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Original article

Management of gallbladder disease after sleeve gastrectomy in a selected Lebanese population

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Abstract

Background: Patients with morbid obesity are at a higher risk of developing gallstones after bariatric surgery. Studies on the incidence of symptomatic gallstones necessitating cholecystectomy after laparoscopic sleeve gastrectomy (LSG) are limited in the Middle East.

Objectives: This study aims to assess the incidence of cholecystectomy after LSG during a 1-year follow-up and to evaluate potential risk factors and potential prophylactic measures.

Setting: Two university hospitals in Lebanon.

Methods: A prospectively maintained bariatric database of 361 patients who underwent primary LSG between January 2009 and December 2012 at the American University of Beirut Medical Center and Makassed General Hospital was reviewed. Data included demographics, preoperative weight, weight at 6 and 12 months postoperatively, and incidence of postoperative symptomatic cholelithiasis.

Results: A total of 319 patients (88.4%) were followed up at 1 year. Twenty-four (7.5%) had symptomatic gallstones and underwent cholecystectomy after LSG. Mean postoperative time for the development of symptomatic gallstones was 426 days (range, 91–1234 days). Patients who developed symptomatic gallstones were significantly younger (29.8 versus 34.8, $P = 0.008$) but comparable to patients who did not undergo cholecystectomy in terms of other baseline characteristics and weight loss results at 1 year. Out of the obesity-related co-morbidities, hypertension was the only co-morbidity associated with post-LSG cholecystectomy (OR = 3.35, $P = 0.036$) after multivariate adjustment.

Conclusion: The incidence of symptomatic gallstones requiring cholecystectomy after LSG in our study cohort was higher than that of the general population (7.5%). This incidence does not warrant prophylactic cholecystectomy or routine pre- or postoperative ultrasounds. (Surg Obes Relat Dis 2016;12:1300–1304.)

Obesity is one of the most prevalent health problems today, with approximately 1.7 billion individuals affected worldwide [1]. The Middle East registers some of the highest rates for obesity, exceeding those in western countries and reaching 40% to 50% [2]. Bariatric surgery is an effective method for weight reduction in a select group of obese patients [3]. However, an increased incidence of gallstone formation has been noticed in morbidly obese patients after bariatric surgery, peaking at approximately 16 months after surgery [4]. This period is associated with significant weight loss, during which 3 factors play an important role in gallstone formation: changes in anatomy secondary to surgery, increased bile saturation with cholesterol, and an increase in mucin leading to a shortened

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nucleation time. These factors are thought to influence gallstone formation via changes in postprandial gallbladder emptying, secondary to a decrease in circulating cholecystokinin [5,6]. Incidence of gallstone formation, as high as 30% over 6 months [7] and 52% over 1 year [8], after Roux-en-Y gastric bypass (RYGB) has been reported. A rate of 26.5% for asymptomatic gallstones after gastric banding is reported by Kiewiet et al. [9], whereas incidence of symptomatic gallstones after gastric banding is reported at 6.8% by O'Brien and Dixon [10].

Laparoscopic sleeve gastrectomy is a purely restrictive procedure that has gained popularity as a stand-alone operation. Approximately 85% of the stomach is excised, leaving a tubularized stomach. Because the procedure has no rerouting of the intestinal tract, it is simpler to perform and has less malabsorption compared with RYGB [3]. However, in our region, the incidence of symptomatic cholelithiasis requiring cholecystectomy after LSG has not yet been studied.

The aim of the present study is to report the incidence of gallstone disease requiring cholecystectomy after LSG during a 1-year follow-up so as to isolate potential risk factors associated with symptomatic gallstones incidence and evaluate the role of prophylactic measures.

Methods

Data

This study is a retrospective observational study that uses prospectively maintained data maintained over a 3-year period. After institutional review board approval, all patients who underwent sleeve gastrectomy at the American University of Beirut Medical Center or at Makassed General Hospital between January 2009 and December 2012 were included. Demographic data, preoperative weight, weight at 6 and 12 months, and incidence of postoperative symptomatic cholelithiasis were collected. Patients were not eligible to participate in this study if they had undergone a previous or concomitant cholecystectomy or a previous malabsorptive bariatric procedure, had presented after bariatric surgical complication from another facility, or had evidence of gallstones before surgery. The presence of diabetes and dyslipidemia at baseline were evaluated using information on self-reported medical diagnoses and medication records. Hypertension was defined as systolic blood pressure $\geq$140 mm Hg, diastolic blood pressure $\geq$90 mm Hg, or self-reporting of a diagnosis of hypertension or use of antihypertensive medication. Sleep apnea was diagnosed based on patient self-reports as well as polysomnography records.

Measures

Weight loss was calculated as change in body mass index (BMI), percentage of excess weight loss (%EWL), and percentage of total weight loss. Ideal weight was considered as the weight needed to achieve a BMI of 25 kg/m^2. Analysis was conducted using SPSS, version 22 (IBM Corp., Armonk, NY). Comparison of means from continuous variables was performed using paired 2-tailed Student's t test whereas comparison of proportions was performed using χ^2 or Fischer exact test, as appropriate. Moreover, a multivariate linear regression analyses was carried out to identity the variables associated with the incidence of postoperative cholecystectomy; factors found to be significant at the univariate level or those of clinical significance were included. The level of statistical significance was set at a $P < .05$.

Results

Out of 421 patients who underwent laparoscopic sleeve gastrectomy at American University of Beirut Medical Center or Makassed General Hospital between January 2009 and December 2012, 41 (9.7%) were excluded due to concomitant or previous cholecystectomy and 19 (4.5%) were excluded due to previous bariatric surgery. Concomitant cholecystectomy was performed in patients who showed evidence of symptomatic gallstone disease on preoperative testing. Of the remaining 361 patients, 42 (11.6%) were lost to follow-up at 1 year. Thus, 319 patients (88.4%) constituted our study cohort. Out of the 319 patients included in the analysis, 24 (7.5%) had symptomatic gallstones and underwent cholecystectomy after sleeve gastrectomy. The mean time postoperative until the development of symptomatic cholelithiasis was 426 days (range, 91–1234 days).

Patient characteristics in the 2 study groups were similar with respect to sex (females predominated both groups), preoperative height, weight, BMI, and obesity-related comorbidities including diabetes, hypertension, dyslipidemia, obstructive sleep apnea, and smoking. Patients who developed symptomatic gallstones, however, were significantly younger (29.8 versus 34.8 yr, $P = 0.008$) (Table 1). Out of 24 patients who underwent cholecystectomy after LSG, 17 patients had their pathology reports available in the medical charts. The main pathology findings in all 17 patients were cholelithiasis, chronic and/or acute cholecystitis, as well as cholesterolosis. No dyskinesia was found. The remaining 7 patients had their cholecystectomies performed at other institutions or abroad, but they had regular follow-ups up to 2 years after LSG.

No statistically significant difference in %EWL and percentage of total weight loss at 6 months or 1 year, respectively, was found between the 2 groups (Table 2). At 1 year, mean %EWL of the 295 patients who did not develop symptomatic cholelithiasis was 68.6 $\pm$ 25.8 compared to 74.4 $\pm$ 28.0 in the 24 patients who underwent postoperative cholecystectomy. None of the variables assessed, including sex, age, initial BMI, or %EWL at 1 year were found to be significantly associated with the development of symptomatic gallstones on either univariate

Table 1
Baseline characteristics of the study population

	No postoperative cholecystectomy (N = 295)		Postoperative cholecystectomy (N = 24)		*P*
	Mean ± SD	N (%)	Mean ± SD	N (%)	
Age (yr)	34.8 ± 12.3		29.8 ± 7.0		0.008
Male		113 (38.3)		10 (41.7)	.830
Female		182 (61.7)		14 (58.3)	
Weight (kg)	120.8 ± 24.4		124.0 ± 26.5		0.55
Height (m)	1.68 ± .09		1.70 ± .11		0.53
BMI (kg/m^2)	42.4 ± 6.9		42.9 ± 7.2		0.71
Diabetes	61 (20.7)			3 (12.5)	0.43
Hypertension	68 (23.1)			7 (29.2)	0.62
Dyslipidemia	72 (24.4)			4 (16.7)	0.47
Sleep apnea	57 (19.3)			3 (12.5)	0.59
Smoking	127 (43.1)			14 (58.3)	0.2

BMI = body mass index; SD = standard deviation.

or multivariate analysis (Table 3). Out of the obesity-related co-morbidities, hypertension was the only co-morbidity associated with post-LSG cholecystectomy (OR = 3.35, $P = .036$) after multivariate adjustment.

Discussion

Recent studies estimated a higher incidence of gallstone formation and/or gall sludge in bariatric surgery patients compared with the general population. The general population in industrialized nations has a prevalence of gallstone formation of 10% to 20%, with 1% to 5% of those requiring cholecystectomy due to symptomatic gallstones [11]. On the other hand, the incidence of gallstone/sludge formation in bariatric surgery patients is 28% to 71%, which is influenced by the rapid weight loss and an increased disposition for biliary stone formation [12,13]. In our study, the incidence of gallstone formation was not evaluated due to the lack of routine ultrasounds in the pre- and postoperative periods. However, the incidence of cholecystectomy due to symptomatic gallstones, up to 2 years after sleeve gastrectomy, was shown to approximate 7.5%, which, as expected, is higher than the general population.

Our reported incidence of cholecystectomy after LSG (7.5%) was higher than that reported in other LSG studies but comparable to that of published RYGB series. Li et al. and Sioka et al. reported a total cumulative incidence of symptomatic gallstones after LSG of 3.8% and 5.8%, respectively [6,14]. Another study by Moon et al. reported an incidence of 6.1% after LSG compared to 5.7% after laparoscopic RYGB and 0% after gastric banding [15]. Incidence of subsequent cholecystectomy after RYGB ranges between 6.7% and 11.8% [15,16]. Theoretically, the incidence of symptomatic gallstones should be higher in RYGB compared with LSG because the former procedure alters the gastrointestinal pathway. However, many studies reported no significant difference in the incidence of postoperative cholecystectomy between the 2 procedures [6,15]. In fact, studies on early hormonal effects after gastric bypass reported no significant change in cholecystokinin level before or after meals [17,18]. Also, factors that are known to promote cholelithiasis such as reduction in gallbladder emptying, increased gallbladder residual volume, and decreased refilling have been shown even after restrictive surgeries such as gastric banding [19].

Rapid weight loss has been postulated as a risk factor for gallstone formation and subsequent symptomatic cholelithiasis in many different studies [7,14,20,21]. A recent study by Li et al. indicated that weight loss $\geq$25% was the only predictive factor for postoperative gallstone formation and could therefore help to select patients for subsequent ultrasound measures after bariatric surgery [20] in accordance with the Perioperative Nutritional, Metabolic, and Nonsurgical Support of the Bariatric Surgery Patient 2013 guidelines [7]. In our study, mean %EWL was not

Table 2
Weight loss results at different follow-up periods

		No postoperative cholecystectomy (N = 295)		Postoperative cholecystectomy (N = 24)		
		Mean ± SD	Range	Mean ± SD	Range	*P* value
6 mo	Weight (kg)	96.2 ± 20.0	56.0–179.0	95.4 ± 23.7	71.0–155.0	.86
	BMI (kg/m^2)	34.1 ± 6.3	22.7–64.7	33.6 ± 7.2	23.9–49.5	.71
	% EWL	51.3 ± 21.3	11.4–126.1	56.6 ± 25.0	12.9–110.3	.29
	% TWL	19.5 ± 7.2	4.6–40.7	20.7 ± 7.9	6.4–34.5	.48
1 yr	Weight (kg)	88.0 ± 18.1	53.0–155.0	89.2 ± 21.0	67.0–142.0	.76
	BMI (kg/m^2)	31.1 ± 5.6	21.5–51.8	30.7 ± 5.5	20.9–38.9	.79
	% EWL	69.7 ± 24.2	14.0–149.4	75.1 ± 27.4	16.5–137.8	.32
	% TWL	26.5 ± 7.9	5.5–48.1	28.5 ± 7.8	6.6–41.7	.24
> 1 yr	Weight (kg)	86.1 ± 20.0	50.0–170.0	88.3 ± 24.4	44.0–128.0	.71
	BMI (kg/m^2)	29.9 ± 5.9	19.8–48.6	29.3 ± 6.4	15.8–37.0	.74
	% EWL	76.6 ± 30.5	(–)5.1–154.2	79.7 ± 30.7	39.5–137.7	.73
	% TWL	29.1 ± 10.3	(–)2.4–51.1	32.8 ± 13.1	15.8–68.1	.23

BMI = body mass index; %EWL = percentage of excess weight loss; SD = standard deviation; %TWL = percentage of total weight loss.

Table 3
Univariate and multivariate analysis of the association between different variables and the incidence of postoperative cholecystectomy

Variable	Unadjusted Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Age	.96	.92–1.00	.96	.92–1.01
Female Sex	.87	.37–2.02	.77	.29–2.05
Initial Weight	1.01	.99–1.02		
Initial BMI	1.01	.95–1.07	1.03	.96–1.11
BMI ≥45 kg/m^2	1.82	.78–4.27		
%EWL at 1 yr	1.01	.99–1.03	1.01	.99–1.03
Diabetes	.55	.16–1.90	.56	.15–2.08
Hypertension*	1.38	.55–3.45	3.26	1.09–10.36
Dyslipidemia	.62	.21–1.87	.42	.11–1.61
Sleep apnea	.59	.17–2.07	.79	.20–3.10
Smoking	1.85	.79–4.3	1.41	.57–3.47

BMI = body mass index; %EWL = percentage of excess weight loss.
Initial weight and BMI ≥45 kg/m^2 were not entered in the multivariate logistic regression to avoid collinearity.
*$P = 0.040$

significantly different between patients who developed symptomatic gallstones and those who did not. This was also the case in other studies [8,15]. Moon et al. found no significant difference in mean %EWL after LSG between patients who developed symptomatic gallstones and those who did not [15].

No standard of care regarding the preoperative workup or even postoperative care regarding cholecystectomy has been established for patients undergoing LSG. In our practice, we do not perform routine preoperative ultrasounds for patients undergoing bariatric surgery and concomitant cholecystectomy is reserved for patients who have evidence of symptomatic gallstone disease preoperatively. Retrospective review of our data found that only 3 out of 23 patients who required cholecystectomy had preoperative ultrasounds, all of which were normal. In Sioka et al.'s study, 23.2% had positive ultrasound findings before undergoing LSG, of whom 13% developed symptomatic cholelithiasis postoperatively. On the other hand, 4.7% of those with negative ultrasound findings required postoperative cholecystectomy [14]. Thus, routine preoperative ultrasonography is unlikely to alter the need for cholecystectomy after sleeve gastrectomy.

All of our patients who eventually underwent cholecystectomy presented with evidence of biliary colic or cholecystitis after an average follow-up of 1 year. One of our patients necessitated cholecystectomy as early as 3 months after LSG. Development of symptomatic gallstones in this patient shortly after LSG might be due to gallbladder disease present before the surgery. In this case, the presence of a preoperative ultrasound would have been helpful. The latest cholecystectomy was 3.5 years after LSG. In Sioka et al.'s study, no patient underwent cholecystectomy earlier than 9 months or later than 23 months after LSG [14]. This short time period between LSG and cholecystectomy should not be misconstrued as evidence supporting concomitant cholecystectomy. Concomitant laparoscopic cholecystectomy carries with it the risks of laparoscopic cholecystectomy and prolongs intraoperative time [22,23]. Moreover, the natural history of asymptomatic gallstones suggests that many affected individuals will remain asymptomatic [23,24]. One of the arguments for concomitant cholecystectomy and RYGB is the inaccessibility of the duodenum to endoscopy. Since access to the duodenum is unaltered in LSG, choledocholithiasis and its subsequent complications can still be treated via ERCP in this population, further weakening the argument for concomitant cholecystectomy. Therefore, prophylactic cholecystectomy should be reserved only for patients with symptomatic gallbladder disease preoperatively.

In addition, several studies have suggested that patients undergoing bariatric surgery should be considered for routine postoperative ultrasounds and prophylactic treatment against cholelithiasis—namely ursodeoxycholic acid—within the first 24 months up to 5 years after surgery [4,25,26]. This argument is due to the fact that rapid weight loss is one of the most important risk factor for cholelithiasis. Since the majority of gallstones formed after rapid weight loss are usually asymptomatic and do not warrant surgical or medical intervention, and since no association between %EWL and symptomatic gallstones has been established so far, no evidence supports %EWL as a criteria for routine postoperative ultrasound screening. As for the prophylactic use of ursodeoxycholic acid, a meta-analysis of 5 RCTs including 521 patients concluded that ursodeoxycholic acid (300–1200 mg/d) significantly reduces gallstone formation after bariatric surgery [4]. However, it might add cost and might not reduce the incidence of symptomatic disease after LSG, and therefore further studies should be conducted to understand the beneficial clinical pathway [27].

No association was found between obesity-related comorbidities such as diabetes, dyslipidemia, or obstructive sleep apnea and the incidence of cholecystectomy after LSG. However, multivariate analysis showed a significant positive association between hypertension and post-LSG cholecystectomy after adjusting for age, sex, and BMI (OR = 3.35, $P = .036$). The reason behind this finding is unclear and might be a false positive result. The association between cholecystectomy for gallstone disease and high blood pressure is not highlighted in the literature; however, one study has shown that patients undergoing cholecystectomy have an increased prevalence of risk factors for cardiovascular disease independent of age, sex, or body mass index [28].

Some limitations of our study should be acknowledged. Its retrospective nature and the sample size should be taken into account. Because our sample size was limited, the study may not have been adequately powered to note a

small difference. Additionally, absence of preoperative ultrasounds did not allow us to determine whether gallstones formation was de novo or due to the presence of asymptomatic gallstones preoperatively. Finally, we did not perform postoperative ultrasound to evaluate the real rate of gallstone formation after LSG. A prospective study with longer follow-up would provide more reliable results.

Conclusion

In our study, 7.5% of patients undergoing LSG developed symptomatic gallstones necessitating surgical intervention. The incidence of symptomatic gallstones was higher than that of the general population and was not associated with %EWL at 1 year. However, this incidence does not warrant prophylactic measures including concomitant cholecystectomy or routine pre- and postoperative screening with ultrasound in patients undergoing LSG. Further studies regarding the effectiveness of ursodeoxycholic acid in the prevention of symptomatic gallstones after LSG are recommended.

Disclosure

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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