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(RESEARCH ARTICLE)

Role of ultrasound in the diagnosis of gallbladder disorders in KSA - Asian patients in associated of nationality and occupation

Sami Elgak [1, 2], Yousif Abdallah [1, 3, *] and Bahaaedin A Elkhader [4]

[1] *Department of Radiological Science and Medical Imaging, College of Applied Medical Sciences, Majmaah University, 11952, Majmaah, Saudi Arabia.*
[2] *College of Radiological Studies and Nuclear Medicine, National Rabit University, Khartoum, Sudan.*
[3] *Sudan University of Science and Technology, College of Medical Radiological Science, Elbaladi Street, 1908, Khartoum, Sudan.*
[4] *Department of Radiological Science, College of Applied Medical Sciences, Taif University, Taif 21944, Saudi Arabia.*

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Abstract

Background: Ultrasound is the important imaging investigation used to diagnose gallbladder and bile duct diseases.

Objectives: This study was undertaken to assess gallbladder disorders in Asian patients and the correlation of gallbladder disease among Saudis compared to other Asian nationalities in addition to the measurement of GB length, width and volume (cm 3) measured using the ellipsoid formula to assess morphology of biliary in concentration and after fatty meal in in Al-Majmaah Province of Saudi Arabia.

Materials and Methods: This was a cross-sectional descriptive analysis of 103 patients with gallbladder disorders from the Al-Majmaah Province of Saudi Arabia using SPSS statistical software.

Results: The gallbladder stone increased in female patient over 40 years (70%) (33 patients out of 47), while the incidence in female patients less than 40 years old (50%) (28 patients out of 56). This study also Reported that 59.2% is incidence of gallbladder stone, 37 patients (60%) out of the 61 patients with gallstones developed Calculous Cholecystitis 40% of the patient had Acalculous Cholecystitis. Symptoms and signs of the patients in study represented in the right upper quadrant RUQ pain 48.5%of patients, was found to be significantly larger in gallbladder stones. Increased incidence of gallstone among Drivers (80%) 8 drivers out of 10 developed gallstones. Also we can notice the increase of gallstones among the 8 female housewives out of 13, and also noticed that 8 out of 12 housemaid patients had incidence of gallstones.

Conclusion: The gall stone represent the high incidence disease compared with other gallbladder pathology. The Incidences of sludge polyp, Acalculous cholesystitis and carcinoma of gallbladder are relatively low. In KSA and according to this study the sign and symptoms of cholelithiasis and cholecystitis almost is RUQ pain.

Keywords: Ultrasound; Gallbladder Disorders; Saudi Arabia; Asian

* Corresponding author: Yousif Abdallah
Department of Radiological Science and Medical Imaging, College of Applied Medical Sciences, Majmaah University, 11952, Majmaah, Saudi Arabia.

1. Introduction

Liver diseases typically cause acute or chronic upper abdominal pain almost nearly in the upper right quadrant. Abdominal pain can also arise from abnormalities in the gall bladder, kidneys, pancreas, stomach, duodenum, spleen, etc. All these conditions can be easily detected by ultrasound [1-2]. Ultrasound is the first imaging investigations used to diagnose gallbladder and bile duct defects. This examination is non-invasive, can perform without dyes, and is not painful. Ultrasound provides clear images of the small ducts in the liver and the upper portion of the main bile duct [3-4]. Ultrasonography is the most useful imaging technique used to diagnose gallstone disease. It is safe, fast and relatively inexpensive and does not require exposure to radiation. It is the image of choice for patients with suspected biliary colic. Positive findings include stones, gallbladder wall thickening, pericholecystic [5-7]. Gallbladder stones are a common condition and are typically asymptomatic. Some patients have biliary colic, and sometimes sever pain in the epigastrium or upper right quadrant, and often between the scapula due to temporary obstruction of the cystic duct with a gallstone. If cystic duct obstruction continues, the patient may develop cholecystitis [8-9]. Cholecystitis was best diagnosed with ultrasound; images typically demonstrate the presence of gallstones, pericholecystic fluid, and a thickened wall of the gallbladder. In cases of symptomatic gallstones and negative ultrasound, endoscopic ultrasound can be helpful [10]. Tumors that develop in the gallbladder are either benign or malignant. Papillomas, adenomyomas, or polyps of cholesterol are associated with benign tumors. Whereas malignant tumors are rare, cholecystectomy tends to be warranted in patients with polyps greater than 10 mm [11-13]. If the gall bladder is not detected, a highresolution scan and a linear or linear array of frequency transducers is necessary. This minimizes the missing of tiny gallstones, particularly in the Gallbladder surface [14]. This measure includes the mucosa, the smooth muscle of the wall, the liver capsule and any tissue between the liver and the gallbladder. Normal measurements are taken in the transverse plane rather than in the longitudinal plane to eliminate any possibility of thickening due to measurement in the off-axis plane. The usual appearance of the wall is not regularly measured at those studies [1,15-16]. In this study, the goal is to see the incidence of different types of GB pathologies and to determine the accuracy of ultrasonography for the diagnosis of different gallbladder disorders. Ultrasound is the diagnostic method of choice. It is more sensitive and precise than CT or MRI, and although some studies report higher diagnostic accuracy with cholescintigraphy, ultrasound is still favored due to clinical preference and cost [17]. Ultrasound also has the benefit of being able to cause a "Sonographic Murphy Symptom" (SMS) that is tender when the ultrasound probe is pushed onto an inflamed gallbladder (and a major symptom of cholecystitis). It is critical to provide an accurate imaging modality for acute calculous cholecystitis to ensure early intervention to avoid complications. It is also important to avoid unnecessary care in the event of false positive findings (such as invasive surgery). While the diagnostic specificity of ultrasound has been reported to be as high as 95-99 %, the sensitivity values vary from 84-97 % [18-19]. There could be significant implications for a false negative result in someone who has acute calculus cholecystitis. Any of the reasons for a false negative may be difficulties in producing SMS due to the patient's body habitus, high intercostal location of the gallbladder fossa, obscuring intestinal gas, and operator or diagnostic error. Despite a negative result, many patients will continue to have emergency cholecystectomy. This judgment is also based on clinical suspicion and excludes other pathologies. Following cholecystectomy, acute cholecystitis can then be confirmed by pathology by macroscopic and histological examination, which is the gold standard for diagnosis. Ultrasound results in acute calculous cholecystitis often involve one or more of the following: gallstone(s), gallbladder wall thickening (> 3 mm), positive SMS, and secondary; hyperaemia and pericholecystic fluid [20-22]. Since gallstones are common, the presence of a stone is not necessary to diagnose acute calculus cholecystitis. Many ultrasound sensitivity and specificity findings cited in the reviews are from studies performed. Latest ultrasound devices have a resolution that is wide enough to detect stones as small as 2 mm in diameter and thus the diagnostic accuracy of ultrasound could be higher than is generally reported [23-27].

2. Material and methods

The study population consisted of patients (20-65 years) presenting at several clinics in Majmaah-KSA during the period from December 2019 to July 2020. The procedure for ultrasound scanning has been explained to the patient and the purpose of incorporating the data into the study. The data was collected using the following variables; Size and texture of gallbladder, Gallbladder wall measurement, Murphy sign, Patient's age, gender and residence, Association of other Pathology. Data was presented as average ± SD in the form of comparison tables. Statistical analysis was carried out using the Standard Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 19.ANOVA and the Person Correlation, Independent T-Test was used. Correlation is significant at the $p<0.05$. Special consideration was given to the right of confidentiality and anonymity of all participants. Anonymity was achieved by using the number for each patient to provide a link between the information collected and the patients. In addition, confidentiality was obtained by making the data collected accessible only to the researcher. Justice and human dignity have been viewed equally by teaching the selected patient an opportunity to participate in the research.

2.1. Machine used

All examinations were carried out with high-resolution ultrasound machine Siemens diagnostic ultrasound model Acuson X-300 and Medison diagnostic ultrasound machine model Accuvix V20, standardized trans-abdominal scan using curvilinear transducer 3.5 MHZ.

2.2. Standardized imaging protocol

Patient preparation Ultrasound examination of the gallbladder and biliary tree should be performed in fasting patients who should not eat or drink anything at least 6-8 hours prior to ultrasound examination for the following reasons: 1) ingestion of food may stimulate the gallbladder to contract and expel bile into duodenum, which makes the gallbladder smaller and the wall thicker than the gallbladder. However, the examination may also be carried out in emergency situations, even if the gall bladder is partially contracted. It is also recommended that the patient be encouraged not to smoke for 6–8 h prior to the ultrasound examination, as there is some evidence that smoking can reduce the image quality to scan the upper abdominal structures and some chemicals in tobacco may cause contraction of the gall bladder, even after fasting. Also we measured gallbladder volumes after the patients ate a fatty meal (fried egg cake).

2.3. Patient history and physical examination

Before the ultrasound examination, clinical data was taken, a short history of the patient and palpating of the abdomen recommended. A convex multifrequency transducer (1-5 MHz) is often ideal for the examination of the gallbladder. However, a linear transducer (5-9 MHz) may also be used to evaluate a very superficial gall bladder to optimize image quality, for example in very slim patients. The lower frequency is often used in obese patients or when the gall bladder is deep.

2.4. Patient position

Supine and left lateral decubitus are the most commonly used positions for the examination of the gall bladder. The ultrasound examination started in the supine position and continued in the left posterior oblique or left lateral decubitus, the latter two positions may cause the liver and the gall bladder to rotate intermediately under the influence of gravity, and this optimize the use of the liver to image the gall bladder through the acoustic window or make the gall bladder easier to reach below the thoracic cage. Prone or standing positions used to demonstrate the mobility of gall bladder sludge or stones. The gall bladder scanned with the right subcostal oblique, intercostal sections. The right subcostal section is often first attempted and is also the most effective. Placing the probe in longitudinal orientation and angling the probe, the scan is performed along the ribs while the patient is asked to take a suspended full inspiration. There are several useful landmark structures, the first being the interlobar fissure, which appears as an echogenic line extending from the neck of the gall bladder to the portal vein. The gall bladder is located below or laterally to the fissure (between the IV and V segments of the liver). Other landmarks include the edge of the right hepatic lobe and the hilum of the liver. To scan the intercostal section of the gall bladder, the probe is placed perpendicular to the Skin between the ribs. Generally, the gall bladder is detected posterior to the parenchyma of the liver immediately below the probe. In the few instances where the gall bladder is not identified, the probe moved sideways, sweep through the liver, and the landmarks mentioned above are useful as well. In a typical stenic patient, the transducer positioned in the mid-clavicular line on the anterior abdominal wall and the position of the transducer adjusted until the gall bladder is positioned. And used the liver as an acoustic window and avoid scanning through the intestine by cranial angling. In order to cause the gall bladder to descend below the lower costal margin, the patient asked to take a suspended full inspiration. With any of the sections, once the gall bladder has been found, stop moving the probe and make small adjustments to achieve the best long-axis view. In the long-axis section, the gall bladder usually appears to be an anechoic, pear-shaped structure with a hyperechoic wall. It is essential to sweep the transducer through the entire gall bladder in its entire long axis, as this is a three-dimensional structure. After scanning the biliary bladder in the long-axis, the transducer rotated through the biliary bladder through 90 ° to represent the biliary bladder in its short-axis section. Again, the transducer angled (cranial caudal) to the image of the gall bladder in its entirety. The size, thickness of the wall and the content of the gall bladder should be subjectively assessed. Frequency increased (or depth reduced) to improve resolution. It should measure 10 × 2–4 × 2–4 cm in a fasted state, but this depends on the volume of bile present. Typical volume of bile is usually 40–60 ml, measured by rotating ellipsoid. However, the estimation of the volume of gall bladder is highly unreliable as it shows wide intra-and inter-operator variability. It is recommended to measure the anterior wall of the gall bladder. And it is important to obtain a view while the ultrasound beam is perpendicular to the gall bladder wall, as the thickness may be falsely raised if the oblique section of the wall is measured. The normal gall bladder wall is thin, smooth and slightly echogenic, with a normal thickness of 1–3 mm. There is no pericholic fluid in the normal state around the gall bladder.

3. Results and discussion

This was cross sectional study done in Saudi Arabia to assess gallbladder disorders in Asian patients and the correlation of gallbladder disease among Saudis compared to other Asian nationalities, the study done in 103 patients, after data collection, it was analyzed by SPSS and the following are the results:

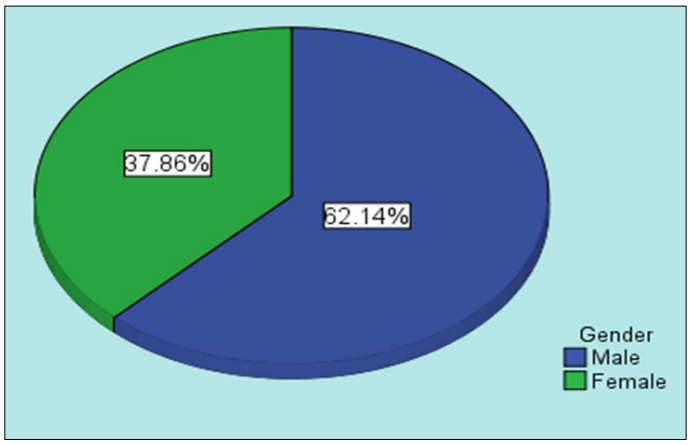

Figure 1 Gender distribution

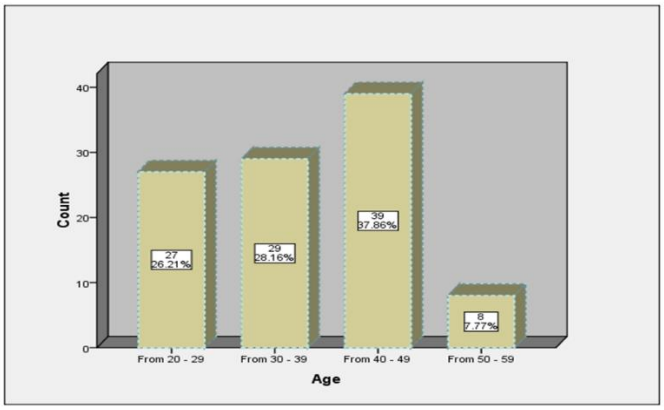

Figure 2 Frequency distribution according to age group

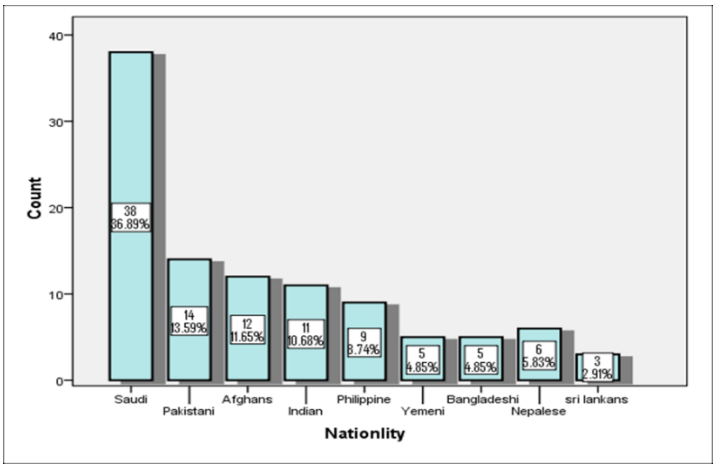

Figure 3 Frequency distribution according to nationalities

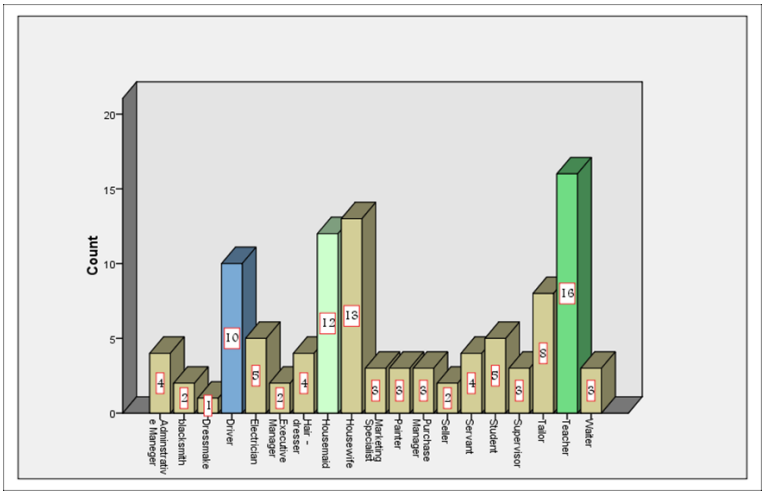

Figure 4 Frequency distribution according to Occupation

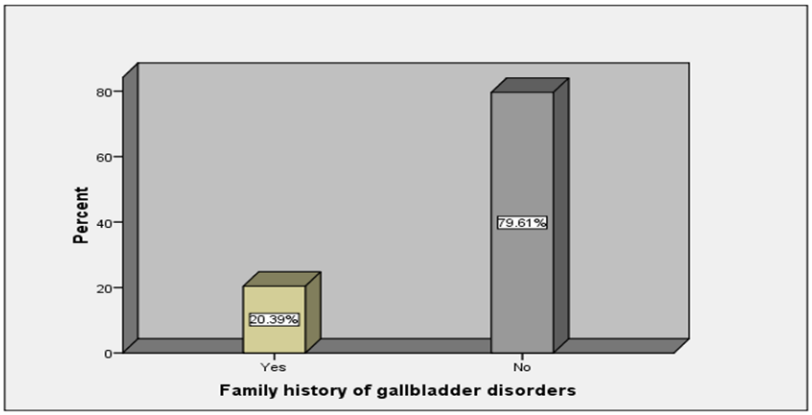

Figure 5 Family history of gallbladder disorders

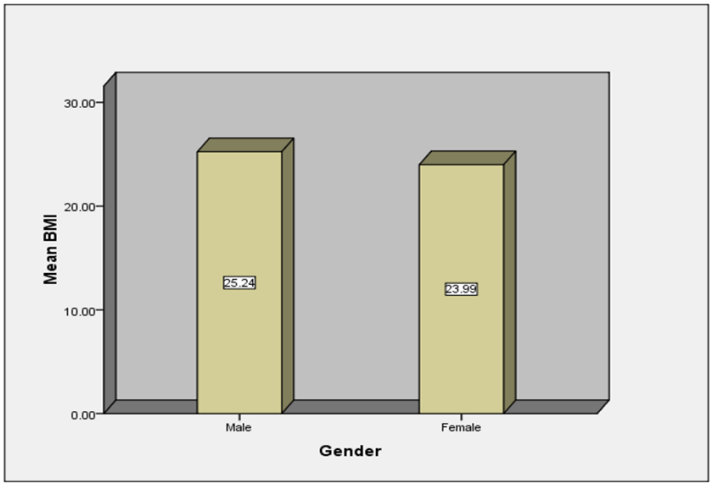

Figure 6 The mean of BMI

Table 1 Correlation between Cholecystitis of gall bladder and RUQ pain

		Cholecystitis	RUQ pain
Cholecystitis	Pearson Correlation	1	0.362**
	Sig. (2-tailed)	0.00	0.000
	N	103	103
RUQ pain	Pearson Correlation	0.362**	1
	Sig. (2-tailed)	0.000	0.00
	N	103	103

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 Correlation between Cholecystitis of gall bladder and Gall stone

		Gall stone	Cholecystitis
Gall stone	Pearson Correlation	1	0.292**
	Sig. (2-tailed)	0.00	0.003
	N	103	103
Cholecystitis	Pearson Correlation	0.292**	1
	Sig. (2-tailed)	0.003	0.00
	N	103	103

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3 RUQ pain * Gall stone Crosstabulation

Count		Gall stone		Total
		Yes	No	
RUQ pain	Yes	46	9	55
	No	15	33	48
Total		61	42	103

Table 4 Age * Gall stone Cross tabulation

Age group (years)		Gall stone		Total
		Yes	No	
Age	20 - 29	13	14	27
	30 - 39	15	14	29
	40 - 49	26	13	39
	50 - 59	7	1	8
Total		61	42	103

Table 5 Frequency distribution of Gall stone

	Frequency	Percent
Gall bladder stone		
Yes	61	59.2
No	42	40.8
Cholecystitis		
Yes	50	48.5
No	53	51.5
Biliary Sludge		
Yes	23	22.3
No	80	77.7
Gallbladder Polyp		
Yes	16	15.5
No	87	84.5
Total	103	100.0

The results of this showed that 64 of them were male (62.14%) and 39 were female (37.86%) as displayed in Figure (1). In figure (3) Frequency distribution according to nationalities denoted by percentile where Saudi 38 (36.9%), Pakistani 14 (13.6%), Afghans 12 (11.7%), Indian 11 (10.7%), Philippine 9 (8.7%), Yemeni 5 (4.9%), Bangladesh 5 (4.9%), Nepalese 6 (5.8), Sri Lankans 3 (2.9%). Marketing Specialist 3 (2.9%), Painter 3 (2.9%), Purchase Manager 3 (2.9), Seller 2 (1.9). In figure (4) occupation of the patient affect extremely occurrence of the gall bladder disorders denoted by percentile where Administrative Manager 4 (3.9%), blacksmith 2 (1.9%), Dressmake 1 (1%), Driver 10 (9.7%), Electrician 5 (4.9%), Executive Manager 2 (1.%), Hair – dresser 4 (3.9%), Housemaid 12 (11.7), Housewife 13 (12.6%), Marketing Specialist 3 (2.9%), Painter 3 (2.9%), Purchase Manager 3 (2.9), Seller 2 (1.9), Servant 4 (3.9%), Student 5 (4.9%), Supervisor 3 (2.9%). Symptoms and signs of the patients in study represented in the right upper quadrant RUQ pain 48.5%of patients, was found to be significantly larger in gallbladder stone (46 patients) as mentioned in Table (1) and Table (2). The mean BMI was 24.76 (±1.954.), gall stone was found to be significantly larger in drivers compared to other occupations. This study also Reported that 59.2% is incidence of gallbladder stone, 37 patients (60%) out of the 61 patients with gallstones developed calculous cholecystitis 40% of the patient had acalculous cholecystitis. Comparing with other report "90 to 95% of acute cholecystitis patients have cholithiasis, the remaining 5% to 10% have acalculous cholecystitis" the current study found that less percentage with the calculous.

The gallbladder wall thickening due to other causes rather than presence of gallstones (fibrosis\ascites) appears in 13% sludged gallbladder without gallstones some cases confirmed with CT imaging. The gallbladder stone increased in female patient over 40 years (70%) (33 patients out of 47), while the incidence in female patients less than 40 years old (50%) (28 patients out of 56) as mentioned in Table (2). So gallstones are common in women as in men and this particularly so before the age of 40. In this study the number found to be 64 males' 39 females also show the increased incidence of gallstone among Drivers (80%) 8 drivers out of 10 developed gallstones. Also we can notice the increase of gallstones among the 8 female housewives out of 13, and also noticed that 8 out of 12 housemaid patients had incidence of gallstones. The previous study carried out in specific occupations only. Patients undergoing emergency or elective abdominal ultrasonography at King Khalid Hospital, the largest tertiary hospital in the Hail area of Saudi Arabia, were examined retrospectively between January 2013 and December 2013 to determine the prevalence of gallbladder disease as assessed by ultrasonography and its complications in Hail City, Saudi Arabia. Results: Of the 4552 patients examined, 494 (10.9%) had gallstones. Of these 494 patients, 173 (35%) were male, 321 (65%) were female and 337 (68.2%) were > 35 years of age. Three hundred and twenty-six patients (66%) had multiple stones, while 168 patients (34%) had single stone. Marked and mild wall thickening was observed in 180 (36.4 percent) and 155 (31.4 percent) patients, respectively. Common bile duct dilation was present in 36 patients (7.3%), 106 patients (21.5 per cent) had fatty liver, 36 patients had hepatomegaly (7.3%), 20 patients had cirrhosis (4%) and 21 patients had ascites (4..3%). Of the 494 patients, 335 (67.8%) were symptomatic. Saudi females had the highest incidence of gallbladder disease

(60.1%) followed by Saudi males (31.6%), non-Saudi females (4.9%) and non-Saudi males (3.8%). The conclusion of that study, the prevalence of gallbladder disease in Hail City was higher than in other cities in Saudi Arabia [34].

A further study was performed to determine the chemical composition of gallstones in patients living in Al-Jouf Province of Saudi Arabia. The findings indicate that gallstones in the province of Al-Jouf occur more commonly in the age group of the third decade of life, with a higher risk among females than males, and that cholesterol is predominant along with calcium bilirubinate and calcium carbonate [36]. A retrospective research was performed at King Abdulaziz University Hospital to discuss the procedure for ultrasound scanning to show the occurrence and complication of Gallbladder (GB) pathologies. Established cases of GB pathologies (100 patients) were examined by Ultrasound using spatial digital iU22 Philips Convex probe 3.5 MHz. All patients were examined with ultrasound following international scanning guidelines and protocols. Patients are between (9-90) years of age, 68 patients (68%) were female, and 32 patients (32%) were male. The age range of accumulation for gallstone presence was (35-50) years in females and over 50 years in males. The incidence of gallbladder pathologies is 59% (female 46% and 13% male). The incidence of gallstone is 37% and the ratio of incidence is 1:3 between male and female. Other pathologies of gallbladder were acute cholecystitis at 12%, chronic cholocystitis at 5%, sludge at 2%, Gallbladder carcinoma at 1%, Gallbladder polyps at 1 %, and Emphysematous cholecystitis at 1%. Ultrasonography is a single imaging modality appropriate for the assessment of patients with suspected gallbladder pathologies (gallstone) that can provide information about the existence of gallstone and more about the location and cause of biliary tract obstruction. Ultrasound is extremely susceptible sensitive and specific means for diagnosis of the gallbladder disorders [37]. Another study carried to conduct a sonographic assessment of the size of the gall bladder in normal adults in 300 healthy adult volunteers, involving 160 males and 140 females, was selected and ultrasound performed after overnight fasting. The length , width, height and thickness of the gall bladder were calculated for these subjects. The Gall Bladder volume was modeled using an ellipsoid formula. Statistical significance among the variables was performed with the Students t-test by means of a 'P' value of ≤0.05. Results: The average age of cases was 31.92 ± 11.7 years. The mean values for the length (L), height (H) and width (W) of the gall bladder were 6.19±1.09 cm; 2.58±0.58 cm; and 2.82±0.59 cm , respectively. The mean gall bladder volume was 26.8±12.8 cm^3 and the wall thickness was 0.34±0.04 cm. Age and gender did not have a major impact on the measurement of the gall bladder [35].

4. Conclusion

The gall stone represent the high incidence disease compared with other gallbladder pathology. Other gallbladder diseases developed due to presence of gallstones like the calculus cholyesistitis and the gallbladder wall thickening. Incidences of gallbladder pathologies such as sludge polyp, Acalculous cholesystitis and carcinoma of gallbladder are relatively low. The characteristic relation between, female's housewives and gallstones, the proportional relation between age and gallbladder stone. In KSA and according to this study the sign and symptoms of cholelithiasis and cholecystitis almost is RUQ pain. Our findings support the hypothesis that increased gallbladder contraction after gastric or fatty meal distension may be associated with dyspeptic symptoms in uncomplicated gallstone disease; these findings may be useful in differentiating functional dyspepsia from gallstone dyspepsia

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interest

Statement of informed consent

Special consideration was given to the right of confidentiality and anonymity of all participants. Anonymity was achieved by using the number for each patient to provide a link between the information collected and the patients. In addition, confidentiality was obtained by making the data collected accessible only to the researcher. Justice and human dignity have been viewed equally by teaching the selected patient an opportunity to participate in the research. The Informed consent was obtained from all individual participants included in the study.

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