

Clinical Outcomes Associated with Treatment Modalities for Gastrointestinal Bezoars

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Background/Aims: With technical and instrumental advances, the endoscopic removal of bezoars is now more common than conventional surgical removal. We investigated the clinical outcomes in a patient cohort with gastrointestinal bezoars removed using different treatment modalities. **Methods:** Between June 1989 and March 2012, 93 patients with gastrointestinal bezoars underwent endoscopic or surgical procedures at the Asan Medical Center. These patients were divided into endoscopic (n=39) and surgical (n=54) treatment groups in accordance with the initial treatment modality. The clinical feature and outcomes of these two groups were analyzed retrospectively. **Results:** The median follow-up period was 13 months (interquartile range [IQR], 0 to 77 months) in 93 patients with a median age of 60 years (IQR, 50 to 73 years). Among the initial symptoms, abdominal pain was the most common chief complaint (72.1%). The bezoars were commonly located in the stomach (82.1%) in the endoscopic treatment group and in the small bowel (66.7%) in the surgical treatment group. The success rates of endoscopic and surgical treatment were 89.7% and 98.1%, and the complication rates were 12.8% and 33.3%, respectively. **Conclusions:** Endoscopic removal of a gastrointestinal bezoar is an effective treatment modality; however, surgical removal is needed in some cases. (*Gut Liver* 2014;8:400-407)

Key Words: Bezoars; Endoscopy; Surgery

INTRODUCTION

Bezoars are retained conglomerates of food or foreign material in the gastrointestinal tract. Their incidence is reported at

less than 1% in the general population.^{1,2} They may be found everywhere in the gut but most reside in the stomach.³ An altered gastric physiology, such as impaired gastric emptying or reduced acid production, is a well-known cause of bezoars. Bezoars are usually caused by previous gastric operations, such as vagotomy or partial gastrectomy, and can also be caused by gastroparesis or a gastric outlet obstruction.⁴ In accordance with their components, bezoars can be classified as several types. Phytobezoar and trichobezoar are common subtypes related to the ingestion of persimmons and trichophagia, respectively. Bezoars may also present with various symptoms, including abdominal pain, nausea, vomiting, gastrointestinal bleeding, intestinal obstruction, or perforation.⁵⁻⁷ Currently, endoscopic procedures and surgical treatments are considered the primary therapeutic options for bezoars, even though dissolution by enteral administration of proteolytic enzymes^{8,9} or cola^{10,11} is also a possible treatment approach. Recent technical advances in endoscopic procedures and improvements in equipment have enabled large bezoars that required surgery in the past to be treated endoscopically.¹² However, surgical treatments are still required for some bezoars. In the present study, we analyzed the clinical outcomes in a cohort patients with gastrointestinal bezoars under different treatment modalities, i.e., endoscopy and surgery.

MATERIALS AND METHODS

1. Patients

The medical records with laboratory and imaging findings for a population of 103 patients who had received treatment at the Asan Medical Center for gastrointestinal bezoars between

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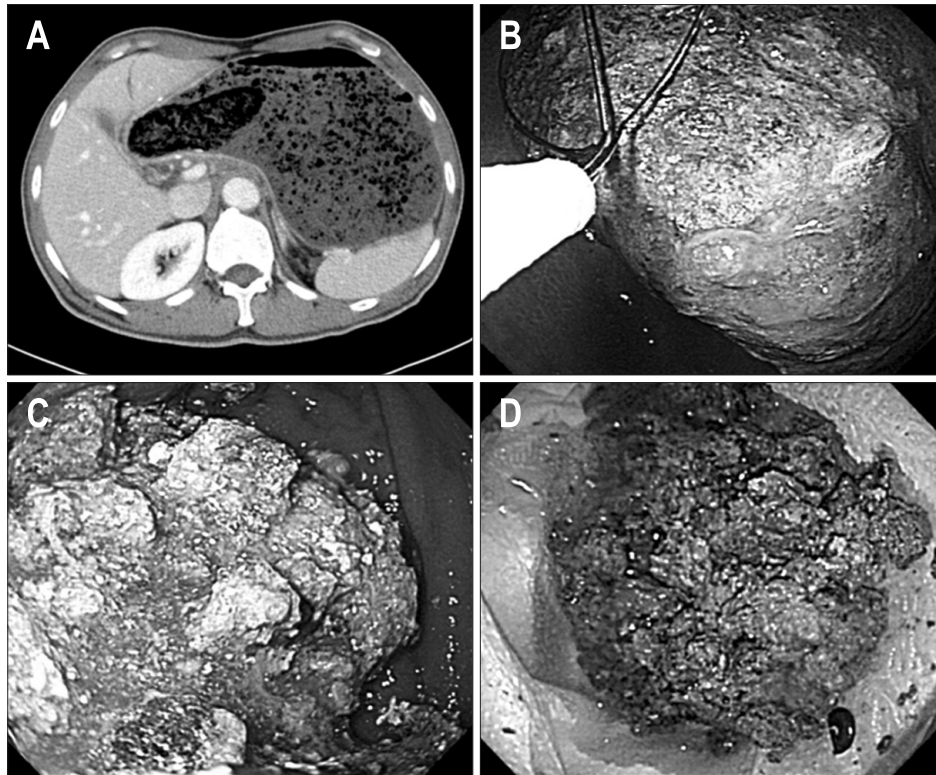


Fig. 1. (A) Detection of a gastric bezoar of approximately 6 cm accompanied by prominent distension of the proximal stomach using preprocedure abdominopelvic computed tomography. (B) A mechanical lithotripter positioned at a part of a bezoar with cola infusion. (C) Image taken after lithotripsy in the stomach. (D) Extracted materials, including a persimmon seed.

June 1989 and March 2012 were retrospectively reviewed. Ten patients with gastrointestinal bezoars that resolved by spontaneous passage were excluded and a final cohort of 93 patients who underwent endoscopic or surgical treatment for a gastrointestinal bezoar was analyzed. Patient data included age, sex, type and duration of symptoms, underlying disease, history of previous abdominal operation, treatment modality, rates and types of complications after treatment, and characteristics of the bezoar based on radiographic or endoscopic findings. The 93 patients were divided into two treatment groups (endoscopic and surgical) in accordance with their initial treatment modality. The followings were analyzed: the baseline characteristics and clinical features of these patients, the clinical characteristics of the bezoars, and the clinical outcomes for both treatment groups. This study was approved by the Institutional Review Board of the Asan Medical Center.

2. Methods of treatment

1) Endoscopic procedures

For endoscopic treatments, the patients were sedated with an intravenous dose of midazolam (0.05 mg/kg) and pethidine (50 mg). Cardiorespiratory functions were continually monitored throughout the procedure, which was performed in each case by experienced endoscopists controlling a single-channel endoscope (GIF-H260 or GIF-Q260; Olympus Optical Co., Ltd., Tokyo, Japan). The fragmentation of bezoars was performed using overtubes, alligator forceps (FG-47L-1; Olympus Co., Ltd.), a basket (MTW Endoskopie, Wesel, Germany), mechanical

lithotripsy equipment (Lithotripter handle; Medi-globe, Grasaau, Germany), and/or a snare (MTW Endoskopie). If necessary, drinking, nasogastric lavage, or endoscopic injection of cola was used as an efficient adjuvant method to dissolve huge and hard bezoars in some patients (Fig. 1). We performed multiple endoscopic procedures, when necessary, especially in the cases of extremely hard, multiple, or huge bezoars.

2) Surgical procedures

Surgical procedures involved a laparotomy under general anesthesia. After opening the abdominal cavity, a gastrotomy with extraction of the bezoars was done to remove the material from the stomach. If the bezoar was located in the small bowel, an enterotomy was done involving extraction of the material from the small bowel. If the patient had multiple bezoars in the stomach and small bowel, gastrotomy and enterotomy were performed simultaneously. If there were combined complications, localized resection and anastomosis, or adhesiolysis, were also performed.

3. Definitions

The success of endoscopic treatment was defined as the complete removal of the detected bezoar, regardless of the number of treatments required. Failure of endoscopic treatment was defined as an incomplete removal of the bezoars requiring surgical treatment to resolve. A successful surgery was considered to be the complete removal of the bezoar from the gastrointestinal tract. A surgical failure was defined as need for a secondary

operation due to a remnant bezoar after the primary surgery. Migration was defined as the movement of the bezoar from the original site to the distal gastrointestinal tract during an endoscopic procedure or surgery. A wound problem consisted of a wound infection and/or dehiscence.

4. Outcomes of treatment

Treatment outcomes included the number of therapeutic trials required until the complete removal of bezoars was achieved, the migration of the bezoars which we could not treat through endoscopic procedure, the number of patients who had undergone surgical treatment due to a failure of an endoscopic procedure, and the number of patients for whom a bezoar failed to be detected during surgical exploration. The bezoar migration rate and complication occurrence rate were also included in the analysis.

5. Statistical analysis

Baseline patient characteristics and both continuous and categorical variable data are presented as the mean±SD, median (interquartile range [IQR]), and number (%). Continuous variables were compared using the Student t-test, and categorical variables were compared using Fisher exact test or Pearson chi-square test. All p-values were two-sided, and p-values less than 0.05 were considered statistically significant. Statistical analysis was performed with SPSS version 18.0 software for Windows (IBM Co., Armonk, NY, USA).

RESULTS

1. Baseline characteristics

The median follow-up period for the total cohort of 93 patients (50 males and 43 females) was 13 months (IQR, 0 to 77 months) with a median age of 60 years (IQR, 50 to 73 years). Among the total cohort of 93 patients, 39 cases underwent endoscopic removal (endoscopic treatment group) and the remain-

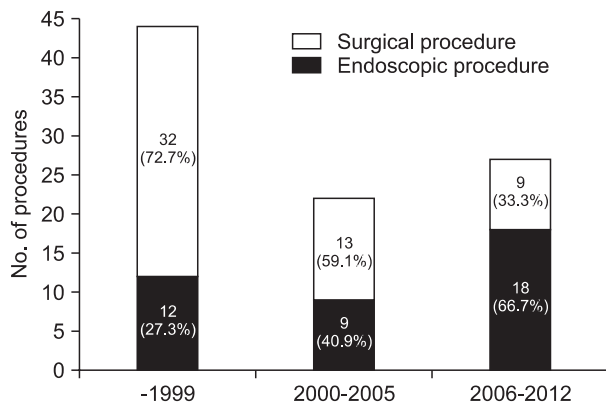


Fig. 2. Distribution of treatment modalities for bezoars. The proportion of patients who are treated using endoscopic procedures has increased in recent years.

ing 54 patients underwent surgical removal (surgical treatment group). In contrast to the decreasing proportion of the patients with bezoars who have been treated with surgery, the proportion of such patients who were treated using endoscopic procedures has been increasing: 27.3% before 2000, 40.9% from 2000 to 2005, and 66.7% since 2006 (Fig. 2). The incidence of underlying medical conditions, including diabetes mellitus, hypertension, a previous history of peptic ulcer disease, and a previous history of surgery, was similar in both groups. Forty-four patients (47.3%) out of the 93 analyzed in this study had a history of previous gastrointestinal surgery; 17 of these patients (43.6%) belonged to the endoscopic treatment group and 27 patients (50%) to the surgical treatment group. No patient had psychiatric history including mental retardation or trichotillomania (Table 1).

2. Symptoms

The duration of the symptoms was similar in both groups and abdominal pain was the most common chief complaint among the whole patient cohort (72.1%). Twenty-four patients in the endoscopic treatment group (61.5%) and 43 patients in the surgical treatment group (79.6%) had abdominal pain as a chief complaint. Specifically, dyspepsia was a more common symptom in the endoscopic treatment group than the surgical

Table 1. Baseline Characteristics of the Patients

Characteristic	Endoscopic treatment group (n=39)	Surgical treatment group (n=54)	p-value
Age, yr	59 (50-75)	61.5 (51.5-72)	0.569
Gender			0.392
Male	23 (59)	27 (50)	
Female	16 (41)	27 (50)	
Underlying disease			
DM	7 (17.9)	9 (16.7)	0.872
HTN	7 (17.9)	10 (18.5)	0.944
PUD	12 (30.8)	19 (35.2)	0.182
Others*	4 (10.3)	7 (13.2)	
Previous history of abdominal surgery			
Surgery of gastrointestinal tract	17 (43.6)	27 (50)	
Surgery of other abdomen [†]	2 (5.1)	2 (3.7)	
Duration of symptoms, day	30 (10-67.5)	14.5 (5.3-52.5)	0.206

Data are presented as median (interquartile range) or number (%). DM, diabetes mellitus; HTN, hypertension; PUD, peptic ulcer disease. *Including cerebrovascular accident, coronary heart disease, hypothyroidism, abnormality in oral cavity, psychiatric history, and radiation therapy; [†]Including an ovarian cystectomy, caesarean section and two hysterectomies with bilateral salpingo-oophorectomy.

treatment group (53.8% vs 29.6%, $p=0.019$). However, small bowel obstruction and abdominal pain were more frequent in the surgical treatment group than in the endoscopic treatment group (68.5% vs 20.5%, $p<0.001$; 94.4% vs 74.4%, $p=0.006$, respectively). The frequency of nausea and vomiting was also higher in the surgical treatment group than in the endoscopic treatment group (70.4% vs 46.2%, $p=0.019$; 66.7% vs 38.5%, $p=0.007$, respectively). The frequencies of anorexia, abdominal bloating, weight loss, constipation, melena, and general weakness were similar in both groups.

3. Bezoar characteristics

The size, number, and multiplicity of the bezoars were similar in both groups. The location of the bezoar revealed a significant, preference tendency in two groups. Bezoars in the endoscopic treatment group were usually located in an area proximal to the stomach (84.6%). In contrast, bezoars in the surgical treatment group were located predominantly in the small bowel (66.7%) (Table 2). Thirty-four patients (87.2%) in the endoscopic treatment group and 32 patients (59.3%) in the surgical treatment group had phytobezoar. The bezoar subtype of the remaining 27 patients could not be confirmed. Regarding exact locations, bezoars in the whole patient population were common in the stomach (47.3%), jejunum (22.6%), and ileum (17.2%).

Table 2. Clinical Characteristics and Bezoar Treatment Outcomes

Characteristic	Endoscopic treatment group (n=39)	Surgical treatment group (n=54)	p-value
Size, cm	6.58±1.86	6.21±2.58	0.454
No.	1.69±1.13	1.41±0.90	0.196
Multiple	13 (33.3)	13 (24.1)	0.326
Location			<0.001
Proximal to stomach	33 (84.6)	12 (22.2)	
Esophagus	1 (2.6)	0	
Stomach	32 (82.1)	12 (22.2)	
Small bowel	2 (5.1)	36 (66.7)	
Duodenum	1 (2.6)	0	
Jejunum	1 (2.6)	20 (37)	
Ileum	0	16 (29.6)	
Multiple location	4 (10.3)	6 (11.1)	
Success rate	35 (89.7)	53 (98.1)	0.157
Migration rate	5 (12.8)	3 (5.6)	0.283
Duration of hospitalization, day	9.97±7.89	21.54±23.10	0.001
Patients with complication	5 (12.8)	18 (33.3)	0.024

Data are presented as mean±SD or number (%).

4. Treatment outcomes

The treatment success rate was 89.7% in the endoscopic treatment group and 98.1% in the surgical treatment group (Table 2). Repetitive endoscopic trials were performed 1.56±0.72 times in 17 patients. Twelve patients underwent two separate procedures and five patients underwent three separate procedures. Four patients in the endoscopic treatment group failed to have their bezoars removed and underwent surgical treatments. Sixty surgical procedures were performed for 54 patients in the surgical treatment group consisting of 17 gastrotomies, 19 jejunotomies, 11 ileotomies, three subtotal gastrectomies, five small bowel resections, one right-sided hemicolectomy, one strictureplasty, one appendectomy, and two explorative laparotomies (Fig. 3).

Nine occurrences of a complication were found in five patients (12.8%) in the endoscopic treatment group and 35 events were evident in 18 patients (33.3%) from the surgical treatment group. Wound problems, intra-abdominal adhesions, and pneumonia arose only in the surgical treatment group. The incidences of complications such as obstruction, bleeding, organ perforation, ileus, and fever did not differ between the groups. Fever (44.4%) was the most common complication in the endoscopic treatment group and wound problems (22.9%) were the most common, followed by fever (20.0%), in the surgical treatment group.

5. Endoscopic treatments of bezoars

All 39 patients in the endoscopic treatment group were treated using mechanical lithotripsy; 26 (66.7%) using only mechanical lithotripsy and 13 (33.3%) using mechanical lithotripsy with cola (Table 3). We performed more frequent procedures in mechanical lithotripsy with cola group than mechanical lithotripsy only group (2.00±0.71 vs 1.35±0.63, $p=0.010$). Mean procedure time was shorter in mechanical lithotripsy with cola group than in mechanical lithotripsy only group, although the difference of time was not statistically significant between two groups. Age, size, number of bezoar, hospital duration revealed no significant difference between two groups. Four patients (15.4%) experienced eight complications in mechanical lithotripsy only group, one patient (7.7%) did one complication in mechanical lithotripsy with cola group.

The most common route for administration of cola was oral ingestion or nasogastric lavage (n=9, 69.2%), followed by direct injection to the bezoars during the procedure (n=1, 7.7%) and a combination of drinking and injection (n=3, 23.1%). Mean volume of administrated cola was 1,943.75 mL. The volume of 750 to 4,500 mL was administrated for drinking or lavage and 500 to 1,000 mL for injection during procedure. Endoscopic procedure was usually performed after drinking or lavage of cola for 1 to 3 days.

Among 39 patients, 17 (43.6%) were treated by multiple sessions of endoscopic procedures (Table 4). The age at the time of

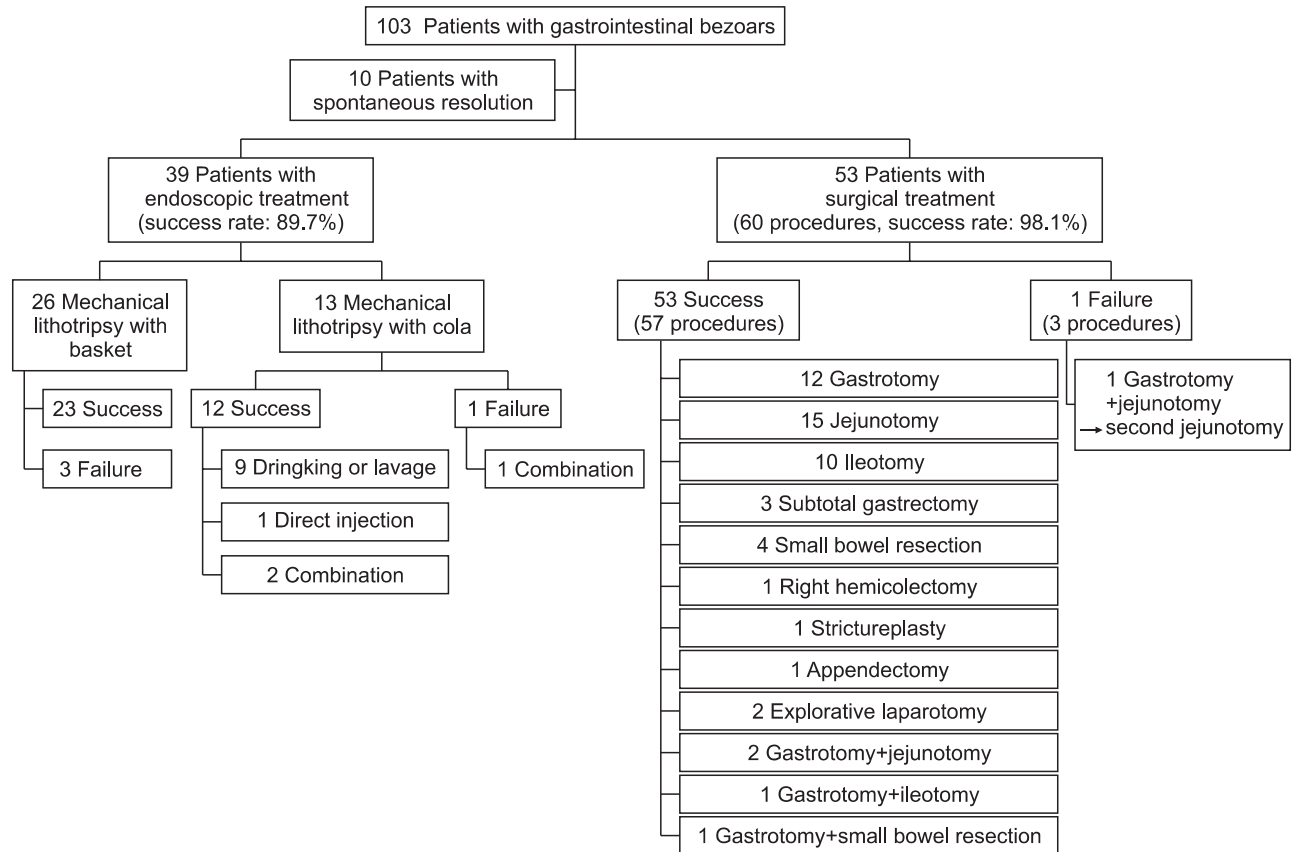


Fig. 3. Flowchart of the treatment results for bezoars.

Table 3. Endoscopic Treatment of Bezoars

Characteristic	Mechanical lithotripsy only (n=26)	Mechanical lithotripsy with cola (n=13)	p-value
Age, yr	58.5 (49-72.5)	66.0 (58-75)	0.109
Size, cm	6.46±1.81	6.81±2.02	0.606
No. of bezoar	1.85±1.19	1.38±0.96	0.203
No. of procedure	1.35±0.63	2.00±0.71	0.010
Procedure time, min	67.21±47.56	47.69±33.04	0.225
Hospital duration, day	10.92±8.88	8.08±5.19	0.216
Patients with complication	4 (15.4)	1 (7.7)	0.648

Data are presented as median (interquartile range), mean±SD, or number (%).

diagnosis was significantly higher in multisession group than in single session group (66 years [IQR, 58 to 75 years] vs 58 years [IQR, 44 to 63 years], p=0.004), and the size of bezoar was larger in multisession group (7.47±1.98 cm vs 5.89±1.46 cm, p=0.007). Because the mean size of bezoar was 5.89 cm in single session group, the number of performed endoscopic procedures between the patients with bezoars larger than 6 cm and less than 6 cm was compared. Similarly, the number of performed endoscopic

Table 4. Characteristics of the Bezoars according to the Frequency of Treatment

Characteristic	Single session (n=22, 56.4%)	Multisession (n=17, 43.6%)	p-value
Age, yr	58 (44-63)	66 (58-75)	0.004
Size, cm	5.89±1.46	7.47±1.98	0.007
No. of bezoar	1.59±1.05	1.82±1.24	0.539
Procedure time, min	54.67±36.57	61.75±48.63	0.680
Hospital duration, day	9.64±9.12	10.41±6.19	0.754

Data are presented as median (interquartile range) or mean±SD.

procedures were compared between the patients older than 60 and younger than 60 years. Twenty-four patients had bezoars larger than 6 cm and 14 patients (58.3%) received multiple sessions of endoscopic procedures, whereas three of 15 patients (20%) with bezoars less than 6 cm received multiple sessions of endoscopic procedures. Nineteen patients were older than 60 and 12 patients (63.2%) received multiple sessions of endoscopic procedures, whereas five of 20 patients (25%) younger than 60 received multiple sessions of endoscopic procedures. Multiple sessions of endoscopic procedures were significantly more necessary for the patients with bezoars larger than 6 cm (p=0.024) and older than 60 (p=0.016).

6. Diagnostic values of different modalities

The diagnostic values of different diagnostic modalities which included abdominopelvic computed tomography (APCT), barium study, endoscopy, and abdominal ultrasonography (USG) were evaluated. In the total patient cohort, endoscopy (diagnostic ratio, 88.1%) was more effective than other diagnostic modalities, followed by barium study (diagnostic ratio, 85.2%). APCT seemed to have less diagnostic value in the total cohort and in the endoscopic treatment group, but was more effective as a diagnostic tool in the surgical treatment group. A barium study had diagnostic value in all groups, particularly in the surgical treatment group. In both treatment groups in our study, abdominal USG did not show utility as a diagnostic modality for the presence of bezoars.

DISCUSSION

Surgical removal has been considered the standard treatment option for gastrointestinal bezoar in the past but the use of endoscopy has increased recently due to technical advances. Lee *et al.*¹³ reported that 50% (5/10) of affected patients had undergone endoscopic removal of bezoars during former 5 years and 77% (10/13) of patients did during later 5 years. Similarly, the proportion of patients treated using endoscopic procedures has been increasing at our institution; 27.3% before 2000, 40.9% from 2000 to 2005, and 66.7% since 2006.

The reported success rate of endoscopic treatment for bezoars has increased in recent studies, from 71.5% to as high as 100%.¹³⁻¹⁵ Because of this enhanced success rate, surgical treatment for bezoars has correspondingly reduced. In our present study, we report an 89.7% rate of success for the endoscopic treatment of bezoars and a 98.3% success rate with surgery. Hence, even though endoscopic removal is a relatively successful treatment modality, we find that surgical treatment still has a higher success rate and remains necessary in several situations such as intestinal obstruction or perforation, and if an endoscopic approach fails. In this regard, four cases of endoscopic treatment failure among our present patients needed to be resolved by subsequent surgical treatment.

Previous gastric surgery, poor mastication, overindulgence of foods with high fiber contents are common factors predisposing to bezoar formation.¹⁵⁻¹⁷ Mental retardation and trichotillomania also are known as risk factors for the development of trichobezoars.^{14,18} In this study, previous history of abdominal surgery was confirmed as a predisposing factor for bezoar. However, we could not find trichobezoar and the patient with history of mental retardation or trichotillomania.

The major symptoms or complications associated with bezoars include dyspepsia, abdominal pain, intestinal obstruction or perforation, gastric ulcer, and gastritis.¹⁵ Among these conditions, intestinal obstruction can be the result of the passage

and subsequent lodging of a bezoar in the distal small bowel. Most commonly, this complication is seen in a gastrectomized patient with an intact vagus nerve due to the increased size of gastric outlet with an undisturbed innervated gastric remnant.¹⁹ In addition, the obstruction could also be caused by primary bezoars formed in small bowel in association with underlying disease such as diverticulum, stricture, or tumor.²⁰⁻²² A previous study reported that small bowel obstruction was the most common complication and required surgeries.¹⁵ Our present data show that vague symptoms such as dyspepsia were higher in the endoscopic treatment group (in which bezoars were mainly located in the stomach) than in the surgical treatment group. However, abdominal pain, small bowel obstruction, nausea, and vomiting were found to predominate more in our surgical treatment group (in which the bezoars were mainly located in the small bowel). Given these findings, we recommend that the presence of additional small bowel bezoars should be considered in gastric bezoar patients who have abdominal pain, obstruction, nausea, or vomiting.

Endoscopic treatment for bezoars consists of mechanical fragmentation and extraction using several instruments. Fragmentation is usually performed with a mechanical lithotripter, large polypectomy snare, electrosurgical knife, drilling, laser destruction, and a dormia basket is used for extraction.^{13,23} In addition to mechanical treatment, 0.1 N-hydrochloric acid solution, sodium bicarbonate (NaHCO₃) solution, and enzymatic dissolution¹⁹ with papain, N-acetylcysteine, cellulose, pineapple juice, cola,^{10,24} or a combination of these has been attempted. In the present study, we used a mechanical lithotripter, large polypectomy snare, and/or cola to fragment the bezoars. Although the indications for endoscopic treatment have widened with the development of more advanced instruments, endoscopic procedures still take a considerable time, are technically challenging and, in some cases, are associated with various complications of concern. Sometimes in Korea, many gastrointestinal endoscopists hesitate to perform time-consuming procedure, especially removal of bezoar, because of low reimbursement rate, labor-intensiveness and other obstacles. Regarding the degree of difficulty, the time and effort required for procedure, the actual price of the removal of bezoar except for materials costs is excessively underestimated compared to that of general endoscopy. There are still lots of difficulties in performing endoscopic procedures in Korea.

Cola was used for dissolution of bezoar in our institute since 2005. During this period, 13 of 19 cases (68.4%) were treated by mechanical lithotripsy with cola, whereas the remaining six cases were treated by mechanical lithotripsy only. The mechanism of bezoar dissolution by cola has not been well explained, but having an acidity of pH 2.6 due to carbonic and phosphoric acid, it resembles gastric acid which is thought to be important for dissolution of bezoar.^{25,26} In addition, NaHCO₃ mucolytic effect and CO₂ bubbles enhance the dissolving mechanism. Ladas

*et al.*²⁶ suggested that cola alone could be effective in gastric phytobezoar dissolution in half of the cases and combination with additional endoscopic methods, was successful in more than 90% of cases. They recommended that drinking or lavage of 3 L cola during 12 hours should be started as a primary treatment for phytobezoar, then combined with mechanical lithotripsy in case of partial dissolution.

We found that the use of cola yielded more shorter procedure time and less complication although it related to more frequent endoscopic procedures in this study. This tendency of increasing number of procedures despite cola administration might probably resulted from the hardness or hugeness of target bezoars. In the cases of quite hard and huge bezoars, gradual dissolution by repetitive administration of cola followed by gentle endoscopic lithotripsy could be better option to minimize the time required in each procedure and complication such as distal migration of fragments rather than excessive mechanical attempts to remove them in one step.

Meanwhile, patient with old age (mean 66 years, roughly more than 60 years) or large bezoar (mean 7.5 cm, roughly more than 6 cm) tended to receive multiple sessions of endoscopic procedures in this study. Large bezoars may need multiple procedures as mentioned before, possibly old patients do so because of some underlying medical problems including cardiopulmonary or musculoskeletal deterioration resulting in intolerance to receive long endoscopic procedure at one time. Therefore, this study has shown that unforced multiple sessions of endoscopic procedures with repetitive administration of cola could be considered for the old patients with large bezoars in order to secure safety and effectiveness of treatment.

Koulas *et al.*²³ have reported a 28% morbidity rate and 4% mortality rate for the surgical treatment of bezoars, and an 11% morbidity rate and 0% mortality rate for endoscopic treatments of these cases. In another earlier study, Erzurumlu *et al.*¹⁵ reported a 32% surgical morbidity rate, a 14% endoscopic morbidity rate, and a 29% total morbidity rate for bezoar patients. Similar to the results of previous studies, the rate of endoscopic morbidity in our present cohort was 12.8% (five patients, nine events) and the rate of surgical morbidity was 33.3% (18 patients, 35 events). Both of our treatment groups had complications that included obstruction, bleeding, perforation, ileus, and fever after treatment.

Bezoars usually cannot be diagnosed based on symptoms or physical examination alone. This is because the symptoms and signs of bezoars are nonspecific and there currently is no specific modality for diagnosing a bezoar. Bae *et al.*²⁷ reported that a 100% diagnosis rate with a 96% sensitivity for gastrointestinal bezoar was made possible using APCT in cases of an intestinal obstruction that was secondary to a bezoar. However, our present data indicate an APCT sensitivity of 66.7% in the endoscopic treatment group and 79.5% in the surgical treatment group. The barium study has shown variable diagnostic

rates (from 25% to 84.6%) in previous studies.^{15,19} In our present study, these rates were 83.3% in the endoscopic treatment group and 95.7% in the surgical treatment group. In this respect, APCT has a superior ability to confirm the cause and the location of the bowel obstruction, whereas the barium study shows a high accuracy for the detection of a bezoar.

Our current investigation has the inherent limitations of a retrospective study, including selection bias between the endoscopic treatment group and the surgical treatment group, incomplete medical records, which did not specify the subtype of bezoars, and the eating habits of patients. Nevertheless, our present findings show the value of a proper methodological study design and provide valuable evidence for the future clinical treatment of bezoars.

In conclusion, endoscopic treatment is now a more widely indicated option for bezoar due to instrument and procedural advances, with surgical interventions for this disorder necessarily becoming used less frequently. However, even though endoscopy has an acceptable success rate and fewer complications than surgery, surgical interventions remain necessary for intestinal obstructions or perforations, and in cases where there is a failure of endoscopic treatment to resolve the bezoar. Hence, we believe that both of these treatment modalities have their own distinct benefits and should be considered as independently efficient treatment options for gastrointestinal bezoars.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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