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GALLSTONES AND LIVER FUNCTION

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ABSTRACT

The gallbladder is a small musculo-membranous hollow organ, located directly under the liver. It stores and concentrates bile produced in the liver, which aids in the digestion of fats in the duodenum. An excess of cholesterol, bilirubin, or bile salts can cause gallstones to form. Gallstones are generally small, hard deposits inside the gallbladder that are formed when stored bile crystallizes. The aim of this research is to classify the different types of gallstones and study their relationship to liver function. Samples were collected from 66 patients who underwent a cholecystectomy in Fezzan Clinic in Sebha. Venous blood samples were collected and taken to the laboratory for complete blood analysis, blood groups and liver function. The results of this study showed that the age of the participants was 40.6 ± 12.7 years, and that the age group of 45-19 years (69.7%) was more affected, and that females were more susceptible to gallstones than males. The study showed that the hematological profile that were studied were in the normal range and (37.9%) were found to have a low haemoglobin concentration. And that the most group susceptible to gallstones is (O+). This study showed that pigmented gallstones were the most common types of gallstones, followed by cholesterol stones and mixed stones. The study showed that (36.4%) of the samples had a regular shape and (63.6%) of the samples had an irregular shape. And that (51.5%) had a smooth texture and (48.5%) had a rough texture. While the results showed that there were no significant differences for both bilirubin and Glutamic Pyrovate Transaminase (GPT) enzyme, while an a significant differences was found in both Glutamic Oxaloacetate Transaminase (GOT) and Alkaline phosphatase (ALP) enzymes between the different species of gallstones.

KEYWORDS: gallbladder, gallstones, hematological profile, liver function, pigmented and cholesterol.

1. INTRODUCTION

The gallbladder is a pear-shaped sac. It is located in the upper right quadrant of the abdomen, below the liver. In adults, its size is 7-10 cm in length and 4 cm in width. This is when fully swollen. The capacity of the gallbladder is about 30-50 ml of yellow liquid.[1]

Bile consists of ~95% water in which are dissolved a number of endogenous solid constituents including bile salts, bilirubin phospholipid, cholesterol, amino acids, steroids, enzymes, porphyrins, vitamins, and heavy metals, as well as exogenous drugs, xenobiotics and environmental toxins.

Approximately 5% of bile consists of organic and inorganic solutes of considerable complexity.

Gallstone are solid parts consisting of bile-forming substances such as cholesterol, salts and calcium, which in turn lead to blocking the bile flow, which is known as cholecystitis.[3] Based on their chemical composition, gallstones are classified as, pigmented, cholesterol or mixed stones.[4] Gallstones range in size from as small as a grain of sand to as large as a golf ball. Some people develop only one stone, while others may have several stones at the same time.[5] All gallstones are a common digestive disorder that poses a major health problem, and it has increased in recent years in Western countries and also in China, for people over 20 years old.[6-7] Some factors have been reported to be risk factors for gallstone development, including ethnicity[8], age, gender, obesity[9], genetic susceptibility[10], and type 2 diabetes mellitus[11], insulin resistance.[12]

This study aims to study the different types of gallstones and their relationship to liver function tests. This is done through the following.

1. Classification of the three types of gallstones: chromosomal, cholesterol, and mixed
2. Classification of gallstones in terms of their external form (regular or irregular)

3. Classification of gallstones in terms of their external texture (smooth or gritty)
4. Study the relationship of gallstones types to some blood indicators and liver function tests

2. MATERIALS AND METHODS

This study was conducted from 1/5/2021 to 6/30/2021 on 66 people of both sexes who attended the Fezzan Clinic in Sebha City. They had their gallbladder removed, gallstones were collected. The stones were classified into three types depending on their color and degree of hardness. Black and dark brown as pigment stones , yellow and whitish stones were identified as Cholesterol stones, , and brownish yellow or green as mixed. Venous blood samples were collected from these persons by drawing 5 ml of blood by plastic syringe and 2 ml was placed in tubes containing EDTA anticoagulant for complete blood count test and the rest of the sample was placed in a tube containing no anticoagulant to obtain serum for the measurement of liver enzymes and total bilirubin. The enzyme activity in the serum was measured using ready-made kitts solutions prepared from Analyticon company, which is based on the method of measurement based on ultraviolet rays. Plasma bilirubin was measured with ready- kits from Analyticon company based on Jendrassik-grof method. The Micro Soft Office Excel and SPSS based on Windows 2007 program were used for statistical test. The probability was calculated at a significant level less than 0.05.

3. RESULTS

3.1. Gender and age

By studying the sex of the participants in this study, it was found that 6 samples (9%) were male and 60 samples (91%) were female, with mean age of 40.6 ± 12.7 years. To study the age group that most affected by gallstones, the participants in the study were divided into three age groups, based on the level of hormones during the different stages of life . The results showed that the age group less than 18 years old had 0 samples (0%), the age group from 19 to 45 years old had 46 samples (69.7%) and the age group over 45 years had 20 samples (30.3%).

3.2. Types of gallstones

Gallstones are classified into three types: pigmented, cholesterol, and mixed. Results of this study showed that 29 samples (44%) were pigmented stones, 21 samples (31.7%) were cholesterol stones, while 16 samples (24.2%) were mixed stones, as shown in Figure (3.1). The study also showed that 49 (74.2%) samples had more than one (multiple) stones, while 17 (25.8%) samples had one gallstone.

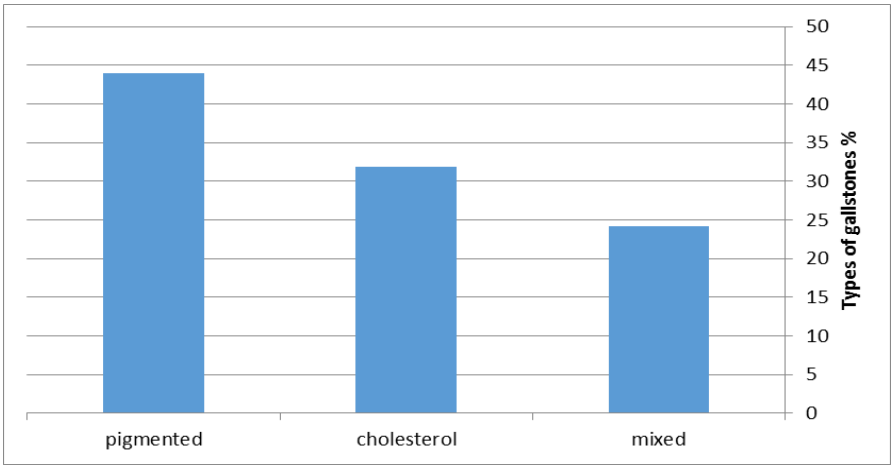

Figure 3.1: shows the percentage of types of gallstones.

3.3. Study of the hematological profile

The complete blood count was done for 66 samples, it was found that the mean hemoglobin concentration, WBC count and platelets count were 12.7 ± 1.7 g/dl, 7.2 ± 2.3 and 256.5 ± 78.8. respectively. as shown in Table No. (3.1).

According to WHO haemoglobin normal range, 41 (62.1%) of samples were found to have a normal haemoglobin concentration(Hb ≥ 12 g/dl) 13.6 ± 1.4 g/dl and 25 (37.9%) were found to have a low haemoglobin concentration(anemic) (Hb < 12 g/dl) 10.9 ± 0.7 g/dl.
The blood group were also investigated and found that 30 (45.5%)samples were from the blood group (O+), 19 (28.9%) samples were blood group (A+), 10 (15.1%) samples were from the blood group (B+), 3 (4.5%)samples were blood type (AB+), two samples(3%) were blood type (O-), one sample (1.5%) was blood type (B-) and one sample (1.5%) was blood type (A -).as shown in Figure (3.2).

Table 3.1: Haematological profile of 66 sample.

Parameter	result
Haemoglobin (g/dl)	12.2 ± 1.7
White blood cells (10^3 cells/mm^3)	7.2 ± 2.3
Platelets count (10^3cells/mm^3)	256.5 ± 78.8

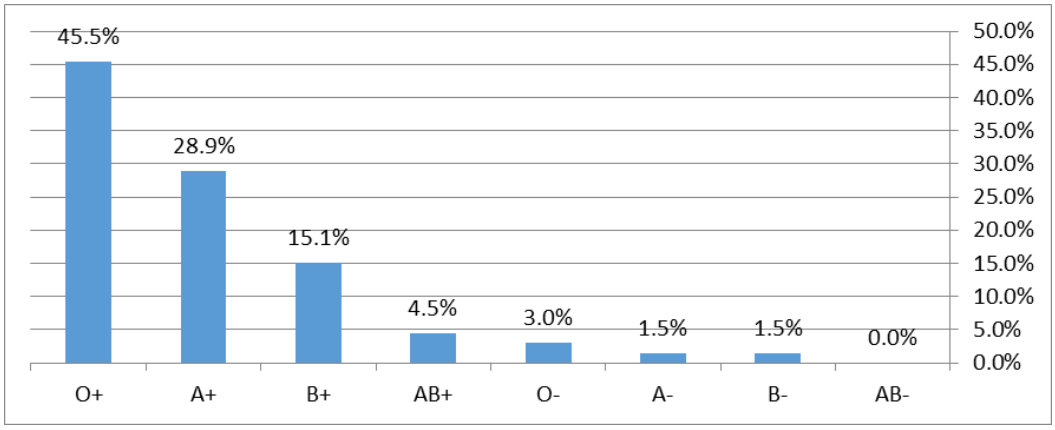

Figure 2.3: shows the percentages of the types of blood groups for the participating samples.

3.4. Liver function tests

The results of total bilirubin and liver enzymes showed that 25 samples are considered to be normal, which represents a 37.9 % of total samples. While 41 samples which represent 62.2% of the total samples had results higher than normal level (In one or more of the studied tests). Total bilirubin and SGOT were raised in 10 (15.1%) of the patients, SGPT was elevated in 18 (27.3%) patient while Alkaline phosphatase was found to be raised in 34 (51.5%). As shown in Table No. (3.2).

Table No. 3.2: showing the results of total bilirubin and liver enzymes.

Parameter	Normal	Abnormal	Normal range
Total bilirubin (TBILI) (g/dl)	N= 56 (84.9%) 0.7 ± 0.2	N= 10 (15.1%) 2.6 ± 0.9	<1.0 (g/dl)
GOT(U/L)	N= 56 (84.9%) 25.4 ± 13	N= 10 (15.1%) 126.5 ± 40.4	<40 (U/L)
GPT (U/L)	N= 48 (72.7%) 25 ± 9	N= 18 (27.3%) 61.7 ± 20.4	<40 (U/L)
Alkaline phosphatase (ALP) (U/L)	N= 32 (49.5%) 146.8 ± 36	N= 34 (51.5%) 297.2 ± 126.6	< 200 (U/L)

3.5. The results of the shape and texture of gallstones

By studying the morphology of gallstones, it was found that 24 samples (36.4%) had a regular shape, while 42 samples (63.6%) had an irregular shape. While 34 samples (51.5%) had a smooth texture and 32 samples (48.5%) had a rough texture as shown in Table No. 3.3.

Table No. 3.3: Showing The External Shape And Texture Of Different Types Of Gallstones.

Parameter	Parameter	Pigmented	Cholesterol	Mixed
External morphology N=66	Regular N=23 (34.8%)	N=9 (31%)	N=9 (42.8%)	N=5 (31%)
	Irregular N=43 (65.2%)	N=20 (69%)	N=12 (57.2%)	N=11 (69%)
External texture N=66	Smooth N=34 (51.5%)	N= 13 (44.8%)	N= 15 (71.5%)	N=6 (37.5%)
	Rough N=32 (48.5 %)	N=16 (55.2%)	N=6 (28.5%)	N=10 (62.5%)

3.6. The hematological profile and liver function for gallstones types

The statistical results showed that there were no significant differences of hematological profile, total bilirubin and (GPT) enzyme between the different types of gallstones as shown in Table No (3.4).

While statistical test showed a significant differences of (GOT) between pigmented and mixed gallstone (P = 0.001) and between Cholesterol and mixed gallstone (P=0.004). Also the result shown that, a significant differences of Alkaline phosphatase between pigmented and mixed gallstone (P = 0.043) and between Cholesterol and mixed gallstone (P=0.054). as shown in Table No (3.4).

Table No. (3.4) Showing The Hematological Profile And Liver Function Test For Gallstones Types.

Parameter	Pigmented	Cholesterol	Mixed
Haemoglobin (g/dl)	12.7±1.4	13±2	12.4±1
White blood cells(103cells/cmm)	7.4±2.6	7.3±2	6.7±2
Platelets count (103cells/cmm)	258±81.3	274±80	313±62
Total bilirubin (mg/dl)	0.75±0.3	0.7±0.3	0.7±0.2
Glutamic Pyrovate Transaminase	27.2±19 U/L	24.2±13	26.5±17
Glutamic Oxaloacetate Transaminase	24.4±9.3	28.1±12.2	$55±11^{*/\Delta}$
Alkaline phosphatase	231±110	223±94	$287±133^{*/\Delta}$

*= significant differences between pigmented and mixed gallstone

Δ= significant differences between cholesterol and mixed gallstone.

4. DISCUSSION

In this study, our findings have mainly shown that the females are more susceptible to gallstones than males, and this is consistent with other studies.[13-14] Female gender is one of the most important risk factors for developing gallstones and the rates of gallstones are two to three times higher among women.[15] Studies show that the increase in estrogen production, which leads to an increase the concentration of cholesterol and an increase in its generation in the bile, thus increasing the saturation of the bile with cholesterol.[16] The risk of developing gallstone disease occur as a result of hormone replacement therapy in postmenopausal women and oral contraceptives.[15] However, the effect of estrogen is dose-dependent, and newer low-dose estrogen oral contraceptives do not appear to increase the rate of gallstone formation.[17]

The results of the study showed that people under the age of puberty (18 years) are less likely to develop gallstones, while the incidence increases with increasing age after puberty. This is consistent with other studies.[18-19-20-21]

Hemoglobin concentration was studied and found that, Approximately 40% of the patient had have low hemoglobin level. Other study reported that, nearly half of the subjects have low hemoglobin level.[22] The reason for this may be due to the fact that bilirubin plays a key role in the formation of gallstones. And it is produced as a result of the breakdown of red blood cells (hemoglobin) and thus leads to a decrease in hemoglobin concentration. ABO and Rh blood group antigens play a pivotal role in transfusions due to their role in the safe management of transfusions.[23] In addition to various diseases associated with ABO blood groups, they also have been shown to be associated with metabolic processes such as metabolism of cholesterol.[24-25] According to our finding, blood group (O+) was mostly present in 45.5% of patients of gallstones followed by (A+). Blood group (A+) was found to be the mostly group among patients with gallstones followed by (O+).[26]

According to the classification on the color of gallstones, the results showed that pigment stones had the highest percentage, followed by cholesterol stones, and then the mixed stones. Pigment stones occur when red blood cells are broken down, resulting in an increase in bilirubin in bile. Pigment black stones are more common in patients with chronic hemolytic conditions such as thalassemia and sickle cell disease, in which the excretion of bilirubin is increased.[27-28] The results of this study disagree with[29-30-31], also with the study conducted in the city of Benghazi, Libya, which showed cholesterol gallstones were the highest among gallstones patient.[32]

The results of the study showed that most of the patients had multiple stones. One of the studies that agrees with this study found that, Most of the patient had multiple stones 384 (84.5%) while few had single stones 70(15.4%). On the contrary[34] found in his study that only 18 (39.1%) of the patients with multiple stones.

Liver function tests are one of the most important ways to diagnose liver disorders and whether they are affected by other diseases such as gallstones. In this study, abnormalities in liver function test was found in more than halfe (62.2%) of patients. Most of the abnormal samples in this study had an elevation in the alkaline phosphatase enzyme. This is consistent with the study of[22], which found that 50% suffering from an a increased in the enzyme. Enzyme elevation may be occurs as a result of post-hepatic jaundice (obstructive jaundice), which is produced as a result of blocked in the hepatic ducts as a result of gallstones. In our study, the subjects were predominantly female and the increase in alkaline phosphatase level may be due to increased bone variability or simultaneous bone formation in these females.[22-35]

Our study is considered one of the first studies conducted in southern Libya, which concluded that women are more affected by gallstones than men. And pigment stones are more prevalent and blood group type (O +) are more susceptible to infection. Also the study found that, there are abnormalities in liver function and hemoglobin concentration in stone patients. Finally, high light of these study, is recommendation that all patients should be undergo laboratory analyzes before surgery, and special attention should be given to the abnormal results. Our study also opens the field for discussions and should continue in more advanced and modified further studies based on our findings.

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