Sudan University of Science and Technology

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Evaluation of certain Biliary System Diseases using Magnetic Resonance CholangioPancreatography(MRCP)

تقييم بعض امراض الجهاز المراري باستخدام التصوير بالرنين المغنطيسي للقناة المرارية والبنكرياس

AThesis Submitted for Partial Fulfillment of the Requirement of The M.Sc. Degree in Diagnostic Radiologic Technology

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بسم الله الرحمن الرحيم

قال تعالى:

(الرحمن* علم القرآن* خلق الانسان* علمه البيان)

صدق الله العظيم

سورة الرحمن

الآية (1-4)

Dedication

:I dedicate this work to my family

Mama, Husband, son, brothers, to my friends

&

.To whom I love so much, I convey this work

Acknowledgement

I would like to thank Dr. Mona Ahmed, for her help, supervising and encouragement during my .research

Special thanks to Dr. Hossain Ahmed and to whole staff in Antalia medical center and Modern medical center for their help in completing this work in success.

List of abbreviations

3D	.Three Dimensions
Abd	Abdomen.
B0	.External magnetic field
Ca	.Carcinoma
CBD	.Common bile duct
CHD	.Common hepatic duct
CT	.Computed tomography
ERCP	.Endoscopic retrograde cholangio pancreatography
FOV	.Field of view
FSE	.Fast spin echo
GB	.Gallbladder
GRE	.Gradient echo
Mg	.milligram
Mm	.Millimeter
MRCP	.Magnetic resonance cholangio pancreatography
MRI	.Magnetic resonance imaging
Ms	.Millisecond
PD	.Proton density
RC	.Respiratory compansator
S	Second
SE	.Spin echo
T1	.Spin-lattice Relaxation time
T1w	Weighted image: image that demonstrate the difference in .T1 times of the tissues
T2	.Spin-Spin Relaxation time
T2w	Weighting image: image that demonstrate the difference in .T2 times of the tissues
TE	.Echo time
TR	.Repetition time

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Abstract

The biliary system have many diseases affecting it and these diseases need to be diagnosed but in this study certain one was evaluated : cholecystitis, .cholangiocarcinoma, gallstones and obstruction

The aim of this study was to study the biliary system disorders using Magnetic Resonance CholangioPancreatography(MRCP) ; the study took place in Khartoum state centers include: Antalia medical center and Modern medical center during the period between August and December 2015.

The sample size was sixty patients were examined used MRCP , using echo time in excess of 200ms and repetition time of more than 10s are required, field of view 300mm and slice thickness 1mm.MRCP images were reviewed at the diagnostic workstation and on hard copy films by expert radiologists. This examination was performed using GE 1.5 Tesla . a body coil was used, peripheral pulse unit and respiratory compensator. The result after analysis by SPSS program, showed that:

The biliary diseases were predominant among age group between(69-79) years as (51.7%) come next (58-68)years as (35%), (47-57)years as (8.3%), (36-46)years as (3.3%) and (25-35)years as (1.7%) as well as predominant among female(38) relative to male(22) as(63.33%) and(36.67%) respectively. The biliary

diseases were predominant among weight group between (70-79)Kg in female(31) relative to male(16) as (65.95%) and (34.05%) respectively, come next the weight group between (80-89)Kg in female (7) relative to male(6) as (53.85%) and (46.15%) respectively. The most common cause of the biliary diseases were biliary obstruction due to different causes and gallstones. The biliary obstruction predominant among female(17) relative to male(7) as (70.83%) and (29.17%) respectively . The gallstone predominant among female(3) relative to male(2) as (60%) and (40%) respectively .The most common cause of biliary obstruction is Ca because the malignancy was seen mainly in elderly people. Cholecystitis and cholangio carcinoma were predominant also among female(10)and (9) relative to male(4) and(8) respectively as (71.4%) and (52.9%), (28.6%) and (47.01%) respectively.

The study showed that elder females with heavy weight were the most patients got biliary diseases.

ملخص البحث

هنالك عدة أمراض تصيب الجهاز المراري وهي تحتاج الي تشخيص ولكن هده الدراسة أمراض معينة فقط تم تقييمها : التهاب الحويصلة الصفراء , سرطان القنوات المرارية, حصوات الحويصلة الصفراء و الانسداد المراري.

هدفت الدراسة الي دراسة الجهاز المراري باستعمال التصوير بالرنين المغنطيسي, الدراسة حدثت في مراكز الخرطوم يتضمن: مركز أنطاليا الطبي والمركز الطبي الحديث أثناء الفترة بين اغسطس 2015 الي يناير 2016.

حجم العينة كان 60 مريض فحصوا باستخدام تصوير الرنين المغنطيسي باستخدام وقت صدي يزيد عن 200مللي ثانية ووقت تكرار اكثر من 10ثواني, ومساحة تعريض 300ملم وسمك شريحة 1ملم. تم تشخيص الصور تحت الدراسة بواسطة اخصائي اشعة. تلك الفحوصات اجريت باستخدام جهاز رنين ماركة جينرال اليكتريك 1.5 تسلا , استعمل للفحص جسم حلزون ووحدة نبضة خارجية وتعويض تنفسي.النتائج بعد التحليل اشارت الي:

امراض الجهاز المراري كانت سائدة بين الاناث(38) نسبة الي الزكور(22)بنسبة(63.33%)و(36.67%)علي التوالي وايضا هي سائدة بين مجموعة اعمار من 69 الي 79 سنة بنسبة (51.7%) تليها مجموعة الاعمار من 58الي 68 سنة بنسبة(35؟%) ثم من 47 الي 57 بنسبة(8.3%) ثم من 36 الي 46 سنة بنسبة (3.3%) و من 25الي 35سنة بنسبة (1.7%). الامراض المرارية كانت سائدة بين مجموعة الاوزان بين 70الي 79 كجم في الاناث(31) نسبة الي الزكور(16)بنسبة 65.95% و 34.05% علي التوالي تليها مجموعة الاوزان بين 80الي 89كجم في الاناث (7) نسبة الي الزكور(6)بنسبة (53.85%) و(46.15%) علي التوالي.أكثر مسبب سائد لامراض الجهاز المراري كان الانسداد المراري باسبابه المختلفة و حصوات الحويصلة الصفراوية. الانسداد المراري كان سائد بين الاناث(17) نسبة الي الزكور(7)بنسبة (70.83%) و(29.17%) علي التوالي. حصوات الحويصلة الصفراء كانت سائدة بين الاناث(3) نسبة الي الزكور(2)بنسبة(60%) و(40%). اكثر مسبب سائد للانسداد المراري هو السرطان لانه يري

تحديدا في الاشخاص كبار السن. التهاب الحويصلة الصفراء وسرطان القنوات المرارية كانا سائدين بين الاناث(10)و(9) نسبة الي الزكور(4)و(8)بنسبة (71.4%)و(52.99%) علي التوالي, و(28.6%) و (47.01%) علي التوالي.

أوجدت الدراسة ان الاناث زوات الاعمار والاوزان الكبيرة هن اكثر المرضي الزين يعانون من امراض الجهاز المراري.

Chapter One

Introduction

1.1. Introduction:

The Biliary system consist of liver, gallbladder, bile ducts, pancreas and pancreatic duct. The basic function of it is to produce and store bile and then drain it when needed to aid in digestion. The liver is the largest organ of the abdomen , occupying a major portion of the right upper quadrant. The liver functions as the primary centre for metabolism, and it also supports multiple body systems. The liver can be divided into lobes (right, left, caudate, quadrate) according to surface anatomy or into segments according to the vascular supply (Kelly Lorrie L and Petersen Connie M,1997).

The pear-shaped gallbladder is located in afossa on the ateroinferior portion of the right lobe of the liver. IT acts as a reservoir for bile. The body of the gallbladder tapers into the neck of the gallbladder and then continues as the cystic duct (Dykstra Kisten et al, 1999).

Bile is produsedin the liver and drains into the right and left hepatic ducts which are leave the liver through the porta hepatic and unite to form the common hepatic duct which is joined by the cystic duct of the gallbladder to form the common bile duct which penetrate the duodenal wall in conjunction with the pancreatic duct (duct of wirsung) at the ampulla of vater. The opening into the

duodenum is guarded by choledochoduodenal sphincter (Kelly Lorrie L and Petersen Connie M, 1997).

The pancreas is long, narrow organ that lies behind stomach and extend transversely from the duodenum toward the spleen. It can be divided into a head, neck,body and tail. The pancreas is both an exocrine and indocrine gland . the pancreatic duct runs the length of gland beginning in the tail and traversing the body and head(Stuart G et al, 2007).

MRCP (Magnetic Resonance CholangioPancreatography) is less costly, non invasive, and sensitive technique for evaluating the biliary and pancreatic ductal system . MRCP show the duct in there natural, non distended state although have images with somewhat lower resolution(Kalra, M, Sahani 2002).

(MRCP) first described in 1986 and improved over the years.

(MRCP) has the advantage of adding 3D images and fast multiple imaging planes capabilities. Moreover it has nigligable morbidity and mortality(Karla, M, Sahani 2002).

1.2. Problem of the study:

There is many diseases affecting biliary system from different age and different gender and there is many modalities can be used to diagnose biliary diseases such as CT, U\S and ERCP but these modalities have some problems like high radiation dose in CT, inaccurate result in U\S because it is an operator dependant and invasive procedures lead to high morbidity in ERCP. Therefore, (MRCP) is a non invasive and radiation dose free, operator independent and informative tool for diagnosing biliary diseases.

1.3. Objectives of the study:

a- General objective:

To evaluate biliary system diseases by using (MRCP)

.

b- Specific objectives:

1. To enumerate different types of biliary system diseases.
2. To correlate between disease incidence percent and gender.
3. To correlate between disease incidence percent and age.
4. To correlate between disease incidence percent and weight.

Chapter two

Literature review

2.1. Anatomy of biliary system:

2.1.1 Liver

Liver is the largest organ of the abdomen, occupying amajor portion of right upper quadrant. The liver functions as the primary center for metabolism, and it also support multiple body systems. The liver can be divided into lobes according to surface anatomy or into segments according to the vascular supply.The four lobes commonly used for reference are the left, right, caudate and quadrate. The left lobe is the most anterior of the liver lobes, extending across the midline. It is separated from the right lobe by the main lobar fissure, an imaginary drawn through the gallbladder fossa and the middle hepatic vein to the inferior vena cava. The upper surface of the right lobe, the largest of the four lobes, lies close to the right lateral abdominal wall directly under the diaphragm. The inferior and posterior surface of the right lobe is bordered by the porta hepatic, gallbladder and inferior vena cava. The smallest lobe is the caudate lobe, which is located on the inferior and posterior liver surface, sandwiched between

the inferior vena cava and the ligament venosum. The quadrate lobe is located on the anteroinferior surface of the left lobe between the gallbladder and ligamentumteres. The round, cord-like, ligamentumteres runs along the free edge of the falciform ligament. The falciform ligament provide the structural support that attaches the upper surface of the liver to the diaohragm and upper abdominal wall. The hilum of the liver, the porta hepatic, is located on the inferomedial border of the liver. It Is the central location for vessels to enter and exit the liver(Kelly Lorrie L and Connie M, 1997).

The liver is about 1,5 Kg in the adult . Its basic architectural unit is the lobule, composed of many cellular plates radiating between the central veins and the portal tracts. The hepatic thick. Between the cells there are bile canaliculi, which drain into biliary ducts, and between the palates are found the blood siusoids. The sinusoids receive the blood from branches of portal vein and hepatic artery(Sukkar M. Y. et al, 2006).

2.1.2 Gallbladder

The pear-shaped gallbladder is located in a fossa on the anteroinferior portion of the right lobe of the liver. It acts as reservoir for bile. The body of the gallbladder tapers into the neck of it and then continues as the cystic duct. Normal gallbladder size is variable according to the amount of bile it is storing. Up to 3cm wide and 7cm to

10cm long is normal size. The wall of GB is less than3mm(Dykstra Kisten et al, 1999).

2.1.3 bile ducts

Bile is produced in the liver and drains into the right and left hepatic ducts which they leave the liver through the porta hepatic and unite to form the common hepatic duct which is joined by the cystic duct to form the common bile duct which is penetrates the duodenal wall in conjunction with the pancreatic duct(duct of wirsung) at the ampulla of vater. The opening into the duodenum is guarded by choledochoduodenal sphinecter. The basic function of the biliary system is to store bile and then drain it when needed to aid in digestion(Kelly Lorrie L and Petersen Connie M, 1997).

Normal common ducts size is variable according to the amount of bile in it and patients age. Common duct may enlarge with age. Up to 4mm is normal for common hepatic duct near the porta hepatic, 2-3cm long and up to 7mm is normal for common bile duct distally, 10-15cm long(Dykstra Kisten et al, 1999).

2.1.4 pancrease

The pancreas is long narrow organ that lies behind the stomach and extends transversely from the duodenum toward the spleen. It can be divided into a head, neck, body and tail. The pancreatic duct runs the length of gland beginning in the tail and traversing the body and head.

The pancreas is both an exocrine and endocrine gland. Exocrine cells secrete pancreatic juice into the small intestine and endocrine cells secrete insulin and glucagon into bloodstream(Stuart G et al, 2007).

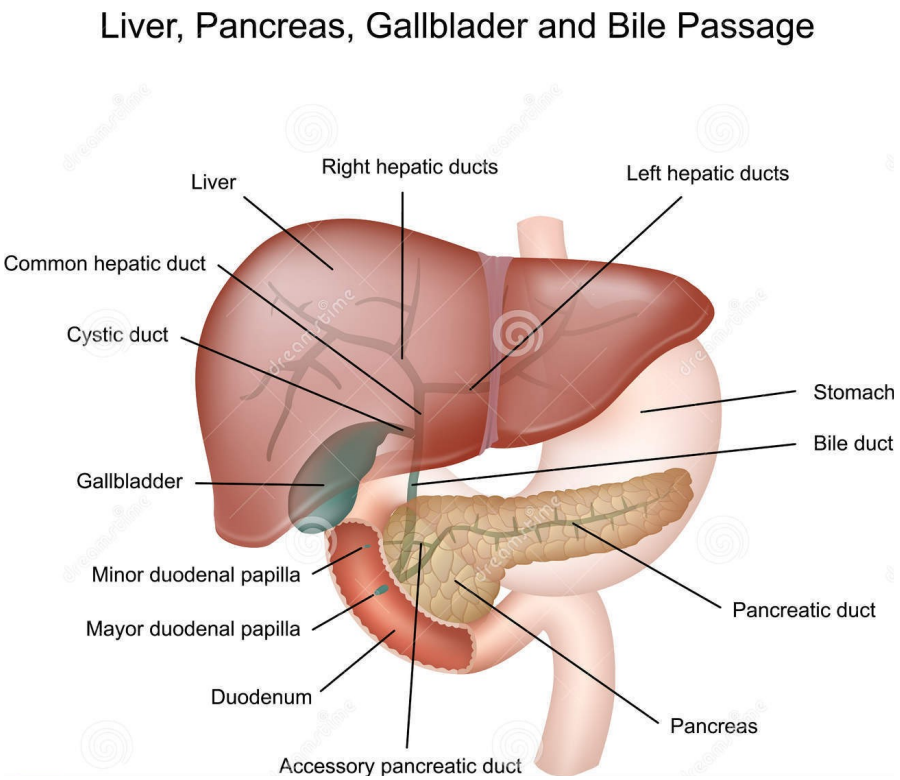

Figure 2:1: show anatomy of the biliary system

(http// thumbs. Dreamstime.com)

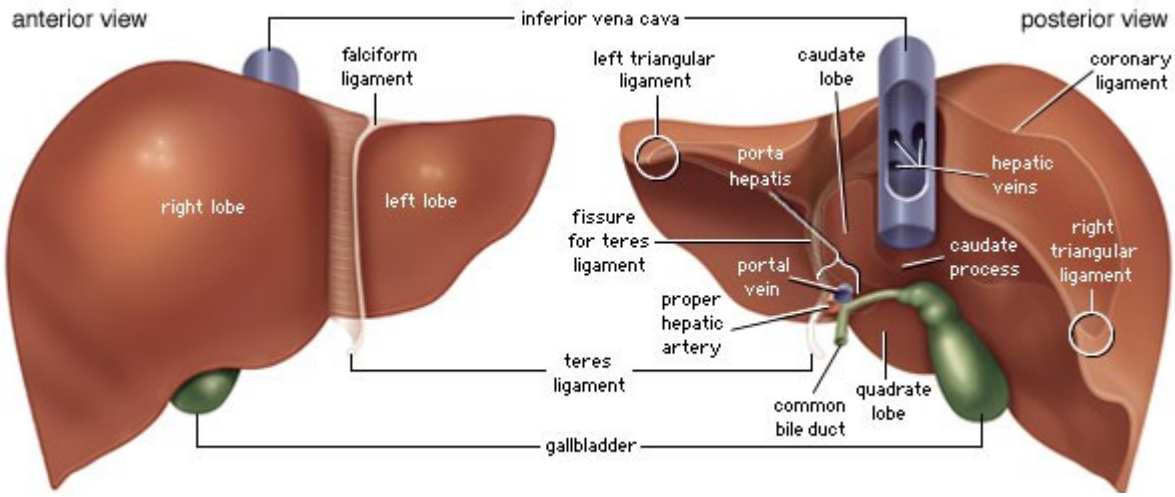

Figure 2:2: show anatomy of the liver(anterior and posterior views) (http//humananatomybody.info.com)

2.2. Physiology:

2.2.1Vascular function:

2.2.1.1: Storage since of liver blood flow is 30% of blood volume; it is one of the important reservoirs of blood in the body. In case of strenuous exercise or hemorrhage, part of the hepatic blood is diverted towards the exercising muscle or vital organ, respectively(Sukkur M. Y. et al, 2006).

2.2.1.2: Antigen clearance. The liver filters the blood coming from the gut and remove bacteria, debris, particulate matter or any other antigens contained in the blood arriving from the gut. secretory function. The liver continuously secrets bile, which, after storage and concentration in the gallbladder, in discharged into the duodenum. Synthesis function. The liver synthesize many useful substance such as albumin and the coagulation

factors. Hepatic failure therefore results in bleeding disords. Metabolic function. The liver has a central role in the metabolism of the major types of foodstuffs as well as substances of endogenous or exogenous origin. Bile is secreted continuously by hepatocytes. As the bile is needed in the intestine only when food is ingested, it needs to be stored between meals. The gallbladder has a capacity of 30-50ml, it stored and concentrates bile and regulates its discharge into the duodenum. Contraction of the gallbladder is followed almost immediately of the choledochoduodenal sphincter. The sphincter is kept closed by cholinergic mechanisms and relaxed by the hormone CCK. The passage of a peristaltic wafe down the duodenum also causes opening of the sphincter of Oddi, which allows bile in the bile duct to enter in spurts during periods of duodenal relaxation, stopping during contraction. Bile is a viscous golden-yellow or greenish fluid with a bitter taste. It is iso-osmotic with plasma and slightly alkaline. The liver produces about 5 liters of bile per day but only 500-600ml are poured into duodenum daily. Bile contains water, cholesterol, bile salts, bilirubin, phospholipids, Na^+, Cl^-, and HCO_3^-. The gallbladder not only stores bile but also concentration is achieved through active absorption water movement out of the lumen. The gallbladder also secretes mucus, which increases the viscosity of bile.$NaHCO_3$ in bile is responsible for alkaline reaction and participates and duodenal secretions in the neutralization of acid chyme delivered from the stomach.

The bile salts are essential for the emulsification and absorption of fats, salts are also important for the absorption of vitamins A, D, E, and K and bilirubin gives bile a yellowish color. In people who produce bile with high concentration of cholesterol, cholesterol gallstones may from in the gallbladder . Gallstones can block the normal flow of bile if they lodge in any of the ducts that carry bile from the liver to the small intestine. If gallstone blocks opening to pancreatic duct, digestive enzymes can become trapped in the pancreas and cause an exetremely painful inflammation called gallstone pancreatitis (Sukkur M. Y. et al, 2006).

2.3. Pathology:

There is many diseases affecting the biliary system that require clinical care. Some of these diseases are listed below as:

2.3.1 Hepatitis: is a medical condition defined by the inflammation of the liver and characterized by the presence of inflammatory cells in the tissue of the organ. Hepatitis may occur with limited or no symptoms, but often leads to jaundice (a yellow discoloration of the skin, mucous membrane, and conjunctiva), poor appetite, and malaise. Hepatitis is acute when it lasts less than six months and chronic when it persists longer. Acute hepatitis can be self-limiting (healing on its own), can progress to chronic hepatitis, or, rarely, can cause acute liver failure.[1]Chronic hepatitis may have no

symptoms, or may progress over time to fibrosis (scarring of the liver) and cirrhosis (chronic liver failure). Cirrhosis of the liver increases the risk of developing hepatocellular carcinoma (a form of liver cancer). Viral hepatitis is the most common cause of liver inflammation. Other causes include autoimmune diseases and ingestion of toxic substances (notably alcohol), certain medications (such as paracetamol), some industrial organic solvents, and plants (S D Ryder , et al. I J Beckingham ,2001).

2.3.2 Toxoplasmosis: Is a parasitic disease caused by Toxoplasma gondii. Infections with toxoplasmosis usually cause no symptoms in adult humans. Occasionally there may be a few weeks or months of mild flu-like illness such as muscle aches and tender lymph nodes. In a small number of people, eye problems may develop. In those with a weak immune system, severe symptoms such asseizures and poor coordination may occur. If infected during pregnancy, a condition known as congenital toxoplasmosis may affect the child. Toxoplasmosis is usually spread by eating poorly cooked food that contains cysts, exposure to infected cat feces, and from a mother to a child during pregnancy if the mother becomes infected. Rarely the disease may be spread by a blood transfusion. It is not otherwise spread between people. The parasite is only known to reproduce sexually in the cat family. However, it can infect most types of warm-blooded animals, including humans. Diagnosis is typically by testing the blood

for antibodies or by testing theamniotic fluid for the parasite's DNA. Prevention is by properly preparing and cooking food. It is also recommended that pregnant women not clean cat litter boxes. Treatment of otherwise healthy people is usually not needed. During pregnancy spiramycin or pyrimethamine/sulfadiazine and folinic acid may be used for treatment(S D Ryder , et al. I J Beckingham ,2001).

2.3.3 Hepatosplenic schistosomiasis: HSS represents a special model of intrahepatic portal hypertension characterized by a presinusoidal portal block and a well-preserved liver parenchyma. Symmers' fibrosis appears in a small but significant proportion of patients with a high worm load. Its pathogenesis is not well established, although experimental and clinical studies point to egg granulomata as the main pathogenetic factor. The eggs carried continuously through the portal circulation produce inflammation and gross amputation of the intrahepatic veins, portal and periportal granulomas, and, eventually, a coarse perilobular fibrosis ("pipe-stem").Portal hypertension,esophagealvarices,and hepatosplenomegaly are the main consequences of these morphologic changes. Gastrointestinal bleeding is the most frequent cause of death. Unlike in cirrhosis, advanced liver failure is not seen except when HSS is associated with liver lesions from other causes such as

virus and alcoholism (S D Ryder , et al. I J Beckingham , 2001).

2.3.4 Portal hypertension: Is hypertension (high blood pressure) in the portal vein system, which is composed of the portal vein, and its branches and tributaries. Portal hypertension is defined as elevation of hepatic venous pressure gradient to >5mmHg. Generally, in clinical practice the pressure is not measured directly until the decision to place a transjugular intrahepatic portosystemic shunt (TIPS) has already been made. As part of that procedure, a hepatic vein wedge pressure is measured with the assumption of no pressure drop across the liver yielding portal vein pressure. Consequences of portal hypertension are caused by blood being forced down alternate channels by the increased resistance to flow through the systemic venous system rather than the portal system (S D Ryder , et al. I J Beckingham ,2001).

2.3.5 Liver abscess :is a pus-filled mass inside the liver. Common causes are abdominal infections such as appendicitis or diverticulitisdue to haematogenous spread through the portal vein. There are three major forms of liver abscess, classified by etiology:

2.3.5.1:Pyogenic liver abscess, which is most often polymicrobial, accounts for 80% of hepatic abscess cases in the United States.

2.3.5.2:Amoebic liver abscess due to Entamoeba histolytica accounts for 10% of cases.

2.3.5.3:Fungal abscess, most often due to Candida species, accounts for less than 10% of cases.

Major bacterial causes of liver abscess include the following: Streptococcus species (including Enterococcus), Escherichia species, Staphylococcus species, Klebsiella species (Higher rates in the Far East),Anaerobes(including Bacteroides species),Pseudo monas species, Proteus species (S D Ryder , et al. I J Beckingham ,2001).

2.3.6 Primary biliary cholangitis : Is an autoimmune disease of the liver. It is marked by slow progressive destruction of the small bile ducts of the liver, with the intralobular ducts and the Canals of Hering(intrahepatic ductules) affected early in the disease. When these ducts are damaged, bile and other toxins build up in the liver (cholestasis) and over time damages the liver tissue in combination with ongoing immune related damage. This can lead to scarring,fibrosis and cirrhosis (S D Ryder , et al. I J Beckingham ,2001).

2.3.7 Fatty liver : Also known as **fatty liver disease** (**FLD**), is a reversible condition wherein

large vacuoles of triglyceride fat accumulate in liver cells via the process of steatosis (i.e., abnormal retention of lipids within a cell). Despite having multiple causes, fatty liver can be considered a single disease that occurs worldwide in those with excessive alcohol intake and the obese (with or without effects ofinsulin resistance). The condition is also associated with other diseases that influence fat metabolism. When this process of fat metabolism is disrupted, the fat can accumulate in the liver in excessive amounts, thus resulting in a fatty liver. It is difficult to distinguish alcoholic FLD from nonalcoholic FLD, and both show microvesicular and macrovesicular fatty changes at different stages. Accumulation of fat may also be accompanied by a progressive inflammation of the liver (hepatitis), called steatohepatitis. By considering the contribution by alcohol, fatty liver may be termed alcoholic steatosis or nonalcoholic fatty liver disease (NAFLD), and the more severe forms as alcoholic steatohepatitis (part of alcoholic liver disease) and Non-alcoholic steatohepatitis (NASH) (S D Ryder , et al. I J Beckingham ,2001).

2.3.8 Liver fibrosis: Is excessive accumulation of scar tissue that results from ongoing inflammation and liver cell death that occurs in most types of chronic liver diseases. Nodules, abnormal spherical areas of cells, form as dying liver cells are replaced by regenerating

cells. This regeneration of cells causes the liver to become hard. Fibrosis refers to the accumulation of tough, fibrous scar tissue in the liver. Fibrosis occurs when excessive scar tissue builds up faster than it can be broken down and removed from the liver. Chronic infection with hepatitis C or hepatitis B virus (HCV or HBV), heavy alcohol consumption, toxins, trauma or other factors can all lead to liver fibrosis. Only in rare instances is liver fibrosis the primary problem; more often, it is secondary to some other liver disease such as cirrhosis (S D Ryder , et al. I J Beckingham ,2001).

2.3.9 Liver cirrhosis: Is a condition in which the liver does not function properly due to long-term damage. Typically, the disease comes on slowly over months or years. Early on, there are often no symptoms. As the disease worsens, a person may become tired, weak,itchy, have swelling in the lower legs, develop yellow skin, bruise easily, have fluid build up in the abdomen, or develop spider-like blood vessels on the skin. The fluid build-up in the abdomen may become spontaneously infected. Other complications includehepatic encephalopathy, bleeding from dilated veins in the esophagus or dilated stomach veins, and liver cancer. Hepatic encephalopathy results in confusion and possibly unconsciousness. Cirrhosis is most commonly caused by hepatitis B,C alcoholic, nonalcoholic fatty liver and Typically, more _. than two or three drinks per day over a number of years is

required for alcoholic cirrhosis to occur. Non-alcoholic fatty liver disease is due to a number of reasons, including being overweight, diabetes, high blood fats,and high blood pressure. A number of less common causes
include autoimmunehepatitis,primarybiliarycirrhosis, he mochromatosis, certain medications, and gallstone. Cirrhosis is characterized by the replacement of normal liver tissue by scar tissue. These changes lead to loss of liver function (S D Ryder , et al. I J Beckingham ,2001).

iver failure: Occurs when large parts of the liver become damaged beyond repair and the liver is no longer able to function. Liver failure is a life-threatening condition that demands urgent medical care. Most often, liver failure occurs gradually and over many years. However, a more rare condition known as acute liver failure occurs rapidly (in as little as 48 hours) and can be difficult to detect initially.The most common causes of liver failure (where the liver fails over months to years) include: Hepatitis B**,** Hepatitis C**,** Long-term alcohol consumption**,** Cirrhosis**,** Hemochromatosis (an inherited disorder that causes the body to absorb and store too much iron)**,** Malnutrition. Early symptoms of liver failure include: Nausea, Loss of appetite, Fatigue, Diarrhea.However, as liver failure progresses, the symptoms become more serious, requiring urgent care. These symptoms include: Jaundice, Bleeding easily, Swollen abdomen, Mental disorientation or confusion

(known as hepatic encephalopathy), Sleepiness, Coma (S D Ryder , et al. I J Beckingham ,2001).

2.3.11 Liver cysts :(also called hepatic cysts) are fluid-filled sacs that occur in the liver of roughly 5% of the population. They are usually asymptomatic and often discovered by chance during an abdominal imaging procedure, like computed tomography (CT) or magnetic resonance imaging (MRI). Even though most liver cysts are benign, an early diagnosis is critical for proper treatment of the parasitic or cancerous subtypes. In most cases, treatment involves removal via minimally invasive surgical techniques (S D Ryder , et al. I J Beckingham ,2001).

2.3.12 Liver tumours(benign, malignant): Are tumors or growths on or in the liver (medical terms pertaining to the liver often start in hepato -or hepatic from the Greek word for liver, hepar). Several distinct types of tumors can develop in the liver because the liver is made up of various cell types. These growths can be benign or malignant (cancerous). They may be discovered on medical imaging (even for a different reason than the cancer itself), or may be present in patients as an abdominal mass, hepatomegaly, abdominalpain,jaundice,orsomeothe r liver dysfunction (S D Ryder , et al. I J Beckingham , 2001).

2.3.13Gallbladder tumours (benign, malignant): Is a relatively uncommon cancer. If it is diagnosed early enough, it can be cured by removing. the gallbladder, part of the liver and associated such as jaundice,abdominal pain, and vomiting, and it has spread to other organs such as the liver (S D Ryder , et al. I J Beckingham ,2001).

2.3.14 Cholelithiasis: A **gallstone**, is a calculus (stone) formed within the gallbladder as a concretion of bile components. Lithiasis (stone formation) in the gallbladder is called **cholelithiasis**. Gallstones are formed in the gallbladder but may pass distally into other parts of the biliary tract such as the cystic duct, common bile duct, pancreatic duct or the ampulla of Vater. Rarely, in cases of severe inflammation, gallstones may erode through the gallbladder into adherent bowel potentially causing an obstruction termed gallstone ileus. Presence of gallstones in the gallbladder may lead to acute cholecystitis, an inflammatory condition characterized by retention of bile in the gallbladder and often secondary infection by intestinal microorganism, predominantly Escherisiacoli, Klebseilla,Enterobacter,and *Bacteroides* sp ecies. Presence of gallstones in other parts of the biliary tract can cause obstruction of the bile ducts, which can lead to serious conditions such as ascending cholangitis or pancrestitis. Either of these two conditions can be life-threatening and are therefore considered to

be medical emergenciesnn (S D Ryder , et al. I J Beckingham ,2001).

2.3.15 Cholecystitis: (Greek, -cholecyst, "gallbladder", combined with the suffix *-itis*, "inflammation") is inflammation of the gallbladder. Although most people with gallstones do not have symptoms and will not go on to develop cholecystitis, cholecystitis occurs most commonly due to blockage of the cystic duct with gallstones (cholelithiasis). This blockage causes a buildup of bile in thegallbladder and increased pressure within the gallbladder, leading to right upper abdominal pain. Concentrated bile, pressure, and sometimes bacterial infection irritate and damage the gallbladder wall, causing inflammation and swelling of the gallbladder.[1]Inflammation and swelling of the gallbladder can reduce normal blood flow to areas of the gallbladder, which can lead to cell deathdue to inadequate oxygen. Risk factors for gallstones and cholecystitis are similar and include female sex, increasing age, pregnancy, oral contraceptive,obesity , diabetes mellitus, , rapid weight loss (S D Ryder , et al. I J Beckingham ,2001).

2.3.16 Cholangitis: Ascending cholangitis or acute cholangitis (or sometimes cholangitis without a modifier – from Greek chol-, bile + ang-, vessel + itis-, inflammation) is an infection of the bile duct (cholangitis), usually caused by bacteria ascending from its junction with theduodenum (first part of

the small intestine). It tends to occur if the bile duct is already partially obstructed by gallstones. Cholangitis can be life-threatening, and is regarded as a medical emergency. Characteristic symptoms include yellow discoloration of the skin or whites of the eyes, fever, abdominal pain, and in severe cases, low blood pressure and confusion (S D Ryder , et al. I J Beckingham ,2001).

2.3.17 Biliary obstructions: Is a blockage of the bile ducts. may be caused by a number of factors involving the: bile ducts**,** liver**,** gallbladder**,** pancreas**,** small intestine**.** The following are some of the most common causes of biliary obstruction: gallstones, which are the most common cause**,** inflammation of the bile ducts**,** trauma**,** a biliary stricture, which is an abnormal narrowing of the duct **,** cysts**,** enlarged lymph nodes**,** pancreatitis**,** an injury related to gallbladder or liver surgery**,** tumors of the bile ducts**,** tumors of the pancreas**,** other tumors that have reached the liver, gallbladder, pancreas, or bile ducts**,** infections, including hepatitis**,** parasites**,** cirrhosis, or scarring of the liver (S D Ryder , et al. I J Beckingham ,2001).

2.3.18 Biliary atrasia: Also known as "extrahepatic ductopenia" and "progressive obliterative cholangiopathy", is a childhood disease of the liver in which one or more bile ducts are abnormally narrow, blocked, or absent. It can occur as a birth defect or as

an acquired disease. The symptoms of biliary atresia are indistinguishable from neonatal jaundice, a usually harmless condition commonly seen in infants after birth. Symptoms of biliary atresia are usually evident between one and six weeks after birth. Infants and children with biliary atresia develop progressive cholestasis, a condition in which bile is unable to leave the liver and builds up inside of it. When the liver is unable to excrete bilirubin through the bile ducts in the form of bile, bilirubin begins to accumulate in the blood, causing symptoms. These symptoms include yellowing of the skin, itchiness, poor absorption of nutrients (causing delays in growth), pale stools, dark urine, and a swollen abdomen. Eventuallycirrhosis with portal hypertension will develop. If left untreated, biliary atresia can lead to liver failure. Unlike other forms of liver failure however, biliary atresia-related liver failure does not result in kernicterus, a form of brain damage resulting from liver dysfunction. The reason for this is that the liver, although diseased, is still able to conjugate bilirubin, and conjugated bilirubin is unable to cross the blood–brain barrier (S D Ryder , et al. I J Beckingham ,2001).

2.3.19 Biliary cysts: Choledochal cysts (aka **bile duct cyst**) are congenital conditions involving cystic dilatation of bile ducts (S D Ryder , et al. I J Beckingham ,2001).

2.3.20 Pancreatitis: Is inflammation of the pancreas. The pancreas is a large organ behind the stomach that produces digestive enzymes. There are two main types, acute pancreatitis and chronic pancreatitis. Symptoms of pancreatitis include pain in the upper abdomen,nausea and vomiting. The pain often goes into the back and is usually severe. In acute pancreatitis a fever may occur and symptoms typically resolve in a few days. In chronic pancreatitis weight loss, fatty stool, and diarrhea may occur. Complications may include infection, bleeding, diabetes, or problems with other organs. The most common causes of acute pancreatitis are gallstones and heavy alcohol use. Other causes include direct trauma, certain medications, infections such as mumps, and tumors among others. Chronic pancreatitis may develop as a result of acute pancreatitis. It is most commonly due to many years of heavy alcohol use. Other causes include high levels of blood fats, high blood calcium, some medications, and certain genetic disorders such as cystic fibrosis among others. Smoking increases the risk of both acute and chronic pancreatitis (S D Ryder , et al. I J Beckingham , 2001).

2.3.21 Pancreatic tumours(benign, malignant): Is any undifferentiated growth detected in the pancreas, usually on medical imaging. A number of terms used to describe abnormal masses (also known astumors) in the pancreas. Masses can be described

based on their physical characteristics, as defined by imaging studies, as solid (consisting of solid abnormal tissue) or cystic (cavities filled with mucus or fluid). Masses can also further be described based on their aggressiveness usually based on imaging and examination of their cells under the microscope as benign (no potential for turning into cancer), premalignant (some potential to turning into cancer) and malignant (cancerous). Masses involving the pancreas are being recognized more frequently, in part because of the growing use of radiology imaging. Many lesions found on the pancreas turn out to be benign “pseudocysts,” but a variety of harmless (benign) and malignant (cancerous) neoplasms (abnormal growths) can involve the pancreas and a multidisciplinary approach including good clinical history, imaging, and careful pathology is often needed to establish the correct diagnosis (S D Ryder , et al. I J Beckingham , 2001).

2.4. Magnetic Resonance Imaging(MRI): Is a medical imaging technique used in radiology to image the anatomy and the physiological processes of the body in both health and disease. MRI scanners use strong magnetic fields, radio waves, and field gradients to form images of the body. A strong magnetic field (B0) first aligns the spins of each atom of the human body (hydrogen is used in clinical MRI) precessing in a center frequency that is dependent of the strength of the

magnetic field. As the magnetic field is directed down the center of the MRI machine, the hydrogen protons align either towards the patient's head or feet, with approximately 50% going either way, effectively cancelling each other out. A very small number of protons are unmatched and aren't canceled out, about 1 to 2 in a million. Next, a radio frequency (RF) pulse (B1) which is specific to hydrogen, is applied by the MRI machine toward the part of the body being examined. This pulse causes the unmatched protons to spin in a different direction at a specific frequency (the Larmour frequency). At the same time, a series of gradient magnets are cycled on and off creating a field gradient, which change the main magnetic field at a specific level, allowing cross-sectional images to be acquired. When the RF pulse ceases, the hydrogen ions return to their native state and release the energy absorbed from the pulses. This low energy (in the pW range) is detected by the receiver coils in the MRI and sent to a computer, where a Fourier transformation converts the signal from the protons as mathematical data into a picture that can be interpreted by the clinician. The technique is widely used in hospitals for medical diagnosis, staging of disease and follow-up without exposure of the body to ionizing radiation. MRI is in general a safe technique but the number of incidents causing patient harm has risen. Contraindications to MRI include most cochlear implants and cardiac pacemakers, shrapnel and metallic foreign bodies in the eyes. The

safety of MRI during the first trimester of pregnancy is uncertain, but it may be preferable to other options. All patients are reviewed for contraindications prior to MRI scanning. Medical devices and implants are categorized as MR Safe, MR Conditional or MR Unsafe: (Hollingworth, W.,Todd, C.J., Bell, M.I., Arafat, Q., Girling, S., Karia, K.R. and Dixon, A.K., 2000. The diagnostic and theraputic impact of MRI: an observational multi-centre study. Clinical radiology, 55(11), pp.825-831).

2.4.1:MR-Safe — The device or implant is completely non-magnetic, non-electrically conductive, and non-RF reactive, eliminating all of the primary potential threats during an MRI procedure (Hollingworth, W.,Todd, C.J., Bell, M.I., Arafat, Q., Girling, S., Karia, K.R. and Dixon, A.K., 2000. The diagnostic and theraputic impact of MRI: an observational multi-centre study. Clinical radiology, 55(11), pp.825-831).

2.4.2:MR-Conditional — A device or implant that may contain magnetic, electrically conductive or RF-reactive components that is safe for operations in proximity to the MRI, provided the conditions for safe operation are defined and observed (such as 'tested safe to 1.5 teslas' or 'safe in magnetic fields below 500 gauss in strength'). MR-Unsafe — Objects that are significantly ferromagnetic and pose a clear and direct threat to persons and equipment within the magnet room. The MRI environment may cause harm in patients with MR-Unsafe devices such as cochlear

implants and most permanent pacemakers(Hollingworth, W.,Todd, C.J., Bell, M.I., Arafat, Q., Girling, S., Karia, K.R. and Dixon, A.K., 2000. The diagnostic and theraputic impact of MRI: an observational multi-centre study. Clinical radiology, 55(11), pp.825-831).

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2.5 MRCP: MRCP is a special type of magnetic resonance imaging (MRI). It uses computer software that specifically images pancreatic and bile ducts, which are often the site of tumors. Fluid naturally present in the ducts serves as a contrast substance. MRCP is an excellent tool for visualizing pancreatic cysts and blockages in the ducts. An MRCP can be done at the same time as an MRI. MRCP provides a similar picture as ERCP, but without the risks of an invasive ERCP procedure (Karla, M, Sahani 2002).

2.6 Previous Studies

Study done by H E Adamek et.al, in evaluation of the patiets with suspected bile duct obstruction by using MRCP. Chi –Square test was done and show that there is statistically significant difference between Age groups in MRCP finding according to (sig.= 0.007 ˂ 0.05) in (chi-square test).

Another study done by Thomas Rosck et al, in evaluation of patients with jaundice by using ERCP, MRCP

and CT. This study show that there is statistically significant difference between 2 sex groups in MRCP finding according to (sig.= 0.05 ˃ 0.003) in (chi-square test).

Chapter Three

Materials and Methods

3.1. Materials:

3.1.1 Patients:

The study group consisted of 60 patients came to MRI department for MRCP imaging, 22 male(36.7%) and 38 female(63. 3%), minimum age is 18 and maximum age is 80, with biliary system broblems for whom magnetic resonance cholangiopancreatography (MRCP) was done. The study was done in antalia medical center and modern medical center in Khartoum state in period of time between august 2015 to april 2016.

3.1.2 MRI machine:

MRI machine from General Elictiric (GE), having 1.5 Tesla. A body coil was used for the examination, peripheral pulse unit and respiratory compensator.

3.1.3 Type of the study:

Retrospective cross sectional study deal with evaluation of certain biliary system diseases using (MRCP)

3.2. Methods:

3.2.1 The Technique:

For(MRCP) examination the patients were well prepared by fasting at least 4 hours before examination and checked for any contraindications.

Liver and bile ducts was performed with the patients supine on examination couch with RC bellows securely attached. The patients are positioned so that the longitudinal aligment light lies in the midline, and horizontal aligment light passes through the level of the third lumber vertebra, or the lower costal margin.

A general survey (scout) was done to show the liver anatomy in three localizers obtained as axial, coronal and sagital. The area from the pubis symphysis to diaphragm is included in the image.

- Coronal breath-hold incoherent(spoiled) GRE\SE \SSFSE BH T1 .
- Axial FR\FSE \RTr Fat SAT ASSET\T2 .
- Axial SE\FSE\ breath-hold incoherent(spoiled) GRE T1 .
- 3D MRCP RTr ASSET .
- Thick slap MRCP ASSET .

This sequences provide images in which only fluid-filled spaces such as gallbladder and biliary ducts return signal. Use long TEs and TRs to effectively nullify the signal from all tissues except those that have long T2 decay times. TEs in excess of 200ms and TRs of more than 10s are required.

(MRCP) images were reviewed at the diagnostic workstation and on hard copy films by expert radiologist.

3.2.2. Data collection:

Data collected by data collection sheet.

3.3. Analysis:

The data were analyzed by SPSS (Cross tabulation and Chi-Square test).

Chapter Four

Results

The following chapter was highlight the result related to the study of biliary system diseases and common diagnostic method in Sudan , which has been carried out on 60 patients. The results have been shown in forms of colomns and correlations as well as percentages.

Table 4:1: show frequency distribution of age groups.

Age	Frequency	percentage
25-35	1	1.7%
36-46	2	3.3%
47-57	5	8.3%
58-68	21	35%
69-79	31	51.7%

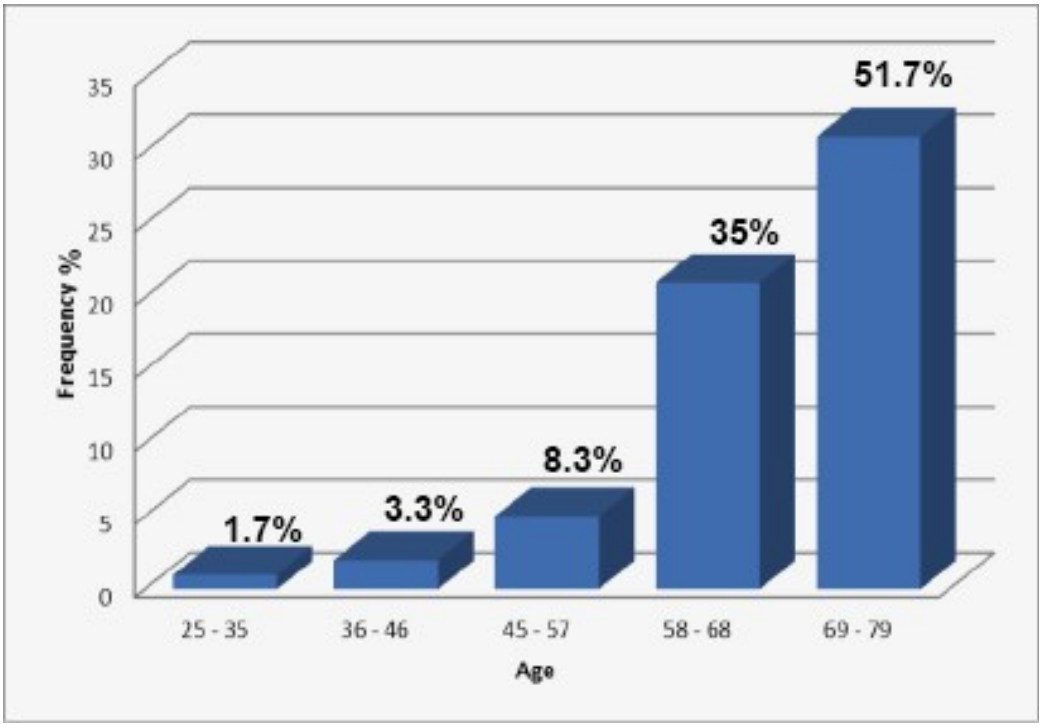

Figure 4:1: shows the distribution of the biliary diseases based on Age.

Table 4:2: Shows frequency distribution of gender groups.

sex	frequency	percentage
Male	22	36.67%
Female	38	63.33%

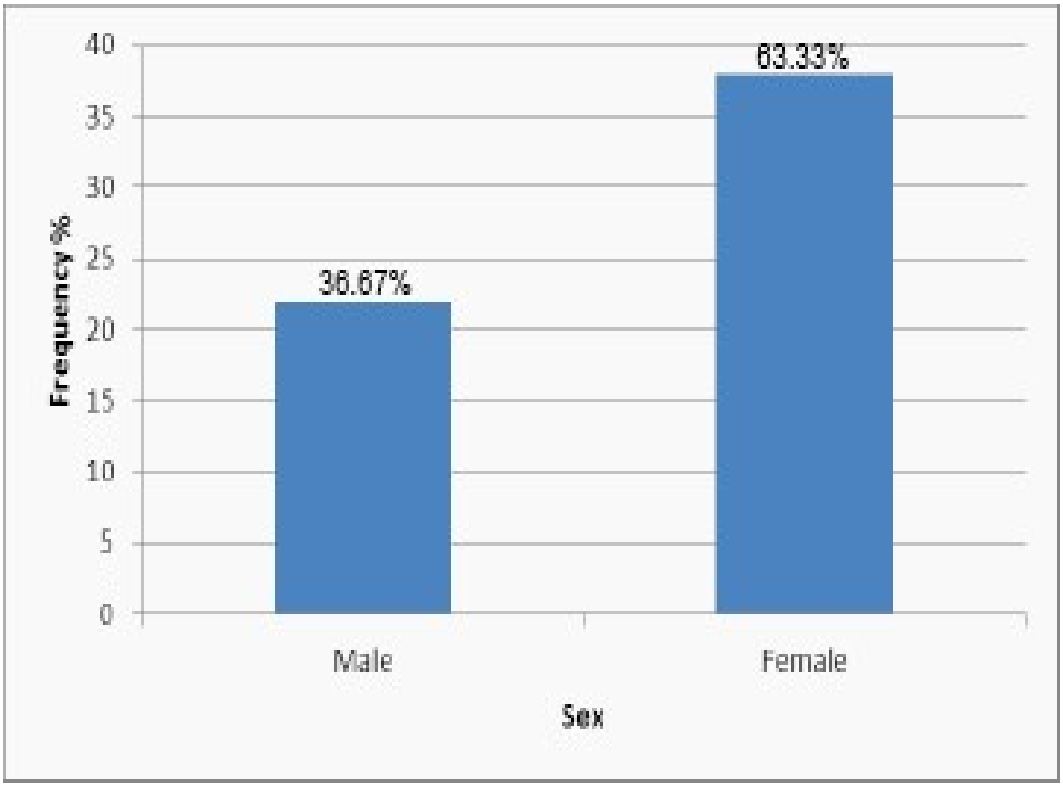

Figure 4:2: shows the distribution of the biliary diseases based in Gender.

Table 4:3: Shows frequencies distribution of weight according to gend.

Weight	Female freq	percentage	Male freq	percentage	total
70-79	31	65.95%	16	34.05%	47
80-89	7	53.85%	6	46.15%	13

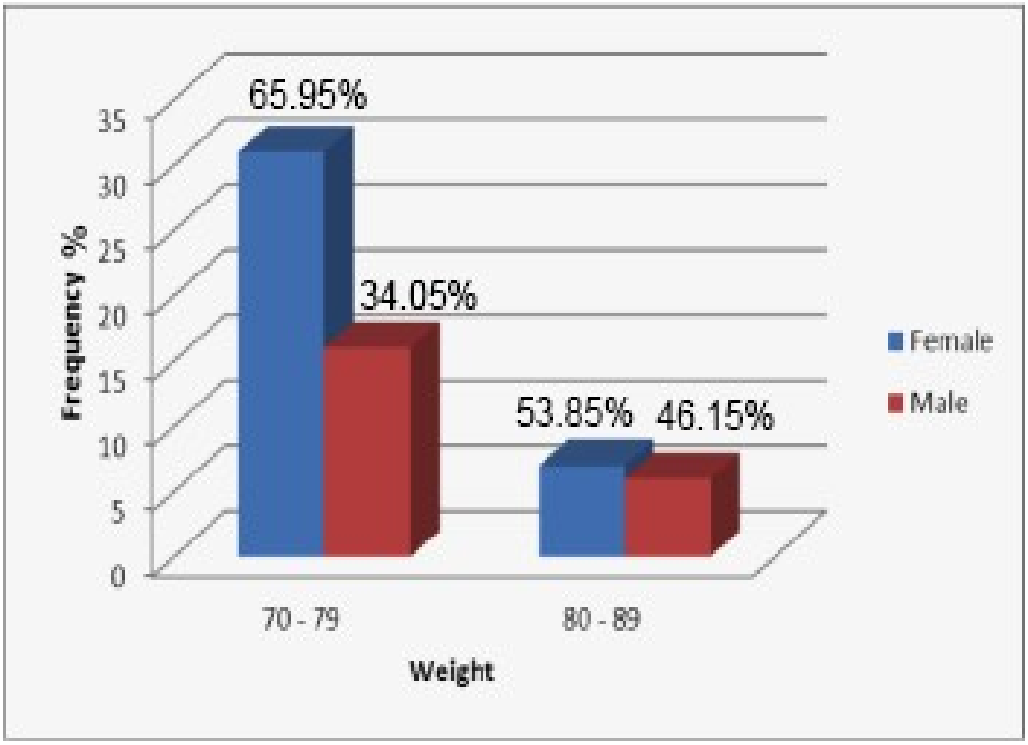

Figure 4:3: shows the frequency percent of the biliary diseases based in weight.

Table 4:4: show frequency distribution of MRCP finding according to gender.

MRCp finding	Female freq	percentage	Male freq	percentage	total
Obstruction	17	70.83%	7	29.17%	24
gallstone	3	60%	2	40%	5
cholangiocarcinoma	9	52.9%	8	47.1%	17
cholecystitis	10	71.4%	4	28.6%	14

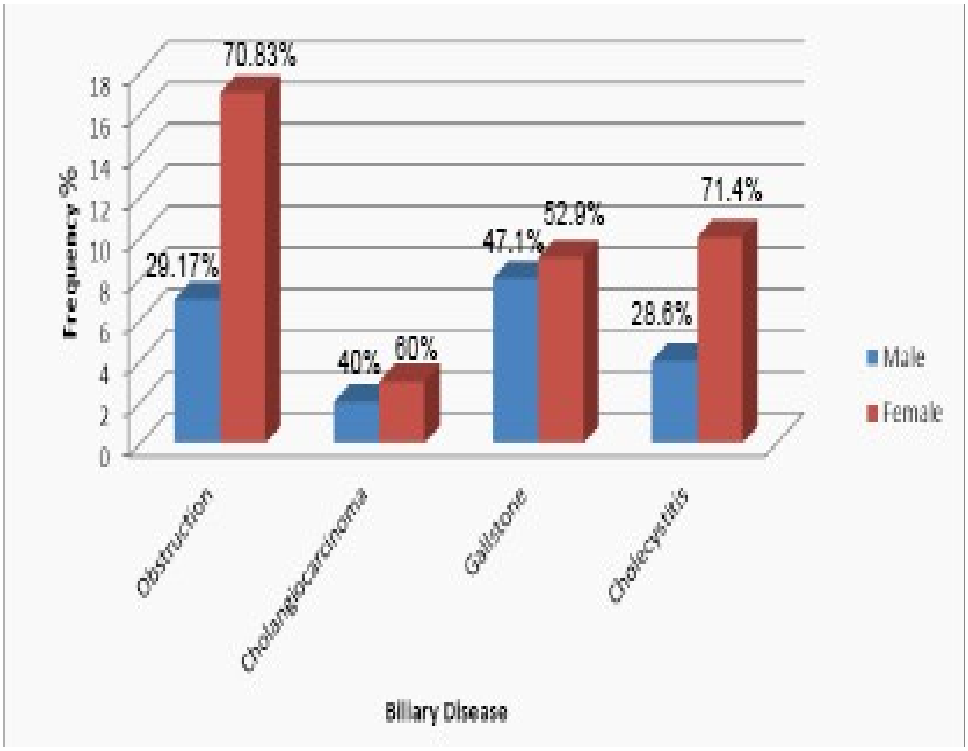

Figure 4:4: shows the frequency percent of the biliary diseases detected by MRCP.

Table 4:5: Shows cross tabulation of sex and MRCP finding.

			Sex		
			Female	**Male**	Total
MRCp	**Obstruction**	Count	17	7	24
		within MRCp %	70.8%	29.2%	100.0%
	Gallstone	Count	3	2	5
		within MRCp %	60.0%	40.0%	100.0%
	Cholangiocarcinoma	Count	9	8	17
		within MRCp %	52.9%	47.1%	100.0%
	Cholecystitis	Count	9	5	14
		within MRCp %	64.3%	35.7%	100.0%
	Total	Count	38	22	60
		within MRCp %	63.3%	36.7%	100.0%

Table 4:6: Shows Chi-Square test of MRCP*sex crosstabulation.

	Value	df	(Asymp. Sig. (2-sided
Pearson Chi-Square	**1.401**	**3**	**705.**
Likelihood Ratio	1.397	3	706.
Linear-by-Linear Association	514.	1	473.
N of Valid Cases	60		

Table 4:7: Shows Cross tabulation of weight and MRCP finding.

MRCp * Weiht Crosstabulation					
			Weight		
			70-79 kg	80-89 kg	Total
MRCp	Obstruction	Count	19	5	24
		% within MRCp	79.2%	20.8%	100.0%
	Gallstone	Count	4	1	5
		% within MRCp	80.0%	20.0%	100.0%
	Cholangiocarcinoma	Count	12	5	17
		% within MRCp	70.6%	29.4%	100.0%
	Cholecystitis	Count	11	3	14
		% within MRCp	78.6%	21.4%	100.0%
Total		Count	46	14	60
		% within MRCp	76.7%	23.3%	100.0%

Table 4:8: Shows Chi-Square test of MRCP * weight cross tabulation.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	**.494**	**3**	**.920**
Likelihood Ratio	.480	3	.923
Linear-by-Linear Association	.074	1	.785
N of Valid Cases	60		

Table 4:9: Shows cross tabulation of Age and MRCP finding.

MRCp * Age Crosstabulation								
			Age					Total
			25-35	36-46	47-57	58-68	69-79	
MRCp	Obstruction	Count	0	1	1	10	12	24
		within % MRCp	0%.	4.2%	4.2%	41.7%	50.0%	100.0%
	Gallstone	Count	0	0	0	1	4	5
		within % MRCp	0%.	0%.	0%.	20.0%	80.0%	100.0%
	Cholangiocarcinoma	Count	0	0	2	6	9	17
		within % MRCp	0%.	0%.	11.8%	35.3%	52.9%	100.0%
	Cholecystitis	Count	1	1	2	4	6	14
		within % MRCp	7.1%	7.1%	14.3%	28.6%	42.9%	100.0%
Total		Count	1	2	5	21	31	60
		within % MRCp	1.7%	3.3%	8.3%	35.0%	51.7%	100.0%

Table 4:10: Shows Chi- Square test of MRCP*Age cross tabulation.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	**8.228**	**12**	**.007**
Likelihood Ratio	8.781	12	.722
Linear-by-Linear Association	1.589	1	.208
N of Valid Cases	60		

Chapter five

Discussion, Conclusion and Recommendations

5.1 Discussion

The aim of this study was to evaluate the biliary system diseases using MRCP among 60 patients with suspected biliary diseases. All patients underwent MRCP and the study revealed that:

The study showed that 60 patients aged groups were (69-79) years (31)patients which were (51%),then (58-68)years (21) patients which were (35%), then (47-57)years (5) patients which were (8%), then (36-46)years (2) patients which were (3%), then (25-35)years (1)patient which was (1%) as shown in table (4:1). In cross tabulation of age with (MRCP) finding we found that (MRCp) (Obstruction, Gallstone, Cholangiocarcinoma and Cholecystitis) were found in lower categories of age less than in upper ones, it is more likely to found statistically significant difference between different groups of age to find (MRCp), that is according to (sig.= 0.007 ˂ 0.05) in (chi-square test) as shown in tables (4:9), (4:10). The biliary diseases were predominant among age group between(69-79) years (31)patients which were (51%),then (58-68)years (21) patients which were (35%), then (47-57)years (5) patients which were (8%), then (36-46)years (2) patients which were (3%), then (25-35)years (1)patient which was (1%) as shown in figure (4:1). This

result is in line with that mentioned by (H E Adamek et.al,1996).

In this study according to gender, male (22) as(36%) and female(38) as(63%)that means the females more affected than males as shown in table (4:2).in cross tabulation of sex, with (MRCP) finding we found that (MRCp) found among Females (70.8%, 60%, 52.9% and 64.3%) for (Obstruction, Gallstone, Cholangiocarcinoma and Cholecystitis) respectively more than in Males group (29.2%, 40%, 47.1% and 53.7%), though there is no statistically significant difference between two groups in (MRCp) finding, according to (sig.= 0.705 ˃ 0.05) in (chi-square test)as shown in tables (4:5), (4:6). As well as predominant among female(38) relative to male(22) as(63%) and(36%) respectively, as shown in figure (4:2).in this result I disagree with (Thomas Rosck et al, 2002-2003).

Forty seven of patients were (70-79)Kg were the highest group (78%) then group (80-89)Kg were (13) patients (21%) come next.as shown in table (4:3). In cross tabulation of weight with (MRCP) finding we found that (MRCp) found among whom 70-79 weighted (79.2%, 80%, 70.6%and 78.6%) for (Obstruction, Gallstone, Cholangiocarcinoma and Cholecystitis) respectively more than in 80-89 weighted group(20.8%, 20%, 29.4% and 21.4%), though is more likely no statistically significant difference between two groups in (MRCp) finding,

according to (sig.= 0.920 ˃ 0.05) in (chi-square test) as shown in tables (4:7), (4:8).

The study showed that the biliary diseases were predominant among weight group between (70-79)Kg (47)patients as (78%), in female(31) as(65%) relative to male(16)as (34%) then group(80-89)Kg (13)as (21%), in female(7)as (53%) relative to male(6)as(46%)as shown in figure (4:3).

In figure (4:4) the study showed that the most common cause of the biliary diseases were biliary obstruction due to different causes and gallstones. The biliary obstruction predominant among female(17) relative to male(7) as (70 %) and (29%) respectively . also gallstone predominant among female(3) relative to male(2) as (60%) and (40%) respectively . the most common cause of biliary obstruction is Ca because the malignancy was seen mainly in elderly people (Kim Vaiphyei et al, 2007).

Choecystitis and cholangio carcinoma were predominant also among female(10),(9) respectively relative to male(4),(8) respectively as (71%) and (52%), (28%) and (47%) respectively .

patients with biliary obstruction are most likely advised for ERCP for stent and biopsy although ERCP has

same reslt as MRCP but in this case there is need for some invasive procedure .

5.2 Conclusion

After finishing of the current study and scoring the specific galls, the conclusion could be given in the following points :

- The biliary diseases were predominant among age group between(69-79) years (31)patients which were (51%),then (58-68)years (21) patients which were (35%), then (47-57)years (5) patients which were (8%), then (36-46)years (2) patients which were (3%), then (25-35)years (1)patient which was (1%).
- The biliary diseases were predominant among weight group between (70-79)Kg (47)patients as (78%), in female(31) as(65%) relative to male(16)as (34%) then group(80-89)Kg (13)as (21%), in female(7)as (53%) relative to male(6)as(46%).
- The most common cause of the biliary diseases were biliary obstruction due to different causes and gallstones.
- The biliary diseases were predominant among female(38) relative to male(22) as(63%) and(36%) respectively.
- The gallstone predominant among female(3) relative to male(2) as (60%) and (40%) respectively .
- Choecystitis and cholangio carcinoma were predominant also among female(10),(9) respectively relative to male(4),(8) respectively as (71%) and (52%), (28%) and (47%) respectively .

- patients with biliary obstruction are most likely advised for ERCP for stent and biopsy although ERCP has same reslt as MRCP but in this case there is need for some invasive procedure.
- We found that, elder with heavy weight females were the most patients got biliary diseases.

5.3 Recommendations

- For biliary obstruction, after MRCP the patient may be advised for additional ERCP for treatment.
- Clinical history should be provided in the request form so as to choose the suitable technique and method of examination.
- Quality assurance for equipments should be performed regularly to increase image quality.
- Proper patient preparation is mandatory to increase the diagnostic accuracy.
- Further studies could be done in bigger sample size.
- Future studies can be more informative by using additional sequences and more advised MRI system.

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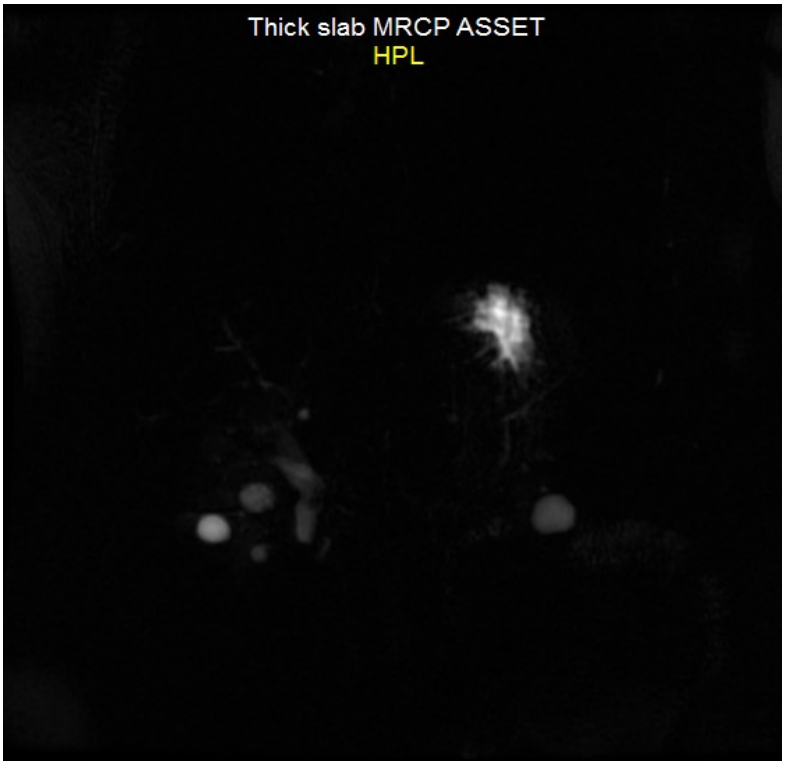
Appendices

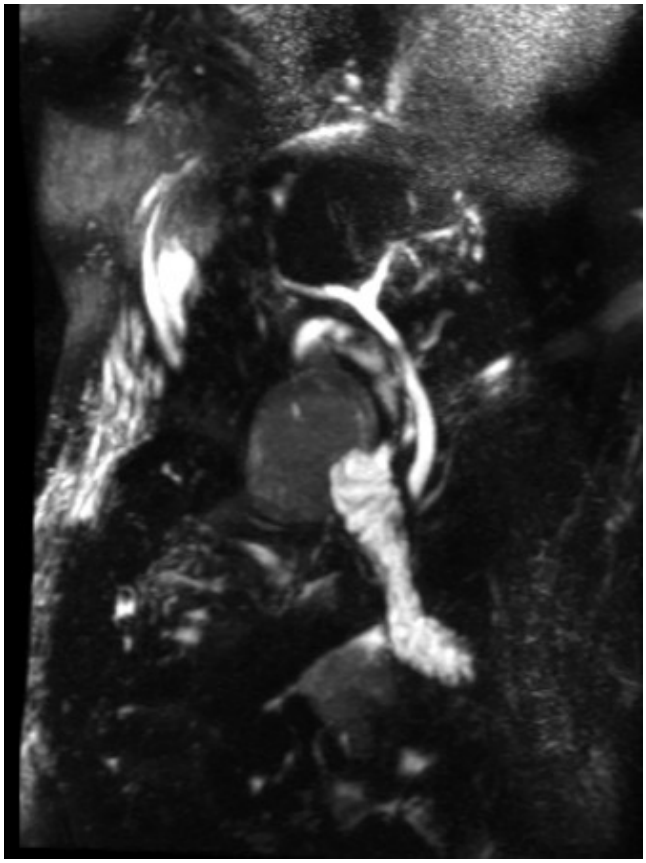
Images of Reaearch

Image[1] show: 3plane localizer SSFSE MRCP image

.70years male patient showing location of the liver



Image[2] show: Thick slab MRCP SSET image 68years female patient showing dilated CBD and multiple .gallstone



Image[3] show: 3D MRCP RTr ASSET image 75years female patient showing multiple gallstones.