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Review article

Gastrointestinal phytobezoar after bariatric surgery: systematic review

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Abstract Bezoars are collections of undigested foreign material that accumulate in the gastrointestinal tract. The most common are phytobezoars, which are formed from plant fibers, especially those related to the ingestion of persimmon. Patients who undergo abdominal surgery, including bariatric surgery for obesity, and particularly gastrectomy, are prone to bezoar formation due to reduced gastric motility, loss of pyloric function, and hypoacidity. Bezoars can form months to years postoperatively. Our objective was to review the published literature regarding phytobezoar formation after bariatric surgery. We investigated the entire scientific literature on phytobezoars as a complication after bariatric surgery using PubMed and Embase searches of all reports published to date. We used the following keywords: "phytobezoars" or "bezoars" and "bariatric surgery" or "laparoscopic adjustable gastric band" or "laparoscopic sleeve gastrectomy" or "Roux-en-Y gastric bypass" or "single anastomosis gastric bypass" or "biliopancreatic diversion." Seventeen eligible articles were included in the study. We provide an overview of the incidence, classification, and manifestations of bezoar formation as a rare, late morbidity of bariatric surgery. Treatment options include chemical enzyme therapy, endoscopic dissolution and removal, or surgery. Nutritional counseling regarding bezoar formation and prevention of recurrence after bariatric surgery should emphasize changing eating habits, including sufficient drinking and chewing and avoiding the overindulgence of foods with high-fiber content, especially citrus pith and persimmons. Clinicians should be aware of this potential rare complication. Additional studies are needed to examine the eating habits and food choices of bariatric patients with bezoar complications and to elucidate more clearly the risk factors for this pathologic condition. (Surg Obes Relat Dis 2016;▮:00–00.)

Keywords: Bezoars; Phytobezoars; Bariatric surgery; Nutritional counseling

Bezoars are collections of undigested foreign material that accumulate in the gastrointestinal tract of both humans and animals [1]. Phytobezoars are the most common type of bezoars found in the alimentary tract and are formed from plant fibers such as cellulose, hemicellulose, lignin, and fruit tannins [2]. The majority of patients who experience bezoars have some history of abdominal surgery; however, additional common factors are poor mastication, overindulgence of foods with high-fiber content, and delayed gastric emptying [1]. The interval between surgery and bezoar detection can be several months to many years [1]. Major complications of bezoars include alimentary tract

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obstruction, gastric perforation, gastric ulcer, and gastritis [3]. Clinical manifestations can vary depending on the location of the bezoar in the gastrointestinal tract. Patients may be asymptomatic, or they may present with an acute surgical problem such as bowel obstruction, peritonitis, or hollow viscus perforation [2].

Bariatric surgery currently is the most effective treatment for morbid obesity and has gained wide acceptance as a treatment for severe obesity and its related co-morbidities [3,4]. Several accepted bariatric surgeries are performed commonly, including laparoscopic adjustable gastric banding (LAGB), laparoscopic sleeve gastrectomy (LSG), laparoscopic Roux-en-Y gastric bypass (RYGB), laparoscopic biliopancreatic diversion with or without duodenal switch [5], and single anastomosis gastric bypass [6]. Patients who have undergone bariatric surgery are prone to bezoar formation [4] due to reduced gastric motility, loss of pyloric function, and hypoacidity [3]. The increasing number of bariatric surgeries for the treatment of morbid obesity has contributed to the increased incidence of intestinal obstruction secondary to bezoars [2]. Accordingly, we reviewed and summarized the scientific literature on bezoar occurrence after bariatric surgery, in accordance with the proposal for reporting Meta-analysis of Observational Studies in Epidemiology guidelines for meta-analyses and systematic reviews of observational studies.

Methods

Literature search strategy

A search of the medical literature was conducted by 2 researchers to identify publications describing phytobezoar occurrence after bariatric surgery. To identify relevant articles, we investigated the entire scientific literature through an online search of the PubMed and Embase databases. First, we performed an Embase limited search with Emtree (search by major focus) using the following combinations of search terms: "bezoar" or "phytobezoar" and "bariatric surgery" or "gastric band" or "sleeve gastrectomy" or "stomach bypass" or "biliopancreatic bypass." Then we performed a PubMed search, using the medical subject headings (MeSH) with the combination of search terms "bezoars" and "bariatric surgery." Finally, we performed a wider PubMed search using combinations of search terms such as "bezoar" or "phytobezoar" and "bariatric surgery" or "LAGB" or "gastric band" or "sleeve gastrectomy" or "LSG" or "SG" or "stomach bypass" or "RYGB" or "gastric bypass." The last of these searches was performed July 3, 2016. Initially, titles of the identified studies were screened, and abstracts of the relevant studies were read. Articles were included if they presented case reports or a cohort of case reports of bezoar occurrence after bariatric surgery. Abstracts and full texts were screened for inclusion by all authors. Any uncertainties about inclusion were discussed.

Results

Literature search

The literature search yielded 81 titles (Fig. 1). Initial screening and exclusion of duplicates revealed 31 studies that reported bezoar complication after gastrointestinal surgeries. We excluded 9 reports of any type of bezoars other than phytobezoars [7–15], 2 articles published in non-English or Spanish language journals [16,17], 1 review article [18], 1 video case report [19], and 1 study of other gastrointestinal surgeries (unrelated to bariatric surgery) [20]. After exclusion of nonrelevant publications, 17 articles of 19 case reports were included [4,21–36].

Classification of bezoars

Bezoars are accumulations of foreign substance in the stomach or intestine and are considered to be the most common foreign objects that can appear inside the digestive tract [1]. This undigested mass can be formed by a variety of materials that are ingested intentionally or accidentally, including plant materials such as fibers, skins, and seeds of vegetables and fruits, but also can be formed by ingested hair, medications, and milk protein in milk-fed infants [37]. Bezoars are classified according to their original material [38]. Trichobezoars consist mostly of hair [38] and generally are seen in individuals with trichophagia, a compulsive psychiatric disorder that occurs during childhood and early adulthood [1]. Pharmacobezoars are collections of medications or medication vehicles [37]. Lactobezoars are formed by an undigested mass of milk and mucus [37], and these generally occur in low-birth-weight newborns as a result of the consumption of concentrated baby formulas [1].

Phytobezoars are the most common type of bezoars, consisting of nondigestible food residue such as cellulose, hemicelluloses [1], lignin, and fruit tannins [39]. Most case reports of phytobezoar occurrence are from Mediterranean countries where diets are commonly rich in persimmons, oranges, and vegetables [40]. Worldwide the most common phytobezoar encountered is related to the ingestion of persimmon, which contains the soluble tannin shibuol [39] that upon reaction with stomach acid polymerizes and forms a conglomerate [37]. Several other fruits and vegetables, however, also have been associated with phytobezoar formation, including celery, pumpkin, grape peels, raisins, prunes [37], citrus pith, tomato skin [39], pineapple [3], sabra, pomegranate, sunflower seeds, watermelon seeds, popcorn [41], coconut [30], berries, figs, apples, potato peels, Brussels sprouts, sauerkraut, and green beans [42].

Causes of bezoar formation

Previous gastrectomy is the most common risk factor for bezoar formation [43], which may occur 9 months to 30 years after surgery [1]. Incidence of postgastrectomy