

Relation between type of Gallstones with Serum lipid profile and Serum bilirubin levels

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Abstract

Introduction: Cholelithiasis is presence of gallstones, which are concretions that form in the gall bladder. Several studies have been done about gallstones incidence, risk factors and composition but few about the prevalence of different parameters in individual stone type.

Aim: To evaluate serum lipid & bilirubin in patients with cholelithiasis.

Objectives: To establish a relationship between serum lipid and serum bilirubin levels and different type of gallstones.

Methods and materials: This is an observational cross sectional study done over a duration of 18 months from January 2021 to June 2022 by including patients undergoing laparoscopic or open cholecystectomy for gallstones after taking written and informed consent. All

data analysis had been done by using SPSS (version 22) software.

Results: Out of 100 cases females (76%) were the most affected when compared to males (24%). Mean total cholesterol levels were highest in Cholesterol stones (211.28 ± 30.11) compared to Mixed stones (184.13 ± 25.24) and pigment stones (182.21 ± 21.18) with statistically significant difference. ($P < 0.05$) The mean serum bilirubin levels were highest in Pigment stones (1.67 ± 0.68) compared to Mixed stones (1.21 ± 0.34) and Cholesterol stones (0.91 ± 0.18) with statistically significant difference. ($P < 0.05$).

Conclusion: Serum lipid profiles are bound to get deranged in patients with cholelithiasis as the type of stones found consist mainly of cholesterol and unconjugated bilirubin

Keywords: Bilirubin, Cholelithiasis, Lipid Profile.

Introduction

Cholelithiasis is a common disorder of the gastrointestinal tract, with a prevalence rate of 10-15% and an incidence rate of 1.4% in people above 18 years of age in developed countries worldwide.¹ In India cholelithiasis is more prevalent in North India than South India and is followed by the coastal regions of Maharashtra.² The basis for gallstone disease is impaired metabolism of bile acid, bilirubin and serum cholesterol, which leads to formation of gallstones in common hepatic duct, gall bladder and common bile duct.³

Gallstones can be divided into 3 basic types: Mixed stones, Pigment stones and Cholesterol stones. Cholesterol stones are made mostly of pure cholesterol (50 – 90%), while mixed stones contain phospholipids, bile acids, calcium and bile pigments in addition to cholesterol.⁴ Most of the patients with cholelithiasis are asymptomatic and thus this study describes an extensive outlook into the biochemical analysis of the stones, their incidence, age and sex distribution, the type of stones, the lipid profile & serum bilirubin levels.

Cholesterol supersaturation is the most important factor in the pathogenesis of gallstones.⁵ Biliary cholesterol hypersecretion is the main cause for cholesterol supersaturation and bile stasis also plays a major role.⁶

Pigment stones contain two main types black pigment stones and brown pigment stones.⁷ Black and brown pigment gallstones are clinically, morphologically and composition wise very distinct. Black stones form primarily in the gallbladder in sterile bile and are associated with advanced age, chronic haemolysis, alcoholism, cirrhosis, pancreatitis, and total parenteral nutrition.⁸

Brown pigment stones are formed in bile infected with enteric bacteria that secrete hydrolytic enzymes: beta-glucuronidase, phospholipase A, and conjugated bile acid hydrolase. Brown stones form not only inside the gallbladder but also within the intrahepatic and extrahepatic ducts; they are uniformly infected with enteric bacteria and are usually associated with ascending cholangitis.

Brown stones are related to juxta papillary duodenal diverticula and are the predominant type of common bile duct stones. Cholecystectomy is usually curative in black pigment stone disease, whereas stones often recur after cholecystectomy for brown stone disease. The pathogenesis of black stones is probably related to non-bacterial, non-enzymatic hydrolysis of bilirubin conjugates.⁹

If impaired lipid homeostasis is the main cause for cholesterol supersaturation and crystallization, a significant difference between serum lipid profiles of patients with cholesterol and pigment gall stone should be observed, as cholesterol hypersecretion is not an etiological factor for the pathogenesis of pigment stones. Therefore, comparison of lipid profiles in patients with different types of gall stone would be important in detecting the significance of different lipid parameters.¹⁰ Therefore, the present study was conducted to see whether a relationship can be established between type of gallstones with serum lipid and serum bilirubin levels.

Material and methods

The present observational cross-sectional study was undertaken to study serum lipid profile and serum bilirubin level in patients with cholelithiasis undergoing cholecystectomy at tertiary care hospital. The present study period was from January 2021 to July 2022. The study population was diagnosed as having cholelithiasis

and undergoing open or laparoscopic cholecystectomy surgery at tertiary care hospital.

A total sample size of 100 patients with cholelithiasis and undergoing open or laparoscopic cholecystectomy surgery was included in the study population. Sample size was calculated with the following assumptions. Assuming a pooled standard deviation of 0.15 units the study would require a sample size of: 79 to achieve a power of 80% and a level of significance of 5% (two sided), for detecting a true difference in means between groups of 0.067 units.

Formula Used

$$n = (Z\alpha/2 + Z\beta) \cdot 2 \cdot \sigma^2 / d^2$$

at 5% level, $Z\alpha/2 = 1.96$

$$Z\beta = 0.84$$

$$\sigma = 0.15$$

Required sample Size = 79

Adding 10% dropout, required sample was $79 + 8 = 87$
Minimum

Hence, minimum sample size of 100 patients with cholelithiasis and undergoing open or laparoscopic cholecystectomy surgery was studied following inclusion and exclusion criteria.

All data analysis had been done by using SPSS (version 22) for windows.

Data were summarized in frequency tables, pie chart and histogram. Categorical variables were reported as proportion. Continuous data were described as means (standard deviation) or medians (interquartile range) depending on the distribution of data.

The T- test were applied in the following results whenever necessary.

The correlation was assessed by using Pearson correlation coefficient. The level of significance criteria was selected at $P < 0.05$.

Results

Table 1: Distribution according to age

Age group (Years)	No. of Patients	Percentage
<20	01	01.00
21-30	19	19.00
31-40	36	36.00
41-50	21	21.00
51-60	14	14.00
>60	09	09.00
Total	100	100

The above table shows age distribution among patients.

The maximum numbers of cases were in the age group of 31-40 years (36%), followed by in 41-50 years (21%). The patients ranged from 18 to 82 years and mean age among the distribution of cases was 44.16 ± 18.12 years.

Figure 1: Distribution according to age

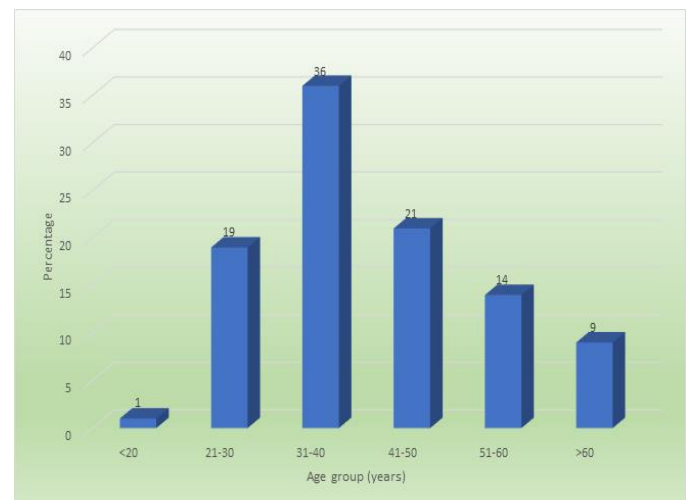


Table 2: Distribution of patients according to sex

Sex	Frequency	Percentage
Male	24	24.00
Female	76	76.00
Total	100	100

The above table shows sex distribution among patients.

Out of 100 cases females (76%) were the most affected when compared to males (24%)

Figure 2: Distribution of patients according to sex

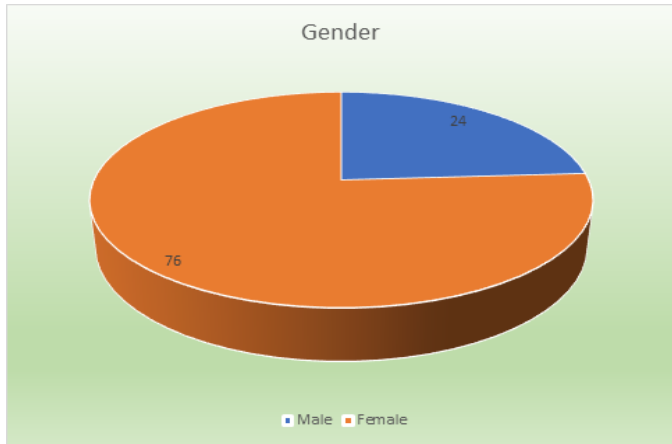


Table 3: Distribution of patients according to type of gall stones

Type of gall stones	Frequency (n=100)	Percentage
Cholesterol stones	24	24.00
Pigment stones	30	30.00
Mixed stones	46	46.00
Total	100	100

The above table shows type of gall stones among patients. The maximum numbers of cases had mixed gall stones (46%), followed by Pigment stones (30%) and Cholesterol stones. (24%)

Figure 3: Distribution of patients according to type of gall stones

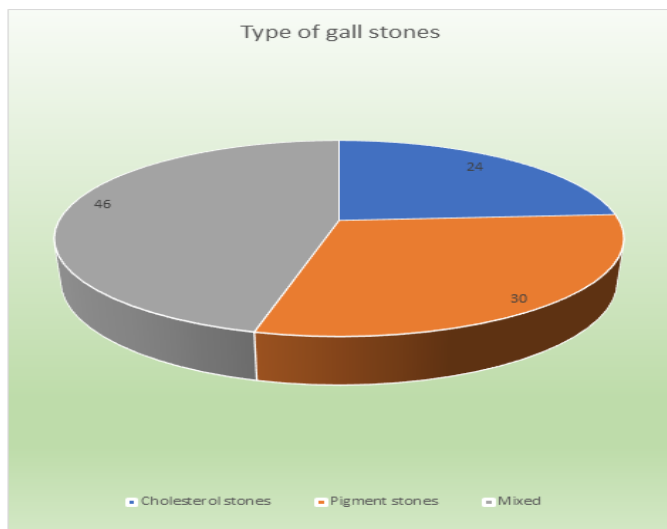


Table 4: Relation of type of stones and lipid profile

Lipid profile	Type of gall stones (Mean ±SD)			P value
	Cholesterol stones	Mixed stones	Pigment stones	
Total Cholesterol (mg%)	211.28 ± 30.11	184.13 ± 25.24	182.21 ± 21.18	0.03 (S)
HDL (mg%)	35.95 ± 9.10	42.28 ± 9.29	43.41 ± 10.12	0.02 (S)
LDL (mg%)	143.1 ± 21.48	123.12 ± 23.45	121.09 ± 21.58	0.004 (S)
VLDL (mg%)	34.26 ± 5.72	30.18 ± 5.99	32.11 ± 6.78	0.19 (NS)
Triglycerides	153.26 ± 21.98	106.95 ± 26.95	104.25 ± 21.98	0.02 (S)

The above table shows relation of type of gall stones and lipid profile levels among patients. It was observed that mean total cholesterol levels were highest in Cholesterol stones (211.28 ± 30.11) compared to Mixed stones (184.13 ± 25.24) and pigment stones (182.21 ± 21.18) with statistically significant difference. (P<0.05)

Similarly, mean triglycerides and LDL levels were highest in Cholesterol stones compared to Mixed stones and pigment stones with statistically significant difference.

(P<0.05) HDL levels were lower in Cholesterol stones compared to Mixed stones and pigment stones with statistically significant difference.

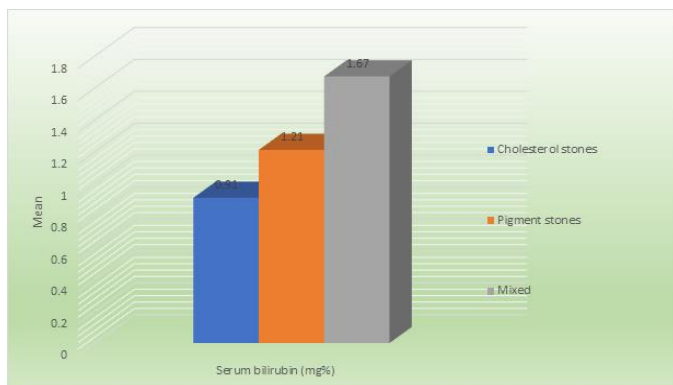
Table 5: Relation of type of stones and serum bilirubin levels

Parameter	Type of gall stones (Mean ±SD)			P value
	Cholesterol stones	Mixed stones	Pigment stones	
Serum bilirubin (mg%)	0.91 ± 0.18	1.21 ± 0.34	1.67 ± 0.68	0.02 (S)

(*P<0.05 statistically significant)

The above table shows relation of type of gall stones and serum bilirubin levels among patients. It was observed that mean serum bilirubin levels were highest in Pigment stones (1.67 ±0.68) compared to Mixed stones (1.21 ±0.34) and Cholesterol stones (0.91 ± 0.18) with statistically significant difference. (P<0.05)

Figure 4: Relation of type of stones and serum bilirubin



Discussion

Gallstone disease (GSD) is the most common disorder affecting the biliary system and is also one of the most common gastro-intestinal disorder requiring hospitalization.

Gallstones (GS) are formed as a result of impaired metabolic regulation in the human body. Abnormal lipid metabolism is partly responsible for the pathogenesis of Gall stones which is mainly rich in cholesterol.

It was seen in this study that females had a greater incidence rate as compared to males and similar results were seen in study done by Shaffer et al.¹¹ Maximum number of patients were seen in the age group of 31-40 yrs. This is in accordance with study by Ahi et al in April 2017 who have found the maximum prevalence of this disease was between 31- 40 years of age group.¹²

In the present study it was seen that there were comparatively high levels of serum cholesterol and LDL level in patients with cholesterol stones than pigment and mixed stones while HDL levels were on lower side in cholesterol stones patients. These findings were similar to those seen in study of Halldestam I et al.¹³

The relationship between serum cholesterol, LDL, and HDL levels and cholesterol gallstone formation is multifactorial and complex and is also dependent on other individual properties.

It was also seen that majority of patients with pigment stones had high serum bilirubin levels as compared to cholesterol and mixed stone patients, which was similar to study of Rama swami B et al.¹⁴

Limitations

- 1.Single Centre Study
- 2.Not optimum Sample Size

Conclusion

The present study concludes that gallstone disease is more common in females as compared to males.

It is also concluded that serum triglyceride levels and serum HDL levels were statistically significant in gallstone patients and there was a positive correlation between these parameters and type of gallstone. Serum lipid profiles are bound to get deranged in patients with cholelithiasis as the type of stones found consist mainly of cholesterol and unconjugated bilirubin. It is also concluded that increased serum bilirubin and serum lipid

have a role in the pathogenesis of different types of human gallstones in this area.

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