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Original Research Article

Prevalence of gallstones among gastric sleeve patients in Saudi Arabia

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ABSTRACT

Background: Gallstones are a common condition affecting millions of individuals worldwide, with obesity being one of the significant risk factors. In Saudi Arabia, the prevalence of obesity is high, and sleeve gastrectomy is one of the leading solutions used to reduce weight. Studies have found that sleeve gastrectomy results in increased onset of gallstones. This study aims to investigate the prevalence of gallstones among gastric sleeve patients in Al-Madinah and Al-Munawara.
Methods: The data was collected through an online questionnaire. A cross-sectional study will be conducted among 380 participants. The data was analyzed using SPSS with descriptive statistics, paired sample t-test, chi-square test, and correlation test.
Results: There were 380 participants, with a mean age of 30.48±7.98 years, out of which 51.6% developed gallstones after the gastric sleeve procedure. The data revealed a significant decrease in body weight and BMI after gastric sleeve, and risk factors such as obesity, cholecystitis, pancreatitis and liver hematoma were positively correlated with the onset of gallstone after gastric sleeve.
Conclusions: The prevalence of gallstones after gastric sleeve is notably high, so pre-operative and post-operative management should be emphasised, and further research on a larger scale should be done.

Keywords: Obesity, Gastric sleeve, Cholecystectomy, Gallstone

INTRODUCTION

Gallstones are hardened deposits of bile in the gallbladder. Bile is the digesting fluid produced by the liver and stored in the gallbladder. Gallstones range from the size of a golf ball to as little as a grain of sand. Majorly, an imbalance in the bile's chemical composition leads to gallstone formation because of certain elemental depositions. The location (gallbladder or biliary tract) and composition of gallstones are defined according to physical-chemical changes in bile, and high cholesterol or bilirubin concentrations distinguish them.[1]

The development of gallstone disease (GSD) is dictated by the combination of many non-modifiable risk variables, including age, ethnicity, genetics, sex, and

parity, as well as modifiable risk factors like physical inactivity, food, medications, and body mass index (BMI). Obesity is reported to be a significant associated factor with gallstones. More than 90% of patients, whether obese or not, develop cholesterol-related stones as a result of cholesterol metabolism products and supersaturation of the bile duct with cholesterol. However, the pathophysiology of this illness involves additional mechanisms.[2]

Obesity, particularly abdominal obesity, raises the risk of both cholelithiasis and the need for a cholecystectomy, which is the surgical removal of the gallbladder. The prevalence of cholelithiasis in Saudi Arabia is approximately 8.6%, which is not surprising given that it's one of the most prevalent gastrointestinal disorders. However, 75% of gallstone patients typically do not exhibit any symptoms initially, suggesting that the ailment may be underdiagnosed.[3] All the genetic and environmental/lifestyle changeable and nonmodifiable variables contribute to the risk of gallstones. An elevated BMI is directly associated with the likelihood of symptomatic stones, and increasing body weight is a known risk factor for the production of gallstones.[4]

Sometimes, to shed the extra pounds of weight, obese patients are prescribed to go for surgical procedures. The most effective treatment now available that enables more substantial and long-lasting weight loss is bariatric surgery. It causes co-morbidities and metabolic syndrome components to reverse, and it can reduce all-cause mortality by up to 89%.[5]

Cholelithiasis following weight loss surgery is not unusual. Within 6 to 12 months following gastric bypass surgery, the rate of asymptomatic gallstone development varied from 30% to 52.8% in the reported series using routine ultrasonography surveillance. Additionally, symptomatic gallstones were seen in 7% to 16% of the individuals.[6] So, it is essential to find the prevalence of gallstones in patients who underwent sleeve gastrectomy in Saudi Arabia. This study will mainly focus on the Madinah region to evaluate the prevalence and to fill the gap in the literature.

GSD has been reported as the leading cause of gastrointestinal disease, representing a common health problem. Obesity increases the risk of GSD due to higher cholesterol concentrations relative to the bile acids and phospholipids.[7]

Cholelithiasis in obese Asian people is significantly related to elevated diastolic blood pressure and hepatitis B surface antigen carriers. Because the chronic liver illness appears to be a risk factor for cholelithiasis in both non-obese and obese populations, obese patients with the HBsAg positive may benefit from a preventative cholecystectomy. Obesity and rapid weight loss from the bariatric surgery are risk factors for cholelithiasis.[8]

GSD affects 11.7% of the population in Saudi Arabia's Asir region. Primary care physicians in the area should pay closer attention to patients with right hypochondriac pain, particularly if they are female, have a family history of GSD, or have a history of pancreatitis.[9]

The prevalence of gallstones was significantly high in adult people aged more than 45 years old, and the female gender was an increased risk factor for gallstones. and physical inactivity and obesity were associated with a higher prevalence of GSD.[10]

Bariatric surgery, which includes sleeve gastrectomy, adjustable gastric band, gastric bypass, and biliopancreatic diversion with a duodenal switch, is one option for treating obesity (American society for metabolic and bariatric surgery). The rising incidence of obesity has led to an increase in the demand for bariatric surgery worldwide. A projected 198,650 bariatric procedures were performed in the US in 2020.[11]

Bariatric surgery has advantages and disadvantages like any surgical operation. Thus, evaluating patients' overall quality of life (QoL) after the procedure is critical. Cholelithiasis is one of the common surgical problems. The number of patients with gallstones increases with age. In this study, more patients with a normal BMI were seen. However, a more significant number of overweight or obese patients were found in the age group of 36-50 years. The current study has shown a high association of gallstones in younger people with metabolic syndrome and obesity. Gallstones were equally common in younger individuals with metabolic abnormalities and obesity as they were in older, non-obese individuals with normal metabolisms. Diet and exercise interventions may help prevent gallstone development 12 for high-risk individuals.

Objective

Objectives were to find the prevalence of gallstones in Saudi with morbid obesity who went through sleeve gastrectomy in Saudi Arabia and to evaluate the risk factors for gallstone formation among patients who underwent sleeve gastrectomy in the Saudi Arabia.

METHODS

This study employed a cross-sectional design, where data was collected through an online questionnaire targeting obese patients who have undergone sleeve gastrectomy in Saudi Arabia based on inclusion criteria. The data was collected from May 2024 to October 2024.

Inclusion criteria

Morbidly obese Saudi males and females who underwent gastric sleeve surgery at a hospital in Saudi Arabia between 2015 and 2019, patients who had a post-operative follow-up period of at least 6 months after

sleeve gastrectomy and patients who had a cholecystectomy (gallbladder removal) performed as part of their gastric sleeve surgery were included.

Exclusion criteria

Patients who had a cholecystectomy (gallbladder removal) performed as part of their gastric sleeve surgery, patients who had a history of gallstones or cholecystitis before undergoing gastric sleeve surgery, patients with any other medical condition that could have contributed to the development of gallstones. Patients who did not have a postoperative follow-up period of at least 6 months were excluded.

Sample size

About 24.7% of Saudis are obese. A report suggests 30,000 individuals go for sleeve gastrectomy annually in Saudi Arabia.[13] Based on that; this study will gather data from 380 individuals (as calculated from Qualtrics with a confidence interval of 95%) living in Saudi Arabia who previously had a sleeve gastrectomy operation.

Sampling technique

We used the convenience sampling technique. The reasons for selecting this sampling technique are the simplicity of sampling, the ease of research, and the fact that data collection can be facilitated quickly.

Data collection methods, instruments used, and measurements

The data collection method involved using an online questionnaire to gather data from patients with morbid obesity who have undergone sleeve gastrectomy in Saudi Arabia.[13-15] A data collection form was utilised to collect information on these patients, and the necessary consent was obtained before data collection.

Data management and analysis plan

Data was analysed using statistical package for social studies program (SPSS, V. 21.0. IBM: Chicago) data obtained from this study were analysed by using statistical package for social science software (SPSS v.22). A value of 0.05 was considered the value of statistical significance for all statistical tests in the present study. The demographic details were analysed using descriptive analysis. A chi-square test and correlation test were applied to find the association of variables.

Ethical considerations

Ethical approval for conducting the study was obtained from the Al-Rayan research ethics committee (registered with the national bioethics committee in KACST, Saudi Arabia). The study ID was HA-03-M-122-118 dated 22, December, 2024. Online consent from the participants was obtained. Questions were asked, and approval was taken in Arabic. They were independent in deciding whether they wanted to fill out the form. The personal data of participants was kept confidential.

RESULTS

There were 380 participants, 210 (55.3%) males and 170 (44.7%) females, aged 30.48±7.98 years, who underwent gastric surgery and participated in this research. The 231 (60.8%) participants were married, and 149 (39.2%) were unmarried. As per employment status 240 (63.2%) were employed, 46 (12.1%) was unemployed, 89 (23.4%) were students and 5 (1.3%) were retired (Table 1).

Table 1: Distribution of samples as per demographic data.

Variables	N	Percentage (%)	Total, N (%)
Age (Mean±SD) (in year)	30.48±7.98		
Gender			
Male	210	55.3	380 (100)
Female	170	44.7	
Marital status			
Married	231	60.8	380 (100)
Unmarried	149	39.2	
Occupation			
Employed	240	63.2	380 (100)
Unemployed	46	12.1	
Student	89	23.4	
Retired	5	1.3	

Participants were further asked about their weight, height and BMI before the gastric sleeve procedure. The mean weight was 128.08 kg, with a standard deviation of 25.95 kilograms. The mean height was 169.40±17.60 cm, and the calculated mean BMI of participants was 44.93±14.69 kg/m^2. on average, the participants were diagnosed as obese 5.74±4.56 years ago (Table 2).

Table 2: Mean body weight and BMI of participants.

Variables	Mean±SD
Weight before surgery (kg)	128.08±25.95
Height before surgery (cm)	169.40±17.60
BMI before surgery (kg/m^2)	44.93±14.69
Obesity diagnosis (year)	5.74±4.56

Based on the question related to obesity complications, 194 (51.09%) participants reported having no complications. In contrast, the remaining 186 (48.91%) reported complications 58 (15.22%) had diabetes, 17 (4.35%) had diabetes and hypertension, 17 (4.35%) had hypertension, 50 (13.04%) had knee and back pain, 8 (2.17%) had cardiovascular diseases, 8 (2.17%) had gastric issues, 8 (2.17%) had PCOs, and 20 (5.43%) had to complain of shortness of breath (Figure 1).

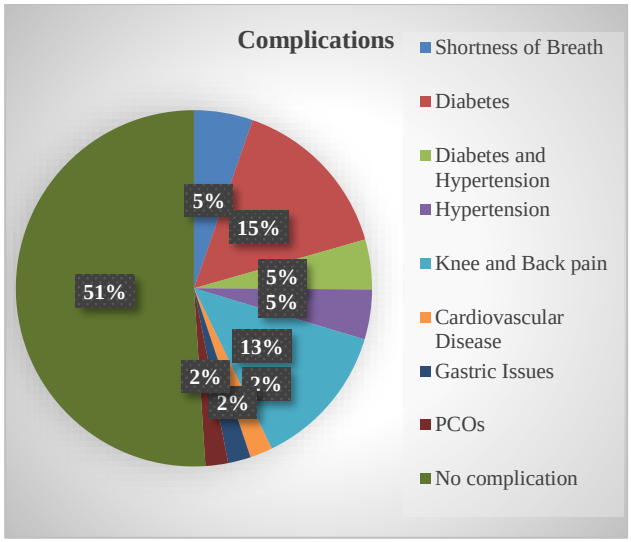

Figure 1: Type of complications patient endure due to obesity.

As per the data collected, 281 (73.9%) had no other medical history, whereas 29 (7.6%) had diabetes, 25 (6.5%) had hypertension, 25 (6.5%) had asthma. The 16 (4.3%) had thyroid issues, and 4 (1.1%) had epilepsy. As per the surgical history, 367 (96.7%) participants underwent the surgery in their lifetime. Before surgery 4 (1.1%) had diabetes, 4 (1.1%) had hypertension, 12 (3.3%) had hypertension and 12 (3.3%) had difficulty in movement (Table 3).

Table 3: Distribution of subjects based on their medical history.

Variables	N	Percentage (%)	Total, N (%)
Medical history			
None	281	73.9	380 (100)
Diabetes mellitus	29	7.6	
Hypertension	25	6.5	
Asthma	25	6.5	
Thyroid issue	16	4.3	
Epilepsy	4	1.1	
Surgical history			
Yes	367	96.7	380 (100)
No	13	3.3	
Complications before surgery			
No	352	92.6	380 (100)
Diabetes	4	1.1	
Hypertension	12	3.3	
Difficulty in movement	12	3.3	

Patients were asked about the reason for going through gastric sleeves: 268 (70.7%) reported it for weight reduction, 70 (18.5%) reported to combat comorbidities, 33 (8.7%) said to improve their appearance, and 9 (2.3%) reported to reduce the onset of binge eating.

Out of 380 participants 360 (94.6%) went through gastric sleeve, 4 (1.1%) had gastric bypass and 16 (4.3%) were not sure. There were only 4 (1.1%) who experienced hypotension, 4 (1.1%) hypoxia and 8 (2.2%) gastric issues after the procedure (Table 4).

Table 4: History of gastric sleeve procedure.

Variables		Mean±SD	P value (between groups)
Body weight (kg)	Before gastric sleeve	128.08±25.95	0.00
	After gastric sleeve	93.33±25.51	0.00
BMI (kg/m^2)	Before gastric sleeve	44.93±14.69	0.00
	After gastric sleeve	32.23±11.58	0.00

As per the follow-up weight loss, it was seen that the post-surgery mean weight of patients was 93.33±25.51 kg, and their BMI was 32.23±11.58 kg/m^2. A paired sample t test revealed that there was a significant loss of weight and BMI after the procedure (Table 5).

Table 5: Paired sample t-test analysis of weight difference before and after the procedure.

Variables	N	Percentage (%)	Total, N (%)
Reason for gastric sleeve			
Decrease weight	268	70.7	380 (100)
Co-morbidities	70	18.5	
Appearance	33	8.7	
Binge eating	9	2.3	
Type of surgery			
Gastric sleeve	360	94.6	380 (100)
Gastric bypass	4	1.1	
No idea	16	4.3	
Complications after gastric sleeve			
No	364	95.7	380 (100)
Hypotension	4	1.1	
Hypoxia	4	1.1	
Gastric issue	8	2.2	

According to the collected data, 196 (51.6%) had gallstones after surgery and 184 (48.4%) did not have gallstones after the gastric sleeve procedure (Figure 2).

As per the modality of gallstone treatment, 108 (28.3%) went through lap chole, 29 (7.6%) had conservative treatment 29 (7.6%) had no idea and 12 (3.3%) had open cholecystectomy (Table 6).

Table 6: Modality of gallstone treatment.

Modality of treatment gallstones	N	Percentage (%)	Total, N (%)
None	202	53.2	380 (100)
Lap chole	108	28.3	
open cholecystectomy	12	3.3	
Conservative	29	7.6	
No idea	29	7.6	

The patients reported Several risk factors that could have resulted in gallstone formation. Chi-square analysis revealed no significant association between these risk factors and the onset of gallstones after gastric sleeve. Pearson correlation analysis showed a significant positive correlation between these factors and gallstone formation of gallstones (Table 7).

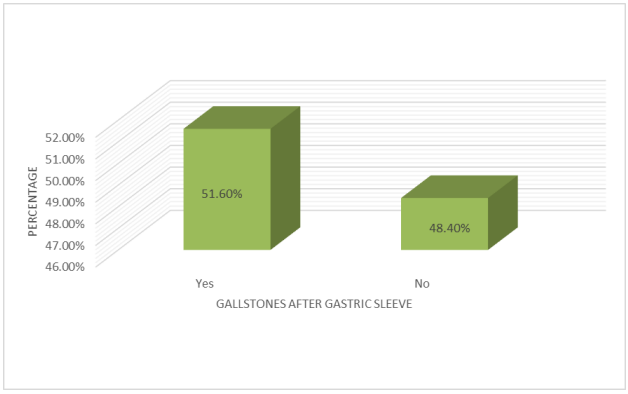

Figure 2: Prevalence of gallstone after gastric sleeve.

Table 7: Association analysis of risk factors with gallstone onset.

Risk factors	N	Percentage (%)	Chi-square	Pearson correlation
No	331	87.0		
Pain	8	2.2		
Obesity	13	3.3		
Cholecystitis	8	2.2	0.75	0.02
biliary pancreatitis	8	2.2		
Liver hematoma	4	1.1		
Surgery	8	2.2		

DISCUSSION

This work showed that 51.6% of the patients had gallstones after the gastric sleeve surgery performed in the Al-Madinah region. These results raise awareness of the postoperative care of patients with bariatric surgery, as gallstones may cause biliary colic, cholecystitis, and pancreatitis. In addition, this study established that obesity and hypertension are among the vital risk factors that predispose this group of people to the development of gallstones. These observations are consistent with previous studies on a similar population, supporting the hypothesis that rapid weight loss precipitates gallstone formation.

This study's 51.6% prevalence of gallstones was determined by Li et al who highlighted a pool prevalence of 25-38% among bariatric surgery patients. It has been postulated that rapid weight loss following bariatric surgery leads to increased levels of supersaturated bile and, therefore, increased risk of forming gallstones.[16] Moreover, in agreement with this study's findings that obesity and hypertension are important risk factors for cholelithiasis, researchers underscored the fact that metabolic disturbances effectively assessed by higher BMI increase the risk of stones.[17]

The association between low-calorie diets and gallstone formation is one example of metabolic changes following bariatric surgery. In particular, losses of body weight and energy intake, which result from VLCD, can influence the synthesis of bile acids and, consequently, the tendency to create cholesterol crystals. Further supporting this is research like that of Miller et al also affirms that fluctuations in diet and weight changes accelerate the bile acid changes.[21] This study has revealed the need to explain these metabolic changes and their bearing on managing patients.

Quite remarkably, gallstone incidence among bariatric patients varies across different geographical regions. The study conducted in the United States established a similar prevalence; the authors agreed and noted that binge eating is a significant risk factor regardless of the region of the world.[18] However, a study by Mathus-Vliegen in Europe revealed a different scenario of 20% prevalence, maybe due to differences in dietary practices, genetic susceptibility, and handling of patients.[19]

There are, however, differences by surgical style: gallstones are more common in gastric sleeve surgery patients than in adjustable gastric banding patients, according to research.[20] The probable reason for this difference may be found in the fact that weight loss after sleeve gastrectomy is more significant and occurs more quickly. However, Roux-en-Y gastric bypass patients showed a prevalence similar to gastric sleeve patients.[16] These comparisons were meaningful in understanding relative risk differences between the bariatric procedures

and the required patient counselling based on surgical preferences.

However, data explaining the relation between genetic factors, regional diets and the formation of gallstones has also been reviewed in different research. For example, persons whose diets are replete with fats and cholesterol may be inclined to develop gallstones. On the other hand, foods high in fibre and low in cholesterol reduce this risk; for instance, there is evidence that suggests Frequent consumption of foods high in fibre and low in cholesterol lessen this risk. Based on these findings, regional differences in diet may partially be blamed for differences in gallstone occurrence across diverse regions.[23]

It is evident from the current literature that there is a positive direct relationship between obesity and gallstone development. These findings of the current study support the notion that obesity, as reflected by increased BMI, stirs up cholesterol saturation of bile, a factor that boosts the development of gallstones. Hypertension, which is another risk factor established in this study, explores the possibility of any correlation between cardiovascular disease and gallbladder disease. Explorations further on these relationships may reveal salutary information with prevention efforts.

Other risk factors for gallstone formation are age, gender and weight cycling. Especially vulnerable are older people and females due to hormonal effects on the composition of bile. It is well-established that oestrogen raises biliary cholesterol output, which could presumably go a long way to explaining the gender discrepancy. This aligns with gallstone research evidence, which established that gallstone incidents were more prevalent among women than men.[22]

Given that up to 90% of patients who received the gastric sleeve develop gallstones after the operation, adequate preventive measures should be critical during preoperative and postoperative management.[24] It is established that using ursodeoxycholic acid prevents the formation of gallstones based on a change in the composition of bile. Furthermore, a systematic second-trimester ultrasound examination of gallbladder movements may help with the early diagnosis and treatment of gallstones in the first postoperative year.

Specific diet changes, such as low-fat and high-fibre meals, may help prevent the formation of gallstones. Patients should also follow general advice on gradual weight loss after bariatric surgery to avoid any likely metabolic complications. Also, the elimination of other associated illnesses like hypertension, when managed through dietary changes and drugs, can help in decreasing the overall risk of developing gallstones.

Other surgical prophylaxis, like cholecystectomy at the time of collective adulthood bariatric operations, has also been held in specific high-risk cohorts. Although such action may offset the risk of future complications, there is the likelihood that trying something new may require another operation. For that reason, researchers stated that a sort of selective procedure that focuses on assessing individual risks might provide the optimum benefits at the lowest levels of risk.

CONCLUSION

This study concludes that the prevalence of gallstones after gastric sleeve is notably high, and obesity is a major contributing factor. This study suggests that gastric sleeve procedures should emphasise pre-operative and post-operative management. Further, longitudinal studies should be conducted on a larger scale.

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