentation with EFBI, bivariate analyses were performed comparing food with nonfood impactions, EoE patients with non-EoE patients, and recurrent impactions with a single impaction. Means were compared with *t* test and proportions were compared with the χ^2 test. For variables where there were not normal distributions, medians were compared by using the Wilcoxon rank-sum test. Multivariate analysis assessing predictors of recurrent EFBI was performed with logistic regression. Potential confounding factors were identified on bivariate analysis and included in the initial model. A backward elimination strategy was used to reduce the model, retaining those covariates whose removal caused a change in estimate greater than 10%. The final model included age, sex, race, GERD, EoE, and whether a procedure was performed. This study was approved by the UNC Institutional Review Board.

RESULTS

Patient characteristics and time trends

Overall, 548 patients with EFBI were identified from our search (Table 1). Subjects were 59% male and 68% white and ranged in age from 3 months to 99 years. Age distribution was bimodal, with peaks between 1 to 5 years and 40 to 80 years; the median age was 39 years. GI comorbidities contributing to the episode of EFBI included GERD (10%), esophageal stricture (12%), Schatzki's ring (7%), achalasia (5%), malignancy (2%), and EoE (9%); 264 patients (48%) had no known GI-related diagnosis. The most common type of impacted item was nonmeat food, occurring in 31% of patients, followed by meat in 25% patients. Coins were the impacted item in 21% of patients, and other items included plastic toys (eg, Lego or Light Bright pieces), beads, batteries, and a golf tee (Table 1).

Over the 8-year time frame of this study, the annual incidence of EFBI increased from 15 episodes in 2002 to 100 in 2009 (Fig. 1A). The proportion of EFBI that was caused by food impaction similarly increased (12 episodes in 2002 to 51 in 2009). The increasing incidence was seen in both children and adults, but appears to have plateaued in the most recent 2 to 3 years of the study.

Procedure characteristics

A total of 482 patients (88%) required a procedure to treat their EFBI (Table 2). The majority of patients (363, 75%) underwent a flexible upper endoscopy, whereas 126 (26%) patients underwent an esophagoscopy or laryngoscopy performed by colleagues in the otolaryngology department. One patient underwent surgical exploration for a mediastinal mass that extended into the esophagus. Over the study time frame, the total number of EGDs performed for EFBI nearly quadrupled (Fig. 1B). The most common techniques used to clear the bolus impaction included extraction (49%), with tools such as rat-tooth or other nonbiopsy forceps, Roth nets, snares, coin graspers, and gentle advancement of the impacted bolus (typically food) into the stomach with an endoscope (45%). Additionally, 66 of the

patients (14%) underwent esophageal dilation during the initial procedure after bolus extraction for treatment of esophageal strictures or rings. A through-the-scope balloon dilator was used in 37 of these patients (56%), a Savary dilator in 28 (42%), and a Maloney dilator in 1 patient.

Only a small minority of patients (3%) experienced a procedure-related complication. The most common complication was an unsuccessful EGD, resulting in subsequent treatment in the operating room from the ear, nose, and throat (ENT) or GI surgical service, which occurred in 7 patients (Table 2). Two patients had bronchospasm, 1 of whom had aspiration; 1 patient had hemorrhage (not requiring administration of blood products); 3 had superficial mucosal tears; and 1 patient went into atrial fibrillation during the procedure. None of these complications occurred in patients who underwent an esophageal biopsy during the procedure.

Type of impactions

When comparing food and nonfood impactions, we observed several significant associations (Table 3). There was a significant difference in mean age (50 years vs 14 years) between food impactions and nonfood impactions ($P < .0001$) as well as race (77% nonwhite vs 53% white, $P < .001$). GERD and other GI-related diagnoses were also associated with food impactions, whereas the vast majority of nonfood impactions were related to swallowed coins in children presumed not to have underlying esophageal pathology. However, patients who had food impactions were more likely to undergo esophageal biopsy than those with nonfood impactions (23% vs 8%, $P < .001$).

EoE and EFBI

Fifty-one patients (9%) with EFBI had a diagnosis of EoE by consensus guidelines, with 45 of those patients receiving a new diagnosis after the episode of EFBI. When limited to cases of esophageal food impactions, 42 patients (12%) had EoE. There were 9 EoE patients with nonfood impactions (1 swallowed a coin and 1 swallowed a tooth; in the other 7 patients, the type of nonfood-impacted object was not specified). There were an additional 7 patients who had 15 or more eos/hpf on a biopsy sample, but who did not meet our definition of EoE because GERD had not been excluded. Between 2002 and 2009, the number of EoE patients undergoing EGD for EFBI increased substantially, but did not completely account for the overall increase in the number of EGDs or EFBI (Fig. 1B). However, only 98 of the 363 patients (27%) who underwent EGD underwent an esophageal biopsy during the initial procedure related to their foreign-body impaction, so not all cases of EoE may have been identified. For example, the 45 EoE patients who received a diagnosis after presenting with EFBI comprised a substantial proportion (46%) of patients who underwent esophageal biopsy on upper endoscopy. There was an increase in the proportion of cases in which biopsies were performed, from less than 5% in 2002 to 2004 to greater than 20% after 2005, but the overall proportion was still less than 30%. Of note, all biopsies were performed during EGDs performed by a GI endoscopist; none were performed during procedures performed by the ENT service.

There were multiple differences between patients with EFBI and EoE and those without EoE (Table 4). Compared with patients without known EoE, EoE was associated with younger age (26 years vs 39 years, $P = .005$), male sex (82% vs 18%, $P < .001$), and white race (92% vs 66%, $P < .001$). Food impaction was significantly more likely to occur in patients with EoE compared with those without (82% vs 61%, $P = .007$), but there was no significant association with type of food. Multiple episodes of EFBI occurred more frequently in patients with EoE compared with those without EoE (35% vs 17%, $P = .002$).

Predictors of recurrent EFBI episodes

A total of 103 patients (19%) were categorized as having recurrent episodes of EFBI. On bivariate analysis, multiple episodes of EFBI were associated with older age, male sex, food as the cause of the impacted bolus, a diagnosis of GERD, and a diagnosis of EoE (Table 5). On multivariate logistic regression analysis, after adjusting for age, sex, race, GERD, and whether a procedure was required, EoE was the strongest independent predictor of multiple EFBI (odds ratio 3.5; 95% CI, 1.8–7.0).

DISCUSSION

EFBI is a GI emergency that frequently requires urgent evaluation and procedural intervention. Although numerous etiologies have been documented in the literature,^{1–3} the effect of EoE on the epidemiology of EFBI is less well understood. Because the incidence and prevalence of EoE are known to be increasing,^{6–8} the goal of this study was to characterize a large number of EFBI cases and assess the impact of EoE on EFBI.

Over the time frame of this study, we observed a striking increase in the number of EFBI that occurred each year, as well as a concomitant increase in the number of EGDs performed, although this increase appeared to plateau in the last years of the study. The reasons for the increasing number of EFBI cases are partially explained by an increase in the number of EoE cases over the same time frame, but this alone does not explain the dramatic increase in annual EFBI. However, the low overall rate of biopsy sample procurement during EGD, which remained less than 30% despite increasing over the study time frame, implies that our findings likely underestimate the incidence of EoE in the population that presents with EFBI. In addition, we found that EoE was the strongest predictor of recurrent episodes of EFBI.

Food impaction in EoE is common, with frequencies ranging from 25% to 100% in previous studies, depending on the specific population.^{9–15} In 2 previous prospective studies specifically examining the prevalence of EoE in patients presenting with food impaction,^{4,5} at least 50% of patients had EoE diagnosed. Among our patients who presented with esophageal food impactions, 12% had EoE, a noticeably lower proportion. The reasons for this are likely twofold. First, as previously mentioned, less than one third of patients in this study underwent esophageal biopsies either during the food impaction or during a follow-up endoscopy, so EoE may have been missed. When examining just the patients who underwent biopsies, the proportion of EoE patients was approximately 50%, in line with the previous studies. Second, the previous studies used a histologic definition of EoE based on esophageal eosinophilia at the time of food impaction, regardless of PPI status. In our study, the EoE patients all had a follow-up endoscopy with biopsies demonstrating at least 15 eos/hpf while on twice-daily PPI therapy, consistent with consensus guidelines¹⁰; there were an additional 7 patients who had esophageal eosinophilia but in whom EoE could not be confirmed. Recent data suggest that a high proportion of patients with esophageal eosinophilia may have normalization of their biopsy samples with PPI use,^{16–18} and this may be particularly true when biopsy samples are only obtained when there is acute tissue injury, as is often the case in EFBI.¹⁹ In the study by Desai et al,⁴ whereas 17 of 31 patients with food impaction met the criteria for EoE (≥ 20 eos/hpf), only 8 were PPI nonresponders who were then treated with topical steroids. The implication of this is that a substantial proportion of patients who present with EFBI will have biopsy findings with esophageal eosinophilia suspicious for EoE, but will have resolution of eosinophilia on PPI therapy. Interestingly, a recent retrospective study of EFBI in children found that of the 72 food impaction events, biopsy samples were only obtained in 49%.²⁰ However, in that group, biopsy sample findings were abnormal and with some degree of esophageal eosinophilia in 88%. Perhaps efforts made to educate physicians about the incidence of EoE among patients

who present with EFBI will help increase the biopsy rate during EGD and allow for a more accurate assessment of the prevalence of EoE in cases of EFBI.

It is important to acknowledge the strengths and limitations of this study. First, we performed an exhaustive review of multiple electronic resources during the study period to capture all episodes of EFBI seen at our institution. Therefore, we have a large sample size with the ability to visualize time trends and analyze predictors. However, because this was a retrospective study, we could not obtain data from patients who were seen in our system once for the acute event and then had follow-up care elsewhere. Consequently, the rate of recurrent EFBI may be underestimated. We attempted to counter this potential weakness by extensively characterizing each patient and EFBI case, and our data demonstrate demographic and disease-specific findings similar to those of other published reports of EFBI.^{1,4,5,20–23} Although this yielded many study variables, some of which were heterogeneous, we focused our analysis to be in line with the aims of the study. In addition, we adhered to the published guidelines for diagnosis of EoE¹⁰ and further cross-referenced these patients with our EoE patient database to confirm their status. Given that this was a retrospective study, we were not able to apply a similar set of criteria to the diagnosis of GERD, which was instead based on diagnosis in the patient's medical record and thus may be subject to error.

In summary, the number of EGDs performed for EFBI has increased dramatically at our center, and the increasing prevalence of EoE in this patient population only partially explains this trend. However, because only a minority of patients underwent biopsies at the time of EFBI, the incidence of EoE in this population is likely substantially underestimated, as supported by our finding that the large proportion of patients who did undergo a biopsy were found to have EoE. The complication rate during an EGD performed for EFBI is quite low in our data, and no complications occurred in patients who had esophageal biopsy samples taken. Therefore, it is important to obtain esophageal biopsy samples in all patients with EFBI without a readily apparent structural cause to assess for EoE as the underlying etiology. It also may be necessary to repeat an EGD subsequently after the patient has been on a PPI to confirm a diagnosis of EoE, assess tissue healing, or perform dilation. Physician education regarding the high prevalence of EoE in subjects with food impaction is likely required to change practice and increase the proportion of subjects with EFBI who undergo biopsy.

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Abbreviations

ED	emergency department
EFBI	esophageal foreign-body impaction
ENT	ear, nose, and throat
EoE	eosinophilic esophagitis
eos/hpf	eosinophils per high-power field
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification

PPI proton pump inhibitor
UNC University of North Carolina

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Take-home Message

- Because only a minority of patients with esophageal foreign-body impaction (EFBI) underwent biopsies and because nearly half of those who did had eosinophilic esophagitis (EoE), the incidence of EoE may be substantially underestimated.
- Physician education is needed to increase the proportion of subjects with EFBI who undergo biopsies.

Figure 1.

A, Time trends of the number of esophageal foreign-body impactions (EFBIs) from 2002 to 2009, divided between the total number of episodes (top of the blue bars) and the number of food impactions (tan bars). **B**, Time trends of upper endoscopies performed for EFBI from 2002 to 2009, divided between confirmed eosinophilic esophagitis (EoE) patients (red bars), patients without EoE who had negative esophageal biopsy findings (blue bars), and patients with an unknown EoE status because they did not undergo esophageal biopsy (tan bars).

TABLE 1

Clinical characteristics of patients with esophageal foreign-body impaction (N = 548)

	No. (%)
Age, y, mean $\pm$ SD	37.3 $\pm$ 30.2
Sex	
Female	224 (41)
Male	324 (59)
Race	
White	374 (68)
Black	111 (20)
Hispanic	28 (5)
Asian	4 (1)
Native American	2 (<1)
Other	29 (5)
Food impaction history	
History of food impaction	73 (13)
Subsequent food impaction	39 (7)
GI diagnoses	
EoE	51 (9)
Diagnosed after EFBI episode	45 (8)
Diagnosed before EFBI episode	6 (1)
GERD/erosive esophagitis	80 (15)
Esophageal stricture	65 (12)
Hiatal hernia	59 (11)
Schatzki's ring	38 (7)
Achalasia	28 (5)
Cancer	13 (2)
Other*	107 (20)
None	264 (48)
Impacted item [†]	
Meat	137 (25)
Other food [‡]	170 (31)
Coin	114 (21)
Other [§]	100 (18)
Unknown	27 (5)

SD, Standard deviation; EoE, eosinophilic esophagitis; EFBI, esophageal foreign-body impaction.

* Other GI diagnoses include esophageal ulcer (n = 10), previous antireflux surgery (n = 23), Barrett's esophagus (n = 4), previous esophageal atresia surgery (n = 2), previous tracheoesophageal fistula repair (n = 10), other (n = 58).

[†] Impacted item as reported by patient or family description or by procedure report.

[‡]Examples of other food include beans, fruit, vegetable.

[§]Examples of other impacted items include pill/vitamin, bone, battery, toy, golf tee, plastic utensil.

TABLE 2

Procedure characteristics for patients undergoing bolus extraction (n = 482)

	No. (%)
Procedure type [*]	
EGD (performed by GI or surgical service)	363 (75)
ENT laryngoscopy/esophagoscopy	126 (26)
Surgical exploration	1 (< 1)
Technique	
Extraction	236 (49)
Advanced into stomach	216 (45)
Lavage	10 (2)
Aspiration	7 (1)
Tools used [†]	
Forceps (nonbiopsy)	116 (24)
Biopsy forceps	42 (9)
Roth net	47 (10)
Snare	18 (4)
Coin grasper	27 (6)
Suction cap	12 (2)
Other [‡]	6 (1)
Underwent dilation at time of procedure	66 (14)
Esophageal biopsy procured at time of procedure [§]	98 (27)
Complication during procedure ^{//}	14 (3)

ENT, ear, nose, and throat.

^{*} Totals more than 100% because some patients had 2 procedures.

[†] More than 1 tool was used for some patients.

[‡] Other tools include catheter, clip, hemostat (used through rigid endoscope), and basket.

[§] Of the 363 patients who underwent EGD.

^{//} Complication defined as unsuccessful endoscopic procedure for esophageal foreign-body impaction clearance, documented respiratory compromise, perforation, mucosal injury, cardiac arrhythmia, hypotension, or death.

TABLE 3

Comparison of patients with food and nonfood impactions*

	Impaction type		<i>P</i> value
	Food (n = 347)	Nonfood (n = 195)	
Age, y, mean $\pm$ SD	50.4 $\pm$ 25.3	13.8 $\pm$ 23.4	<.001
Female, no. (%)	134 (39)	85 (44)	.24
White, no. (%)	267 (77)	102 (53)	<.001
Multiple EFBI episodes, no. (%)	95 (27%)	6 (3%)	<.001
Presumptive cause of EFBI, no. (%)			
EoE	42 (12)	9 (5) [†]	.004
GERD	48 (14)	8 (4)	<.001
Other	219 (63)	33 (17)	<.001
Underwent procedure, no. (%)	301 (87)	176 (91)	.39
Esophageal biopsy sample obtained, no. (%)	80 (23)	18 (9)	<.001

SD, Standard deviation; EFBI, esophageal foreign-body impaction; EoE, eosinophilic esophagitis.

* Type of impaction was unclear in 6 patients. Those patients were excluded from this analysis. Means were compared with *t* test, medians with Wilcoxon rank-sum, and proportions with χ^2 test.

[†] Of the 9 EoE patients with nonfood impaction, 1 had a coin impaction, 1 had a tooth impaction, and in the other 7 patients, the type of impacted nonfood item was not specified.

TABLE 4

Comparison of EFBI patients with EoE and without a known diagnosis of EoE

	EoE (n = 51)	No EoE (n = 497)	P value
Age, y, mean $\pm$ SD	26.1 $\pm$ 15.9	38.5 $\pm$ 31.1	.005
Female, no. (%)	9 (18)	215 (43)	<.001
White, no. (%)	47 (92)	327 (66)	<.001
Food impaction, no. (%)	42 (82)	305 (61)	.007
Underwent procedure, no. (%)	47 (92)	438 (88)	.24

SD, Standard deviation; *EFBI*, esophageal foreign-body impaction; *EoE*, eosinophilic esophagitis.

TABLE 5

Comparison of single and multiple episodes of EFBI

	Single EFBI (n = 445)	Multiple EFBIs (n = 103)	P value
Age, y, mean $\pm$ SD	35.2 $\pm$ 30.7	46.5 $\pm$ 26.4	<.001
Female, no. (%)	191 (43)	33 (32)	.04
White, no. (%)	296 (67)	78 (76)	.07
Diagnosis of GERD, no. (%)	34 (8)	23 (22)	<.001
Diagnosis of EoE, no. (%)	33 (7)	18 (17)	.002
Underwent procedure, no. (%)	388 (87)	94 (91)	.27

SD, Standard deviation; EFBI, esophageal foreign-body impaction; EoE, eosinophilic esophagitis.

* Multiple EFBIs defined as 1 or more additional episode of EFBI, documented by multiple International Classification of Diseases, 9th Revision, Clinical Modification code matches and/or previous episodes of EFBI as described by the patient during the visit.