

Prevalence and risk factor of cholelithiasis after laparoscopic sleeve gastrectomy among Hail population, Saudi Arabia

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ABSTRACT

Background and Aims: The prevalence of cholelithiasis after different kinds of bariatric operations was found to increase in recent studies. The incidence rate internationally ranges from 2 to 50%, locally it is between 2.3 and 3.5%. The purpose of this study was to evaluate the incidence and risk factors for cholelithiasis among the Hail community in Saudi Arabia following laparoscopic sleeve gastrectomy. **Methodology:** A cross-sectional study was done on 505 patients who underwent laparoscopic sleeve gastrectomy in Hail region, Saudi Arabia. An online questionnaire was used to assess participants' demographic data, family history of gallstones, operative history, pre and postoperative BMI, DM, HTN and high TG, daily fat rich foods and diagnosis with gallstones after operation. **Results:** The prevalence of gallstone development after surgery was 19.8% and it was significantly higher among patients who underwent laparoscopic sleeve gastrectomy for more than a year, who had diabetes or triglycerides prior to surgery and who often ate meals high in fat. The chance of gallstone formation following surgery did not significantly correlate with the patients' demographics or family history of gallstones, according to a multivariate logistic regression analysis. **Conclusion:** It is critical to regularly check on each patient's postoperative weight. In addition, patients must be informed about gradual weight loss in order to reduce their risk of developing cholelithiasis.

Keywords: Prevalence, cholelithiasis, laparoscopic, sleeve, gastrectomy, Hail

1. INTRODUCTION

Gallbladder anomalies are one of the most common surgical issues in general surgery. Cholecystitis is a gallbladder inflammation that often occurs from gallstones, is the condition that affects the gallbladder most frequently (Alsaif et al., 2020). The accumulation of bile acid is referred to in medicine as cholelithiasis. Numerous risk factors can result in gallstones. Older persons from all ethnic groups are most at risk and females are more likely to

experience it (Stinton et al., 2012). Gallstone development is known to be more common in obese people and can be brought on by secondary dyslipidemia. 30-53 percent of patients who undergo bariatric surgery are at risk for developing gallstones (Haal et al., 2022). Rapid weight reduction, which may occur after bariatric surgery, is one of the known risk factors for gallstones (Aldriweesh et al., 2020). Gallstones may also develop as a result of using medications like oral contraceptives and having a family history of gallstones (Jones et al., 2022).

Gallstone patients may experience consequences including biliary colic, no symptoms, cholecystitis, jaundice or severe pancreatitis (Sigmon et al., 2022). Abdominal ultrasound is a technique for diagnosing gallstones, even though alternative modalities like MRCP, endoscopic ultrasonography, Laparoscopic cholecystectomy is advised for patients who experience acute cholecystitis and biliary colic as a result of gallstones (Cremer and Arvanitakis, 2016). Making lifestyle adjustments, such as eating healthier foods and decreasing weight, can help prevent gallstones (Yousef et al., 2020). The frequency of cholelithiasis following various types of bariatric procedures has been quantified in recent studies. Locally, the incidence rate is between 2.3 and 3.5%, although it varies from 2 to 50% globally (Alsaif et al., 2020; Cremer and Arvanitakis, 2016; Makki and Aldaqal, 2016). The development of cholelithiasis after bariatric surgery is closely linked to quick weight loss (Li et al., 2009; Coupaye et al., 2015). 3.5% of patients who underwent bariatric surgery developed cholelithiasis, according to a recent Saudi Arabian study. Additionally, it discovered a link between the onset of cholelithiasis and the purpose of this study was to evaluate the prevalence and risk factors for cholelithiasis among the Hail population in Saudi Arabia following laparoscopic sleeve gastrectomy.

2. METHODOLOGY

Study design, setting and time

This was a cross-sectional study done in Hail region, Saudi Arabia in the time from February to May 2022. Study population: All patients who underwent laparoscopic sleeve gastrectomy among Hail population, Saudi Arabia during the study period were included. And the exclusion criteria were any participant who did not have the mentioned surgery and those who had an incomplete questionnaire.

Data collection

To the targeted demographic that matched the inclusion requirements, online surveys were given out. The questionnaire included items to assess the participants' demographic data, family history of gallstones, operative history, pre and postoperative BMI, DM, HTN and high TG, daily fat rich foods and diagnosis with gallstones after operation. Each participant gave his/her consent at the beginning of the questionnaire link, before answering the questionnaire.

Data analysis

Using the (SPSS) program version 26 to analyze the data. Quantitative information was expressed as numbers and percentages in order to evaluate the relationship between the variables and the Chi-squared test (χ^2) was used. The Odds Ratio was calculated at a Confidence Interval (CI) of 95% to assess risk factors (independent predictors) of diagnosis with gallstones after operation. A p-value of less than 0.05 was regarded as statistically significant. A p-value < 0.05 was considered statistically significant.

3. RESULTS

Table 1 shows that 39.2% of studied patients had an age ranging from 15-30 years, 55.4% were females and 97.8% had a Saudi nationality. Of them, 49.1% had a family history of gallstones.

Table 1 Distribution of study subjects based on their racial and ethnic backgrounds and gallstones (No:505)

Variable	No. (%)
Age	
15-30	198 (39.2)
31-40	147 (29.1)
41-50	130 (25.7)
>51	30 (5.9)
Gender	
Female	280 (55.4)
Male	225 (44.6)

Nationality	
Saudi	494 (97.8)
None-Saudi	11 (2.2)
Has anyone in your family been diagnosed with gallstones?	
No	257 (50.9)
Yes	248 (49.1)

Table 2 shows that most of patients (54.7%) had the laparoscopic sleeve gastrectomy for >1 year. Most of patients (37%) had a BMI of 45-49.9 kg/m². While 33.3% had a BMI of 25-29.9kg/m² after surgery. Of them, 19.4%, 17.6% and 27.9% had DM, HTN and high triglycerides before surgery. And 39% reported that they have daily diet contain foods rich in fat. Figure 1 Illustrates that 19.8% of patients were diagnosed with gallstones after the operation.

Table 2 Distribution of studied participants according to operative history, pre and postoperative BMI, DM, HTN and high TG and daily fat rich foods (No:505)

Variable	No. (%)
How long was the laparoscopic sleeve gastrectomy?	
2-4 months	28 (5.5)
5-7 months	41 (8.1)
8-10 months	83 (16.4)
11-12 months	77 (15.2)
>1 year	276 (54.7)
Preoperative body mass index (BMI)	
30-34.9	21 (4.2)
35-39.9	54 (10.7)
40-44.9	129 (25.5)
45-49.9	187 (37)
50-54.9	83 (16.4)
55-59.9	17 (3.4)
>60	14 (2.8)
Post-operative body mass index (BMI)	
<18.5	37 (7.3)
18.5-24.9	143 (28.3)
25-29.9	168 (33.3)
30-34.9	79 (15.6)
35-39.9	40 (7.9)
40-44.9	24 (4.8)
45-49.9	8 (1.6)
>50	6 (1.2)
Diagnosed with diabetes?	
Before operation	98 (19.4)
After operation	6 (1.2)
No	401 (79.4)
Diagnosed with high blood pressure?	

Before operation	89 (17.6)
After operation	11 (2.2)
No	405 (80.2)
Diagnosed with high triglycerides?	
Before operation	141 (27.9)
After operation	10 (2)
No	354 (70.1)
Does your daily diet contain foods rich in fat?	
No	36 (7.1)
Maybe	272 (53.9)
Yes	197 (39)

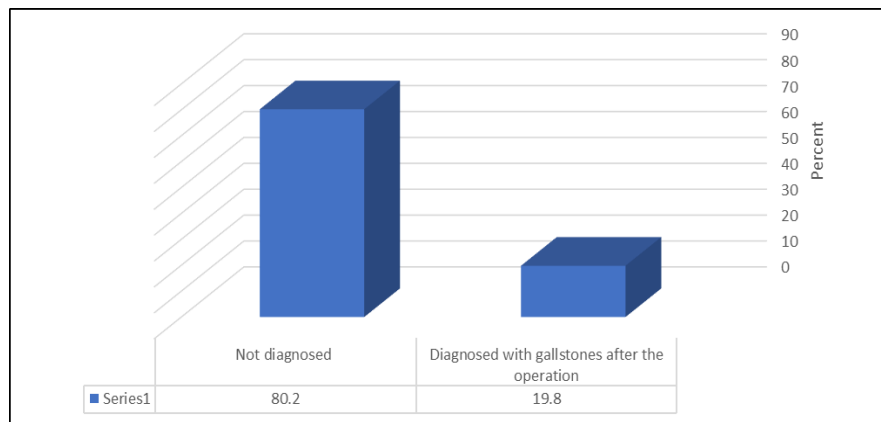


Figure 1 Percentage distribution of patients according to diagnosis with gallstones after the operation (No:505)

Table 3 demonstrates that a non-significant relationship was found between diagnosis with gallstones after operation and patients' demographic data or family history of gallstones ($p \geq 0.05$). While the prevalence of gallstones after operation was significantly higher among patients who had the laparoscopic sleeve gastrectomy for >1 year and who had DM before operation ($p < 0.05$) (Table 4).

Table 3 Relationship between diagnosis with gallstones after operation and patients' demographic data and family history of gallstones (No:505)

Variable	Diagnosed with gallstones after the operation		χ^2	P value
	No No. (%)	Yes No. (%)		
Age				
15-30	163 (40.2)	35 (35)	2.22	0.527
31-40	115 (28.4)	32 (32)		
41-50	101 (24.9)	29 (29)		
>51	26 (6.4)	4 (4)		
Gender				
Female	216 (53.3)	64 (64)	3.69	0.055
Male	189 (46.7)	36 (36)		
Nationality				
Saudi	369 (97.8)	98 (98)	0.01	0.892
None-Saudi	9 (2.2)	2 (2)		

Has anyone in your family been diagnosed with gallstones?			1.19	0.275
No	211 (52.1)	46 (46)		
Yes	194 (47.9)	54 (54)		

Table 4 Relationship between diagnosis with gallstones after operation and operative history, pre and postoperative BMI, DM and HTN (No:505)

Variable	Diagnosed with gallstones after the operation		χ ²	p-value
	No No. (%)	Yes No. (%)		
How long was the laparoscopic sleeve gastrectomy?				
2-4 months	22 (5.4)	6 (6)	1.64	0.02
5-7 months	39 (9.6)	2 (2)		
8-10 months	72 (17.8)	11 (11)		
11-12 months	63 (15.6)	14 (14)		
>1 year	209 (51.6)	67 (67)		
Preoperative body mass index (BMI)				
30-34.9	16 (4)	5 (5)	7.03	0.318
35-39.9	48 (11.9)	6 (6)		
40-44.9	107 (26.4)	22 (22)		
45-49.9	149 (36.8)	38 (38)		
50-54.9	61 (15.1)	22 (22)		
55-59.9	12 (3)	5 (5)		
>60	12 (3)	2 (2)		
Post-operative body mass index (BMI)				
<18.5	30 (7.4)	7 (7)	7.59	0.37
18.5-24.9	105 (25.9)	38 (38)		
25-29.9	137 (33.8)	31 (31)		
30-34.9	68 (16.8)	11 (11)		
35-39.9	35 (8.6)	5 (5)		
40-44.9	19 (4.7)	5 (5)		
45-49.9	6 (1.5)	2 (2)		
>50	5 (1.2)	1 (1)		
Diagnosed with diabetes?				
Before operation	69 (17)	29 (29)	5.5	0.014
After operation	6 (1.5)	0 (0.0)		
No	330 (81.5)	71 (71)		
Diagnosed with high blood pressure?				
Before operation	72 (17.8)	17 (17)	0.41	0.318
After operation	8 (2)	3 (3)		
No	325 (80.2)	80 (80)		

Figure 2 and 3 show that the prevalence of gallstones after operation was significantly higher among patients diagnosed with high triglyceride before operation and who have daily diet contains foods rich in fat (p<0.05).

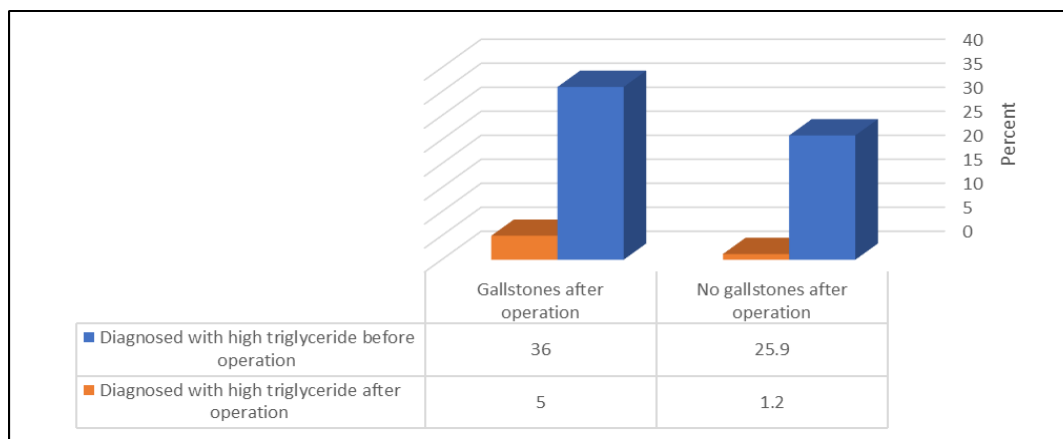


Figure 2 Relationship between diagnosis with gallstones after operation and high triglyceride levels (No:505)N.B: ($\chi^2 = 10.84$, p-value = 0.004)

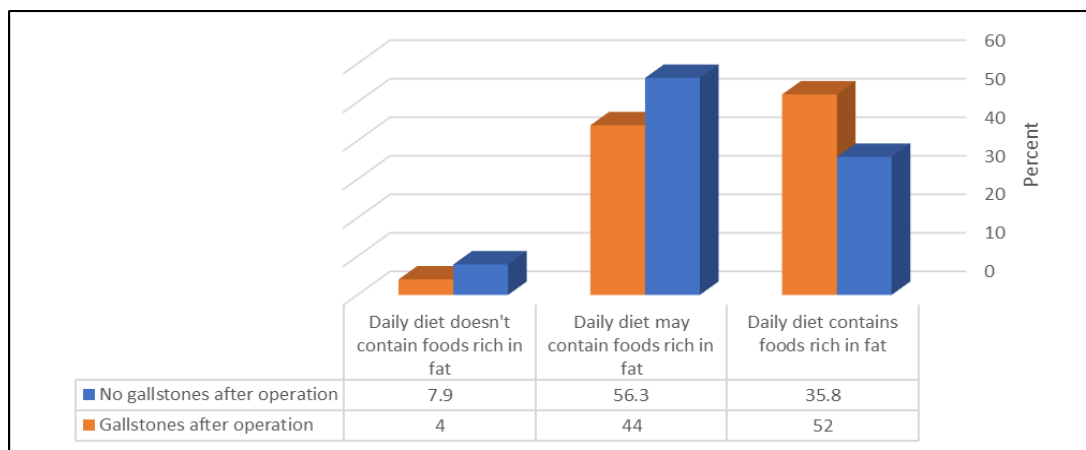


Figure 3 Relationship between diagnosis with gallstones after operation and daily fat rich foods (No:505) N.B.: ($\chi^2 = 9.35$, p-value = 0.009)

Multivariate logistic regression analysis was done to assess the risk factors (independent predictors) of diagnosis with gallstones after operation. It was found that having DM before operation and having daily diet contains foods rich in fat were risk factors (independent predictors) of risk factors of diagnosis with gallstones after operation among studied patients (Table 5).

Table 5 Investigation of the risk factors for identification of gallstones following surgery using multivariate logistic regression

Variable	B	Wald	p-value	Odds Ratio (CI:95%)
Age	0.05	0.17	0.68	0.94 (0.72-1.23)
Gender	0.45	3.45	0.063	0.63 (0.39-1.02)
Nationality	0.39	0.23	0.631	1.47 (0.3–7.29)
How long was the laparoscopic sleeve gastrectomy?	0.2	3.07	0.08	1.22 (0.97-1.54)
Has anyone in your family been diagnosed with gallstones?	0.17	0.56	0.451	1.19 (0.75-1.88)
Preoperative body mass index (BMI)	0.18	2.96	0.085	1.19 (0.97-1.46)
Post-operative body mass index (BMI)	0.15	2.59	0.108	0.85 (0.7-1.03)
Diagnosed with diabetes?	0.4	5.82	0.016	0.66 (0.47-0.92)
Diagnosed with high blood pressure?	0.34	3.15	0.076	1.41 (0.96-2.08)
Diagnosed with high triglycerides?	0.18	1.78	0.181	0.83 (0.63-1.08)
Does your daily diet contain foods rich in fat?	0.46	5.04	0.025	1.59 (1.06-2.4)

4. DISCUSSION

Numerous studies have found that laparoscopic sleeve gastrectomy enhanced the formation of gallstones. 505 individuals who underwent laparoscopic sleeve gastrectomy in Hail, Saudi Arabia, were included in this study. According to the current study, gallstones appear in 19.8% of patients who have sleeve gastrectomy and most of these people see a significant drop in BMI as a result of the treatment. The rate is also higher in women than in men. But among patients who had diabetes mellitus (DM) before the operation, had had a laparoscopic sleeve gastrectomy for more than a year and regularly ate high-fat foods, the prevalence was significantly greater. Of the study subjects, 19.8% had gallstones found after the procedure.

In a previous Saudi study, Alsaif et al., (2020) found that 3.5% of post-LSG patients developed symptomatic cholelithiasis over the course of two years. Various incidence rates of post-LSG gallbladder disease have been documented in the literature. Rates as high as 25.5% and 28% have been recorded in some research (Gustafsson et al., 2005; Coupaye et al., 2014), which is much higher than our findings. Several further studies but similar reported incidence rates between 3 and 6 percent have also been found (Li et al., 2009; Sioka et al., 2014; Tsirlina et al., 2014). According to the current study, after surgery, 33.3% of patients had a BMI between 25 and 29.9 kg/m², while 37% of patients had a BMI between 45 and 49.9 kg/m². Gallstones can develop following laparoscopic sleeve gastrectomy for a variety of reasons, including a quick drop in BMI, being female, having diabetes prior to the procedure and regularly eating foods high in fat.

Many studies link the sudden loss of weight to an increased risk of gallstone development following sleeve gastrectomy (Stokes et al., 2021; Haal et al., 2022; Aldriweesh et al., 2020). Rapid weight loss was found to be the only risk factor for post-LSG gallbladder illness in a recent Saudi study. In addition, a strong correlation was found between the prevalence of cholelithiasis and the degree of weight loss following bariatric surgery. In other words, a high BMI previous to surgery and rapid weight loss over a short period of time both increase the risk of developing cholelithiasis following surgery (Erlinger, 2000). In contrast to a study done by Hernan et al., (2019) it was discovered that CL could develop in up to one-third of patients monitored for 12 months following bariatric surgery, but that the risk was not increased by significant weight reduction. The risk that patients in the southern region of Saudi Arabia who underwent bariatric surgery would develop gallstones was investigated in a study.

The study found that 61.4% of the time, gallstone formation followed surgery. Within one year, one to three years and three to six years following bariatric surgery, gallbladder stones were discovered in 8.6%, 62.9% and 28.4% of patients, respectively. The findings show a statistically significant correlation between the time since the surgery and the development of gallstones (Shubayret et al., 2022). Numerous studies have shown that DM can raise the risk factor for gallstones after surgery and our study demonstrates that the likelihood of gallstone formation is noticeably higher in patients who had DM before to the procedure (Elmehdawi et al., 2009; Pagliarulo et al., 2004).

The current study also discovered that patients with high triglyceride levels before surgery had a considerably greater post-operative gallstone prevalence. Therefore, by adopting healthy eating habits and lowering cholesterol, you can prevent the development of stones by lowering (Wang et al., 2013). The lack of exercise, gaining weight and improper eating practices may all contribute to a decrease in HDL cholesterol, which in turn may be the cause of the production of kidney stones (Di et al., 2019).

Limitation

A limitation of the present study was having a cross-sectional study design that could reveal the association between variable without the casual relationships.

5. CONCLUSION

This study found that following surgery, 33.3% of patients had a BMI between 25 and 29.9 kg/m² and 37.5% had a BMI between 45 and 49.9 kg/m². Before surgery, 39.9% of them had a diet high in fatty foods and 19.4%, 17.6%, and 27.9% of them had diabetes, high blood pressure and high triglycerides. Gallstone formation after surgery was prevalent (19.8%) and it was much more frequent in people who had laparoscopic sleeve gastrectomy for longer than a year, who had diabetes before surgery, who had high triglycerides before surgery and who frequently consumed meals high in fat. According to a multivariate logistic regression analysis, there is no significant correlation between the patients' demographics or family history of gallstones and the likelihood of formation of gallstones after surgery and having diabetes before surgery. To prevent rapid weight loss, it is essential that each patient's postoperative weight be monitored weekly. Additionally, it is necessary to educate patients about progressive weight loss to lower their chance of getting cholelithiasis.

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Author Contributions

All authors designed the study, developed the questionnaire and the informed consent, wrote the protocol and planned the study. Assisted in data collection, data entry and shared in statistical design and analysis.

Ethical approval

Ethical confederations: The ethical committee of the University of Hail's College of Medicine gave their approval before the start of the study initiation (approved number H-2022-063).

Informed consent

An online informed consent was obtained from all individual participants included in the study.

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This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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