

## REVIEW ARTICLE

# Diet After Cholecystectomy

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## ARTICLE HISTORY

Received: December 08, 2016  
Revised: March 14, 2017  
Accepted: March 14, 2017

DOI:  
10.2174/0929867324666170518100053

**Abstract:** Patients with gallstones are often affected by alimentary disorders contributing to the onset of gallstones disease. Cholecystectomy can have nutritional and metabolic consequences in the short-term (diarrhea, abdominal pain and bloating) and in the long-term (increased Body Mass Index with metabolic syndrome, gastritis, liposoluble vitamin deficiency). Pathogenic mechanisms behind these disturbances are reviewed and the need for an early post-operative nutritional intervention based on low-lipid, high-fibers diet, is highlighted.

**Keywords:** Post-cholecystectomy syndrome, biliary acids, diarrhea, hypo-lipid diet.

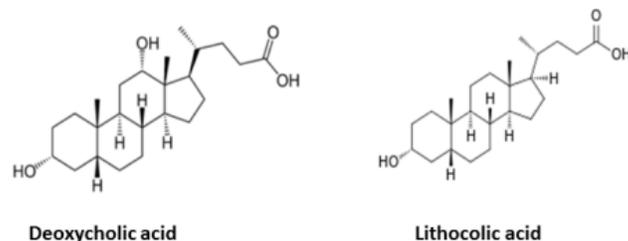
## INTRODUCTION

Gallstone disease is one of the most common gastroenterologic diseases, which can be complicated by several fearsome conditions including cholecystitis, pancreatitis, and jaundice. Cholecystectomy remains the only definitive therapy for acute cholecystitis and the gold standard for the treatment of symptomatic gallstones [1,2]. Since the introduction of laparoscopic cholecystectomy in the late 80', a dramatic increase in the number of cholecystectomies has been reported by several authors [3]. Nevertheless, even if the gallbladder is not a vital organ, its role in food digestion is important and its removal is not without nutritional and metabolic consequences.

The human liver produces at least 1000 ml of bile per day, composed by three major elements like cholesterol, bile salts, and bilirubin. Bile acids (BAs) are the final products of cholesterol metabolism and their synthesis is one of the procedures leading to the cholesterol excess elimination. They are not only involved in the digestion and absorption of dietary lipid and fat-soluble nutrients in the gastrointestinal tract, but also act as signaling molecules implicated in different metabolic pathways. Recent findings, in fact, report the role of BAs in the regulation of glucose metabolism,

energy expenditure, in control of liver regeneration and describe them as major regulators of the gut microbioma [4-6]. Bile is physiologically stored in the gallbladder until digestion of foods and neurohormonal signals, such as cholecystinin and Fibroblast Growth Factor (FGF) 15/19, trigger the gallbladder contraction and emptying [7].

This complex mechanism is interrupted by cholecystectomy or by the complete cystic duct occlusion by stones (functional cholecystectomy) leading to continuous, unregulated secretion of hydrophobic secondary bile acids (Fig. 1) directly into the small bowel.



**Fig. (1).** Deoxycholic and lithocolic acid chemical structures, the main secondary biliary acids.

The consequences of this altered mechanism is a modified gastrointestinal motility in most of the cases increased migrating motor complex leading to diarrhea and, probably, important changes in the composition of the gut microflora [8]. Other bowel properties like the permeability of the enteric barrier could also be modified, but this issue has never been investigated. A post-cholecystectomy syndrome characterized by nausea,

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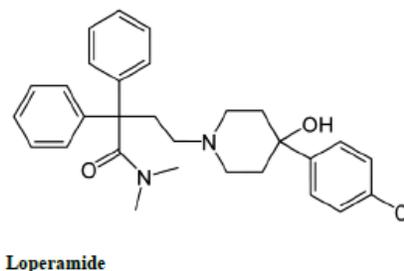
bloating, diarrhea and abdominal pain has been reported in 5 to 40% of patients submitted to cholecystectomy [8]. The increased rate of bile acid enterohepatic recirculation following cholecystectomy can also induce metabolic effects. In fact, the association with metabolic syndrome, Non Alcoholic Fatty Liver Disease and even cirrhosis has been reported in epidemiological studies [9-11] highlights the critical role of the adoption of a long-term nutrition intervention.

From a nutritional point of view, the literature dealing with the need of specific diet for patients submitted to cholecystectomy is very scarce. General recommendation includes the prescription of a hypo-lipid diet (cholesterol <200mg/die) [12]. In fact, digestion of lipids in the diet requires an adequate quantity of bile acids, which cannot be provided without the gallbladder. Consequently, gastric emptying may slow facilitating the onset of gastritis due to duodeno-gastric reflux, and the whole digestion may become prolonged and bothersome. Moreover, Yeuh and colleagues demonstrated that patients not observing a low-fat diet showed a significant tendency to diarrhea syndrome one week after cholecystectomy [13].

Despite new insight into the physiopathology of gallstone disease phenotypes have highlighted the role of genetic factors [14], it is very likely that chronic over-nutrition based on high carbohydrates and low fiber diet and other not fully defined environmental factors, contribute considerably to the onset of this disease. Epidemiological data support the notion that gallbladder stones are significantly more frequent in overweight females in whom over-nutrition and high serum cholesterol levels (and sometimes diabetes) are often present [15]. Consequently, the post-cholecystectomy diet must take into consideration the need for a low calorie, high fiber diet to compensate a pre-existing alimentary disorder.

The usefulness of restoring the gut microbiota with oral supplementation of pre/probiotic should also be taken into consideration particularly when diarrhea occurs after cholecystectomy. BAs have been documented to play an important role in gut microbiota composition and metabolism. An abnormally high concentration of BAs, in fact, may cause dysbiosis due to cytotoxic and oxidative effects [8]. Loperamide drug (Fig. 2) is rarely necessary in these patients, but can be prescribed in case of persistent diarrhea to slower gastrointestinal motility, while cholestyramine can help to minimize the effects of the bile salts by binding them into an insoluble compound which is eliminated with the feces.

Cholestyramine, however, can interact with some other drugs and can affect the absorption of fat soluble vitamins, leading to their deficiency [16]. Therefore oral supplementation of fat-soluble vitamins (particularly vitamin A, D, E and K) can sometimes be useful, also because of the shorter gut transit time, which can continue four years after cholecystectomy [17], and can lead to inadequate synthesis and absorption of such nutrients. Supplementation of minerals and vitamins has been also proposed as a safe and efficient tool for the management of persistent diarrhea in children [18,19].



**Fig. (2).** Loperamide chemical structure.

A further nutritional problem after cholecystectomy is the tendency to gain weight for a sort of gluttony described in these patients. Changing in the body mass index has been described after gallbladder removal with an increased carbohydrate and lipid consumption together with a decreased protein intake leading to weight gain. This can be inscribed into an alimentary disturbance of these patients, which probably pre-existed to the gallbladder removal which in some way was linked to gallstone formation. This is a another reason for these patients to seek a dietary consultation immediately after the surgery.

## CONCLUSION

In conclusion, although there are no specific diets to recommend after removal of the gallbladder, some nutritional advices should be followed by these patients, like avoid high-fat, fried, spicy and greasy foods, foods contained refined sugar, caffeine. A slow and progressive increase of the amount of soluble fibers (oats and barley) in the diet [20,21], to have smaller and more frequent meals in order to allow an adequate mixture with the small quantity of bile present into the duodenum, is also recommended [Tab 1]. A physical activity together with a tailored nutritional planning for each patient could help to reduce post-surgical complications following cholecystectomy and minimize symptoms, and a long-lasting educational program to change erroneous eating habits and to promote a varied and balanced diet, such as

Table 1. Diet after cholecystectomy.

Time period	Targeted disturbances	Nutritional suggestions
Post-surgical	Nausea, vomit, diarrhea, abdominal pain, gastritis, reflux	Hypolipidic diet (cholesterol <200 mg/die) Slow increasing intake of fiber, particularly soluble fibers. Avoid alcohol, food contained refined sugar, caffeine, spicy and fried foods, carbonated drinks Smaller and more frequent meals Oral supplementation of probiotics and fat soluble vitamins (A,D,E,K)
Long-term	Metabolic Syndrome NAFLD, Cirrhosis	Weight management High fiber and low saturated fat diet Adherence to the Mediterranean dietary pattern and lifestyle

balanced diet, such as Mediterranean diet and lifestyle [22], should be provided by clinicians and nutritionists.

#### CONSENT FOR PUBLICATION

Not applicable.

#### CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

#### ACKNOWLEDGEMENTS

Declared none.

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**PMID: ??????????**