

## Mini Review Article

# Cholecystolithotomy, a new approach to reduce recurrent gallstone ileus

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The incidence of gallstone ileus (GSI) is increasing. Current treatment options include enterolithotomy with or without cholecystectomy and repair of the biliodigestive fistula. Although most surgeons defer the management of the biliodigestive fistula to avoid the associated morbidity and mortality, this can lead to increased rate of recurrence of GSI by the remaining gallstones. More than 130 cases of recurrent GSI were reported in published works, and the incidence of recurrent GSI is reported to be between 5% and 20%. Some cases of second recurrent attacks have also been reported. Most cases were reported in elderly women with faceted stones during the first 2 months from the first episode of GSI. This article reviews the current treatment options for more than 4,300 reported cases of GSI. A treatment algorithm is recommended based on the severity of the inflammation around the gallbladder, including cholecystolithotomy as a third treatment approach that aims to reduce the risk of recurrent GSI.

**Key words:** Cholecystectomy, cholecystolithotomy, gallstone, ileus, recurrent

## INTRODUCTION

GALLSTONE ILEUS (GSI) is a complication of gallstone disease when mechanical bowel obstruction develops secondary to stone impaction in the small bowel. The stone passes through a biliodigestive fistula usually between the gallbladder and the duodenum. The condition has a higher tendency to affect elderly patients with large gallstones. Surgical treatment by extraction of the impacted gallstone through a small enterotomy is the traditional treatment option. The consensus among surgeons favors deferred management of the biliodigestive fistula to avoid the high morbidity and mortality risk associated with the single approach. Interval cholecystectomy and fistula repair are seldom offered, and patients will face the risk of a recurrent attack of GSI. The incidence of recurrent GSI is reported to be between 5% and 20%, and some cases of second recurrent attacks have also been reported. This article aims to review the current treatment options for GSI with a treatment algorithm, including cholecystolithotomy as a third

approach to reduce the significant morbidity risk from recurrent GSI.

## DISCUSSION

GALLSTONE ILEUS IS a mechanical bowel obstruction caused by an impacted gallstone in the lumen of the small bowel. The obstructing gallstone migrates to the bowel through a biliodigestive fistula that has developed between the repeatedly inflamed gallbladder and nearby bowel loop, commonly the duodenum. Gallstones, especially if larger than 2.5 cm, tend to obstruct the terminal ileum (Barnard's syndrome).<sup>1</sup> Less commonly, the obstruction can occur at the level of the duodenum (Bouveret's syndrome), which represents 3% of GSI.<sup>2</sup> Gallstone ileus was estimated to develop in 0.3–3% of patients with cholelithiasis and contributed to 3–4% of benign small bowel obstruction requiring surgery in a recent study.<sup>3</sup> This figure was reported to be as high as 25% of non-strangulated small bowel obstruction in patients over the age of 65 years.<sup>4</sup>

Gallstone ileus represents an acute surgical condition and the mainstay of management is surgical intervention to remove the obstructing gallstone. Non-operative management was associated with a mortality of 26.5%.<sup>5</sup> Two surgical approaches have been described with more than 4,000 cases reported (Table 1). The first, more commonly used, enterolithotomy alone procedure involves making a small

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**Table 1.** Comparison of reported postoperative mortality associated with different treatment approaches for gallstone ileus (updated from Kirchmayr *et al.*<sup>6</sup>)

Primary author	Year	One-stage operation			Enterolithotomy only			Enterolithotomy + cholecystolithotomy		
		Total	Mortality (n)	Mortality (%)	Total	Mortality (n)	Mortality (%)	Total	Mortality (n)	Mortality (%)
Warsaw <sup>7</sup>	1966	2	0	0.0	13	0	0.0	2	0	0.0
Cooperman <sup>8</sup>	1968	8	1	12.5	6	0	0.0	–	–	–
Day <sup>9</sup>	1975	3	0	0.0	26	3	12.0	–	–	–
Kasahara <sup>10</sup>	1980	105	20	19.0	7	0	0.0	–	–	–
Heuman <sup>11</sup>	1980	–	–	–	20	1	5.0	–	–	–
Hesselfeldt <sup>12</sup>	1982	2	0	0.0	31	5	16.0	–	–	–
Deitz <sup>13</sup>	1986	4	0	0.0	18	3	17.0	–	–	–
Lausen <sup>14</sup>	1986	1	0	0.0	31	5	16.0	–	–	–
Moss <sup>15</sup>	1987	5	0	0.0	12	2	16.0	–	–	–
Braun <sup>16</sup>	1989	2	0	0.0	8	0	0.0	–	–	–
Clavien <sup>1</sup>	1990	8	2	25.0	29	5	17.0	–	–	–
Keck <sup>17</sup>	1993	11	0	0.0	3	1	33.0	–	–	–
Reisner <sup>5</sup>	1994	113	19	17.0	801	96	12.0	–	–	–
Rodriguez <sup>18</sup>	1997	9	3	33.0	16	3	19.0	–	–	–
Zuegel <sup>19</sup>	1997	14	1	7.0	2	0	0.0	–	–	–
Pavlidis <sup>20</sup>	2003	6	1	17.0	3	0	0.0	–	–	–
Doko <sup>21</sup>	2003	19	2	10.5	11	1	9.0	–	–	–
Tan <sup>22</sup>	2004	12	0	0.0	7	0	0.0	–	–	–
Kirchmayr <sup>6</sup>	2005	4	1	25.0	–	–	–	–	–	–
Ayantunde <sup>23</sup>	2007	2	1	50.0	20	4	20.0	–	–	–
Muthukumarasamy <sup>24</sup>	2008	3	0	0.0	10	0	0.0	–	–	–
Riaz <sup>25</sup>	2008	5	0	0.0	5	0	0.0	–	–	–
Martínez Ramos <sup>26</sup>	2009	4	1	25.0	27	4	15.0	–	–	–
Yakan <sup>27</sup>	2010	1	0	0.0	11	2	18.0	–	–	–
Williams <sup>28</sup>	2012	2	0	0.0	–	–	–	1	0	0.0
Mallipeddi <sup>29</sup>	2012	14	1	7.0	113	60	53.0	–	–	–
Halabi <sup>30</sup>	2014	607	42	7.0	2,022	101	5.0	–	–	–
Mir <sup>31</sup>	2015	17	2	12.0	73	12	16.0	–	–	–
Tartaglia <sup>32</sup>	2017	3	0	0.0	17	0	0.0	–	–	–
Sánchez-Pérez <sup>33</sup>	2017	1	0	0.0	5	1	20.0	–	–	–
Koganti <sup>34</sup>	2017	–	–	–	–	–	–	1	0	0.0
Erdas <sup>35</sup>	2018	1	0	0.0	3	0	0.0	–	–	–
Total		988	98	10.0%	3,350	309	7.4%	4	0	0.0%

–, not applicable.

enterotomy proximal to the site of stone impaction to allow extraction of the gallstone. The procedure can be followed by a delayed cholecystectomy if needed when the patient recovers and the inflammatory process around the gallbladder improves (two-stage surgery). The second procedure, also known as the one-stage procedure, includes enterolithotomy with simultaneous cholecystectomy and fistula repair. The benefits of the one-stage approach include the prevention of recurrent attacks of cholecystitis, cholangitis, and

recurrent GSI. A number of authors<sup>1,6,36,37</sup> cited Bossart *et al.*<sup>38</sup> as reporting a 15% incidence of gallbladder cancer in patients undergoing surgery for biliodigestive fistula, advocating for the one-stage procedure. On reviewing the original article by Bossart *et al.*,<sup>38</sup> the authors reported an incidence of cancer in 0.82% of patients undergoing cholecystectomy and there was no mention of the incidence of cancer in patients with biliodigestive fistula. Hence, it seems that the risk of developing cancer in patients with

biliodigestive fistula has been overstated. However, the possibility of fistulising gallbladder cancer at the time of presentation leading to GSI is very rare and would indicate an advanced stage of gallbladder cancer. Such findings should be evident on preoperative computed tomography scans and would dictate different management.

There is no current guideline for the management of GSI. Historically, the one-stage approach was found to be associated with a high rate of postoperative morbidity and mortality and hence most surgeons advocate the enterolithotomy only approach.<sup>3</sup> In 1994, Reisner and Cohen reviewed 1,001 cases of GSI, the one-stage approach was associated with a mortality rate of 16.9% versus 11.7% for enterolithotomy alone.<sup>5</sup> In this review, we included the reported case series on the management of GSI and the Reisner and Cohen review, with a total of more than 4,300 patients (Table 1). The one-stage approach was associated with higher mortality when compared to enterolithotomy alone, however, both procedures had similar mortality rates in the last three decades (7.5% and 7.8% for the one-stage procedure and enterolithotomy alone, respectively). The overall improvement in survival, and especially with the one-stage procedure, can be explained by the improvement of intraoperative and postoperative management of surgical patients, and by the selection of more stable and fit patients for the one-stage procedure.

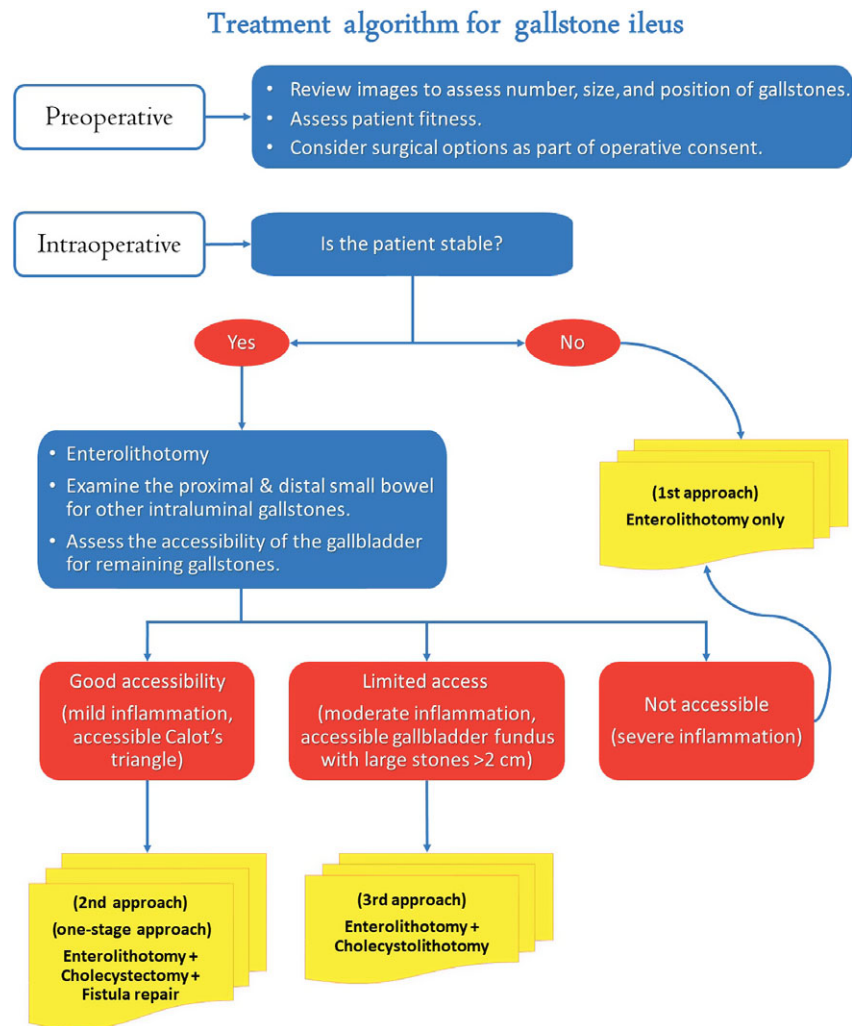
The incidence of GSI is increasing and one of the concerns with the enterolithotomy-only approach is the remaining gallstones in the gallbladder and persistent fistula leading to the possibility of developing recurrent GSI. This risk was estimated to reach between 5% and 20% in patients who survived the first enterolithotomy.<sup>5,33,39</sup> In a recent review of published reports by Mir *et al.*, at least 113 cases of recurrent GSI were reported since 1913. The majority of recurrences occurred in the early postoperative phase with 62% and 85% of the cases re-presenting within 6 weeks and 6 months from the index attack, respectively.<sup>31</sup> Recurrence can occur due to persistent biliodigestive fistula or due to missed stones in the digestive system during the first operation, which was reported to occur even after the biliodigestive fistula was repaired.<sup>18</sup> It was also suggested that obstruction caused by faceted stones indicates that more stones are present in the gallbladder and increases the possibility of recurrence.<sup>31</sup> Cases of second recurrence of GSI were also reported.<sup>40,41</sup>

There is a general agreement between surgeons that less is better in treating GSI. However, a repeat laparotomy for a recurrent GSI is a significant morbidity especially in elderly patients recovering from a recent laparotomy. A mortality rate of up to 20% was reported in repeat laparotomies for recurrent GSI.<sup>5</sup> With the current improvement in patient

survival after emergency laparotomies, more cases of recurrent GSI are expected and measures to avoid recurrence should be considered during the first operation. As most of the patients will not be fit for a single approach procedure, a less invasive approach that focuses on reducing the risk of recurrence is required.

Cholecystolithotomy might not be a commonly used procedure in modern surgery, however, it used to be the standard treatment of cholecystitis until cholecystectomy became a safe procedure in the late 19th century.<sup>42</sup> It has also been adopted as a treatment option for cholecystitis in unfit patients or as a gallbladder preservation procedure.<sup>43</sup> A recent meta-analysis reported a gallstone recurrence rate of 3% during an average follow-up duration of 4 years following laparoscopic cholecystolithotomy.<sup>44</sup> Cholecystolithotomy with or without fistula repair was first reported for treatment of GSI in 1966 by Warshaw and Bartlett.<sup>7</sup> Another case was reported by Williams *et al.*<sup>28</sup>, and Koganti *et al.*<sup>34</sup> reported the first laparoscopic cholecystolithotomy for GSI in 2017.

This article recommends a treatment algorithm (Fig. 1) for GSI that aims to prevent disease recurrence. Treatment options will depend on each patient's general condition, the presence of further stones in the gallbladder, the amount of inflammation around the gallbladder, and surgeon experience. Treatment of GSI starts with the assessment of preoperative images searching for additional gallstones in the gallbladder and the small bowel. Patient counselling and operative consent should include the risk of developing recurrent GSI and possible intervention to reduce this risk based on the patient's clinical condition. The operative technique is personalized based on the patient's condition during surgery and the amount of inflammation around the gallbladder. The unfit patient should not be exposed to prolonged surgery and enterolithotomy only should be carried out (the first approach). Whenever possible, the small bowel loops proximal and distal to the obstruction should be examined for other gallstones. If any stones are found, they can be retrieved through the same enterotomy. For more fit patients who can tolerate a longer procedure, assessment of the gallbladder accessibility should be undertaken. In most cases, the gallbladder can be surrounded by significant inflammation, limiting access to the gallbladder. In cases with mild to moderate inflammation in the right upper abdomen, gentle examination of the gallbladder can be carried out without disturbing the cholecystoduodenal fistula. If the surgeon can feel large stone(s) in the gallbladder and there is good exposure of the gallbladder fundus, cholecystolithotomy can be carried out (the third approach) through the open<sup>28</sup> or laparoscopic approach.<sup>34</sup> An incision is made



**Fig. 1.** Treatment algorithm for gallstone ileus including three approaches of treatment depending on the patient's clinical condition, the extent of inflammation around the gallbladder, presence of remaining stones in the gallbladder, and the surgeon's expertise.

in the fundus of the gallbladder wide enough to allow stone extraction and irrigation of the gallbladder. The incision is then closed using absorbable sutures.

The single-stage procedure includes cholecystectomy and repair of the cholecystoduodenal fistula. This might require partial resection of the duodenum and bile duct involvement is not unusual. This procedure should be performed only by an experienced surgeon and in specialized centers in selected fit and relatively young patients. The addition of cholecystolithotomy to enterolithotomy in suitable cases of GSI is a less invasive approach compared to the single-stage procedure and will reduce the risk of early recurrence of GSI and subsequently reduce the morbidity and mortality associated with these recurrences. Patients with persistent symptoms related to cholecystitis can be offered delayed

cholecystectomy and fistula repair, however, there have been reports that biliodigestive fistulas do close spontaneously in the absence of cholelithiasis.<sup>4</sup>

Cholecystolithotomy has been reported previously for the treatment of recurrent GSI with no reported complications<sup>7,28,34</sup> and the aim of this article is to bring this approach as a treatment option to be considered and discussed with suitable patients. Future studies and reports are still required to support the safety and applicability of this approach.

## CONCLUSION

**G**ALLSTONE ILEUS IS becoming increasingly common in the aging population, and recurrent GSI is a

significant morbidity when it occurs. A surgical approach based on the severity of the inflammation around the gallbladder is recommended. Cholecystolithotomy is an example of a less invasive surgical approach that can reduce the risk of recurrent GSI.

## DISCLOSURE

Approval of the research protocol: N/A.

Informed consent: N/A.

Registry and the registration no. of the study/trial: N/A.

Animal studies: N/A.

Conflict of interest: None declared.

Ethical approval: Ethical approval was not required for this study.

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