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Original Article

Importance of Second-look Endoscopy on an Empty Stomach for Finding Gastric Bezoars in Patients with Gastric Ulcers

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Most gastric bezoars can be treated with endoscopic fragmentation combined with or without cola dissolution, whereas laparotomy or laparoscopic surgery is generally inevitable for small intestinal bezoars because they cause small bowel obstruction. Therefore, early diagnosis and management of gastric bezoars are necessary to prevent bezoar-induced ileus. To investigate the incidence of overlooked gastric bezoars during the initial esophagogastroduodenoscopy, we retrospectively reviewed the cases of 27 patients diagnosed with gastrointestinal bezoars. The bezoars were diagnosed using esophagogastroduodenoscopy (n = 25), abdominal ultrasonography (n = 1), and barium follow-through examination (n = 1). Bezoars were overlooked in 9/25 patients (36.0%) during the initial endoscopy examination because the bezoars were covered with debris in the stomach. Of the 9 patients, 8 had concomitant gastric ulcers, and the other patient had gastric lymphoma. Although a computed tomography (CT) scan was performed before the second-look endoscopy in 8 of the 9 patients, the bezoars were mistaken as food debris on CT findings and were overlooked in these patients. In conclusion, gastric bezoars may not be discovered during the initial esophagogastroduodenoscopy and CT scan. In cases with debris in the stomach, second-look endoscopy is essential to detect bezoars.

Key words: bezoar, gastric ulcer, foreign bodies, phytobezoar

A bezoar is a solid mass formed in the gastrointestinal tract as a result of aggregation of undigested or semi-digested material. Substances constituting bezoars include plant material fibers, skins, and seeds (*i.e.*, phytobezoars), ingested hair (*i.e.*, trichobezoars),

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medications (*i.e.*, pharmacobezoars), and milk protein in milk-fed infants (*i.e.*, lactobezoars) [1, 2]. The majority of bezoars are speculated to be formed in the stomach, and some of them move from the stomach into the small intestine. Although endoscopic fragmentation combined with or without Coca-Cola dissolution can be applicable for most cases with gastric bezoars [2-4], laparotomy or laparoscopic surgery is generally inevitable for small intestinal bezoars because they result in small bowel obstruction. In this context, early diagnosis and management of gastric bezoars are necessary to prevent bezoar-induced ileus.

In our previous study, we reviewed 19 patients with gastrointestinal bezoars and investigated their epidemiology and etiology [4]. We noticed several cases of overlooked gastric bezoars during the initial esophagogastroduodenoscopy examination. The aim of this multi-center study was to retrospectively investigate the incidence of misdiagnosed cases with gastric bezoars and show their clinical characteristics.

Methods

Patients with an indigestible mass in the gastrointestinal tract diagnosed by esophagogastroduodenoscopy were included in this study. Letters of inquiry on patients with gastrointestinal bezoars were sent from the Department of Gastroenterology and Hepatology, Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences to 12 collaborating institutions. We identified 27 patients who had been diagnosed with gastrointestinal bezoars between August 2007 and January 2016. These patients were retrospectively registered in this study. Some of the 27 patients examined were also the subjects of our previous studies [2-8].

We retrospectively examined whether bezoars were found during the initial esophagogastroduodenoscopy examination. The patient's sex, age at diagnosis, medical history, complications, modalities used for diagnosis, and contents of the bezoars were also investigated. The Ethical Committee of the Okayama University Hospital approved this study (no. 1602-025), which also adhered to the Declaration of Helsinki.

Results

Table 1 shows the characteristics of the 17 female and 10 male patients. Their ages ranged from 10 to 91 years, and the median age was 74 years. The patients' ages were all 60 years or older, except for the 10-year-old patient with a trichobezoar [4]. The patients' medical histories before gastric bezoar detection included diabetes mellitus (n = 5), gastrointestinal tract surgeries (n = 5), hypertension (n = 4), dementia (n = 3), and gastric ulcer (n = 3).

All patients had bezoars in the stomach. In one patient, a bezoar was impacted in the duodenum in addition to a gastric bezoar [9]. During esophagogastroduodenoscopy, gastric ulcers (n = 22), duodenal ulcers (n = 2), acute gastric mucosal lesions (n = 1), and diffuse large B-cell lymphoma lesions in the stomach (n = 1) were identified. One patient had a conglomerate of hair (trichobezoar) [4]. Infrared spectroscopy was performed in 13 patients. Persimmon tannin was detected in the bezoar fragments retrieved from 12 patients, whereas the composition was not completely identified in one patient because only a small amount of protein was detected in the biopsy samples endoscopically obtained from the bezoar. The main composition of the bezoars was unknown in the remaining 13 patients. Fig. 1 shows a bar chart illustrating the monthly incidence of gastrointestinal bezoars. All patients with persimmon bezoars were diagnosed between November and May.

The bezoars were diagnosed by esophagogastroduodenoscopy in 25 patients. Among the two remaining patients, the gastric bezoar was detected incidentally during an abdominal ultrasonography performed for screening purposes (n = 1 patient), or visualized as a mass lesion in a barium follow-through examination performed for routine medical checkup (n = 1). Among the 25 patients who were diagnosed with bezoars by esophagogastroduodenoscopy, the bezoars were discovered during the initial endoscopy examination in 16 patients (64.0%). Alternatively, the bezoars were overlooked in 9 patients (36.0%) because they were covered with debris in the stomach. Of the 9 patients, 8 had concomitant gastric ulcers, and the other patient had gastric lymphoma. Although a computed tomography (CT) scan was performed before second-look endoscopy in 8 of the 9 patients, the bezoars were mistaken as food debris on CT findings and were overlooked in these patients. Among the 9 patients in whom the bezoars were overlooked during the initial esophagogastroduodenoscopy, the bezoars were detected on the

subsequent day in 3 patients. In the remaining 6 patients, the intervals between bezoar detection and the initial endoscopy examination were 4, 5, 8, 11, 14, and 34 days, respectively.

Treatment of the bezoars included endoscopic mechanical fragmentation and cola administration via endoscopy (n=6, 22.2%); endoscopic mechanical fragmentation without cola or carbonated water administration (n=6, 22.2%); peroral administration of carbonated water and endoscopic mechanical fragmen tation (n=4, 14.8%); peroral administration of cola and endoscopic mechanical fragmentation (n=1, 3.7%);

Table 1 Clinical background of the study subjects with bezoars

	n	%
Sex		
Female	17	63.0
Male	10	37.0
Median age (range, years)	74 (10–91)	
Medical histories		
Diabetes mellitus	5	18.5
Post-GI surgery	5	18.5
Hypertension	4	14.8
Dementia	3	11.1
Gastric ulcer	3	11.1
Modality used for diagnosis		
EGD	25	92.6
Abdominal ultrasonography	1	3.7
Barium follow-through	1	3.7
Location of the bezoar		
Stomach	26	96.3
Stomach and duodenum	1	3.7
Complications		
Gastric ulcer	22	81.5
Duodenal ulcer	2	7.4
AGML	1	3.7
Gastric lymphoma	1	3.7
Contents of the bezoar		
Persimmon tannin	12	44.4
Hair	1	3.7
Indefinite	1	3.7
NA	13	48.1
Discovery of bezoars during initial EGD*		
Yes	16	64.0
No	9	36.0
Treatment		
EMF and cola administration via endoscopy	6	22.2
EMF	6	22.2
None	5	18.5
Peroral administration of carbonated water and EMF	4	14.8
Surgical removal	2	7.4
Peroral administration of cola and EMF	1	3.7
Peroral administration of cola and endoscopic suction removal	1	3.7
Peroral cola administration, EMF, and cola administration via endoscopy	1	3.7
Metoclopramide	1	3.7

GI, gastrointestinal; EGD, esophagogastroduodenoscopy; AGML, acute gastric mucosal lesion; NA, not analyzed; EMF, Endoscopic mechanical fragmentation.

*One case was diagnosed by abdominal ultrasonography and another case was diagnosed by barium follow-through prior to EGD examination.

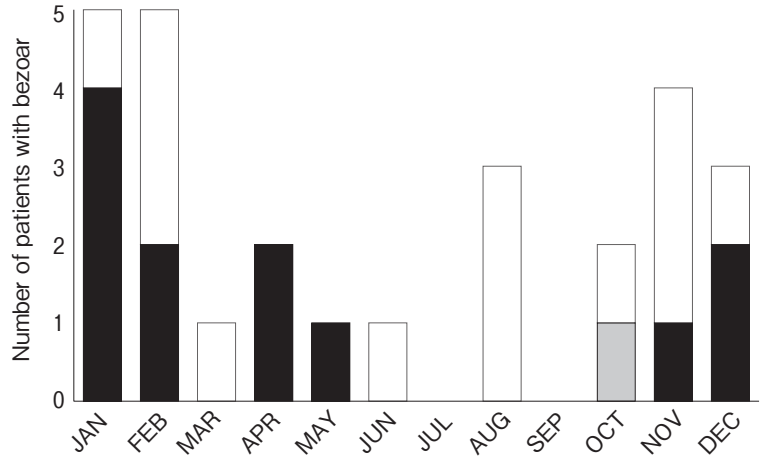

Fig. 1 Monthly incidence of bezoar. Black squares represent the number of patients diagnosed with persimmon phytobezoar (diospyrobezoar). A gray square represents a patient with trichobezoar. White squares represent the number of patients with bezoars wherein the chief component was not analyzed or unidentified.

peroral administration of cola and endoscopic suction removal (n = 1, 3.7%); a combination of peroral cola administration, endoscopic mechanical fragmentation, and cola administration via endoscopy (n = 1, 3.7%); and administration of metoclopramide (n = 1, 3.7%). Bezoars spontaneously disappeared without specific treatment in 5 patients (18.5%). On the other hand, 2 patients (7.4%) required surgery for bezoar removal.

Fig. 2 shows a patient with a gastric bezoar that was overlooked during the initial esophagogastroduodenoscopy. A 72-year-old Japanese woman underwent esophagogastroduodenoscopy for investigation of epigastric pain, melena, and anemia. A gastric ulcer with active bleeding was found in the gastric angle (Fig. 2A). Endoscopic hemostasis was performed with metal clips. Debris was also seen in the gastric body, but bezoars were not identified. Bezoars were not noted even in the CT scan (Fig. 2B). The patient underwent esophagogastroduodenoscopy 6 days after initial endoscopy examination, but the bezoar was not detected because it was covered with debris in the stomach. She left the hospital on day 6. Esophagogastroduodenoscopy performed 34 days after the initial examination revealed a bezoar in the gastric body, in addition to an open ulcer in the gastric angle (Fig. 2C). The bezoar was endoscopically fragmented in combination with oral administration of Coca-Cola.

Discussion

This retrospective multi-center survey of 13 institutions is the first study to show that bezoars were not discovered during the initial endoscopy examination in more than a third of the examined patients (9/25: 36.0%). The gastric bezoars were overlooked due to the presence of debris in the stomach, which covered the bezoars. Patients with bezoars often have impaired gastric motility. For example, older age, diabetes mellitus, and gastrointestinal tract surgery are all risk factors for bezoar formation [1, 2, 10, 11]. These settings cause delayed clearance of gastric contents, finally leading to bezoar formation. The present study also included patients with diabetes mellitus (n = 5, 18.5%) and post-gastrointestinal tract surgeries (n = 5, 18.5%). Moreover, the patients were all 60 years of age or older, except for the 10-year-old patient with a trichobezoar. Therefore, patients with bezoars are more likely to have debris in the stomach due to delayed gastric emptying, compared with healthy individuals.

Gastric ulcers result from pressure necrosis of the gastric mucosa due to chronic contact with bezoars and mechanical forces of gastric peristalsis that press the bezoars against the mucosal folds. In this study, gastric ulcers were concomitantly observed in 22 patients (81.5%), in addition to duodenal ulcers (n = 2, 7.4%), acute gastric mucosal lesion (n = 1, 3.7%), and gastric lymphoma (n = 1, 3.7%). A high prevalence of gastric ulcers in patients with bezoars is consistent with the

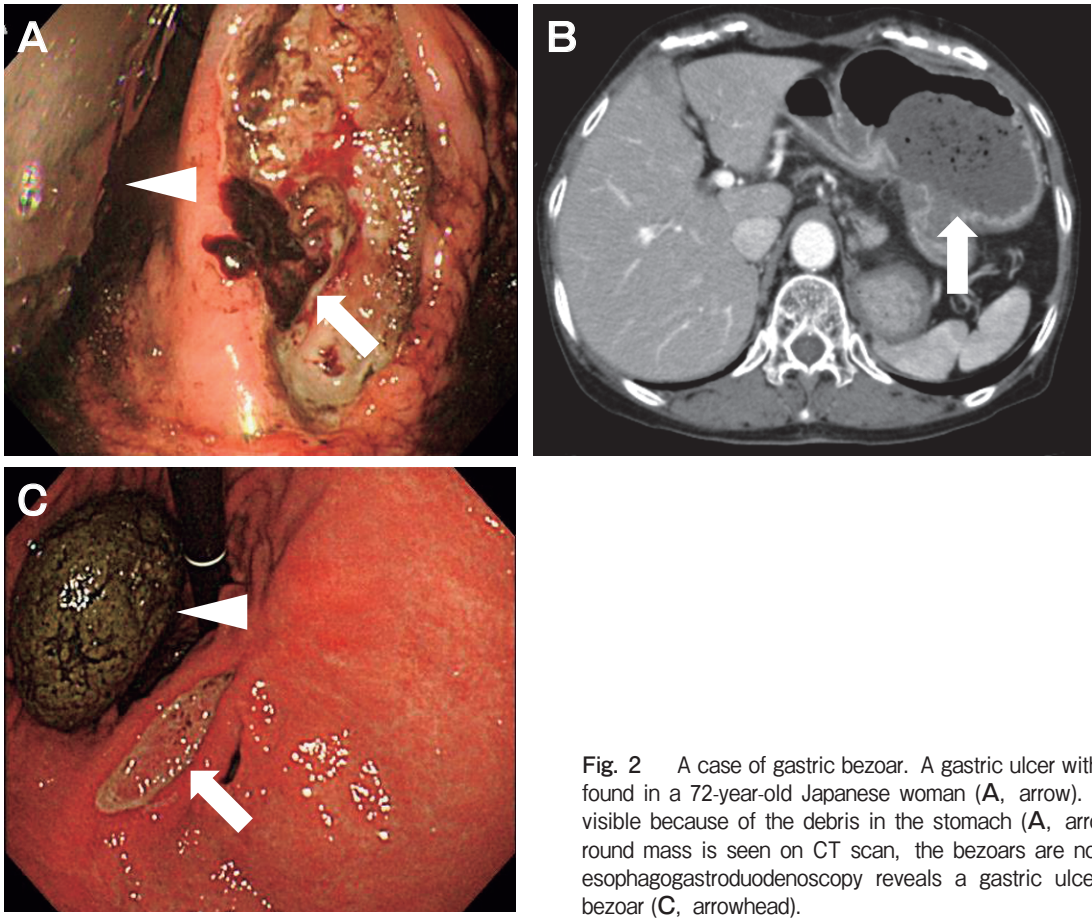

Fig. 2 A case of gastric bezoar. A gastric ulcer with active bleeding was found in a 72-year-old Japanese woman (**A**, arrow). The bezoars are not visible because of the debris in the stomach (**A**, arrowhead). Although a round mass is seen on CT scan, the bezoars are not noted (**B**). Repeat esophagogastroduodenoscopy reveals a gastric ulcer (**C**, arrow) and a bezoar (**C**, arrowhead).

results described in previous studies [1,2,4,12]. It was noteworthy that, in our case series, the bezoars were initially overlooked in 9 cases because they were covered by debris in the stomach. Only concomitant gastric ulcers or lymphoma lesions were identified during the initial esophagogastroduodenoscopy examination in these cases. Although gastrointestinal bezoars are infrequent disorders, these results underscore the importance of second-look endoscopy examination after fasting and thorough observation of the entire stomach to discover bezoars, particularly in patients with gastric ulcers.

As described earlier, because patients with bezoars are likely to have impaired gastric motility, debris may exist even during second-look endoscopic examination. In these cases, we should consider extending the starvation period and performing third-look endoscopy. Another possible option that may facilitate faster evacuation of gastric contents is to administer gastroprokinetic agents such as metoclopramide.

Phytobezoars appear as well-defined, round, or ovoid masses with heterogenous density on CT scan [13]. Their interiors have a mottled appearance and contain air bubbles [14,15]. CT scan with contrast media is useful in differentiating bezoars from other neoplasms [14,16,17]. However, in patients with bezoar-induced small bowel obstruction, it can be difficult to differentiate a bezoar from feces by CT findings alone. Oh *et al.* reported that the diagnostic accuracy of CT was 46.7% (7/15) among 15 patients with small intestinal bezoars; the bezoars were overlooked by CT scan before surgery in 8 patients (53.3%) [18]. Similarly, in the present study the CT findings were misinterpreted in patients with gastric bezoars (n=7) and in the single patient with a gastric and duodenal bezoar (n=1). The CT images were retrospectively reviewed again in several cases in this study, and gastric or gastroduodenal bezoars were identified as round or ovoid masses.

Consequently, although cases with gastric and gastroduodenal bezoars can cause confusion for radiologists because the CT images often have a mottled appearance similar to that by food debris, an appropriate diagnosis can still be made by CT scan, providing that the attending physicians suspect this disease entity based on the patient's history and clinical symptoms [19].

Infrared spectroscopy analysis is widely used in urology to analyze materials that constitute kidney and urinary tract stones. Because it shows a combination of wavelengths and intensities, the infrared spectrum allows accurate quantitative and qualitative analyses of the components of stone formation [20, 21]. In this case series, the spectra obtained from the bezoar fragment in 12 patients were quite similar to those of Kaki-shibu, a persimmon juice extracted from unripe persimmons [2]. Green, unripe persimmon fruits contain plenty of tannin. Persimmon tannin has been speculated to polymerize upon reaction with gastric acid and develop a mass containing cellulose, hemicelluloses, and various proteins, finally resulting in persimmon phytobezoar formation (diospyrobezoar) [22, 23]. Most of the persimmon phytobezoars are diagnosed in autumn and winter because persimmon is usually harvested and consumed in these seasons [24-26]. For example, Wang *et al.* reported that 31 of 35 cases (82.9%) of bezoar-induced small intestine obstruction were detected in autumn and winter [27]. In our study, 9 of the 12 patients (75.0%) with spectroscopically proven persimmon phytobezoars were diagnosed in autumn and winter (between November and February), and the remaining 3 patients were diagnosed in spring (April and May). In addition, four cases of suspected persimmon phytobezoars were detected in summer (June and August), although these diagnoses could not be confirmed because spectroscopy analysis was not performed for the bezoar fragments. These results suggest that bezoars can be detected throughout the year, irrespective of season, in Japan.

In summary, we reviewed 27 cases with gastric bezoars. Such bezoars may be overlooked during the initial esophagogastroduodenoscopy and even in CT scan. Although a bezoar is a rare disease entity, gastroenterologists and endoscopists should consider the possible presence of gastric bezoars when they encounter patients with ulcers and debris in the stomach. In such cases, second-look endoscopy on an empty stomach is essential to detect bezoars.

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