Is concomitant cholecystectomy with laparoscopic sleeve gastrectomy mandatory?

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Background
Currently, laparoscopic sleeve gastrectomy (LSG) is one of the most common bariatric surgeries. Concomitant cholecystectomy is routinely performed for symptomatic patients. However, the management of patients with asymptomatic gallstones is still controversial. Again, the incidence, the prospective presentation of postoperative cholelithiasis in patients without previous gallstones disease is also deficient and unpredictable.

Patients and methods
This prospective study included 95 patients with asymptomatic gallstone disease (group A) and 755 patients without gallstone disease (group B) who underwent LSG. The endpoint was the development of symptomatic gallstones requiring surgical intervention. Types of presentation, relevant preoperative workup, and operative and postoperative findings were reported.

Results
In groups A and B, the mean age was 35.6±7.6 and 35.34±7.7 years; the preoperative BMI was 39.4±1.02 and 40.3±0.76 kg/m^2; the percentage of excess weight loss was 50±2.54% and 67±2.8% at the time of presentation, and 67.4 and 71.3% patients were women, respectively. Symptomatic gallstones were found in 17 (18%) patients in group A, two of whom had acute presentation. Two hundred and eighteen (29%) patients in group B had newly developed symptomatic gallstones, 35 (16%) of whom had acute presentation; two of them showed obstructive biliary symptoms. The time of presentation was significantly different between the two groups (group A: 10.5±1.7 months; group B: 21±6.6 months; P=0.0001). The mean follow-up periods were 26±9 and 28±12 months in groups A and B, respectively. Our results showed a high incidence of symptomatic gallstone after LSG. Family history and percentage of excess weight loss were also significantly correlated with symptom development. No operative difficulties were encountered in any patients, and no conversion occurred in our study.

Conclusion
Symptomatic cholelithiasis can present soon after sleeve gastrectomy and may warrant surgical intervention. A significant number of preoperatively healthy patients develop gallstones, with acute presentation in some cases. Although no consensus on concomitant cholecystectomy for treating asymptomatic patients has been reached, we found this procedure mandatory for high-risk patients.

Keywords:
laparoscopic cholecystectomy, sleeve gastrectomy, symptomatic cholelithiasis

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Introduction

Obesity is a major risk factor for cholelithiasis, and up to 45% of obese patients have symptomatic cholelithiasis during their lifetime. After weight-reduction surgery, up to one-third of patients develop cholelithiasis [1,2]. Although most patients are asymptomatic, a significant percentage of these patients become symptomatic especially after gastric bypass surgery with reported incidence of 3–28%. [2–7]. Rapid weight loss causing cholesterol mobilization from tissue stores increases the cholesterol index in the secreted bile, along with increased mucin and calcium as well as increased prostaglandin and arachidonic acid levels in the bile; all of these changes are implicated in the high incidence of gallstones after bariatric surgery [8,9]. Laparoscopic sleeve gastrectomy (LSG) is currently one of the most common restrictive bariatric procedures. However, patients with asymptomatic cholelithiasis tend to

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progress to symptomatic disease, and those without cholelithiasis tend to newly develop symptomatic cholelithiasis after LSG; furthermore, the type of prospective presentation of cholelithiasis is still unpredictable [10]. To date, no consensus on routine cholecystectomy as an integral step during LSG has been reached due to the associated technical difficulties and operative hazards (both occurring in up to 3% of cases) [11]. Thus, the surgical approach for cholelithiasis treatment in such patients is still a matter of debate, especially the exact timing of the procedure and the choice between concomitant cholecystectomy, routine cholecystectomy, and conventional approach when symptoms appear during follow-up [12]. The current study aims to highlight the prevalence of symptomatic cholelithiasis after LSG in our locality and determine the type of presentation. It also aims to determine the relationship between specific preoperative parameters, including BMI and family history, and the development of symptomatic cholelithiasis in these patients.

Patients and methods

This prospective study included patients undergoing LSG between January 2012 and June 2018. The study was approved by the Institutional Review Board. Informed consent was obtained from all participants included in the study. Patients with a history of previous cholecystectomy, known symptomatic gallstones with or without concomitant cholecystectomy, or previous weight-reduction surgery were excluded from the study. All patients considered for LSG were counseled in our outpatient clinic regarding other options for weight-reduction surgery, and all relative risks related to the surgery, postoperative care, and follow-up were explained.

All patients underwent routine preoperative gallbladder ultrasound to rule out gallstones or sludge. Only the patients with ultrasound abnormalities associated with symptoms of gallstone diseases were counseled for concomitant laparoscopic cholecystectomy (LC) and were excluded from the study. Prophylactic cholecystectomy was not performed in asymptomatic patients as per our local protocol.

Patients were followed up regularly in the outpatient clinic. General and local examination, BMI measurement, and transabdominal ultrasound were performed during the follow-up period. Further radiological assessment was performed for emergency admission due to biliary colic or manifestation of complicated gallbladder diseases (acute cholecystitis, obstructive jaundice, gallstone pancreatitis, or cholangitis). Symptoms suggestive of cholelithiasis or its complications include dyspepsia, acute, or chronic abdominal pain associated with or without vomiting or fever, and obstructive jaundice with elevated enzyme levels.

The patients were divided into two groups for comparison. Group A included patients with asymptomatic gallstones who underwent LSG and group B included patients with no history of clinical or radiological findings of gallstone diseases who underwent LSG. Important baseline characteristics, such as age, sex, BMI, time of presentation, percentage of excess weight loss (%EWL), family history of cholelithiasis, and the associated risk factors and other comorbidities were compared between the two groups. The primary outcome measure was the development of symptomatic gallstones for which LC was performed as a scheduled or emergency procedure. The secondary outcomes were intraoperative or postoperative difficulties, such as duct injury, longer hospital stay, and the conversion rate. According to the protocol, patients with positive findings of acute cholecystitis on ultrasound were scheduled for LC, and those presenting with obstructive biliary symptoms underwent further laboratory and radiological evaluation comprising transabdominal ultrasound, magnetic resonance cholangiopancreatography, and endoscopic retrograde cholangiopancreatography (ERCP) if indicated. LC was performed within 72 h after evaluations in all patients, including patients with post-ERCP. Operative findings and postoperative complications were recorded.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Ethical approval was obtained from the Institutional Review Board of Mansoura Faculty of Medicine and Al-Azhar Faculty of Medicine.

Statistical analysis

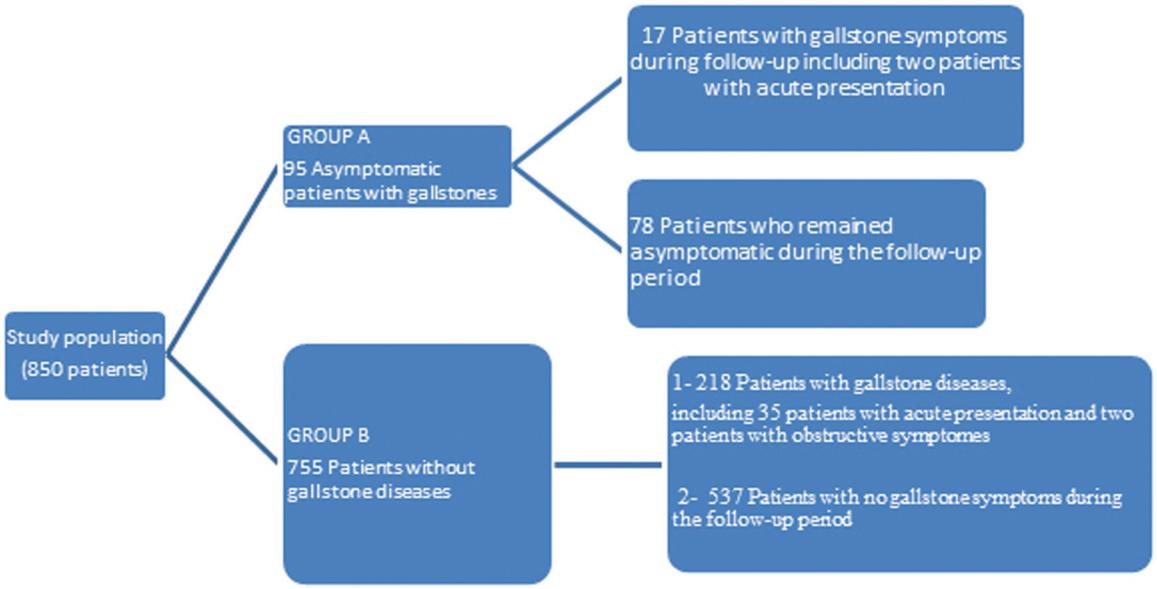
Data were collected in a spreadsheet using Microsoft Excel for Windows (Microsoft Corporation, Redmond, Washington, USA), and analysis was performed using the MedCalc statistical software (MedCalc Software BVBA, Ostend, Belgium). Data

are presented as the mean and SD. The χ^2 test or Fisher's exact test was used to evaluate nominal variables as appropriate. The independent t test was used to compare continuous variables. Multivariate logistic regression analysis was used to adjust for differences in baseline characteristics between the two groups. P values of less than 0.05 were considered statistically significant. The survival rate was estimated using the Kaplan–Meier estimator.

Results

Between January 2012 and June 2018, 850 patients underwent LSG. The study patients and their gallstone presentations are illustrated in Fig. 1. Baseline characteristics of the group A and B patients are presented in Table 1. The mean age was 35.7 years for group A, and 64 (67.4%) of the patients were women, whereas the mean age was 35.3 years for group B, and 538 (71.3%) of the patients were women. The mean age (P=0.715), female-to-male ratio (P=0.432), and follow-up duration (P=0.861) were not significantly different between the groups (Table 1). However, the preoperative BMI was higher in group B (40.3±0.76 kg/m^2) than in group A (39.4±1.02 kg/m^2, P=0.0001; Table 1). In addition, %EWL was lower in group A (50.3±2.54%) than in group B (67±2.8%, P=0.0001; Table 1).

Figure 1



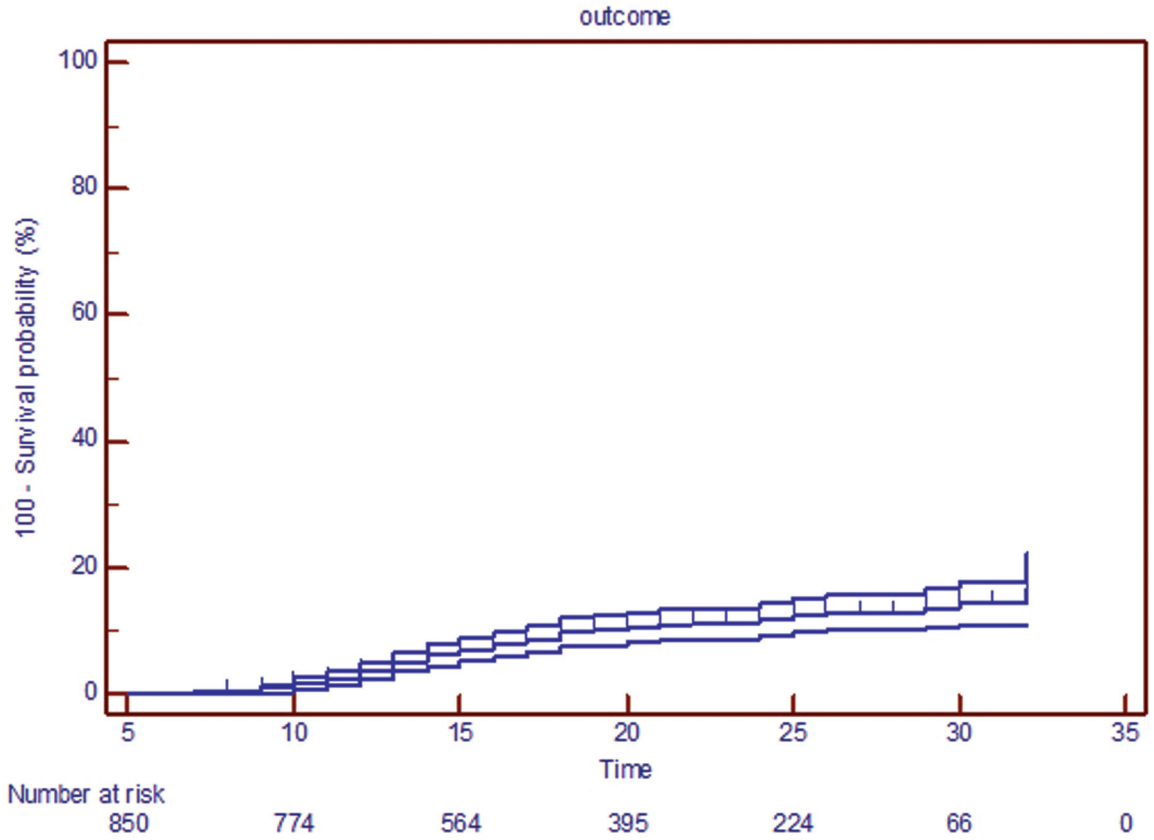
Study population and gallstone presentations.

Table 1 Patient demographic characteristics

	Group A (N=95/850)	Group B (N=755/850)	P value
Patients with symptomatic gallstone disease during the follow-up period [n (%)]	17 (18)	218 (29)	
Age (years)	35.7±7.6	35.34±7.7	0.715
Sex [n (%)]			
Female (633)	64 (67.4)	538(71.3)	0.432
Male (217)	31 (32.6)	217(28.7)	
Follow-up period (months)	26±9	28±12	0.861
Time of the first presentation (months)	10.5±1.7	21±6.6	<0.001
BMI (kg/m^2) before LSG	39.4±1.02	40.3±0.76	0.0001
%EWL	50.3±2.54	67±2.8	0.0001
Type of presentation [n (%)]			
Acute	2/17 (2)	35/218 (16)	
Chronic	15/17 (88)	183/218 (84)	
ERCP before LC	0	2	
Family history	15 (15.8)	54 (7.2)	

LC, laparoscopic cholecystectomy. %EWL, percentage of excess weight loss; ERCP, endoscopic retrograde cholangiopancreatography; LSG, laparoscopic sleeve gastrectomy.

Figure 2



Kaplan–Meier survival estimate plot showing the survival rate of gallstone symptom-free patients after LSG. LSG, laparoscopic sleeve gastrectomy.

Of the total 850 patients, preoperative asymptomatic gallstone disease was present in 95 (11.2%) patients who constituted group A, whereas the remaining 755 (88.8%) patients had no gallstone disease and constituted group B. Seventeen (18%) patients in group A developed gallstone symptoms postoperatively, with acute presentation in two (2.1%) of them warranting LC. Two hundred and eighteen (29%) patients in group B developed symptomatic gallstones, with acute presentation in 35 (16%) of them. Two of these 35 patients presented with obstructive jaundice and underwent ERCP; one of whom also underwent common bile duct stent insertion which removed successfully during routine follow-up. The time of first symptomatic gallstone presentation was significantly later in group B (21±6.6 months) than in group A (10.5±1.7 months, $P<0.001$; Table 1).

The multiple logistic regression analysis showed that family history and %EWL were significantly correlated with the development of symptomatic gallstone disease in the study population (groups A vs. B: odds ratio, 0.0245 vs. 0.7124; 95% confidence interval, 0.0056–0.1077 vs. 0.6116–0.8298; $P\leq0.0001$ vs. $P<0.0001$). The Kaplan–Meier analysis showed gallstone symptom-free survival rates of 96.5% at 12 months, 90.1% at 18 months, 88.2% at 24 months, and 83.3% at 32 months after LSG (Fig. 2).

Discussion

Obesity is a well-known risk factor for the development of cholelithiasis. After bariatric surgery, an altered gallbladder function and rapid weight loss are the main causes for the development of symptomatic cholelithiasis [5,13–15]. It is estimated that 50% of patients who undergo bariatric surgery develop gallstones or sludge within almost 2 years [2,5]. Because most of the patients remain asymptomatic, routine cholecystectomy cannot be justified [16]. However, some investigators have recommended concomitant cholecystectomy during bariatric surgery [6,15,17], whereas others argue against it due to its associated morbidity [4].

The association between the type of surgery and the incidence of gallstone disease is well established [16]. It is estimated that up to 28.9% cases of cholelithiasis develop after gastric bypass [1,5–7,10,18–20], 12% after biliopancreatic procedures [21], and 5.8% after

gastric banding [1,16,19,20,22]. The reported incidence of gallstone formation after sleeve gastrectomy is up to 27.5% in the Asian population with only a small number of patients being symptomatic (0.9%) [23]. Some authors have found no significant difference between the incidence of gallstones after LSG and that after gastric bypass (8.7% vs. 3.8%; *P*=0.296) [13].

The management of patients with gallstone diseases undergoing gastric bypass has been established [24]. Three management options are available, and their benefits and disadvantages can be weighed according to the patient's condition and the surgeon's preference. These options included simultaneous cholecystectomy [25], elective, or selective approach in the presence of symptoms only [21], and expectant approach, which may be accompanied with prophylactic treatment with ursodeoxycholic acid [26]. To reduce the incidence and complications of gallstones after weight-reduction surgery, routine prophylactic cholecystectomy [27], use of intraoperative ultrasound for gallstone detection, and concomitant cholecystectomy [19,28], postoperative use of ursodeoxycholic acid [29], regular ultrasound surveillance of asymptomatic gallstones [19], or their combinations have been suggested.

At present, LSG is well accepted as a definitive bariatric procedure with low morbidities and acceptable weight loss results [30], but the best approach for treating patients with preoperative asymptomatic or newly developed cholelithiasis is still controversial. There is an agreement that most symptoms of cholelithiasis appear in the first 2 years irrespective of the type of weight-reduction surgery as its occurrence is mostly related to the postoperative weight loss [31,32]. In our series, 235 (27.6%) of the total patients developed gallstones symptoms over a mean follow-up period of 26.95±12.1 months.

Reportedly, the only predictive factor for cholelithiasis after weight-reduction surgery is a weight loss of more than 25% [13]. In this study, we considered %EWL at the time of symptom presentation as an independent factor for the development of gallstone symptoms; such correlation was observed in both groups ($P \leq 0.0001$). In a recent comparative study between patients who had preoperative asymptomatic cholelithiasis (group 1) and those who developed cholelithiasis after LSG (group 2), 5.6 and 31% of patients developed symptoms over a mean follow-up period of 8.9±6.2 and 14.7±3.9 months, respectively (*P*=0.005). In addition, %EWL was 58±24 vs. 70±22% (*P*=0.11) over the same follow-up period [33]. These findings suggest that the same pathological events occurred in patients of both groups at the same rate, with the difference in only the time of the first presentation of these events.

In a recent study, a family history of gallstone disease was found in 36% of all patients with gallstone disease, indicating that family history must be taken into consideration while counseling high-risk patients [34]. In our study, 8.1% of our patients had a family history of gallstone diseases. A strong correlation was observed between the family history of gallstone disease and the development of symptoms after LSG, as 84.1% of our patients with postoperative symptomatic cholelithiasis had a family history of cholelithiasis.The mean time of presentation in group A was 10.5±1.7 months, with an incidence of 18%. On the other hand, the incidence of symptomatic cholelithiasis in group B was 29%, with mean time of presentation of 21±6.6 months. In total, 37 patients out of 235 (15.7%) postoperative symptomatic patients presented with acute symptoms, two of whom required ERCP. Sioka *et al.* [31] found that the incidence of asymptomatic cholelithiasis in their study was 13.04% (3/23 patients); further, four patients showed acute presentation, two of whom had obstructive biliary symptoms. Among the 35 (16%) patients in our study with newly developed symptomatic cholelithiasis with acute presentation, two reported obstructive biliary symptoms. In another study by Tucker *et al.* [17], 1.8% patients exhibited acute presentation, with pancreatitis in one of them. However, no patient in our study developed pancreatitis. In the study by Arias *et al.* [35], 3.8% of patients developed symptomatic gallstones after sleeve gastrectomy, only 1.8% of them had gallstone symptoms preoperatively. These findings suggest that the incidence of acute presentation of symptomatic cholelithiasis varies between studies [36,37].

No intraoperative difficulties, such as duct injury, were encountered during LC in our study; furthermore, there were no cases of longer hospital stays or conversion. Notably, a considerable number of our patients with acute presentation had obstructive biliary symptoms. In addition, according to our protocol, all patients with acute cholelithiasis presentation underwent LC within 72 h of first presentation or after ERCP, but we cannot assume this finding as due to the disease process in the selected cases or merely due to regular follow-up with rapid access to our surgical facilities for such patients.

Our study has some limitations. These include the heterogeneity in the types of patients and the lack of long-term follow-up of asymptomatic patients in both groups.

Conclusion

The percentage of newly developed symptomatic cholelithiasis was higher in our study than other studies. A considerable number of post-LSG symptomatic patients may exhibit acute symptoms at the first presentation. A family history of gallstone disease with higher preoperative BMI and increased % EWL are independent risk factors for postoperative symptomatic cholelithiasis. Preoperative assessment of high-risk patients is mandatory, and concomitant cholecystectomy must be considered for such patients.

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Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on request.

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Conflicts of interest

There are no conflicts of interest.

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