The Use of a Soft Gel Capsule as a Medium for Modified Barium Esophagogram in Detecting Esophageal Foreign Body

ABSTRACT

Objectives: To test a soft gel capsule with barium sulfate as a medium for modified barium esophagogram in detecting esophageal foreign body.

Methods:

Design: Preliminary Diagnostic Test Assessment; Consecutive Convenience Sample

Setting: Tertiary Government Hospital

Patient: Soft gel capsule with barium sulfate was pilot tested on patients with a history and diagnosis of radiolucent foreign body ingestion between June 1 and November 30, 2014.

Results: Seven patients (6 males, 1 female; aged 26 – 61 years) underwent the procedure. In all seven, the enhanced capsule immediately stopped above the level of the esophageal foreign body, easily identifying the exact location of the obstruction. Foreign bodies included 1 embryonated duck-egg white “balut”, 5 chunks of pork meat and 1 claspless denture. All were successfully marked by the capsule on fluoroscopy and documented on X-ray. Esophagoscopy under general anesthesia was successfully performed after fluoroscopy in all patients.

Conclusion: We were able to improvise a new medium for use in modified barium esophagograms that was easy to prepare and that rendered good radiographic imaging and localization of radiolucent foreign bodies. A randomized trial in comparison to the prevailing test may confirm our findings further. Meanwhile, we recommend exploring the procedure in other hospitals as an alternative to barium-soaked cotton in the diagnosis of radiolucent esophageal foreign bodies.

Keywords: soft gel capsule, barium sulfate, esophagogram, esophageal foreign body

Esophageal foreign body obstruction is a common and potentially serious cause of morbidity among a wide spectrum of age groups. In our setting, the most common esophageal foreign bodies are radiolucent (impacted meat or other food). Imaging including contrast studies are performed to identify the character and location of the foreign body and to rule out any complications. Biplane radiographs are the initial imaging modality of choice. Contrast examination is not recommended because of associated risk of aspiration and coating the foreign body or the mucosa precluding subsequent endoscopy. However, widespread local practice employs a cotton-ball coated in barium sulfate to diagnose radiolucent esophageal foreign bodies. As an alternative to cotton, we decided to test a soft gel capsule with barium sulfate as a medium for modified barium esophagogram in detecting esophageal foreign body.
SURGICAL INNOVATIONS AND INSTRUMENTATION

METHODS

Study Design  preliminary diagnostic test assessment; consecutive convenience sample

Participants  With technical review board approval, all patients with a history of foreign body ingestion consulting in the emergency room of the Western Visayas Medical Center (WVMC) between June 1 and November 30, 2014 were considered for this study. All those who were clinically diagnosed to have radiolucent foreign body ingestion and who gave informed consent was included. Patients diagnosed to have radiopaque foreign body ingestion were excluded.

Preparation  The materials used were:

1. Ibuprofen (Advil®) Soft Gel Capsule (Pfizer Consumer Inc.; Zuellig, Philippines) (Figure 1A & 1B)

2. Barium sulphate (E-Z-HD®) 98g/100g Powder for Suspension (Oral) Radiocontrast Media 340g (E-Z-EM, Inc., Anjou, Quebec, Canada) (Figure 1B)

3. Terumo® 3cc syringe with gauge 23 needle (Terumo Philippines Corporation) (Figure 1C)

4. Absolute pure distilled drinking water (Asia Brewery, Inc., Philippines)

Each soft gel capsule content was aspirated using a 3cc syringe with gauge 23 syringe needle. A solution of 1:2 (barium sulphate: water) was injected back into the soft gel capsule using another syringe barrel with plunger into the same needle until the entire capsule was filled.

Procedure  Each patient donned a hospital gown was positioned standing for fluoroscopy using a Flexavision Collimator R-300 (Shimadzu Europa GmbH, Dulsburg, Germany) at the WVMC radiology section and swallowed a prepared capsule with sips of water. As the soft gel capsule was ingested, it was tracked through the esophagus until it reached the area of obstruction. (Figure 2A) While the movement of the soft gel containing barium was being tracked on a fluoroscopic video monitor, a chest X-ray APL image was obtained using the same machine. (Figure 2B). Esophagoscopy under general anesthesia was done after fluoroscopy.
**SURGICAL INNOVATIONS AND INSTRUMENTATION**

**Figure 2A.** Fluoroscopic study of a 56-year-old woman showing soft gel barium capsule as it was tracked through the esophagus until it reached the area of obstruction.

**Figure 2B.** Chest X Ray in a 56-year-old woman showing location of ingested meat marked by soft-gel barium capsule.

**Figure 3A.** Soft tissue lateral X Ray in a 29-year-old man showing location of ingested meat with bone.

**Figure 3B.** Antero-posterior X Ray in a 29 year-old man showing location of ingested meat with bone.

**Figure 3C.** Soft tissue lateral X Ray in a 29-year-old man showing location of ingested meat with bone marked by soft-gel barium capsule.

**Figure 3D.** Comparative image of soft tissue lateral X Ray in a 29-year-old man showing location of ingested meat with bone marked by barium impregnated cotton.
RESULTS
Seven (7) patients underwent the procedure, six (6) males and one (1) female with ages ranging from 26 – 61-years-old (mean age, 43-years-old). In all seven, the enhanced capsule immediately stopped above the level of the esophageal foreign body easily identifying the exact location of the obstruction. The findings were one (1) embryonated duck-egg white “balut”, five (5) chunks of pork meat and one (1) claspless denture. All were successfully marked by the capsule on fluoroscopy and documented on X-ray. (Figures 3 A-D) In all 7 patients, esophagoscopy under general anesthesia was performed after fluoroscopy.

DISCUSSION
Accidental foreign body or large food bolus ingestion occurs primarily in edentulous, alcohol intoxicated or mentally impaired elderly subjects. At the Western Visayas Medical Center, food (typically meat and egg white of an embryonated duck egg or “balut”) bolus impactions are the most common cause of esophageal foreign body obstruction in adults. It is hard to identify the exact location, presence or absence of a foreign body in the absence of bone or denture wires. Although endoscopy is of value in assessing gastrointestinal tract mucosal disease, barium studies are indispensable for clarifying uncertain findings at endoscopy or CT. However, barium studies are physically taxing, labor-intensive and difficult for radiologists to master. In our setting, a modified barium swallow involves the use of a cotton ball coated in barium sulfate solution which can be messy and uncomfortable for the patient as well.

In our study, all subjects swallowed the soft gel capsule without difficulty and expressed their ease in swallowing. We were also able to obtain a good radiographic view of the exact location of the foreign body in all cases. No adverse reactions were noted in any of the participants.

We were able to improvise a new medium for use in modified barium esophagograms that was easy to prepare and that rendered good radiographic imaging and localization of radiolucent foreign bodies. Our study only assessed our proposed diagnostic test in a preliminary manner, using a consecutive convenience sample without comparison to the prevailing test, and our results may not be applicable in all indicated situations. A randomized trial involving more subjects over a longer period in comparison to the prevailing test may confirm our findings further. Meanwhile, we recommend exploring the procedure in other hospitals as an alternative to barium-soaked cotton in the diagnosis of radiolucent esophageal foreign bodies.

REFERENCES