

# A Comparative Study of Serum Lipid Profile and Common Bile Duct Dimensions in Pre and Post Cholecystectomy Patients

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## ABSTRACT

**Introduction:** Post cholecystectomy the common bile duct dilates in an effort to restore the storage function of gall bladder and helps in metabolism of lipids. There are many studies determining the association of abnormal lipid parameters with gall stones but there are not many studies comparing the diameter of CBD pre and post cholecystectomy and its clinical implication.

Hence, under the light of above-mentioned data, we planned the present study to assess the effect of cholecystectomy on common bile duct diameter and lipid profile.

**Methodology:** Patients with gall bladder stone eligible for cholecystectomy were included in the study. In this study pre and post operative cholecystectomy values of lipid profile and CBD diameter were compared. Patients were followed up till one year post operative to assess changes.

**Results:** Out of total 55 cases included in the study 38.2% were male and 78.2% has mixed type of stone. Post operatively Serum cholesterol, triglyceride, HDL and LDL value improved significantly at the end of one year follow up ( $p < 0.01$ ). Pre operative mean CBD diameter was 4.38 mm which was increased to 5.6 mm at the end of one year post operatively ( $p < 0.01$ )

**Conclusion:** Cholecystectomy leads to significant impact on in lipid profile. Significant compensatory dilatation of common bile duct diameter occurs post cholecystectomy. This indicates a very positive impact of cholecystectomy on lipid profile.

## INTRODUCTION

Gallstones represent a significant public health problem in modern societies, affecting 10% to 15% of the adult population. [1] Its incidence is increasing because of change in dietary habits of people and also due to easy availability of sonographic evaluation of abdomen.

The types of gallstones include mixed, cholesterol and pigment stones. [2] The major contents of gallstones are cholesterol, bilirubin (conjugated and unconjugated) and calcium. The constitutional risk factors for gallstones include female gender, elderly age group and interaction between genetic and environmental factors. Pure Cholesterol stones are associated with metabolic syndromes

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which is defined as a group of risk factors which include central obesity, increased levels of triglycerides and decrease in levels of HDL lipoprotein.

Gall bladder disease is more common in patients with hyperlipidemia Type IV. [3] Major factors that govern stone formation are: Supersaturation of bile with cholesterol, enhanced nucleation of cholesterol crystals, impaired gallbladder emptying [4] with stasis along with decreased bile acid pool are the pathologic mechanisms responsible for cholesterol gallstones formation.

The normal range of CBD size depends on age. Siegel stated that in infancy the normal CBD size should be <2 mm, in childhood <4 mm, and 7 mm after adolescence. [5] Post cholecystectomy the common bile duct dilates in an effort to restore the storage function of gall bladder and helps in metabolism of lipids.

Based on autoptic observations, some authors identified loss of elastic fibers in the wall of CBD and distal sclerosis post cholecystectomy as potential causes of the above phenomenon. The use of drugs like calcium antagonists and nitroglycerine reduces the contractility and causes hypotony of common bile duct resulting in dilatation of CBD. [6]

A positive association of occurrence of gallstone diseases and lower levels of high-density lipoprotein cholesterol (HDL-c) and high triglycerides has also been demonstrated in the past literature.

There are many studies determining the association of abnormal lipid parameters with gall stones but there are not many studies comparing the diameter of CBD pre and post cholecystectomy and its clinical implication.

Hence, under the light of above-mentioned data, we planned the present study to assess the effect of cholecystectomy on common bile duct diameter and lipid profile.

## MATERIALS AND METHODS

The prospective interventional study was conducted in Dr D. Y. Patil Medical College, Hospital and Research Centre, Pune, India between September 2020 to August 2022. Adult Patient having gall stone disease comprise of the study population.

**Eligibility criteria:** Patient aged between 25-60 years diagnosed having confirmed gall stone and fit for surgery were included in the study. Patients on lipid lowering agents; having history of renal failure, cardiac failure or morbid obesity; or who were immune-compromised were excluded from the study.

**Ethical Consideration:** Study was conducted only after approval of institutional ethical committee. All the subjects were explained about the study in the vernacular language. Participation in the study was purely voluntary and all participants were informed about their right to withdraw at any stage of the study. Informed written

voluntary consent was taken from all study participants before the study. Data were analysis and presented without direct identifier of the cases.

**Sample size:** The sample size was calculated using Open EPI software. A study by Kuldip Singh Ahi et al. [7] found that serum LDL value was  $153.90 \pm 43$  mg% pre-operatively which was reduced to  $132.08 \pm 36$  mg% on 7<sup>th</sup> post operative day. Considering these values, the calculated sample size was 52 for pre and post operative group using Open EPI software, taking Confidence Interval (2-sided) 95%, Power 80%. Additional 10% samples were added to adjust possible attrition. So, the final sample size was 57. Out of total 57 patients recruited for the study; 2 cases were lost in follow up. These two cases were removed during the data analysis, so, finally 55 cases were analyzed.

All cases diagnosed and admitted in the hospital were considered for the study. All were screened for inclusion and exclusion criteria and those who were eligible for the study were explained about the study and asked for the voluntary consent. Those who had given written consent were proceed further.

**Pre-operative Assessment:** Detailed history and physical examination of the patients was carried out and documented. Various investigations were carried out which include Routine investigations-complete blood count, bleeding time, clotting time, liver function tests, fasting lipid profile (S.TGL, S.HDL, S. LDL), renal function tests, blood sugar levels, Electrocardiography, chest x ray, USG abdomen & pelvis, MRCP if indicated.

**Pre-operative management:** Patient was kept NBM by 10 pm on previous night of surgery. Injection TAXIM 1gm IV was administered preoperatively. Xylocaine sensitivity testing was assessed. All cases were undergoing elective surgery. All cases were operated under General / Spinal anesthesia. Intraoperatively surgical procedure was carried out as per standard technique.

**Operative procedure:** Cholecystectomy was done for surgical removal of the gallbladder. After anesthesia, a small incision was made in the abdomen. The gallbladder was dissected free from the liver and bile ducts, then removed. The cystic duct and artery were ligated. The incision was closed, and the patient was monitored for complications.

**Postoperative management:** Injection Cefotaxime 1gm 12 hourly given for 5 days. Injection Tramadol 1 ampoule in 100ml NS according to complaints of the patient given for 1st 2 days. Tablet Voveran 12 hourly was started on 5th postoperative day and was continued for next 3 days. Wound was checked on 3rd postoperative day in all patients and dressing was done. Suture removal was done on 10th postoperative day.

**Follow up:** Patient was be followed up on 7th day, 1 month, 3 months and 1 year post operatively. During the follow up Fasting Lipid Profile (S.TGL, S.HDL, S.LDL), LFT, and USG abdomen & pelvis and detailed physical examination was carried out.

**Statistical Analysis:** Data from each patient was collected and tabulated using Microsoft Excel. Each corresponding variable from both pre operative and post operative groups was compared separately using the paired T-Test. Preoperative values were compared with different post operative time interval i.e. 7<sup>th</sup> day, one month, 3<sup>rd</sup> month and one year. Lipid profile values were presented in mean and standard deviation. P value less than 0.05 was considered as statistically significant at 95% confidence interval.

## RESULTS

This study was conducted among 55 cases to study the serum lipid profile parameters before and after cholecystectomy and also to study the common bile duct dimensions before and after cholecystectomy.

This study included cases between age group 25 to 60 years. Highest number of cases were in the age group 30-40 years (41.8%) followed by 30.9% between 40 to 50 years of age. Out of total 55 cases, 34 cases (61.8%) were female and remaining 38.2% were male. (Table 1)

The common presenting symptoms were flatulence (76.4%), Pain in right hypochondrium (70.9%) and Dyspepsia (67.3%). Less common symptoms were epigastric pain (45.5%), Murphy sign (38.2%) and nausea (27.3%). More than three fourth stones (78.2%) were mixed type of stone. Pigment type of stones was found in 12.7% cases and cholesterol type of stone found in 10.9% cases. (Table 1)

Pre-operatively S. Total Cholesterol values were 185.74 mg/dl which was gradually start declining after the surgery and reached to 165.16 mg/dl one year after surgery (Table 2). After 7<sup>th</sup> post-operative day mean reduction was 7.22 mg/dl. Serum TC decreased gradually and at the end of one year the mean reduction was 20.58 mg/dl. Up to three months after surgery the reduction in mean S. TC was not significant compared to pre-op level. However, after three month the reduction became statistically significant ( $p < 0.05$ ) (Table 3).

Pre-operatively mean Serum Triglyceride, serum. LDL and serum HDL values was 155.64 mg/dl, 105.96 mg/dl and 44.40 mg/dl respectively, which was initially increased in first post-op week and then gradually start declining and reached to 133.22 mg/dl, 105.96 mg/dl and 81.1 mg/dl one year after surgery (Table 2).

After 7<sup>th</sup> post-operative day mean increase was 7.44 mg/dl. Then Serum TG decreased gradually and at the end of one year the mean reduction was 22.42 mg/dl. Post rise in S. TG was significant after one week ( $p < 0.01$ ). However, on three months follow up and later the reduction in S. TG became statistically significant ( $p < 0.01$ ). After 7<sup>th</sup> post-operative day mean reduction was 30.68 mg/dl. Serum LDL decreased gradually and at the end of one year the mean reduction was 59.50 mg/dl. The reduction in mean S. LDL was significant compared to pre-op level at all the follow-up measure-

ments ( $p < 0.01$ ). After 7<sup>th</sup> post-operative day mean increase was 31.86 mg/dl. Serum HDL further increased gradually and at the end of one year the mean rise was 36.70 mg/dl. The rise in mean S. HDL was significant compared to pre-op level at all the follow-up measurements ( $p < 0.01$ ) (Table 3).

**Table 1: Distribution of Cases according to Age**

| Variables                   | Cases (n=55) (%) |
|-----------------------------|------------------|
| Age (years)                 |                  |
| <30 yrs.                    | 9 (16.4)         |
| 30-40 yrs.                  | 23 (41.8)        |
| 40-50 yrs.                  | 17 (30.9)        |
| >50 yrs.                    | 7 (12.7)         |
| Gender                      |                  |
| Male                        | 21 (38.2)        |
| Female                      | 34 (61.8)        |
| Symptoms                    |                  |
| Epigastric Pain             | 25 (45.5)        |
| Pain in right hypochondrium | 39 (70.9)        |
| Flatulence                  | 42 (76.4)        |
| Dyspepsia                   | 37 (67.3)        |
| Murphy sign                 | 21 (38.2)        |
| Nausea                      | 15 (27.3)        |
| Type of stone               |                  |
| Cholesterol                 | 6 (10.9)         |
| Pigment                     | 7 (12.7)         |
| Mixed                       | 43 (78.2)        |

**Table 2: Pre and post operative values for lipid profile and CBD diameter**

| Variables                 | Values (Mean $\pm$ SD) |
|---------------------------|------------------------|
| Total Cholesterol (mg/dl) |                        |
| Pre-Operative             | 185.74 $\pm$ 46.41     |
| Post-op Seventh Day       | 178.52 $\pm$ 48.59     |
| Post-op One Month         | 173.36 $\pm$ 38.34     |
| Post-op Three Month       | 167.34 $\pm$ 37.42     |
| Post-op One Year          | 165.16 $\pm$ 36.29     |
| S. Triglyceride (mg/dl)   |                        |
| Pre-Operative             | 155.64 $\pm$ 37.79     |
| Post-op Seventh Day       | 163.08 $\pm$ 34.46     |
| Post-op One Month         | 153.92 $\pm$ 35.59     |
| Post-op Three Month       | 144.48 $\pm$ 33.87     |
| Post-op One Year          | 133.22 $\pm$ 35.08     |
| S. LDL (mg/dl)            |                        |
| Pre-Operative             | 105.96 $\pm$ 49.73     |
| Post-op Seventh Day       | 75.28 $\pm$ 33.09      |
| Post-op One Month         | 53.14 $\pm$ 26.06      |
| Post-op Three Month       | 48.54 $\pm$ 23.46      |
| Post-op One Year          | 46.46 $\pm$ 21.38      |
| S. HDL (mg/dl)            |                        |
| Pre-Operative             | 44.40 $\pm$ 17.76      |
| Post-op Seventh Day       | 76.26 $\pm$ 20.47      |
| Post-op One Month         | 94.62 $\pm$ 23.28      |
| Post-op Three Month       | 84.54 $\pm$ 22.00      |
| Post-op One Year          | 81.10 $\pm$ 20.34      |
| CBD Diameter (mm)         |                        |
| Pre-Operative             | 4.38 $\pm$ 1.42        |
| Post-op Seventh Day       | 4.91 $\pm$ 1.91        |
| Post-op One Month         | 5.15 $\pm$ 1.85        |
| Post-op Three Month       | 5.47 $\pm$ 1.75        |
| Post-op One Year          | 5.60 $\pm$ 1.87        |

SD - Standard Deviation; CBD - Common Bile Duct

**Table 3: Comparison of Preoperative and post operative Total Cholesterol values at various point of time**

| Variable                                | Mean Difference | SD of Mean Difference | P value (2-tailed) |
|---|-----------------|-----------------------|--------------------|
| Difference of Total Cholesterol (mg/dl) |                 |                       |                    |
| Preop to 7th day                        | 7.22            | 71.34                 | 0.48               |
| Preop to One month                      | 12.38           | 61.75                 | 0.16               |
| Preop to 3rd month                      | 18.40           | 64.66                 | 0.05               |
| Preop to One year                       | 20.58           | 51.73                 | 0.01               |
| Difference of S. Triglycerides (mg/dl)  |                 |                       |                    |
| Preop to 7th day                        | -7.44           | 8.65                  | .000               |
| Preop to One month                      | 1.72            | 10.09                 | .234               |
| Preop to 3rd month                      | 11.16           | 10.90                 | .000               |
| Preop to One year                       | 22.42           | 9.59                  | .000               |
| Difference of S. LDL (mg/dl)            |                 |                       |                    |
| Preop to 7th day                        | 30.68           | 43.17                 | <0.001             |
| Preop to One month                      | 52.82           | 42.41                 | <0.001             |
| Preop to 3rd month                      | 57.42           | 42.57                 | <0.001             |
| Preop to One year                       | 59.50           | 42.74                 | <0.001             |
| Difference of S. HDL (mg/dl)            |                 |                       |                    |
| Preop to 7th day                        | -31.86          | 10.08                 | <0.001             |
| Preop to One month                      | -50.22          | 15.90                 | <0.001             |
| Preop to 3rd month                      | -40.14          | 18.47                 | <0.001             |
| Preop to One year                       | -36.70          | 20.45                 | <0.001             |
| Difference of CBD Diameter (mm)         |                 |                       |                    |
| Preop to 7th day                        | -0.52           | 0.67                  | <0.001             |
| Preop to One month                      | -0.76           | 0.53                  | <0.001             |
| Preop to 3rd month                      | -1.08           | 0.41                  | <0.001             |
| Preop to One year                       | -1.22           | 0.57                  | <0.001             |

SD= Standard Deviation;

Pre-operatively mean CBD diameter was 4.386 mm which was gradually start improving after the surgery and reached to 5.604 mm one year after surgery (Table 2). After 7<sup>th</sup> post-operative day mean increase was 0.52 mm which was significant rise compared to pre-op level ( $p < 0.01$ ). CBD diameter further increased and at the end of one year the mean expansion was 1.22 mm. The expansion in CBD diameter was significant compared to pre-op level at all the follow-up measurements ( $p < 0.01$ ) (Table 3).

## DISCUSSION

This research was conducted among 55 cases to study the serum lipid profile parameters before and after cholecystectomy and also to study the common bile duct dimensions before and after cholecystectomy.

### Effect of Cholecystectomy on serum Lipid profile

Pre-surgery, total cholesterol was 185.74 mg/dl, dropping to 165.16 mg/dl a year later. By day 7 post-surgery, it decreased by 7.22 mg/dl on average. Over the year, there was a mean reduction of 20.58 mg/dl. Reductions were not significant in the first three months but became significant afterward ( $p < 0.05$ ).

Before surgery, mean serum triglyceride, LDL, and HDL levels were 155.64 mg/dl, 105.96 mg/dl, and 44.40 mg/dl respectively. They initially increased post-surgery, then gradually decreased to 133.22 mg/dl, 105.96 mg/dl, and 81.1 mg/dl respectively one year later. By the 7th day post-surgery, triglycerides rose by 7.44 mg/dl, later

reducing by 22.42 mg/dl after a year. Triglycerides significantly rose after one week ( $p < 0.01$ ) but reduced significantly after three months ( $p < 0.01$ ). LDL decreased over the year by 59.50 mg/dl, significantly different from pre-op levels at all follow-ups ( $p < 0.01$ ). HDL increased by 36.70 mg/dl, also significantly different from pre-op levels at all follow-ups ( $p < 0.01$ ).

A study by Jain A et al [8] found that the pre-operative mean Serum TC was 140 mg/dl which was 188 mg/dl after 6 months post operatively. The pre-operative mean Serum TG was 188 mg/dl which was reduced to 139 mg/dl after 6 months post operatively. the pre-operative mean Serum LDL was 77 mg/dl which was 56 mg/dl after 6 months post operatively. the pre-operative mean Serum HDL was 41 mg/dl which was raised to 49mg/dl after 6 months post operatively.

In a study by Yogendra Kumar et al [9] found that the preoperative serum TC was 170 mg/dl which reduced to 166mg/dl after three days post operatively and further reduced to 160 mg/dl on 20th day. The reduction was statistically significant. the preoperative serum TG was 148 mg/dl which reduced to 147mg/dl after three days post operatively and further reduced to 138 mg/dl on 20th day. The reduction was statistically significant. the preoperative serum HDL was 96 mg/dl which reduced to 48 mg/dl after three days post operatively and further reduced to 44 mg/dl on 20th day. The reduction was statistically significant. the preoperative serum LDL was 41 mg/dl which increased to 90mg/dl after three days post operatively and slightly reduced to 80 mg/dl on 20th day. The reduction was statistically significant.



Jindal N et al [10] assessed the serum lipid profile in gallstone patients. They evaluated a total of 71 gallstone patients and 96 patients without gallstones and investigated their mean serum lipid profile. They observed that serum lipid levels of gallstone patients were significantly higher in comparison to patients without gallstone diseases. From the results, the authors concluded that metabolic disorders do alter the lipid profile in gallstone patients.

Atamanalp SS et al [11] examined the impact of serum lipid profile on gallstone cholesterol concentration. In 75 patients with gallstones, they inspected using spectrophotometry. They observed that high cholesterol stone rates were associated with High serum cholesterol and LDL levels. From the results, they concluded that the association between cholesterol, LDL, and HDL levels and cholesterol gallstone formation is multifactorial and complex and is also dependent on other individual properties.

Khokhlacheva NA et al [12] assessed the properties of liver bile and lipid profile in patients undergoing laparoscopic cholecystectomy. They spent the unpredictable examination of physical-concoction characteristics of bile and lipid levels in 210 patients with cholelithiasis group I (pre-stone) and in 90 patients with cholelithiasis group II and III (with gallstones) after cholecystectomy. In all analyzed patients we uncovered aggravations of physical-concoction characteristics of bile and lipid trade. With relationship examination it was discovered that bile lithogeneity increments in high bile thickness, in advancing of aggravation process in bile pipes, in progressing of aterogene parts of blood cholesterol. After cholecystectomy in liver-cells dyscholia the capacity to stones development preserves. It implies that patients after cholecystectomy require in catching up with utilizing of prophylactic measures to reestablishing of bile-formation.

Batajoo H et al (2013) [13] thought about the serum lipid variations from the normal in females who have cholelithiasis with controls. A review investigation of females who experienced cholecystectomy for gallstone ailment was done. An aggregate of 133 patients were partitioned into two age groups  $\leq 40$  and  $>40$  years. In age group  $\leq 40$  years, there were 72 cases without any controls, while, in  $>40$  years, 61 cases were contrasted and 67 controls. The serum lipid profile was gathered and contrasted concurring with the age group. The investigation demonstrated that serum LDL level was measurably noteworthy in females  $>40$  years old, though different parameters were not factually altogether different.

### **Effect of Cholecystectomy on common bile duct dimensions**

In the present study pre-operatively mean CBD diameter was 4.386 mm which was gradually start improving after the surgery and reached to 5.604 mm one year after surgery. The dilatation was statistically significant ( $p < 0.01$ ). Dilatation of bile duct after cholecystectomy was thought way back in the 1880s. However, direct evi-

dence not generated due to lack of technology. Dilatation of the bile duct was proved in the case of gallbladder resection compared to normal cases of human autopsy samples. [14] Introduction of the abdominal ultrasonography enables the direct measurement of bile duct diameter. The dilatation of the bile duct after cholecystectomy was confirmed by the present study.

In prospective study by Graham MF et al that can represent the direct change of the bile duct after gallbladder resection, the bile duct dilatation occurred in a limited number of cases, revealed by the different results of the 16-month follow-up study, 7 out of 67 cases revealed a dilatation of up to 6 to 10 mm, [15] but there was also a report by Mueller PR et al that showed a dilatation in only a single case out of 40 cases. [16] Similar results were reported in the more long-term observational studies. The result of a 5-year follow-up for 21 cases after surgery conducted by Hunt DR et al revealed that only 2 cases showed a common hepatic duct dilatation of about 4 mm, and 7 cases showed a slight change of CBD diameter from 4.8 to 5.9 mm. [17]

In a 5-year post-operative follow up study by Majeed AW et al showed common bile duct dilatation of more than 6.0 mm in only a single case out of 59 cases. [18] The longest follow-up observational study by Csendes GP et al, which investigated bile duct dilatation up to 12 years after the cholecystectomy, reported that cases who were 60 years of age or older found a significant increase from 5.0 to 6.7 mm, but there was no difference for those under 60 years old. [19] When integrating the above results, most of the cases showed a bile duct dilatation after gallbladder resection in the normal range and only a limited number of cases showed a dilatation higher than normal range.

## **CONCLUSION**

From the present study we conclude that Cholecystectomy leads to significant impact on in lipid profile. Serum Total Cholesterol value, Serum Low Density Lipoprotein (S. LDL) and Serum VLDL significantly reduce after cholecystectomy. The value of serum HDL rises significantly after cholecystectomy. Initially increases and then significantly reduces after cholecystectomy. Significant compensatory dilatation of common bile duct diameter occurs post cholecystectomy.

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