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ORIGINAL CONTRIBUTIONS

Incidence and Risk Factors for Cholelithiasis After Bariatric Surgery

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Abstract

Background Obesity and rapid weight loss after bariatric surgery (BS) are independent risk factors for development of cholelithiasis (CL), a prevalent disease in the Chilean population. This study aimed to determine the incidence of CL in obese Chilean patients 12 months after BS and identify risk factors for development of gallstones.

Methods Retrospective study of patients who underwent BS in 2014. Patients with preoperative negative abdominal ultrasound (US) for CL and follow-up for at least than 12 months were included. Patients underwent US at 6 months and 12 months. We analyzed sex, age, hypertension, dyslipidemia, type 2 diabetes mellitus, body mass index (BMI), surgical procedure, percentage of excess BMI loss (%EBMIL) at 6 months, and BMI at 6 months.

Results Of 279 patients who underwent bariatric surgery during 2014, 66 had previous gallbladder disease and 176 met the inclusion criteria (82.6%), while 54.6% were female. The mean age was 37.8 ± 10.5 years and preoperative BMI was 37.5 kg/m^2. BMI and %EBMIL at 6 months were 27.8 ± 3.3 kg/m^2 and 77.9 ± 33.6%, respectively. At 12 months after BS, CL was found in 65 patients (36.9%). Hypertension turned out to be protective against occurrence of gallstones at 1 year with an OR 0.241.

Conclusions Incidence of CL was up to one-third of the patients followed up for 12 months after BS. Excessive weight loss and other variables studied did not increase risk. Hypertension seems to be protective against gallstone formation, but this result needs further analysis.

Keywords Obesity · Bariatric surgery · Cholelithiasis · Weight loss · Sleeve gastrectomy · Sleeve gastrectomy with jejunal bypass · Roux-en-Y gastric bypass

Introduction

Bariatric surgery is commonly accepted as the best treatment for obesity and related comorbidities, and an increasing number of patients are undergoing a weight-loss procedure [1]. Chile has one of the world's highest rates of cholelithiasis (CL), and CL prevalence could be as high as 51% in women [2]. Risk of CL can increase in obese people fourfold compared with that in the non-obese population [3]. Some surgeons perform simultaneous cholecystectomy with bariatric surgery, while others postpone gallbladder removal unless patients are symptomatic [4]. As a high weight correlates with gallstone formation, there is also a high risk of developing CL after bariatric surgery. This is strongly related to rapid weight

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loss and has been reported for many decades, even with obsolete procedures such as jejunoileal bypass [3, 5–7]. The incidence of CL after bariatric surgery varies but is close to 30% in the majority of recent studies [9–15]. Risk factors for development of CL in the general population and in patients with obesity and metabolic syndrome have been studied extensively; however, there is scarce evidence on the relations of these factors during rapid weight loss after bariatric surgery [16]. Causes are not well clarified, but among factors correlated with CL are bile oversaturation with cholesterol and raising of nucleation factors such as mucin, calcium, prostaglandins, and arachidonic acid. There is also an increased risk due to slowed and incomplete emptying of the gallbladder, causing bile stasis [6, 17, 18]. These are some of the reasons abdominal ultrasound (US) is routinely indicated in bariatric surgical patients' follow-ups.

This study was aimed at determining the incidence of CL 1 year after bariatric surgery, by abdominal US, and using multivariate analysis to seek risk factors for development of gallstones.

Material and Methods

This was a retrospective study of patients who underwent bariatric surgery between January and December 2014 at our institution. The study was previously approved by the scientific ethics committee of that same institution. The year of the study was selected randomly. Patients with previous cholecystectomy, sludge, stones, or gallbladder polyps recognized in the abdominal ultrasound (US) and documented follow-up of less than 12 months were reported but were excluded from the final analysis. Previous to bariatric surgery, all patients were evaluated using complete laboratory work, upper endoscopy, and US and by the multidisciplinary team.

The primary outcome was incidence of de novo CL in the 12 months following bariatric surgery. The secondary outcome was to determine preoperative risk factors for gallstone formation, as established by multivariate analysis. Patients were followed up at our outpatient office and underwent US at 6 months. Patients with negative US for CL was repeated at 12 months. No intraoperative US or ursodeoxycholic acid (UDA) was used in these patients.

Continuous variable parametricity was tested using the Shapiro–Wilk test. Parametric results are presented as the mean values with 95% standard deviation, and non-parametric results are presented as the median values with interquartile ranges. Multivariate analysis was performed using logistic regression to determine independent variables related to postbariatric CL. The independent variables were sex, age, hypertension, dyslipidemia, type 2 diabetes mellitus, body mass index (BMI), surgical procedure, percentage of excess BMI loss (%EBMIL) at 6 months, and BMI at 6 months. Statistical analysis was performed using Stata 14.0 software (StataCorp LLC, College Station, TX, USA), and statistical significance was accepted at $P < 0.05$.

Results

During the study year, 279 patients underwent bariatric surgery in our institution. Among them, 23.7% ($n = 66$) were excluded for previous biliary disease, 14.4% ($n = 39$) had a positive US for gallstones, and 9.7% ($n = 27$) had undergone cholecystectomy before bariatric surgery (Fig. 1). Of the patients with positive preoperative US, 84.6% ($n = 33$) underwent simultaneous cholecystectomy and the other 15.4% ($n = 6$) were deferred for technical reasons (i.e., hepatomegaly or technically difficult surgery). Of the 213 patients without evidence of gallstones, 37 were excluded for not having US at 6 or 12 months (loss of follow-up), leaving a total of 176 (82.6%) patients with complete follow-up for analysis.

Table 1 shows the patients' preoperative characteristics. Among these patients, 54.6% were female, mean age was 37.8 ± 10.5 years, and preoperative BMI was 37.5 kg/m^2. BMI and %EBMIL at 6 months were 27.8 ± 3.3 kg/m^2 and 77.9 ± 33.6%, respectively. The surgical procedures were sleeve gastrectomy in 85 patients (48.3%), sleeve gastrectomy with jejunal bypass [19, 20] in 59 (33.5%), and Roux-en-Y gastric bypass (RYGB) in 32 (18.2%).

Overall, CL was found in 65 patients (36.9%). Thirty-eight patients were diagnosed at 6 months, and 27 at 12 months.

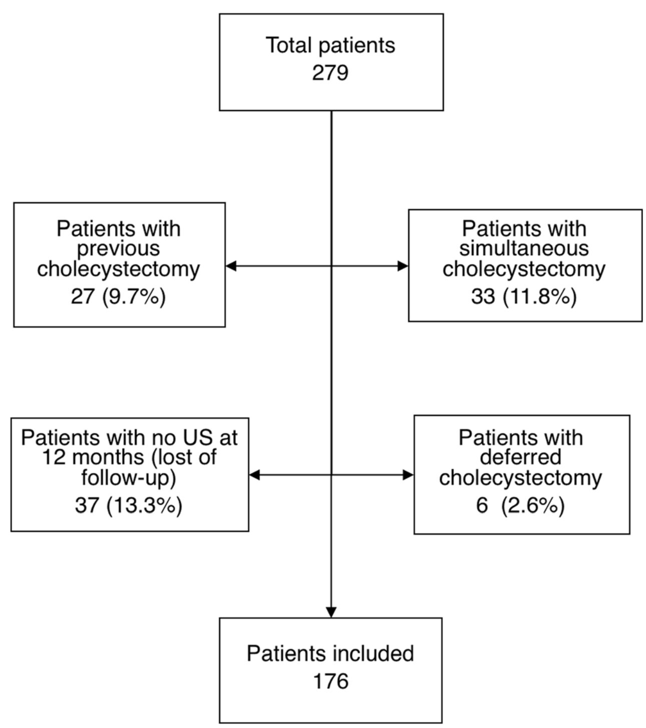

Fig. 1 Distribution of patients in the study

Table 1 Patients characteristics and independent variables

Variables	
N	176
Age (years)	37.8
Preop BMI (kg/m^2)	37.5
BMI at diagnosis (kg/m^2)	27.9
%EBMIL at diagnosis of CL	97.1
Female (%)	96 (54.6)
Arterial hypertension n (%)	46 (26.1)
Type 2 diabetes, *n* (%)	15 (8.5)
Dyslipidemia, *n* (%)	89 (50.5)
SG, *n* (%)	85 (48.3)
SGJB, *n* (%)	59 (33.5)
RYGB, *n* (%)	32 (18.2)
US+, *n* (%)	65 (36.9)

BMI, body mass index; *%EBMIL*, percentage of excess BMI loss; *SG*, sleeve gastrectomy; *SGJB*, sleeve gastrectomy with jejunal bypass; *RYGBP*, Roux-en-Y gastric bypass; *CL*, cholelithiasis; *US+*, ultrasound positive for cholelithiasis

Multivariate analysis showed no statistical relation between sex, age, or preoperative BMI and %EBMIL at 6 months, or surgical procedure and development of CL at 12 months. However, the odds ratio for hypertension was 0.241 with a confidence interval of 0.084–0.689 and a *P* value of 0.008, suggesting that this comorbidity might be protective against occurrence of gallstones at 1 year (Table 2).

Discussion

This study of incidence of CL included a complete 12 months of follow-up with US, the period of the highest weight loss before it stabilizes.

Table 2 Odds ratio (OR) and 95% confidence intervals (CI) of risk factors for cholelithiasis after bariatric surgery

Cholelithiasis after BS	OR	95% CI	*P*
Sex	1.75137	0.8217904, 3.732456	NS
Age	1.015914	0.9767872, 1.056607	NS
Arterial hypertension	0.2408435	0.0841892, 0.688991	0.008
Dyslipidemia	0.9531442	0.4489154, 2.023731	NS
BMI (kg/m^2)	1.041196	0.9419082, 1.150949	NS
Type 2 diabetes	0.9793216	0.2412529, 3.975375	NS
Surgical technique	0.8261784	0.4744954, 1.438519	NS
%EBMIL at diagnosis	0.993627	0.9792902, 1.008174	NS
BMI at diagnosis (kg/m^2)	1.010551	0.9017279, 1.132508	NS

BS, bariatric surgery; *BMI*, body mass index; *%EBMIL*, percentage of excess BMI loss

In the present cohort of patients, we found the incidence of postbariatric CL was 36.9%, which was highly similar to that found by other authors with more than 30 patients and using US as the diagnostic method [1, 6–15]. The lowest incidence reported thus far, in the same period of follow-up, was also from Chile [21]. That study found incidence of only 3.5% with US, which was an unusual outcome considering the high prevalence of gallstones in this country [2].

Risk factors for development of gallstones in the general population and in obese patients have been extensively studied; however, there is scarce evidence on the relations of these factors during rapid weight loss after bariatric surgery [16]. In the present study, multivariate analysis to relate the CL outcome with independent variables was performed. The odds ratio for hypertension of 0.241 can be interpreted as hypertension might be protective for development of gallstones, but it also can be a consequence of chance since there is no physiological explanation for this result**.** Weight loss (%EBMIL or BMI) at 6 months was not related to higher incidence of CL in the patients we studied. Other authors have found a positive relation between greater weight loss and gallstone development. Li et al. [22] found a percentage of total weight loss greater than 25% was related to symptomatic gallstone formation. Coupaye et al. [13] found weight loss of more than 30 kg at 6 months following bariatric surgery was a risk factor for CL. However, authors such as Oliveira et al. and Nagem et al. did not find predictive factors of CL [8, 12].

The relatively high incidence of gallstones found in our patients leads us to consider prophylactic cholecystectomy as an option. Cholecystectomy is a safe procedure in the general population, but performing it during bariatric surgery in an obese patient can be challenging. According to a meta-analysis [4] and a large longitudinal cohort study [23], both addressing safety in simultaneous cholecystectomy, it is not justified in asymptomatic patients because of higher rates of complications and mortality. However, Amstutz et al. and Nougou et al. found prophylactic cholecystectomy concomitant to an RYGB can be performed safely in most patients and could avoid the need for emergency surgery while improving quality of life, not prolonging hospital stay and bringing economic benefit [24, 25]. In our experience, all patients with positive preoperative US are scheduled for simultaneous cholecystectomy, unless it should be deferred for technical reasons, as happened with 6 of 32 patients with preoperative positive US (18.7%). We do not perform prophylactic cholecystectomy during bariatric surgery in negative US patients. This is the reason why we monitor these patients every 6 months during the first year and, when US is positive, we systematically do laparoscopic cholecystectomy. The majority of patients was diagnosed with CL in an outpatient approach, not in an emergency context, thus making simultaneous cholecystectomy, in our center, probably unnecessary. In Chile, gallbladder cancer remains one of the leading causes of death from cancer especially in females [26], so prophylactic gallbladder removal in patients at risk (with cholelithiasis) is part of the healthcare strategy in this country. On the other hand, we found no preoperative or postoperative feature for properly selecting patients who are at an increased risk of gallstone formation.

There is evidence that UDA can prevent gallstone formation after bariatric surgery with mild-to-moderate side effects similar to placebo [27, 28]. In fact, US and French recommendations advocate the use of UDA for 6 months after RYGB because of UDA's efficacy in reducing incidence of CL after RYGB [29, 30].

There were some limitations in the present study. This was a retrospective study, with a randomly selected period of study and with a follow-up of 12 months; however, we had only 12.4% loss at follow-up, which is a very low number and may not affect outcomes. Our institution does not have an emergency room, so we do not know if some patients consulted for pain or were operated for acute cholecystitis in other institutions (patients lost from follow-up).

Conclusions

In this study, up to one-third of the patients followed during 12 months after bariatric surgery developed CL. Excessive weight loss did not increase the risk and we did not find pre- or postoperative risk factors for the development of CL. Hypertension seems to be protective against gallstone formation, but this result is a matter of further analysis. Our results could lead us to consider the use of UDA as a preventive measure against CL after bariatric surgery, but costs and patient's adherence to this treatment make it unlikely to be effective in our patients.

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Compliance with Ethical Standards

The study was previously approved by the scientific ethics committee of that same institution.

Conflict of Interest The authors declare that they have no conflict of interest.

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