ARTÍCULO ORIGINAL

Comparison between surgical techniques in gallstone ileus and outcomes

Comparación de técnicas quirúrgicas en el íleo biliar y sus resultados

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Abstract

Introduction: *Gallstone ileus is a rare cause of mechanical bowel obstruction, generally found in elderly patients who often have other significant medical conditions.* **Objective:** *The objective of the study was to determine the prevalence of gallstone ileus and the number of postsurgical complications and outcomes depending on what type of surgical management is performed.* **Method:** *Cohort, retrospective, observational, and comparative study was conducted, which included 31 patients undergoing surgery for gallstone ileus. Three groups were integrated according to the type of surgical procedure: Group 1: enterotomy and stone extraction alone,. Group 2: enterotomy and cholecystectomy with fistula closure, and Group 3: bowel resection alone.* **Results:** *A total of 31 patients were analyzed. Gallstone ileus represented the 1.44% of all cases of bowel obstruction. Complication rates were similar between three groups. Mortality rate was lower in Group A, especially when compared to Group B, with a statistically significant difference ($p < 0.05$).* **Conclusions:** *Surgery is the pillar in treatment of gallstone ileus. Enterotomy with stone extraction alone appears to be associated with a lower mortality rate and better outcomes when compared to more extensive techniques.*

Key Words: *Gallstone ileus. Surgery. Mortality. Bowel obstruction. Bilioenteric fistula.*

Resumen

Antecedentes: *El íleo biliar es una causa rara de obstrucción intestinal mecánica, que se presenta generalmente en pacientes ancianos que a menudo tienen otras afecciones médicas importantes.* **Objetivo:** *Determinar la prevalencia del íleo biliar, el número de complicaciones y los resultados según el tipo de tratamiento quirúrgico que se realice.* **Método:** *Estudio de cohorte, retrospectivo, observacional y comparativo, que incluyó 31 pacientes sometidos a cirugía por íleo biliar. Se integraron tres grupos según el tipo de procedimiento quirúrgico: grupo 1, enterotomía y extracción de cálculos únicamente; grupo 2, enterotomía y colecistectomía con cierre de fístula; y grupo 3, resección intestinal únicamente.* **Resultados:** *Se analizaron 31 pacientes. El íleo biliar representó el 1.44% de todos los casos de obstrucción intestinal. Las tasas de complicaciones fueron similares en los tres grupos. La tasa de mortalidad fue menor en el grupo 1, en especial cuando se comparó con el grupo 2, con una diferencia estadísticamente significativa ($p < 0.05$).* **Conclusiones:** *La cirugía es el pilar en el tratamiento del íleo biliar. La enterotomía con extracción de cálculos parece asociarse con una menor tasa de mortalidad y mejores resultados en comparación con técnicas más extensas.*

Palabras Clave: *Íleo biliar. Cirugía. Mortalidad. Obstrucción intestinal. Fístula bilioentérica.*

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Introduction

Gallstone ileus is a rare cause of mechanical bowel obstruction, generally found in elderly patients who often have other significant medical conditions. It occurs in the setting of chronic cholecystitis when de impacted gallstone erodes into the adjacent duodenum, producing a cholecystoenteric fistula most commonly, although it also can be a cholecystogastric or cholecystocolonic fistula. Then, the gallstone passes down through the gastrointestinal tract until it reaches the distal ileum causing obstruction[1].

Objective

The objective of the study was to determine the prevalence of gallstone ileus and the number of post-surgical complications and outcomes depending on what type of surgical management is performed: enterotomy with stone extraction alone (EE), enterotomy and cholecystectomy with fistula closure (enterocutaneous fistula [ECF]), and bowel resection (BR).

Method

Cohort, retrospective, and observational study was conducted. We included all those patients diagnosed with gallstone ileus that underwent exploratory laparotomy at our unit in a time lapse of 16 years from January 1, 2003, to December 31, 2018. Data were collected from the physical and electronic files. A total of 31 patients were diagnosed with gallstone ileus over this period of time. According to the surgical procedure, we integrated three different groups: Group 1: patients who underwent enterotomy and stone extraction alone, Group 2: patients who underwent enterotomy and cholecystectomy with fistula closure, and Group 3: patients who underwent BR alone without fistula closure.

Factors such as sex, age, and length of hospital stay were evaluated and placed into a database. Multivariate logistic regression was used to compare mortality and morbidity between groups after controlling for age, gender, surgery type Stone Extraction, Enterocutaneous fistula or Bowel Resection (SE, ECF or BR), and comorbid conditions. The presence or absence of post-operative complications from the immediate post-operative period was determined in each group, with a follow-up of 6 months. The quantitative variables were defined by the median and the qualitative variables by frequency and percentage. Statistical analysis was performed using the IBM SPSS Statistics 24.0 software. A reliability of 95% was granted and it was considered $p < 0.05$ as statistically significant.

Table 1. General characteristics

Characteristics	Group 1	Group 2	Group 3
Sex			
Female	16	5	3
Male	4	1	2
Mean age	68.7	70.2	65.9
Weight (kg)	70.1 ± 5.5	68.1 ± 4.5	69 ± 5.2
Hospital stay (days)	12	14	13

Table 2. Comparison of comorbidities and comorbidity scores between groups

Comorbidities	Group 1 (n = 20)	Group 2 (n = 6)	Group 3 (n = 5)
Diabetes	12 (60%)	4 (66.6%)	2 (40%)
Hypertension	10 (50%)	2 (30%)	1 (40%)
Chronic kidney disease	6 (30%)	1 (16.6%)	1 (20%)
Congestive heart failure	4 (20%)	0	0
Chronic pulmonary disease	6 (30%)	1 (16.6%)	1 (20%)
Comorbidity score with adjusted age**	6 (3-9)	4 (3-8)	5 (3-6)
Total comorbidities per group	38	8	5

**Comorbidity scores are based on the Charlson comorbidity index

Results

During this period, 2138 cases of bowel obstruction were registered and only 31 (1.44%) were due to gallstone ileus. Patients in this study were mostly elderly, with a median age of 67 years (62-78), with females accounting for the vast majority of patients, 24 (77.41%) of which were women and 7 (22.58%) men. General characteristics, including weight and hospital stay, are summarized in table 1.

All patients were treated surgically, three procedures were performed. The most common was Stone Extraction (SE) with 20 cases, followed by ECF closure, and finally BR with 6 and 5 cases, respectively.

All patients had at least one comorbidity, some patients had even 4-5 comorbidities, comorbidity scores ranged from 3 to 9. Results, including comorbidity scores, are summarized in table 2.

Regarding clinical manifestations the most common were abdominal pain and vomit, presenting in all

Table 3. Clinical manifestations

Clinical manifestations	Number of cases (%)
Abdominal pain	31 (100)
Vomit	31 (100)
Abdominal distention	18 (58)
Constipation	16 (51.6)
Anorexia	10 (32.2)

Table 4. Comparison of complications between groups

Complications	Group 1 (n = 20) (%)	Group 2 (n = 6) (%)	Group 3 (n = 5) (%)	P_1 value	P_2 value	P_3 value
Anastomotic leak or abscess	2 (10)	2 (33.3)	1 (20)	0.073	0.15	0.24
Bleeding	1 (5)	0	0	0.08	0.08	0.72
Cardiac complications	1 (5)	1 (16.6)	0	0.09	0.68	0.09
Pneumonia	2 (10)	1 (16.6)	1 (20)	0.07	0.08	0.25
Acute renal failure	3 (15)	1 (16.6)	1 (20)	0.09	0.12	0.65
Wound complications	2 (10)	1 (16.6)	1 (20)	0.07	0.09	0.55
Total	11 (55)	6 (100)	4 (80)	0.09	0.26	0.81

P_1: comparison between EE and ECF; P2: comparison between EE and BR;
P3: comparison between ECF and BR.
($p < 0.05$ statistically significant).
ECF: enterocutaneous fistula; BR: bowel resection.

patients. The second most common manifestations were abdominal distention and constipation that were present in 50-60% of the cases. All clinical manifestations are summarized in table 3.

The diagnosis was made by abdomen radiographs in 10 patients (32.25%), computed tomography (CT) was required in 15 cases (48.38%) and in 6 patients (19.35%), the diagnosis of gallbladder ileus was made intraoperatively.

The fistula encountered intraoperatively was cholecystoenteric in 23 cases (74.19%), cholecystogastric in 7 cases (22.58%), and cholecystocolonic in 1 case (3.22%).

We found no statistically significant difference in complications rates between groups, the most common complications were anastomotic leak/intraabdominal abscess and acute renal failure, which were present in 10 patients (32.25%), followed by pneumonia and wound complications, with 4 cases each (25.8%). Bleeding was seen only in one patient belonging to Group 1. Two patients had cardiac complications, they belonged to Group 1 and Group 2. The results are summarized in table 4.

Table 5. Comparison of mortality rates

Groups	Mortality
Group 1	2 (10%)
Group 2	2 (33.3%)
Group 3	1 (20%)
P1	0.042
P2	0.72
P3	0.95

P1: Group 1 versus Group 2; P2: Group 1 versus Group 3; P3: Group 2 versus Group 3; ($p < 0.05$) statistically significant.

Finally, mortality rates vary between all groups. The highest rate was observed in Group 2, with 2 fatal cases representing 33.33%. Group 1 had a mortality rate of 5%, corresponding to 1 patient and Group 3 had a mortality rate of 20%, corresponding also to 1 patient. We observed a total mortality rate of 12.9%. The mortality rate in Group 1 was lower in comparison with the other two groups; however, a statistically significant difference was only observed when comparing enterotomy with gallstone extraction alone with enterotomy and cholecystectomy with fistula closure ($p < 0.05$). A comparison of mortality rates is summarized in table 5.

Discussion

Gallstone ileus is an unusual complication of cholelithiasis and represents a small percentage of mechanical small bowel obstruction cases[2]. It is caused by the passage of a stone through a fistula, which can be cholecystoenteric, accounting for approximately 60% of all cases followed by cholecystogastric or cholecystocolonic[1,3].

Over the past 50 years, gallstone ileus was attributed to be the cause in 1-5% of mechanical bowel obstructions[3-5]. However, only 1001 cases were reported in the United States in the past century[6]. On the other hand, the data collected by Halabi et al. revealed that from 2004 to 2009, an estimated 3268 patients underwent surgery for gallstone ileus in the United States. Although the number of cases in this time lapse of 6 years was more than the triple of the cases reported over the last century, it actually accounts only for 0.095% of mechanical bowel obstruction in that country, a much lower percentage than previously thought[2]. Unfortunately, in Mexico, there is no precise registry to determine the correct incidence or prevalence of this entity.

The fistula formation in this disease probably follows this sequence. Repeated cholecystitis and pericholecystic inflammation produce adhesions between the biliary and enteric systems. Then, the gallstone presses the biliary or enteric wall causing erosion and fistula formation[1]. Furthermore, cases of gallstone ileus following endoscopic sphincterotomy have been reported[7].

The obstruction is produced depending on the gallstone size. More than 90% of obstructing gallstones are > 2 cm, the majority measuring over 2.5 cm[8].

Approximately 70% of gallstones impact at the ileum, corresponding to the narrowest segment of the intestine. The second and third sites in order of frequency are jejunum and stomach, respectively[9].

The classic clinical picture of gallstone ileus is an elderly woman with episodic subacute obstruction. The episodic obstruction is produced by the stone tumbling through the bowel lumen. Transient gallstone impaction produces diffuse abdominal pain and vomiting, which subside as the gallstone becomes disimpacted, only to recur again as the stone lodges in the more distal bowel lumen. This results in vague and intermittent symptoms that generally are present for some days before hospital admission, the mean symptom duration before this is approximately 5 days[3].

Gallstone ileus should be suspected in elderly patients, especially women, with a clinical picture of acute or subacute small bowel obstruction, it can be confirmed by either radiologic evaluation or, in some cases, intraoperatively[1].

With the current usage of modern radiologic tests, especially the CT, diagnosis can be made in 77% of patients preoperatively, in contrast with other radiologic tests used in the past, where > 1½ of the patients were diagnosed before surgery (Fig. 1)[3,9].

The imaging modality of choice for gallstone ileus is the abdominal CT (Fig. 2). The radiologic findings consistent with gallstone ileus include gallbladder wall thickening, pneumobilia, bowel obstruction, and obstructing gallstones[10].

Due to the limited availability of CT, surgeons may make use of other diagnostic tests, plain films and ultrasound may be helpful in these cases. The classic findings of gallstone ileus on a plain abdominal film include signs of partial or complete bowel obstruction, pneumobilia, visualization of the gallstone, and change in the position of a previously located stone. Two of the first three findings were found in up to 50% of cases of gallstone ileus in one study. On the other hand, Rigler's triad is the appearance on plain radiograph of pneumobilia, small bowel obstruction, and gallstone (usually in the iliac fossa) but is seen only in approximately 25% of cases[11].

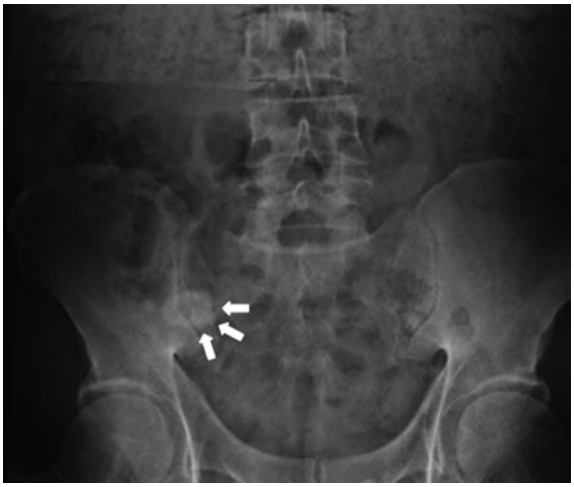

Figure 1. *Plain abdominal film showing a foreign body in the right lower abdomen (arrows) and some distension of bowel loops.*

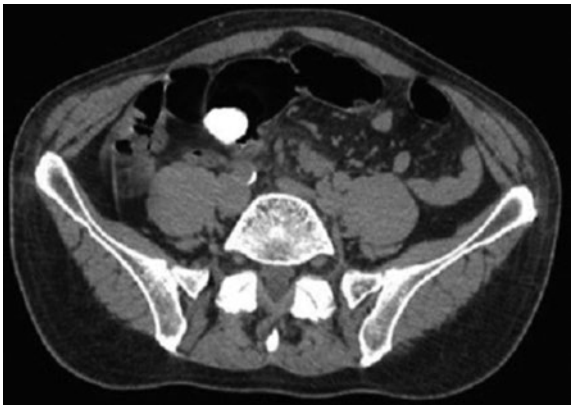

Figure 2. *Abdominal computed tomography scan image demonstrating an obstructing, calcified intraluminal stone. Evidence of small bowel obstruction noted with dilated loops proximal to the obstruction.*

The treatment for gallstone ileus is primarily surgical. Gallstone ileus involves three key elements cholelithiasis, biliary-enteric fistula, and bowel obstruction. The latter is typically addressed with an enterotomy with stone removal. Cholelithiasis and biliary-enteric fistula are typically addressed by cholecystectomy and fistula closure[1].

The majority of patients with gallstone ileus are typically treated with an open enterolithotomy first. A longitudinal enterotomy is made along the antimesenteric border proximal to the point of impactation[12]. The stone is extracted proximally and removed. A transverse closure of the enterotomy is made to avoid residual bowel stenosis. If the cecum is manipulated in the presence of stones, it can produce mucosal injury and undetected serosal rupture and therefore should not be performed routinely[3].

The entire bowel should be inspected for more gallstones, it has been reported that multiple gallstones are present in up to 16% of cases. In some cases, gallstones are cylindrical and are associated with an increased likelihood of multiple stones present[13]. The majority of cases of recurrent gallstone ileus are presumably due to cylindrical stones missed at initial operation[14].

In high-risk patients (multiple comorbidities, shock, or significant intra-abdominal inflammation or adhesions), enterolithotomy followed by close observation is highly recommended[15,16].

Expectant management after enterolithotomy is completely justified and it has been observed that biliary-enteric fistulas may close or shrink spontaneously, especially with a patent cystic duct and the absence of residual stones[6,16].

Enterolithotomy with a definitive biliary surgery as a one-stage procedure can be done in low-risk patients. Advantages of the one-stage procedure include a reduced recurrence of gallstone ileus, also prevent malabsorption and weight loss from persistent fistula, and prevent cholecystitis, cholangitis, and gallbladder carcinoma; however, it has higher morbidity and mortality[3].

Conclusions

Gallstone ileus is a rare condition that should be kept in mind in patients with a clinical picture of bowel obstruction, especially elderly women. There is no exact incidence reported in our country; in this study, this entity represented 1.44% of all cases of bowel obstruction.

Despite the decreased mortality rates over the past decades, mainly due to improvement in diagnostic tests and more efficient management, it still carries significant morbidity and mortality. The mainstay of treatment is surgical removal of the obstructing stone after resuscitating the patient. Early recognition of biliary obstruction before complications occurs is essential to improve prognosis. Treatment with enterotomy and stone removal alone, should be performed in most cases, since this procedure is associated with a lower mortality rate compared to segmental bowel resection. However, it is important to mention that each procedure has advantages and disadvantages, so we recommend to individualize each case because the type of surgical treatment depends on many variables such as patient conditions and comorbidities, time of evolution, resources availability, and to name a few.

We observed a total mortality rate of 12.9% which is very similar to other rates reported in recent series, which ranged between 5 and 13%[2]. The lowest mortality rate was seen in patients that underwent enterolithotomy only when compared to the other two techniques; it was only statistically significant when compared to enterotomy and cholecystectomy with fistula closure. Hence, we recommend that the latter should be undertaken in highly selected patients, and only on an elective basis.

Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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