



BEZOARS: CLINICAL CHARACTERISTICS, CLASSIFICATION AND MANAGEMENT, A REVIEW ARTICLE

General Surgery

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ABSTRACT

Introduction- The formation of a bezoar is a relatively rare disease entity. Bezoars are mainly of four types depending on their composition: phytobezoars, trichobezoars, pharmacobezoars, and lactobezoars. Depending on their location in gastrointestinal tract they are classified into Gastric bezoars which often lead to ulcerative lesions in the stomach and subsequent bleeding, and the Small intestinal bezoars which usually present with small bowel obstruction. **Diagnosis** – Xray abdomen and USG abdomen are less sensitive to diagnose bezoars while GI endoscopy and CT scan abdomen better modalities to make a diagnosis of bezoars. **Management-** A number of articles have emphasized the usefulness of Coca-Cola administration for the dissolution of phytobezoars. However, persimmon phytobezoars are resistant to such dissolution because of their harder consistency. Cellulase and Papain are used to dissolve bezoars. Endoscopic removal, electro-hydrolytic lithotripsy, argon plasma coagulation are a few newer techniques used. Surgical removal of bezoars, both open and laparoscopically are performed if dissolution methods and endoscopic methods fail. Here we provide an overview of the prevalence, classification, predisposing factors, clinical features, diagnosis and management with review and recent updates.

KEYWORDS

Bezoars; Gastrointestinal endoscopy; Endoscopic removal, Coca Cola

INTRODUCTION

Collection of indigestible material in gastrointestinal tract is known as bezoars.^{1,2}

The word bezoar is derived from the Arabic word 'padzahr' which means antidote.^{3,4}

They are more commonly seen in psychiatric female patients. Bezoars of the gastrointestinal tract is a relatively rare disease entity, with a variable incidence among studies.⁵ Kadian, et al did 1400 gastroscopies over the time period of 4 years in which they found only 6 cases of gastric bezoars (i.e., 0.43% of gastroscopies).⁶ Similar findings were reported by Ahn, et al in 1987 over a period of 7 years (0.43% esophagogastroduodenoscopy examinations).⁷ Mihai, et al noted 49 cases of bezoars over a period of 20 years that was around 0.068% of all endoscopies.⁸ Yalkan, et al reviewed 430 cases of small bowel obstruction in 10 years out of which 14 were caused by phytobezoars.⁹ Between the time period of 1994-2005, 19 reported studies were published in which bezoars were found to be the 5th most common cause of acute small bowel obstruction on laparoscopy done on 1061 patients as reported by Ghosheh, et al.^{10,11} Gökbulut, et al did a study between January 2012 to December 2015 in which they found 66 cases of bezoars in 8200 endoscopies.¹²

Overall, bezoars can be found in the stomach in less than 0.5% of individuals undergoing esophagogastroduodenoscopy examinations and in the small intestine in 0.4%-4.8% of all cases presenting with intestinal obstruction.¹ However, the prevalence of bezoars likely varies among ethnic groups and geographic locations, since the occurrence rate of phytobezoar, the most common type of bezoar, is mostly reflected by food cultures. For example, multiple cases of persimmon phytobezoar (diospyrobezoar) have been reported in regions where the residents frequently consume fresh persimmon fruits and dried persimmons, such as South Korea, Japan, Israel, Spain, Turkey, and Southeastern United States.¹

Bezoars Classification

They are classified into different categories based on their

composition:-

- 1. Phytobezoars-** Phytobezoars are mainly composed of indigestible vegetable fibers. They are the most common type of bezoars. The incidence of phytobezoars varies depending on various factors such as poor mastication, medical conditions like diabetes, hypothyroidism, high fiber diet, previous gastric surgeries, and geographical factors, therefore phytobezoars tend to be more common in regions such as Asia, Spain, and Turkey.¹
- 2. Trichobezoars-** These are composed of hair and food particles.¹ Trichobezoars (hair ball) are usually located in the stomach but may extend through the pylorus into the duodenum and small bowel. This is known as Rapunzel syndrome, first described by Vaughan et al.¹³ They are usually seen in patients with psychiatric disorders. Human hair is resistant to digestion as well as peristalsis, hence this leads to its accumulation between the mucosal folds of the stomach. Over a period, continuous ingestion of hair leads to the impaction of hair together with mucus and food, causing the formation of a trichobezoar.¹
- 3. Pharmacobezoars-** These are composition of undissolved medication, extended-release medicines, bulk forming laxatives, enteric coated medicines contribute to formation of bezoars (e.g., Bulk forming laxatives, peridium and psyllium, and guar gum).^{1,14}
- 4. Lactobezoars-** they are commonly seen in children and are composed of milk proteins and mucus.¹⁵ Both exogenous i.e. the composition of synthetic milk, medication, lowering gastric motility, secretion, and methodologies of feeding as well as endogenous factors i.e. dehydration, premature birth and the subsequent insufficient activity and capacity of the digestive tract contribute to formation of lactobezoars. Now a days incidence of lactobezoars is decreasing due to improvement in synthetic milk composition as well as advances in premature infant management.
- 5. Diospyrobezoars-** they are a different kind of phytobezoars which occurs due to over consumption of fruit persimmons. Persimmons means the "God of fruits" in Greek.¹⁶ Diospyrobezoars are formed by the agglutination of the tannins in the skin of the fruit that forms a glue-like coagulum after contact with dilute acid in the stomach.^{11,17} Persimmon phytobezoars are

often resistant to chemical dissolution because of their hard consistency and they are thus usually removed endoscopically or surgically.^{18,19}

6. **Miscellaneous bezoars** – they are composed of different materials such as plastic, metals, parasitic worms (ascaris). Theoretically, all indigestible food materials and foreign bodies can cause a mass formation together with mucus and semi-digested foodstuffs.

Predisposing Factors

1. Prior gastric surgery such as gastrectomy, vagotomy and pyloroplasty.
 2. Peptic ulcer disease
 3. Chronic gastritis
 4. Crohn's disease
 5. Carcinoma of gastrointestinal tract
 6. Dehydration
 7. Hypothyroidism
 8. Age (elderly individuals)
 9. Diabetic patients with neuropathy or myotonic dystrophy
 10. Displaced NG tube in ICU patients
 11. High fiber diet
 12. Increased consumption of persimmon fruit.
- (All these conditions reduce acid formation in stomach, gastric stasis or loss of pyloric function which contributes to bezoars formation)^{20,21}

Manifestation And Diagnosis

Patient presents with

1. Pain (depending on site of bezoar i.e., epigastric region, umbilical)
2. Abdominal Fullness and discomfort
3. Nausea
4. Vomiting
5. Anemia
6. fainting
7. Gastrointestinal bleeding (Hematemesis and bloody/tarry stools) due to gastric ulceration in mucosa due to pressure necrosis induced by bezoars
8. Anorexia
9. Clinical features of intoxication due to pharmaco-bezoar formation.^{2,18}

Investigation

1. **Xray Abdomen** – x-ray abdomen can detect signs of bowel obstruction but is a poor modality to identify bezoar as cause of obstruction as it looks similar to faeces filled colon.¹
2. **USG** – on USG, bezoar can be identified as a hyperechoic intraluminal mass with arc like surface and a acoustic shadow. It is less sensitive to identify multiple bezoars. May also be confused with ectopic gall stones. USG has even more limited role in identifying gastric bezoars as compared to intestinal bezoars.¹
3. **Endoscopic Examinations** - Endoscopic examinations play the most important role in the detection as well as in the treatment of bezoars. The bezoars are mostly found in the gastric fundus as a single mass (mostly) but can also be multiple. The colour of bezoar differs depending on the materials constituting its formation beige, tan, yellow green, to black (Fig 1,2). As described above, the black colour of persimmon phytobezoar's surface is probably imparted by iron(III) tannate.¹

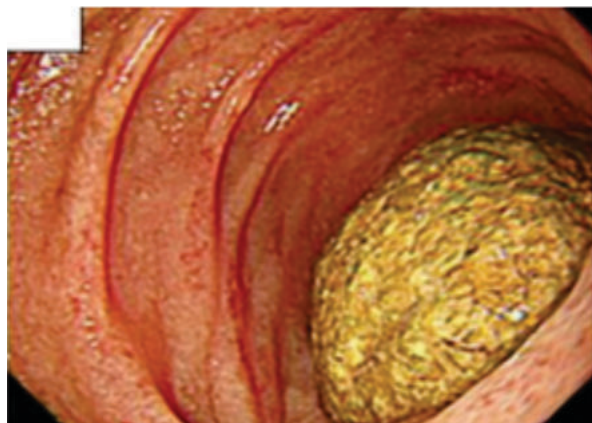


Fig 1. Endoscopic finding showing a phytobezoar stuck in the lumen of the duodenum.



Fig 2. Tricho-phytobezoar extending into the duodenum.

4. **CT Scan** - CT scanning is useful to detect both gastric and small intestinal bezoars. They appear as an ovoid or round intraluminal mass in the gastrointestinal tract with air bubbles and mottled appearance in its interstices.^{1,22} There is also a dilated small bowel proximal to the mass and a normal or collapsed bowel loop distal to it. (Fig 3) It also helps to differentiate small bezoars and retained food particles in stomach. Food particles show higher density than a gastric bezoar.

A CT scan is helpful in patients requiring the surgical removal of small intestinal bezoars because it demonstrates the obstructed site of the intestines as well as helps in better visualization of multiple bezoars.¹

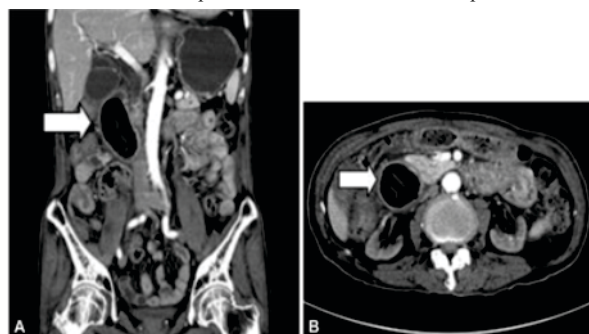


Fig 3. (A) Abdominal computed tomography scan shows a duodenal mass considered to be a bezoar (white arrow). (B) Axial view (white arrow).

Therefore gastrointestinal endoscopy is the gold standard diagnostic procedure for bezoar detection which can provide both direct visualization and therapeutic intervention.

Treatment Of Bezoars

Overview

Currently there are different type of treatment options available for bezoars which includes dissolution therapy, removal by endoscopic devices, laparoscopic surgery, open surgeries.¹

Dissolution Therapies

Coca Cola (carbonated drink) According to a systemic review by Ladas SD, et al, approx. 50% cases of phytobezoar are completely resolved by Coca cola²³, while Lee BJ, et al reports around 23.5 % success rate with 3 liters of coca cola.¹⁸ Though success rates of coca cola treatment alone is low, but when combined with endoscopic therapy, up to 90% may resolve.^{18,23} Pretreatment with cola results in better outcomes with endoscopic therapy as compared to endoscopic therapy alone.^{18,23,24}

Brand of cola (Pepsi/Coca-Cola) does not influence the outcome.²⁴ It is also important to note that diospyrobezoar is more resistant to cola therapy than phytobezoar.^{1,18}

Care must be taken as partial dissolution of phytobezoar may lead to

acute small bowel obstruction, hence it should preferably combined with endoscopic therapies.²⁵

Papain-papain is an enzyme extracted from the Carica papaya plant. It is thought to cleave protein linkages within bezoars. Several authors have described bezoar dissolution by the oral administration of Adolph's Meat Tenderizer (which contains papain). Physicians should be cautious while giving papain therapy as adverse events such as gastric ulceration and oesophageal perforation following papain therapy have been documented.²⁶

Cellulase As cellulose is the main component of phytobezoars, enzyme cellulase therefore helps in dissolving it. The specific mechanism of action of cellulase is thought to consist of an attack on the leucoanthocyanidin-hemicellulose-cellulose bonds of the bezoar, resulting in the bezoar's dissolution. A successful outcome of bezoar treatment with tablet-form gastroenterase (containing pepsin, pancreatic enzyme concentrate, cellulase, and dehydrocholic acid) was described in the 1970s.¹ However, these tablets have been discontinued. Additionally, in many countries, cellulase is not readily available for ingestion as a commercial product even as a medication under prescription.²⁷ However in some studies, one capsule of cellulase supplement was not effective for the lysis of bezoar fragments.

Endoscopic Removal

Endoscopic removal is one of the commonest methods for removal of gastric bezoars. There are various types of endoscopy devices including -

- biopsy forceps
- alligator forceps
- polypectomy snare
- basket catheter
- argon plasma coagulation device
- Nd:YAG laser
- Water jet spray
- electrohydraulic lithotripsy device have been used for fragmentation.¹ (Fig 4)

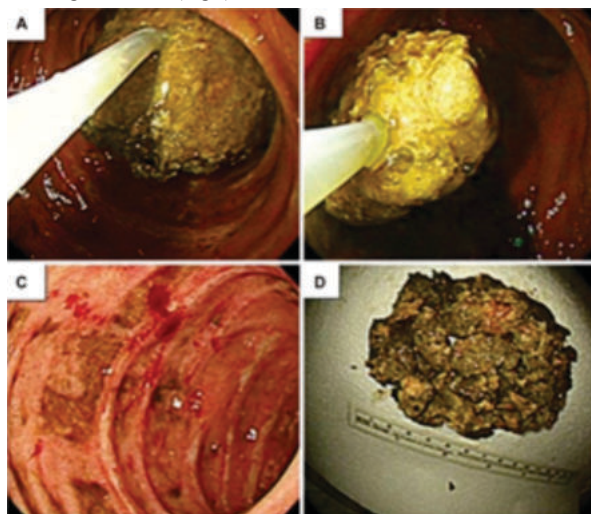


Fig 4. Endoscopic findings. (A) The bezoar was pulled out into the gastric cavity using a snare. (B) The bezoar was fragmented into small pieces using lithotripsy. (C) Residual ulcers in the duodenum. (D) The removed bezoar.

Electrohydraulic Lithotripsy - electrohydraulic lithotripsy (EHL) as an alternative form of treatment of gastric bezoars. In a study conducted Between July 1988-May 1996, 11 patients with large gastric bezoars, defined as those greater than 5 cm in diameter, received endoscopic-guided fragmentation using electrohydraulic lithotripsy

RESULTS

The 11 patients in the study underwent EHL for the treatment of their gastric bezoars, with a 100% success rate, which was defined as the lack of residual bezoar seen on post-procedure barium study or endoscopy done 2 days after the procedure. Patients were followed-up clinically for 30-68 months. No procedure-related complications were seen, except for pharyngeal pain which was most probably secondary to the placement of the silicon over tube.

Endoscopically guided electrohydraulic lithotripsy is a safe, highly effective, alternative nonsurgical technique for the treatment of gastric bezoars.²⁸

Argon plasma coagulation/the woodworm technique

In 2013, after failed maneuver for removal of a large 8cm diameter persimmon bezoar, a new argon plasma coagulation (APC) approach also known as "woodworm technique," was used to treat the bezoar.

Technique the APC probe was advanced through the bezoar creating multiple tunnels in order to weaken the structure. When snared again, the weakened bezoar was successfully ruptured. By repeating the APC-snare sequence, smaller fragments were obtained and crushed with a standard lithotripter to complete bezoar fragmentation.²⁹ (Fig 5)

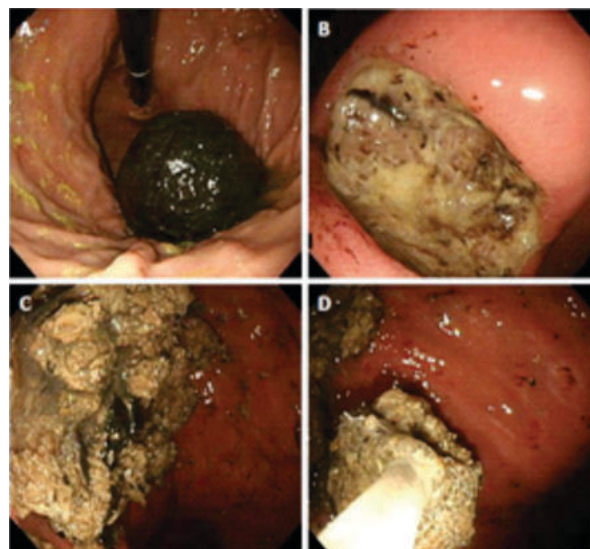


Fig5. Endoscopic view of the "woodworm technique." (a) The argon plasma coagulation probe. (b) Coagulation. (c, d) Tunnel creation.

Surgical Removal

Open surgery for removal of bezoars- trichobezoars are resistant to chemical dissolution and endoscopic removal therefore if endoscopy fails next step of management, is open approach. this approach can be done by a small incision using Alexis's retractor. (Fig 6) A 4 cm upper midline incision is made following which Alexis wound retractor is inserted which helps in additional exposure and fixation of bezoar position following which trichobezoar is broken down into smaller fragments. After removal, cavity is examined using fingers for left out fragments and the abdomen is closed.³⁰ (Fig 7)

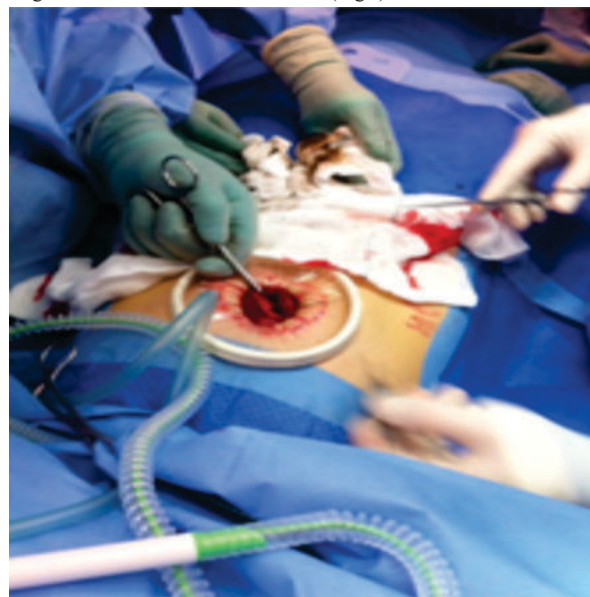


Fig 6 – Alexis retractor in use



Fig 7 – Trichobezoar specimen.

Laparoscopic approach for surgical removal is also an option. This is performed in Lloyd-Davis position with a 30° reverse Trendelenburg tilt. A gastrostomy can be done for gastric bezoars over anterior wall of stomach. The stomach contents are aspirated, bezoars mobilized inside stomach. Bezoar is then lifted with claw forceps and inserted into a Endo bag before removing it. (fig8) The stomach is then irrigated and if any residues left, are removed.

Advantage of laparoscopic over open technique is that us laparoscope could be inserted via the gastric rent proximally into the fundus and distally to the 1st part of duodenum.²²

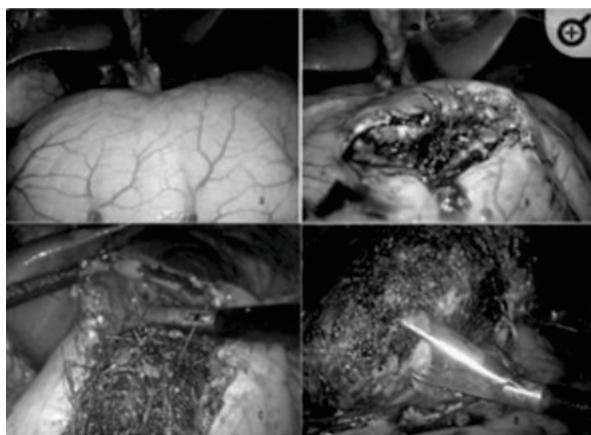


Fig 8–laparoscopic Removal Of Trichobezoar.

Prokinetic Agents

In some patients, the administration of prokinetic agents was reportedly effective in resolving the gastric bezoar because bezoar formation was a result of reduction in the evacuation of indigestible foods due to insufficient gastric motor activity therefore prokinetic agents such as itopride, mosapride, and metoclopramide may improve gastric emptying and facilitate the break-down of a bezoar by enhancing contractions of the gastrointestinal tract and increasing their frequency.¹

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