Chapter One

General Introduction

1.1Introduction:

Magnetic resonance cholangiopancreatography (MRCP) is an abdominal magnetic resonance imaging method that allows non-invasive visualization of the pancreatobiliary tree and requires no administration of contrast agent. (Adamek HE et al, 1998).

MRCP is increasingly being used as a non-invasive alternative to ERCP and a high percentage of the diagnostic results of MRCP are comparable with those from ERCP for various hepatobiliary pathologies. (Vogl TJ et al.2006).

It has been exactly two decades since magnetic resonancecholangiopancreatography (MRCP) was first described. Over this time, the technique has evolved considerably, aided by improvements in spatial resolution and speed of acquisition. It has now an established role in the investigation of many biliary disorders, serving as a non-invasive alternative to endoscopic retrograde cholangiopancreatography (ERCP).It makes use of heavily T2-weighted pulse sequences, thus exploiting the inherent differences in the T2-weighted contrast between stationary fluid-filled structures in the abdomen (which have a long T2 relaxation time) and adjacent soft tissue (which has a much shorter T2 relaxation time). Static or slow moving fluids within the biliary tree and pancreatic duct appear of high signal intensity on MRCP, whilst surrounding tissue is of reduced signal intensity. (WallnerBK ,et al 1991).

Heavily T2-weighted images were originally achieved using a gradient-echo (GRE) balanced steady-state free precession technique. A fast spin-echo (FSE) pulse sequence with a long echo time (TE) was then introduced shortly after, with the advantages of a higher signal-to-noise ratio and contrast-to-noise ratio, and a lower sensitivity to motion and susceptibility artefacts. (Morimoto K, et al 1992).

Modified FSE sequences have been described, including rapid acquisition with rapid enhancement (RARE), half-Fourier acquisition single-shot turbo spin-echo (HASTE), and fast-recovery fast spin-echo (FRFSE) sequences. Both breath-hold (using a single shot approach) and non-breath-hold techniques (with respiratory triggering) have been used, with images obtained either as a two-dimensional (2D) or three-dimensional (3D) acquisition. A 3D technique provides a higher signal to noise ratio, which is traded off for thinner contiguous slices.(Takehara Y, et al 1994).

A 3D technique provides a higher signal to noise ratio, which is traded off for thinner contiguous slices. Acquiring images with near isotropic voxels allows improved post-processing manipulation of the images with multi-planar reconstruction, maximum intensity projection (MIP) and volume rendering. (Barish MA, et al 1995).

The introduction of faster gradients and a parallel acquisition technique has resulted in even greater spatial resolution and faster acquisition times. More recently, functional assessment of biliary excretion and pancreatic exocrine function has become possible with the use of hepatobiliary contrast media and secretin respectively. (Fayad LM, Holland GA, Bergin D, et al 2003).

MRCP is currently gaining wider use as a non-invasive alternative to ERCP. The techniques are comparable with respect to diagnostic accuracy but

MRCP offers the advantages of 3D imaging and imaging reformatting, as well as having no morbidity and mortality. MRCP is non-invasive and well tolerated, and in cases where it is not possible to carry out interventional endoscopy, MRCP should be the first choice of diagnostic tool. (Fayad LM, Holland GA, Bergin D, et al 2003).

With MRCP, stones are seen as hypointense circular signal voids on axial images. However stones may appear in various forms, such as filling defects or sudden breaks in the intra- or extrahepatic biliary tree with proximal dilatation. The literature indicates that MRCP is a highly sensitive (50% to 100%) and specific (83% to 100%) tool for diagnosing biliary stone disease. (Vogl TJ, et al.2006).

Pancreatobiliary malignancy is another fascinating domain in which MRCP has a very important role. Biliary malignancies appear as filling defects, irregular stenosis, or post-stenotic dilatations in the biliary or pancreatic channels. Hyperintense structures surrounding the biliary or pancreatic ductal systems may also indicate the location and extension of such tumors.(Vogl TJ, et al.2006).

MRCP is as accurate as ERCP for diagnosing biliary and pancreatic malignancies. Some authors have suggested that MRCP combined with abdominal MR imaging is better than any other imaging regime for staging tumors of the pancreatobiliary tree. MRCP has a sensitivity of 94% in diagnosing Klatskin tumors. In contrast, ERCP studies yielded a sensitivity of 87 %.(Vogl TJ, et al.2006).

Taylor (2002) research about MR Cholangiopancreatography (MRCP) at 0.5 T: technique optimization and preliminary results aim to evaluate the accuracy of magnetic resonance cholangiopancreatography (MRCP) in 129

patients with suspected biliary tract disease who were referred for ERCP. MRCP results were interpreted by an expert in hepatobiliary imaging who was

blinded to ERCP findings. Forty-six patients had choledocholithiasis, and 12 had biliary strictures. Compared with ERCP as the gold standard, the sensitivity, specificity, positive predictive value, and negative predictive value of MRCP for diagnosing stones were 98%, 89%, 83%, and 99%, respectively. Of the 14 patients with small calculi (1-5 mm in diameter) diagnosed at ERCP, 13 were detected on MRCP (sensitivity, 93%), but there were 9 false-positive MRCP results. All 12 biliary strictures were diagnosed by MRCP (sensitivity, specificity, positive predictive value, and negative predictive value; 100%, 99%, 92%, and 100%, respectively).

1.2 Objectives:

1.2.1General Objectives:

- To evaluate the causes of hepatobiliary diseases by using the Magnetic resonance cholangiopancreatography (MRCP).

1.2.2 Specific Objectives:

- To detect or diagnose the hepatobiliary diseases by MRCP.
- To compare between the MRCP and ultrasound in detecting the hepatobiliary diseases.

1.3 Hypothesis:

Magnetic resonance cholangiopancreatographyMRCP is more efficient method in diagnose the hepatobiliary diseases and noninvasive procedure.

1.4 Problem of study:

Most of the imaging modalities fail to show the causes, level, and size of the obstruction at the same time mainly in the early stage and then if the hepatobiliary diseases diagnosed in late stage then leads tomany complications and many imaging procedures cause risks due to contrast media use , and using ionizing radiation .

1.5 Significance of the study:

Performing of Magnetic resonance cholangiopancreatographyMRCP has significant in accurate diagnose of the hepatobiliary diseases and give a higher degree of patent health care without mistakes and risks.

1.6 Overview of the study:

This study contains five chapters named as follow chapter one the introduction, chapter two the literature review, chapter three the methodology, chapter four results and chapter five the discussion and conclusion.

Chapter two

Literature review & previous studies

2.1 The anatomy of the hepatobilliarysystem:

2.1.1 Liver:

The liver is divided macroscopi- cally into the right and left lobe by the falciform ligament anteriorly (Fig. 1.1). Inferiorly, this corresponds to the round ligament and umbilical fissure. The right lobe is further divided by the gallbladder fossa into the right hemiliver to the right of the gallbladder and the quadrate lobe to the left. The fourth lobe (caudate) is posterior and surrounds the inferior vena cava. Hence, anatomically the liver is divided into two main lobes and two accessory lobes.(HPB 2000) .

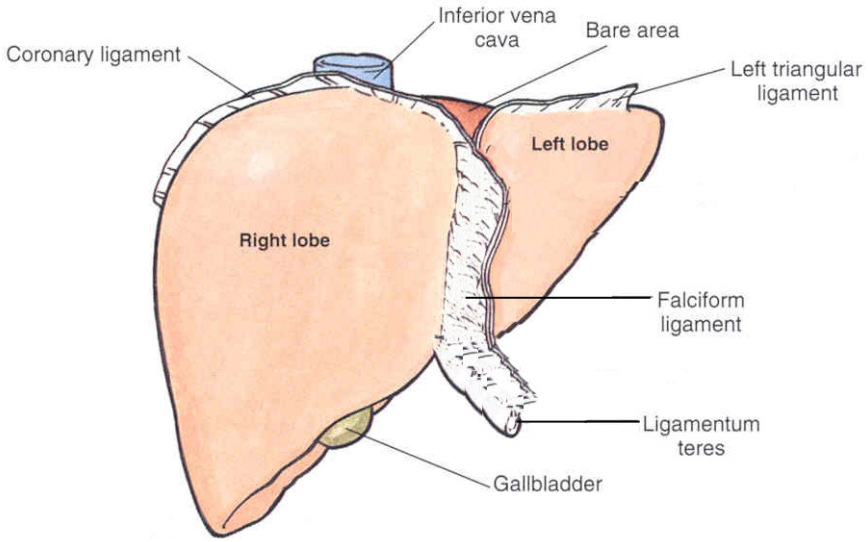

Fig.2.1 anatomy of hepato-bi;iary system (google/images.com)

2.1.2. Intrahepatic bile ducts: There are more than 2 km of bile ductules and ducts in the adult human liver (Fig 1.2). These structures are far from being inert channels, and are capable of significantly modifying biliary flow and composition in response to hormonal secretion.(Michels NA, 1957).

2.1.3. Extrahepatic bile ducts:The joining of the right and left hepatic ducts forms the common hepatic duct. The accessory biliary apparatus, composed of the gallbladder and cystic duct, joins the common hepatic duct to form the common bile duct that drains bile into the second part of duodenum. (Michels NA, 1957).

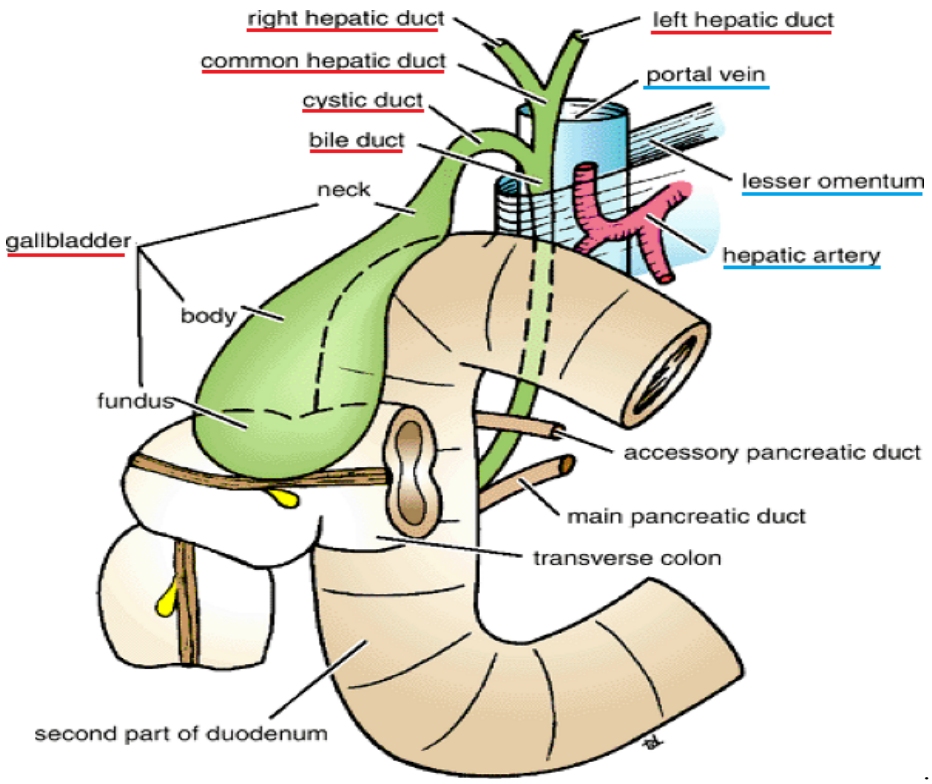

Fig 2.2biliareyducts .(google/images.com).

2.1.4Gallbladder and cystic duct: The gallbladder is a reservoir of bile in the shape of a piriform sac partly contained in a fossa on the inferior surface of the right hepatic lobe. It extends from the right extremity of the portahepatis to the inferior border of the liver. It is 7 to 10 cm long and 3 to 4 cm broad at its widestpart, and can hold from 30 to 50 ml. The gallbladder is divided into a fundus, body, in- fundibulum and neck. The fundus extends about 1 cm beyond the free edge of the liver. The body is the largest segment. The infundibulum is the transitional area between the body and the

neck. The neck is the tapered segment of the infundibulum that is narrow and joins the cystic duct. The cystic duct is 3 to 4 cm long and passes posteriorly inferior and to the left from the neck of the gallbladder to join the common hepatic duct to form the common bile duct (CBD). The mucosa of the cystic duct is arranged with spiral folds known as the valves of Heister (Wood D.1979).

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2.1.5The duct of Luschka: The duct of Luschka is a small bile duct, running in the bed of the gallbladder, outside the wall. It is present in 50% of individuals (Kune GA.1969).

2.1.6The Common bile duct: The common bile duct (CBD) forms by the junction of the cystic duct with the common hepatic duct. Its course is divided intosupraduodenal, retroduodenal, pancreatic and intraduodenal (joins the main pancreatic duct to form the sphincter of Oddi).The supraduodenal segment usually lies in the free border of the hepatoduodenal ligament. It runs to the right of the hepatic artery and anterior to the portal

vein. The retroduodenal segment descends posterior to the first part of the duodenum and slightly obliquely from right to left. The pancreatic segment is related to the head of the pancreas; it can run entirely retropancreatic or travel through its parenchyma. The diameter of the common bile duct is often used as an indication of biliary pathology. Its “normal” size varies depending on the

modality used to measure it, and a range of 4 to 13 mm has been reported. (Dowdy GS, Waldron GW, et al.1962).

2.1.7Sphincter of Oddi: The common bile duct enters the duodenum approximately 8 cm from the pylorus in the second part ofthe duodenum.

The site entry is marked by a papilla (major papilla). Its position can be variable; in approximately 13% of individuals it can be located at the junction of the second and third part of the duodenum, or even more distally. A trans- verse fold of mucosa usually covers the papilla.The main pancreatic duct of Wirsung joins the common bile duct and forms a common channel in approximately 85% of individuals. In 15%, they open either separately or as a V junction with the duodenal mucosa.(Lindner HH, Penz VA, Ruggeri RA, et al.1976).

2.2Physiology of the biliary system:

The biliary tract is functionally integrated with the digestive tract by neurohormonal mechanisms in the fasting and digestive phases [W. J. Doddset all 1989]. The liver secretes bile continuously into the intrahepatic ducts flowing into the extrahepaticducts.The gallbladder is filled with the aid of the sphincter of Oddi (SO) where the bile is stored and concentrated in the fasting state and emptied during all three phases of the digestive

periods.[W. J. Dodds, et all 1989].In the interdigestive period about 10% of the hepatic bile can drain into the duodenum occurring during intervals between the phasic contractions of the sphincter of Oddi (diastolic periods) when the secreted bile raise the ductal pressures above the sphincter of Oddi basal pressures [J. Behar and P. Biancani1989].

The remaining 90% of bile is redirected toward the cystic duct to be stored in the gallbladder.The remaining 90% of bile is redirected toward the cystic duct to be stored in the gallbladder. The main neurohormonal mechanisms regulating the motility of the gallbladder are the vagus and splanchnic nerves and the hormone CCK [K. Sonobe, et all 1995]. The vagus nerve contains afferent and efferent fibers.Stimulation of the efferent fibers of the vagus nerve contracts the gallbladder. During the fasting period the gallbladder maintains a moderate tonic contraction that is superimposed with non-propulsive and propulsive contractions [H. Abiru, S. K. Sarna, and R. E. Condon, 1994].

These contractions are responsible for the additional albeit small discharge of gallbladder bile in the duodenum that takes place during this period.In the digestive period strong gallbladder contractions and sphincter of Oddi relaxation lead to the high rates of bile discharge flowing into the commonbileductandduodenum.During this period, the gallbladder motor activity like the rest of the gastrointestinal tract is influenced by the three phases of digestive process: cephalic, antral, and duodenal [I. Takahashi, M. K. Kern, W. J. Dodds et al, 1986].

The cephalic phase is initiated by stimuli that activate the central nervous system, as individuals are exposed to olfactory, visual, and the taste of food.Once food reaches the stomach it triggers an antral-gallbladder reflex

also mediated by vagal fibers.The gallbladder empties most of its remaining contents during the intestinal phase induced by the release of CCK from the duodenum and proximal jejunum.In conclusion the Functions of the biliary system to drain waste products from the liver into the duodeunmand to help digestion with the controlled release of bile.Bile is the greenish-yellow fluid (consisting of waste products, cholesterol, and bile salts) that is secreted by the liver cells to carry away waste and to

break down fats during digestionBile salt is the actual component which helps break down and absorb fats. Bile, which is excreted from the body in the form of feces, is what gives feces its dark brown color.[I. Takahashi, M. K. Kern, W. J. Dodds et al, 1986].

2.2.1Blood supply and venous drainage of the liver:

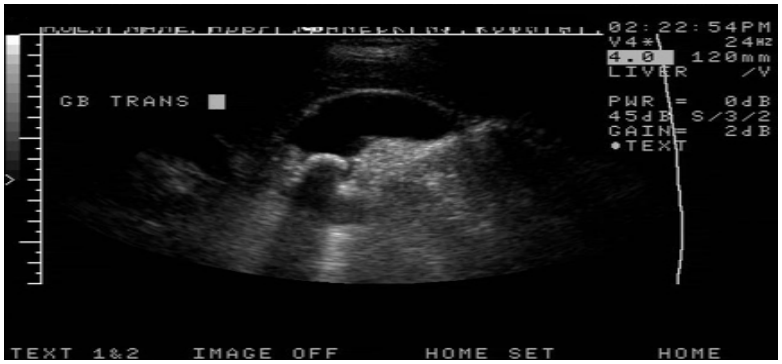
The arterial supply to the liver in early gestation life is from three main sources: the left hepatic artery from the left gastric artery; the middle hepatic artery (common hepatic artery) from the celiac trunk; and the right hepatic artery from the superior mesenteric artery. With further development, the blood supply assumes the adult pattern, with atrophy of both the right and left hepatic arteries and the common hepatic artery (middle hepatic) supplying the whole liver. The venous drainage of the liver is into the inferior vena cava through the right, middle and left hepatic veins. (Jones AL, et al 1980).The arterial supply to the gallbladder is from the cystic artery.The gallbladder is innervated by the vagus nerve through its hepatic branch from the anterior vagal trunk. The venous drainage is through the cystic vein, which drains into the portal vein. There are also some small veins that drain directly into the liver to the hepatic veins. The gall- bladder is also innervated by the sympathetic nervous system through the celiac

plexus. The blood supply to the common bile duct is also divided into three segments. The supraduodenal segment of the duct essentially has an axial blood supply. The blood supply originates from the retroduodenal artery, right hepatic artery, cystic artery, gastroduodenal artery and the retroportalartery.The veins draining the bile duct correspond to the described arteries.The nerve supply to the extrahepatic bile duct is from extrinsic and intrinsic nerves.(Northover IM, Terblanche J.1978)

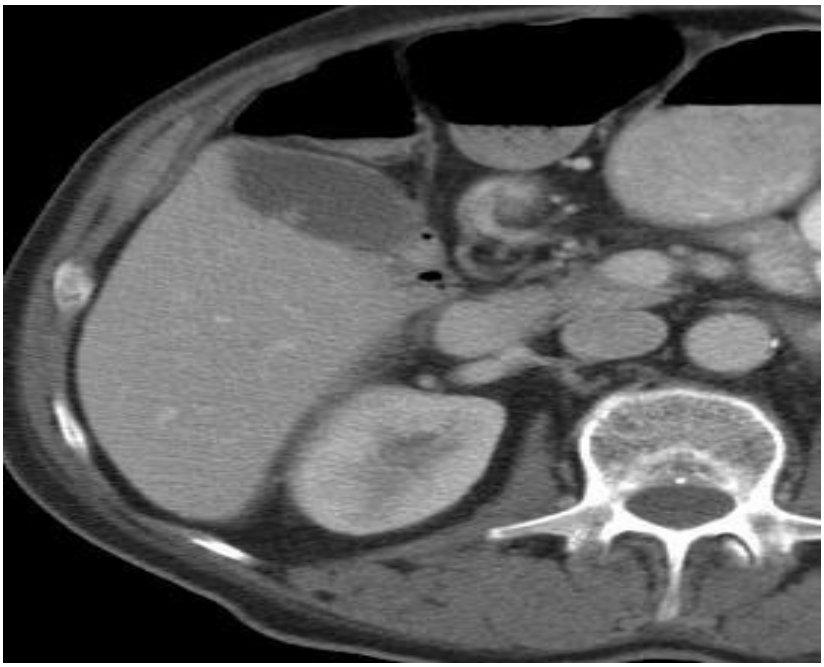
2.3 Pathology of the Biliary System:

2.3.1 Cholelithiasis: Cholelithiasis is the medical name for hard deposits (gallstones) that may form in the gallbladder.The cause of cholelithiasis is not completely understood. The most common type of gallstones form in cholelithiasis., called a cholesterol stone, results from the presence of too much cholesterol in the bile. Another type of stone, called a pigment stone, is formed from excess bilirubin, a waste product created by the breakdown of the red blood cells in the liver. The size and number of gallstones varies in cholelithiasis .the gallbladder can form many small stones or one large stone.(Kahan S, 2009).

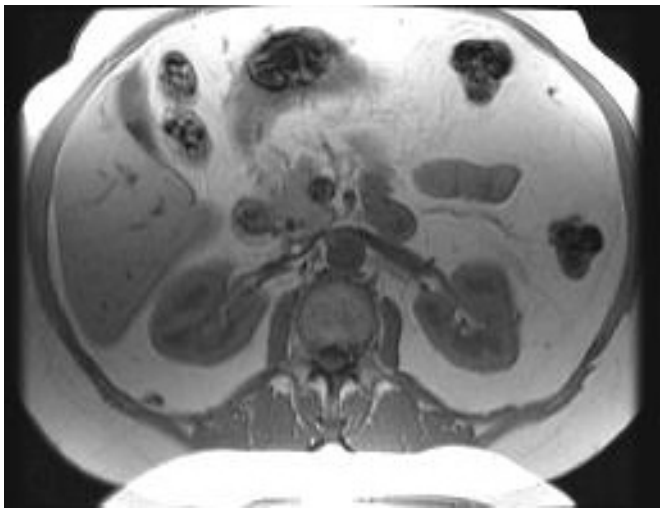
Cholelithiasis can lead to cholecystitis, inflammation of the gallbladder. Acute gallstone attacks may be managed with intravenous medications. Chronic (long-standing) cholelithiasis is treated by surgical removal of the gallbladder. (Hermann RE.1989).



(Fig.2.3.1) Cholelithiasis. Ultrasound image obtained with a 4-MHz transducer demonstrates a stone in the gallbladder neck with typical acoustic shadow.(http://radiopaedia.org/images).



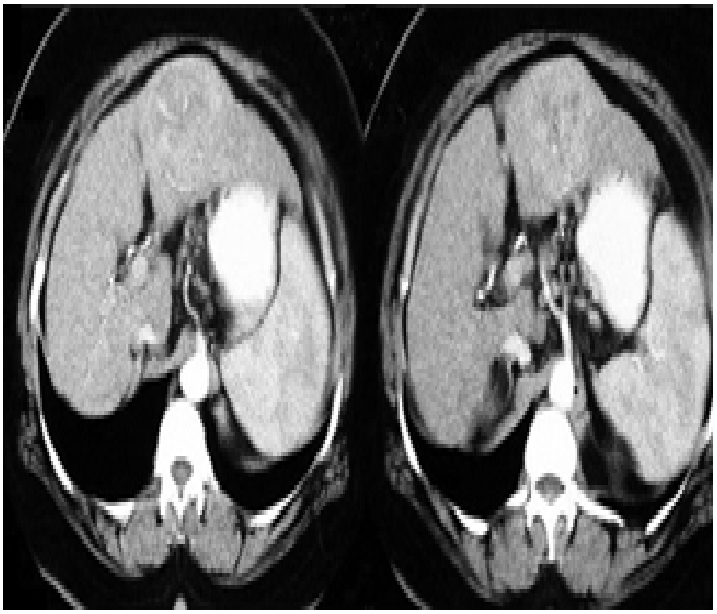
(fig.2.3.2)Cholelithiasis. A noncalcified filling defect is present in the gallbladder on this contrast-enhanced CT. Ultrasound examination confirmed a mobile stone and excluded the other possible diagnoses of polyp or tumor.(http://radiopaedia.org/images)



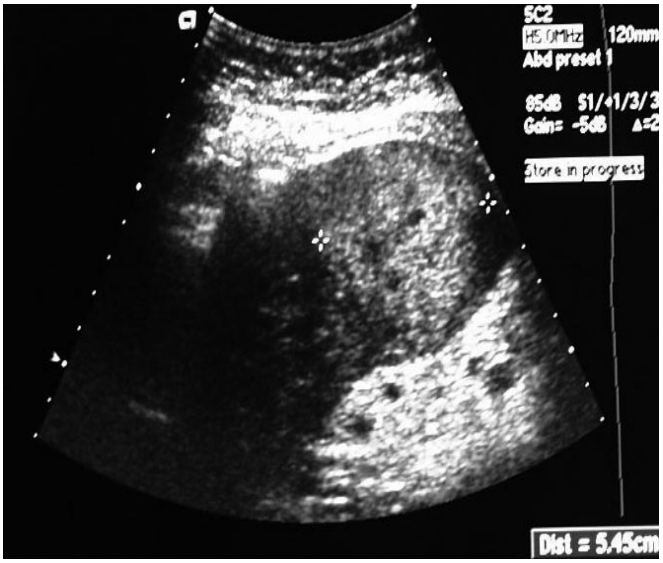
(fig.2.3.3)Cholelithiasis. Multiple tiny gallstones appear as signal void-filling defects in the gallbladder on this T1-weighted spoiled gradient-echo sequence. (http://radiopaedia.org/images)

2.3.2 Hepatocellular carcinoma: Hepatocellular carcinoma is the cancer of the liver. It is also called "hepatoma". Hepatocellular carcinoma is commonly seen in people at the age of 50 to 60 years old. Hepatocellular carcinoma is the liver cancer that arises from the liver itself. It is not the same as the metastatic liver cancer which is a cancer that comes from the other organs of the body and spread to the liver. The most common cause of the hepatocellular carcinoma is the scarring of the liver due to alcohol abuse,

hepatitis B, hemochromatosis or iron overload, autoimmune diseases, as well as diseases that causes inflammation of the liver.This type of liver cancer is more often seen in men. This is probably because men are more prone to alcohol abuse. People with hepatitis B and C are also at higher risk of this liver cancer. Here are the most common symptoms of hepatocellular carcinoma..(Khan SA, Davidson BR, Goldin R, et al 2002).



(fig2.3.4) CT scan in the hepatic arterial phase of contrast enhancement showing neovascularity in a low-density hepatic mass.(http://radiopaedia.org/images)



(fig 2.3.5) Ultrasound image showing hyper echoic mass representing hepatocellular carcinoma.(http://radiopaedia.org/images).

2.3.3 Gall Stones: Gallstones form in the gallbladder, a small organ located under the liver.Gallstones are pieces of solid material that form in the gallbladder. These stones develop because cholesterol and pigments in bile sometimes form hard particles.(Hermann RE.1989).

2.3.3.1 The two main types of gallstones are:

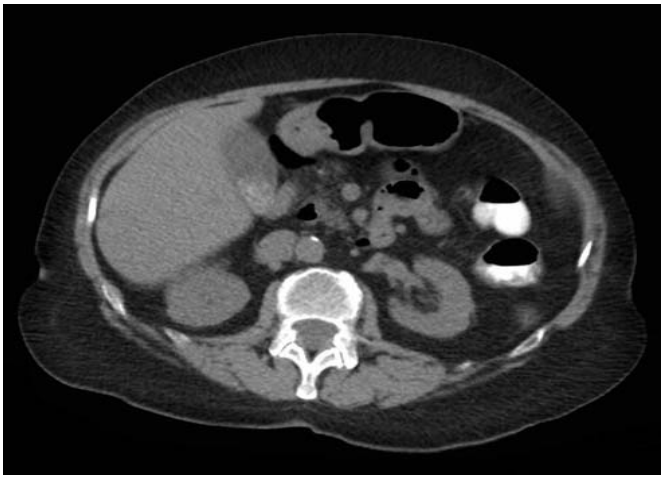
2.3.3.1.1 Cholesterol stones: Usually yellow-green in color, approximately 80% of gallstones are cholesterol stones.

2.3.3.1.2 Pigment stones: These stones are smaller and darker and are made up of bilirubin.Pigment stones are more common in people with certain medical conditions, such as cirrhosis (a liver disease in which scar

tissue replaces healthy liver tissue) or blood diseases such as sickle cell anemia. (Hermann RE.1989).

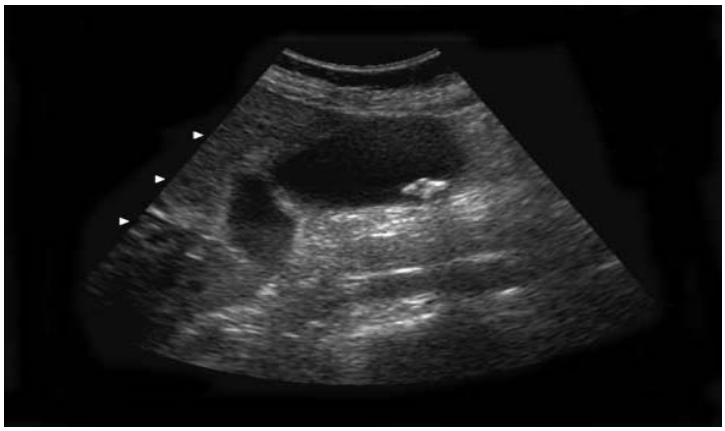
2.3.3.2 Feature of gall stone in different modalities:

2.3.3.2.1 Gall Stone appearance in CT image:



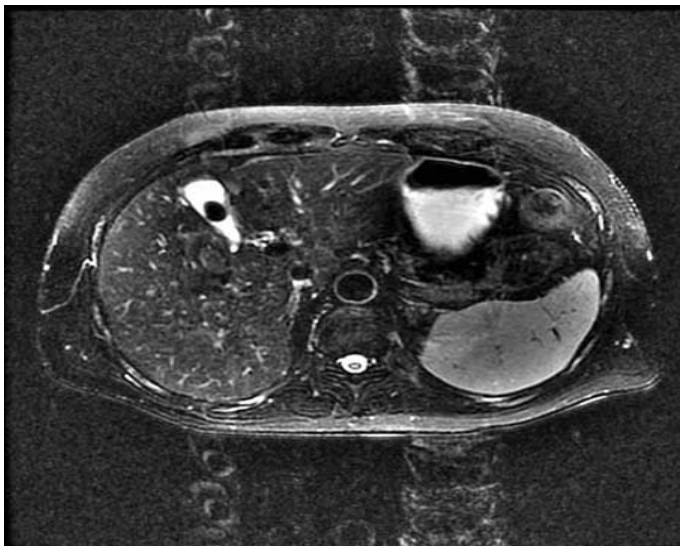
(fig 2.3.6) (http://radiopaedia.org/images).

2.3.3.2.2 Gall stone in abdominal ultrasound: Ultrasound produces pictures of the gallbladder and bile ducts. It shows signs of inflammation or indications that there is blockage of bile flow. Ultrasound is the most common test performed to evaluate gallbladder abnormalities. (Varghese JC, Liddell RP, Farrell MD, et al:2002).



(Fig 2.3.7)Ultrasound image of a patient's gallbladder showing a gallstone (arrow).(http://radiopaedia.org/images).

2.3.3.2.3 Gall stone in MRI Images:



(Fig 2.3.8) MRI of a patient's abdomen showing a gallstone.(http://radiopaedia.org/images).

2.3.3 CommonBile duct stones (choledocholithiasis): are gallstones that are present in the bile ducts, sometimes within the cystic duct of the gallbladder but more frequently in the common bile duct. Most gallstones are formed in the gallbladder and if small enough, it will pass out into the cystic duct and then into the common bile duct (CBD) along with the flow of bile. These stones may lodge in the duct and become impacted thereby causing a blockage of the duct. Most small stones, however, will pass out with the bile into the duodenum of the small intestine. Less frequently, a stone may originate within the hepatic or common bile duct and this is referred to as a primary bile duct stone. There are two different types of gallstones – cholesterol and pigment stones. (Balfe DM, Ralls PW, Bree RL, et al: 2000)

Utrasonography laparoscopic is used in detecting common bile duct stones during laparoscopic cholecystectomy. The aim of this study is to describe thelaparoscopicultrasonographic appearance of the common bile duct mucosa in patients with choledocholithiasis.(Varghese JC, Liddell RP, Farrell MD, et al: 2002).

2.3.4Obstructive jaundice:

Obstructive jaundice is a condition in which there is blockage of the flow of bile out of the liver. Any type of obstruction that blocks the flow of bile from the liver can cause obstructive jaundice. Most commonly, gallstones create the blockage. Other causes of obstruction include inflammation, tumors, trauma, pancreatic cancer, narrowing of the bile ducts, and structural abnormalities present at birth.(Bope ET, Kellerman RD (Eds.) Conn's Current Therapy.Philadelphia: Saunders, 2012.)

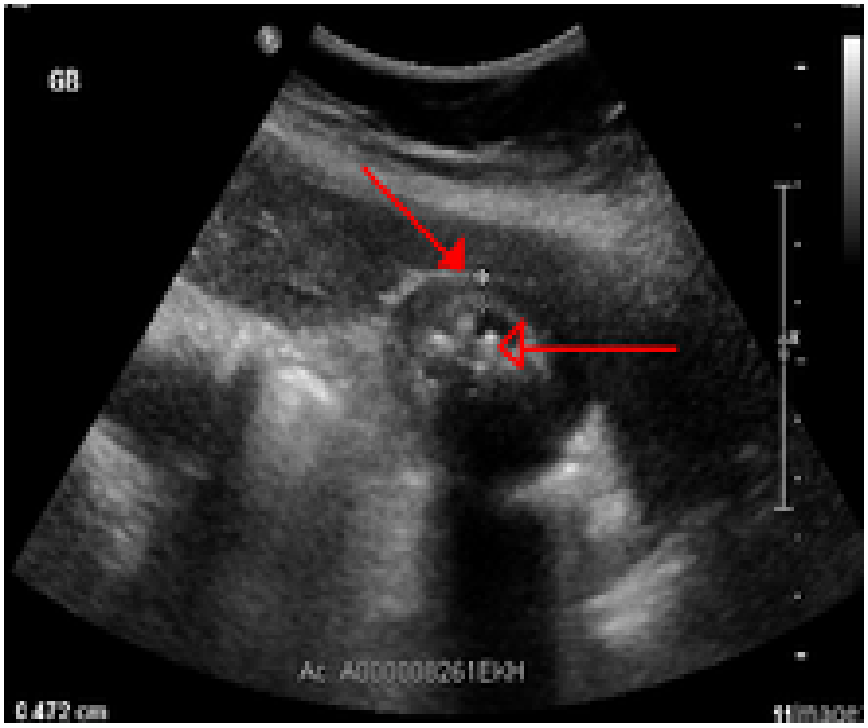
2.3.5 Biliary colic or chronic cholecystitis:

The commonest presentation of gallstone disease is biliary pain. The pain starts suddenly in the epigastrium or right upper quadrant and may radiate round to the back in the interscapular region. (Hermann RE.1989).

Ultrasound is paramount in differential diagnosis. Ultrasound findings suggestive of acute cholecystitis include pericholecystic fluid, >4 mm gallbladder wall thickening, and Murphy's sign. Visualization of gallstones on ultrasound helps confirm the diagnosis of cholecystitis. Computed tomography (CT) scan, magnetic resonance imaging (MRI), and hepatobiliaryscintigraphy (HBS) are also useful in the detection of cholecystitis. Endoscopic retrograde cholangiopancreatography (ERCP) may be useful to visualize the anatomy.(Varghese JC, Liddell RP, Farrell MD, et al 2002).

2.3.6 Acute cholecystitis:

When obstruction of the cystic duct persists, an acute inflammatory response may develop with a mild fever. Irritation of the adjacent parietal peritoneum causes localised tenderness in the right upper quadrant. As well as gall stones, ultrasonography may show a tender, thick walled, oedematous gall bladder with an abnormal amount of adjacent fluid. Liver enzyme activities are often mildly abnormal.(Varghese JC, Liddell RP, Farrell MD, et al 2002).



(Fig 23.9)Acute cholecysitis as seen on ultrasound.Closed arrow points to gall bladder wall thickening. Open arrow points to stones in the GB. (http://radiopaedia.org/images).

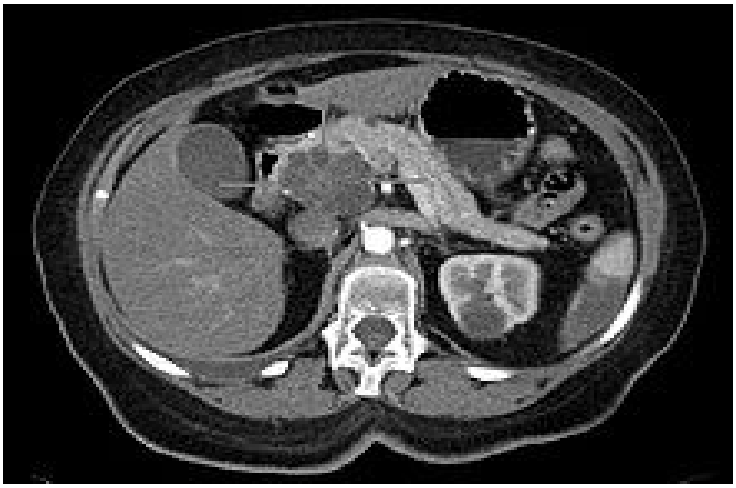
2.3.7 Pancreatic Diseases:

2.3.7.1Pancreatic cancer:

Is when cancer cells develop from the pancreas, a glandular organ located behind the stomach. By the time of diagnosis the cancer has usually spread to other parts of the body..(Ryan ME, Baldauf MC.1994).

2.3.7.2Pancreatitis: This happens when digestive enzymes start digesting the pancreas itself.(Ryan ME, Baldauf MC.1994).

2.3.7.3Cystic fibrosis: a genetic disorder in which thick, sticky mucus can also block tubes in the pancreas.(Ryan ME, Baldauf MC.1994).



(Fig 2.3.10)Axial CT image with i.v. contrast.Macro cystic adenocarcinoma of the pancreatic head.. (http://radiopaedia.org/images).

2.3.8 Liver Disorders: Liver disease (hepatic disease) is a type of damage to or disease of the liver(Balfe DM, Ralls PW, Bree RL, et al.2000).

There are more than a hundred kinds of liver disease but the most widely spread are as follows:

2.3.8.1 Hepatitis: inflammation of the liver, is caused mainly by various viruses (viral hepatitis) but also by some liver toxins (e.g. alcoholic hepatitis), autoimmunity (autoimmune hepatitis) or hereditary conditions.(Khan SA, Davidson BR, Goldin R, et al:2002).

2.3.8.2 Alcoholic liver disease: is any hepatic manifestation of alcohol overconsumption, including fatty liver disease, alcoholic hepatitis, and cirrhosis. Analogous terms such as "drug-induced" or "toxic" liver disease are also used to refer to the range of disorders caused by various drugs and environmental chemicals.(Khan SA, Davidson BR, Goldin R, et al:2002).

2.3.8.3 Fatty liver disease (hepatic steatosis):is a reversible condition where large vacuoles of triglyceride fat accumulate in liver cells. Non-alcoholic fatty liver disease is a spectrum of disease associated with obesity and metabolic syndrome, among other causes. Fatty liver may lead to inflammatory disease (i.e. steatohepatitis) and, eventually, cirrhosis.. (Khan SA, Davidson BR, Goldin R, et al:2002).

2.3.8.4 Cirrhosis: is the formation of fibrous tissue (fibrosis) in the place of liver cells that have died due to a variety of causes, including viral hepatitis, alcohol overconsumption, and other forms of liver toxicity. Cirrhosis causes chronic liver failure..(Khan SA, Davidson BR, Goldin R, et al:2002).

2.3.8.5Primary liver cancer: most commonly manifests as hepatocellular carcinoma and/or cholangiocarcinoma; rarer forms

include angiosarcoma and hemangiosarcoma of the liver. (Many liver malignancies are secondary lesions that have metastasized from primary cancers in the gastrointestinal tract and other organs, such as the kidneys, lungs, breast, or prostate.).(Khan SA, Davidson BR, Goldin R, et al:2002).

2.3.8.6 Primary biliary cirrhosis: is a serious autoimmune disease of the bile capillaries..(Khan SA, Davidson BR, Goldin R, et al:2002).

2.3.8.7 Primary sclerosing cholangitis: is a serious chronicinflammatorydisease of the bile duct, which is believed to be autoimmune in origin..(Khan SA, Davidson BR, Goldin R, et al:2002).

2.3.8.8 Hereditary disease: that cause damage to the liver include hemochromatosis, involving accumulation of iron in the body, and Wilson's disease, which causes the body to retaincopper. Liver damage is also a clinical feature of alpha 1-antitrypsin deficiency and glycogen storage disease type II. .(Khan SA, Davidson BR, Goldin R, et al:2002).

2.4 Radiographic procedure:

2.4.1 Plain abdomen x-ray radiograph:

x-ray is a form an electromagnetic wave of high energy and very short wave length (ionizing radiation) which is able to pass through many materials opaque to light . plain radiograph of the biliary system may be taken to demonstrate opacities, including calcifications in the region of gall bladder and biliary tree.The gall bladder and biliary ducts blend in with other abdominal soft tissue and in most cases can not be visualized without the additional of contrast media examination.(Bontrager et al (2006))

2.4.2 Oral cholecystography (OCG):

It is a radiographic contract media examination in which the contrast ingested orally to study the anatomy and function of biliary system. The patient fast at least 8hr before the exam and the evening meal before the exam should be light and should not contain fats.(Bontrager et al (2006))

Patient ingest four to six tablets or capsules during the evening before exam.Scout radiograph (first radiograph) is taken with the patient prone .it checked to determine the presence or absence of opacified gall bladder . Right posterior oblique projection taken to demonstrate the biliary duct system drainge into duodenum and right lateral decubitus position demonstrate the opacified gall bladder is project away from the vertebral column.

Many projections may be taken after administer fatty meal which stimulate the duodenum mucosa to produce CCK which is will turn the gall bladder to contract to assessment the contracting ability of the gall bladder.The number of OCG is being ordered has decreased generally because of increase used of sonography.(Bontrager et al (2006).

2.4.3Diagnostic Ultrasound (sonography) :

Sonography is a noninvasive imaging method that uses high frequency sound waves (above to audible sound) so called ultrasound- to produce relatively precise images of structures within the body.

Ultrasound is first imaging investigation of choice for the jaundiced patient it is able to detect small calculi in the gall bladder and biliary ducts that generally are not visualized during OCG also ultrasound excellent in distinguish between the dilated and non dilated ducts , common bile duct measurements are graded as follows : normal <6 .equivocal 6-8 mm dilated>8 .the site and cause of obstruction are defind only 25 percent of

causes as overlying duodenal gas often obsecure the lower end of common bile duct depending on the finding of US other more definitive imaging of the biliary system may be done .(Bontrager et al (2006).

2.4.4Operative cholangiography:

Operative cholangiogram involves the injection of radiopaque dye into the ducts of the biliary tract during gall bladder surgery. X-ray then reveal clear images of biliary tract .This is test is used occasionally when other less invasive test do not provide enough information.The primary purpose of operative cholangiography are:to reveal any cholelithiasis (stones) not previously detected ,determine the function of hepatopancreatic ampulla , and demonstrate small lesions, strictures or dilatation in biliary ducts ..(Bontrager et al (2006).

2.4.5 Postoperative (T tube or delayed)cholangiography:

Delayed cholangiogram usually performed in radiology department following acholecystoctomy .the surgeon may be concerned about the residual stones in the biliary ducts that went undetected during the surgery.

The surgeon will place a special tube catheter into the common bile duct .the catheter extend to the outside of the body and is clamped off, because the T-tube catheter has been clamped off drainge of excess bile is performed at the beginning of the procedure,after duct drainge and under fluoroscopic control the iodinated contrast media is injected fractionally and fluoroscopic spot films are taken..(Bontrager et al (2006).

2.4.6 PTC (Percutaneous trancehepaticcholangiography): It is another type of cholangiography that demonstrate the biliary duct, it is more

invasive than other form of cholangiography. PTC involve direct puncture of biliary duct with a needle passing through the liver once within duct , iodinated contrast media is injected under fluoroscopic control .fluoroscopic spot films and conventional radiographs are taken during the procedure. PTC Is indicated for assessment of high biliary obstruction at the level of porta and where biliary obstruction is unable to outlined by ERCP due to previous biliary diversion surgery.(Bontrager et al (2006).

2.4.7 ERCP (Endoscopic retrograde cholangiopancreatography):

In which small canula is passed into the ampulla of vater under the direct endoscopic visualization .then contrast media is injected into the biliary and pancreatic ducts and image acquired.

ERCP is used to assess biliary obstruction diagnosed on ultrasound or computed tomography .ERCP is the investigation of choice for suspected distal biliary obstruction that may require investigation such as sphincterotomy , basket retrieval of stones , biliary biopsy or biliary stent placement .(Bontrager et al (2006).

2.4.8 Nuclear medicine:

A hepato-biliary or HIDA scan is a scan of the gall bladder and biliary system. Patients with a history of the abdominal pain, nausea, and vomiting, or chest pain resulting from gall bladder or biliary diseases are candidates for this procedure.

Patients are injected with radio-active isotope and images are taken approximately 1 to 2 hours after injection.

After the completion of the examination, another procedure may be performed to indicate the response of the gall bladder to hormonal stimulation. It requires a second injection.

Liver and spleen nuclear medicine scans evaluate functional liver disorders that include cirrhosis, hepatitis, and metabolic disorders.(Bontrager et al (2006).

2.4.9Computer tomography (CT):

Computer tomography mean using of rotating x-ray tube detector to produce cross section image for only selected layer this layer is free from superimposition of other organ and tissue. CT Cholangioraphy is a reasonable reliable method of imaging the biliary system Involve a slow intravenous contrast infusion of an iodine containing choleangiographic agent (biliscopin) to opacify the bile duct.(Bontrager et al (2006).

2.4.10 MRI:

Magnetic resonance imaging (MRI) is a noninvasive medical test that helps physicians diagnose and treat medical conditions.

MRI uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, and virtually all other internal body structures. The images can then be examined on a computer monitor, transmitted electronically, printed or copied to a CD. MRI does not use ionizing radiation (x-rays).

(http://www.radiologyinfo.org/en/info.cfm?pg=bodymr).

2.4.10.1 MRCP:

Magneticresonancecholeangiopencreatographyis uses heavily T2 weighted image that show stationary fluids such as high signal with moving fluids and solids as low signal,The bile ducts and gallbladder are there for seen as bright structures on a dark background.MRCP has largely replaced by diagnostic ERCP , as the investigation of choice for imaging of the biliary system including assessment of jaundice patients with dialated bile duct on Ultra

sound. MRCP is commonly used prior to laparosopiccholecystoctomy to diagnose bile duct calculi and bile duct varianls and to avoid of intraoperative exploration of common bile duct.(Catherine (2008).

2.4.10.2MRCPProtocol:

Coronal breath –hold incoherent (spoiled) GRE –SET1

Act as a localizer if three plan localization is unavailable,or as diagnostic sequence / Thick slices .gap are prescribed relative to the vertical alignment light, from the posterior abdominal muscles to thwanterior abdominal wall .the area from the pubis symphysis to the diaphragm is included in the image.Axial SE/ FSE /incoherent (spoiled) GRE T1 -/+in and out of phase As for coronal T1,except prescribe slices from the inferior margin of the liver to the diaphragm .(Catherine Westbrook (2008).

2.4.10.3. Additional sequences:

2.4.10.3.1 SS-FSE (MRP):

This is sequence provides images in which only fluid –filled spaces such as the gall bladder and biliary ducts return signal .it is necessary to use very

long TEs and TRs to effectively nullify the signal from all tissues except those have long T2 Decay times .TEs in excess of 200 ms and TRs of more than 10 s as required .if SS-FSE is unavailable then an FSE sequence may be substituted.(Catherine Westbrook (2008).

2.4.10.3.2 SS-FSE/GRE-EPI /Diffusion imaging:

The use of real time imaging has application in the liver and biliary system .this includes biopsies and thermal ablations of liver lesion under real time MR control.in addition ,diffusion and perfusion techniques of the liver have been developed that may negate the use of contrast agent in the further . DWI images are overlaid onto T1 weighted acquisition provides pathology information, whereas the T1 weighted acquisition provide anatomical data .the images produced are not dissimilar to a PET/CT scan.in addition diffusion tensor imaging use in conjunction with parallel imaging techniques enables differentiation of benign from malignant hepatic lesions and may also assist in the quantification of hepatic fibrosis.(Catherine Westbrook (2008).

2.4.10.4 Magnetic resonance Imaging (MRI):

Is a noninvasive technique for evaluating the intrahepatic and extra hepatic bile ducts and the pancreatic duct.

2.4.10.5 MRI Equipment.

The MRI equipment consists of following components:

2.4.10.5.1The magnet generates the magnetic field: And the magnet is three types are Permanent, Resistive and Superconductive.. (Thomas S.R.1992)

2.4.10.5.2. Shimcoils: make the magnetic field homogeneous. The uniform field achieved by shimming also has a role in ensuring accurate slice thickness and profile, slice location, and geometric fidelity for all imagingShimming is typically achieved by some combination of four methods Passive Shimming, ResistiveShimming, Superconductive Shimming and Gradient Offset Shimming. (Thomas S.R.1992)

2.4.10.5.3. Radiofrequency coils:

transmit the radio signal into the body part being imaged.All excitation energy is provided by magnetic fields rotating in the X-Y plane, at the Larmor frequency of Hydrogen (42.58 Mhz/T). These rotating magnetic fields are created by passing RF alternating current, generated by the RF transmitter, through suitably shaped and orientated conductors known as the RF coils.This

energy realigns the nuclear magnetic fields of the subject into the transverse plane and bring the nuclei fields into phase coherence by acting as a fixed magnetic field in the rotating frame. The nuclear magnetic fields rotating coherently in the transverse plane induce RF currents (MR signal) in the receive coil which are detected and analysed in the receiver system. (Thomas S.R.1992)

2.4.10.5.4.Receivercoils:detect the returning radio signals.(Thomas S.R.1992)

2.4.10.5.4.1.Linear Array Coil:A receiver coil with more than one segment, which can be utilized as a single or a multiple segment coil. (Thomas S.R.1992)

2.4.10.5.4.2 Surface Coil:A surface coil is essentially a loop of conducting material, such as copper tubing. This type of receiver coil is

placed directly on or over the region of interest for increased magnetic sensitivity.The loop may form various shapes and be bent slightly to conform to the imaged body part. (Thomas S.R.1992)

2.4.10.5.4.3 Antenna:A device that enables the sending and/or receiving of electromagnetic waves. (Thomas S.R.1992)

2.4.8.10.4.4. Body Coil: The body coil is installed in the magnet and functions both as transmit than also as a receiver coil. This coil has a large measurement field, but does not have the high SNR of special coils. When specific receiver only coils are used (the most surface coils), the body coil serves as the transmit coil. (Thomas S.R.1992)

2.4.10.5.5 Gradient coils:provide spatial localization of the signals. Current carrying gradient coils with reduced gradient fringe field inside of the magnet cryostat structures like cryoshields and He-vessel. (Thomas S.R.1992)

2.4.10.5.6 Shielding coils:produce a magnetic field that cancels the field from primary coils in regions where it is not desired. (Thomas S.R.1992)

2.4.10.5.6.1 Cry shielding:

2.4.10.5.6.2Room Shielding: Magnetic shielding through the use of high permeability material in the walls (plus floor and ceiling) of the magnet room. Room shielding can be complete (e.g., six sides of a box, Faraday cage), or partial if the fringe field is to be reduced only in certain areas.(http://www.mr-tip.com).

2.4.10.5.6.3Self-Shielding:

Magnetic shielding by attaching a high permeability yoke to the magnet (passive shielding) or by incorporating additional magnetic field-generating coils designed to reduce the external field (active shielding). (http://www.mr-tip.com)

2.4.10.5.6.4Active Shielding:

Magnetic shielding through the use ofsecondary shielding coils designed to produce a magnetic field that cancels the field from primary coils in regions where it is not desired. These coils may be inside the magnet cryostat. Active shielding can be applied to the main magnet or to the gradient magnetic fields.(Thomas S.R.1992)

2.4.10.5.7 The computer reconstructs the signals into the image.

2.4.10.5.8 The MRI scanner room is shielded by a faraday shield.

2.4.10.5.9 Different cooling systems cool the magnet, the scanner room and the technique room. (http://www.mr-tip.com).

2.5previous studies

2.5.1 Taylor (1991) research about MR cholangiopancreatography (MRCP) at 0.5 T: technique optimization and preliminary results ametoevaluated the accuracy of magnetic resonance cholangiopancreatography (MRCP) in 129 patients with suspected biliary tract disease who were referred for ERCP.MRCP results were interpreted by an expert in hepatobiliary imaging who was blinded to ERCP findings. Forty-six patients had choledocholithiasis, and 12 had biliary strictures. Compared with ERCP as the gold standard, the sensitivity, specificity, positive predictive value, and negative predictive value of MRCP for diagnosing stones were 98%, 89%, 83%, and 99%, respectively. Of the 14 patients with small calculi (1-5 mm in diameter) diagnosed at ERCP, 13 were detected on MRCP (sensitivity,

93%), but there were 9 false-positive MRCP results. All 12 biliary strictures were diagnosed by MRCP (sensitivity, specificity, positive predictive value, and negative predictive value; 100%, 99%, 92%, and 100%, respectively).

2.5.2 American Journal of Gastroenterology (2005) The study about Detection of Bile Duct Stones in Suspected Biliary Pancreatitis: Comparison of MRCP, ERCP, and Intraductal US reported on *The* aim to evaluate of the ability of MRCP to detect choledocholithiasis in patients with acute biliary pancreatitis.in addition, we investigated whether intraductal US (IDUS) could help manage these patients. The study done on Thirty-two patients with suspected biliary pancreatitis were studied prospectively. MRCP was performed immediately before ERCP by separate blinded examiners within 24 h of admission. Wire-guided IDUS was performed during ERCP within 72 h of admission, regardlessof the results of MRCP. The sensitivity of US, CT, MRCP, ERCP, and IDUS for identifying choledocholithiasis was 20.0%, 40.0%, 80.0%, 90.0%, and 95.0%, respectively. The sensitivity of MRCP for detecting choledocholithiasis decreased with dilated bile ducts (bile duct diameter > 10 mm, 72.7% *vs* 88.9%).in conclusion MRCP can be used to select patients with biliary pancreatitis who require ERCP. IDUS may be applied in the management of biliary pancreatitis if ERCP is performed.

2.5.3 Kim JH, Kim MJ, et al (2002) research about MRCP compared to diagnostic ERCP for diagnosis when biliary obstruction is suspected aim to compare MRCP to diagnostic ERCP in patients with suspected biliary obstruction was conducted. The study contain 25 studies were identified reporting several conditions including choledocholithiasis (18 studies), malignancy (four studies), obstruction (three studies), stricture (two studies)

and dilatation (five studies). Three of the 18 studies reporting choledocholithiasis were excluded from the analysis due to lack of data, or differences in study design. The sensitivity for the 15 studies of choledocholithiasis ranged from 0.50 to 1.00 while specificity ranged from 0.83 to 1.00. The positive likelihood ratio ranged: from 5.44–47.72 and the negative likelihood ratio for the 15 studies ranged from 0.00–0.51. For malignancy, sensitivity ranged from 0.81 to 0.94 and specificity from 0.92 to 1.00. Positive likelihood ratios ranged from 10.12 to 43 and negative likelihood ratios ranged from 0.15 to 0.21, although these estimates were less reliable.In conclusion MRCP is a comparable diagnostic investigation in comparison to ERCP for diagnosing biliary obstruction.

Chapter Three

Materials and Method

3.1. Materials:

3.1.1. MR Machine :

3.1.1.1. Use MR Machine Produced by Philips Company with 1.5 tesla , made in German.

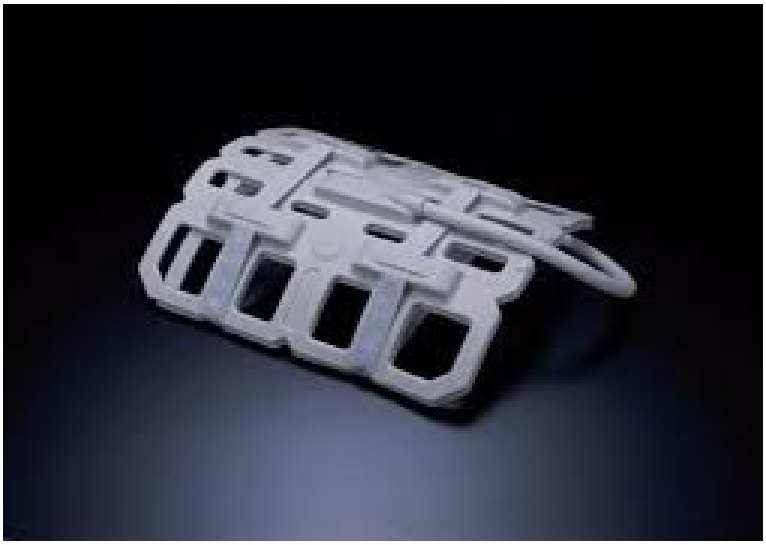
(Fig 3.1)Philips MRI scanner. (www.healthcare.philips.com).

3.1.1.2. Used GC MR Machine 1.5 tesla, made in U.S.A.

(Fig3.2)MRI Scanner made by G.C Company.(www.cancerresearchuk.org).

3.1.1.3. Used body Coils.

(Fig 3.3.)Body coils (www.healthcare.philips.com).



(Fig 3.4) Body coil (www.healthcare.philips.com).

3.1.2. Area Of The Study :

3.1.2.1. Al Amal Hospital (khartoum - Sudan)

3.1.2.2. Alribat Hospital (khartoum - Sudan)

3.1.2.3. AntaliaDiagnosti Center.

3.1.3. Duration Of The Study :

The Study Started at 19 . June 2014 to 27 July 2014 .

3.1.4. Study Population :

Patient seen during that period were 20 patients included 8 males , 12 females , with different ages and different weights.

3.2. Method of Data Collection:

Each patient of referred was interviewed and short history taken e.g.: age , gender ,weigh, and ultrasound findings.

3.2.3 Data Analysis: The MRCP images achieved in this study were directly diagnosed by confirmed radiologist and the result was analysis by the statistics computation of this study was performed using excel and manually.

3.2.4. Technique used.

3.2.4.1. Patient preparation: Patient fast for 4 hours before the exam , ensured there is not ferromagnetic substance such as implanted medical device e .g : pedicle screws and pacemaker .

Immediately before the scan the patient wear gown and ensure there is no external metallic objects .Full explanation the procedure to the patient and how long should he /she remain still to avoid motion.

3.2.4.2. patient position : Patient spine head first , arms elevated above his /her head and immobilized in this position

3.2.4.3. breathing technique : Instruct the patient to take deep breathe to obtain an image for specific section to avoid image artifacts .

3.2.4.4. protocols used : Coronal plan as localizer to obtain axial section T2 weighted image with used sat for fat suppression and take coronal from axial plan 3D format.

3.2.3.4. Protocolused: Coronal plan as localizer to obtain axial section T2 weighted image with used sat for fat suppression and take coronal from axial plan 3D format.

3.2.3.5 Image interpretation:

The collected images were diagnosed by a referred radiologist who report the final diagnoses and we collected the data from those reports .

Chapter Four

Results

The following tables and figures present data that obtained from (20) patients whose were examined by MRI for detecting diseases of hepato-biliary system, those patients variable in gender, age, weight, x-ray and ultrasound findings.

4.1 Table shows number of patients under examination.

Gender	Male	Female	Total
No.	8	12	20
Frequency	40%	60%	100%

Fig 4.1shows the gender of population under study.

4.2 Table shows range of weight in kg.

Rang of weight in kg	**Patients Number**
50-60	5
61-71	8
72-82	6
83-93	1

Total	20

Fig 4.2shows the rangeof weight in the population under study.

Age Group	patients ages
20-40	**5**

41-61	**6**
62-82	**7**
83-103	**2**
Total	**20**

4.3 Table presents Age group.

Fig:4.3 showsAge group.

4.4 Table shows the MRCP findings of 20 patients.

Gall stones	**C.B.D stones**	**Cholesesto Ctomy**	**Choleangio-carcinoma**	**Intra-Hepatic Stone**	**Liver masses**	**Normal**	**Ascites**
8	2	1	4	1	1	1	2

Fig 4.4 shows hepatobiliary abnormalities by using MRCP.

Table 4.5 shows abnormalities that detected by using ultrasound.

Gall stones	**C.B.D stones**	**Cholesesto-ctomy**	**Choleangio-carcinoma**	**Intra-Hepatic stone**	**Liver masses**	**Cystic Duct stones**	**Normal**	**Ascites**
4	1	1	3	0	1	0	10	0

Fig4.5 shows abnormalities that detected by using ultrasound.

Table4.6 shows the similar findings of MRCP and U/S

Disease	Gall stones	C.B.D Stones	Cholesesto-ctomy	Choleangio-carcinoma	Intra-Hepatic stone	Liver masses	Normal	Ascites
MRCP	**8**	**2**	**1**	**4**	**1**	**1**	**1**	**2**
U/S	**4**	**1**	**1**	**3**	**0**	**1**	**10**	**0**

Fig.4.6 shows the similar findings of MRCP and U/S

Chapter five

Discussion, Conclusion and Recommendations

5.1 The discussion:

We found that MRCP detecting 95% of population under the study with hepato-biliary system abnormalities. Only50% of the abnormalities detected by ultrasound.50% of the common bile duct stonesand Gall stones detected by the ultrasound. And this is agree with a previous study of American journal of gastroenterology (2005).

The most common affected weight rangebetween(61-71) years.

Also we foundMRCP is detected 40% of the population under study as Gall stone, and 20% as common bile duct stone and 20% as choleangiocarcinoma.and this is agree with a previous study of Taylor (1991).

This means that the MRCP is the best choice for detecting the hepatobiliary diseases comparing with ultrasound and x-ray radiographs.

5.2 The conclusion:

The study concludes that most of hepato-biliary diseases diagnosed by MRCP than other imaging modalities.

The study concludes that females are more affected by hepato-biliary diseases more than males. MRCP T2 weighted images are effective procedure in characterization and differentiation of hepato-biliary diseases.

The study concludes that the elderly patients are more affected than the younger patients.

At last the study decided that the MRCP is noninvasive procedure and not operator dependent. These feature make MRCP good choice in diagnose the hepato-biliary diseases.

The study concludes that MRI scanner with high Tesla (1.5) can perform the MRCP imaging, and more as best type for detecting the hepato-biliary abnormalities.

This study confirmed that MRCP was good diagnosing procedure in detecting and differentiated hepato-biliary diseases, especially those cannot be diagnosed by ultrasound.

The correct diagnose of the hepato-biliary diseases is MRCP T2 weighted image.

The diagnose may need to revised as more details from the patient history, ultrasound result, and compare this with lap investigation histopathology in cases those suspected carcinoma .

MRCP offer new method for detecting the hepato-biliary disease in its early stage, without complication as other invasive procedure.

5.3Recommendations:

1-MRCP is good procedure in detecting and characterization of the hepato-biliary diseases, so that we recommend to use it in hepato-biliary disorders.

2-Using T2 weighted imaging to obtain signal from biliary system and inhibit signals from surrounding fats which produce good visulaition of the hepato-biliary diseases.

3- We recommend by more trained for all technicians and radiologists to make full use of MRI technology.

4-All government medical centers in hospitals must have MRI machines to offering MRI services for all patients with low cost.

5-All colleges of medical and radiology must have MRI machine for well education and researching to investigate new protocols for different diseases same as world.

6-Furtherresearch including more data for other protocols of MRI.

7- Further studies with more study population.

5.4 Limitations of MRCP:

1-MRCP is breath-depending procedure that will be impossible with those cannot control their breathing.

2-MRCP is contraindicated with patients who have claustrophobia.

3-MRCP is contraindicated with patients those implanted medical devices sensitive to MRI (ferromagnetic substances).

4-MRCP is high cost relative to other radiographic procedures.

5-MR machines are less available than other modalities (high cost machine price).

5.5Limitations of the research:

1- Limited number of population under study.

2- Short duration of the study.

3- Analyzed by Excel and manual.

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Appendixes

Appendix (1): Data collection sheet:

NO	Age	Gender	weight	Protocol	U S findings	Diagnoses
1	36	F	70	T2 WI	0	A
2	52	M	67	T2 WI	0	B
3	66	F	80	T2 WI	0	A
4	44	F	72	T2 WI	1	C
5	38	F	62	T2 WI	0	A
6	63	M	71	T2 WI	1	A

7	50	F	80	T2 WI	1	I
8	25	M	67	T2 WI	1	C
9	48	F	79	T2 WI	0	A
10	59	M	71	T2 WI	1	F
11	75	F	68	T2 WI	1	H
12	56	M	62	T2 WI	1	C
13	45	F	59	T2 WI	1	A
14	57	F	73	T2 WI	1	D
15	22	F	65	T2 WI	0	G
16	48	F	52	T2 WI	1	B
17	80	M	69	T2 WI	1	A
16	36	M	73	T2 WI	0	E
19	92	M	77	T2 WI	1	A
20	26	F	53	T2 WI	0	I

A= Gallbladder stone

B= Common bile duct stone

C= Choleangiocarcinoma

D= Cholecystictomy

E= Intrahepatic duct stone

F= Cystic duct

G=

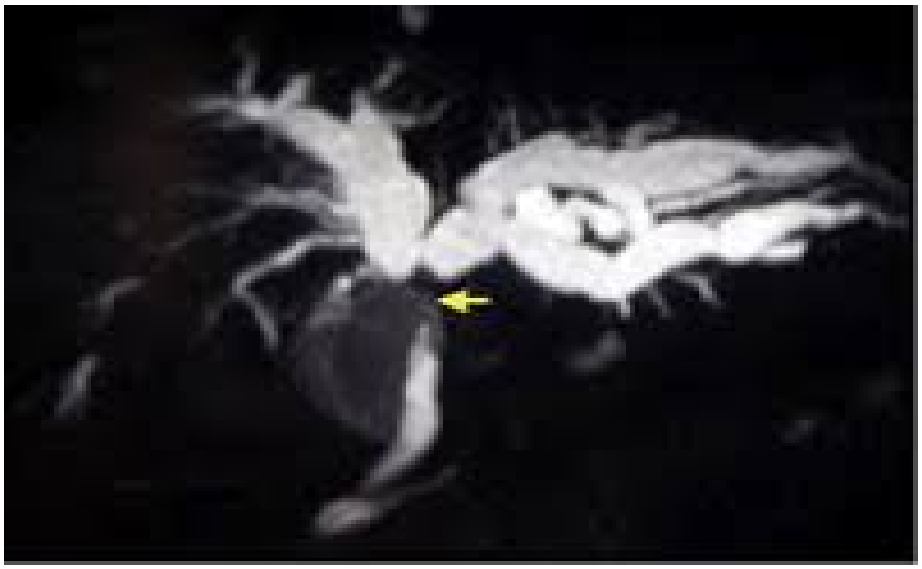
H= Normal

I= Ascites

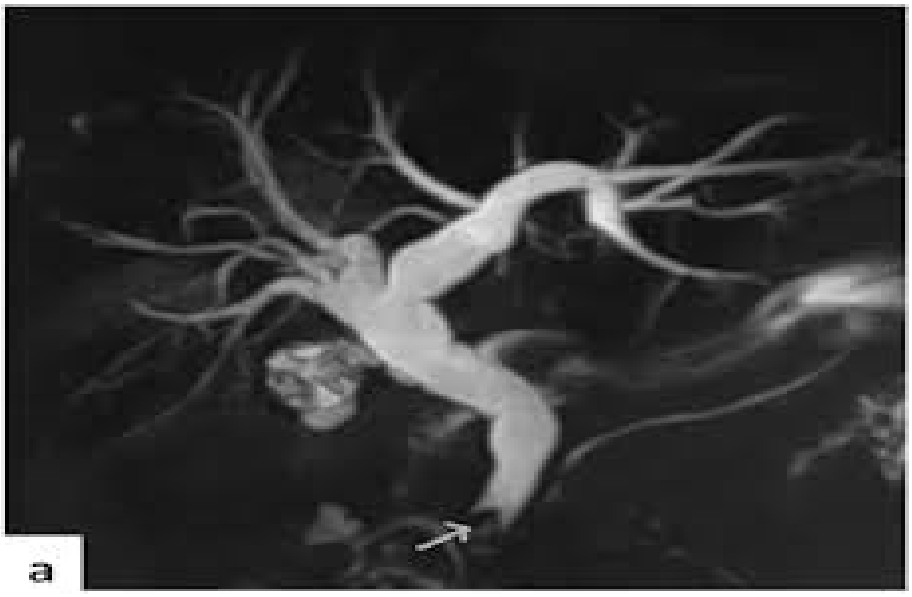
0= Undeteted

1= Detected

Appendix 2: Imaging Consideration:

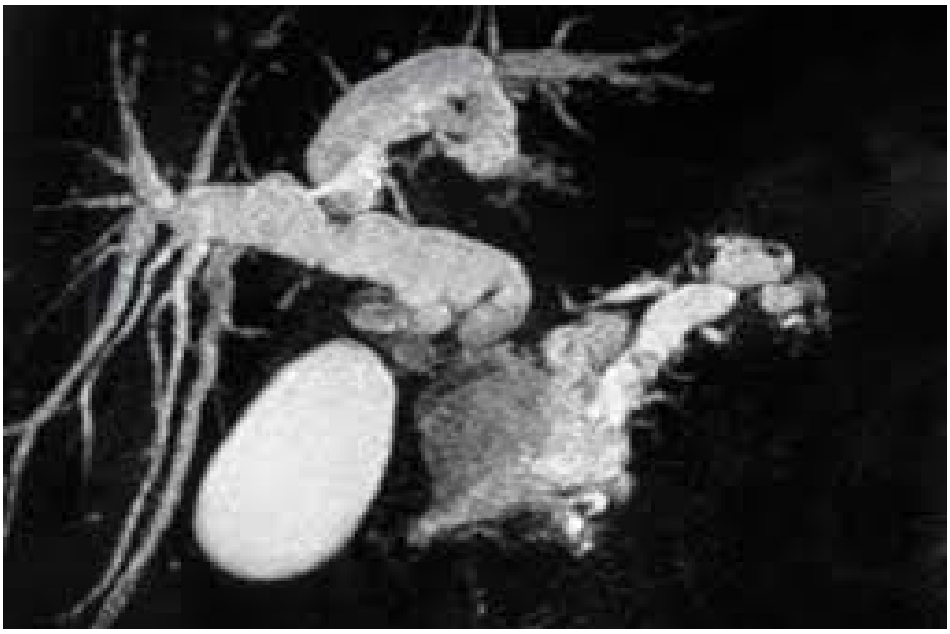


(Appendix 2 .1) shows Hepatic ducts dilation with tumor at the confluence, 64 years female.

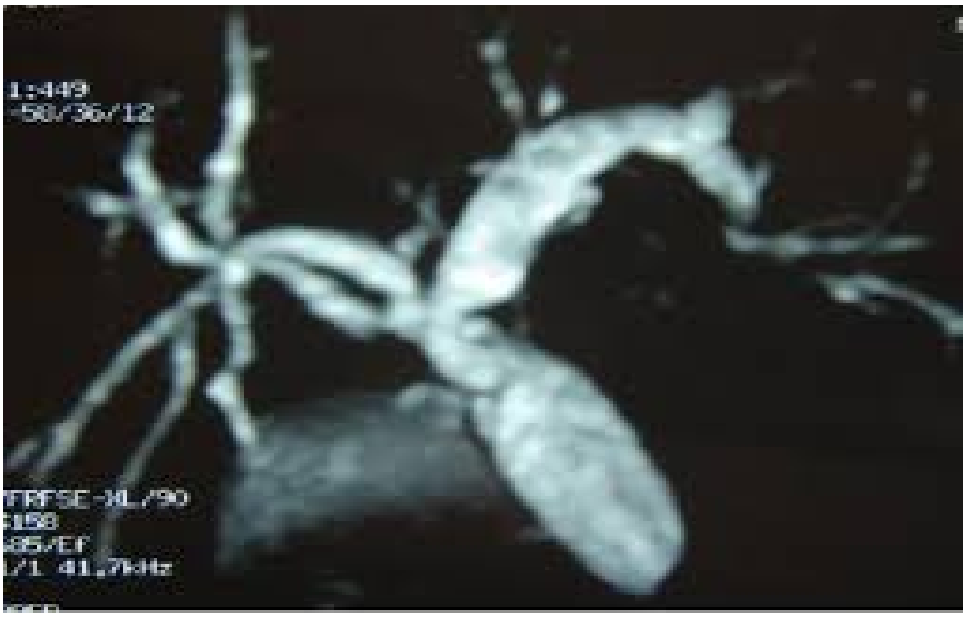


(.Appendix 2.2) shows Axial HASTE MRCP image, showing dilated CBD with multiple signal voids within it, suggestive of choledocholithiasis.70 years male pt. has a severe abdominal pain.

(Appendix 2.3)27 years old, female who presents with abdominal pain. MRCP images demonstrate an intrahepatic biliary stone.



(Appendix 2.4) 72 yearsold, female with abdominal pain.MRCP showing pancreatic cyst in the head of the organ with dilation of the main and branch pancreatic ducts as well as of the extra- intra hepatic biliary tree.



(Appendix 2.5)MRCP showing important intrahepatic biliary dilatation (more pronounced on the left) and a saccular dilatation of the common bile duct.Male 52 year old.

(Appendix 2.6) 65years old with stones in the gall bladder, and a dilated common bile duct. Patient has a severe abdominal pain. Female 65 year old.