Sudan University of Science and Technology

College of Graduate Studies

Study of Liver Changes in Diabetic Patients using Computed Tomography

دراسة تغييرات الكبد لدى مرضى السكري باستخدام الأشعة المقطعية

A thesis submitted for partial fulfillment of M.Sc. Degree in Medical Diagnostic radiological

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الآية

بسم الله الرحمن الرحيم

قال تعالي :

﴿ قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنا إِلَّا مَا عَلَّمْتَنا إِنَّكَ أَنتَ العَلِيمُ الحَكِيمُ ﴾

صدق الله العظيم

سورة البقرة الآية (32)

Dedication

This work is dedicated to

My   family

Acknowledgment

First of all, I thank Allah the Almighty for helping me complete this research. I thank **Dr. Hussein Ahmed Hassan** supervisor, for his help and guidance.

Finally I would like to thank everybody who helped me preparing and finish this study.

Abstract

Diabetes mellitus [DM] is a clinical syndrome characterized by hyperglycemia due to absolute or relation insulin deficiency or resistance or both

This was descriptive study done for 50 adult Sudanese patient at different ages all were affected with diabetic, Had CT examination for abdomen to find out the relation between duration of diabetic and volume of liver for (length, weight, and CT number) in period from May2018 to October 2019 In SENNAR hospital SENNAR State.

The main objective of this study is to study of liver changes in diabetic patient using computed tomography

The results showed that the density of the liver increases with increase diabetes duration. and average Width and length for RT lobe of liver, the width was increase by (0.02), and The length increased by (1.16) , And average width and length, for LT lobe of liver the average width was decrease by (0.3) The length increased by (0.2) when the diabetes duration increased .

The main findings of the study were that' s the relation between the liver measurements (length, width, and density) and diabetic duration .

CT has great value in detection changes happened for subjects affected by Diabetes Mellitus.

مستخلص البحث

مرض السكري هو متلازمة سريرية تتميز بارتفاع السكر في الدم بسبب نقص الانسولين المطلق أو علاقة نقص الأنسولين أو المقاومة أو كليهما.

تم إجراء دراسة وصفية أجريت على 50 مريضًا سودانيًا بالغًا في مختلف الأعمار ، جميعهم مصابون بالسكري ، وأجروا فحوصات بالأشعة المقطعية للبطن لمعرفة العلاقة بين مدة السكري وحجم الكبد (الطول والوزن ورقم التصوير المقطعي) في الفترة من من مايو 2018 إلى أكتوبر 2019 في مستشفى سنار التعليمي .

الهدف الرئيسي من هذه الدراسة هو دراسة التغيرات في الكبد لدى مرضى السكري باستخدام التصوير المقطعي

أظهرت النتائج أن كثافة الكبد تزداد مع زيادة مدة مرض السكري. ومتوسط العرض والطول للفص الايمن من الكبد ، زاد العرض بمقدار (0.02) ، وزاد الطول بمقدار (1.16) ، ومتوسط العرض والطول ، بالنسبة للفص الايسر من الكبد ، كان متوسط العرض ينقص بمقدار (0.3) زاد الطول بمقدار (0.2) عندما تزيد مدة السكري.

وكانت النتائج الرئيسية للدراسة هي العلاقة بين قياسات الكبد (الطول والعرض والكثافة) ومدة مرض السكري.

الأشعة المقطعية لها قيمة كبيرة في اكتشاف التغييرات التي حدثت للموضوعات المتأثرة بمرض السكري.

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List of Abbreviations

DM	Diabetes mellitus
IVC	Inferior Vana Cava
SMA	Superior Mesenteric Artery
IDDM	Insulin Dependent Diabetes mellitus
NIDDM	Non Insulin Dependent Diabetes mellitus

Chapter One

Chapter One

1.1. Introduction:

Diabetes mellitus [DM] is a clinical syndrome characterized by hyperglycemia due to absolute or relation insulin deficiency or resistance or bath. This can arise in many different ways. Most cases of diabetes are primary and relatively few are secondary to identifiable causes primary diabetes are subdivided on clinical ground Into insulin -dependent and non-insulin dependent diabetes mellitus [IDDM AND NIDDM] the critical different between these primary types is the degree of insulin deficiency which is so profound in IDDM that even the low insulin concentration which is normally prevent lipolysis and ketogeneses cannot be sustained without insulin therapy. Diabetes is worldwide in distribution and the incidence of both types of primary diabetes is rising The prevalence of both varies considerably in different part of world and this is probably due to different in genetic and environmental factors. The great majority of cases scan worldwide have primary diabetes and in Europe and north America the ratio of type 2 ;type I is approximately 7:3. "Diabetes Blue Circle Symbol 2006"

The diabetes may cause live threatening metabolic complication and is the seventh leading cause of death in the U S .Contributing to roughly 160.000 deaths per year. Complications of diabetes are frequently association with permanent and irreversible functional and structural change in the cell of the body 'Mitch characteristically affects the eye, kidney. liver and nervous system. "Diabetes Blue Circle Symbol 2006"

The diabetic is classified with 2 types. Type I or insulin dependent diabetes Mellitus [IDDM] Type 2 or non-insulin dependent diabetes mellitus [NIDDM].

Causes of secondary diabetes are pancreatic disease. e.g. [pancreatitis – hzemocluonuttosis -neoplastic disease -pancreatectomy -cystic fibrosis].

Pregnancy : Neuropathy is one of most common complication of diabetes. When it affects the autonomic nerves system it can damage the cardiovascular, gastrointestinal and genitourinary system.

Diabetic autonomic neuropathy impairs the ability to do the activities of daily life. Lowers quality of life and increase risk of death it also account for large portion of the cost of care.

Neuropathy begins early and the most causation factor one poor glycogenic control Jong duration ,increasing age female sex and higher body mass index of patient with symptomatic autonomic dysfunction 25%to50% die within 5 to 10 years of diagnosis .

 The 5 year mortality rote in patient with diabetic timonvinicvteurupathyIs three times higher than In diabetic patient without autonomic neuropathy. Militant worktruthnew

1.2. Statement of the problem:

The diabetic can affected liver texture and characteristic. There are many tools to investigate the effected of diabetic on abdominal organs, on study showed the change in liver size related to duration of diabetes mellitus. CT can detect the tissue characteristic by the change its CT number.

1.3. Objectives of the study:

1.3.1 General objectives

The main objective of this study is to study of liver change in diabetic patients using computed tomography.

1.3.2 Specific objectives:

1-Estimate liver density between duration of diabetes mellitus .

2-Estimate length and width of Rt liver lobe between duration of diabetes mellitus .

3-Estimate length and width of Lt liver lobe between duration of diabetes.

Chapter Two

Theoretical Background and Previous Studies

Chapter Two

Theoretical Background and Previous Studies

2.1 Theoretical Background

2.1.1 Anatomy of the liver

The liver lies in the right upper quadrant of the abdomen, immediately inferior to the diaphragm. Weighing 1–2 kilograms, it constitutes approximately 2% of an adult's body weight. The liver is covered by a connective tissue capsule and a layer of visceral peritoneum, except for a small region on its diaphragmatic surface called the bare area.(McKinley, (2008)).

The liver is composed of four incompletely separated lobes and supported by two ligaments. The major lobes are the right lobe and the left lobe. The right lobe is separated from the smaller left lobe by the falciform ligament, a peritoneal fold that secures the liver to the anterior abdominal wall. In the inferior free edge of the falciform ligament lies the round ligament of the liver(or ligamentum teres), which represents the remnant of the fetal umbilical vein. Subdivisions of the right lobe include the caudate lobe and the quadrate lobe. The caudate lobe is adjacent to the inferior venacava, and the quadrate lobe is adjacent to the gallbladder. the inferior vena cava and the ligamentum venosum form the vertical inferior parts. This vessel shunted blood from the umbilical vein to the inferior venacava.) Finally, the porta hepatis represents the horizontal and is where blood and lymph vessels, bile ducts, and nerves enter and leave the liver. In particular, the hepatic portal vein and branches of the hepatic artery proper enter at the porta hepatis.(McKinley, (2008)).
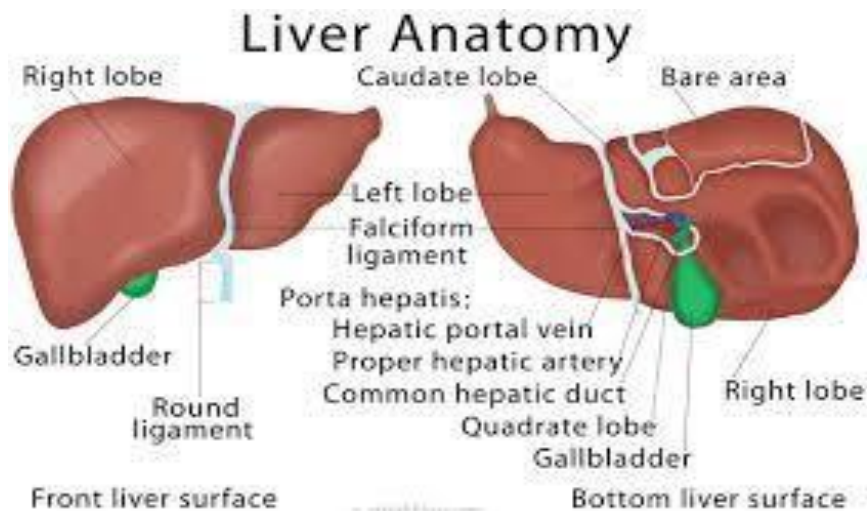
Figure(2-1) liver anatomy (McKinley, 2008).

The blood supply: Blood is supplied from the hepatic artery, and branch of the celiac artery, divide into right and left terminal branches that enter the porta hepatics.

The portal vein divides into right and left terminal branch that enter the porta hepatics behind the arteries. The hepatic veins (three or more)emerge from posterior surface of the liver and drain into the inferior vena cava.(Anne, 2005)

Lymph Drainage of the liver: The liver produces a large amount of lymph about one third to one half of all body lymph. The lymph vessels leave the liver and enter several lymph nodes in the porta hepatics. The efferent vessels pass to the celiac nodes. A few vessels pass from the bare area of the liver through the diaphragm to the posterior mediastinal lymph nodes (Anne,2005).

Portal circulation: The blood vessels conveying blood to the liver are the hepatic artery (30%)and portal vein (70%).The hepatic artery brings oxygenated blood to the liver, and the portal vein brings venous blood rich in the products of digest ion, which have been absorbed from

gastrointestinal tract. The arterial and venous blood is conducted to the central vein of each liver lobule by the liver sinusoids. The central veins drain into the right and left hepatic veins, and –these leave the posterior surface of the liver and open directly into the inferior vena cava.(Anne, 2005).

2.1.2 Physiology of the liver

Metabolic Functions: Fibrinogen, Prothrombin and Heparin SynthesiThe liver manufactures the clot proteins fibrinogen and prothrombin and also the anticoagulant heparin. (Heparin is also found in several other organs of the body).People with liver disease will have longer clotting times because the clot process is slower due to the lack of fibrinogen and prothrombin.(Devin, 2005)

Amino Acid Synthesis: Many of the liver functions are achieved through enzymes, which it also manufactures. Enzymes called transaminases are stored in the liver and are used by the liver to move amino groups around from protein to protein as different amino acids are made. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT)are two important enzymes that will back up into the bloodstream whenever there is acute hepatic cell damage or death. Therefore marked elevations of these transaminases in the serum are indicators of an acute hepatic disorder. It is important to note though that marked elevations of AST and ALT are nonspecific indicators of an acute hepatic disorder in that these can be elevated for a variety of causes.(Devin,(2005)).

Carbohydrate Metabolism:The pancreatic hormones insulin and glucagon work in conjunction with glucose regulation by the liver.

Fat Metabolism: The liver removes fatty acids from the blood and changes them into lipoproteins which are more readily used by the body. (Devin, (2005)).

2.1.3 Pathology of the liver

There are more than a hundred kinds of liver disease; these are some of the most common

2.1.3.1. Cirrhosis:

Is a slowly progressing disease in which healthy liver tissue is replaced with scar tissue, eventually preventing the liver from functioning properly. The scar tissue blocks the flow of blood through the liver and slows the processing of nutrients, hormones, drugs, and naturally produced toxins. It also slows the production of proteins and other substances made by the liver.(chan et al 2014)

Causes of liver Cirrhosis The most common causes of cirrhosis of the liver Hepatitis C, fatty liver, alcohol abuse. Symptoms Loss of appetite ,Lack of energy ,Weight loss ,Jaundice ,Fluid retention(edema) and swelling in the ankles and abdomen (often an early sign) ,A brownish or orange tint to the urine ,Light colored stools, Confusion and personality changes ,Fever.(chan et al 2014)

2.1.3.2 Polycystic liver disease:

Is a rare condition that causes cysts -- fluid-filled sacs -- to grow throughout the liver. A normal liver has a smooth, uniform appearance. A polycystic liver can look like a cluster of very large grapes. Cysts also can grow independently in different parts of the liver. The cysts, if they get too numerous or large, may cause discomfort and health

complications. But most people with polycystic liver disease do not have symptoms and live a normal life(chan et al 2014).

Causes of Polycystic Liver Disease The majority of people with polycystic liver disease inherit the condition Polycystic kidney disease (PCKD), with its frequency increasing with age and advanced renal disease. Symptoms of Polycystic Liver Disease Abdominal pain, Bloating or swelling in the abdomen, bleeding into a cyst, Infection of a cyst, Bile duct obstruction and jaundice (yellowing of the skin and eyes). (chan et al 2014)

2.1.3.3 Fatty liver disease:

Some fat in your liver is normal. But if it makes up more than 5%-10% of the organ's weight, you may have fatty liver disease. (chan et al 2014)

There are two main types of fatty liver disease: Alcoholic liver disease, (ALD) Nonalcoholic fatty liver disease (NAFLD) (chan et al 2014)

Cassese of fatty liver disease Alcoholic Liver Disease (ALD)Alcohol, Hepatitis c (which can lead to inflammation in your liver), too much iron in your body, being obese.Nonalcoholic Fatty Liver Disease (NAFLD) Overweight or obese, High cholesterol and diabetes as well. , Medication, Viral hepatitis, Autoimmune or inherited liver disease, Fast weight loss, Malnutrition. (chan et al 2014)

Symptoms of Fatty Liver Disease Feeling tired, Loss of weight or appetite, Weakness, Nausea, Confusion, poor judgment, or trouble concentrating. You might have some other symptoms, too. Your liver may get larger. You could have a pain in the center or right upper part of your belly. And the skin on your neck or under your arms may have dark, colored patches. (chan et al 2014)

2.1.3.4 Hepatocellular Carcinoma:

Hepatocellular carcinoma is a cancer that starts in your liver. Causes of Hepatocellular carcinoma:Hepatitis B or hepatitis C, cirrhosis. , Heavy alcoholicdrink, Obesityand diabetes. .

Symptoms Pain in the upper right part of your belly ,A lump or feeling of heaviness in your upper belly ,bloating or swelling in your belly ,Loss of appetite and ,feelings of fullness ,Weight loss ,weakness or deep fatigue

,nausea and vomiting ,Yellow skin and eyes ,Pale and chalky bowel movement and dark urine ,Fever.(chan et al 2014)
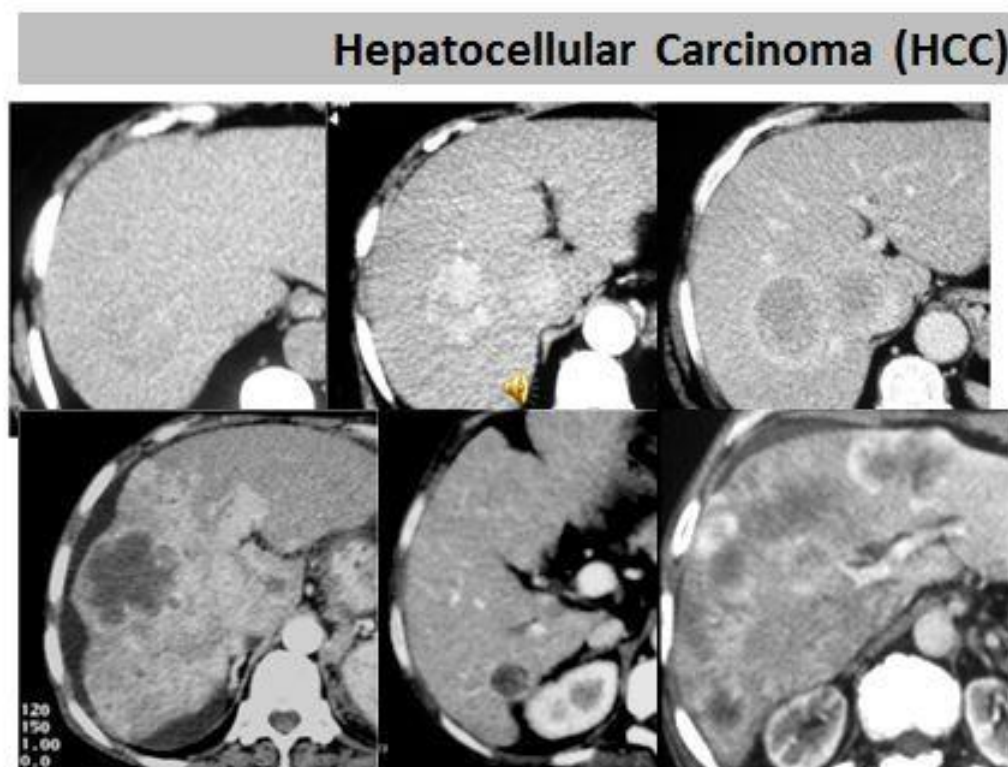

Figure (2_2) show HCCct.(chan et al 2014)

2.1.3.5 Enlarged Liver (Hepatomegaly):

Causes of hepatomegaly Inflammation or fatty liver. This could be from:

obesity ,An infection ,Some medication or alcohol ,Toxins ,Certain types of hepatitis ,Autoimmune disease ,Metabolic ,Genetic disorders . (chan et al 2014)

Symptoms of hepatomegalyA feeling of fullness, Discomfort in your belly, Yellowing of the skin or eyes (jaundice), Weakness, Nausea, Weight loss. (chan et al 2014)

2.1.3.6 Liver Abscess:

A liver abscess is a pus-filledmass inside the liver, Causes of liverabscessCommon causes are abdominal infections such as appendicitis or diverticulitis due to haematogenous spread through the portal vein(chan et al 2014)

Type of liver abscessThere are three major forms of liver abscess, classified by etiology Pyogenic liver abscess, which is most often polymicrobial, accounts for 80% of hepatic abscess cases in the United States Amoebic liver abscess due to entamoebahistolytica accounts for 10% of cases Fungal abscess, most often due to Candida species, accounts for less than 10% of cases Symptoms of liver abscess Symptoms of amebic liver abscess Abdominal pain particularly in the right upper part of the abdomen; pain is intense continuous or stabbing, Cough, Fever and chills, Diarrhea (in only one-third of patients), General discomfortor ill feeling (malaise).(chan et al 2014)

Symptoms of Pyogenic Liver Abscess Vomiting, fever, right upper abdominal pain, sudden dramatic weight losssuch as 10 pounds in a few weeks, dark-colored urine, whitish or clay-colored stool, diarrhea. (chan et al 2014)

2.1.3.7Hepatic hemangiomas :

are thought to be congenital in origin, non-neoplastic, and are almost always of the cavernous subtype. Blood supply is predominantly hepatic arterial, similar to other liver tumours. A peripheral location within the liver is most common .Sub typestypical hepatic haemangiomaandatypical hepatic haemangiomahepatichaemangiomagiant hepatic haemangioma and flash filling hepatic haemangioma: can account for up to 16% of all hepatic haemangiomas

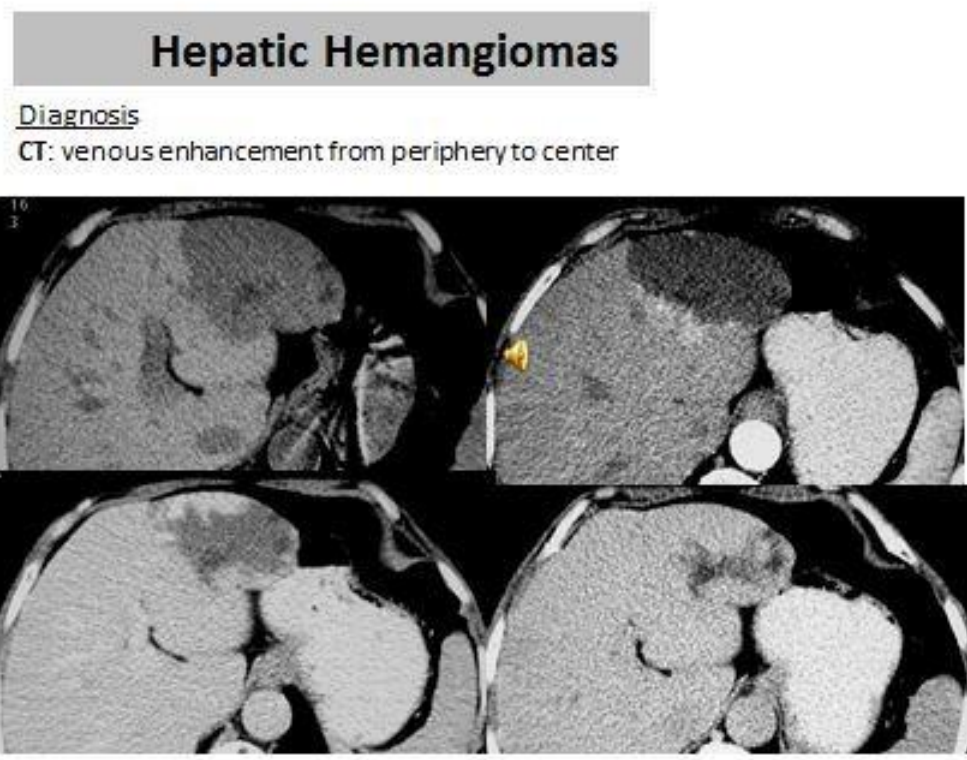Figure (2_3) show Hemangiomact venous enhancement.CT(chan et al 2014)

2.1.3.8 Liver Metastases:

A liver metastasis is a cancerous tumor that has spread to the liver from another place in the body. Causes of Liver Metastases The risk that

cancer will spread (metastasize) to the liver depends on the location of the original cancer. Primary cancers that are most likely to spread to the liver. (chan et al 2014)

Figure (2_3) show CT Metastases.(chan et al 2014)

Symptoms of Liver Metastases loss of appetite ,weight loss ,dark- colored urine ,abdominal swelling or bloating ,jaundice (yellowing of the skin or the whites of the eyes) ,pain in the right shoulder ,pain in the upper right abdomen ,nausea ,confusion ,sweats and fever

2.1.3.11 Overview: Diabetes mellitus (DM)

Is a common disease in which the blood sugar (glucose) is abnormally elevated. Normally, the body obtains glucose from food The produces insulin, which enables glucose to enter cells and serve as fuel for the body. In patients with diabetes, glucose accumulates in the blood instead of being properly transported into cells. Excess blood sugar is a serious problem that may damage the blood vessels, and other organs (Carla, 2011). Diabetes can be due to a deficiency of insulin, or to a decreased responsiveness to insulin. Thus, diabetes is not one but several diseases

with different causes. Classification of these diseases rests on how much insulin a person's pancreas is secreting. In type 1diabetes mellitus (T1DM; formerly called insulin-dependent diabetes mellitus), insulin is completely or almost completely absent from the islets of Langerhans and the plasma. (Eric. et al .2008)

In type 2 diabetes mellitus (T2DM, formerly called non–insulin dependent diabetes mellitus), insulin is usually present in plasma at nearly normal or even above-normal levels, and therapy does not normally require insulin administration (although in roughly one-third of T2DM patients, insulin therapy is beneficial). T1DM is less common, affecting approximately 10 percent of diabetic patients in the United States. T1DM is due to the total or near-total destruction of the pancreatic beta cells by the body's own white blood cells. The triggering events for this autoimmune response are not yet fully established. (Eric. et al .2008)

Treatment of T1DM always involves the administration of insulin (by injection, since oral administration of insulin would not be effective due to the actions of gastrointestinal enzymes). It is very likely that future therapies for T1DM will make use of alternative routes of insulin administration, such as inhalers and nasal sprays. It is also possible that transplantation of normal islet cells into a person with T1DM will someday prove to be an effective therapy. Administration of insulin by any route, however, is not a cure for T1DM. Ultimately, the cure for T1DM will involve prevention of the autoimmune response. (Eric. et al .2008)

Because of insulin deficiency, untreated patients with T1DM always have elevated glucose concentrations in their blood. The increase in glucose occurs because glucose fails to enter insulin's target cells normally, and

the liver continuously makes glucose by glycogenolysis and gluconeogenesis, and secretes the glucose into the blood. Recall also that insulin normally suppresses lipolysis and ketone formation. Thus, another result of the insulin deficiency is pronounced lipolysis with subsequent elevation of plasma glycerol and fatty acids. Many of the fatty acids are then converted by the liver into ketones. (Eric. et al .2008)

If extreme, these metabolic changes culminate in the acute life-threatening emergency called diabetic ketoacidosis. Some of the problems are due to the effects that extremely elevated plasma glucose concentration produces on renal function. The elevated plasma glucose of diabetes increases the filtered load of glucose beyond the maximum tubular re absorptive capacity, and therefore large amounts of glucose are excreted. For the same reasons, large amounts of ketones may also appear in the urine. These urinary losses deplete the body of nutrients and lead to weight loss. The fact that of these un reabsorbed solutes cause an osmotic diuresis increased urinary excretion of sodium and water, which can lead to hypotension, brain damage, and death. The other serious abnormality in diabetic ketoacidosis is the increased plasma hydrogen ion concentration caused by the accumulation of ketones. Two ketones, known as hydroxybutyric acid and acetoacetic acid, are acidic at the pH of blood. This increased hydrogen ion concentration causes brain dysfunction that can contribute to the development of coma and death. (Eric.P et al .2008)

Diabetic ketoacidosis is seen primarily in patients with untreated T1DM. About 90 percent of diabetics are in the T2DM category and rarely develop metabolic derangements severe enough to go into diabetic ketoacidosis. T2DM is a disease mainly of overweight adults, typically starting in middle life. Given the earlier mention of progressive

weight loss in T1DM as a symptom of diabetes. One major problem is target cell hypo responsiveness to insulin, termed insulin resistance. Obesity accounts for much of the insulin resistance in T2DM. Is that the excess adipose tissue overproduces a messenger that causes down regulation of insulin- responsive glucose transporters or in some other way blocks insulin's actions. One putative messenger, or hormone, has been named resistin, but its physiological actions are still under investigation. In additional components (possibly genetic) of insulin resistance, not related to obesity and not yet understood, may also occur with T2DM. (Eric. et al .2008)

Most people with T2DM not only have insulin resistance but also have a defect in the ability of their beta cells to secrete insulin in response to a rise in plasma glucose concentration. Insulin resistance is the primary factor inducing hyperglycemia in T2DM, an as-yet-unidentified defect in beta cell function prevents these cells from responding maximally to the hyperglycemia. (Eric. et al .2008)

The most effective therapy for obese persons with T2DM is weight reduction, since obesity is a major cause of insulin resistance. An exercise program is also very important, because insulin responsiveness is increased by frequent endurance-type exercise, independent of changes in body weight. If plasma glucose concentration is not adequately controlled by a program of weight reduction, exercise, and dietary modification (specifically low-fat diets), then the person may be given orally active drugs that lower plasma glucose concentration by a variety of mechanisms. The sulfonylureas lower plasma glucose by acting on the beta cells to stimulate insulin secretion. Other drugs increase insulin sensitivity or decrease hepatic gluconeogenesis. A people with either form of diabetes mellitus tend to develop a variety of chronic

abnormalities, including atherosclerosis, kidney failure, small-vessel and nerve disease, susceptibility to infection, and blindness. Elevated plasma glucose contributes to most of these abnormalities either by causing the intracellular accumulation of certain glucose metabolites that exert harmful effects on cells when present in high concentrations, or by linking glucose to proteins, there by altering their function. The reason for this is that insulin normally inhibits glucagon secretion, and the low insulin of T1DM releases glucagon secretion from this inhibition. Finally, as we have seen, all the systems that increase plasma glucose concentration are activated during stress, which explains why stress worsens the symptoms of diabetes. Since diabetic ketoacidosis itself constitutes a severe stress, a positive feedback cycle is triggered in which a lack of insulin induces ketoacidosis, which elicits activation of the glucose- counter regulatory systems, which worsens the ketoacidosis. (Eric.P et al .2008)

Long-term complications of diabetes include retinopathy with potential loss of vision; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction. Patients with diabetes have an increased incidence of atherosclerotic cardiovascular, peripheral arterial, and cerebrovascular disease. Hypertension and abnormalities of lipoprotein metabolism are often found in people with diabetes. (American Diabetes Association, 2014).

2.1.4 Computerized Tomography

2.1.4.1 CT History:

CT was invented in 1972 by British engineer Godfrey Hounsfield of EMI Laboratories, England and by South Africa-born physicist Allan Cormack

of Tufts University, Massachusetts. Hounsfield and Cormack were later awarded the Nobel Peace Prize for their contributions to medicine and science.(https://en.m.wikipedia, org/wiki/ct scan)

The first clinical CT scanners were installed between 1974 and 1976. The original systems were dedicated to head imaging only, but "whole body" systems with larger patient openings became available in 1976. CT became widely available by about 1980. There are now about 6,000 CT scanners installed in the U.S. and about 30,000 installed worldwide. (https://en.m.wikipedia, org/wiki/ct scan)

During its 25-year history, CT has made great improvements in speed, patient comfort, and resolution. As CT scan times have gotten faster, more anatomy can be scanned in less time. Faster scanning helps to eliminate artifacts from patient motion such as breathing or peristalsis. CT exams are now quicker and more patient-friendly than ever before. Tremendous research and development has been made to provide excellent image quality for diagnostic confidence at the lowest possible x-ray dose. (https://en.m.wikipedia, org/wiki/ct scan)

2.1.4.2 CT Protocolling:

The happens when an exam is requested A requisition is completed.The requested exam is protocolled according to history, physical exam and previous exams. The patient information is confirmed The exam is then performed images are ready to be interpreted in uncomplicated exam – 5-10 minutes after completion complicated exams with reconstructions take at least 1 hour but usually 1-2 hours. (https://en.m.wikipedia, org/wiki/ct scan)

2.1.5 Contrast Media:

Different tissues within the body attenuate the beam of X-rays to different degreesSince 1973 an imaging technique known as computed tomography (CT) has developed to become one of the most important radiological examinations in the industrialised countries. CT uses conventional X-rays in a thin nondivergent beam to produce cross sectional images of thebody. The X-ray tube and an array of detectors mounted within a supporting framework, rotate round the patient with each scan. CT produces digitalized images, although these are usually printed onto hard copy film in a format that is useful for transfer and viewing throughout the hospital. By electronic means CT improves via a higher contrast sensitivity, the natural radiological contrast between organs. However, it cannot create contrast where none exists naturally. CT is exceptionally sensitive to contrast media and can detect abnormalities, caused by disease, following an injection of an intravenous dose of contrast medium. This procedure is known as "enhancing" the scan. About 43% of all CT procedures involve the use of a contrast medium. CT is widely used throughout the body but the most frequently investigated areas using this technique are neuroradiology (brain and lumbar spine) and general radiology of the chest, abdomen and pelvis. It is particularly useful for the diagnosis, staging and follow up of malignant disease. There are numerous types of contrast media which have different applications, depending on their differing chemical and physical properties. Radiological contrast media are usually water soluble solutions, but there is one commonly used variety that is based on a suspension of large insoluble particles. (https://en.m.wikipedia, org/wiki/ct scan)

2.2 Previous study:

Radiographic findings of the Abdomen in the diabetic patients using CT scan, Fatima Ahmed Sedge

The purpose of this study was to evaluate the abdominal finding for patient with diabetes by using computer tomography. And to assess pancreas, liver, spleen, and kidney length and width as well as CT number and its correlation with duration of diabetes mullets and subjects age and gender. The study was performed on fifty patients(15 male-45female), between (23->82)years, and this study was done in Alamal Diagnostic Centers, Ibn alhyitham Medical Centers Alfaisal Medical Centers, from September 2012 to December 2012. All of patient underwent CT KUB or abdomen, axial cut for abdomen using 120KV, 160MAS.The CT image of these patient were interpreted by radiologist. The CT number, length and width for pancreas, liver, spleen, and kidney was taken for each patient. The main findings of study were that, the diabetes affected all of these organs in size and texture as the CT number had been changed. CT has great value in detection changes happened for subjects affected by Diabetes Mellitus. (Fatima, 2012)

Chapter Three

Material and Method

Chapter Three

Materials and Methods

3. 1 Materials

3.1.1 Patient

50 Sudanese patients (20 male 30 female) and at different ages all were affected with diabetic, Had CT examination for abdomen .

3.1.2 CT Machine
TOSHEPA 16 SLICES SENNAR hospital (KV 120_MAS160).

3.2Methods

3.2.1Technique

All patients underwent CT scan for Abdomen with patient supine_ feet first 'the arms are raised and placed behind the patient head (out of the scan plane): positioning, is add by alignment light "the median sagittal plan to perpendicular and the commit pine is parallel to Scanner table top" the scanner table height is adjusted to ensure that's the coronal plane alignment is at the level of mid axillary line. the patient was moved in to the scanner until the scan reference point is at the level of the xiphoid process. Same images were done without contrast media. the scout View was obtained to include the diaphragm and pubis" with slice thickness (3_5) mm" with patient preparation and by using 120KVP and (140_160) MAS and then trans axial images were taken during normal respiration. The married female patients were ensuring that 10 day rule where appropriate.

3.2.2 Image interpretation

All images were studied by technologist and the following data were collected from CT images: weight, length and CT number this was done

by electronic measurement which present on CT machine. Images diagnoses were seen from the radiologist.

3.2.3 Area and Duration:

The study was done in SENNAR HOSPETAL at the period from May2018 to October 2019. In SENNAR State.

3.2.4 Data analysis

The collected data was analyzed statistically by excel. The patient weights were measured by using weight measuring tools and height using meter. the abdomen organs as liver were measured as RI and I.T lobe from point standing from superior prouder to inferior prouder for length and width was measured from medial to portal vein for LT lob and from portal vein to lateral prouder.

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Chapter four

Results

Chapter four

Results

Table 4:1 the classification of the sample according to age groups

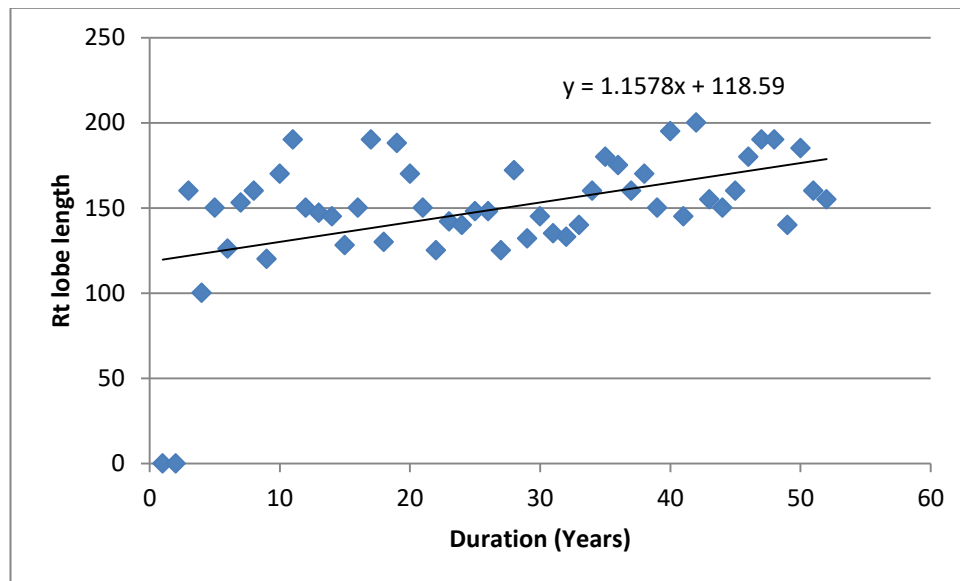| Age group	Frequency	Percent
20-29	2	4.0
30-39	3	6.0
40-49	4	8.0
50-59	8	16.0
60-69	17	34.0
70-79	11	22.0
80-89	3	6.0
90-100	2	4.0

Figure 4 .1 A scatter plot diagram show the relation between diabetes mellitus duration and RT liver lobe length. The length increase by 1.16 starting from 119 as dibetes duration increased .
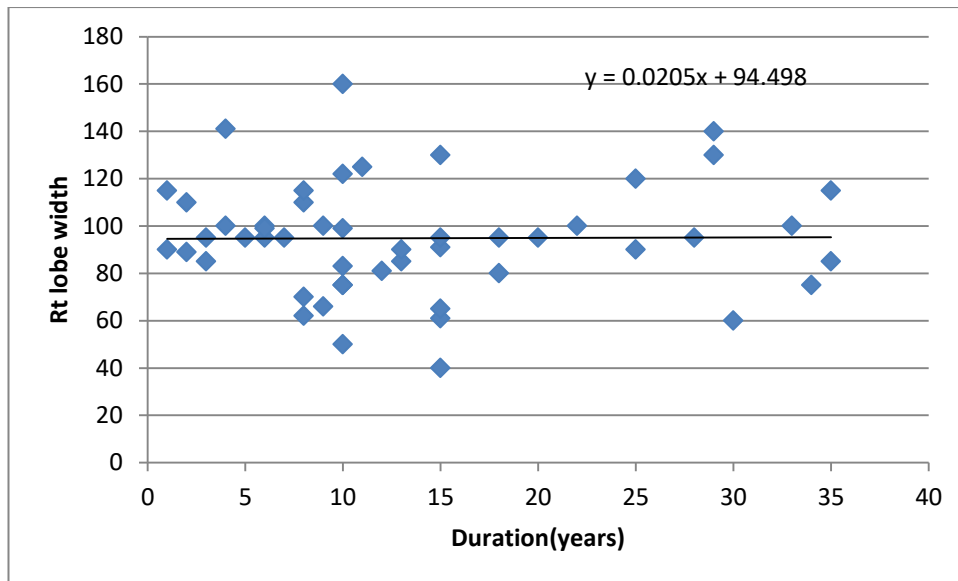
Figure 4.2A scatter plot diagram show the linear relation between diabetes mellitus duration and RT liver lobe width. The width increase by 0.02 starting from 94 as diabetes duration increased .
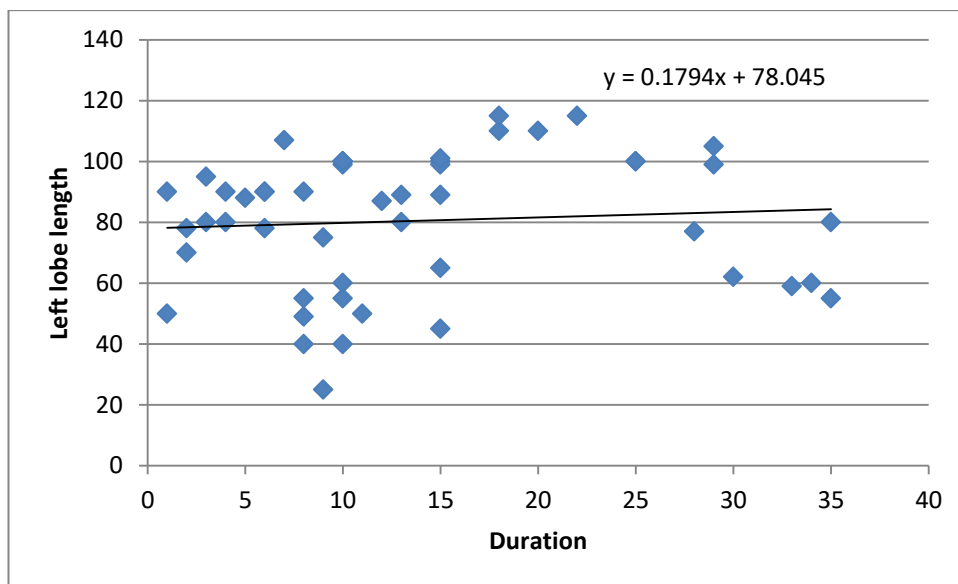

Figure 4.3 A scatter plot diagram show the linear relation between diabetes mellitus duration and LT liver lobe length. The length increase by 0.2 starting from 78 as diabetes duration increased.
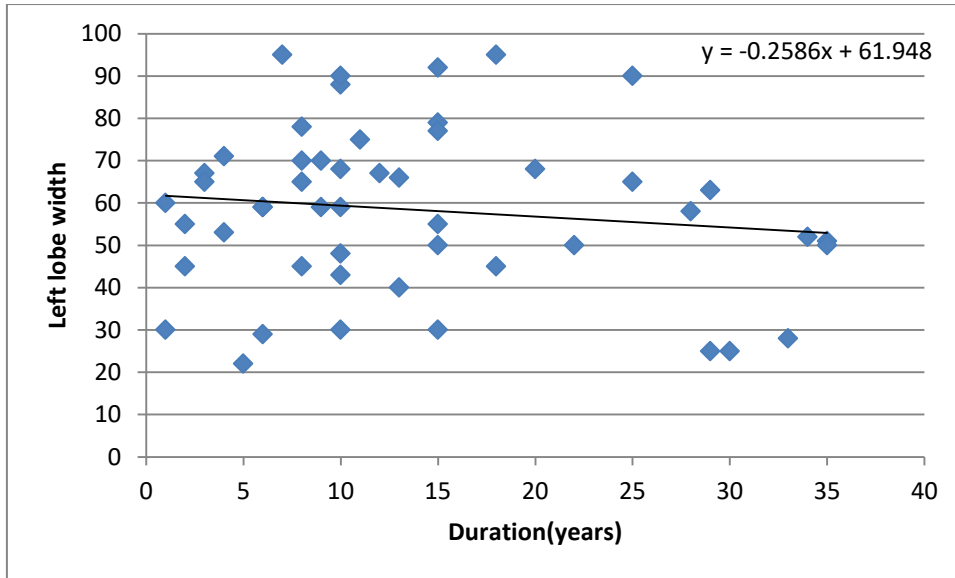
Figure 4.4 A Scatter plot diagram shows the linear relationbetween diabetes mellitus duration and Lt liver lobe width . the width decrease by -0.3 starting from 62 as diabetes durations increased.
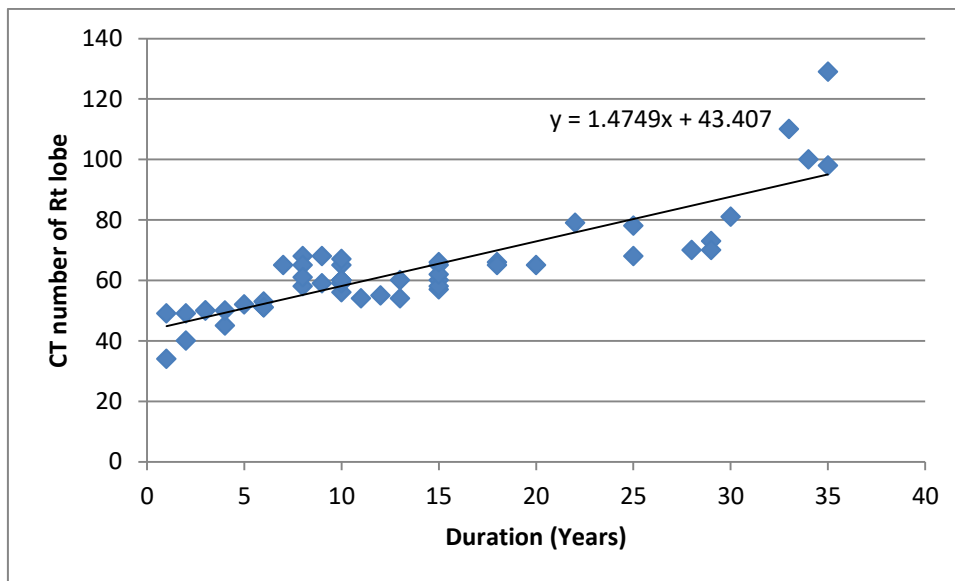

Figure 4.5 A Scatter plot diagram show the relation between CT numbers of Rt liver lobe and diabetes mellitus duration . The Ct number of Rtliver lobe increases by 1.5 starting from 43 as diabetes durations increased.
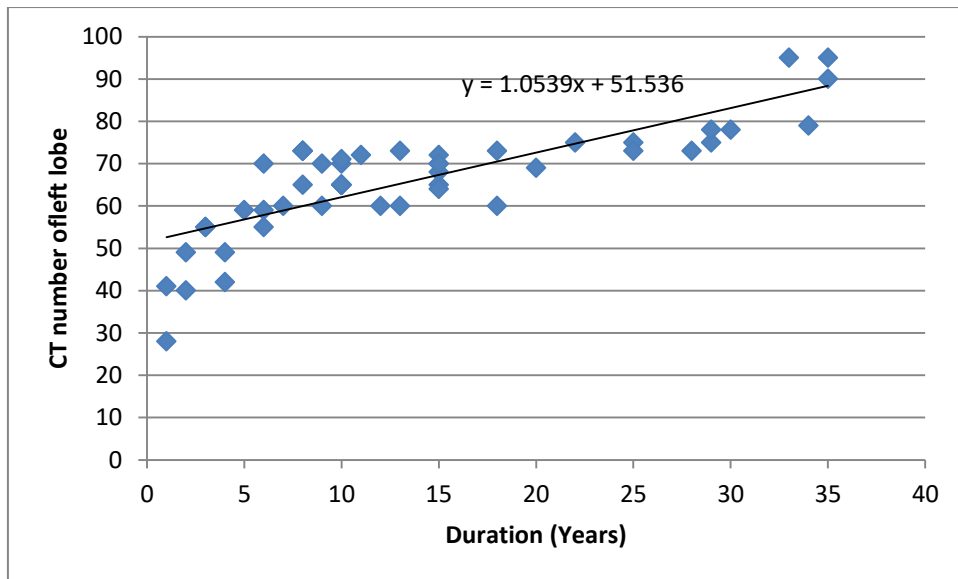
Figure 4.6 A Scatter plot diagram show the linear relation between Ct number of Lt liver lobe and diabetes mellitus duration . the Ct number of Lt liver lobe increases by 1.05 stsrting from 51 as diabetes durations increased .

Chapter five

Discussion, conclusion and recommendation

Chapter five

Discussion, conclusion and recommendation

5.1 Discussion

This study was done for 50 adult Sudanese patient using CT scan as well as to find out the relation between duration of diabetic and liver (length, weight, and CT number) .

This data were collected for patients age between 23 ± 80 years old, (were different period of duration of diabetic).the diabetes influence by age of patient and genders. The diabetes increase the risk after long term complication, these typically develop after many years (10-20) , the major long term complication relate to damage to blood vessel. Kleinfield, N. R. (September 13, 2006) mentioned that the Diabetes mellitus prevalence increases with age, and the numbers of older persons with diabetes are expected to grow as the elderly population increases in number. The National Health and Nutrition Examination Survey (NHANES III demonstrated, in the population over 65 years old, 18% to 20% have diabetes, with 40% having either diabetes or its precursor form of impaired glucose tolerance).

In table 4-2 the classification of the variable CT number in one group of patients the RT and LT lob of the liver were different according to segmentation of the liver.

The study showed that the average Width and length for RT lobe of liver, the width was increase by 0.02), and The length increased by 1.16 , And average width and length, for LT lobe of liver the average width was decrease by 0.3 The length decreased by 0.2 when the diabetes duration increased, and the fatty glucose dose not storage in the liver and make liver faty.

5.2 Conclusion

The main findings of the study were that' s the relation between the liver measurements (length, width, and CT number) and diabetic.

The diabetes mellitus is a chronic disease cause- d by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many of the body's systems, in particular the blood vessels and nerve.

5.3 Recommendation

 The researcher recommended that:

More researches should be used a large sample of patient for further assessment.

Similar study should be done using different modalities such as ultrasound and magnetic resonance imaging due to the fact that they are safer with no using radiation.

All government hospital should introduce the CT in the radiology department.

References

Baron RL, Dodd GD, Holbert BL, Oliver JH, Cam B. (1994)Helical biphasic contrast CT in evaluation of hepatocellular carcinoma . Radiology; l93(P):435.

Bonaldi VM, Bret I'M, Reinhold C, Atni M. (1995).Helical CT of the liver: value ot an early hepatic arterial phase. Radiology; 197: 357-363.

Ch'en IY, Katz DS, Jeffrey RB Jr, et al. (1997) Do arterial phase helical CT images improve detection or characterization of colorectal liver metastases J Comput Assist Tomogr; 21(3):391-397.

Foley WD, Mallisee TA, Hohenwalter MD, Wilson CR, Quiroz FA, Taylor AJ. (2000)Multiphase hepatic computed tomography with a multi row detector computed tomography scanner. AJR Am J Roentgenol; 175: 679-85.

Hollett, Brooke Jeffrey R, Nino-Murcia M, Jorgensen MJ, Harris DP. (1995)Dual-phase helical CT of the liver: value of arterial phase scans in the detection of small (< 1.5 cm) malignant hepatic neoplasms. AJR; 164:879-884.

Hwang GT, Kim MJ, Yoo HS, Lee JT. (1997)Nodular hepatocellular carcinoma, detection of arterial, portal and delayed phase images at Spiral CT. Radiology,;202:383-88

J. Ueda,Y . Kobayashyi,.Kenkoh, .Koiket, .Kubo,Y . Takanaon D K. Har (1988) Distribution of Water, Fat, and Metals in Normal Liver And In Liver Metastases Influencing Attenuation On Computed Tomography ActaRadiologica29

Kristina Zviniene (2012). Differential Diagnosis of Hepatocellular Carcinoma on Computed Tomography,Hepatocellular Carcinoma - Clinical Research, Dr. Joseph W.Y. Lau (Ed.), ISBN: 978-953-51-0112-3

Iannaccone R, Laghi A, Catalano C, Rossi P, Mangiapane F, Murakami T, et al. (2005)Hepatocellular carcinoma, role of unenhanced and delayed phase multi detector row helical computed tomography in patients with cirrhosis. Radiology; 234: 460-7.

Johnson PT, Fishman EK. (2006) IV Contrast selection for MDCT: Current thoughts and practice. AJR Am J Roentgenol; 186: 406-15.

Jones EC, ChezmarJL, Nelson RC, Bernardino ME. (1992)The frequency and significance of small (< 15 mm) hepatic lesions detected by CT. AJR;158:535-539

Miller FH, Butler RS, Hoff FL, Fitzgerald SW, Nemcek AA Jr, Gore RM. (1998)Usingtriphasic helical computed tomography to detect focal hepatic lesions in patientswith neoplasms. AJR Am J Roentgenol; 171: 643-9.

Murakami T, Kim T, Oi H, et al. (1995)Detectability of hypervascular hepatocellular cancinoma by arterial phase images of MR and spinal CT. ActaRadiol; 36:372-376.

Oliver JH, Baron RL, Federle MP, Rockette HE Jr. (1996)Detecting hepatocellular carcinoma, value of unenhanced or arterial phase computed tomography imaging or both used in conjunction with conventional portal venous phase contrast enhanced computed tomography imaging. AJR Am J Roentgenol;167: 71- 7

Sheafor DH, Frederick MG, Paulson EK, Keogan MT, DeLong DM, Nelson RC. (1999).Comparison of unenhanced, hepatic arterial-dominant

and portal venousdominant phase helical CT for the detection of liver metastases in women with breast carcinoma. AJR Am J Roentgenol; 172: 961-8.

Takayasu K, Moriyama N, Muramatsu Y, Makuuchi M, Hasegawa H, Okazaki N et al(1990). The diagnosis of small hepatocellular carcinomas efficacy of various imaging procedures in 100 patients. AJR Am J Roentgenol; 155:49-54.

Thieme 2004 and E Harold 2006 anatomy of liver

Vallls C, Andia E, Rocca Y, Cos M, Figueras J. (2002)Computed tomography in hepatic cirrhosis and chronic hepatitis. Semin Ultrasound, CT MRI; 23: 37-61.