

## Synergistic effect of multiple predisposing risk factors on the development of bezoars

Metin Kement, Nuraydin Ozlem, Elif Colak, Sadik Kesmer, Cem Gezen, Selahattin Vural

Metin Kement, Nuraydin Ozlem, Elif Colak, Sadik Kesmer, Department of General Surgery, Samsun Education and Research Hospital, Samsun 55000, Turkey

Cem Gezen, Selahattin Vural, Department of General Surgery, Kartal Education and Research Hospital, Istanbul 34865, Turkey

Author contributions: Kement M and Ozlem N designed the research; Kement M, Colak E and Kesmer S performed the research; Gezen C and Vural S contributed analytic tools; Kement M wrote the paper.

Correspondence to: Metin Kement, MD, Department of General Surgery, Samsun Education and Research Hospital, Samsun 55000, Turkey. [mkement@yahoo.com](mailto:mkement@yahoo.com)

Telephone: +90-532-6383570 Fax: +90-362-3111500

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### Abstract

**AIM:** To describe the clinical characteristics of patients with gastric or intestinal bezoars recently treated in our hospital.

**METHODS:** In this study, a retrospective chart review of consecutive patients with gastrointestinal bezoars, who were treated at the Samsun Education and Research Hospital between January 2006 and March 2011, was conducted. Data on demographic characteristics, clinical presentation, history of risk factors, diagnostic procedures, localization of bezoars, treatment interventions, and postoperative morbidity and mortality rates were collected and evaluated.

**RESULTS:** Forty-two patients [26 (61.9%) males and 16 (31.1%) females] with a mean  $\pm$  SD (range) age of  $55.8 \pm 10.5$  (37-74) years were enrolled in this study. Thirty-six patients (85.7%) had one or more predisposing risk factors for gastrointestinal bezoars. The most common predisposing risk factor was a history of previous gastric surgery which was identified in 18 patients (42.8%). Twenty three patients (54.8%) had multiple

predisposing risk factors. Phytobezoars were identified in all patients except one who had a trichobezoar in the stomach. Non-operative endoscopic fragmentation was performed either initially or after unsuccessful medical treatment in 14 patients with gastric bezoars and was completely successful in 10 patients (71.5%). Surgery was the most frequent treatment method in our study, which was required in 28 patients (66.7%). Intestinal obstruction secondary to bezoars was the most common complication ( $n = 18$ , 42.8%) in our study.

**CONCLUSION:** The presence of multiple predisposing factors may create a synergistic effect in the development of bezoars.

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**Key words:** Bezoar; Diospyrobezoars; Persimmon; Phytobezoar; Trichobezoar

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### INTRODUCTION

Bezoars can be defined as masses of indigestible, hard materials formed in the gastrointestinal tract. Etymologically, the word bezoar came from the Persian word "padzahr" meaning to expel poison. In some societies, animal bezoars were formerly considered a useful medicine and possessed certain magical properties<sup>[1]</sup>. In 1854,

Quain reported an intragastric alimentary mass in an autopsy and called it a "bezoar"<sup>[2]</sup>.

Bezoars can be classified as phytobezoars (undigested vegetables), trichobezoars (hairs), lactobezoars (milk) and pharmacobezoars (medications) according to their composition<sup>[3]</sup>. They usually form in the stomach and can pass into the small bowel where they occasionally cause obstruction. Phytobezoars are composed of undigested food fibers, such as cellulose, hemicellulose, lignin and fruit tannin. These fibers occur in fruits and vegetables such as celery, pumpkin, prunes, raisins, leeks, beets and persimmons.

The aim of this study was to describe the clinical characteristics of patients with gastric or intestinal bezoars recently treated in our hospital.

## MATERIALS AND METHODS

A retrospective chart review of consecutive patients with gastrointestinal bezoars, who were treated at the Samsun Education and Research Hospital between January 2006 and March 2011, was conducted. Data on the demographic characteristics, clinical presentations, history of predisposing risk factors, diagnostic procedures, localization of bezoars, treatment interventions, morbidity and mortality rates were collected and evaluated. In addition, the patients were contacted by phone to determine any recurrence of bezoars after treatment.

In this study, previous gastric surgery, excessive consumption of some types of fruit and vegetables, diabetes mellitus, mastication problems, long-term antacid treatment and mental disorders were considered predisposing risk factors in the development of bezoars.

All calculations were performed in Microsoft Office Excel 2007. Continuous variables were summarized as mean  $\pm$  SD or median when appropriate, and categorical variables as frequency and percentage (%).

## RESULTS

### Demographic characteristics and presentation

Forty-two patients [26 (61.9%) males and 16 (31.1%) females] with a mean  $\pm$  SD (range) age of 55.8  $\pm$  10.5 (37-78 years) were enrolled in this study. The peak incidence was in the 6th decade of life (51-60 years). Twelve patients (28.6%) were in the 6th decade.

The most common presenting symptom was abdominal pain which was noted in 40 patients (95.2%). Dyspeptic symptoms other than epigastric pain were found in 32 patients (76.2%). Mild to severe nausea and vomiting were observed in 29 cases (69%). Loss of appetite was found in 19 patients (45.2%) and a significant weight loss history was identified in 5 (11.9%) patients. Some degree of abdominal distention as a sign of intestinal obstruction developed in 18 patients (42.9%). Two patients presented with acute gastric outlet obstruction.

Twelve patients with intestinal or gastric outlet obstruction (47.6%) were admitted to our emergency service. Five patients (11.9%) were referred by gastroenterologists.

Table 1 Distribution of predisposing factors

Predisposing factors	n	%
Single predisposing factor	13	31.0
Only gastric surgery	4	9.5
Only persimmon consumption	3	7.1
Only mastication problems	3	7.1
Only diabetes mellitus	2	4.8
Trichotillomania	1	2.4
Multiple predisposing factors	23	54.7
Gastric surgery + persimmon consumption	3	7.1
Gastric surgery + diabetes mellitus	3	7.1
Gastric surgery + mastication problem	3	7.1
Gastric surgery + mastication problem + persimmon consumption	3	7.1
Gastric surgery + mastication problem + diabetes mellitus	2	4.8
Persimmon consumption + mastication problem	3	7.1
Persimmon consumption + diabetes mellitus	2	4.8
Mastication problem + diabetes mellitus	1	2.4
Diabetes mellitus + antacid drug	1	2.4
Persimmon consumption + antacid drug	1	2.4
Mastication problem + antacid drug + persimmon consumption	1	2.4
No predisposing factor	6	14.3

The remaining patients ( $n = 17$ , 40.4%) were admitted to the general surgery clinic.

During the study period, 257 patients with mechanical bowel obstruction due to various reasons were admitted to our emergency service. Bezoars were the cause of mechanical bowel obstruction in 18 of these patients (7%).

### History of predisposing factors

Thirty-six patients (85.7%) had one or more predisposing risk factors (Table 1). The most common predisposing risk factor was previous gastric surgery which was identified in 18 patients (42.8%). Excessive persimmon consumption was another significant predisposing risk factor in our study. A history of excessive persimmon consumption was observed in 17 patients (40.5%). Mastication problems and diabetes mellitus were identified in 16 (38.1%) and 12 (28.6%) patients, respectively. Twenty-three patients (54.8%) had multiple predisposing risk factors. All predisposing risk factors are summarized in Table 1.

### Diagnostic procedures

Initial diagnosis was made by gastroscopy in 15 patients (35.7%). Abdominal sonography was the first diagnostic method used in 7 patients (16.7%), which was carried out in 12 patients as the first imaging method. Plain abdominal radiography (PAR) showed air-fluid levels in 18 patients (40.5%). The typical bezoar image on PAR, involving a mottled air pattern, was identified in only two patients. Abdominal tomography was carried out in 16 patients and bezoars were revealed in 14 of these patients (87.5%).

### Localization and composition

A single bezoar was found in 38 (90.4%) patients. Four patients (9.6%) had multiple bezoars in different locations.

Bezoars were mainly located in the stomach ( $n = 28$ ). Other locations were the ileum, jejunum and colon ( $n = 14$ ,  $n = 3$  and  $n = 1$ , respectively). Phytobezoars were identified in all patients except one who had a trichobezoar in the stomach. The patient with the trichobezoar was a 43-year-old woman, who had a history of psychiatric problems and trichotillomania.

### Intervention

Medical treatment with various enzymatic agents (including cellulase and cola) was initially tried in 15 cases with small gastric bezoars, however, enzymatic treatment was completely successful in only 4 patients (26.7%). Non-operative endoscopic fragmentation was performed either initially or after unsuccessful medical treatment in 14 patients and was completely successful in 10 patients (71.5%).

Surgery was the most frequent treatment method in our study, which was required in 28 patients (66.7%). Bezoars were removed from the stomach by gastrotomy in 8 patients. Preoperatively diagnosed small bezoars which were located in the distal ileum were carefully milked into the cecum in 8 cases. In 9 cases, it was not possible to milk the bezoars into the large intestine and an enterotomy was required. The patient who had a colonic bezoar in the ascending colon was treated with colotomy. In these 18 patients with intestinal bezoars, the stomach was surgically explored for additional bezoars and additional gastric bezoars were found and extracted *via* gastrotomy in 4 patients.

Coexisting gastric ulcers were identified in 5 (20.8%) of the patients with gastric bezoars. While anti-ulcer medication was prescribed in endoscopically treated patients, ( $n = 3$ ), wedge resection of ulcers was added to the gastrotomy in operated patients ( $n = 2$ ). Histopathological examinations of the ulcers revealed benign findings in all 5 patients.

### Postoperative outcomes and complications

The mean postoperative hospital stay was  $6.1 \pm 1.7$  d (range, 3-12 d) in our study. Postoperative complications developed in 7 (25%) patients (surgical site infection in 3 (10.7%) cases, chest infection in 2 (7.1%) patients and prolonged ileus in 2 (7.1%) patients).

We were only able to contact 32 (76.2%) patients by phone. There were no clinical recurrences in these patients during a median follow-up time of 25 mo (range, 3-63 mo).

## DISCUSSION

A number of predisposing factors may contribute to the risk of bezoar formation. Previous gastric surgery was reported in 20% to 93% of patients with bezoars and the incidence of bezoar formation after gastric surgery ranged from 5% to 12%<sup>[4-8]</sup>. Similar to previous published studies, the most common predisposing risk factor was previous gastric surgery which was identified in 42.8% of the patients in our study. Altered anatomy and physiology of the gastric remnant after vagotomy and partial

gastrectomy are largely responsible for bezoar formation. Vagotomy and partial gastrectomy diminish the ability of the stomach to break up and digest food. Both the quantity and the acidity of the gastric juice are reduced and peptic activity is adversely affected<sup>[9,10]</sup>. Additionally, the antrum has an important role in the mechanical fragmentation of ingested material, and the pylorus prevents large boluses from reaching the small intestine. Resection of the antrum and pylorus may lead to the passage of a non-fragmented, large bolus to the small intestine. The interval between gastric surgery and bezoar detection was 9 mo to 30 years<sup>[4-7]</sup>. In our study, the mean interval between surgery and bezoar detection was  $7.4 \pm 2.3$  years (5-11 years).

Excessive consumption of persimmon was identified in 40.5% of our patients. Persimmon, which grows in many areas in our region and widely consumed, is the fruit of a number of species of trees belonging to the genus *Diospyros*. The word *Diospyros* means "the fruit of the gods" in ancient Greek. Persimmon bezoars are also known as diospyrobezoars. Unripe persimmons contain soluble tannin. Tannin polymerizes in an acidic environment to form a glue-like coagulum, which can affix to other materials in the stomach<sup>[11]</sup>. In 1986, Krausz *et al*<sup>[4]</sup> reported that 91.2% of 113 patients with phytobezoars had a history of persimmon intake. Erzurumlu *et al*<sup>[12]</sup> from our country reported that 17.6% of their 34 patients with bezoars had a history of persimmon or cherry laurel intake.

Mental retardation and trichotillomania are major risk factors for the development of trichobezoars<sup>[13]</sup>. In our study, there was only one patient with trichobezoar who had a history of psychiatric disorders and trichotillomania. The other predisposing factors observed in our study included mastication problems, diabetic gastroparesis and antacid drug use. Consequently, 85.7% of patients had one or more predisposing factors in our study. While about one third of our patients had only one predisposing risk factor, over fifty percent had multiple predisposing risk factors. In our opinion, these results may indicate that the presence of multiple predisposing risk factors creates a synergistic effect in the development of bezoars. On the other hand, 14.3% of the patients in our study had no apparent predisposing risk factors. Erzurumlu *et al*<sup>[12]</sup> reported that only 5.9% of the patients in their study had no apparent predisposing risk factors. Bezoar formation is postulated to be provoked by dietary and eating habits in patients without predisposing factors<sup>[14]</sup>.

Until only a few decades ago, the differential diagnosis of intestinal obstruction secondary to bezoars was difficult before surgery, because the clinical and radiographic findings are similar to those of intestinal obstruction attributable to other causes<sup>[11,15]</sup>. However, findings from recent studies suggest that sonography or computerized tomography (CT) can assist radiologists in diagnosing bezoars before surgery<sup>[6,16]</sup>. In our study, PAR showed air-fluid levels in 18 patients with intestinal obstruction. The typical bezoar image on PAR, involving a mottled air pattern, was identified in only two patients (11.1%). Abdom-

inal CT was carried out in 16 patients and bezoars were revealed in 14 (77.7%) of these patients before surgery. Although sonography was not the preferred imaging modality for the patients with intestinal obstruction in our study, it was carried out in 12 patients with gastric bezoar as the first imaging method and the presence of a bezoar was suspected in 7 (58.3%) of these patients before endoscopy.

Both mechanical and chemical procedures are used in the treatment of gastric bezoars. Bezoars can be endoscopically fragmented into pieces using polypectomy snares, endoscopic forceps, Dormia baskets, endoscopic lithotripsy, electrosurgical knives or YAG laser. However, this technique requires specific equipment and is not complication free. Bleeding, perforation or even migration of bezoar pieces causing intestinal obstruction are potential complications<sup>[17]</sup>. In our study, endoscopic fragmentation was performed either initially or after unsuccessful medical treatment in 14 patients and was completely successful in 10 patients (71.5%). Medical treatment may also be useful in the management of gastric bezoars. Several chemical agents have been tested; these are administered orally, through a nasogastric tube or injected directly into the bezoar *via* endoscopy. However, the development of these techniques usually takes time, is not free of complications such as electrolytic disorders, gastric ulcer and has indistinct results<sup>[17]</sup>. In our study, medical treatment was initially tried in 15 cases with gastric bezoars, but was completely successful in only 4 patients (26.7%).

Although bezoars are the most common type of foreign body lodged in any part of the gastrointestinal tract, the overall incidence of bezoar-induced intestinal obstruction remains relatively low. Epidemiological data show that 2% to 4% of intestinal obstructions are caused by bezoars<sup>[2]</sup>. This figure was 7% in our study. Although intestinal obstruction was reported to be the most frequent clinical presentation of bezoars in the majority of previous studies, it was observed in 42% of the patients in our study. Surgical management of intestinal obstruction secondary to bezoars entails milking the object into the cecum or performing enterotomy for retrieval in difficult cases. In our study, 47% of patients with intestinal obstruction were managed by milking. Enterotomy was performed in 53% of patients with intestinal obstruction. Although therapeutic laparoscopy has been demonstrated to be feasible in the management of intestinal obstruction secondary to bezoars<sup>[18]</sup>, all operations were conducted as open surgery in our study.

Intestinal bezoars are often found in association with gastric bezoars<sup>[6]</sup>. Coexisting gastric bezoars was reported in 17%-21% of patients<sup>[19,21]</sup>. In our study, a coexisting gastric bezoar was found in 22.2% of patients with an intestinal bezoar. Consequently, when an intestinal bezoar is diagnosed, the possible presence of coexisting gastric or intestinal bezoars should be investigated cautiously.

Major complications of bezoars other than intestinal obstruction include gastric ulcer, gastritis, gastric perforation and gastric outlet obstruction. In our study, coexisting

gastric ulcers were identified in 20.8% patients with gastric bezoars. While anti-ulcer medication was prescribed in endoscopically treated patients, wedge resection of ulcers was added to the gastrotomy in operated patients. Two patients with gastric outlet obstruction were treated with gastrotomy and extraction of bezoars.

Although, there was no clinical recurrence of bezoars during a median follow-up time of 25 mo after treatment in our study, Klamer *et al.*<sup>[22]</sup> reported recurrence in approximately 20% of patients with gastric bezoars after initial treatment. Therefore, patients should be instructed to avoid a high fiber diet, persimmons and certain medications to minimize the potential risk of recurrence.

In conclusion, over fifty percent of the patients in our study had multiple predisposing factors for gastrointestinal bezoars. In light of these results, it may be concluded that the presence of multiple predisposing factors create a synergistic effect in the development of bezoars. Intestinal obstruction is the most common complication of bezoars. Although the prevalence of intestinal obstruction secondary to bezoars is quite low, differential diagnosis of intestinal obstruction secondary to adhesions is important in patients with previous abdominal surgery; CT can help to make this differentiation. Therefore, CT should be obtained whenever possible in all patients with bowel obstruction to establish the diagnosis and avoid inappropriate treatment.

## COMMENTS

### Background

Bezoars have become increasingly recognized as a cause of acute mechanical intestinal obstruction. Bezoars are classified according to their composition. The major types are phytobezoars, trichobezoars, and pharmacobezoars. Phytobezoars, composed of undigested vegetable matter, are the most common type of bezoar. Trichobezoars, composed of hair, are often associated with psychiatric problems. *Pharmacobezoars* are composed of ingested medications.

### Research frontiers

Previous studies have shown that different types of predisposing factors may increase the risk of developing bezoars. During data extraction, the authors realized that most of their patients had more than one predisposing factor for bezoar formation. This result was of interest to them and they would like to emphasize this finding. The present study is the first to address the possible synergistic role of multiple predisposing factors in the development of bezoars.

### Innovations and breakthroughs

The results of the present study suggest that the presence of multiple predisposing factors may create a synergistic effect in the development of bezoars.

### Applications

Early recognition of high-risk individuals, who have multiple predisposing factors, may prompt early investigation and the prevention of potential life-threatening sequelae of intestinal obstruction due to bezoars.

### Terminology

Diospyrobezoar is a type of phytobezoar which is caused by unripe persimmons and it is considered to be harder than other types of phytobezoars. Trichotillomania is a disorder where people compulsively pull out their hair.

### Peer review

The manuscript has been written properly and clearly. Case reports are the most common types of articles considering this problem.

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