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Analysis of the Clinical Characteristics and Endoscopic Features of Phytobezoar-Induced Ulcers and Gastric Ulcers: A Single-Center Retrospective Study in China

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Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Background: Bezoar-induced ulcers are the most common complication of bezoars, and they may cause severe complications such as gastrointestinal perforation and bleeding. We analyzed the clinical characteristics and endoscopic features of bezoar-induced ulcers and gastric ulcers, to make a diagnosis and administer appropriate treatment for bezoars and bezoar-induced ulcers as soon as possible to reduce the incidence of complications.

Material/Methods: Records from 163 patients with bezoar-induced ulcers (Group A) and 155 patients with gastric ulcers (Group B) from 2014-2025 were collected in the study. We compared demographic and clinical characteristics, endoscopic data, treatments, and complications between the 2 groups.

Results: Bezoar-induced ulcers were more common in women and were more prevalent in the autumn and winter seasons. Gastric ulcers were more common in men. Abdominal pain was more common in Group A (92.0% vs 35.5%). The mean size of the bezoar-induced ulcers was 15.86±10.94 mm, and they were more common in the gastric angle. Most patients had multiple bezoar-induced ulcers but they were often superficial enough to be healed with a short treatment course. The mean length of the gastric ulcers was 10.44±7.78 mm, and they were more common in the gastric sinus. These ulcers were mostly solitary but were difficult to heal, requiring a long treatment course.

Conclusions: Bezoar-induced ulcers and gastric ulcers can be distinguished based on different demographic and clinical characteristics and endoscopic features. Bezoar-induced ulcers are mostly multiple and superficial and can be healed with a short course of treatment.

Keywords: **Bezoars • Endoscopy • Ulcer**

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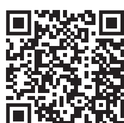

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Introduction

The term "bezoar" refers to concretions formed from undigested or partially digested material that have built up within the gastrointestinal tract [1]. Although the stomach is the primary site for their formation, bezoars can also develop in other regions, including the esophagus, duodenum, small intestine, and colon [2]. The reported incidence of bezoars is 0.4-1.0% [3]. Based on their constituent materials, bezoars are classified into several types. These include phytobezoars, which are primarily formed from indigestible plant fibers; trichobezoars (Rapunzel syndrome), composed of hair; lactobezoars, made up of milk components like lactose and casein; pharmacobezoars, resulting from accumulated medications such as aspirin or sucralfate; and bezoars formed from various foreign bodies [2,4]. Phytobezoars are the most common type of bezoars [4].

Previous studies have indicated that the formation of bezoars is closely associated with gastric functional abnormalities. Impaired gastrointestinal motility and delayed gastric emptying, as well as hypochlorhydria or achlorhydria, may increase the risk of bezoar formation and subsequently predispose patients to gastric ulcer development. Bezoars may cause abdominal pain, nausea, and vomiting, and in severe cases, lead to gastric mucosal injury and ulceration, potentially exacerbating gastroesophageal reflux symptoms. However, gastroesophageal reflux disease does not necessarily occur in patients with bezoars, and the causal relationship between these conditions requires further clarification and literature support [5,6]. The severity of bezoar-induced ulcers largely depends on the bezoar's location, type, size, and duration of disease. Clinically, bezoars may cause pyloric obstruction or intestinal obstruction and result in pressure-related mucosal ulceration. As the condition progresses, severe complications such as gastrointestinal perforation and bleeding may occur [6,7]. Therefore, our study aims to compare these 2 types of ulcers in terms of demographic and clinical characteristics, endoscopic features, complications, and treatments, with the aim of reducing misdiagnoses or missed diagnoses of bezoars, preventing complications, and providing optimal treatment plans.

Typically, the treatment of gastric ulcers involves a combination of acid suppressants and protective agents for the gastric mucosal system, and the course of treatment is 6-8 weeks. However, there is no unified standard for the treatment of bezoar-induced ulcers. Our study will aid in standardizing the treatment of bezoar-induced ulcers based on the similarities and differences between the 2 diseases.

Material and Methods

Patients

This study is a single-center retrospective analysis. From October 2014 to April 2025, 247 of the 59 773 patients (0.413%) who underwent endoscopy (using a GIF-HQ290 or GIF-Q260 endoscope, Olympus Optical Co., Ltd., Tokyo, Japan) in our medical center were diagnosed with bezoars. In addition, 26 patients were diagnosed with bezoars by abdominal computed tomography (CT) without endoscopy. All together, 163 patients with bezoar-induced ulcers among 273 cases of bezoars were selected as Group A, and 155 patients with gastric ulcers confirmed by endoscopy were selected as Group B, concurrently. Patients with malignant ulcers, confirmed by pathology, were excluded from the study.

For the patients in Group A, most of the patients with phytobezoars were treated with endoscopic lithotripsy, which employed a Shanghai WILSON Bezoars Cutting Loop Sleeve to cut the bezoars into pieces, combined with drug lithotripsy. Drug lithotripsy was performed by giving the patient 5% sodium bicarbonate (250 mL or 500 mL/day) orally or via nasogastric lavage injection along with intravenous administration of proton pump inhibitors (PPIs) and glucose in the initial stage of the study (about 5 years). On the basis of the early data, we retrospectively found that the efficacy of drug lithotripsy was comparable to that of endoscopic lithotripsy combined with drug lithotripsy. However, drug lithotripsy as sole treatment had a lower average hospitalization period, average hospitalization cost, second endoscopy rate, and average endoscopic operation time, along with higher patient tolerance [5]. Therefore, we chose drug lithotripsy alone in the later stage of the study (about 6 years), with endoscopic lithotripsy added only when drug lithotripsy failed after 2-4 days.

Moreover, patients were asked to fast for 2-6 days. They were then allowed to eat after the phytobezoars were dissolved but told to take acid suppressants, PPIs, and the gastric mucosal protective agent rebamipide, once the absence of bezoars and intestinal obstruction was confirmed by gastroscopy and abdominal CT. The patients in Group B were typically treated with PPIs and gastric mucosal protective agents alone.

Study Design

This study received approval from our institution's internal review board (IRB-AF-37-02), and informed consent was obtained from all participating patients. We collected and analyzed data related to demographic characteristics, previous history (medical and surgical history, disease), symptoms, size and location of bezoar-induced ulcers and gastric ulcers, complications, and therapy methods.

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Statistical Analysis

Data analysis was performed with IBM Statistical Package for Social Sciences (SPSS), Version 26. Continuous variables, expressed as median (range) or mean±standard deviation, were compared using independent *t*-tests. Categorical variables, presented as frequencies and proportions, were analyzed using chi-square (χ^2) tests. A *P*-value of less than 0.05 was defined as the threshold for statistical significance.

Results

Baseline Characteristics and Causative Factors

In Group A, the patients had a median age of 63 years (range: 24-90 years). This group consisted of 46 male and 117 female participants, yielding a male-to-female ratio of approximately 1: 2.54. Conversely, in Group B, the median age was also 63 years (range: 28-88 years), with 113 male and 42 female patients, resulting in a male-to-female ratio of about 1: 0.37. Statistical analysis revealed no significant difference in age between the 2 groups (*t*=-.542, *P*=0.588), while a statistically significant difference was found in sex distribution (*P*<0.001). In terms of onset time, the incidence rate in Group A during autumn and winter was significantly higher than that in Group B in the current study (autumn and winter: 82.2% vs 56.1%) (*P*<0.001). The details are shown in **Table 1**.

Univariate analysis results showed that the common causative factors that were significantly different between Group A and Group B included diabetes mellitus status (41.1% vs 25.2%, *P*=0.003), smoking history (16.6% vs 47.1%, *P*<0.001), drinking history (13.5% vs 36.8%, *P*<0.001), and nonsteroidal anti-inflammatory drug (NSAID) use (20.9% vs 31.6%, *P*=0.029). The details are shown in **Table 1**. However, binary logistic regression analysis results showed that only patient sex and seasonal distribution were significantly different between the 2 groups (*P*<0.005). Binary logistic regression analysis indicated no significant difference in diabetes, smoking consumption, alcohol consumption, and NSAID use between the 2 groups. The details are shown in **Table 2**.

Clinical Characteristics and Complications

There were some asymptomatic patients in both groups (1.23% vs 14.8%). These patients were most often diagnosed during endoscopy. The common symptoms in the 2 groups included abdominal pain (92.0% vs 35.5%), abdominal distension (47.2% vs 25.1%), nausea (68.1% vs 23.9%), vomiting (43.6% vs 15.5%), acid reflux (55.8% vs 27.8%), and heartburn (45.4% vs 23.3%). These symptoms were more common in Group A. Melena (2.5% vs 36.1%) was more common in Group B (*P*<0.001 for all). The most common complication in Group A was gastric outlet obstruction (87/163, 53.4%), followed by gastric mucosal erosion (20/163, 12.3%) and intestinal obstruction (11/163, 6.7%). The most common complication in Group B was upper gastrointestinal bleeding (61/155, 39.4%). The details are shown in **Table 3**.

Endoscopic Data

Among all the patients with bezoars, 93 patients (93/273, 34.1%) were found to have round or ovoid masses with air bubbles and a mottled appearance ranging from 1.5 to 12 cm in diameter via endoscopy, as shown in **Figure 1A, 1B**. The most common location of bezoars was the gastric antrum (127/273, 46.5%), followed by the gastric body (98/273, 35.9%). A total of 163 patients (163/273, 59.7%) presented with bezoar-induced ulcers, which were mostly multiple ulcers (105/163, 64.4%) and more frequently in the gastric angle (110/163, 67.5%). The mean length of the ulcers was 15.86±10.94 mm (2-50 mm), with 50 ulcers (30.7%) having a length ≥20 mm. Their endoscopic morphological features were as follows: the ulcers were mostly relatively regular and round or oval; some larger ulcers showed irregular shapes; and they were relatively shallow, with flat and clear boundaries covered with white coating at the base, as shown in **Figures 1C, 1D and 2A**.

A total of 155 patients had gastric ulcers. The majority of these ulcers were single ulcers (104/155, 67.1%) and were located in the gastric antrum (102/155, 65.8%). The mean length of the gastric ulcers was 10.44±7.78 mm (2-40 mm), with 19 ulcers (12.3%) having a length ≥20 mm. Their endoscopic morphological features were as follows: they were mostly relatively regular and round or oval; and they were relatively deep and had a base covered with a yellowish-white coating or blood scab, with the surrounding mucosa being inflamed, swollen, or ulcerated, as shown in **Figure 1E, 1F**.

There were significant differences in the number of ulcers (*P*<0.001), the mean ulcer length (*t*=4.892, *P*<0.001), and the ulcer location (*P*<0.001) between the 2 groups. The details are shown in **Table 4**.

Treatment and Efficacy

In this study, all 273 bezoars were phytobezoars. A total of 173 cases (63.4%) were successfully eliminated via drug lithotripsy (5% sodium bicarbonate and PPIs), 96 cases (35.2%) were treated with endoscopic lithotripsy and drug lithotripsy, and 4 cases (1.4%) were treated with surgery. Three patients with small bowel obstruction underwent small bowel dissection for foreign body removal, and 1 patient with intestinal obstruction and gastrointestinal perforation underwent open exploration and gastrostomy.

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Table 1. Demographic characteristics and risk factors of bezoar-induced ulcers and gastric ulcers.

	Bezoar-induced ulcers (N=163)	Gastric ulcers (N=155)	*P*
Age	61.58±12.92 y	62.28±12.09 y	0.588
<40 y	9 (5.5%)	4 (2.6%)	
41-49 y	10 (6.1%)	18 (11.6%)	
50-59 y	39 (23.9%)	41 (26.5%)	
60-69 y	68 (41.7%)	54 (34.8%)	
≥70 y	37 (22.7%)	38 (24.5%)	
Sex (Female/Male)	117/46 (2.54: 1)	42/113 (0.37: 1)	**0.000**
Season			**0.000**
Spring or summer	29 (17.8%)	68 (43.9%)	
Autumn or winter	134 (82.2%)	87 (56.1%)	
Risk factors			
Hypertension	89 (54.6%)	86 (55.5%)	0.874
Diabetes	67 (41.1%)	39 (25.7%)	**0.003**
Gastrectomy[a,b]	5 (3.1%)	1 (0.6%)	0.113
Hypothyroidism	7 (4.3%)	3 (1.9%)	0.228
Peptic ulcer	8 (4.9%)	10 (6.5%)	0.552
Constipation	9 (5.5%)	12 (7.7%)	0.425
Smoking	27 (16.6%)	73 (47.1%)	**0.000**
Alcohol	22 (13.5%)	57 (36.8%)	**0.000**
NSAID use	34 (20.9%)	49 (31.6%)	**0.029**
HP	73 (44.8%)	74 (47.7%)	0.597

Notes: ([a]) In Group A: 5 patients who were evaluated by our investigators had undergone gastrectomy. Of these 5, 3 patients underwent major gastrectomy for gastric adenocarcinoma (2 patients were Billroth-I and 1 patient was Billroth-II); 1 patient underwent dissection and distal gastric resection and Billroth-I gastrointestinal anastomosis for gastric ulcer with hemorrhage; and 1 patient underwent gastric diversion for type 2 diabetes mellitus. ([b]) In Group B: 1 patient underwent major gastrectomy for gastrointestinal stromal tumor. NSAID, nonsteroidal anti-inflammatory drug; HP, *Helicobacter pylori*.

Table 2. Risk factors of bezoar-induced ulcers and gastric ulcers in binary logistic regression analysis.

	β	*P*
Age	0.022	0.118
Sex	1.880	**0.000**
Season	-1.338	**0.001**
Hypertension	-0.397	0.299
Diabetes	-0.339	0.348
Smoking	0.479	0.329
Alcohol	-0.375	0.433
NSAID use	0.476	0.373
HP	0.579	0.112

NSAID, nonsteroidal anti-inflammatory drug; HP, *Helicobacter pylori*.

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Table 3. Symptoms and complications of bezoar-induced ulcers and gastric ulcers.

	Bezoar-induced ulcers (N=163)	Gastric ulcers (N=155)	*P*
Symptoms			
Asymptomatic	2 (1.23%)	23 (14.8%)	**0.000**
Abdominal pain	150 (92.0%)	55 (35.5%)	**0.000**
Abdominal distension	77 (47.2%)	39 (25.1%)	**0.000**
Nausea	111 (68.1%)	37 (23.9%)	**0.000**
Vomiting	71 (43.6%)	24 (15.5%)	**0.000**
Acid reflux	91 (55.8%)	43 (27.8%)	**0.000**
Heartburn	74 (45.4%)	36 (23.3%)	**0.000**
Anorexia	86 (52.8%)	64 (41.3%)	0.041
Melena	4 (2.5%)	56 (36.1%)	**0.000**
Hematemesis	5 (3.1%)	13 (8.4%)	0.100
Weight loss	6 (3.7%)	15 (9.7%)	0.031
Complications			
Gastric outlet obstruction[a]	87 (53.4%)	10 (6.5%)	**0.000**
Bleeding[b]	7 (4.5%)	61 (39.4%)	**0.000**
Obstruction[c]	11 (6.7%)	2 (1.3%)	0.014
Perforation[d]	1 (0.6%)	2 (1.3%)	0.533

Notes: ([a]) Gastric outlet obstruction: Patients presented with nausea and vomiting, and endoscopy or abdominal CT suggested signs of pyloric obstruction and gastric retention. ([b]) Bleeding: patients presented with black stool or vomiting blood, and the results of vomitus occult blood or stool occult blood tests were positive. ([c]) Obstruction: Patients presented with decreased or lack of defecation and gas evacuation, and abdominal CT suggested signs of mixed-density shadow, gas, fluid or gas-liquid level in the intestines. ([d]) Perforation: Patients presented with peritoneal irritation and signs of free gas in the abdominal cavity on abdominal CT. CT, computed tomography.

After bezoars were successfully eliminated, 163 bezoar-induced ulcers were treated with PPIs (omeprazole, pantoprazole, or esomeprazole) and gastric mucosal protective agents (rebamipide, teprenone, or gefarnate) for 6-8 weeks. Bezoar-induced ulcers can be healed with a short treatment, as shown in **Figure 2B-2F**. After 1 to 2 weeks, 62 patients were reexamined by endoscopy. Of these, 9 patients were cured, and 51 patients' ulcers were obviously reduced.

A total of 155 gastric ulcers were treated with PPIs and gastric mucosal protective agents for 6 to 8 weeks. After 8 weeks, 64 patients were reexamined via endoscopy; 32 patients were cured, and 32 patients presented with obviously reduced ulcers.

Discussion

Currently, the diagnosis of bezoars mainly depends on history, clinical symptoms, and endoscopic manifestations. In terms of causes, history of eating high-tannin food is the culprit in the formation of many bezoars, according to Gayà et al, who also report that the most common component of phytobezoars is persimmon [8]. However, in our study, the most common component of the bezoars we saw was hawthorn (200/273,73.3%). Some diseases that can reduce gastric motility can ultimately result in delayed gastric emptying as well, such as diabetes, gastric anatomical abnormalities, gastroparesis, and previous history of gastric surgery [5,9,10].

The symptoms we saw included various gastrointestinal symptoms. The most common symptoms in the literature include abdominal pain, nausea, vomiting, early satiety, anorexia, and weight loss [5,10].

The bezoars visualized via endoscopy were single masses or multiple masses in the stomach, with various colors according to the different components (yellow, green, black, beige, or other colors) [5]. Most bezoar-induced ulcers are relatively easy to diagnose on the basis of the above criteria; however, smooth bezoars are asymptomatic and are incidentally found in the stomach, or even in the small intestine. It is therefore difficult for patients with smooth bezoars to receive timely

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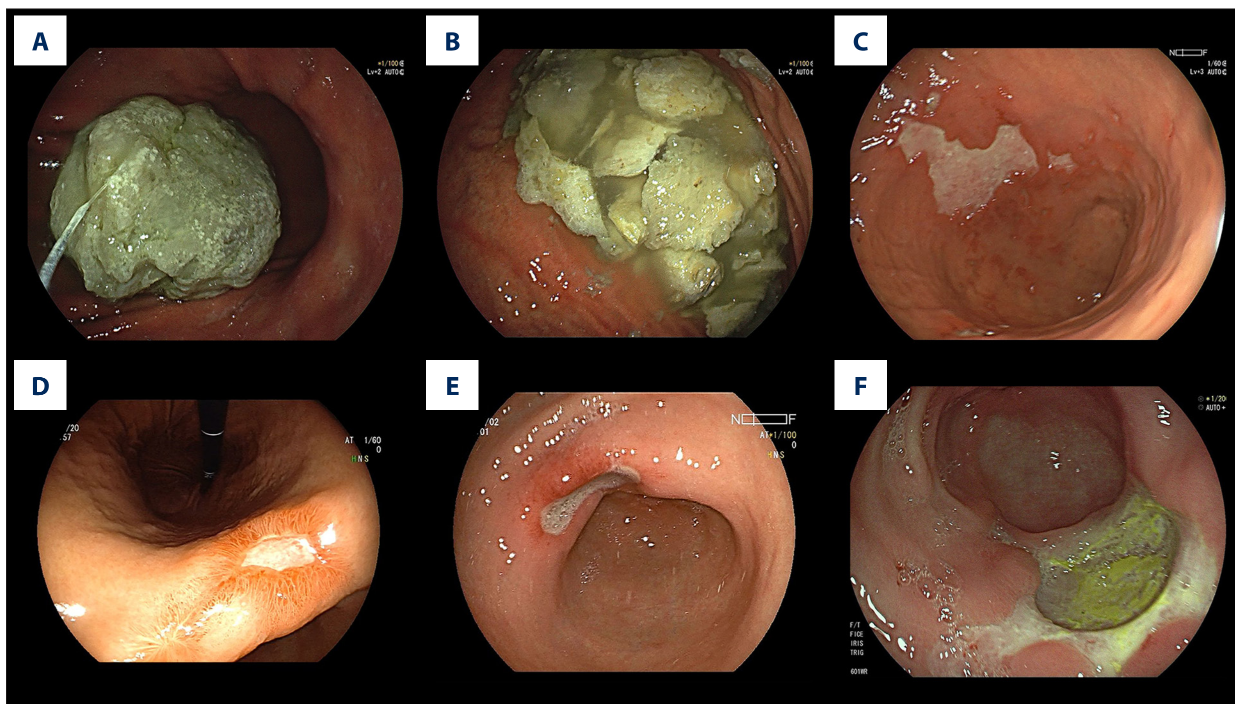

Figure 1. Endoscopic features of phytobezoars, bezoar-induced ulcers, and gastric ulcers (white light). (**A**) Endoscopy shows a single gray mass in the stomach. (**B**) The phytobezoar's fragmentation by the endoscopic device is shown. (**C**) Endoscopy shows 4 shallow bezoar-induced ulcers in the gastric body. (**D**) Endoscopy shows a solitary bezoar-induced ulcer in the gastric angle. (**E**) Endoscopy shows a solitary deep gastric ulcer covered with a yellowish-white coating in the gastric sinus. (**F**) Endoscopy shows a solitary gastric ulcer covered with a white coating in the gastric sinus.

Table 4. Endoscopic features of bezoar-induced ulcers and gastric ulcers.

	Bezoar-induced ulcers (N=163)	Gastric ulcers (N=155)	*P*
Number			**0.000**
Singular ulcers	58 (35.6%)	104 (67.1%)	
Multiple ulcers	105 (64.4%)	51 (32.9%)	
Size (cm)	15.86±10.94	10.44±7.78	**0.000**
Location[a]			**0.000**
Angle	110 (67.5%)	45 (29.0%)	
Sinus	58 (35.6%)	102 (65.8%)	
Body	41 (25.2%)	30 (19.4%)	
Others	13 (8.1%)	1 (0.6%)	

Notes: ([a]) Multiple ulcers were recorded in multiple locations.

diagnosis and treatment. Some patients have digestive system symptoms, but they are not diagnosed with bezoar disease at their first gastroscopy due to the covering of food over the bezoar or the discharge of the bezoar from the stomach. These patients may be diagnosed after a second gastroscopy or auxiliary diagnosis with abdominal CT, which will reveal a bezoar as a well-defined round or oval shape with a honeycomb-like mixed-density mass. These bezoars can slide back and forth gastrointestinally on the basis of the patient's position [11,12].

For patients who have digestive system symptoms in the absence of bezoar visualization, it is important to be vigilant when gastroscopy reveals ulcers. We should ask about the patient's medical history in detail and pay attention to various

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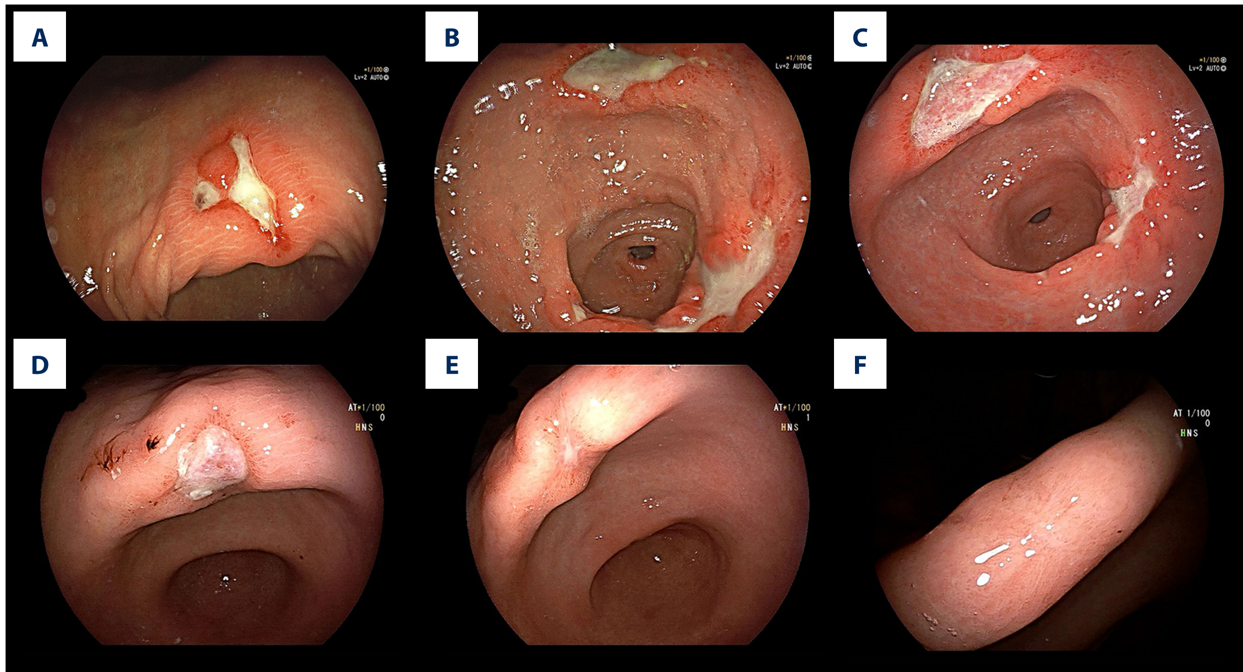

Figure 2. Endoscopic features of bezoar-induced ulcers and treatment efficacy (white light). (**A**) Endoscopy shows a solitary irregular bezoar-induced ulcer in the gastric angle. (**B**) Endoscopy shows 2 irregular bezoar-induced ulcers in the gastric angle and gastric antrum. (**C**) After treatment for 3 days, endoscopy shows the ulcers in the gastric antrum becoming shallower and smaller, and the ulcers in the gastric angle becoming shallower. (**D**) Endoscopy shows a solitary bezoar-induced ulcer in the gastric angle. (**E**) After treatment for 6 days, endoscopy shows the ulcers becoming shallower and smaller. (**F**) After treatment for 2 months, endoscopy shows that the ulcers have healed. (Panels **B and C** belong to one patient, and Panels **D-F** belong to a different patient.)

risk factors, such as diabetes status, history of gastric surgery, combined symptoms, imaging manifestations, and endoscopic ulcer manifestations. Therefore, we can make a diagnosis and administer appropriate treatment as soon as possible to reduce the incidence of complications.

In this study, bezoars and bezoar-induced ulcers were more common in women, while gastric ulcers were more common in men. These 2 types of ulcers are common in 60 to 69-year-old patients, but the incidence rate of bezoar-induced ulcers varies according to time of year; and is significantly higher than that of gastric ulcers during autumn and winter. In terms of risk factors, our univariate analysis results showed that bezoar-induced ulcers were likely to be associated with diabetes (likely due to delayed gastric emptying), whereas gastric ulcers are likely to be associated with a history of smoking, alcohol consumption, and NSAID use, all of which damage the gastric mucosa ($P<$ 0.05 for all). Our results were similar to those of Lin et al [10]. However, binary logistic regression analysis results showed that only patient sex and seasonal distribution were significantly different between the 2 groups ($P<0.005$), which was similar to the findings in our previous studies that bezoars had a higher prevalence among female patients and in the autumn and winter.

Bezoar-induced ulcers form primarily as a result of 2 factors: sustained pressure exerted by the bezoar on the gastric lining and the subsequent prolonged contact of the compromised mucosa with acidic gastric secretions [13]. Iwamuro et al [14] described a gastric ulcer rate of 64.5% and Lee et al [15] reported a gastric ulcer rate of 41.2% in patients with bezoars. However, the incidence of gastric ulcers in Western countries appears to be lower. Ladas et al [16] reported a gastric ulcer rate of 21.7%. Similarly, Gökbulut et al [17] reported a gastric ulcer rate of 27% and a duodenal ulcer rate of 11% in a series of 66 bezoars.

Liu et al [18] observed that bezoars more commonly cause solitary gastric ulcers, with the majority of ulcers measuring less than 2 cm in maximum diameter. In a study by Meng et al, ulcers were observed in 70.1% of phytobezoar cases, most frequently located at the gastric angle, with the gastric antrum being the second most common site [13]. Bezoar-induced ulcers of a long diameter <2 cm were more common than those with a diameter ≥2 cm, and ulcers rapidly shrank after the removal of the bezoars [13]. Our findings indicated ulceration in 59.7% of our phytobezoar patients, with the morphological characteristics of these ulcers being consistent with those previously described by Meng et al [13]. However, in our observations,

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bezoar-induced ulcers were mainly present as multiple ulcers. We found that the number of ulcers was not significantly associated with the number, size, or location of the bezoars. In the future, we will study whether ulcers are related to the shape of bezoars or the duration of abdominal pain caused by mucosal compression by bezoars. Our research found that, for our sample, bezoar-induced ulcers were mostly multiple and superficial and were able to be healed with a short treatment. Gastric ulcers were more frequent in the gastric sinus, and they were mostly solitary and difficult to heal, thus requiring a long treatment course.

The treatment of bezoars mainly involves endoscopic treatment, drug therapy, and surgical treatment [10,19]. Our early study of 165 cases of phytobezoars [5] revealed that drug lithotripsy is the preferred effective and safe treatment option for phytobezoars. In this study, 148 phytobezoars were cured with drug lithotripsy. The following 2 pharmacological approaches play important roles in the treatment of phytobezoars: beverages that release carbon dioxide and PPIs or gastric mucosal protective agents. Solutions of sodium bicarbonate, cola, pineapple juice, or similar beverages are inexpensive, effective, safe, and have few adverse effects [20]. The mechanism involves the release of carbon dioxide from a solution under the action of gastric acid, which promotes the softening and disintegration of phytobezoars [21]. It is recommended to use 5% sodium bicarbonate at a dosage of 250 mL/d or 500 mL/d, which should be taken orally or injected through a nasogastric tube or endoscope, and divided into doses taken 4 to 5 times a day.

PPIs and gastric mucosal protective agents act via the following mechanisms: PPIs can alter the pH value in the patient's stomach to favor the destruction of tannic acid and promote the dissolution of bezoars, thereby reducing local ischemia resulting from prolonged compression of the gastric mucosa by bezoars. At the same time, PPIs can inhibit gastric acid secretion by inactivating HK-ATPase, thereby reducing the further stimulation of gastric acid on the damaged mucosa. Gastric mucosal protective agents promote ulcer healing by enhancing the "defense/repair factors" of the gastric mucosa, such as various mucus barriers. In our study, PPIs and rebamipide were used to treat the phytobezoars and bezoar-induced ulcers until the ulcers healed.

Insufficient gastric acid secretion or the use of acid-suppressive medications may be one of the contributing factors to the formation of phytobezoars and may potentially increase the risk of bezoar recurrence. However, the formation of bezoars requires both tannic acid and food, so patients are kept fasting until the bezoar disappears, and subsequently are told to avoid foods containing tannic acid to decrease the risk of recurrent bezoars.

Currently no unified or standardized bezoar-induced ulcer treatment guidelines have been issued in China or abroad. We administered PPIs and gastric mucosal protective agents for 6-8 weeks to patients with bezoar-induced ulcers and gastric ulcers, but we found that the healing rate of ulcers caused by bezoars was relatively high, and that bezoar-induced ulcers can be healed with a short treatment. In subsequent studies, we will explore the standard treatment course of bezoar-induced ulcers through prospective studies.

Limitations

This research has certain limitations that should be acknowledged. Primarily, as a single-center retrospective analysis, it is subject to potential selection biases such as unbalanced bias, nonsimultaneous control bias, and clinical data omission bias. Therefore, the findings require validation through future multicenter prospective studies. In addition, other factors exist that could have caused biased data, such as a possible low diagnosis rate of gastric mucosal erosion.

Conclusions

Bezoar-induced ulcers represent the most frequently observed complication of bezoars. In our study, such ulcers showed a higher prevalence among female patients and in the autumn and winter. Additionally, the symptom of abdominal pain was more common in patients with bezoar-related ulcers compared with those with gastric ulcers from other causes. The 2 types of ulcers can be distinguished based on different endoscopic features, with bezoar-induced ulcers being mostly multiple and superficial and able to be healed with a short treatment.

Patient Consent/Assent Statement

All patients provided informed consent.

Data Availability

Data availability can be requested from the corresponding author with a reasonable justification.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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References:

1. Kement M, Ozlem N, Colak E, et al. Synergistic effect of multiple predisposing risk factors on the development of bezoars. World J Gastroenterol. 2012;18(9):960-64
2. Robles R, Parrilla P, Escamilla C, et al. Gastrointestinal bezoars. Br J Surg. 1994;81(7):1000-1
3. Guner A, Kahraman I, Aktas A, et al. Gastric outlet obstruction due to duodenal bezoar: A case report. Int J Surg Case Rep. 2012;3(11):523-25
4. Yan X. Gastric bezoar: A simple and innovative lithotripsy method – A case report and review of the literature. Front Gastroenterol (Lausanne). 2025;4:1527031
5. Zheng X, Qiu B, Jin XW, et al. Endoscopic lithotripsy combined with drug lithotripsy vs. drug lithotripsy for the treatment of phytobezoars: analysis of 165 cases. Surg Endosc. 2024;38(5):2788-94
6. Vorovskiy OO, Shushkovska YY, Afanasiuk OI. Stomach bezoars, causes of development, diagnosis and methods of treatment. Wiad Lek. 2021;74(1):128-31
7. Hemmasi G, Zanganeh E, Hosseini SA, et al. Risk factors, endoscopic findings, and treatments in upper gastrointestinal bezoars: Multi-center experience in Iran. Gastroenterol Hepatol Bed Bench. 2021;14(2):160-64
8. Gayà J, Barranco L, Llompart A, et al. Persimmon bezoars: A successful combined therapy. Gastrointest Endosc. 2002;55(4):581-83
9. Khan S, Jiang K, Zhu LP, et al. Upper Gastrointestinal manifestation of bezoars and the etiological factors: A literature review. Gastroenterol Res Pract. 2019;2019:5698532
10. Liu LN, Wang L, Jia SJ, et al. Clinical features, risk factors, and endoscopic treatment of bezoars: A retrospective analysis from a single center in northern China. Med Sci Monit. 2020;26:e926539
11. Iwamuro M, Tanaka S, Moritou Y, et al. Importance of second-look endoscopy on an empty stomach for finding gastric bezoars in patients with gastric ulcers. Acta Med Okayama. 2017;71(3):241-47
12. Eisen GM, Baron TH, Dominitz JA, et al. American Society for Gastrointestinal Endoscopy. Guideline for the management of ingested foreign bodies. Gastrointest Endosc. 2002;55(7):802-6
13. Meng Y, Luo XY, Zhou YH, et al. Characteristics of clinical and endoscopic findings of phytobezoars: Analysis of 77 cases. Chinese J Gastroenterol Hepatol. 2022;31(7):784-87
14. Iwamuro M, Okada H, Matsueda K, et al. Review of the diagnosis and management of gastrointestinal bezoars. World J Gastrointest Endosc. 2015;7:336-45
15. Lee BJ, Park JJ, Chun HJ, et al. How good is cola for dissolution of gastric phytobezoars? World J Gastroenterol. 2009;15:2265-69
16. Ladas SD, Kamberoglou D, Karamanolis G, et al. Systematic review: Coca-Cola can effectively dissolve gastric phytobezoars as a first-line treatment. Aliment Pharmacol Ther. 2013;37:169-73
17. Gökbulut V, Kaplan M, Kaçar S, et al. Bezoar in upper gastrointestinal endoscopy: A single center experience. Turk J Gastroenterol. 2020;31:85-90
18. Liu B, Kuang S. Gastric bezoars: A retrospective analysis of 44 cases. Med Sci Monit. 2024;30:e945377
19. Liu YP, Wang D, Li ZS. Clinical progress of treatment in bezoar. China J Endoscopy. 2016;22(11):79-82
20. Vats M, Ramasamy S, Neogi S, et al. Ingestion of nine metallic nails with corrosive: What happened next? BMJ Case Rep. 2017;2017:bcr2017222338
21. Xu YN, Wu LQ, Zhao ZhS. Comparative analysis of the effectiveness of endoscopic treatment and drug conservative treatment in 7 patients with gastric bezoars. Clin Intern Med. 2020;37(1):61-62

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