

Evaluation of Effect of Cholecystectomy on Common Bile Duct Diameter using Ultrasonography and Liver Function Test: A Prospective Study

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ABSTRACT

Introduction: Post cholecystectomy, dilatation of common bile duct has been a matter of controversy in the surgical and sonographic literature. Whether this dilatation is compensatory / physiological or related to any post cholecystectomy symptoms has been studied extensively in literature and have shown variable results. Hence; we assessed the diameter of CBD before cholecystectomy and after cholecystectomy and to look for any increase in size of the diameter of CBD.

Material and Methods: In our study 100 cases of simple cholelithiasis with chronic cholecystitis were subjected to cholecystectomy. The diameter of the common bile duct was measured preoperatively and postoperatively at the same site at the postoperative interval of 10 days and 3 months.

Results: Increase of the order of 3 or more than 3 mm in common bile duct diameter after 3 months of cholecystectomy, postoperative common bile duct diameter increased in 64% cases, decreased in 8% cases and remained same in 28% of cases.

Conclusion: Significant compensatory dilatation does occur in common bile duct diameter after cholecystectomy.

Keywords: Bile, Cholecystectomy, Cholelithiasis, Sonographic

INTRODUCTION

Post cholecystectomy, dilatation of common bile duct has been a matter of controversy in the surgical and sonographic literature. Whether this dilatation is compensatory / physiological or related to any post cholecystectomy symptoms has been studied extensively in literature and have shown variable results.¹ In the digestive system's patho-physiology, the biliary system plays a central role, since it allows bile sterile flow from hepatocytes, through intra- and extra-hepatic ducts, Oddi's sphincter and Vater's ampulla, to the duodenum determining lipids absorption and excretion of metabolites and toxins in the small bowel. Liver biochemical abnormalities usually occur and appear either alone or in conjugation with abdominal pain or fever in cases of obstruction of this structures.^{2,3}

An increase in the diameter of CBD has been reported in several past studies in the last 20 years in older patients, even if with consistent variability. Based on autoptic observations, some authors identified loss of elastic fibers and proximal compensatory dilatation due to distal sclerosis as potential causes of the phenomenon. Moreover, the fragmentation of the longitudinal smooth myocyte bands in elderly subjects and use of drugs such as calcium antagonists and nitroglycerine may reduce contractility and cause hypotonus of the duct.⁴ In recent years, due to the widespread use of high-resolution imaging techniques in order to investigate the causes of nonspecific abdominal symptoms, isolated bile duct dilatation in non-jaundiced patients with normal liver function tests

has been increasingly reported.⁵ The aim of this study was to assess the diameter of CBD before cholecystectomy and after cholecystectomy and to look for any increase in size of the diameter of CBD.

MATERIAL AND METHODS

The present study was conducted in the department of general surgery of the institution and included assessment of 100 cases of cholelithiasis. Ethical approval was taken from institutional ethical committee and written consent was obtained after explaining in detail the entire research protocol. A detailed history was taken from each case and a thorough clinical check-up was carried out. A complete biochemical profile comprising of routine investigations and liver function tests to rule out any associated liver or extrahepatic biliary disorder was done. CBD diameter was measured pre-operatively and post operatively at the same site, on the same machine and by the same ultrasonologist. In addition, the ultrasonologist was blinded by preoperative measurements. A acoustical impedance of bile is significantly different from surrounding structures which makes measurement of the size of common hepatic duct quite easier with ultrasound. Any pathology of the biliary system may alter biochemical processes related to it. So, important biochemical determinations have been made an integral part of this study. An ultrasound study for liver, gall bladder, CBD and pancreas was carried out. Special attention was given to diameter of CBD. These patients underwent cholecystectomy. A post-operative follow up study of CBD diameter was carried out at intervals of 10 days and 3 months after surgery. Post-operative diameters were compared with pre-operative diameter of common bile duct. The study was conducted on the patients without any liver and extrahepatic biliary disorder.

STATISTICAL ANALYSIS

The results of the study were statistically analysed with chi square test using SPSS software and p value of less than 0.05 was considered significant.

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RESULT

Serum Alkaline Phosphatase

Mean serum alkaline phosphatase level was 8.3 KA units (Pre-operative), 8 KA units (10th post-operative day) and 8.2 KA units (3 months interval). The difference between mean pre-operative and mean post-operative 10th day as well as 3 months interval was not statistically significant.

CBD diameter

Preoperative Mean diameter of 100 patients was 4.12 mm. 94 patients had common bile duct diameter between 2-7mm pre-operatively which is a normal range of CBD diameter on ultrasonography. Only 6 patients had CBD diameter more than 7 mm. Post operative mean diameter of 100 patients at 10th day follow up was 4.75 mm. The difference between mean pre-operative and mean post-operative (10th day follow up) diameter was found to be 0.63 (p<0.01) mm which is statistically significant. Post operative mean diameter of the 100 patients at 3 months follow up was 5.14 mm. The difference between mean preoperative and mean postoperative (3 months follow up) diameter was found to be 1.02 mm (P<0.01) which is statistically significant. 86 patients of the mean age 43.04 years (range 21-74 years) showed increase of less than 3mm in CBD diameter at 3 months follow up after cholecystectomy while 14 patients of the mean 47.5 years (range 29-65 years) showed increase of the order of 3 or more than 3 mm in common bile duct diameter after 3 months of cholecystectomy (Table 1, Figure 1).

Difference of size of CBD between pre-operative and post-operative (10th day) measurement

32 patients had no change in diameter of common bile duct. 36 patients showed post cholecystectomy CBD dilatation ranging from 0.1-1.0 mm. 16 patients showed it to be ranging from 1.1-2.0 mm. 8 patients showed it to be ranging from 2.1-3.0 mm. No patients showed any increase in diameter ranging from 3.1-4.0mm. 8 patients actually showed decrease (range 0.7-1.1) in CBD after cholecystectomy.

Difference of size of CBD between pre operative and post operative (3 months) measurements

28 patients had no change in diameter of common bile duct. 28 patients showed post cholecystectomy CBD dilatation ranging from 0.1-1.0 mm. 14 patients showed it to be ranging from 1.1-2.0 mm. 12 patients showed it to be ranging from 2.1-3.0 mm. 10 patients showed post cholecystectomy CBD dilatation ranging from 3.1-4.0 mm. 8 patients showed decrease (range 0.6-1.1 mm) in common bile duct diameter after cholecystectomy. So, postoperative common bile duct diameter increased in 64% cases, decreased in 8% cases and remained same in 28% of cases (Table 2, Figure 2). The difference between mean preoperative and mean postoperative (10th day) diameter was found to be 0.63 (p<0.01) mm which is statistically significant. The difference between mean preoperative and mean postoperative (3 months) diameter was found to be 1.02 (p<0.01) mm which is statistically significant.

DISCUSSION

Ultrasonographic evaluation of CBD caliber has been a matter of interest for several decades however available data are not

| Authors | Pre-operative diameter mm | Post-operative diameter mm | Difference mm |
|--------------------------------|---------------------------|----------------------------|---------------|
| Wedmann et al ⁹ | 4.6 | 5.3 | 0.7 |
| Hunt and Scott ¹⁰ | 3.95 | 4.48 | 0.53 |
| Feng and song ⁷ | 5.9 | 6.1 | 0.2 |
| Hammarstrom et al ⁸ | 5.6 | 7.1 | 1.5 |
| Present study | 4.12 | 5.14 | 1.02 |

Table-1: The observations of various previous studies in comparison to the present study

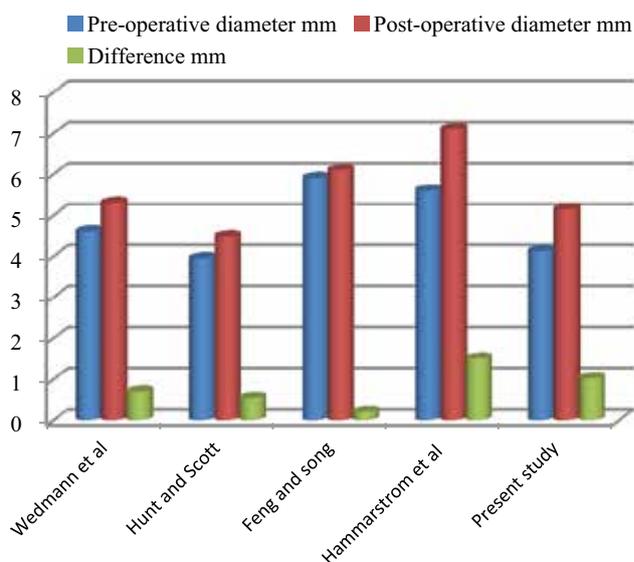


Figure-1: The observations of various previous studies in comparison to the present study

| Authors | Increased (%) | Remained same (%) | Decreased (%) |
|---------------|---------------|-------------------|---------------|
| Wedmann et al | 32.0 | 59.0 | 9.0 |
| Feng and Song | 47.0 | 27.0 | 26.0 |
| Present study | 64.0 | 28.0 | 8.0 |

Table-2: Comparative study of post-operative CBD diameter

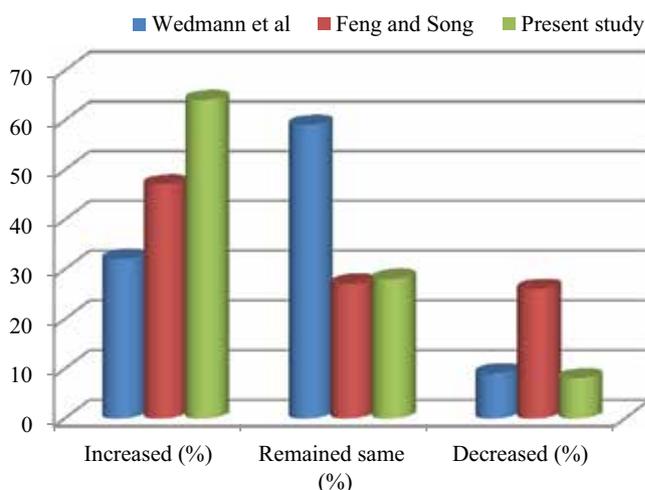


Figure 2: Comparative study of post-operative CBD diameter

univocal. In 1887 cholecystectomy was done on 3 dogs and common bile duct becomes dilated after cholecystectomy. Many scientists felt that such dilatation is pathological and is

indicative of biliary tract disease. Others, however, felt that this diameter is purely physiological because the common bile duct begins to act as a reservoir of bile in the absence of the gall bladder and it gets inflamed, dilated and fibrotic due to previous passage of the stone and does not regain back its original caliber. Many investigators have done a variety of studies in order to establish the status of common bile duct following cholecystectomy.¹⁻³ Hence; we assessed the diameter of CBD before cholecystectomy and after cholecystectomy and to look for any increase in size of the diameter of CBD.

In the present study the ratio of SGOT to SGPT was 1.25 to 1. In a study by Don and Campbell, Wise et al and Edmunds et al they found that bile duct does not dilate usually after cholecystectomy and even if dilatation occurs it is not significant. Mueller et al further described the capacity of the common bile duct to distend and collapse over a short period.²⁻⁵ Chang et al concluded after performing ERCP in 43 patients that there is small but significant rise in bile duct diameter after cholecystectomy.⁶ Feng and Song studied 234 patients to determine the effect of cholecystectomy on common bile duct width and found that there is small but significant increase in CBD width after cholecystectomy. They concluded that postoperative common bile duct diameter increased in 47% cases, decreased in 26% cases and remained same in 27% of cases.⁷ Hammarstorm et al strongly supported the opinion that there is a significant compensatory dilatation in bile duct diameter after cholecystectomy. It is clear from above literature that there are studies both for and against the opinion that common bile duct dilates after cholecystectomy.⁸

Wedmann et al studied the effects of cholecystectomy on common bile duct diameter in 32 patients with chronic cholecystitis and cholelithiasis. They found the preoperative median diameter to be 4.6 which increased to 5.3 mm (median) post-operatively after 27 to 39 months ($p < 0.05$). According to them postoperative diameter increased in 32% cases, decreased in 9% of cases and remained same in 59% of cases. The difference between preoperative and post-operative diameter was 0.7 mm which he considered was significant. In the present study, the mean preoperative diameter was 4.12 mm (range 2.0 to 8.1mm), postoperatively, the mean diameter of the CBD in early follow up period i.e. at 10th day and at 3 months, was found to be 4.75 and 5.14 mm respectively. So, postoperative common bile duct diameter increased in 64% cases, decreased in 8% cases and remained same in 28% of cases. Regarding the liver function tests of the patients 94% of the patients showed normal levels of serum bilirubin, 96% of the patients had normal values of SGPT, 100% patients had normal values of SGPT, 100% showed normal values of serum alkaline phosphatase and 96% of the patients had shown normal values of total serum proteins. Biochemically, virtually, all the patients were proved to be without any liver or extrahepatic biliary disorder.^{9,10}

Chinsky et al showed that on comparing the oxaloacetic to pyruvic transaminase in normal healthy subjects the ratio is SGOT/SGPT = 1.25/1 i.e. 1.25 to 1.0.¹¹ Chopra et al proved that false positive elevations in serum glutamic oxaloacetic transaminase levels have been reported in patients when levels are determined by calorimetric assay. They had 6 patients complaining of post-cholecystectomy symptoms (5 out of 6 presented with upper abdominal pain and 1 out of 6 presented with dyspepsia). In all these cases upper GI Endoscopy

was done. 2 had gastric erosions, 3 had antral gastritis with duodenitis. One patient was having hiatus hernia-1 with mild reflux esophagitis. All of these patients had CBD size less than 5mm at three months follow up. All of them responded well to conservative treatment. It was found that the patients with post-operative common bile duct dilatation up to 3mm or more than 3mm did not present with any of the post cholecystectomy symptoms at subsequent follow ups. This showed that there is no relation of post cholecystectomy symptoms with the post cholecystectomy compensatory dilatation.¹²

Konsten J et al found that post cholecystectomy symptoms were mostly atypical and not related to biliary tract disorders.¹³ Bruno M et al assessed the diagnostic yield of endoscopic ultrasound (EUS) in patients with CBD dilatation, normal LFTs, and prior inconclusive imaging tests, and to assess the natural history of these subjects. They retrospectively reviewed their EUS database for patients referred for evaluation of CBD dilatation, normal LFTs, and prior inconclusive imaging. They excluded patients with a prior endoscopic retrograde cholangiopancreatography or a history of biliary obstruction, pancreatitis, or jaundice. Follow-up data were retrieved from medical records or by calling the general practitioners, referring specialists, patients, or their closest relatives. A total of 57 patients were enrolled. The mean CBD diameter was 12.5±3.6 mm. The majority of patients (50.8%) were asymptomatic. Abnormal EUS findings were recorded in 12 (21%) subjects: 6 patients had a periaampullary diverticulum, 2 had ampullary adenoma, 2 had signs of chronic pancreatitis, 1 had a cancer of the pancreatic head, and 1 had a 7 mm CBD stone. Neither age, sex, prior cholecystectomy, clinical presentation, CBD diameter, nor a dilated main pancreatic duct were predictors of abnormal EUS findings. None of the patients complained of biliary symptoms or showed abnormal LFTs on long-term follow-up. CBD dilatation with normal liver chemistry is not always a benign condition. Even when prior imaging tests are negative, EUS may allow to diagnose conditions overlooked by standard diagnostic imaging.¹⁴

CONCLUSION

From the above study the authors concluded that significant compensatory dilatation does occur in common bile duct diameter after cholecystectomy in most of the patients but it does not has any physiological relevance. Post cholecystectomy symptoms are not related to compensatory dilatation of common bile duct. Conservative management protocol should be followed unless an organic cause is found which may need invasive intervention.

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