

Prevalence, Morphology and Chemical Composition of Gallstones in 150 Cholecystectomised Patients

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ABSTRACT:

BACKGROUND:

Gallstones are a major cause of morbidity worldwide, and cholecystectomy is the most commonly performed abdominal surgery in medicine. Gallstone-induced complications have a limited and overlapping pattern of clinical presentation. In this article, morphology, composition of gallstones as well as diagnosis and therapeutic options employed in their management are reviewed.

OBJECTIVE:

The study is to define the different types of gallstones, and to identify their characteristics and chemical composition in 150 patients.

PATIENTS AND METHODS:

A retrospective study was performed on one hundred and fifty patients who were subjected to cholecystectomy during the period from January 1992 to January 2007, in the gastro-enterology & hepatology center and Al-Mustansyria Private Hospital in Baghdad by one consultant surgeon.

RESULTS:

The female: male ratio was 4:1 and the peak age group was that between 41-50 years. Thirteen percent of patients required explorations of the common bile duct (CBD), 72.7% of them were jaundiced, and 27.3% of those who had CBD exploration were not jaundiced. Ninety point seven percent of cholecystectomies were performed for calculus cholecystitis and 9.3% were for acalculus cholecystitis.

Of the 136 patients with calculus cholecystitis, 19.9% had a solitary stone, and 32.4% had 2-10 stones; the highest number of stones was 250. Forty nine percent of stones were less than one centimeter in size; with the biggest stone being 4.5 cm in size.

Unlike what is expected of "mixed stones", they were not more than 30.9% of cases, while "cholesterol stones" constituting 40.4% of cases. "pigment stones" constituted only 8.8% of stones; with "combined stones" constituting 17.6% of cases.

CONCLUSION:

There is an increased prevalence of gallstones in females and the frequency of gallstones increases with age in both sexes.

In this article, there has been recognized three types of gallstones, cholesterol, mixed and pigment (black and brown) stones. The cholesterol stones account for more than 40% (the highest percentage of gallstones in the study).

KEY WORDS: gallstones.

INTRODUCTION:

Cholelithiasis is the gallstone disease (GSD) where stones are formed in the gallbladder. The main function of the gallbladder is to concentrate bile by the absorption of water and sodium. GSD has high prevalence among elderly patients. There are three major types of gallstones found in patients, White, Black and Brown. The major chemical component of white stone is cholesterol. Black and brown stones contain different proportions of cholesterol and bilirubin⁽¹⁾.

The basic mechanism underlying the formation of gallstones is supersaturation, with constituents in bile

exceeding their maximum solubilities. Additional factors contributing to gallstone formation are nucleation factors, bile stasis within the gallbladder and calcium in bile⁽²⁾. Analysis of the chemical composition of gallstones using various spectroscopic techniques offers clues to the pathogenesis of gallstones⁽³⁾.

Patients and methods:

This is a retrospective study representing a clinical experience of consultant professor of surgery Zuhair R. Al-Bahrani at the gastroenterology & hepatology center and Al-Mustansyria private hospital during the period from January 1992 to January 2007. The study includes 150 patients who were diagnosed to have cholecystitis and operated on by open

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cholecystectomy. All stones removed during surgery were placed on sterile gauze to air dry, transferred into a paper envelope bearing the name, age, and gender of the patient as well as the date. The stones were sent to Al-Rafidain laboratory in Baghdad.

All stone specimens were first examined for shape, size, and color. They were classified as cholesterol, black or brown pigmented stones, examined under a polarized microscope. The composition of the nidus, the internal and external shells was determined by X-ray diffraction. The percentage of cholesterol, calcium carbonate, and amorphous material such as black bilirubinate, black phosphate, glycoproteins and salts was determined. A descriptive analysis was done for stones from each patient.

Diagnosis of calculus/acalculus cholecystitis was made by clinical examination and the use of ultrasonography & if needed HIDA scan and/or oral cholecystography.

All patients were treated by surgery in form of open cholecystectomy, & if needed other surgical options were used like choledochotomy, choledochoduodenostomy or sphincterotomy. No on-

table cholangiogram is available till today in the teaching and the private hospitals in which these 150 cholecystectomies were performed, thus choledochoduodenostomy or sphincteroplasty is done when there is doubt about total clearance of the extra hepatic biliary tree from calculi.

RESULTS:

One hundred fifty cholecystectomies were performed for cholecystitis, 120 of them (80%) were females and 30 (20%) were males, thus the female: male ratio was 4:1. the peak age was 41 – 50 years (30.7 % of patients) with an age range of 17 – 79 (Table – 1).

Twenty two patients (14.7%) had concomitant exploration of the common bile duct, 16 of them (72.7%) were jaundiced, and six of them (27.3%) were non-jaundiced.

Thirteen of those 22 patients (59.2%) with choledochotomy underwent added surgical procedures, in which 8 of them (36.4%) having sphincteroplasty, and 5 (22.8%) had choledochoduodenostomy.

Table 1: "Distribution of Cases According to Age".

Age Group	No. of patients	% of total
10-20 years	2	1.3%
21-30 years	21	14%
31-40 years	28	18.7%
41-50 years	46	30.7%
51-60 years	27	18%
61-70 years	23	15.3%
71-80 years	3	2%
Total	150	100%

Of the 150 cholecystectomies, 136(90.7%) were performed for calculus cholecystitis, and 14(9.3%) were for non-calculus cholecystitis.

The 14 patients with non-calculus cholecystitis had an ultra-sonographic imaging technique showing no-gall stones. However, 13 patients (92.9%) had thickened gall bladder wall suggesting chronic cholecystitis. All these patients with a diagnosis of chronic acalculus cholecystitis had a histopathological confirmation of this pathology, and all had well to excellent results regarding the disappearance of their symptoms following cholecystectomy.

Twenty eight over 150 patients (18.7%) had an acutely inflamed gall bladder at the time of cholecystectomy, 11/28 (39.9 %) were cases of

empyema of the gall bladder; yet, in all 28 patients cholecystectomy was performed with no patient having cholecystostomy alone. There was no mortality, no significant complications, no choledochal injury in these patients with acute cholecystitis or empyema treated by cholecystectomy; even wound infection rate was relatively low occurring in 4/28 patients (14.3%).

Of the 136 patients with chronic calculus cholecystitis, 27(19.9%) have solitary stone(Figure "1"), 44(32.4%) have 2-10 in number (Figure "2"), 25(18.4%) have 11-20 in number, 19(13.9%) have 21-50 in number (Figure "3"), 9(6.9%) have 51-100 in number, and 9(6.9%) have 101-250 in number, in three patients (2.3%), only biliary sludge was present. (Table 2)

Table 2: Number of Gall stones: (in 136 gall bladders)

No. of gall stones	No. of patients	% of Total
Solitary	27	19.9%
2-10	44	32.4%
11-20	25	18.4%
21-50	19	13.9%
51-100	9	6.9%
101-250	9	6.9%
sludge only	3	2.3%
Total	136	100%



Figure 1: Solitary stone.

As to the size of stones, it ranges from less than 0.5 cm in 35 patients (25.7%), up to > 3 cms in four patients (2.8%). (Figure “4”) & (Table 3)



Figure 2: Gall stones less than 10 in number.

Table 3: Size of Gall stones

Size of stone	No. of patients	% of Total
<0.5 cm	35	25.7%
0.5-1 cm	32	23.5%
1.1-1.5 cm	25	18.4 %
1.6-2.0 cms	18	13.2%
2.1-2.5 cms	12	8.8%
2.6-3.0 cms	10	7.4%
>3 cms	4	2.8%



Figure 3: Gallstones more than 20 in number.

In 19 patients with gallstones (14%), two different sizes of gallstones were found in the same gallbladder and in seven patients (5.2%), three groups of gallstones of different size were identified in the same gall bladder and in one patient (0.7%), four different groups of gallstones according to the size were found.



Figure 4: Gallstone more than 2.5 in diameter.

As to the types of gallstones, 55/136 (40.4%) were pure cholesterol stones, 12/136 (8.8%) were pigment stones, while only 42/136 (30.9%) were mixed stones, 24/136 (17.6%) were combined stones, and in three patients (2.2%) only "biliary sludge" was found (Figure 5). Of those pigment stones, 7(5.14%) were brown & 5(3.67%) were black.

As to the shape of gallstones, the commonest were oval or round, then triangular, but even rectangular stones were rarely encountered. As to the color of gallstones, this varied from yellow to green to yellow green and greenish yellow, gray color, different shades of brown, and black in most pigment stones.

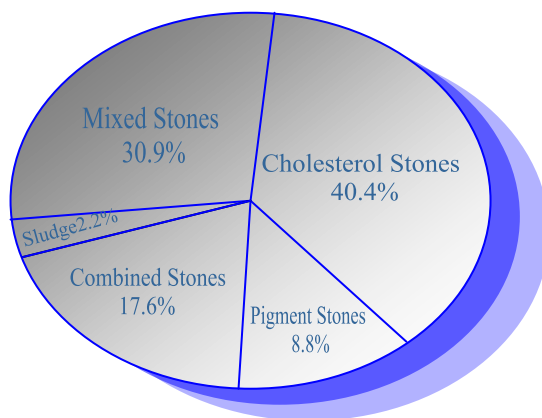


Figure 5: Types of Gall Stones

DISCUSSION:

Gallstones represent a prevalent and costly health problem. The changing epidemiology and the emerging surgical and non-surgical interventions for gallstone disease necessitate the definition of target populations for future therapies. Chronic calculus cholecystitis is a common western disease due to the low-roughage high fat refined western diet, yet, with all major differences between the developed west, and developing Iraq, chronic calculus cholecystitis is a common disease in middle aged Iraqi women, and cholecystectomy is one of the commonest major operations performed in Iraq as is the case in the west⁽⁴⁾.

The female: male ratio was 4:1, with the peak age group being the fifth decade of life in which 30.7% of cases occurred. Such a gender ratio, and age distribution has great similarities to that in the study of Mahgoub E.S. and Malaika S.⁽⁵⁾.

Out of 150 cholecystectomies, 136 were for calculous cholecystitis, in 27/136 of these cases, the gall bladder contained a "solitary stone" (19.9%) which is classically a cholesterol stone, however, some may be combined stones. This is in agreement with results of Shiffman ML and Moore EW, who showed that cholesterol stones whether solitary or multiple are the typical "stasis stones" which occur initially in a normal gall bladder as a result of stasis⁽⁶⁾.

It was noticed that in some gall bladders, two distinctly different sizes of gall stones were present in 19 patients (14%), and three distinctly different sizes in 7 patients (5.2%), and four distinctly different sizes in one patient (0.7%), thus, in 27/136 patients (19.9%), more than one distinct size of gall stones was present, in some cases, this was due to the presence of more than one type of gall stones in the same gall bladder, or one type of gall stone converting in to another type with a group of stones having converted, and another group which have not converted yet (for example :- a group of cholesterol stones in the same gall bladder with a group of combined gall stones which started as cholesterol, then a shell of mixed components enveloped the cholesterol stone), thus any gall stone may at any stage have an envelope of a different component converting them into combined stones. This is similar to the reports on gallstone composition carried out in different parts of the world, which indicate that several groups of gallstones may be present not uncommonly in the gall bladder, suggesting that the causes for their formation may operate at different periods (7-10).

Pure stones are hardly existent, and what is called a

pure stone is really made of multiple components, with one component (for eg. Cholesterol) being t

predominant component; the classical classification (cholesterol, pigment, and mixed stones) also does not mention the "combined stones" which is a well established entity as mentioned in the study of Mok HYI et.al. They have pure nucleus with a mixed shell or the reverse.⁽¹¹⁾

In our study, cholesterol stone was the commonest type of gall stones (40.4%), some western studies have shown similar results with cholesterol stone being the predominant type of gall stones as in the study of Holzback TR⁽¹²⁾, while many other studies have shown the "mixed stones" to be the commonest type. Why cholesterol stones in this study were the commonest types of gall stones related mainly to the etiology of cholesterol stones which are primarily "stasis stones", and since most ladies having gall stones over the last few years are multiparous and obese. Thus long periods of stasis are present leading to cholesterol stasis gall stones. As mentioned in the study of Bateson MC, who showed that obesity will lead to increased liver synthesis and secretion of cholesterol. The age of 40 years, and the female sex are the other risk factors⁽¹³⁾.

The second commonest type of gall stones was the "mixed stones" (30.9%), then the combined stones (17.6%), with pigment (calcium bilirubinate) stones constituting 8.8% of cases (Figure 5). The low percentage of pigment stone in this study was similar to the study of Aijaz Ahmed et.al. who showed a percentage of them of about 10%. Pigment stones were the least common type, with hemolytic states being an etiological⁽¹⁴⁾. In Iraq, and many other developing countries, parasitic infestation with *ascaris lumbricoides* is one cause of pigment gall stones. *Ascaris lumbricoides* eggs have been repeatedly found in the nucleus of pigment stones as shown in the study of Way LW⁽¹⁵⁾.

The largest regional paper was from Kuwait, where M.H. Alwan reviewed "894" cholecystectomies in 1984, the largest ever regional series reported. The results to a large extent were comparable to our series: - Cholelithiasis was common in Kuwait as in Iraq; females also predominated with a female: male ratio of 3:1, while it was 4:1 in our paper. Mean age was 45 years, and our peak age was also in the fifth decade of life⁽¹⁶⁾.

CONCLUSION:

There is an increased prevalence of gallstones in females and the frequency of gallstones increases with age in both genders. In this article, there has been recognized three types of gallstones,

cholesterol, mixed and pigment (black and brown) stones. The cholesterol stones account for more than 40% (the highest percentage of gallstones in the

study). Biliary sludge is composed of mucin, calcium, monoconjugated bilirubin and cholesterol and is now thought to be the direct precursor of gallstones.

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