

Sudan University of Science and Technology
College of Graduate Studies

Characterization of Acute Cholecystitis Using
Ultrasonography

توصيف التهاب المرارة الحاد باستخدام التصوير بالموجات فوق الصوتية

Thesis Submitted for Partial Fulfillment for the Requirements of
M.sc Degree in Medical Diagnostic Ultrasound

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2017

الاية

قال تعالى:

وَقَدْ عَلِمْتُمُ ابْنَ مَرْيَمَ إِذْ قَالَ لِلَّهِ رَبِّي اعْنِمْ لِي ذَرَّةً ذَرَّةً

سورة طه ، آية (144)

Dedication

I dedicated this work to:

- My father and mother
- My sister and brothers
- My husband, sons and daughter
- My friend
- All Academics who helped me
- My colleagues

Acknowledgement

I would like to thank Dr. Ahmed Mostafa Mohamed ,my supervisor for his kind advice, true guidance, great help and valuable critics, my thanks extend to Dr.awadia qarib allah

Thanks also to my sister salma sirag and my friend Myada Ali Albasheer for encouragement and support.

Abstract

This was a descriptive cross sectional study carried out during the period from September 2016 to March 2017. This study was conducted in Khartoum state, Sudan, in the ultrasound departments of Dar Al-Elaj specialist hospital and Ribat National hospital.

The study aimed to characterize the acute cholecystitis. 50 patients with clinical suspected of acute cholecystitis (37 female and 13 male) were enrolled in the study.

The study revealed an increased incidence of cholecystitis in female patients. Furthermore, (26.0%) were males and (74.0%) were females, the majority, (74.0%) had acute calculous cholecystitis and the rest 13 out of 50 (26.0%) were Acalculous cholecystitis.

المستخلص

أجريت هذه الدراسة في ولاية الخرطوم - السودان باقسام الموجات فوق الصوتية بمستشفى دار العلاج التخصصى ومستشفى الرباط الوطنى

. تكمن مشكلة البحث في ان تزايد حالات التهاب المرارة الحاد و ضرورة التشخيص و العلاج المبكر حتى نقلل من حطورة مضاعفات المرض التي يمكن ان تؤدي الى الوفاة . الهدف من هذه الدراسة هو تأكيد دور و أداء الموجات فوق الصوتية في تشخيص التهاب المرارة الحاد . هذه الدراسة دراسة وصفية ، مقطعية أجريت في الفترة من سبتمبر 2016م حتى مارس 2017م . تم جمع البيانات ، تصنيفها وتحليلها بواسطة برنامج الحزم الإحصائية للعلوم الاجتماعية . تم جمع البيانات من 50 مريض حضروا لقسم الموجات فوق الصوتية بأعراض التهاب المرارة الحادو قد كان عدد النساء 37 مريضة و الرجال 13 مريض. و قد تراوحت أعمارهم بين 30-80 سنة.

افادت الدراسة أن التهاب المرارة الحاد مع حصوة المرارة هو الاعلى نسبة من التهاب المرارة الحاد من غير حصوة. كذلك توصلت الدراسة الى أن الموجات فوق الصوتية ذات درجة عالية من الدقة في تشخيص زيادة سمك جدار المرارة، زيادة حجم المرارة، و الالم الحاد في منطقة الالتهاب.

و قد خلصت الدراسة الى ان للموجات فوق الصوتية دور عظيم و قيم في زيادة الدقة لتشخيص حالات التهاب المرارة الحاد و ان استخدام الموجات فوق الصوتية في تشخيص التهاب المرارة الحاد يؤدي الى نقص معدل التشخيص الخاطئ السالب و تزيد من دعم مخرجات التشخيص .

أوصت الدراسة بضرورة توفر خدمة الموجات فوق الصوتية بالمستشفيات على مدى 24 ساعة لأن التهاب المرارة الحاد من الحالات الطارئة.

Table of Contents

الاية.....	i	
Dedication	ii	
Acknowledgement.....	iii	
Abstract	iv	
المستخلص	v	
List of tables:.....	vii	
List of abbreviations:.....	ix	
Chapter One: Introduction		
1.1 Introduction:	1	
1.2 Problem of the study:	2	
1.3 Objectives:.....	2	
1.4 Over view of the study:	2	
Chapter two: Literature review and Theoretical background		
2.1 Anatomy:	3	
2.2 Gallbladder physiology:	8	
2.3 Gallbladder Pathology:.....	9	
2.4 Methods of diagnosingacutecholecystitis:	12	
2.5 Sonographic appearance of the gall bladder with acute cholecystitis:	13	
2.6 Previous studies:.....	18	
Chapter three: Materials and Method		20
3.2.2 Data collection:	21	
3.2.3 Data analysis:	21	
Chapter Five: Discussion, conclusion and recommendations		
5.1 Discussion:	30	
5.2 Conclusion:.....	32	
5.3 Recommendations:	33	
<u>5.3</u> References:	34	
5.3 Appendices.....		

List of tables:

No.	Title	Page No.
4-1	Frequency distribution according to gender	22
4-2	Frequency distribution according to residence	23
4-3	Frequency distribution according to Diabetes	23
4-4	Frequency distribution according to Jaundice	24
4-5	Frequency distribution according to Ascites	25
4-6	Frequency distribution according to PHT	25
4-7	Frequency distribution according to Gall stone	25
4-8	Frequency distribution according to Wall thickness	26
4-9	Frequency distribution according to Murphy sign	27
4-10	Frequency distribution according to Distension	27
4-11	Frequency distribution according to pericholecystic fluid	27
4-12	Frequency distribution according to final Diagnosis	28

List of Figures

No.	Content	Page
2-1	Gallbladder Anatomy	4
2-2	Gallbladder physiology	14
2-3	Gallbladder Pathology	15
2-4	Methods of Diagnosing acute cholecystitis	15
2-5	Sonographic appearance of the gall bladder with acute cholecystitis	16
2-6	previous studies	16
4-1	Frequency distribution according to gender	22
4-2	Frequency distribution according to diabetes	24
4-3	Presence of gall stone	26
4-4	Sonographic final Diagnosis	29

List of abbreviations:

AC	Acute cholecystitis
GB	Gall Bladder
PHT	Portal Hypertension
PV	Portal Vein
RUQ	Right Upper Quadrant
UQP	Upper Quadrant Pain

Chapter One

Introduction

Chapter One

Introduction

1.1 Introduction:

Acute cholecystitis occurs as a result of inflammation of the gall bladder wall, usually caused by impaction of gallstone in the gall bladder neck obstructing the gall bladder. 90 to 95% of acute cholecystitis patients have cholelithiasis (acute calculous cholecystitis), the remaining 5 to 10% have acute acalculous cholecystitis (Center, 2009).

Acute emphysematous cholecystitis is another form of acute cholecystitis characterized by the presence of gas within the wall and/or lumen of the gall bladder. It occurs more commonly in diabetic men and less frequently in association with cholelithiasis (Jones et al., 1976).

Emphysematous cholecystitis is considered either a complication of Ac or a separate entity. The patient presents with fever, leukocytosis, biliary colic and right upper quadrant (RUQ) pain, the pain often begins after fatty meal. Risk factors for cholecystitis mirror those for cholelithiasis and include increasing age, female sex, certain ethnic groups, obesity or rapid weight loss, drugs, and pregnancy (Cwik et al., 2013).

Complication of acute cholecystitis includes emphysematous, perforation, pericholecystic abscess, and development of empyema.

Ultrasound significantly aids in the diagnosis of acute cholecystitis, ultrasound is more sensitive and specific methods in diagnosing the gall bladder stones, gall bladder texture and gall bladder wall thickness, Murphy sign.

Ultrasound findings of acute calculous cholecystitis are gall stone, gall bladder wall thickness > 3 mm, positive sonographic Murphy sign and distension of gall bladder (Hwang et al., 2014).

Ultrasound findings of acute a calculous cholecystitis are gall bladder wall thickness > 3 mm, positive sonographic murphy sign, pericholecystic fluid and intraluminal gas or membrane(Singh et al., 2014).

1.2 Problem of the study:

Increasing the incidence of acute cholecystitis, and importance of early diagnosis for easy management to prevent the occurrence of complications.

1.3 Objectives:

1.3.1 General objective:

To characterize acute cholecystitis using ultrasonography.

1.3.2 Specific objectives:

1. To identify the main sonographic findings in acute cholecystitis.
2. To find out the correlation between acute cholecystitis and gender.
3. To find out the correlation between acute cholecystitis and age.
4. To find out the main complications of acute cholecystitis.

1.4 Over view of the study:

This study was concerned with characterize of acute cholecystitis sonographically. Using gall bladder texture and gall bladder wall thickness, murphy sign, analysis accordingly it falls into five chapters.

Chapter one is an introduction which include introductory notes on acute cholecystitis causes and complications, role of ultrasound as well as the problem and objectives, while chapter two include gall bladder anatomy, physiology and pathology, chapter three deals with the methodology, were it provides of material and methods used to acquire the data in this study as well as the methods analysis approach.

While the results were presented in chapter four and finally chapter five include discussion of the results conclusion and recommendation followed by references and appendices.

Chapter two

Literature review and Theoretical
background

Chapter two

Literature review and Theoretical background

2.1 Anatomy:

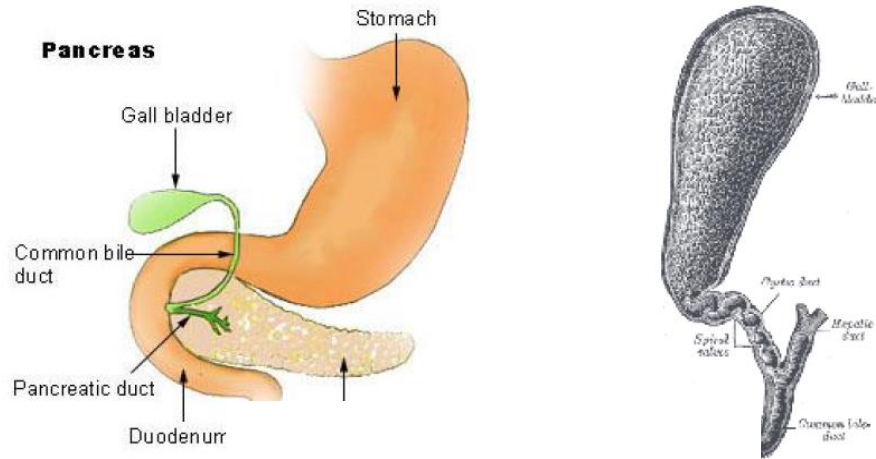
The gallbladder is a pear-shaped organ which lies on the visceral inferior surface of the liver between segments IV and V of the liver. The first and second parts of the duodenum lie behind it and the transverse colon lies below. It is covered with peritoneum except where it is adherent to a depression in the liver surface known as the gallbladder fossa. The expanded lower end of the gallbladder, or fundus, may or may not project beyond the inferior border of the liver in the region of the right ninth costal cartilage and the body of the organ narrows to form the neck which terminates in the cystic duct. The dilated area proximal to the junction of the neck and cystic duct is known as Hartmann's pouch. The cystic duct arises from the neck of the gallbladder and joins the common hepatic duct. It is typically of 1-3 mm diameter although may be much wider in some individuals. The mucosa is arranged in spiral folds known as the valve of Heister. It most frequently is 3-4 cm in length and joins the common hepatic duct at a slight angle (Patton, 2015).

The main blood supply to the gallbladder is provided by the cystic artery, which arises from the right branch of the hepatic artery posterior to the common hepatic duct. The cystic artery runs above and behind the cystic duct to reach the neck of the gallbladder where it divides into an anterior and a posterior branch. The gallbladder also receives a variable blood supply from the liver through its bed.

A major portion of the venous drainage passes directly to the liver through the gallbladder fossa but veins may be seen around the cystic artery and these drain directly into the portal vein (Patton, 2015).

The cystic lymph node lies adjacent to the cystic artery where it meets the gallbladder wall, and is therefore a useful landmark during cholecystectomy.

Lymph from the gallbladder and bile ducts passes through the cystic node and into other hepatic nodes in the edge of the lesser omentum.



Richards Snell clinical anatomy

2.1.2 Bile ducts:

The right and left hepatic bile ducts fuse at a variable distance below the liver to form the common hepatic duct. The area between the common hepatic duct which lies within the edge of the lesser omentum, the liver and the cystic duct, is called Calot's triangle. Its contents are the cystic artery and lymph node and its accurate identification and dissection are crucial to the safe performance of cholecystectomy. (Calot actually described the triangle lying between the cystic artery, cystic duct and hepatic duct but the above description is the one usually referred to and of more practical relevance (Patton, 2015 #1327).

The hepatic artery lies on the left of the common hepatic duct and the portal vein lies posteriorly. The cystic duct joins the common hepatic duct to form the common bile duct approximately 2cm above the duodenum. As it passes behind the first part of the duodenum and the head of the pancreas the bile duct loses its peritoneal covering, and it enters the duodenum through the posteromedial wall to join the main pancreatic duct within the ampulla of

Water, which then opens into the duodenum via a papilla in the second part of the duodenum approximately 10cm beyond the pylorus. Circular muscle fibers are present around the terminal portion of the bile and pancreatic ducts and their confluence at the ampulla. The combination of all these sphincteric mechanisms is known as the sphincter of Oddi (Patton, 2015).

The blood supply to the bile ducts is complex and branches are received from the gastroduodenal, hepatic and cystic arteries, as well as the coeliac and superior mesenteric vessels. Two vessels run along the lateral borders of the supraduodenal segment and 60% of their blood supply is provided from arteries below, mainly from the retroduodenal and retroportal vessels. The right hepatic artery provides most of the blood supply of the main bile duct from above and only 2% of the blood is derived from the common hepatic artery. This arrangement of the blood supply suggests that bile duct damage during surgery can be minimized by restricting dissection at the lateral margins of the common bile duct so as to avoid damaging the axial vessels. Flush ligation of the cystic duct on the common bile duct is also best avoided for the same reason. Anastomotic complications after transplant surgery may also be related to arterial damage (Saladin, 1998).

The nerves to the extrahepatic bile ducts are derived from segments 7-9 of the thoracic sympathetic chain and from the parasympathetic vagi. Afferent nerves which include pain fibers from the biliary tract run in sympathetic nerves and pass through the coeliac plexus and the greater splanchnic nerves to reach the thoracic spinal cord via the white rami communicants and dorsal ganglia. The preganglionic efferent nerves from the spinal cord relay with cell bodies in the coeliac plexus and the post-ganglionic fibers run with the hepatic artery to supply the biliary tract. A small contribution of pain afferents may travel within the right phrenic nerve and peritoneum below the right diaphragm. These fibers may account for the radiation of gallbladder pain to the right shoulder tip during attacks of gallstone colic. Vagal fibers

supply the hilum of the liver and the bile ducts. Although vagal stimulation results in gallbladder contraction and relaxation of the sphincter of Oddi, the effects are overshadowed by the action of gastrointestinal hormones such as cholecystokinin (Saladin, 1998).

2.1.3 Variations and anomalies of Gallbladder:

The gallbladder may rarely be absent or rudimentary, and when this occurs it may be associated with other congenital anomalies such as tracheo-oesophageal fistula or imperforate anus. Left-sided or intrahepatic gallbladders and double and triple gallbladders have also been reported. Discovery of duplications at operation, usually by operative cholangiography, should be followed by removal of both gallbladders. A second operation may be necessary later if only one organ is removed. The gallbladder may be abnormal in structure, for example the body may be divided completely or partially by a septum. Complete division may result in two separate cavities fused at their necks to form a single cystic duct or they may drain by two separate ducts. Partial separation of the fundus from the body seen at surgery or during pre-operative imaging is known as a Phrygian cap, and is caused by a localised thickening of the gallbladder wall. It is of little significance and gallbladder function is usually normal. Complete investment of the gallbladder with peritoneum can predispose to torsion around its associated mesentery, particularly when this is restricted to the neck of the organ so that the body and fundus remain free. Bile ducts

Major variations in bile duct anatomy are common, and their frequency has been analyzed in a large series of operative cholangiograms. The most important anatomical variations from an operative viewpoint are those pertaining to the cystic duct. The most important, and potentially dangerous, variations involve different types of right sub-segmental ducts and their drainage into the biliary tract via, or close to, the cystic duct.

A few examples of the commoner variations include:

A high insertion of the cystic duct into the region of the common bile duct bifurcation (3.1%).

An accessory hepatic duct, defined as a separate channel draining a segment of the right lobe of the liver into the common hepatic duct, cystic duct or gallbladder. The incidence is between 1 and 4% and it may be the only drainage from the relevant segment. An injury can easily occur to these ducts during cholecystectomy and may result in partial or total occlusion of a portion of the biliary tract as there is a lack of interductal communications within the liver.

The cystic duct entering the right hepatic duct. This is an uncommon variation (0.2%), but increases the risk of transection or ligation of the right duct during surgery(Center, 2009).

The right and left hepatic ducts may join the common hepatic duct in a variable manner, and occasionally this junction may be truly intrahepatic. The right duct occasionally fuses with the cystic duct.

Duplication of the cystic ducts is very rare. Intraoperative cholangiography is used for the recognition of these anomalies. Accessory ducts may be tied off if small, but larger ducts should be preserved and implanted into a Roux loop if necessary. Bile peritonitis or fistula may be a consequence of the unrecognized division of such a duct. Anomalies of the common bile duct itself are very rare but ectopic drainage of accessory ducts into the stomach has been described on five occasions, including an original report by Vesalius in 1543. The anomaly has been associated with symptomatic biliary gastritis. Occasionally during cholecystectomy an accessory duct (or ducts) is encountered in the gallbladder bed — a duct of Luschka. When missed these ducts may present as bile leaks in the post-operative period. Once thought to be intrahepatic ducts draining directly into the gallbladder, anatomical studies and the common finding of two transected ducts confirms that they are segmental or sub-segmental ducts lying superficially in the

gallbladder bed. They should be clipped or sutured to prevent leakage(Mariat et al., 2000).

2.1.4 Hepatic and cystic arteries:

Major anomalies of vessel origin are particularly important during hepatectomy and pancreatectomy. The left hepatic artery arises from the left gastric, splenic or superior mesenteric in 3-6% of the population and may be especially at risk during gastrectomy and laparoscopic fundoplication. The right hepatic artery arises from the superior mesenteric artery in 10-20% and an accessory right hepatic artery arising from the superior mesenteric is found in 5% of patients. The right hepatic artery is particularly at risk during cholecystectomy if it takes a tortuous course close to the cystic duct and neck of the gallbladder, as the cystic artery may be very short in this variation. Anatomical variations of the cystic artery itself are common, and it may arise from the left, common or accessory hepatic arteries and pass anterior or posterior to the main bile duct. More than one cystic artery is present in some patients. The cystic artery not uncommonly runs in front of the common bile duct, which increases its risk of damage to the bile duct during cystic artery dissection and ligation(Patton, 2015).

2.2 Gallbladder physiology:

The gallbladder is a pear-shaped, hollow structure located under the liver and on the right side of the abdomen. Its primary function is to store and concentrate bile, a yellow-brown digestive enzyme produced by the liver. The gallbladder is part of the biliary tract.

The gallbladder serves as a reservoir for bile while it's not being used for digestion. The gallbladder's absorbent lining concentrates the stored bile. When food enters the small intestine, a hormone called cholecystokinin is released, signaling the gallbladder to contract and secrete bile into the small intestine through the common bile duct(Simeone et al., 1989).

The bile helps the digestive process by breaking up fats. It also drains waste products from the liver into the duodenum, a part of the small intestine.

2.3 Gallbladder Pathology:

The term "Gallbladder Pathology" is used for several types of conditions that can affect your gallbladder. The gallbladder is a small pear-shaped sac located underneath your liver. Your gallbladder's main function is to store the bile produced by your liver and pass it along to the small intestine. Bile helps you digest fats in your small intestine(Center, 2009).

The majority of gallbladder diseases are caused by inflammation due to irritation of the gallbladder wall, which is known as cholecystitis. This inflammation is often due to gallstones blocking the ducts leading to the small intestine and causing bile to build up. It may eventually lead to necrosis (tissue destruction) or gangrene. Other diseases of the gallbladder include gallbladder polyps and gallbladder cancer.

2.3.1 Gallstones:

Gallstones develop when substances in the bile (such as cholesterol, bile salts, and calcium) form hard particles that block the passageway to the gallbladder. Gallstones also tend to form when the gallbladder doesn't empty completely or often enough. They can be as small as a grain of sand or as large as a golf ball(Center, 2009). Numerous factors contribute to risk of gallstones include:

- _ Being overweight or obese.
- _ Eating a high-fat or high-cholesterol diet.
- _ Having diabetes.
- _ Being age 60 or older.
- _ Taking medications that contain estrogen. Having a family history of gallstones.
- _ being female

2.3.2 Cholecystitis:

Cholecystitis is the most common type of gallbladder disease. It presents itself as either an acute or chronic inflammation of the gallbladder.

2.3.2.1 Acute Cholecystitis:

Acute cholecystitis is generally caused by gallstones, but it may also be the result of tumors or various other illnesses. It may present with pain in the upper right side or upper middle part of the abdomen. The pain tends to occur right after a meal and ranges from sharp pangs to dull aches that can radiate to your right shoulder. Acute cholecystitis can also cause:

- _ Fever.
- _ Nausea
- _ Vomiting
- _ Jaundice.

Different colored stools

2.3.2.2 Chronic Cholecystitis:

After several attacks of acute cholecystitis, the gallbladder will shrink and lose its ability to store and release bile. Abdominal pain, nausea, and vomiting may occur.

2.3.3 Choledocholithiasis:

Gallstones may become lodged in the neck of the gallbladder or in the bile ducts. When the gallbladder is plugged in this way, bile can't exit. This may lead to the gallbladder becoming inflamed or distended. The plugged bile ducts will further prevent bile from traveling from the liver to the intestines.

Choledocholithiasis can cause:

- _ Extreme pain in the middle of your upper abdomen.
- _ Fever.
- _ Chills.
- _ Nausea.

- _ Vomiting.

2.3.4 Acalculous Gallbladder Disease:

Acalculous gallbladder disease, or biliary dyskinesia, occurs without the presence of gallstones. It can be chronic or acute and may result from the gallbladder muscles or valve not working properly. The symptoms can include abdominal pain on the right side of your body that radiates to your shoulder. Eating foods high in fat often triggers this. Related symptoms may include:

- _ Nausea.
- _ Vomiting.
- _ Bloating.
- _ Loose stools.

2.3.5 Sclerosing Cholangitis:

Inflammation, scarring, and damage to the bile ducts is referred to as sclerosing cholangitis. It's unknown what causes the disease. People with sclerosing cholangitis may have an enlarged liver or spleen along with a decrease in appetite and weight loss(McGillicuddy et al., 2011).

2.3.6 Gallbladder Cancer:

Cancer of the gallbladder is a relatively rare disease. If it's not treated, however, it can spread from the inner walls of the gallbladder to the outer layers and then to the other organs and ducts. The symptoms of gallbladder cancer may be similar to those of acute cholecystitis(Center, 2009).

2.3.7 Gallbladder Polyps:

Gallbladder polyps are lesions or growths that occur on the gallbladder. They're usually benign and have no symptoms.

2.3.8 Gangrene of the Gallbladder:

Gangrene develops when the gallbladder stops functioning due to inadequate blood flow. This may occur due to infections, injury, diabetes, surgery or diseases related to blood circulation.

The symptoms of gallbladder gangrene can include:

- _ Pain in the gallbladder region.
- _ Fever.
- _ Nausea or vomiting.
- _ Gas disorientation.
- _ Low blood pressure.

2.3.9 Abscess of the Gallbladder:

Abscess of the gallbladder results when an area of the body becomes inflamed with pus. Pus is the accumulation of white blood cells, dead tissue, and bacteria. It may present with upper right-sided pain in the abdomen(Center, 2009).

2.4 Methods of diagnosing acute cholecystitis:

Acute cholecystitis can be diagnosed by ultrasound, CT-scan, MRI.

2.4.1 Computed Tomography scan:

Can be useful in diagnosing acute cholecystitis. Common C.T finding of acute cholecystitis include wall thickening, pericholecystic fluid, distension, high attenuation bile, and subserosal edema. When these findings are present the diagnosis of acute cholecystitis can be suggested(Center, 2009).

2.4.2 Magnetic Resonance Imaging:

Has high degree of accuracy in diagnosing acute cholecystitis based on the single finding of pericholecystic fluid. A similar level of accuracy is demonstrated in detecting gall bladder stones, biliary duct calculi are detected with even greater accuracy than with sonography in patients with acute cholecystitis(Vivek et al., 2015).

2.4.3 Ultrasound:

significantly aid in the diagnosis of acute cholecystitis, ultrasound is more sensitive and specific method in diagnosing the gall bladder stones gall bladder texture and gall bladder wall thickness, Murphy sign(Singh et al., 2014).

2.4.3.1 Sonographics technique:

The gallbladder should be examined in numerous patient positions: supine, left lateral decubitus, and the left posterior oblique position, in order to demonstrate stone mobility, scans may need to be performed in prone or erect position to show acoustic shadowing of calculi, it is essential to use the highest frequency possible and to have the transducer focus in the region of the suspected calculi. The sound beam is directed through the most dependent portion of the gallbladder. In most supine position this is the region of the gall bladder neck and cystic duct. In prone and erect positions the fundus is the most dependent region. Every study of the gallbladder includes an image demonstrating the gall bladder neck to prove or rule out the presence of a stone in this location.

"Scanning with high resolution high frequency curved linear or linear array transducers are mandatory in patient when gall stones are not detected, this minimizes missing tiny gallstones, especially in the fundus of superficial gallbladder (Mendler et al., 1998).

The standard measurement of the gallbladder not exceed 4 cm in width (transverse diameter), the standard measurement of the gallbladder wall not exceed 3 mm (the anterior wall) and the standard measurement of the common bile duct not exceed 9 mm in diameter near its entrance into the pancreas.

2.5 Sonographic appearance of the gall bladder with acute cholecystitis:

The two most useful secondary supporting signs in patients with suspected acute cholecystitis are gallbladder wall thickening ($> 3\text{mm}$) and a positive sonographic Murphy sign. A positive sonographic Murphy sign consists of maximum reproducible tenderness over the sonographically localized gallbladder. A negative sonographic Murphy sign is: absence of tenderness, diffuse tenderness, and tenderness not localized to the GB or maximal

tenderness is inconsistently present over the gallbladder(Mendler et al., 1998).

In a patient with suspected acute cholecystitis the presence of gallstones plus either a thickened GB wall or a positive Murphy sign has a positive predictive value of greater than 99% for patients whose pain is cured by cholecystectomy.



Figure (2-2) ultrasound image shows gallstones plus a thickened GB wall.

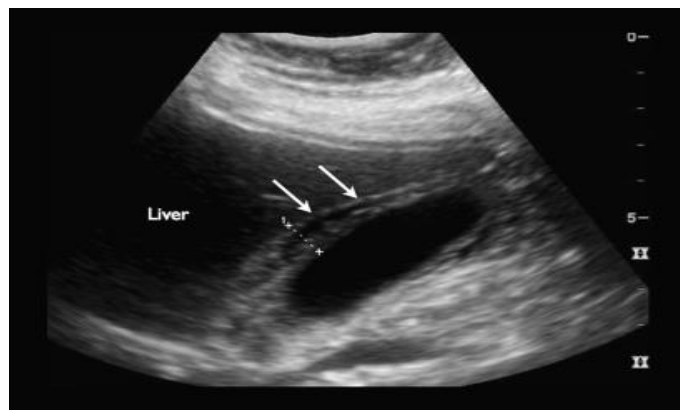
A negative Murphy sign can be extremely helpful since it redirects the search for other causes of the patient's symptoms. This is especially true when stones are imaged in the GB, since sonographic detection of gallstones might prematurely halt the investigation when another cause of pain is actually present.

Ultrasound findings of acalculous cholecystitis are nonspecific. Whenever a hospitalized patient who subsequently develops abdominal pain and they have one or more of the following criteria, consider acalculous cholecystitis:

- _ Gallbladder wall thickening
- _ A positive sonographic Murphy sign
- _ Pericholecystic fluid

Intraluminal gas or membranes

If a suspected acalculous cholecystitis gallbladder appears normal, a 24 hour follow up scan is recommended to demonstrate possible wall thickening. Acute acalculous cholecystitis remains a difficult diagnosis from both an imaging and clinical perspective. CT scanning to detect pericholecystic abnormalities (indicative of small perforations) and progressive gallbladder wall thickening on serial sonographic examinations appear to be the most reliable signs of acute acalculous cholecystitis currently available (Center, 2009).



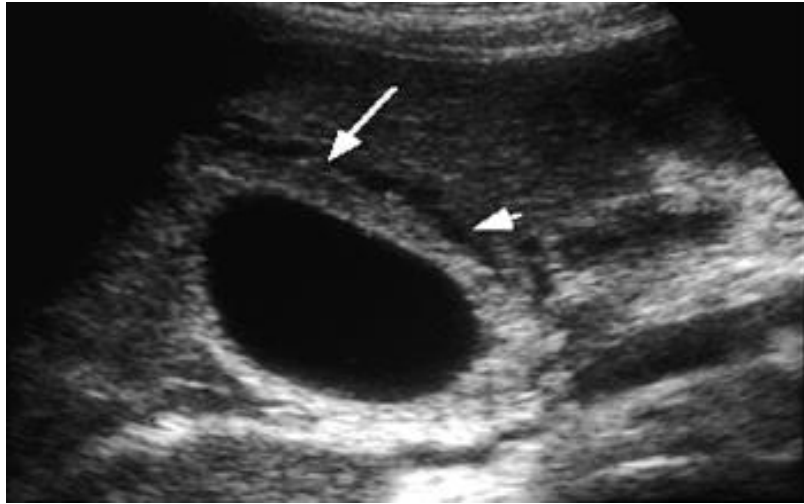
<http://www.emedicine.medscape.com>

Figure (2-3) ultrasound image shows gallbladder wall thickening with pericholecystic fluid



<http://www.Slideshare.net>

Figure (2-4) ultrasound image shows gallstones with edematous thickened GB wall.



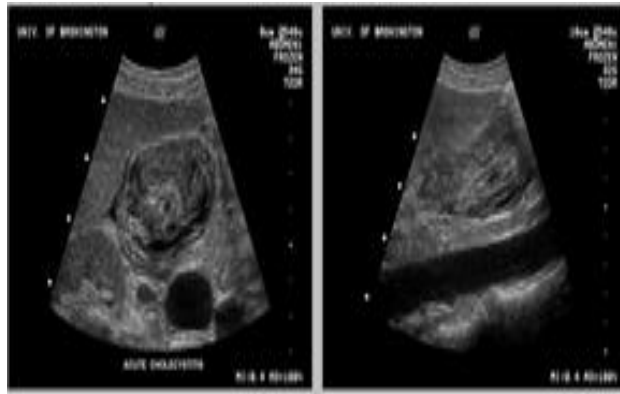
<http://www.ualberta.ca>

Figure (2-5) ultrasound image of right upper quadrant in patient with acute cholecystitis reveals edematous marked thickening of GB wall.



<http://www.scielo.br>

Figure (2-6) ultrasound image shows emphysematous cholecystitis. Observe echogenic parietal image of the GB with reverberation compatible with gas.



<http://www.Slideplayer.com>

Figure (2-7) Transverse and longitudinal ultrasound image demonstrate complex echo pattern in the area of the GB and pericholecystic fluid. Acute gangrenous cholecystitis

2.6 Previous studies:

Pinto studied the accuracy of ultrasonography for diagnosing acute cholecystitis in the regional hospital. 145 patients required an emergency cholecystectomy in the study period, 105 of them underwent ultrasonography, for cholelithiasis, ultrasonography had 100% sensitivity, when combined with positive Murphy's sign and wall thickening and elevated neutrophil count, and ultrasound showing acute cholecystitis yielded a sensitivity of 74% specificity of 62% positive predictive value of 80% and negative predictive value of 53% for the diagnosis of acute cholecystitis (Pinto et al., 2013).

Golea et al. had discussed the role of ultrasonography for acute cholecystic conditions in the emergency room. The study group included 179 patients with a mean age of 59.31 ± 15.82 years. Ultrasonography is a method of high accuracy for diagnosing gallbladder lithiasis (93.39%), wall thickening of the gallbladder. The increased risk of developing a severe form of acute cholecystitis in a patient without documented lithiasis proves the essential contribution of ultrasonography in optimizing emergency surgical decision and therapy (Golea et al., 2010).

Ultrasonography as a diagnostic tool has been studied by **Mawia Gamereldeen**; the aim of their study was to analyze the performance of ultrasonography in the diagnosis of acute cholecystitis. The study included 100 patients with clinically suspected acute cholecystitis who were randomized into two groups. The first group included patients with a final diagnosis of acute cholecystitis and the other group included patients with alternative diagnoses of acute cholecystitis. The study found that the incidence of acute cholecystitis is high in obese patients, acute cholecystitis incidence is higher within the age of 41.50, females (57%) are more affected, Khartoum population suffers more than Omdurman and Kasala (71%), and tenderness is observed on examination in 30%.

It concluded that ultrasound had a great value in increasing accuracy in diagnosis of acute cholecystitis, and it decrease the false negative diagnostic rate and improves the clinical outcome (Mawia et.al, 2010)

Hwang et.al conducted study about accuracy of ultrasonography in the diagnosis of acute cholecystitis; a total of 107 patient spresented during the study period: 69 woman and 38 men with mean aged of55.5 year. For cholelithiasis,ultrasonography had 100% sensitivity, followed by positive Murphy sign (64%) and elevated total white blood cell count (62%), saw ultrasound help in diagnoses of acute cholecystitis and improve the clinical outcome(Hwang et al., 2014).

Chapter three

Materials and Method

Chapter three

Materials and Method

3.1 Materials:

3.1.1 Subjects:

50 patients with acute cholecystitis and were enrolled in the study. Clinically, patient came with right upper quadrant (RUQ) pain, positive Murphy sign and fever. These clinical signs were identified by surgical or physician who estimated the patient suggested having acute cholecystitis with more assessment including laboratory investigation (elevated white blood cells). This study was conducted in Dar Al-Elaj specialist hospital and Ribat hospital, in the department of ultrasonography from September 2016 to March 2017.

The procedure of the scanning with ultrasound was explained to the patient and the purpose of incorporating his data in the study. Permission from the hospital and the department was granted.

3.1.2 Machine used:

Ultrasound machines with transducer frequency 3.5 MHz, these include:

- _ MINDRAY ultrasound machine. Model DP 2200 made in Germany with convex transducer 3.5MHz.
- _ FUKUDA 4100 ultrasound machine made in Japan .1995 with convex transducer 3.5 MHz.

3.2 Method:

3.2.1 Technique used:

Gallbladder was examined in numerous patient positions; supine, left lateral decubitus and left posterior oblique position in order to demonstrate stone mobility, scans may need to be performed in prone position or erect position to show acoustic shadow of calculi it is essential to use the highest frequency possible and to have the transducer focused in the region of the suspected calculi. The sound beam is directed through the most depended

portion of the gallbladder. In most supine patients this is the region of the gall bladder neck and cystic duct. In prone and erect positions the fundus is the most depended region. Every study of the gallbladder was included an image demonstrating the gallbladder neck to prove or rule out the presence of a stone in this location.

Scanning with high resolution high frequency curved liner or linear array transducers is mandatory in patents when gall stones are not detected, this minimizes missing tiny stone, especially in the fundus of superficial gall bladder.

Compression as the right upper quadrant has beam done to detect murphy's sign.

Presents of gall bladder stone manly impacted stone in the gall bladder neck was detected.

3.2.2 Data collection:

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.

3.2.3 Data analysis:

The data was analyzed using statistical packaged for social science (SPSS), frequency distribution as well as cross tabulation were performed.

Chapter four

Results

Chapter four

Results

Table 4-1: gender Frequency distribution

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	13	26.0	26.0	26.0
Female	37	74.0	74.0	100.0
Total	50	100.0	100.0	

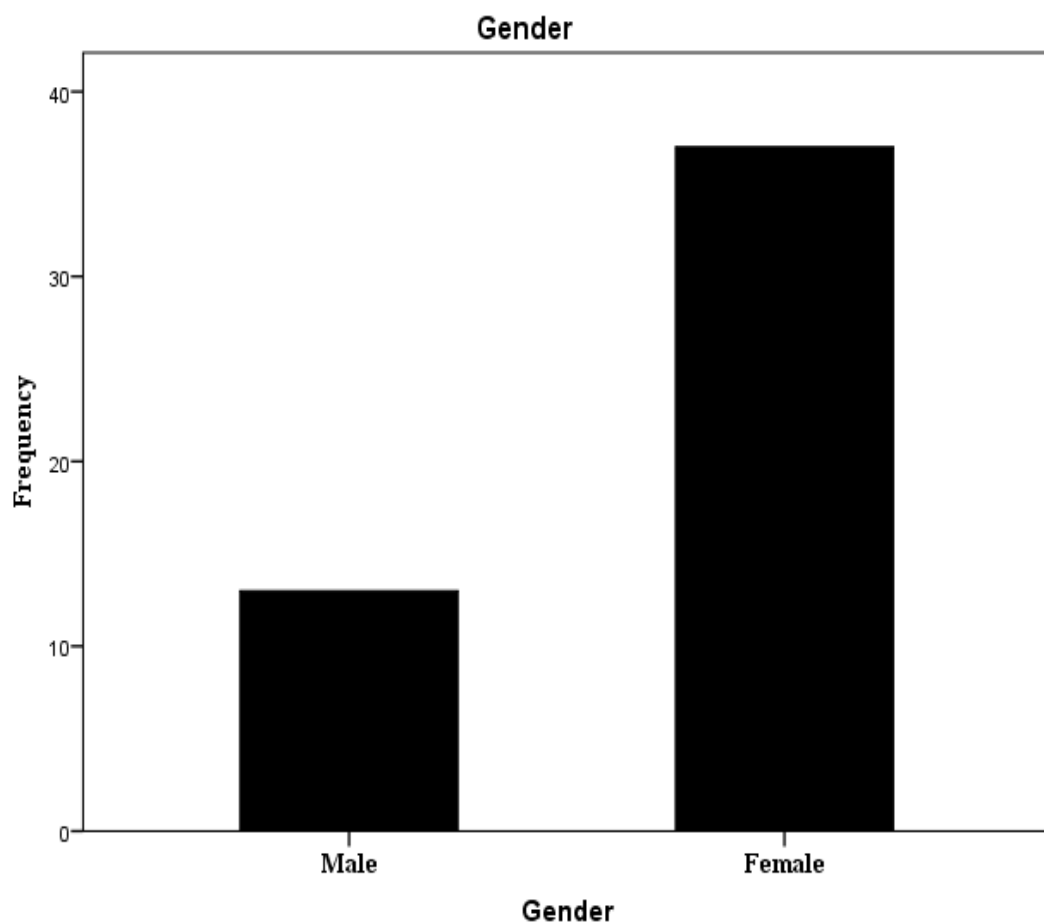


Figure (4-1) Gender distribution

Table (4-2): Frequency distribution of age group

Age group	Frequency	%
<30	1	2
30-39	15	30
40-49	17	34
50-59	11	22
60-69	3	6
≥70	3	6
Total	50	100

Table (4-3): Frequency distribution according to residence

	Frequency	Percent	Valid Percent	Cumulative Percent
North	14	28.0	28.0	28.0
Central	28	56.0	56.0	84.0
East	4	8.0	8.0	92.0
West	4	8.0	8.0	100.0
Total	50	100.0	100.0	

Table(4-4):Diabetic Patients frequency distribution
Diabetes

	Frequency	Percent	Valid Percent	Cumulative Percent
YES	15	30.0	30.0	30.0
NO	35	70.0	70.0	100.0
Total	50	100.0	100.0	

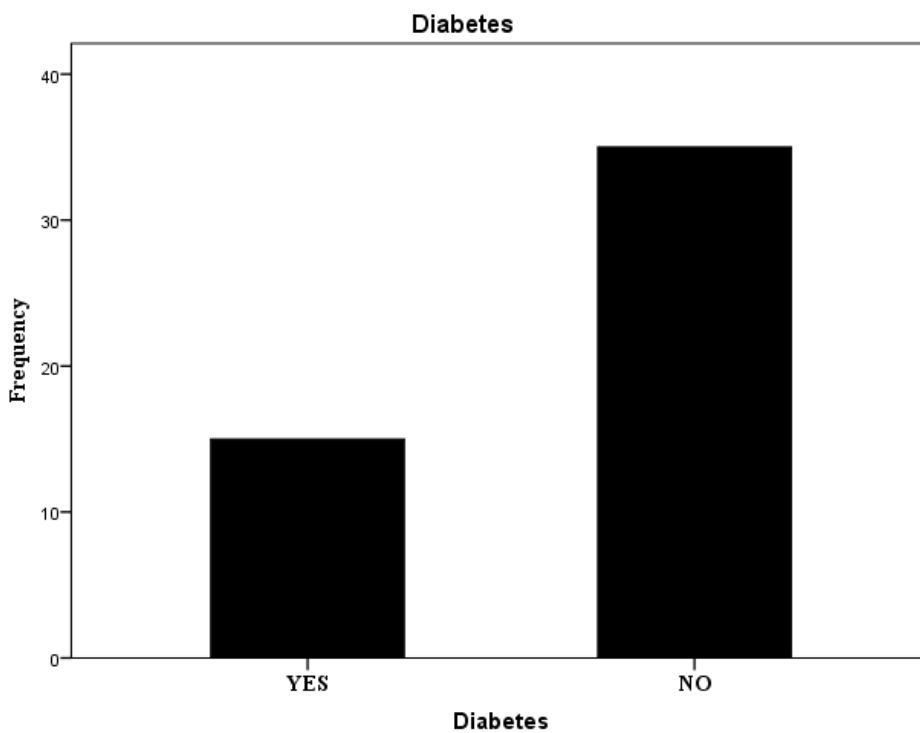


Figure (4-2) Presence of Diabetes

Table (4-5): Frequency distribution according to Jaundice

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	5	10.0	10.0	10.0
Valid NO	45	90.0	90.0	100.0
Total	50	100.0	100.0	

Table (4-6): Frequency distribution according to Ascites

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	2	4.0	4.0	4.0
Valid NO	48	96.0	96.0	100.0
Total	50	100.0	100.0	

Table (4-7): Frequency distribution according to PHT

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	1	2.0	2.0	2.0
Valid NO	49	98.0	98.0	100.0
Total	50	100.0	100.0	

Table (4-8): Frequency distribution according to presence of Gall stone

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	38	76.0	76.0	76.0
NO	12	24.0	24.0	100.0
Total	50	100.0	100.0	

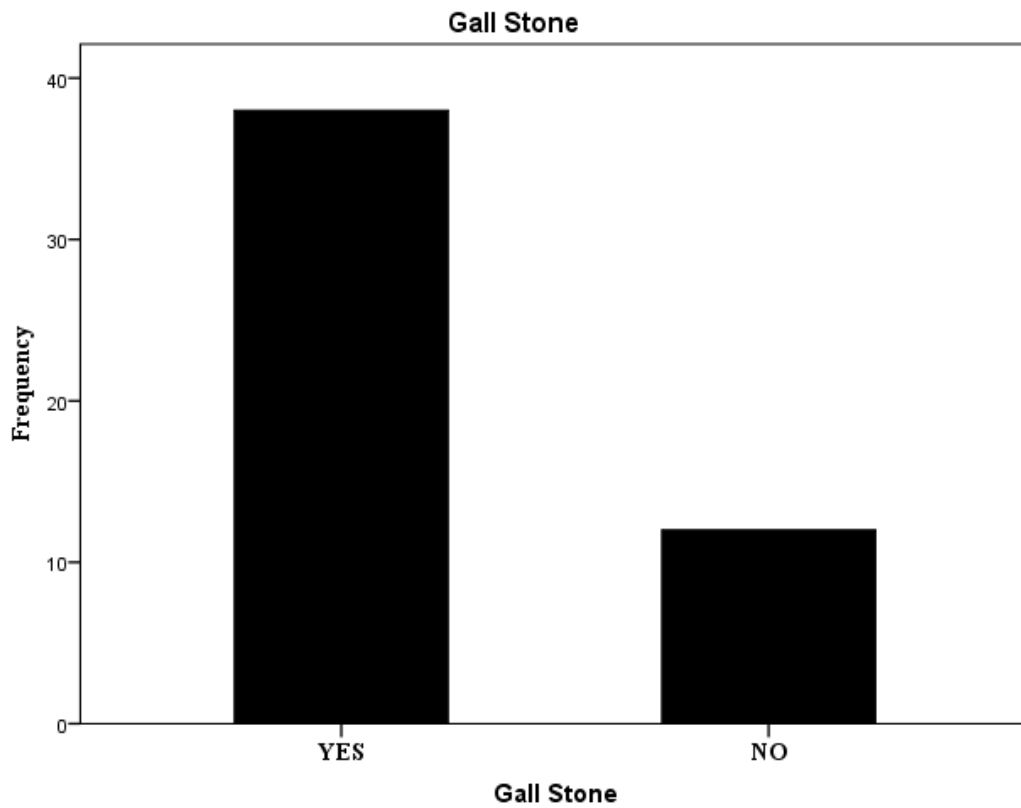


Figure (4-3): Presence of gall stone

Table (4-9): Frequency distribution according to wall thickness

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Thickened	46	92.0	92.0	92.0
Not thick	4	8.0	8.0	100.0
Total	50	100.0	100.0	

Table (4-10): Frequency distribution according to murphy sign

Murphy Sign

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	50	100.0	100.0	100.0

Table (4-11): Frequency distribution according to distension

Distension

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Distended	50	100.0	100.0	100.0

Table (4-12): Frequency distribution according to pericholecystic fluid

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	15	30.0	30.0	30.0
Valid NO	35	70.0	70.0	100.0
Total	50	100.0	100.0	

Table (4-13): Sonographic final Diagnosis

Final Diagnosis

	Frequency	Percent	Valid Percent	Cumulative Percent
Acute Calculus cholecystitis	37	74.0	74.0	74.0
Non Calculus Cholecystitis	13	26.0	26.0	100.0
Total	50	100.0	100.0	

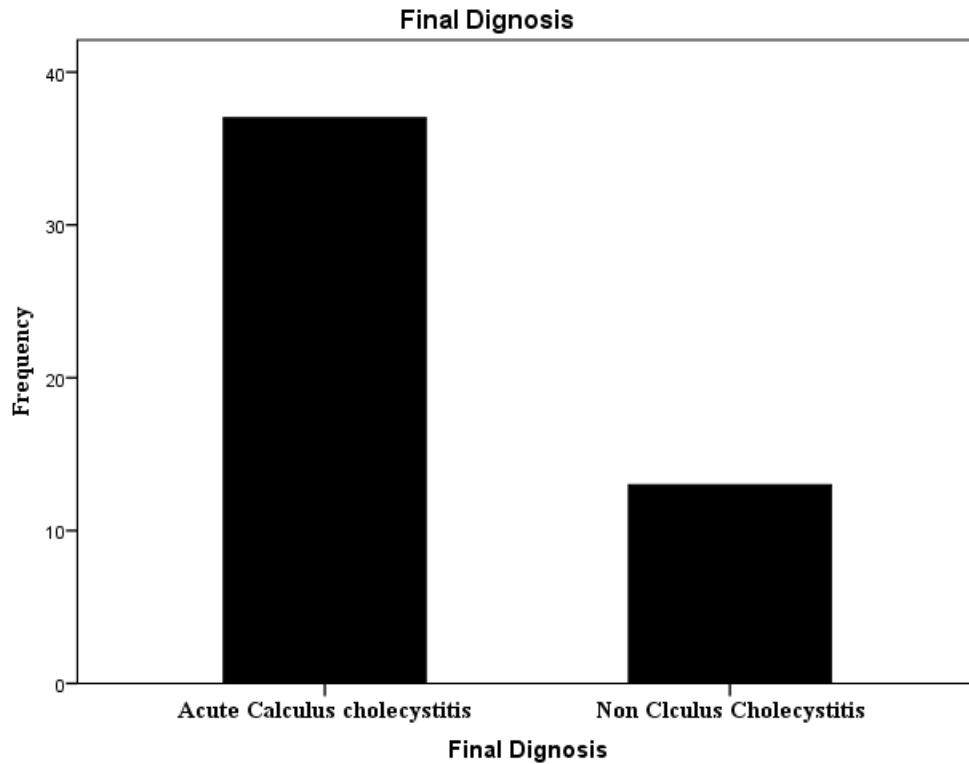


Figure (4-4) Sonographic final Diagnosis

Table (4-14): Frequency distribution according to complications

Complications	Frequency	%
Emphysematous cholecystitis	3	6%
Perforation of the gall bladder	1	2%
Gangrene cholecystitis	1	2%
Pericholecystic fluid collection	15	30%
Free complications	30	60%
Total	50	100

Chapter Five

Discussion, conclusion and
recommendations

Chapter Five

Discussion, conclusion and recommendations

5.1 Discussion:

Acute cholecystitis is the most frequent complication of biliary lithiasis, with the incidence increasing with age, as demonstrated after analyzing the number of admissions and cholecystectomies in patients over the age of 60 (Golea et al., 2010). US is one of the methods most frequently used in the emergency Department for the diagnosis of acute cholecystitis; however, several studies have stressed the limitations of the method related to the operator's expertise, the ultrasound machines used and the possibility of performing the investigation at the bedside (Rosen et al., 2001).also there were studies proving the accuracy and advantages of US performed in emergency as compared to hepatobiliary scintigraphy or computer tomography(McGillicuddy et al., 2011).

In this study as shown in Table (4-1), 13 out of 50 (26.0%) were males and the rest 37 out of 50(74.0%) were females. This result agrees with the previous study which found that female more affected by acute cholecystitis (Golea et al., 2010).

Age of patients was illustrated in Table (4-2). In which threr was 1 out of 50 (2%) below 30 years, 15 out of 50 (30%) between 30-39 years, 17 out of 50(34%) between 40-49 years, 11 out of 50 (22%) between 50-59 years, 3 out of 50 (6%) between 60-69 years and 3 out of 50 (6%) were 70 years or above. This result agrees with study done by MawiaGamereldeen et.al when found that acute cholecystitis incidence was higher within age of 41-50.

The ultrasound findings shows that ultrasonography was excellent and more sensitive modality for diagnosis of gall stone and more sensitive in diagnosis of gallbladder walls thickening, positive sonographic murphy

sign, distension of gall bladder as shown in Tables (4-8),(4-9),(4-10)and(4-11). This result agrees with Golea et.al.

Final diagnosis of patients under study was shown in Table (4-13), the majority, 37 out of 50 (74.0%) were acute calculous cholecystitis and the rest 13 out of 50 (26.0%) were A calculous cholecystitis.

According to complications which illustrated in Table (4-14). 3 out of 50 (6.0%) were emphysematous cholecystitis, 1 out of 50 (2.0%) were perforation of the gall bladder, 15 out of 50 (30.0%) were pericholecystic fluid collection, 1out of 50 (2.0%) were gangrene cholecystitis, while the majority 30 out of 50 (60.0%) had no complications. This result was in line with previous studies which revealed that the high percentage of patients with acute cholecystitis have cholelithiasis (acute calculous cholecystitis)(Hwang et al., 2014).

Ultrasonography is a method of high accuracy in the diagnosis of gallbladder lithiasis and its complication - acute cholecystitis. The risk analysis for the occurrence of gallbladder complications and the increased risk for developing a severe form of acute cholecystitis in patients without documented lithiasis prove the essential contribution of ultrasonography in optimizing emergency surgical decision and therapy.

5.2 Conclusion:

The study shows that the acute calculus cholecystitis was higher than acute a calculus. The incidence of acute cholecystitis in the studied group was higher in females that males. The study also reflects that complications of acute cholecystitis mainly on obese patients.

The incidence of acute cholecystitis higher in patients from central Sudan.

Ultrasound was a method of high accuracy for the diagnoses of cholelithiasis. It had a great value in of accuracy in the diagnoses of acute cholecystitis and improves the clinical outcome.

5.3 Recommendations:

- Easy and immediate ultrasound technique should be used to diagnose acute cholecystitis.
- Adequate and good sonographic technique with more experience should be applied because ultrasound is operator dependent.
- Modern diagnostic instruments should be used to increase the accuracy outcome in diagnoses of acute cholecystitis.
- CT scan should be done in cases with complicated acute cholecystitis eg. Gangrenous cholecystitis, emphysematous, perforated cholecystitis.
- The service of the ultrasound department in hospitals must be available 24 hours because acute cholecystitis is an urgent case.
- Further studies with large sample volume were recommended.

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Appendices

Appendix I: ultrasound images from the sample of the study:



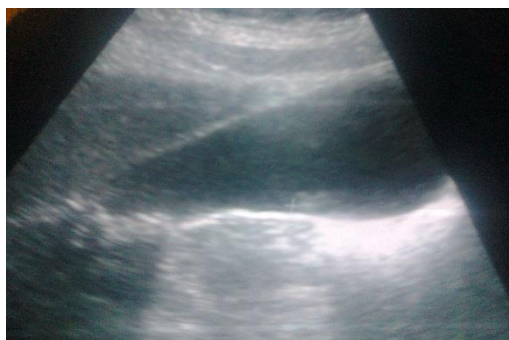
Female with age 53 years

Image (1): Longitudinal transabdominal scan shows gall stone, wall thickening and distension of the gallbladder.



Male with age 42

Image (2): Longitudinal transabdominal scan shows gall stone, at the neck of the gallbladder and wall thickening.



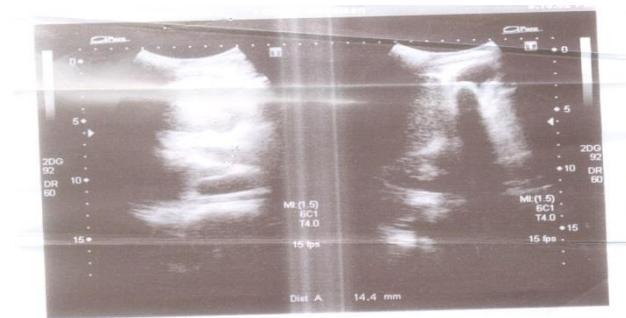
Obese Female with age 50

Image (3): Longitudinal transabdominal scan shows distension of the gallbladder, wall thickening, and small gallstones.



Female with age 41 years

Image (4): Transverse transabdominal scan shows gallstone, wall thickening



Male with age 45 years

Image (5): Transabdominal scan shows gallstone wall thickening, dilation of portal vein



Female with age 40 years

Image (6): Transverse transabdominal scan shows gallstone, distension of gallbladder, wall thickening



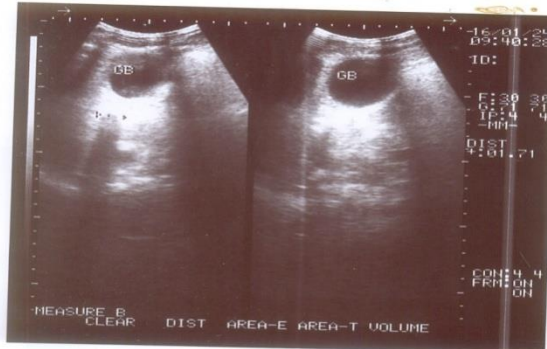
Male with age 37 years

Image (7): Longitudinal transabdominal scan shows stone at the neck of the gall bladder, wall thickening



Female with age 43 years

Image (8): Longitudinal transabdominal scan shows gall stone, wall thickening.



Male with age 44 years

Image (9): Transverse transabdominal scan shows gall stone, wall thickening, distension in gallbladder.



Female with age 60 years

Image (10): Longitudinal transabdominal scan shows wall thickening, distension in gallbladder, periecholel cystic fluid



Female with age 70 years

Image (11): Transverse and longitudinal transabdominal scan shows wall thickening, distension in gallbladder, intraluminal gas.



Female with age 43 years

Image (12): Transverse and longitudinal transabdominal scan shows stone at the neck of gallbladder, wall thickening, distension of gallbladder.

Appendix II:

Patient age:

Data collection sheet

Patient Name:

Patient gender: Male:

Female: t:

Patient Residence: North Central East West

Other Pathology: diabetic jaundice ascites

PHT

Ultrasound Findings:

Ultrasound findings of acute calculous cholecystitis:

- Gall stone.
- Gall bladder wall thickness > 3 mm.
- Positive sonographic Murphy sign.
- Distension of gall baldder.

Ultrasound findings of acute a calculous cholecystitis:

- Gall bladder wall thickness > 3 mm.
- Positive sonographic Murphy sign.
- Pericholecystic fluid.
- Intraluminal gas or membrane.

Final diagnose:

- Acute calculous cholecystitis
- Acute a calculous cholecystitis