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Bezoars: Recognizing and Managing These Stubborn, Sometimes Hairy, Roadblocks of the Gastrointestinal Tract



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A bezoar is a concretion of foreign, indigestible material in the gastrointestinal tract. While bezoars are relatively rare, and often found incidentally, they can be the cause of vague symptoms like nausea and fullness, and lead to complications such as obstructions within the gastrointestinal (GI) tract. This article summarizes the types of bezoars, risk factors for formation, and management.

INTRODUCTION

A bezoar is a concretion of foreign, indigestible material in the gastrointestinal tract. While bezoars are relatively rare, and often found incidentally, they can be the cause of vague symptoms like nausea and fullness. The composition defines the bezoar classification, with the most common type being a phytobezoar (plant materials). Other types include trichobezoar (hair), pharmacobezoar (medications), and lactobezoar (milk proteins), though any foreign, indigestible material can be involved in bezoar formation. Bezoars are most commonly reported in the stomach, but can move distally and have the potential to cause small bowel obstruction or ileus. Risk factors for bezoar formation include conditions that lead to poor gastric emptying, reduced gastric acidity, and a psychiatric illnesses that leads to the consumption of indigestible material like hair. There are medical

therapies to help dissolve some bezoars, though many require endoscopic or surgical management for fragmentation and removal.

Types of Bezoars

The main types of bezoars are listed in Table 1. The most common type is the phytobezoar, where the bulk of material is made of plant fibers. Plant cell walls include cellulose and lignins as structural components, both which contribute to the fibrous and indigestible nature. Foods high in cellulose include prunes, raisins, celery, leeks, pumpkin, and green beans. Foods high in lignin include flax seeds, root vegetables, wheat bran, edible vegetable and fruit seeds, peas, and peaches.

Another contributor to phytobezoars are tannins, which are astringent compounds that bind to and precipitate proteins. In foods like unripened fruit and red wine, they cause the characteristic mouth-puckering taste. Persimmons have been identified as a particular high-risk food for causing bezoars,

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due to a persimmon skin tannin (phlobatannin) that has a strong protein binding capacity and coagulates in dilute acid. A persimmon phytobezoar is also known as a diospyrobezoar.¹ R. Moriel et al. noted a dramatic increase in incidence in 1982 in Israel, which correlated with an increase in persimmon sales in the country; 68 patients presenting to one of the 12 hospitals during a 6 month period all reported a history of persimmon intake.² High persimmon consumption is noted in South Korea, Japan, Israel, Spain, Turkey, and Southeastern United States.

The next most commonly reported type of bezoar, though still rare, is a trichobezoar, where the primary component is hair. Human hair is especially resistant to digestion; its smooth surface resists peristalsis, leading to accumulation in the gastric folds. It is most commonly found in the stomach; if it extends into the intestine, the condition is referred to as Rapunzel Syndrome. The bezoar may form after long periods of time, with one case report suggesting a 20-year history of intermittently consuming hair, 1-2 years of abdominal pain, and loss of appetite for 6 months prior to presenting.³

Medication bezoars, known as pharmacobezoars, involve either medications or components of medications accumulating in the GI tract. Medications reported to cause bezoars in case reports⁴ are listed in Table 2. Usually, pharmacobezoars occur in the setting of other patient risk factors (Table 3), though they have been reported to occur in an otherwise normal GI tract. In one case, a patient with normal GI tract motility presented with a Metamucil bezoar after mixing his usually well-tolerated dose of Metamucil in minimal liquid, resulting in a semi-solid mass that needed to be chewed down.⁵

A bezoar composed of undigested milk concretions is termed a lactobezoar and is found in young children, primarily infants. Lactobezoars were previously believed to occur only in pre-term infants being fed high-density formulas, however, there are now many cases reported for infants and toddlers involving many other milk products, including breast milk.⁶ Most common presenting symptoms are abdominal distention and non-bilious emesis, and some patients have

Table 1. Major Types of Bezoars

| Bezoar Type | Components |
|----------------|--|
| Phytobezoar | Nondigested plant fibers (cellulose, lignins), tannins |
| Diospyrobezoar | Persimmon skin tannin (phlobatannin) |
| Trichobezoar | Hair |
| Pharmacobezoar | Medications or components of medications |
| Lactobezoar | Undigested milk concretions |
| Lithobezoar | Stones |

a palpable mass. Because symptoms are non-specific and conservative measures may lead to quick resolution, prevalence may be higher than appreciated in the literature.

Other types of bezoars are extremely rare. A lithobezoar is the accumulation of stones in the digestive tract, associated with a history of pica. Individuals with pica have been reported to ingest non-nutritive substances such as clay, dirt, crayons, paint chips, chalk, etc.⁷ Other materials include parasites (*ascaris*), fungi (*Candida*), and ceramics.⁸

Risk Factors

There are several risk factors predisposing some to bezoar formation (Table 3). Gastric surgery is a key risk factor as procedures may decrease gastric motility through vagotomy or decrease acid production in the stomach, allowing for the collection of undigested material. For procedures involving antrectomy, the loss of pyloric function prevents the appropriate mixing of acid and food, resulting in unhydrolyzed fibers entering the intestine. Bezoars can take months to years to form.⁹ Case reports have reported bezoars in those having multiple procedures (including gastric banding),¹⁰ peptic ulcer surgeries (Billroth I and Billroth II),¹¹ and Roux-en-Y gastric bypass.^{12,13} Increase in bariatric surgeries has been theorized to contribute to an increased incidence in bezoars.¹⁴

Another risk factor is poor movement of food through the GI tract. Gastroparesis and other medical disorders associated with poor motility, like scleroderma, amyloidosis, and hypothyroidism,

Table 2. Medications Associated with Pharmacobezoars

| Medications | Component or Perceived Cause |
|--|---|
| Aluminum hydroxide | Large amount of aluminum becoming more desiccated in dehydration |
| Bulk laxatives (psyllium seed husks, Metamucil, Perdiem) | Concretion of fiber |
| Cholestyramine | Concretion, medication-induced constipation |
| Enteric-coated aspirin | Acetate phthalate coating accumulating in the stomach if not emptied |
| Extended-release medications like nicardipine, procainamide, verapamil | Cellulose acetate or other undigestible/slowly digesting material in the pill coating |
| Guar gum (noncellulose polysaccharide) | Expansion with liquid into a gelatinous mass |
| Sucralfate | Decreased gastric acidity leading to insoluble sucralfate complexes and collection of other gastric content |
| Opioid medications | GI dysmotility |
| Lecithin - containing capsules | Lipids slow gastric emptying |

Table 3. Risk Factors

| |
|---|
| <p>Poor Gastrointestinal Motility</p> <ul style="list-style-type: none"> • Gastric surgeries <ul style="list-style-type: none"> ○ Gastric banding, Billroth I, Billroth II, Roux-en-Y gastric bypass • Vagotomy • Gastroparesis • Scleroderma • Amyloidosis • Hypothyroidism |
| <p>Anatomic Abnormalities</p> <ul style="list-style-type: none"> • Gastric outlet obstruction • Pyloric stenosis • Duodenal web • Poor mastication |
| <p>Ingestion of Implicated Materials</p> <ul style="list-style-type: none"> • Foods with high cellulose • Medications that disturb motility or provide obstructive material • Pattern of ingestions of undigestible materials (hair, clay) |

have been associated with gastric bezoars. Insufficient fluid intake reduces production of mucus in the GI tract. Anatomic abnormalities like gastric outlet obstruction and pyloric stenosis have been associated with bezoars as well, as have other less common causes for obstruction like a duodenal web.¹⁵ Poor mastication, often due to dentures or poor dentition, may lead to larger food fragments that are difficult to digest. There is no evidence of acid suppression therapy alone resulting in bezoar formation, though it theoretically may contribute in the setting of other risk factors.

Central to the formation of phytobezoars is fiber consumption. Vegetables and fruits are most often contributory to gastric bezoars due to high cellulose content. As described above, phlobatannin in persimmons are especially difficult to digest, thus leading to the higher prevalence of bezoars in countries with high consumption.

Other types of bezoars are associated with specific risk factors. Trichobezoars are most often associated with trichotillomania (urge to pull one's hair) and trichotillophagia (urge to eat hair). Medications described above that either disturb motility or provide obstructing material can result in pharmacobezoars. Other disorders in ingestion like pica can lead to the formation of bezoars from other more rare materials.

Prevalence, Clinical Presentation and Complications

Bezoars are relatively rare, with one busy single center reporting an average of 2.5 cases per year.¹⁶ The incidence is higher in places with risk factors like persimmon consumption. A single center from Turkey reports 16.5 per year during a four year study.¹⁷

Most often, gastric bezoars are found incidentally during endoscopy or on imaging (x-ray or CT) as most bezoars do not cause symptoms. Alternatively, there may be nonspecific symptoms related to retained material in the stomach: early satiety, reduced or loss of appetite, nausea, emesis, all possibly resulting in weight loss from reduced intake.

A case series of patients with Roux-en-Y gastric bypass highlights 16 patients found to have bezoars in different parts of the GI tract: gastric pouch, jejunal limb, anastomotic sites, distal ileum, and ileocecal valve.¹³ All 16 patients had symptoms, ranging from just nausea to acute abdominal pain with nausea and vomiting.

If the bezoar is applying pressure on the gastric mucosa, it can cause gastric ulcers or bleeding. All types of bezoars may also cause gastric outlet obstruction or, if more distally, intestinal obstruction. Review of 108 case reports of patients with trichobezoars found complications to include ulceration, perforation, intussusception, and pancreatitis in one case, though these are rare and dependent on the size and extent of the trichobezoar.¹⁸

Management

The first goal of treatment is removal of the bezoar. Lactobezoars, which are relatively soft, most often improve with withholding oral feedings and gentle gastric lavage. Other bezoars require more aggressive management. The general accepted methods are (1) enzymatic disintegration, (2) endoscopic removal, and (3) surgical removal (Table 4).

Enzymatic Disintegration

Medical management through enzymatic disintegration is most effective on phytobezoars, in which plant fibers are susceptible to dissolution. Even if requiring further therapy with endoscopic

Table 4. Methods for Bezoar Removal

| | |
|---------------------------------|--|
| Enzymatic Disintegration | Dark soda Cellulase Papain Prokinetic agents |
| Endoscopic Removal | Fragmentation with snare and forceps Removal with Roth net Specialized lithotripsy |
| Surgical Removal | Aiding distal passage Surgical excision |

maneuvers or surgery, these techniques may soften the bezoar consistency and facilitate further intervention.

The most commonly reported substance used is dark soda (i.e. Coca-Cola, RC Cola, Pepsi), where the acidity from carbonic and phosphoric acid allows for fiber digestion, the sodium bicarbonate acts as a mucolytic, and carbon dioxide bubbles penetrate between fibers to increase the surface area for interaction with acid. The dose often reported is 3L over 24 hours, either through oral intake or nasogastric tube, though this can vary in clinical practice based on tolerance. Use of dark soda is also favorable in that it is cheap, easy to use, and safe. A 2013 systematic review concluded that Coca-Cola is effective in dissolving gastric phytobezoars 50% of the time; due to the hard consistency of diospyrobezoars, it was only effective 23% in this subcategory and 60.6% for all other phytobezoars.¹⁹ Combination with endoscopy resulted in resolution in 91.3% of cases.

The pH of diet sodas are not that much higher and are worth considering, especially in the setting of diabetes. Non-dark sodas have slightly higher pH. Table 5 details pH and carbohydrate content of sodas by brand, for consideration based on availability.

There are a few additive or alternative therapies to consider, especially if the patient cannot tolerate low pH due to the presence of a peptic ulcer or severe GERD. Cellulase at a dose of 3-5 grams in 300-500ml of water over 2-5 days has been utilized in the past, though seen to be inferior to soda.²⁰

Some have seen impact in combination with soda for a more resistant diospyrobezoar in the setting of acid suppression therapy with a proton pump inhibitor.^{21,22} Papain, an enzyme extracted from the *Carica papaya* plant was also reported to be used as an alternate therapy. It used to be found in Adolph's Meat Tenderizer, but is no longer so, and the dose for efficacy is not known, so this has largely fallen out of favor.²⁰ Prokinetic agents, like metoclopramide or erythromycin, may facilitate fragmentation and improve gastric emptying and has been used on occasion.²³

Endoscopic Removal

If symptoms or imaging are concerning for a bezoar or remnant material in the stomach, the next step may be endoscopic evaluation and removal. Due to the inherent risk of aspiration from remnant material in the stomach, it is strongly advised to discuss concerns with the endoscopy team and have the patient avoid oral intake for an extended period prior to endoscopy, as determined by the endoscopist. As many bezoars are found incidentally during endoscopy, the endoscopist may attempt removal during the procedure, though in many scenarios, there may not have been the appropriate precautions taken prior to procedure for airway protection to proceed during the endoscopy. In this case, the procedure may be aborted, and the patient may be scheduled for another date with interim attempts for chemical dissolution as appropriate.

There are a few common endoscopic techniques for managing a bezoar. For phytobezoars that are amenable to fragmentation, a polypectomy snare (a wire loop that is used for the removal of polyps) or endoscopic forceps can be used to break the bezoar into smaller pieces. Lavage with soda or cellulase may aid in the fragmentation of the bezoar prior to endoscopy. Small pieces may pass through the GI tract. For remaining pieces or larger pieces that could not be fragmented, one option is to collect the material with a Roth net and remove it with the endoscope.

Less common techniques have been reported. A proposed technique is to use a bezoaratum, a specialized device that involves a snare connected to a handle for easier lithotripsy of the bezoar.²⁴ For a particularly firm, calcified bezoar in the rectum

Table 5. Carbohydrate Content and pH of Sodas Based on Brand

| Type | Brand | pH | Carbs (g/L) |
|--------|-----------------------|------|-------------|
| Dark | Barq's Root Beer | 4.11 | 124 |
| | Dr. Pepper | 2.88 | 108 |
| | Pepsi | 2.39 | 116 |
| | Pepsi Wild Cherry | 2.41 | 118 |
| | RC Cola | 2.32 | 121 |
| | Tab | 2.72 | 0 |
| | Coca-Cola Cherry | 2.38 | 118 |
| | Coca-Cola Classic | 2.37 | 110 |
| Orange | Crush Orange | 2.87 | 206 |
| | Fanta Orange | 2.82 | 79 |
| Clear | 7UP | 3.24 | 108 |
| | Canada Dry Ginger Ale | 2.82 | 102 |
| | Mountain Dew | 3.22 | 130 |
| | Sprite | 3.24 | 104 |
| Diet | Coca-Cola Diet | 3.1 | 0 |
| | Coke Zero | 2.96 | 0 |
| | Diet 7UP | 3.48 | 0 |
| | Diet Dr. Pepper | 3.2 | 0 |
| | Diet Pepsi | 3.02 | 0 |
| | Pepsi Max | 2.74 | 0 |
| | Diet Mountain Dew | 3.18 | 0 |

that was refractory to routine endoscopic removal, a team used cholangioscopy-guided electric hydraulic lithotripsy (EL) to fracture the bezoar enough for piecemeal removal with Roth Net.²⁵

Surgical Removal

For bezoars that cannot be fragmented and endoscopically removed, or are too difficult to access endoscopically, surgery may be necessary. Trichobezoars are especially resistant

to fragmentation; in one review, endoscopy was attempted in 40 of 108 cases, and only 2 (5%) were successful; the rest required surgery.¹⁸ Depending on location, the bezoar may be amenable to being milked passed the ileocecal valve, from where it may be able to pass naturally through the rectum. Most are surgically excised, either through traditional open laparotomy or less invasive laparoscopic approach when possible. Complications from the bezoar like ulcerations and signs of necrosis may require segmental resection.²⁶

Secondary Prevention

The second goal of management after removal is prevention of recurrence by identifying and addressing risk factors. If there are comorbidities concerning for gastric dysmotility, the patient will likely benefit from a gastroparesis diet of small frequent meals, reduced whole fiber, and emphasis on liquids. Handouts for patient education are available online.^{27,28} For phytobezoars, they may benefit from reducing the amount of causative fibrous foods, especially persimmons if found to have a diospyrobezoar. For pharmacobezoars, causative medications may have alternative therapies and dose adjustments to consider. Those with trichobezoars may benefit from psychiatric assessment.

CONCLUSION

Given their rarity, many clinicians may never encounter a patient with a bezoar. Yet it is prudent to be aware of predisposing factors and consider bezoars in the differential diagnosis of nonspecific GI complaints. For primary care physicians, the key is to trial methods for enzymatic disintegration, if appropriate, consider endoscopic evaluation, and be aware that many require surgical management. Long-term management after a bezoar is diagnosed requires addressing predisposing factors as possible. ■

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