

Predictors of Gallstone Formation in Morbidly Obese Patients after Bariatric Surgery: A Retrospective Observational Study

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ABSTRACT

Background: Obesity alone and rapid weight loss induced by bariatric surgery are recognized risk factors for the development of cholelithiasis. This study aimed to identify the predictive factors for gallstone formation after bariatric surgery. **Patient and methods:** The files of all morbidly obese patients underwent bariatric surgery in our unit during the period from March 2003 till October 2010 were reviewed and analyzed. All patients underwent routine preoperative ultrasonography and selective concomitant cholecystectomy was done in all patients with ultrasonographic-confirmed cholelithiasis. After excluding cases with prior and concomitant cholecystectomies, patients were divided into two groups; those who developed gallstones and those who did not and the two groups were compared. **Results:** Of the 143 reviewed files 135 were eligible to be included in the study. The incidence of cholelithiasis before surgery was 25.9% (35 cases). 19 cases (19%) of the 100 cases free at surgery developed gallstone at a mean of 13.2 months. Comparing the two groups, no significant difference was revealed regarding gender, age, preoperative BMI or type of the operation. But the percent of excess weight loss was significantly higher in the group that formed gallstones. **Conclusion:** Gender, age, preoperative BMI and type of the operation were not predictive of gallstones formation after bariatric surgery. The percent of excess weight loss was the only predictive postoperative factor.

KEYWORDS

Obesity; Gallstone; Bariatric Surgery

1. Introduction

Worldwide, the incidence of obesity has increased dramatically, reaching epidemic proportions. Surgery has been demonstrated to be the most effective method to achieve long-term sustained weight loss in the morbidly obese with resolution of most co-morbidities [1-4]. Gallbladder disease is one of the most frequent obesity-related co-morbid conditions [5-7]. The prevalence of cholelithiasis, symptomatic or not, is directly correlated to the body mass index (BMI) [6,8-10]. Additionally, it has been clearly shown that periods of rapid weight loss further enhance the risk of cholesterol cholelithiasis [11-13]. In order to reduce the risk of gallstone formation and its

complications, policies of routine prophylactic cholecystectomy [6], use of intra-operative ultrasound for gallstone detection and concomitant cholecystectomy [12,14,15], postoperative use of ursodeoxycholic acid [15,16], regular ultrasound surveillance for asymptomatic gallstone [12,14-16], and their combinations have been suggested. However, none of these have been widely accepted as a standard of practice. The present study was designed to identify potential risk factors for gallstone formation after weight reduction surgery.

2. Patients and Methods

We reviewed the files of all morbidly obese patients underwent bariatric surgery in our unit during the period

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from March 2003 till October 2010. All patients were candidates for bariatric surgery in accordance with National Institutes of Health consensus criteria for the management of morbid obesity [4] (BMI ≥ 40 kg/m² or BMI ≥ 35 kg/m² with significant co-morbidities related to obesity). All patients underwent routine preoperative abdominal ultrasonography and selective concomitant cholecystectomy was done in all patients with ultrasonographic-confirmed cholelithiasis whether symptomatic or not. Postoperative prophylactic bile salt therapy was not administered to our patients. After excluding cases with prior and concomitant cholecystectomies, patients were divided into two groups; those who developed gallstones and those who did not. Patients were followed in our outpatient clinic at 1, 3, 6, and 12 months, and yearly thereafter. The data collected were submitted to the chi-squared test to evaluate the association between cholelithiasis development and gender, age, preoperative BMI, and percent of excess weight lost (%EWL) during the first postoperative year. *P*-value < 0.05 was considered significant.

3. Results

During the period from March 2003 till October 2010, 143 morbidly obese patients underwent bariatric surgery in our unit. Seven files were incomplete and excluded because of non compliance with follow up and one patient died in the first postoperative month due to pulmonary embolism also excluded. The remaining 135 files included 52 Roux-en-Y gastric bypass (RYGBP), 37 vertical banded gastroplasty (VBG) and 46 sleeve gastrectomy (SG). One hundred and nine cases (81%) were females and 26 (19%) were males. The age at surgery ranged from 19 - 58 years with a mean of 37.6, the preoperative BMI ranged from 40 - 78 kg/m² with a mean of 52.8 and the follow up period ranged from 20 - 85 months with a mean of 60.4 months. Of the eligible 135 cases, 13 (9.6%) have had prior cholecystectomy due to cholelithiasis. Preoperative ultrasonography proved the presence of gallstones in 22 cases (16.3%) all of them underwent concomitant cholecystectomy. So the total incidence of cholelithiasis in this series was 25.9%. The remaining 100 cases were free of gallstone disease at the time of surgery. During follow up, 19 of them (19%) developed gallstones postoperatively in a range of 6 - 30 months with a mean of 13.2 and 81 (81%) did not develop gallstones. Of those developed gallstones 8 cases (42%) were symptomatising and the other 11 cases (58%) discovered by routine ultrasonography during follow up. So the incidence of symptomatising cholelithiasis after surgery in this series was 8% (Table 1). Comparison of both groups those formed gallstones (n = 19) and those did not (n = 81) revealed no significant difference as re-

gard; gender (*P* = 0.979), age (*P* = 0.635); preoperative mean BMI (*P* = 0.996), and type of operation (*P* = 0.393). However the mean percent of EWL in the first postoperative year was significantly higher in the group formed gallstones (*P* = 0.042) (Table 2).

4. Discussion

Obesity is a risk factor for gallbladder pathology, with histological abnormalities including cholelithiasis reported in 45% - 96% of morbidly obese patients [6,17-19]. A seven-fold increase in the risk of development of gallstones has been observed in women with BMI ≥ 45 compared to those with BMI < 24 [8]. Following routine cholecystectomy at bariatric surgery cholelithiasis, cholesterosis, or cholecystitis has been documented in up to 96% of gallbladders removed [18,20]. Bateson defined the prevalence of cholelithiasis in a given population as the sum of patients with proven cholelithiasis plus those with evidence of prior cholecystectomy [21]. In this study the prevalence of cholelithiasis was 25.9% which is similar to that reported in other studies [22-25]. The literature reported values between 13.6% and 47.9% [7,14, 15,18,22,26]. The high prevalence of cholelithiasis in

Table 1. Distribution of patients in the study.

Eligible cases	distribution	Number (%)	
Cholelithiasis incidence before surgery	Prior cholecystectomy	13 (9.6%)	35 (25.9%)
	Concomitant cholecystectomy	22 (16.3%)	
Free of gallstone at time of surgery	Developed gallstones	symptomatic	8 (8%)
		Non symptomatic	11 (11%)
	Did not develop gallstones	81 (81%)	
total		135	

Table 2. Predictors of stone formation in either group.

Variable	Gallstone	No gallstone	<i>P</i> -value
No. (%)	19 (19%)	81 (81%)	-
Mean age in years	38.7	37.2	0.635
Gender			
Female	15	68	0.979
male	4	13	
Mean preoperative BMI in kg/m ²	51.9	51.4	0.996
Mean percent of EWL in the first year	62.6	55.4	0.042*
Type of operation			
RYGBP	10	32	0.393
VBG	4	20	
SG	5	29	

* = significant.

obese individuals is due to threefold increased rate of excretion of cholesterol into hepatic bile, decreased cholecystokinin-induced gallbladder contractility with stasis and increased nucleation factors including increased levels of gallbladder mucin promoting precipitation of cholesterol crystals [7]. Also It is agreed that gallstone formation is increased after weight reduction surgery followed by rapid weight loss. The incidence of gallstone formation in those who were free by preoperative ultrasound ranges from 30% to 52% within 6 - 12 months after the operation in most of the published series [12,14, 27]. In this study the incidence was somewhat lower 19%; that may be because the restrictive gastric operations (VGB & SG) were more than the RYGBP operation (58 vs 42) while the previous studies included only RYGBP operations. The reason for increased risk of cholelithiasis after rapid weight loss produced by weight reduction surgery remains uncertain. It has been postulated that, during rapid weight loss, cholesterol was mobilized from tissues stores and was excreted in bile, resulting in so-called lithogenic bile due to increased bile cholesterol saturation index. Others found that increased gallbladder secretion of mucin and calcium and increased presence of prostaglandins and arachidonic acid in bile had significant attribution to gallstone formation [5,9,28,29]. Of the 19 cases developed gallstones in our study, 8 (42%) were symptomatic. So the overall symptomatic gallstone incidence after surgery in this series was 8%. Tucker *et al.* [30] reported incidence of 6%, Portenier *et al.* [31] 8.1%, Papisavas *et al.* [32] 6.9% and Villegas *et al.* [14] 7.3%. The mean time for gallstone formation in our study was 13.2 months coinciding with the period of rapid weight loss as it was reported in many published series [14-16, 24,30]. This pattern of incidence (higher in the phase of greater weight loss) has motivated several surgeons to use ursodeoxycholic acid in the first 6 postoperative months [14-16]. This drug is a bile acid that prevents biliary lithiasis by decreasing cholesterol and mucin concentration, increasing bile acid concentration, decreasing bile saturation, and enhancing gallbladder emptying [16, 33]. Various risk factors for formation of gallstones are known, in the general population, such as age, obesity, female gender, parity, positive family history, use of contraceptives, etc. To identify risk factors for gallstone development after weight reduction surgery in this study, we compared the group of patients who formed gallstones during the period of rapid weight loss with those who did not. Age, gender, preoperative mean BMI were not predictors of gallstone formation in our series as it was reported by others [24,27]. However the mean percent of excess weight loss in the first postoperative year was significantly higher in the group that formed gallstone. This agrees with the findings of Schmidt *et al.* [17] Ming Li *et al.* [24] Wudel *et al.* [34] and Yang *et al.* [35].

In our study we found no significant difference between both groups as regard the type of the operation as it was reported by Ming Li *et al.* [24]. However most of the published series include only RYGBP and the reported incidence after the pure restrictive procedures is variable [36,37].

5. Conclusion

This study adds more evidence that the incidence of gallstones in morbidly obese patients is higher than that found in the overall population and also higher during the period of rapid weight loss after bariatric surgery. However, gender, age, preoperative BMI and type of the operation were not predictive of gallstones formation after bariatric surgery. In the other hand the percent of excess weight loss was the only predictive postoperative factor of gallstones formation. And as this will not be useful in preventing its formation, it will be wise to adopt either the policy of prophylactic use of ursodeoxycholic acid in patients who will be compliant and can afford its cost or the policy of the regular postoperative ultrasound surveillance and subsequent cholecystectomy once gallstones were identified to avoid presentation with complications specially after RYGBP where there is no access to the biliary passages.

Conflict of Interests

The authors have no conflict of interest or anything to disclose.

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