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Original Research Article

The effect of cholecystectomy on the lipid profile of patients with gallstone disease: a prospective study

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ABSTRACT

Background: Gallstones are a common cause for abdominal pain and discomfort. Laparoscopic cholecystectomy is the 'gold standard' for the treatment of gallstone disease. The association of gallstones in patients with altered lipid profiles is well documented. Recent studies have shown that there is an improvement in the lipid profile following cholecystectomy. The aim of the study was to study the effect of cholecystectomy on lipid profile and to study the relation between lipid profile and the nature of gallstones.
Methods: Prospective study involving 100 patients admitted to the surgery department for cholecystectomy at Kempegowda Institute of Medical Sciences (KIMS) hospital, Bangalore. Study period was on between October 2016 to July 2018. The pre-operative lipid profile was compared to the post-operative lipid profile done 6 months after cholecystectomy. Gallstone analysis was done with the extracted specimen.
Results: There was a significant improvement in the lipid profiles of study subjects post cholecystectomy. The total cholesterol, low density lipoprotein (LDL) cholesterol, very low density lipoprotein (VLDL) cholesterol and triglycerides decreased significantly ($p<0.001$) post cholecystectomy. Simultaneously, there was a significant increase ($p<0.001$) in the high density lipoprotein (HDL) cholesterol levels post-surgery. Majority of the stones were cholesterol stones (51%) followed by pigment stones (6%) and mixed stones (43%).
Conclusions: Cholecystectomy has a favourable effect on the lipid profile of patients. However, we found no correlation between lipid profile and nature of gallstones.

Keywords: Cholecystectomy, Gallstones, Lipid profile

INTRODUCTION

Gallstone disease is one of the most commonly encountered disorders in clinical practice. However, most of the patients are asymptomatic and are diagnosed incidentally during abdominal scans for unrelated diseases. The prevalence of the disease in India ranges from 6% to 9% of the adult population.[1,2] Gallstone disease is more prevalent in Northern India due to a diet rich in saturated fats and decreased fibre intake. Other risk factors include age, gender, ethnicity and sedentary lifestyle.[3-5] Symptomatic cholelithiasis is usually treated with cholecystectomy. Laparoscopic cholecystectomy has become the 'gold standard' for the treatment of gallstone disease.[6] It is estimated that most cholecystectomies are performed laparoscopically because of the significant advantages i.e. early return of bowel function, less postoperative pain, improved cosmesis, shorter length of hospital stay, earlier return to full activity.[7-11] The association of gallstones in patients with altered lipid profiles is well known. More than 50% of patients with gallstone disease have some sort of lipid disorder.[12] During routine pre-operative check-up, we often encounter many patients with deranged lipid profiles.[13]

There is also a strong association between altered lipid profile and increase in risk of coronary artery disease and stroke.[14]

The concentration of cholesterol in bile is higher than other phospholipids in people having cholesterol stones. This has given rise to a general consensus that the pathogenesis of cholesterol stone involves altered lipid metabolism. Recent studies have shown that there is an improvement in the lipid profile following cholecystectomy.[15-20] The hypothesis is that post-cholecystectomy there is a reduction in the bile acid pool size and an increase in the frequency of entero-hepatic circulation. This causes a decrease in total cholesterol and low density lipoprotein (LDL)-cholesterol levels.

Aims and objectives

- To study the effect of cholecystectomy on lipid profile.
- To study the relation between lipid profile and the nature of gallstones.

METHODS

This prospective study was carried out in Kempegowda Institute of Medical Sciences and Research Centre (KIMS), Bangalore from October 2016 to July 2018. Sample size**:** 100; Sampling type**:** Purposive sampling.

Inclusion criteria

All patients with symptomatic cholelithiasis admitted to the Department of General Surgery, KIMS, Bangalore for elective cholecystectomy (laparoscopic and open cholecystectomy).

Exclusion criteria

Exclusion criteria were the patients on lipid lowering drugs; patients with renal failure; nephrotic syndrome; pancreatitis; cardiac failure; hypothyroidism; pregnancy; patients with obstructive jaundice.

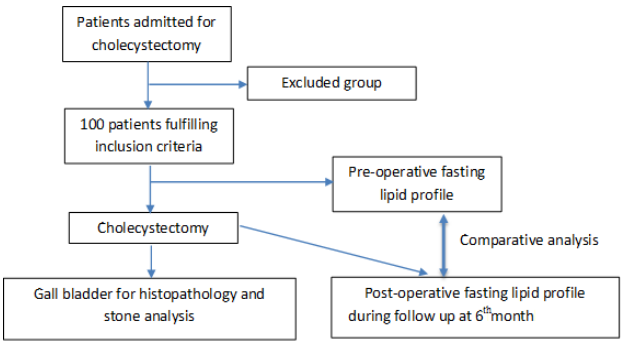

Figure 1: Protocol.

After taking a written informed consent, a detailed history, clinical examination and routine pre-operative investigations were done. Special blood investigations such as serum amylase, fasting thyroid profile and pre-operative fasting lipid profile were done in all the patients. After cholecystectomy, the specimen was sent for histopathological examination and stones were analysed. For the sake of comparing with other studies the older classification of cholesterol stones, pigment stones and mixed stones was adopted. A post-operative lipid profile was done at 6 months during the follow up period and compared with the initial pre-operative lipid profile.

Statistical analysis

Statistical Package for Social Sciences (SPSS) for Windows (Version 22) was used to perform statistical analyses. Descriptive analysis of all the explanatory and outcome parameters was done using frequency and proportions for categorical variables, whereas in mean and standard deviation for continuous variables. Wilcoxon signed rank test was used to compare the mean values of lipid profile parameters between pre and post cholecystectomy procedure. Spearman's correlation test was used to assess the relationship between number of gallstones and lipid profile parameters during pre and post cholecystectomy procedures. Kruskal Wallis Test was used to compare the mean lipid profile parameters based on the type of gallstones before cholecystectomy procedures. The level of significance was set at $p<0.05$.

RESULTS

Age of the study population

The mean age of the study population was 44.3±14.4 years with majority of the study population being of the age group between 21-30 years.

Table 1: Age distribution.

Age group (in years)	Number	Percentage (%)
21-30	26	26
31-40	19	19
41-50	20	20
51-60	20	20
61-70	12	12
> 70	3	3

Mean 44.3±14.4.

Gender distribution

The male to female ratio of the study group was 1:2.2

Operative procedures

Most of the cholecystectomies were done laparoscopically (94%). Only 6 cases needed open cholecystectomy (6%).

Comparison of mean values of lipid profile parameters pre-operatively versus post-operatively at 6 months

There was a significant improvement in the individual components of the lipid profile of study subjects post cholecystectomy:

Total cholesterol: There was a decrease in the total cholesterol level 6 months post-operatively. The mean pre-operative total cholesterol was 197.66±27.47 mg%. The mean post-operative total cholesterol at 6 months was 158.66±17.02 mg% (p<0.001).

Serum HDL cholesterol: The mean pre-operative serum high density lipoprotein (HDL)-cholesterol value was 35.28±6.18 mg%. At 6 months post-operatively the mean value was 42.06±4.12 mg% (p<0.001) showing significant increase in level of HDL-cholesterol at 6 months post-operatively.

Serum LDL cholesterol: The mean pre-operative serum LDL-cholesterol was 158.66±23.14 mg%. At 6 months post-operatively the mean value was 104.75±12.38 mg%. This decrease is statistically significant (p<0.001).

Serum triglycerides: The mean serum triglyceride level fell from 183.62±38.04 mg% pre-operatively to 159.99±8.40 mg% 6 months post-surgery (p<0.001).

Serum VLDL cholesterol: There was a significant decline in serum VLDL-cholesterol level from 38.20±7.01 mg% pre-operatively, to 30.32±2.86 mg% at 6 months post-operatively (p<0.001).

Table 2: Comparison between pre-operative and post-operative lipid profiles.

Parameter	Time	N	Mean	SD	Mean Diff	Z	P value
Total cholesterol	Pre-op	100	197.66	27.47	39.00	-7.850	<0.001*
	Post-op		158.66	17.02			
HDL	Pre-op	100	35.28	6.18	-6.78	-6.784	<0.001*
	Post-op		42.06	4.12			
LDL	Pre-op	100	158.66	23.14	53.91	-8.515	<0.001*
	Post -op		104.75	12.38			
VLDL	Pre-op	100	38.20	7.01	7.88	-7.161	<0.001*
	Post-op		30.32	2.86			
Triglycerides	Pre-op	100	183.62	38.04	23.63	-5.316	<0.001*
	Post-op		159.99	8.40			

Table 3: Characteristics of Calculi.

Variables	Category	Number	Percentage (%)
Number	Single	0	0
	Multiple	100	100
Type	Cholesterol	51	51
	Pigment	6	6
	Mixed	43	43

Table 4: Correlation between lipid values and number of gallstones

Time	Coefficients	TC	HDL	LDL	VLDL	Triglycerides
Pre-operative	Rho	0.10	-0.25	0.13	0.17	0.35
	P value	0.34	0.01*	0.21	0.09	<0.001*
Post-operative	Rho	-0.03	-0.09	0.01	0.16	0.01
	P value	0.77	0.35	0.95	0.11	0.99

Table 5: Correlation between pre-operative lipid profile values and type of gallstones.

Parameter	Cholesterol		Pigmented		Mixed		P value
	Mean	SD	Mean	SD	Mean	SD	
TC	196.98	28.54	178.17	15.41	201.19	26.72	0.08
HDL	34.24	5.24	33.00	5.55	36.84	7.01	0.09
LDL	159.35	23.92	153.33	29.57	158.58	21.74	0.73
VLDL	38.39	6.29	39.83	11.34	37.74	7.26	0.44
Triglycerides	186.39	39.97	167.17	48.48	182.63	34.36	0.16

Table 6: Correlation between post-operative lipid profile values and type of gallstones.

Parameter	Cholesterol		Pigmented		Mixed		P value
	Mean	SD	Mean	SD	Mean	SD	
TC	159.29	16.93	148.83	19.03	159.28	16.86	0.39
HDL	42.24	4.39	44.83	4.17	41.47	3.67	0.16
LDL	104.25	12.75	109.00	9.27	104.74	12.43	0.57
VLDL	29.94	2.77	31.33	3.08	30.63	2.94	0.33
Triglycerides	159.25	8.39	159.17	9.24	160.98	8.4	0.60

Characteristics of calculi: The number of calculi and the nature of calculi were studied.

- Number (Stones larger than 5mm were considered): 100% of the study population had multiple stones.
- Nature: Majority had cholesterol stones (51%) followed by mixed stones (43%) and least had pigmented stones (6 %).

There was no correlation between lipid value and number of gallstones. It was noticed that those patients with cholesterol stones had higher pre-operative LDL-cholesterol, VLDL- cholesterol and triglycerides and those with pigment stones had lowest mean pre-operative HDL-cholesterol levels. However, all these associations are statistically insignificant**.**

The highest decline in post-operative value of total cholesterol was seen in mixed stones while highest decrease in post-operative LDL-cholesterol, VLDL-cholesterol and triglycerides was seen in those with cholesterol stones. Highest increase in HDL-cholesterol post-operatively was seen in those with pigment stones. However, all these changes are statistically insignificant.

DISCUSSION

Classically, gallstones are more prevalent in the following demography: 'fatty, fertile, female of forty'. However, in our study group we noticed that the maximum incidence of gallstone disease was noted in females of the 3rd decade (26%). However, the other age groups viz., 31-40 years, 41-50 years and 51-60 years also had a similar distribution i.e., 19%, 20% and 20% respectively. In this study group, more than half of the population had a deranged pre-operative lipid profile. Hypertriglyceridemia, hypercholesterolemia, and low level of HDL-cholesterol were the abnormalities documented which were as those in similar studies in the past.[18,19]

The effect of cholecystectomy on lipid profile**:** Theoretically, cholecystectomy would result in a favourable alteration in the lipid profile. These changes in the lipid values are partly due to enhanced secretion of phospholipids and bile acids into bile following cholecystectomy. This leads to an increased frequency of enterohepatic circulation which will lead to enhanced excretion of lipids hence to an effective decrease in total bile acid pool. In this study we have compared the pre-operative and post-operative lipid profile. An analysis of the effect of cholecystectomy on the individual components of lipid profile was done by comparing each parameter pre-operatively and at 6 months post-operatively. There was a significant decrease in total cholesterol, LDL-cholesterol, VLDL-cholesterol and triglycerides and a significant increase in HDL-cholesterol. These results were similar to those of other studies.[15-18,20,22]

Nature of gallstone and lipid profile**:** In our study, the majority of the subjects had cholesterol stones (51%), followed by mixed stones (43%). Only a few patients (6 %) had pigmented stones. This result is similar to other studies.[22-24] However, the correlation between the lipid profile and nature of gall bladder stone was statistically insignificant.

CONCLUSION

The results of our study show that cholecystectomy does have a favourable effect on the lipid profile of patients. However, we found no relationship between the nature of gallstone and the lipid profile.

Limitations

In this study we have included only those subjects with symptomatic cholelithiasis who have undergone surgery. This is just the tip of the iceberg. Many patients who are asymptomatic but have an altered lipid profile go undetected. Hence the application of the results to the general population is yet to be understood. In addition, since the follow-up period was short, we could not ascertain whether this favourable alteration in the lipid profile was purely because of the surgery or because of the dietary modifications advised post-surgery. Further studies in regard to this subject are required.

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Ethical approval: The study was approved by the Institutional Ethics Committee, Kempegowda Institute of Medical Sciences and Research Centre, Bangalore

REFERENCES

1. Khuroo MS, Mahajan R, Zargar SA, Javid G, Sapru S. Prevalence of biliary tract disease in India: A

Sonographic study in adult population in Kashmir. Gut. 1989;30:201-5.
2. Unisa S, Jagannath P, Dhir V, Khandelwal C, Sarangi L, Roy TK, et al. Population-based study to estimate prevalence and determine risk factors of gallbladder diseases in the rural Gangetic Basin of North India. HPB (Oxford). 2011;13:117-25.
3. Shaffer EA. Epidemiology and risk factors for gallstone disease: Has the paradigm changed in the 21st century? Curr Gastroenterol Rep. 2005;7:132-40.
4. Sun H, Tang H, Jiang S, Zeng L, Chen EQ, Zhou TY, et al. Gender and metabolic differences of gallstone diseases. World J Gastroenterol. 2009;15:1886-91.
5. Liu CM, Tung TH, Chou P, Chen VT, Hsu CT, Chien WS, et al. Clinical correlation of gallstone disease in a Chinese population in Taiwan: Experience at Cheng Hsin general hospital. World J Gastroenterol. 2006;12:1281-6.
6. Soper NJ, Stockmann PT, Dunnegan DL, Ashley SW. Laparoscopic cholecystectomy. The new 'gold standard'? Arch Surg. 1992;127(8):917-21.
7. Singh P, Gupta SK, Kumar M. A comparative study of open cholecystectomy and laparoscopic cholecystectomy in patients with cholelithiasis. Int Surg J. 2018;5:253-6.
8. Karim T, Kadyal A. A Comparative Study of Laparoscopic vs. Open Cholecystectomy in a Suburban Teaching Hospital. J Gastrointest Dig Syst. 2015;5:371.
9. Doke A, Gadekar N, Gadekar J, Dash N, Unawane S. A comparative study between open versus laparoscopic cholecystectomy. Sch J App Med Sci. 2016;4(1):57-61.
10. Gadacz TR, Talamini MA. Traditional versus Laparoscopic Cholecystectomy. Am J Surg. 1999;161:336-8.
11. Agrawal SN. A study of open versus laparoscopic management of cholecystectomy. International Medical J. 2016;3(2):219-21.
12. Bell GD, Lewis B, Petrie A, Dowling RH. Serum Lipids in Cholelithiasis: Effect of Chenodeoxycholic Acid therapy. Br Med J. 1973;3:520-3.
13. Ahmad F, Soomroo I, Maher M. Role of Laparoscopic Cholecystectomy in the Management of Acute Cholecystitis. Annals. 2007;13(4):238-24.
14. Miller M. Dyslipidemia and cardiovascular risk: the importance of early prevention. QJM: monthly journal of the Association of Physicians. 2009;102(9):657-67
15. Jindal N, Singh G, Ali I, Sali G, Reddy R. Effect of cholelithiasis and cholecystectomy on serum lipids and blood glucose parameters. Arch Int Surg. 2013;3:97-101.
16. Gill GS, Gupta K. Pre- and Post-operative comparative analysis of serum lipid profile in patients with cholelithiasis. Int J App Basic Med Res. 2017;7:186-8.
17. Jain A, Singh MM, Choudhary P. Effect of cholecystectomy on serum lipid profile. Global J Res Analysis (GJRA). 2018;7(4).
18. Haq AMM, Giasuddin ASM, Jhuma KA, Choudhury MAM. Effect of cholecystectomy on lipid profile in Bangladeshi patients with cholelithiasis. J Metabolic Synd. 2015;4:192.
19. Ahi KS, Singh RP, Kaur H, Moudgil A. Serum lipid profile in pre and post cholecystectomy patients. Int J Anatomy Radiol Surg. 2017;6(2):1-6.
20. Malik AA, Wani ML, Tak SI, Irshad I, Ul-Hassan N. Association of dyslipidaemia with cholelithiasis and effect of cholecystectomy on the same. Int J Surg. 2011;9(8):641-2.
21. Volzke H, Baumeister SE, Alte D, Hoffmann W, Schwahn C, Simon P, et al. Independent risk factors for gallstone formation in a region with high cholelithiasis prevalence. Digestion. 2005;71(2):97-105.
22. Kurtul N, Pence S, Kocoglu H, Aksoy H, Capan Y. Serum lipid and lipoproteins in gallstone patients. Acta Med. 2002;45(2):79-81.
23. Saqib A, Shaik SS, Sodhar JM. Gallstones; Frequencies of gallstones in the patients attending surgical OPD at Isra Hospital Hyderabad. Professional Med J. 2014;21(2):386-90.
24. Pradhan SB, Joshi MR, Vaidya A. Prevalence of different types of gallstone in the patients with cholelithiasis at Kathmandu Medical College, Nepal. Kathmandu Univ Med J(KUMJ). 2009;7(27):268-71.

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