Laparoscopic Approach Compared With Conventional Open Approach for Bezoar-Induced Small-Bowel Obstruction

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Background: Bezoar-induced small-bowel obstruction (SBO) is an uncommon surgical emergency. Accurate preoperative diagnosis is notoriously difficult, and conventional management often necessitates laparotomy. Recent articles demonstrate the feasibility of laparoscopy in the management of SBO. This study compares the outcomes of a series of cases managed laparoscopically with the outcomes of matched open cases.

Hypothesis: Laparoscopic management of bezoar-induced SBO is safe and effective when compared with traditional laparotomy treatment.

Patients and Methods: A retrospective study was conducted from November 1, 1998, to November 30, 2003, to compare laparoscopic vs open treatment for bezoar-induced SBO. Patients’ demographics, operative details, and surgical outcomes were evaluated.

Results: During the study period, 24 patients (16 men and 8 women) with a mean age of 68.2 years underwent operative treatments for bezoar-induced SBO. Ten patients received laparoscopic treatments and the other 14 received laparotomy treatments. The patients were comparable in age, sex, and physiological status. There were 3 conversions in the laparoscopy group owing to technical difficulties. The laparoscopic approach was associated with statistically significant shorter operative time ($P=0.048$), fewer postoperative complications ($P=0.04$), and reduced hospital stay ($P=0.009$).

Conclusions: When expertise is available, laparoscopy is safe and effective in the management of bezoar-induced SBO and is associated with superior postoperative outcomes when compared with the conventional open approach.

Arch Surg. 2005;140:972-975

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EZOAR-INDUCED SMALL-bowel obstruction (SBO) is an uncommon problem.\textsuperscript{1,3} Accurate preoperative diagnosis is difficult, and operative diagnosis is the rule rather than the exception. Conventional treatment for SBO necessitates laparotomy and is associated with significant morbidity and mortality.\textsuperscript{5} In the past, patients with previous abdominal procedures and intestinal obstruction had been regarded as relative contraindication for laparoscopy.\textsuperscript{5}

With mastery in advanced minimally invasive procedures in emergencies, the laparoscopic approach for SBO has been gaining popularity among various centers.\textsuperscript{6-8} We conducted a retrospective cohort study comparing laparoscopic vs open approach in the management of SBO secondary to bezoar.

METHODS

Diagnosis of SBO was attained by a combination of a detailed history, clinical signs, and imaging characteristics on plain radiography. The same management protocol for patients with SBO was applied in our unit. Patients without signs of strangulation received “drip-and-suck” therapy. Patients who had received previous abdominal procedures or those who had equivocal clinical and radiographic findings on plain radiography underwent contrast-meal and follow-through studies.\textsuperscript{9} Patients were elected for operative interventions when the condition failed to improve or worsened on conservative treatment, or when contrast imaging delineated complete mechanical obstruction.

From November 1, 1998, to November 30, 2003, patients with the diagnosis of SBO with or without previous procedures were identified from the computerized hospital records. The case summaries and operative records of all of the patients treated operatively for SBO...
were reviewed. Patients with previous operative procedures for abdominal malignancies and patients with SBO not related to bezoar were excluded from data analysis. Case records of the patients with bezoar-related SBO were reviewed and recorded in standardized forms.

**OPERATIVE APPROACH SELECTION**

The decision to operate on the patients with SBO via the open approach or the laparoscopic approach was based on the experience in laparoscopy of the surgeon. All of the patients with SBO under the care of a team of surgeons with experience in emergency laparoscopy (K.K.Y. and W.T.S.) received laparoscopic treatment. All of the other patients with SBO were treated by laparotomy.

**OPERATIVE TECHNIQUE**

Following informed consent, emergency surgery was performed after fluid resuscitation. Prophylactic antibiotics were given. Under general anesthesia, patients were placed in the supine position, with the surgeon and assistant standing at the patient’s left side. Open insertion of a Hasson trocar at the umbilicus was performed, and a 30° laparoscope was introduced. Two additional 5-mm ports were then inserted under direct vision at the right and left midclavicular lines along the level of the umbilicus. Starting from the ileocecal junction, the small bowel was traced proximally to the duodenojejunal flexure using atraumatic forceps. Extreme care was taken during bowel manipulation to avoid inadvertent bowel injury. Exposure and localization of the site of obstruction was helped by adjusting the operating table to either side in steep Trendelenburg position. After delineation of the bezoar at the site of the obstruction, we systematically searched for a synchronous lesion or anatomical abnormalities in the small bowel and stomach in a retrograde manner.

The bezoar was initially “milked” in the retrograde direction to the dilated bowel segment to relieve the obstruction and to allow for the drainage of intestinal fluid to the collapsed small-bowel segment. Laparoscopic extramural fragmentation of the bezoar was performed using atraumatic forceps. The fragmented bezoar was then milked into the cecum. The entire small bowel was reexamined for a synchronous lesion and to ensure absolute relief of the bowel obstruction. The laparoscopic procedure was converted to minilaparotomy (of 7-8 cm) when the bezoar was too hard to crush or whenever technical difficulties were encountered.

Standard midline laparotomy was performed for patients in the laparotomy group. Manual crushing and manipulation were performed. In cases in which fragmentation via extraluminal manipulation was not technically feasible, enterotomy was fashioned at the antimesenteric border of a healthy bowel segment proximal to the bezoar for bezoar retrieval. The bowel defect was then repaired with sutures.

Postoperatively, the patients were allowed to resume their diets when the ileus subsided. Before discharge, all of the patients were advised by dietitians regarding eating habits. Patients’ characteristics, including age, sex, American Society of Anesthesiologists physical health status class, previous gastric procedures, and time from gastric procedures to attacks of SBO, were recorded.

Operative details, including operation time and reasons for conversion, were evaluated. In addition, the postoperative complications, hospital stays, and recurrence rates were also compared between groups. An intention-to-treat analysis was used (ie, converted cases were included in the laparoscopy group for calculation).

The t test, Mann-Whitney U test, χ² test, and Fisher exact test were used to compare the results between groups using Statistical Product and Service Solutions for Windows, version 8.0 (SPSS Inc, Chicago, Ill). A P value of less than .05 was considered to be statistically significant.

From November 1, 1998 to November 30, 2003, there were 496 patients with SBO due to various reasons admitted to our unit. Excluding patients with history of intra-abdominal malignancies, 94 patients required operative interventions. The laparoscopic approach was adopted in 35 patients, and 10 of these cases were due to bezoar. Twenty-four (4.8%) of the cases of bezoar-related SBO were managed by either the conventional open approach or the laparoscopic approach.

Patients’ demographics are summarized in Table 1. Both patient groups were comparable in age, sex, and American Society of Anesthesiologists class. No sign of strangulation was noted in the present series. There were 13 patients (30%) in the laparoscopy group and 10 patients (71%) in the laparotomy group who had history of previous abdominal procedures. Six patients (60%) in the laparoscopy group and 6 patients (43%) in the laparotomy group had preoperative contrast studies performed to diagnose and localize the sites of obstruction (P = .68, Fisher exact test). There was no concurrent bezoar detected in other parts of the digestive tract among these 24 patients. There were 10 cases in the laparoscopy group and 3 cases converted to minilaparotomies (for an obscured lesion [1 case], inability to crush the bezoar [1 case], and failure to negotiate the bezoar through the ileocecal valve [1 case]).

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Table 1. Patient Demographics

<table>
<thead>
<tr>
<th></th>
<th>Laparoscopy Group</th>
<th>Laparotomy Group</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, No.</td>
<td>10*</td>
<td>14</td>
<td>NA</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>66.3 (14.7)</td>
<td>71.1 (8.1)</td>
<td>.31</td>
</tr>
<tr>
<td>Sex, men/women</td>
<td>7/3</td>
<td>9/5</td>
<td>.77</td>
</tr>
<tr>
<td>ASA class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>3</td>
<td>5</td>
<td>.57</td>
</tr>
<tr>
<td>III</td>
<td>7</td>
<td>9</td>
<td>.10</td>
</tr>
<tr>
<td>Patients with previous abdominal procedure (including gastrectomy), No.</td>
<td>3</td>
<td>10</td>
<td>.21</td>
</tr>
<tr>
<td>Patients with previous gastrectomy, No.</td>
<td>2</td>
<td>7</td>
<td>.68</td>
</tr>
<tr>
<td>Patients with preoperative contrast studies performed, No.</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: ASA, American Society of Anesthesiologists; NA, not applicable.

*Includes 3 converted cases.
The operative outcomes between groups are summarized in Table 2. The operative time was significantly shorter in the laparoscopy group. The mean (SD) operative times were 48.0 (13.4) minutes in the laparoscopy group and 71.8 (33.8) minutes in the laparotomy group. The mean difference was 23.8 minutes (95% confidence interval, 0.3-47.3; t_{22}=2.1; P = .048). Within the laparoscopy group, the mean (SD) operative time for procedures completed laparoscopically (n=7) was 47.9 (11.5) minutes whereas the mean (SD) operative time for the converted cases (n=3) was 48.3 (20.0) minutes.

Laparoscopy facilitated early resolution of intestinal ileus and allowed earlier resumption of diet. The mean (SD) times for return of bowel function were 2.2 (0.6) days in the laparoscopy group and 4.7 (2.9) days in the laparotomy group. The mean difference was 2.5 days (95% confidence interval, 0.6-4.5; t_{22}=2.7; P = .01).

The hospital stay was also shorter in the laparoscopy group. The median hospital stays were 4.0 days whereas the median hospital stay for patients with procedures completed laparoscopically (n=7) was 4 days whereas the median hospital stay for patients with converted procedures (n=3) was 6 days.

There were no postoperative complications in the laparoscopy group, but there were 2 cases of chest infection, 1 case of wound infection, and 1 case of prolonged ileus.

While bezoars are the most common type of foreign body lodged in any part of the digestive tract, the overall incidence of bezoar-induced SBO remains relatively low. The present study shows a frequency of 24 (4.8%) of 496 patients with SBO, which was similar to some described series. Although the prevalence of bezoars is low, its associated complications, such as ulceration, perforation, intussusception, and obstruction, may cause mortality in up to 30% of cases. In adults, bezoar formation is predisposed by previous gastric procedures, incomplete mastication secondary to poor dentition, gastric stasis, and hypothyroidism. Patients with digestive tract abnormalities such as diverticulum, adhesion bands, and stricture can also have bezoar formation.

In some described series of bezoar-associated SBO, 56% to 76.3% of the patients had undergone gastric procedures whereas only 37.5% of the patients of the present series had previous gastric procedures. Moreover, the present recruited patients did not have significant association with excessive persimmon consumption, which was described in other articles. The majority of our patients (16 [66.7%] of 24 patients) had poor dentition or ill-fitted dentures that may have allowed a poorly chewed food bolus to pass beyond the stomach and to increase in size, thus causing SBO. To prevent bezoar recurrence, postoperative denture adjustment is mandatory. All patients should also be advised to avoid excessive intake of food with high fiber content.

For patients without apparent predisposing factors for bezoar, the origin of bezoar is postulated to be provoked by odd dietary and eating habits. In contrast to other described series, concurrent bezoar in other parts of the digestive tract was not discovered in our group of patients.

Preoperative diagnosis of bezoar-induced SBO is, for the most part, difficult, and hence most of the diagnoses are revealed by laparotomies. The role of computed tomography in the diagnosis of SBO has been well documented in radiological literature, and the use of computed tomographic scans to diagnosis SBO secondary to bezoar has been proposed by some.

With the advent of advanced minimal access techniques, there are recent descriptions of the application

### Table 2. Operative Outcomes

<table>
<thead>
<tr>
<th>Site of obstruction</th>
<th>Laparoscopy Group ((n = 10)^{\text{a}})</th>
<th>Laparotomy Group ((n = 14)^{\text{a}})</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal ileum, No.</td>
<td>8</td>
<td>11</td>
<td>&gt;.99(^{\dagger})</td>
</tr>
<tr>
<td>Mid-jejunum, No.</td>
<td>2</td>
<td>3</td>
<td>&gt;.99(^{\dagger})</td>
</tr>
<tr>
<td>Conversion to mini laparotomies, No.</td>
<td>3</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Enterotomies for bezoar retrieval, No.</td>
<td>2</td>
<td>5</td>
<td>.65(^{\dagger})</td>
</tr>
<tr>
<td>Operative time, mean (SD), min</td>
<td>48.0 (13.4)</td>
<td>71.8 (33.8)</td>
<td>.048(^{\dagger})</td>
</tr>
<tr>
<td>Time for return of bowel function, mean (SD), d</td>
<td>2.2 (0.6)</td>
<td>4.7 (2.9)</td>
<td>.01(^{\dagger})</td>
</tr>
<tr>
<td>Hospital stay, median (range), d</td>
<td>4.0 (3-14)</td>
<td>7.5 (5-120)</td>
<td>.009(^{\ddagger})</td>
</tr>
<tr>
<td>Postoperative complications, No.</td>
<td>0</td>
<td>4(^{\parallel})</td>
<td>.04(^{\dagger})</td>
</tr>
</tbody>
</table>

Abbreviation: NA, not applicable.

\(^{\text{a}}\)Includes 3 converted cases.

\(^{\dagger}\)By Fisher exact test.

\(^{\ddagger}\)By t test.

\(^{\parallel}\)By Mann-Whitney U test.

\(^{\text{\textcircled{2}}\text{Two cases of chest infection, 1 case of wound infection, and 1 case of prolonged ileus.}}\)

A bezoar is a conglomeration of food or foreign material in the alimentary tract. Bezoars can be classified according to their origins as phytobezoar (undigested fruit or vegetable fibers), trichobezoar (hair), lactobezoar (undigested milk), pharmacobezoar (medications), food bolus bezoar, or miscellaneous.
of diagnostic and therapeutic laparoscopy in the management of SBO. Laparoscopy not only can be used to assess the cause, location, gut viability, and degree of bowel obstruction, but also can provide direction for the definitive treatment. Laparoscopic treatment has been shown to be associated with better postoperative outcomes than conventional open treatment. Furthermore, the laparoscopic approach is also appealing because it produces fewer postoperative intra-abdominal adhesions than open procedures.

Nevertheless, laparoscopic operative exposure and manipulation can be very difficult in the presence of distended and fragile bowel loops. Some surgeons tend to apply laparoscopic-assisted procedures when performing definitive procedures for SBO whereas some advocate applying laparoscopy in all cases of SBO and claim that definitive therapeutic procedures can also be achieved in most cases via the laparoscope.

Bezoar is an uncommon cause of acute SBO. Traditionally, surgical management of SBO secondary to bezoar entails milking the offending object into the cecum or performing enterotomy for retrieval in difficult cases. Therapeutic laparoscopy has been demonstrated to be feasible in the management of SBO secondary to bezoar.

To our knowledge, our study represents the largest series of successful laparoscopic management of bezoar-related SBO. Our study illustrates that the laparoscopic approach is associated with significantly shorter operative time, reduced hospital stay, and fewer complications as compared with the conventional open method.

We accepted the limitations of our retrospective study involving a small number of patients; however, the low incidence of this disease and the uncertainty in obtaining a preoperative diagnosis made further evaluation in a randomized, controlled trial rather difficult. The verified feasibility and superior outcomes in patients who received laparoscopic treatment deserve further consideration when we decide on the operative strategy for patients suspected to have bezoar-related SBO.

In conclusion, in the presence of predisposing factors, bezoar-induced SBO should be considered a differential diagnosis in patients with SBO. When expertise is available, laparoscopy is safe and effective in the management of bezoar-induced SBO and is associated with lower morbidity as compared with the conventional open approach.

Accepted for Publication: December 1, 2004.

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REFERENCES