

Prevalence of Cholelithiasis and Associated Factors of Gallstone Formation after Laparoscopic Sleeve Gastrectomy in the Gastroenterology and Hepatology Teaching Hospital-Baghdad

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Abstract:

Background: Bariatric surgery (BS) is the most effective method for long-term weight loss. Rapid weight reduction after BS may contribute to the formation of gallstones.

Objectives: To assess the rate, and to identify the associated factors, of gallstone formation after laparoscopic sleeve gastrectomy.

Methods: This was a cross-sectional study among 128 patients with morbid obesity, who were treated with laparoscopic sleeve gastrectomy and followed up at two weeks, one month, six months, and one year after surgery between October 2018 and July 2020, at the Gastroenterology and Hepatology Teaching Hospital in Baghdad and the Dowaly Private Hospital. Data was collected using a structured questionnaire.

Results: The mean age of patients was 36.5 ± 5.21 (17–54) for females and 41.6 ± 3.04 (24–58) for males. Gallstone formation happened in 49 cases (38.3%). Of all males, four (36.4%) developed gallstones after (LSG), compared to 45 (38.5%) females. Sixty (46.9%) patients had a Body Mass Index (BMI) ≥ 40 kg/m², of whom 29 (48.3%) developed gallstones after LSG ($p = 0.031$). The p -values for weight loss regarding timing and degree of loss show a significant relationship with gallstone formation after LSG ($p < 0.05$). Comorbid conditions were not significantly associated with the incidence of gallstone formation after LSG ($p > 0.05$).

Conclusions: More than a third of the cases developed gallstones after Laparoscopic Sleeve Gastrectomy. This was associated with Gross obesity prior to surgery (BMI ≥ 40 kg/m²), losing $\geq 25\%$ of the original weight, and rapid weight loss during the first six months after LSG.

Keywords: Bariatric Surgery; BMI; Gallstone; Obesity; Laparoscopic Sleeve Gastrectomy.

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Introduction:

Obesity is associated with an increased risk of hypertension (HT), diabetes (DM), pulmonary disease, hyperlipidemia, cardiomyopathy, malignancy, arthritis, infertility, sleep apnea, gallstone formation, and psychosocial impairments (1). Weight loss has been shown to reduce many conditions associated with obesity. Bariatric surgery (BS) is the most effective method for long-term weight loss (2). In addition to restricting and reducing the surface area for absorption, hormonal changes after bariatric surgery are the primary mechanism of action (3, 4). The specific criteria established are that bariatric surgery is appropriate for patients with a body mass index (BMI kg/m²) of more than 40 and patients with a BMI of 35–40, with associated medical conditions. (2). Gallstones develop in patients who experience rapid weight reduction after dietary restriction and BS (5). Patients with rapid weight reduction after BS may be exposed to a high level of anxiety, depression (6),

increased bile cholesterol saturation, decreased bile acid secretion, increased mucin secretion by 10–20 times, and finally decreased gallbladder emptying, causing bile stasis, all of which mainly contribute to the formation of gallstones (7). Cholelithiasis is common after BS, with a high incidence during the first 12–14 months after the procedure (8). In Saudi Arabia, a study found that the overall incidence rate of gallbladder stones after BS was 61.4%. (9) It was found that the risk of gallstones was as high as 51.2%, in patients who underwent Roux-en-Y gastric bypass (R-YGB) and were followed for a year afterward (10). The rate of developing cholelithiasis after laparoscopic sleeve gastrectomy (LSG) ranged from 29%–48%, as reported in the literature (11, 12). Other studies have reported that R-YGB surgery has a greater risk of gallstone formation than SG (13, 14). The role of prophylactic cholecystectomy at the time of BS remains controversial. In asymptomatic patients, who require cholecystectomy after BS, concomitant

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cholecystectomy during BS prevents them from being exposed to a second surgery (15). The present study assessed the rate and investigated the possible factors associated with cholelithiasis development after a sleeve gastrectomy. It also evaluated the association between weight loss parameters and gallstone development in these patients.

Patients and Methods:

This was a cross-sectional study on 128 patients with morbid obesity who were treated with LSG between October 2018 and July 2020, at the Gastroenterology Hepatology Teaching Hospital of Baghdad and the Dowaly Private Hospital. Data collection began preoperatively and continued until the final postoperative visit. The patients were selected according to BS guidelines, and the suitable candidates were operated on by a single senior surgeon using the same surgical procedure. Patients who had a complete follow-up (at two weeks, one month, six months, and one year) after BS, at an outpatient clinic, were included in this study. We excluded from this study patients who had gallbladder disease and those with a history of cholecystectomy. The demographic data of patients were collected together with their medical history, clinical examination, and hormonal study preoperatively. The complete blood count, biochemical parameters, anthropometric measurements; and weight before surgery and at six and 12 months after surgery were recorded. Positive findings according to the abdominal ultrasound or MRI reports were recorded. Ethical approval was obtained from the committee of the Iraqi Board for Medical Specializations. Verbal informed consent was obtained from all patients.

Statistical Analysis:

All data were collected using Excel for Windows and an analysis with the Statistical Package for Social Sciences (SPSS) version 25 was performed. The Chi-squared test or Fisher’s exact test was used for nominal variables, as appropriate. The *t*-test was used to compare continuous variables. A *P*-value less than 0.05 was considered significant.

Results:

The mean age of patients included in this study was 36.5±5.21 (17–54) years for females and 41.6±3.04 (24–58) years for males. Gallstone formation happened in 49 (38.3%) patients, Figure 1.

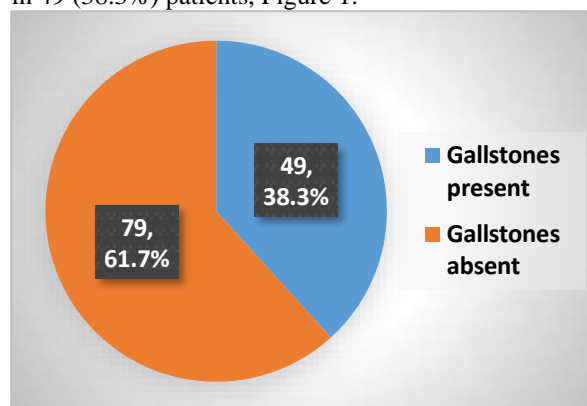


Figure 1: Gallstones formation after bariatric surgery.

Age and gender did not appear to be associated with gallstone formation after LSG, *P* value >0.05 (Table 1). Four out of 11 males (36.4%) developed gallstones after LSG compared to 45 (38.5%) out of 117 females. Age was also not associated with gallstone formation, *p*-value > 0.05. Parity did not appear to be associated with gallstone formation (*P*=0.97).

Table 1: Distribution of the cases by gender, age, parity, and gallstone formation after LSG

Variable	Category	Gallstone		Chi-squared	P-value
		Present	Absent		
Gender	Male (n-11) (8.6%)	4 (36.4%)	7 (63.6%)	0.018	0.914
	Female (n-117) (91.4%)	45 (38.5%)	72 (61.5%)		
Age (years)	≤ 45 (N = 82)	28 (34.1%)	54 (65.9%)	0.165	0.617
	> 45 (N = 46)	21 (45.7%)	25 (54.3%)		
Parity	Null (N = 29)	11 (37.9%)	18 (62.1%)	0.0012	0.97
	Parous (N = 88)	34 (38.6%)	54 (61.4%)		

There were 19 (14.8%) diabetics among the cases, of whom only five (26.3%) developed gallstones, the *p*-value was (0.527) indicating no increase in the risk of gallstone formation after LSG, among diabetics. The same was true for cases with hypertension. The mean BMI preoperatively was 41 ± 8.4 (range from 35.4–55.7). out of 128 patients, 60 (46.9%) had a BMI ≥40 kg/m². Of those 29 (48.3%) developed gallstones after LSG, the *p*-value is (0.031), able 2.

Table 2: Distribution of the cases by diabetes, hypertension, BMI, and gallstone formation after LSG

Variable	Category	Gallstone		Chi-squared	P-value
		Present N = 49 (38.3%)	Absent N = 79 (61.7%)		
DM	Diabetic N = 19	5 (26.3%)	14 (73.7%)	0.135	0.527
	Non-diabetic N = 109	44 (40.4%)	65 (59.6%)		
HT	Hypertensive N = 21	6 (28.6%)	15 (71.4%)	0.1	0.595
	Non-hypertensive N = 107	43 (40.2%)	64 (59.8%)		
BMI	≥ 40 Kg / m ² , N = 60	29 (48.3%)	31 (51.7%)	4.83	0.031
	< 40 kg/m ² , N = 68	20 (29.4%)	48 (70.6%)		

The period and magnitude of weight loss are significantly associated with gallstone formation after LSG, *p*-values (0.032) and (0.047), table 3.

Table 3: Distribution of the cases by weight-loss period and magnitude and gallstone formation after LSG

Weight loss	Category	Gallstone N = 49 (38.3%)	No gallstone N = 79 (61.7%)	P-value
Period of weight loss	First six months (n=40)	23 (57.5%)	17 (42.5%)	0.032
	Second six months (n=88)	26 (29.5%)	62 (70.5%)	
Magnitude of weight loss	$\geq 25\%$	31 (63.3%)	21 (26.6%)	0.047
	< 25%	18 (36.7%)	58 (73.4%)	

Table 4 shows that co-morbidities were not significantly associated with the development of gallstones after LSG.

Table 4: Distribution of the study group by co-morbidities and the development of gallstone after LSG

Co-morbidity	Gallstone	No gallstone	P-value
Sleep apnea	6 (35.3%)	11 (64.7%)	0.862
Hypothyroidism	1 (25%)	3 (75%)	0.527
Dyslipidemia	7 (35%)	13 (65%)	0.846

Discussion:

Laparoscopic sleeve gastrectomy is fast becoming one of the most effective surgeries in the management of obesity. It significantly reverses some metabolic abnormalities, such as diabetes mellitus, hypertension, sleep apnea, and dyslipidemia (16). Rapid weight loss is the only risk factor that contributes to the development of post-LSG gallbladder disease (17). Mishra et al. in 2016 reported that the incidence of development of gallstones post-bariatric surgery was 8.42% in the LSG group (18), while it was 38.3% in the current study, which is comparable to the results of the studies of Coupaye *et al* in Colombia in 2015 and Manatsathit *et al* in the USA in 2016 (29% and 48% respectively) (11, 12). The difference can be explained by the difference in sample size. The current study found a non-significant slightly more females than males developing gallstone disease after LSG, in disagreement with the results of Mishra T *et al.*, 2016 where cholelithiasis was much more common in females (18). Parous females showed more gallstones after BS, but not significantly so. Female sex hormones appear to be the underlying factor for the differences observed with cholelithiasis. Gender is one of the most prominent risk factors for developing gallstone disease. At all ages, women are generally more likely to develop cholelithiasis than men, due to naturally high estrogen levels in women as suggested by Cirillo *et al* in 2005 (19), multiparity as suggested by Galyani in 2013 (20), or taking estrogen-based oral contraceptives (19). Females are more likely to undergo cholecystectomy than men at all ages as reported by Racine et al. (2013) (21), gallstone formation in the current study was

highest during the first six months after surgery, during the time of weight loss compared to the next six months, indicating that the follow-up period is important in identifying complications after LSG; similar to the findings of Elshaer *et al* (22). Kielani *et al.* (23), reported the incidence of gallstone formation to be highest during the first six months after surgery (33.8% in the first six months versus 21.6% in the next six months), postoperatively, which supports our findings, whereas, Elshaer *et al.* reported that gallstone formation after surgery was 33.3% in the first six months and 10.3% in next six months (22). Our finding that patients with BMI ≥ 40 kg/m² are at higher risk factor for gallstone formation after surgery agrees with that of Grover et al, that a BMI ≥ 40 kg/m², risk of developing gallstones is eight-fold higher than those with a normal BMI (24). Risk factors for gallstone development in comorbid diseases, such as, diabetes, hypertension, sleep apnea, hypothyroidism, and dyslipidemia were not found to be significant in our study as in other studies (22-26). The importance of our study lays in identifying the associated factors for gallstone formation after LSG that may be necessary for selecting patients for specific prophylactic interventions, such as regular ultrasound surveillance for gallstones.

Conclusions:

More than a third of cases developed gallstones after LSG. This was associated with Gross obesity prior to surgery (BMI ≥ 40 kg/m²), losing $\geq 25\%$ of the original weight, and rapid weight loss during the first six months after LSG.

Authors' declaration:

The manuscript is an original work, not previously published or sent to other journals. We hereby confirm that all the figures and tables in the manuscript are ours. The project was approved by the local ethical committee of the Iraqi board for medical specialization, code no. 64.

Conflicts of Interest: None

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Authors' contributions:

Study conception & design: (Dr. Abdulrahman Mahmood Mohammed). Literature search: (Dr. Abdulrahman Mahmood Mohammed). Data acquisition: (Dr. Tuka Younis Hassan). Data analysis & interpretation: (Dr. Tuka Younis Hassan). Manuscript preparation: (Dr. Abdunaser Mahmood Mohammed). Manuscript editing & review: (Dr. Abdunaser Mahmood Mohammed).

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انتشار حصوات المرارة والعوامل المساعدة في تكوينها بعد تكميم المعدة بالمنظار في مستشفى امراض الجهاز الهضمي التعليمي والكبد

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الخلاصة:

الخلفية: جراحة السمنة هي الطريقة الأكثر فعالية لفقدان الوزن على المدى الطويل. إن تخفيض الوزن السريع بعد جراحة السمنة قد يساهم في تكوين حصوات المرارة.

الهدف من الدراسة: احتساب معدل وتحديد العوامل المرتبطة بتكوين حصوات المرارة بعد عملية تكميم المعدة بالمنظار.

المرضى والمنهجية: كانت هذه دراسة مقطعية على 128 مريضاً يعانون من السمنة المفرطة والذين تم علاجهم عن طريق تكميم المعدة بالمنظار وتمت متابعتهم بعد أسبوعين، وشهر واحد، و 6 أشهر، وسنة واحدة بعد الجراحة في الفترة ما بين تشرين الأول 2018 وتموز 2020 في مستشفى الجهاز الهضمي والكبد التعليمي في بغداد ومستشفى الدولي الخاص. تم جمع البيانات باستخدام استبيان منظم. وتم الحصول على الموافقة الأخلاقية من لجنة البورد العراقي للاختصاصات الطبية ومن المشاركين. وتم استخدام البرنامج الإحصائي للعلوم الاجتماعية لتحليل البيانات.

النتائج: كان متوسط عمر المرضى 5.21 ± 36.5 (17-54) للإناث و 3.04 ± 41.6 (24-58) للذكور. حدث تكوين حصوات المرارة في 49 حالة (38.3%). من بين جميع الذكور، أصيب أربعة (36.4%) بحصوات في المرارة بعد إجراء عملية تكميم المعدة بالمنظار، مقارنة بـ 45 (38.5%) من الإناث. كان لدى 60 مريضاً (46.9%) مؤشر كتلة الجسم ≥ 40 كجم/م²، منهم 29 (48.3%) أصيبوا بحصوات في المرارة بعد تكميم المعدة بالمنظار ($P = 0.031$). تظهر النتائج لفقدان الوزن فيما يتعلق بالتوقيت ودرجة الخسارة وجود علاقة كبيرة بتكوين حصوات المرارة بعد تكميم المعدة بالمنظار ($P < 0.05$). لم ترتبط الحالات المرضية المصاحبة بشكل كبير بحدوث تكوين حصوات المرارة بعد تكميم المعدة بالمنظار ($P > 0.05$).

الاستنتاجات: أصيب أكثر من ثلث الحالات بحصوات المرارة بعد عملية استبدال مفصل الركبة. وكان هذا مرتبطاً بما يلي: السمنة المفرطة قبل الجراحة (مؤشر كتلة الجسم ≥ 40 كجم/م²)، وفقدان $\geq 25\%$ من الوزن الأصلي، وفقدان الوزن السريع خلال الأشهر الستة الأولى بعد عملية استبدال مفصل الركبة.

الكلمات المفتاحية: السمنة، تكميم المعدة بالمنظار، جراحة السمنة، حصوة المرارة.