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journal homepage: [www.elsevier.com/locate/ajem](http://www.elsevier.com/locate/ajem)Bedside sonography for the diagnosis of esophageal food impaction<sup>☆</sup>Jennifer Singleton<sup>a,\*</sup>, Jesse M Schafer<sup>a</sup>, Jeremiah S Hinson<sup>b</sup>, Erin M Kane<sup>b</sup>, Sherieka Wright<sup>b</sup>, Beatrice Hoffmann<sup>a</sup><sup>a</sup> Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, 1 Deaconess Road, Boston, MA 02215, United States<sup>b</sup> Department of Emergency Medicine, Johns Hopkins Hospital, Johns Hopkins Medical Institutions, 1800 Orleans Street, Baltimore, MD 21287, United States

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## ABSTRACT

**Background:** Esophageal foreign body (EFB) and impaction are common gastrointestinal emergencies. Detection with standard imaging can be challenging. Computed tomography is a commonly used non-invasive imaging modality, but is not 100% sensitive and not always feasible. Sensitivity of plain film x-ray varies widely and the addition of a barium swallow can obscure evaluation by subsequent esophagogastroduodenoscopy (EGD). Use of emergency ultrasound (EUS) for detection of EFB in adults has not been previously studied.

**Objective:** To evaluate the role of EUS in detection of EFB and to characterize sonographic findings.

**Methods:** A case control series of five patients with clinical suspicion of EFB underwent EUS, and findings were compared to five healthy controls. Patients were evaluated for persistent air-fluid levels after swallowing, esophageal dilatation, and visualization of EFB. **Results:** All patients with suspected EFB had esophageal dilatation (17.5 mm vs 9.3 mm in healthy controls;  $p = 0.0011$ ) and persistent air-fluid levels after swallowing. EFB was visualized on EUS in 60% of patients. All patients had EFB confirmed on EGD except one, who vomited a significant food bolus during EUS and prior to EGD.

**Conclusion:** In patients with suspected EFB, point-of-care ultrasound may identify those with impaction. Suggestive findings include cervical esophageal dilatation and persistent intraluminal air-fluid levels after swallowing. EUS is a rapid, convenient test with the potential to expedite definitive management while decreasing cost and radiation exposure in this patient population.

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## 1. Introduction

Esophageal foreign body (EFB) and impaction are common endoscopic (GI) emergencies, ranking third after upper and lower GI bleed [1]. Clinical presentation can vary from a clear history of ingestion to nonspecific symptoms [2–4]. In cases where dementia, developmental delay, age, or communication impairment limits history, diagnosis may be impeded. Indeed, a retrospective study of 522 foreign body ingestions in the pediatric population found 8% were considered chronic or occult and commonly presented with respiratory rather than gastrointestinal symptoms [5].

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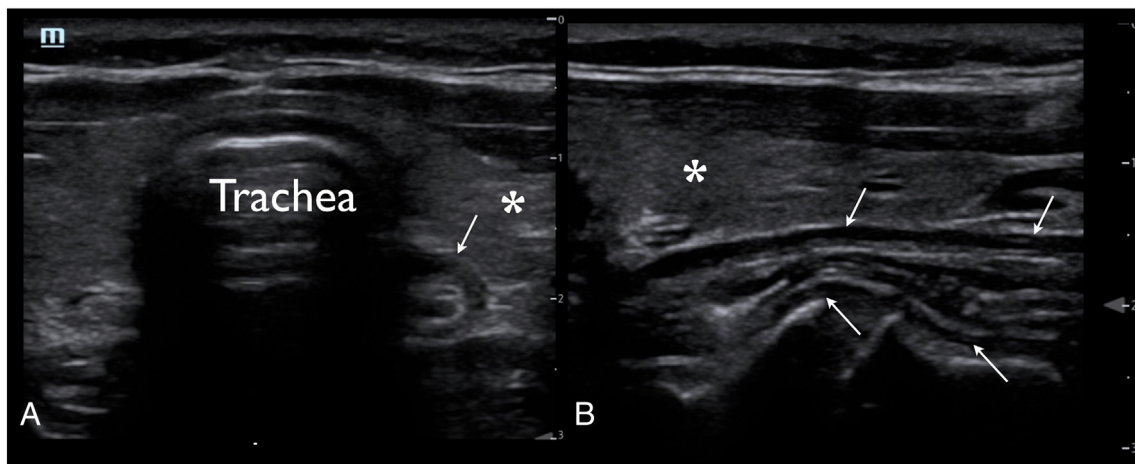
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Computed tomography (CT) is frequently used for identification of EFB, but is not 100% sensitive [6] and, depending on the clinical presentation, may not always be feasible. Radiography has a sensitivity ranging from 42 to 80% [6,7] and barium swallow may interfere with subsequent esophagogastroduodenoscopy (EGD) [7]. There is no proven effective pharmacological management of EFB. Definitive treatment of retained EFB is by removal with rigid or flexible EGD, which carries risks for perforation and mediastinitis, and is thus ideally reserved for patients with an established diagnosis. A bedside test, therefore, may be useful to the emergency physician in confirming the diagnosis of impacted EFB. Point-of-care ultrasound (POCUS) is routinely applied in the emergency department (ED) to identify emergent conditions of the heart, lungs and abdomen and for procedural guidance. The cervical esophagus can be visualized during neck ultrasound for internal jugular access, parts of the thoracic esophagus can be visualized during transthoracic echocardiography, and the gastro-esophageal junction (GEJ) can be visualized with ultrasound of the upper aorta [8–10] (Fig. 1, Supplemental video 1).

Although the cervical esophagus and GEJ are relatively easy to visualize with ultrasound, there are few case reports describing the use of POCUS to diagnose EFB in adults, and only five cases are reported in the pediatric population [11,12]. In pediatrics, sonography is more frequently performed as the initial imaging test given concerns for

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**Fig. 1.** (A) Transverse view of the mid-neck demonstrates the trachea, left thyroid lobe (\*) and cervical esophagus (arrow). (B) Longitudinal view, \* = left thyroid lobe ventral to cervical esophagus (arrows).

radiation exposure. Anatomy and maturity of spine and neck cartilage differ with skeletal maturity, hence sonography of the esophagus will be unique to a patient's age group and is usually more complex in adults. However, a recent case report described the role of ultrasound in diagnosing esophageal perforation in an adult patient [13], and another study reported the intra-operative localization of cervical EFB by neck ultrasound [14]. To our knowledge, the role of POCUS in diagnosing esophageal impaction in the adult population in the ED has not yet been described.

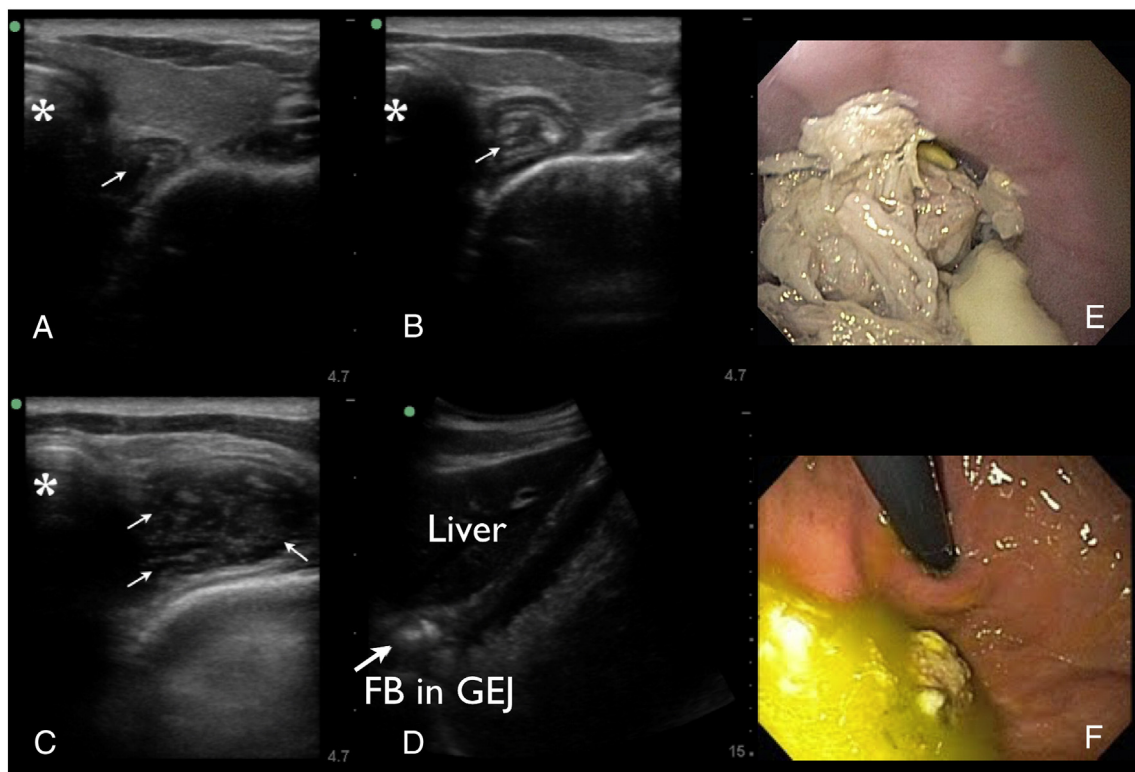
We present a case control series of five patients with symptoms variably suggestive of EFB impaction, in whom POCUS either confirmed or increased the probability of EFB impaction prior to EGD. Additionally, we compare sonographic findings from these patients to five healthy control subjects. The study model was reviewed and approved by the

local IRB. Finally, we will discuss sonographic techniques and implications of esophageal ultrasound in the evaluation of EFB impaction.

## 2. Patients and sonographic technique

### 2.1. Case 1

A 28-year-old male with developmental delay presented to the ED with nausea, vomiting and epigastric pain. Physical exam and laboratory workup were unremarkable. He was initially treated for presumptive acute gastritis with antiemetics and intravenous fluids but continued to have symptoms after overnight observation. An ultrasound of the cervical esophagus and GEJ was performed with a technique described previously [8,10]. In brief, a 5–10 MHz high-frequency linear probe



**Fig. 2.** Upper (A), mid (B) and lower (C) cervical esophagus with increasing degree of dilatation. Trachea = \*, esophagus = arrows. (D) demonstrates the GEJ with a foreign body (FB) posterior to the left hepatic lobe. Endoscopic images of the foreign body at the GEJ (E, F).

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