

Incidence of symptomatic cholelithiasis after laparoscopic sleeve gastrectomy and its association with rapid weight loss

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Abstract

Background/Aim: The worldwide prevalence of obesity has increased dramatically over the past years. In the Arab region, 66%–75% of adults and 25%–40% of children are either overweight or obese. Bariatric surgery has become the most effective approach for managing obesity and its co-morbidities. An expected outcome of bariatric surgery is cholelithiasis, which is one of the established risk factors of rapid weight loss. The aim of this study is to detect the incidence of symptomatic cholelithiasis among bariatric patients.

Patients and Methods: A retrospective cohort study on 711 patients aged between 18 and 60 who underwent laparoscopic sleeve gastrectomy (LSG) was conducted at King Saud University Medical City from January 2016 to January 2018.

Results: The postoperative incidence of symptomatic cholelithiasis was 3.5%. The mean duration of symptom development was 12.4 months. The rates of weight loss at 6 and 12 months for patients with symptomatic cholelithiasis were $28.94 \pm 4.89\%$ and $38.51 \pm 6.84\%$, respectively ($P = 0.002$), which were significantly higher than in patients without symptomatic cholelithiasis during the same follow-up period ($24.41 \pm 6.6\%$ and $32.29 \pm 10.28\%$), respectively; ($P = 0.012$).

Conclusion: We found a 3.5% incidence of symptomatic cholelithiasis among post-LSG patients in a period of 2 years. Rapid weight loss was the only risk factor that contributed to the development of post-LSG gallbladder disease.

Keywords: Bariatric surgery, cholelithiasis, gallstones, laparoscopic sleeve gastrectomy, weight loss

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Submitted: 16-Sep-2019 **Revised:** 20-Oct-2019 **Accepted:** 10-Dec-2019 **Published:** 31-Jan-2020

INTRODUCTION

The worldwide prevalence of obesity has increased dramatically over the past years. In the Arab region, 66–75% of adults and 25–40% of children are either overweight or obese.^[1] The Kingdom of Saudi Arabia, in particular, ranks among the countries with the highest prevalence of metabolic syndrome. A recent population-based study

in the Kingdom showed that among 12,126 participants aged ≥ 10 years, 36.5% of females and 29.4% of males are considered obese, with a body mass index (BMI) of ≥ 30 .^[2] Given this sharp increase, bariatric surgery has become the most effective approach for managing obesity and its co-morbidities.^[3]

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How to cite this article: Alsaif FA, Alabdullatif FS, Aldeghaither MK, Alnaeem KA, Alzamil AF, Alabdulkarim NH, *et al.* Incidence of symptomatic cholelithiasis after laparoscopic sleeve gastrectomy and its association with rapid weight loss. Saudi J Gastroenterol 2020;26:94-8.

Access this article online	
Quick Response Code:	Website: www.saudijgastro.com
	DOI: 10.4103/sjg.SJG_472_19

A study of the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) found that 468,609 bariatric surgeries were performed worldwide in 2013. The most commonly used techniques were Roux-en-Y gastric bypass (RYGB; 45%), sleeve gastrectomy (LSG; 37%), and adjustable gastric banding (AGB; 10%).^[4] Despite the fact that AGB and LSG are classified as restrictive procedures, LSG is thought to have stronger metabolic effects compared to RYGB. In LSG, a high-pressure gastric tube is created by dividing the stomach vertically, leaving only a 200-ml pouch.^[5]

Gallbladder disorders are the most common surgical diseases in general surgery.^[6] Cholecystitis is considered the most common type of gallbladder disease.^[7] The most common cause of cholecystitis is cholelithiasis, which is the development of gallstones.^[8] Various factors may contribute to gallstone formation. Aging is considered a risk factor among all ethnic groups. Females are at greater risk of developing cholelithiasis,^[9] with a female-to-male ratio of approximately 2.1:1 in the United States and in Europe. However, the risk and type of stones in females vary between ethnicities.^[10-12] Furthermore, females are at greater risk of requiring surgical intervention. Obesity is also a risk factor for gallstone formation, which may be secondary to increased cholesterol secretion by the liver.^[9] Paradoxically, bariatric patients are prone to gallstone formation, with an alarming overall postoperative risk of 30%–53%. One of the established risk factors for cholelithiasis is rapid weight loss, which is an expected outcome of bariatric surgery.^[13-15] One study reported a fivefold increase in the risk of cholelithiasis among bariatric surgery patients compared with the normal population.^[16] It is of note that even less extreme weight loss, as through dieting, also poses a risk of developing gallstones.^[17,18] Other risk factors include an age of 40 years or older, Caucasian ethnicity, pregnancy, the use of oral contraceptive pills (OCP) or estrogen replacement therapy, diabetes mellitus, and a family history of gallstones.^[19]

To our knowledge, no previous study has been conducted in our region to explore the incidence of gallstone disease in different bariatric surgery techniques. However, there are studies in the international literature that have determined the prevalence of symptomatic gallstone formation in various bariatric procedures. Multiple studies have suggested that the incidence of symptomatic gallstone formation in both RYGB and LSG is higher than in AGB.^[15,20,21] Some studies also showed that the incidence of symptomatic gallstone formation is higher in RYGB than in LSG, but their results yielded no statistical significance.^[14,22]

The aim of this study was to determine the incidence of symptomatic cholelithiasis among adult laparoscopic sleeve gastrectomy (LSG) patients at King Saud University Medical City.

PATIENTS AND METHODS

Following the approval of the Institutional Review Board, we conducted a retrospective cohort study on patients aged between 18 and 60 years who underwent LSG at King Saud University Medical City (KSUMC) from January 2016 to January 2018. The data was obtained from the Obesity Center database of KSUMC. Our initial sample consisted of 840 patients. We excluded 129 patients for the following reasons: Undergoing either RYGB or AGB, having previously undergone cholecystectomy, having asymptomatic gallstones preoperatively, and being lost to follow-up [Figure 1]. A preoperative ultrasonographic examination was performed to ensure that all patients had no preexisting gallbladder disease. The patients were vetted for previous cholecystectomies, established gallbladder disease, and pregnancy. Patients who were found to have previously undergone cholecystectomy or to have gallstones or sludge, as well as patients who did not undergo preoperative ultrasonographic examination, were excluded from the study. The final sample included a total of 711 patients. All surgical procedures were performed at KSUMC, following the guidelines of the Society of American Gastrointestinal and Endoscopic Surgeons.^[23]

Examinations and surgical procedures

The patients were followed up in the outpatient clinic at 3, 6, and 12 months postoperatively. Patients who

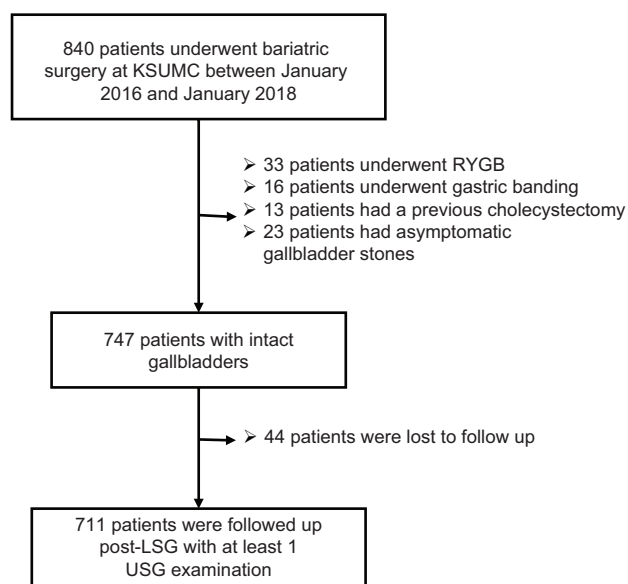


Figure 1: KSUMC: King Saud University Medical City; USG: Ultrasonography; RYGB: Roux-en-Y gastric bypass

Table 1: Demographic characteristics of patients included for analysis

Variables	Bariatric Surgery Patients: n= 711		P
	Patients Without GB disease: n=686	Patients with GB disease: n=25	
Age	34.7±11.9	31.1±14	0.521
Gender	410 F, 302 M	14 F, 11 M	0.589
Weight	122.5±29.6	125.64±23.33	0.729
BMI	45±10.3	46±8.7	0.468

DM: Diabetes mellitus; HTN: Hypertension; DLP: Dyslipidemia; BMI: Body mass index; GB: Gallbladder; F: Female; M: Male

exhibited symptoms of gallbladder diseases underwent ultrasonographic examination to establish a diagnosis. Baseline characteristics [age, gender, BMI, weight, and co-morbidities (diabetes and hyperlipidemia)] were recorded. The patients were then examined 6 and 12 months postoperatively for weight loss, BMI, and the presence of gallbladder diseases.

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 23.0 (IBM, Armonk, NY, USA). Results were expressed as absolute numbers and percentages for categorical variables and as mean and standard deviation for continuous variables. A paired sample *t*-test was performed to determine significant differences between means at different time stamps. A Pearson correlation test was performed to determine any significant relationship between the development of symptomatic cholelithiasis and demographic variables such as age and gender, as well as co-morbidities. A value of *P* < 0.05 was considered statistically significant.

RESULTS

We studied 711 patients aged between 18 and 60 years who underwent LSG from January 2016 to January 2018. Their mean age was 34.7 ± 11.9 years (range 18–67 years). Of the 711 patients, 57.8% were female and 42.2% were male [Table 1]. Their mean weight and BMI upon admission were 123.1 ± 28.4 kg (range 80–255 kg) and 45 ± 10.3 kg/m² (range 33–88.5 kg/m²), respectively [Table 2].

The postoperative incidence of symptomatic cholelithiasis was 3.5%, corresponding to 25 patients, of whom 14 were female (56%) and 11 were male (44%). The average duration of the postoperative development of symptomatic cholelithiasis was 12.4 months. The mean preoperative weight and BMI of patients who developed postoperative symptomatic cholelithiasis were 125.64 ± 23.3 kg (range 85.5–182 kg) and 46 ± 8.7 kg/m² (range 34–66 kg/m²), respectively (*P* = 0.729), while those

Table 2: Weight loss rate

Variables	Bariatric Surgery Patients: n=711		P
	Patients without GB disease: n=686	Patients with GB disease: n=25	
Weight upon admission	123±28.5	125.64±23.33	0.729
BMI upon admission	45±10.3	46±8.7	0.468
Weight loss at 6 months (%)	24.41±6.6	28.94±4.89	0.002
Weight loss at 12 months (%)	32.29±10.28	38.51±6.84	0.012
Weight loss Lap Chole (%)	-	36.27±8.87	-

BMI: Body mass index; GB: Gallbladder

of patients who did not develop gallbladder disease were 123 ± 28.5 kg (range 80–255 kg) and 45 ± 10.3 kg/m² (range 33–88.5 kg/m²), respectively (*P* = 0.468). Upon diagnosis of gallbladder disease, the mean weight and BMI were 78.4 ± 12 kg (range 63–107 kg) and 30.2 ± 6.5 kg/m² (range 23–44 kg/m²), respectively. The rates of weight loss in patients with symptomatic cholelithiasis were 28.94 ± 4.89% at 6 months and 38.51 ± 6.84% at 12 months, both of which were significantly higher than in patients without symptomatic cholelithiasis at the same follow-up periods [24.41 ± 6.6% (*P* = 0.002), and 32.29 ± 10.28% (*P* = 0.012), respectively] [Table 2]. The percentage of weight loss was significantly higher upon diagnosis compared to the first follow-up (*P* = 0.006) but not compared to the second follow-up (*P* = 0.572).

Finally, no significant correlations were found between the development of symptomatic cholelithiasis and co-morbidities [diabetes mellitus (DM), hypertension (HTN), dyslipidemia (DLP)] among LSG patients (*P* > 0.05) [Table 3].

DISCUSSION

Our main findings can be summarized as follows: (a) the percentage of patients who developed post-LSG symptomatic cholelithiasis was 3.5%; (b) the rate of weight loss at follow-up checkpoints played a significant role in developing post-LSG gallbladder disease; and (c) there was no correlation between co-morbidities (DM, HTN, and DLP) and postoperative development of symptomatic cholelithiasis.

Table 3: Correlation between comorbidities symptomatic cholelithiasis

Variables	Bariatric Surgery Patients: n=711			P
	Patients without GB disease: n=686	Patients with GB disease: n=25	Pearson correlation	
Presence of DM	126 (17.6)	4 (16)	0.024	0.523
Presence of HTN	130 (18.2)	5 (20)	0.021	0.58
Presence of DLP	66 (9.2)	1 (4)	-0.012	0.739

DM: Diabetes mellitus; HTN: Hypertension; DLP: Dyslipidemia; GB: Gallbladder

Although our study was retrospective, it analyzed one of the largest sample of patients undergoing LSG. In Western countries, RYGB is much more popular than other bariatric procedures, which could explain the limited data available regarding cholelithiasis after LSG. Varying incidence rates of post-LSG gallbladder disease have been reported in the literature. Some studies reported rates as high as 25.5% and 28%,^[14,23] which are notably higher than our findings. Several other studies, however, reported incidence rates ranging from 3% to 6%,^[22,24,25] which are comparable with our results.

Well-established risk factors of gallbladder disease include age, female gender, rapid weight loss, and metabolic syndrome. In our study, age and components of the metabolic syndrome (DM and DLP) were comparable in both groups. The outstanding risk factor was the rate of weight loss in a short period of time, which was more pronounced in patients who developed gallbladder disease. Li *et al.*^[22] suggested that losing more than 25% of body weight after bariatric surgery increases the risk of developing gallstones.^[20] Patients in our study lost more than that in the first 6 months (28.94%). Other studies with prospective follow-ups also concluded that weight loss is the decisive determinant of developing cholelithiasis after bariatric surgery.^[14,15]

The reason that rapid weight loss causes cholelithiasis is cholesterol oversaturation in the bile, which impedes the ability of solubilizing agents such as bile salts and phosphatidylcholine to incorporate cholesterol and eventually be discharged from the body. This leads to the accumulation of cholesterol crystals and eventually to the formation of cholesterol stones.^[26]

Of all bariatric procedures, RYGB is associated with the highest incidence of postoperative gallbladder disease, with some studies reporting rates as high as 32.5% and 34%.^[14,22,23,25] The reason for such high rates is that, in addition to the rapid weight loss after surgery, the dissection of the lesser curvature during RYGB might limit the release of cholecystokinin and promote gallstone formation due to gallbladder stasis.^[27] However, Moon *et al.* reported a higher incidence of symptomatic gallbladder disease in LSG compared to RYGB,^[21] and Melmer *et al.* reported a higher incidence of gallstone formation and cholecystectomy in an LSG/AGB group compared to an RYGB group.^[15] Usually, gastric banding has the lowest incidence of gallbladder disease, which can be as low as 0%.^[21,25]

This study's limitation is that it investigated the incidence of symptomatic cholelithiasis among patients who underwent

only one type of bariatric surgery (LSG). Even though our institution performs a large number of bariatric surgeries annually, very few of them were RYGB or gastric banding during the period covered in this study. In light of the high prevalence of obesity and metabolic syndrome and a large number of patients undergoing bariatric surgery, we encourage further studies to be conducted in our region.

CONCLUSION

In conclusion, we determined a 3.5% incidence of symptomatic cholelithiasis among post-LSG patients in a period of 2 years. The rates of weight loss at 6 and 12 months were significantly higher among patients who developed postoperative symptomatic cholelithiasis compared to those who did not. Rapid weight loss was the only risk factor that contributed to post-LSG development of symptomatic cholelithiasis. We did not find a significant correlation between symptomatic cholelithiasis and other risk factors, such as gender, DM, HTN, and DLP.

Acknowledgements

We would like to thank the Saudi Laparoscopic Society for providing the expertise that greatly assisted the research and Scribendi.com for language editing.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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