Sudan University of Science and Technology

College of Graduate Studies

ASSESSMENT OF RENAL CHANGE IN DIABETIC PATIENTS USING COMUTED TOMOGRAPH

تقييم التغيرات الكلوية لمرضى السكري باستخدام الأشعة المقطعية المحسوبة

Thesis submitted for partial fulfillment required for MS.c. Degree in diagnostic radiology

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى:

﴿ وَفِي أَنفُسِكُمْ أَفَلَا تُبْصِرُونَ ﴾

صدق الله العظيم

سورة الزاريات (21)

Dedication

To my mother and father

To my brothers and sister

To my friends

Acknowledgment

After thanking Allah Almighty thanks all who contributed and helped out in this research, special thank to **Dr Hussain Ahmed Mohamed.**

LIST OF ABBREVIATIONS

US	Ultrasound
CT	Computed Tomography
CAT	Computed Axial Tomography
IVC	Inferior Vena Cava
GFR	Glomerular Filtration Rate
ACE	Angiotensin Converting Enzyme

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ABSTRACT

Advance in medical diagnostic technology induced accurate diagnostic for most of disease especially abdominal ones, the main objective of the study was to assess renal change in diabetic patient using CT, in fact diabetes is the most common cause of kidney failure, diabetic nephropathy begins silencet before patient having symptoms and early discovery of it may slow down kidney damage.

This study was done for 50 diabetic patient (34 male and 16female) all of them have diabetes mellitus type1 and type2 for more than many years, their age range from 30-90 year. Patient with renal congenital anomalies, urinary tract obstruction, hydronephrorsis, malignant tumor and renal failure were excluded.

From the result showed more frequent ages affected by diabetic nephropathy between (46-60) by 32%, because physical characteristic of male are more affected than female by 68% to 32% respectively, according to diabetic type patient with type 2 more affected by disease than patient with type1 by 58% to 42%, according to kidney size result show decrease in kidney size in comparison with normal range.

الملخص

التطور الذي حدث في تقنيات التشخيص أدى إلى التمكن من تقديم فائدة تشخيصية عظمى لمختلف أعضاء منطقة البطن، ومن أهداف البحث تحديد التغيرات في الكلى عند المرضى المصابين بمرض السكري باستخدام الأشعة المقطعية، في الحقيقة داء السكري يتسبب تدريجيا في الفشل الكلوي قبل أن يشعر المريض بالتغيرات المرضية، الاكتشاف المبكر للمرض قد يبطئ من تأثير المرض على الكلى.

تم عمل الدراسة على 50 مريض (ذكور + إناث) مصابين بمرض السكري النوع الأول أو النوع الثاني، أعمارهم ما بين الثلاثين إلى التسعين عام. باستثناء المرضى المصابين بعيوب خلقية بالجهاز البولي والمصابين بانسداد المجاري البولية والأورام الخبيثة.

أكثر المصابين بالمرض أعمارهم تتراوح من (46-60) بنسبة 32%، الذكور أكثر إصابة من الإناث بنسبة 68% إلى 32% على التوالي. أما بالنسبة لنوع السكري عند المرضى المصابين بالنوع الثاني أكثر عرضة للإصابة بمرض الكلى من المرضى المصابين بالنوع الأول بنسبة 58% إلى 42% على التوالي. بالنسبة لحجم الكلى أوضحت الدراسة نقص في حجم الكلى مقارنة بحجم الكلى الطبيعي.

Chapter one
Introduction

Chapter one

1.1 Introduction

Is progressive kidney disease caused by damage to capillaries in the kidney glomeruli, it characterized by nephritic syndrome and diffuses scarring of the glomeruli, it is due to longstanding diabetes mellitus, effect 40% of type 1and type 2 diabetic Pt, this stage has been refer to overt nephropathy, proteinuria, or macroalbuminura. Is most common cause of end stage kidney disease which may require hemodialysis or kidney transplantation, it is associated with increase risk of death in general particular from cardiovascular disease. (Preminger, 2007).

During early course diabetic nephropathy has no symptoms, symptoms can take 5 to 10 years to appear after kidney damage begins, the cause of diabetic nephropathy is not well understood hyperglycemia, increased blood pressure level and genetic predisposition are the main risk factors for development diabetic nephropathy.(Johri,2010).

Screening for microalbuminuria should be performed yearly, starting 5 years after diagnosis in type 1 diabetes or earlier in the presence of poor metabolic control, in pt with type 2 diabetes screening should be performed at diagnosis and yearly thereafter.(Johri,2010).

Diagnosis is usually based on measurement of high levels of albumin in the urine or evidence of reduced kidney function, to test kidney function the person estimated glomerular filtration rate measured from blood sample. Assessment of

renal function is often required in radiological diagnosis, mainly for assessment of renal insufficiency, renovascular disease, metabolic disorders and renal transplant. Several non invasive test of renal function have been developed, this includes measurement of serum creatinine level, renal scintigraphy and contrast enhanced computed tomography. Renal scintigraphy requires radioactive trace and provides little information about kidney anatomy. CT has excellent spatial resolution, but exposes the patient to radiation and potentially toxic contrast agent.(Perminger, 2007).

1.2 Problem of the Study

Diabetic kidney disease has sever effect on kidney, which lead to loss function by change both secretion and execration of filter blood component, examination of patient kidney early it is important in diagnosis and treatment.

1.3 Objective

1.3.1 General objective

The general objective of Assessment Of Renal Change In Diabetic Patients Using Comuted Tomograph.

1.3.2 Specific objective

1. To study renal change in diabetic Patient.
2. To detect change in shape and size of kidney patient by using CT.
3. To correlate between duration of diabetes and renal change.

Chapter Two
Literature Review

2.1 ANATOMY OF RENAL SYSTEM

The renal system consists of two kidneys, two ureters, one urinary bladder and one urethra. (Worf, 2011)

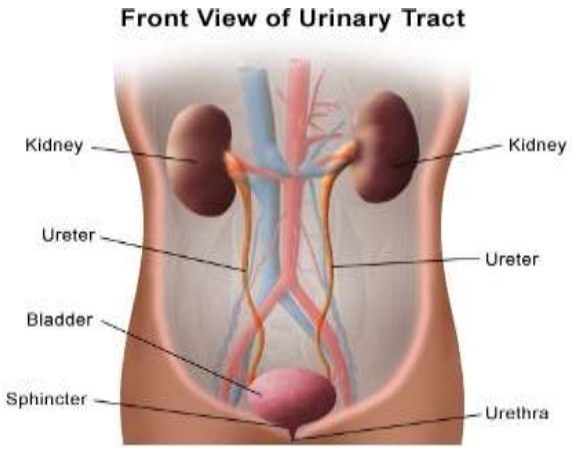

Fig [2.1]. Anatomy of renal system.

2.1.1 Kidney

Two kidneys are retroperitoneal organ, bean shaped lie on either side of vertebra column between T12-L4, right kidney is slightly lower than the left because the presence of liver, surrounded by thin strong capsule of connective tissue, each kidney has a concave hilum facing medially, branches of the renal artery, vein, lymph vessels and ureter enter or leave the kidney at the hilum, ureter is expanded forming the renal pelvic. Near the upper medial part of each kidney is adrenal gland, is important gland of endocrine system are located in the fatty capsule that surround each kidney. (Worf,20011).

Adult kidney 9-12cm in length, 4-6cm in diameter, 2.5-4 in depth, weight between 120-170gm, neonatal kidney 3.5 to 5cm in length, 2-3cm in diameter, 1.5-2.5 cm in depth, cortical and parenchyma thickness 2.5-3.5 cm, the thickness of renal parenchyma decrease at about 10% per decade. Each kidney is composed of an outer cortex and inner medulla, renal cortex is responsible for filtration of urine, where as the medulla consisting of segments called renal pyramids function as beginning of the collecting arising from the apices of the pyramids, cup shaped calyces which join together to form the renal pelvis system.(wolf, 2011).

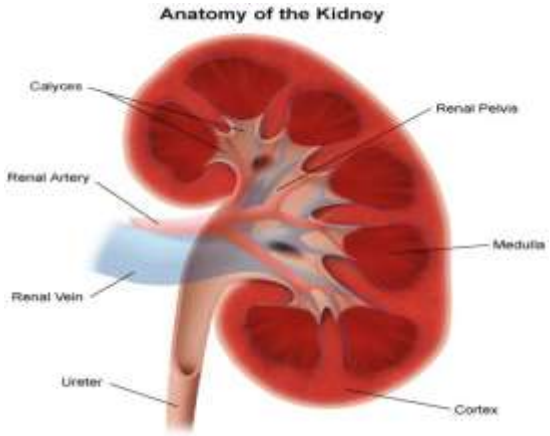

Fig [2.2]. Cross section of right kidney.

2.1.2 Ureters

The ureters are paired muscular tubes, that transport urine to the urinary bladder, each uerter originates at the renal pelvis and descends anteriorly and medially to the psoas muscles, enter the posterior wall of the bladder at an oblique angle. (Evan et.al 2005)

2.1.3 Urinary bladder

Is a triangular shaped, muscular organ, which lies immediately posterior to the symphysis pubis, it functions as temporary reservoir for the storage of urine. Three openings in the floor of the bladder from the a triangular area called trigone, two of the openings at the base of the trigone are created by the ureters, third opening is located in the apex of the trigone and formed by the entrance to the urethra. (Evan et.al 2005).

2.1.4 Urethra

The urethra is single tubular structure that drains to urinary bladder, skeletal muscle fibers are organized as the external sphincter of the urethra reverse to the internal sphincter. (Evan et.al 2005).

2.1.4.1 Female urethra

Short muscular tube that drains urine to bladder, external urethral opening is located just anterior to the vagina, has lumen normally collapsed except during micturition, it is lined by a transitional epithelium near the bladder and by a stratified squamous non epithelium along the rest of its length, thin vascular coat of erectile tissue similar to the corpus spongiosum of male surrounds the mucosa, the muscular layer has an inner longitudinal and an outer circular layer of smooth muscle. (Wolf, 2011).

2.1.4.2 Male urethra

Is much longer and extends from the bladder to the tip of the penis, it can be subdivided into three, prostatic urethra, membraous urethra and penile urethra. Prostatic urethra surrounded by the prostate gland, lined by transitional epithelium, receives openings from the two ejaculatory ducts and multiple excretory ducts of prostate gland. Membranous urethra is the shortest and narrowest portion of the urethra and is portion that penetrates

the external urethral sphincter. Penile urethra is the longest portion, extending from the external urethral sphincter to the tip of the penis, it lodges the corpus spongiosum and is lined by stratified columnar epithelium. (Even, 2005).

RENAL BLOOD VESSELS

Renal arteries

They are a rise from the lateral wall of aorta just below the superior mesenteric artery, each vessel travels horizontally to the hilum of the corresponding kidney, because the position of the aorta on the left side of the vertebral column, the right renal artery is slightly longer than the left, in addition the right renal artery passes posterior to the Inferior Vena Cava (IVC) and right renal vein on its course to the right kidney. (Thakker, 2000).

Renal veins

They are a rise at the hilum of the kidneys and pass anterior to the renal arteries to empty into the IVC, the left renal vein passes posterior to the superior mesenteric artery and anterior to the aorta, on its route from the left kidney to enter the left lateral wall of the IVC, the shorter right renal vein typically lower than the left renal vein, its short course to enter the right lateral wall of the IVC. (Hoppe, 2003).

PHYSIOLOGY OF THE RENAL SYSTEM

Function of urinary system is production of urine, excretion organic waste products from body fluids, elimination waste products into the environment, regulating blood volume and pressure, regulating plasma ion concentrations, stabilizing blood pH, synthesis and secretion of erythropoietin, activation of vitamin D, release of rennin enzyme in to the blood, remove nitrogenous wastes, regulate water level in the body, regulate acid base balance and

electrolyte levels of blood, filter out unnecessary product from blood stream and retain the necessary elements such as protein and electrolytes. (Hoppe,2003).

The basic functional unit of the kidney is the nephron, there are over one million nephrons in each human kidney, they are responsible for the complex water regulation and waste elimination functions of the kidneys, the heads of the nephrons are in the cortical region and the tubular component descends through the medulla and eventually drains into the renal pelvis. (Hope,2003). Nephron surrounded by a fine network of capillaries called the peritubular capillaries these perform an important role in direct secretion, selective reabsorption and regulation of water, in addition to glomerular filtration some substances are secreted directly from the adjacent capillaries into the proximal tubule, these substances include potassium ions and some hormones.(Thakker,2000).

The area between the circulatory system and the tubular part of the kidney is the glomerular capillaries in the Bowman's capsule, these liquid parts of the blood that are able to cross through the filtration membrane of the capillaries, pass into the Bowman's capsule and then into the tubular section of the nephron, filtration membrane only allows water to pass through it and small molecules that will dissolve in water and blood cells are too large to filtered and remain in the blood. Filtered fluid enters the proximal tubule and then into the loop of henle which is the part of the nephron, dips in and out of the medulla, from the loop of henle the filtrate travels through the distal tubule and then into a common collecting ducts which passes through the medulla and into the renal pelvis.(hoppe et.al 2003).

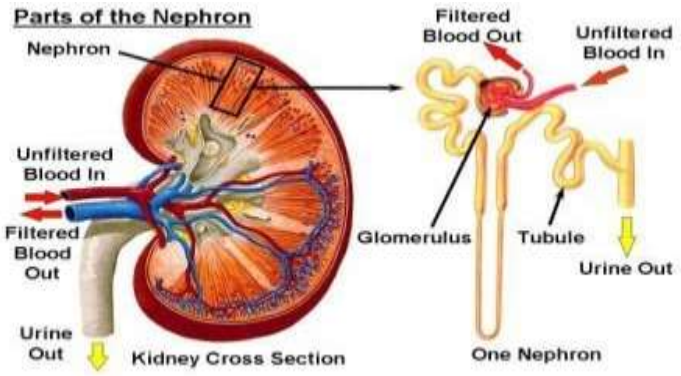

Fig [2.3]. Micro structure of kidney (nephron).

DIABATIC NEPHROPATHY

DEFINTION

Means kidney disease or damage caused by diabetes, in sever causes lead to kidney failure but not everyone with diabetes has kidney damage, kidney have many tiny blood vessels that filter waste from blood, high blood sugar can destroy these blood vessels, over time kidney is not able to do it is job as well, later it may stop working completely called kidney failure. (Parmar, 2004).

Almost third of people with diabetes develop diabetic nephropathy, people with diabetes and kidney disease do worse overall than people with kidney disease alone, this is because people with diabetes tend to have other long standing medical condition, like high blood pressure, high cholesterol and blood vessel disease, high glucose level can lead to an abnormality that allow necessary element such as protein to be wasted into urine, people with diabetes also are more likely to have other kidney problem such as bladder infection and nerve damage to bladder. (liebman et.al 2011). Diabetic kidney disease take many years to develop, in some people function of kidney is higher than normal in first few years of diabetes, over several years people are developing kidney disease will have small amount of the

protein albumin begin to lake in the urine. (Parmer,2004). Kidney disease in type 1 diabetes is slightly different than in type 2 diabetes, in type 1 diabetes kidney disease rarely begins in first 10 years after diagnosis of diabetes, usually 15 to 25 years will pass before kidney failure occurs, in type 2 diabetes some pt already have kidney disease by time they are diagnosed with diabetes. (Goodwin et.al 1998). Type 1 diabetes happens when immune system destroys cell in pancreas called beta cell, they are ones that make insulin, some people get condition called secondary diabetes, it is similar to type 1 except the immune system doesn't destroy beta cell, they are wiped out by something else like disease or injury to pancreas. Type 2 diabetes which is more common usually occurs in people over 40 and is called adult onset diabetes mellitus, it is also called adult non insulin dependent diabetes mellitus, in type 2 pancreas makes insulin but does not use it properly. (liebman et.al 20011). Small blood vessels in the body are injured, kidney cannot clean the blood properly, the body retain more water and salt than it should, diabetes also may damage to nerve, this can cause difficulty in emptying bladder, the pressure result from full bladder can develop and infection from rapid growth of bacteria in urine that has high sugar level. (Parmer, 2004). Diabetes is the common metabolic cause of renal disease it cause chronic renal failure in more than 10% of all diabetic, and in over 40% of those developing diabetes in childhood, end stage renal failure occur when kidney are no longer able to support pt in reasonably healthy state and dialysis transplantation is needed, happens when kidney function at 10 to 15%. The most important pathological lesion are glomerulosclerosis and hyaline thickening of afferent glomerular arterioles which is similar to that in

hypertensive and old people, it affect that afferent arterioles to greater degree than in non diabetes.(Liebman et.al 2011).

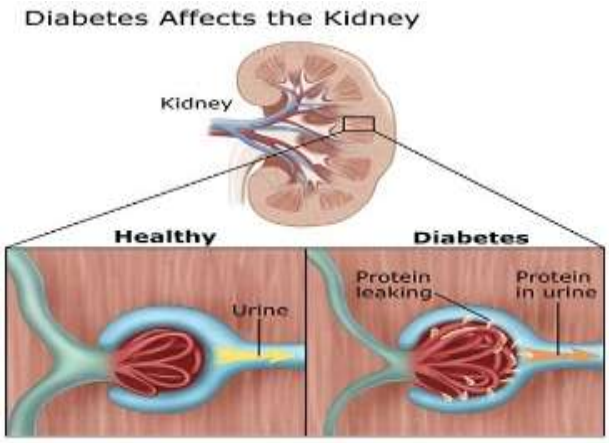

Fig [2.4]. Diabetic affect kidney.

KIDNEY DISEASE SIZE

Renal size is important parameter in assessment of renal disease, kidney continues to grow in size after birth and reaches the near adult size of 10cm by 12 years old, decrease or increase in kidney size important size sign of renal disease, kidney size helps differentiate acute kidney injury where the size normal or large in chronic kidney disease. (Goodwin et.al 1998). Renal size can be estimated by measure renal length, volume and cortical volume or thickness, renal volume is most accurate measurement of kidney size, kidney measurement change according to age, gender obesity and length, greater in men than women. Kidney static in size over time may be indicator of chronic kidney disease, in early stages is larger and later is decreasing, resistivity index is very important parameter in characterization of diabetic kidney in early and late stage of evolution, thickness of renal parenchyma decrease about 10% per decade after 20 years, overall size decrease gradually but is only apparent in the elderly. (Goodwin et.al 1998).

KIDNEY DISEASE FUNCTION

Kidney disease affect two fundamental part of kidney called glomerulus and tubules, there are millions of glomeruli in each kidney, these are very small bundles of thiny blood vessels through which blood pumped, the pressure in this bundles of vessels is very high, some of fluid get pushed out of them, fluid collected in tubules, tubules filter fluid and remove some substance that body wants to keep, disposing some toxins that it wants to grid of, in kidney disease filtration process breaks down, so glomeruli and tubules not work as well, toxin can start to build up and cause problem, kidney can start to leak protein into urine, this can lead to some very severe problem with balance of chemical enviroment inside the body.(Norenderg et.al 1977).

STAGE

Stage1

Is characterized by early hyper function and hyper trophy, these change are found at diagnosis, before insulin treatment, increase urinary albumin excretion. (Norenderg et.al 1977).

Stage2

Develop over many years and is characterized by morphological lesion without signs of clinical disease, the function is characterized by increase GFR, during good diabetes control albumin excretion is normal, during poor diabetes control albumin excretion goes up both at rest and during exercise. (Norenderg et.al 1977).

Stage3

Incipient diabetic nephropathy, is the forerunner overt diabetic nephropathy, it is manifestation is abnormally elevated urinary albumin

excretion, level higher than the value found in normal subject but lower than clinical disease is the main characteristic of this stage. (Ercal et.al 1997).

Stage4

Is overt diabetic nephropathy is characterized by persistent proteinuria, when associated high blood pressure is left untreated, renal function(GFR) declines.(Goodwin,1998).

Stage5

Is end stage renal failure with uremia due to diabetic nephropathy, as many as 25% of the population presently entering end stage renal failure program. (Norenberg,1997).

SING AND SYMPTOMS

There are often no symptoms with early diabetic nephropathy, as the kidney function worsens, symptoms include:

- High blood pressure.
- Protein in urine.

Increase blood urea nitrogen and creatinine levels. Swelling of hand, feet and face.

Trouble sleeping or concentrating. Poor appetite.

Nausea.

Itching and dry skin. (Ercal et.al 1997)

RISK FACTOR

- ❖ Increase age.
- ❖ Family history.
- ❖ Genetic.
- ❖ Previous kidney disease.
- ❖ Low birth weight. (Priya et.al 2009).

DIAGNOSIS

People with diabetes should be screened regularly for kidney disease, the two key markers for kidney disease are GFR and urine albumin, kidney function can be checked by estimating how much blood glomeruli in minute, the calculation of GFR is based on amount of creatinine, waste product found in blood sample, as the level of creatinine goes up the GFR goes down. Urine albumin is measured by comparing the amount of albumin to amount of creatinine, when are healthy the urine contain large amount of creatinine but almost no albumin, small increase in ratio of albumin to creatinine is sign of kidney damage, urine does not usually contain protein, but in early of kidney damage some protein may be found in urine, raised level of albumin in the urine is the typical first sign that the kidney damage by diabetes. Kidney US is a diagnostic technique in which high frequency sound waves are passed into the kidney to detect obstructions and changes. CT scan involves injecting a dye into the body that infiltrates the kidneys and accentuates the images, using a series of cross sectional x-rays, the images made by the dye make it possible to detect kidney stones (Habbu et.al 2006).

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2.5 COMPUTED TOMOGRAPHY (CT)

Also called Computed Axial Tomography (CAT), can be used for medical imaging, imaging methods employing tomography created by computer processing and mechanical imaging system to provide sectional anatomic images in axial, sagittal and coronal planes. (Bhatt,2008). CT scan can be used to study all parts of your body organs, such as the liver, pancreas, intestines, kidneys, bladder, adrenal glands, lungs, and heart, it also can study blood vessels, bones, and spinal cord. (Bhatt, 2008).

2.5.1 CT SYSTEM COMPONENT

CT scanner containing rotating X-ray device to create cross sectional images of the body, CT scanner is a large square machine like hole in the center contains a gantry, X- ray tubes and detectors, gantry rotate and the X-ray tube moves around the patient's body to produce the required images, X-ray detectors also rotate around the patient at all times opposite to the X-ray tubes, X-ray beams pass through the body part being examined at different angles, detector convert X-ray energy into light which is convert into electrical energy and then sent to a special computer that uses special algorithms to reconstruct an image in cross section. (Priya et.al 2009).

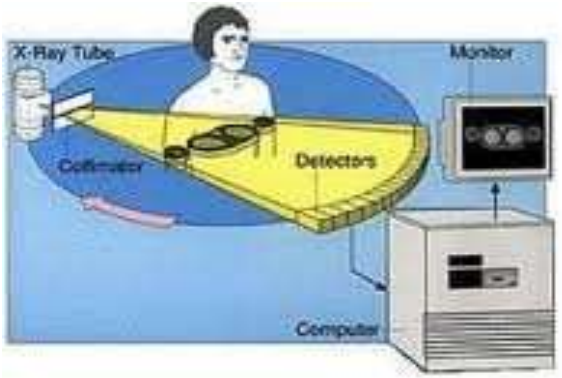


Fig [2.5]. CT system component.

2.6 PREVIOUS STUDY

Describe the role of CT in assessment of renal morphological change in diabetic patient, evaluation of both kidneys was performed in 100 diabetic patients, from the result found more frequent ages affected by diabetic disease between (50-70) by 65%. Renal parameter like kidney length and thickness show decrease in size with progression of disease, studies performed over the last decade now allow definition of series of stage in the development of renal change in diabetes, about 30% of pt with type 1 (juvenile onset) diabetes and 10 to 40% with type 2 (adult onset). (Harish,2006).

Describe characteristic of diabetic impact in kidney morphology by using CT, total sample size consisting 100 diabetic patients to assess impact of diabetes in kidney morphology, the result show male are more affected than female by 70% to 30% respectively, diabetes disease has been endemic disease in central Sudan representing 55% and in west Sudan representing 38%, kidney size decrease following age, impact of duration reduction in size significantly, from result found type 2 are more affected than type 1, diabetic nephropathy is more prevalent among African, American and Asians, among pt starting renal replacement therapy the incidence of diabetic nephropathy doubled.(Omer,2008).

Aim to evaluation of diabetic renal disease by using CT, the study contained 50 patients with diabetic disease, diabetes is the most common cause of kidney failure accounting for 44% of new causes, result showed kidney volume is indicator of diabetic nephropathy, in early stage kidney is larger, later decreasing in volume, mean of length in RT kidney 8.2cm, mean of width RT kidney 3.0cm, mean of thickness in RT kidney 2.4, mean of length in LT kidney 8.4 cm, mean of width in LT kidney 3.3 cm, mean of thickness in LT kidney 2.4. Later morphological finding and laboratory finding represent renal functional status, 50% of patient with diabetes of more than 20 years having this complication, diabetes is responsible for 30-40 % of all end stage renal disease cases. (Platt et.al 1994).

Chapter Three

Material and Method

Material and Method

3.1 Materials

3.1.1 Patients

This research carried out in 50 patients 34 male and 16 female with age between 31-90 years undergo to abdomen CT scan.

3.1.2 Inclusion Criteria

Inclusion done for patient diagnosed by diabetic disease.

3.1.3 Exclusion Criteria

Exclusion done for diabetic patient with renal transplant, patient with congenital anomalies, renal calculi and renal mass.

3.1.4 Study Area

This study conducted in Khartoum state in many diagnostic center

3.1.5 Duration of Study

This study conducted in period from September 2017 to December 2017.

3.1.6 Variables of the Study

Age, gender, length, width and thickness of kidney.

3.1.7 Machine Used

GE 2dedector, GE 16 dedector, Seimence 16 dedector.

3.2 Method

3.2.1 Technique Used

Metallic object from the abdomen and pelvic must be removed before the exam, patient placed supine on the table with feet first and arm elevated, routine abdomen CT protocol typically includes scanning from the diaphragm to the symphysis pubic in 5 to 7 millimeter slices, any suspicious area visualized may be scanned with the use of thinner slices, faster exposure times have improved the quality of CT image as artifacts in the peristalitic motions have been reduced, contrast media is injected into vein and excreted through kidneys, is useful for this application because it has higher atomic number than the body tissues, making it more dense and causing the iodine to absorb more X-rays so area with contrast appear white in film.

3.2.2 Data Analysis

Data analyze and display statistically in table and graphs.

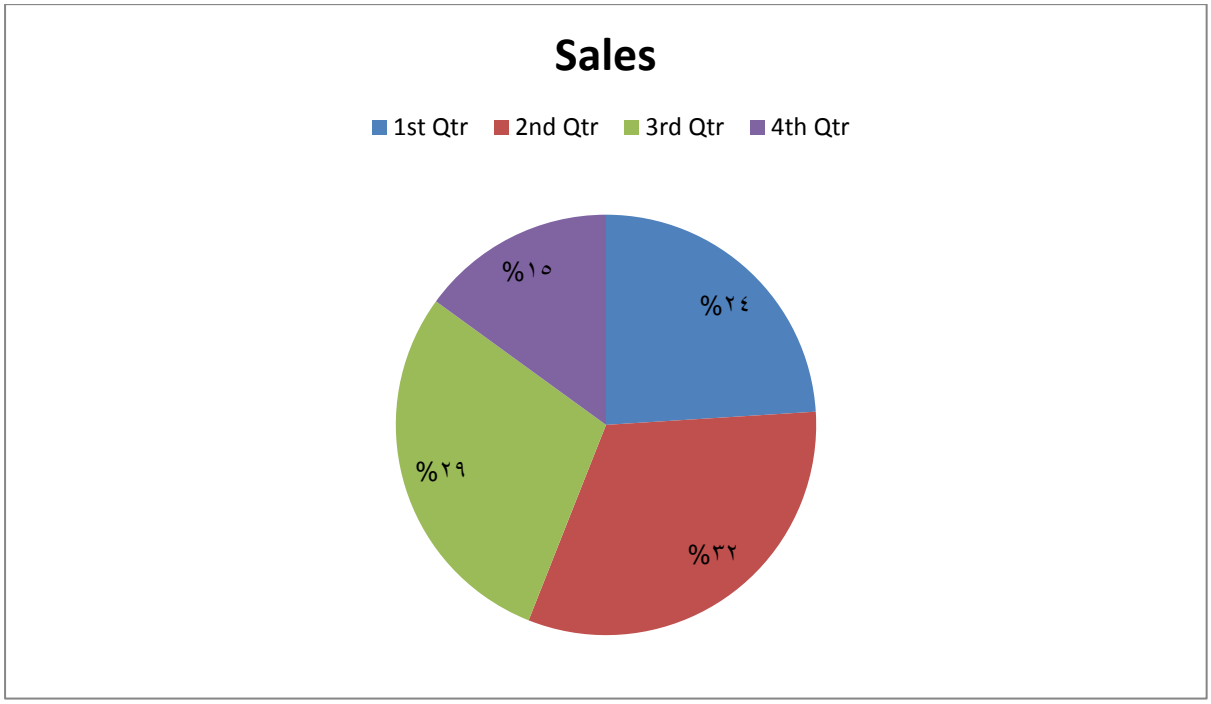
Chapter Four
Results

4.1 Results

The following table and graphs show summary of result include distributing of gender, age, type of diabetic frequency, measurement of length, width and thickness of kidney.

Table [4.1]. Showing the distribution of age.

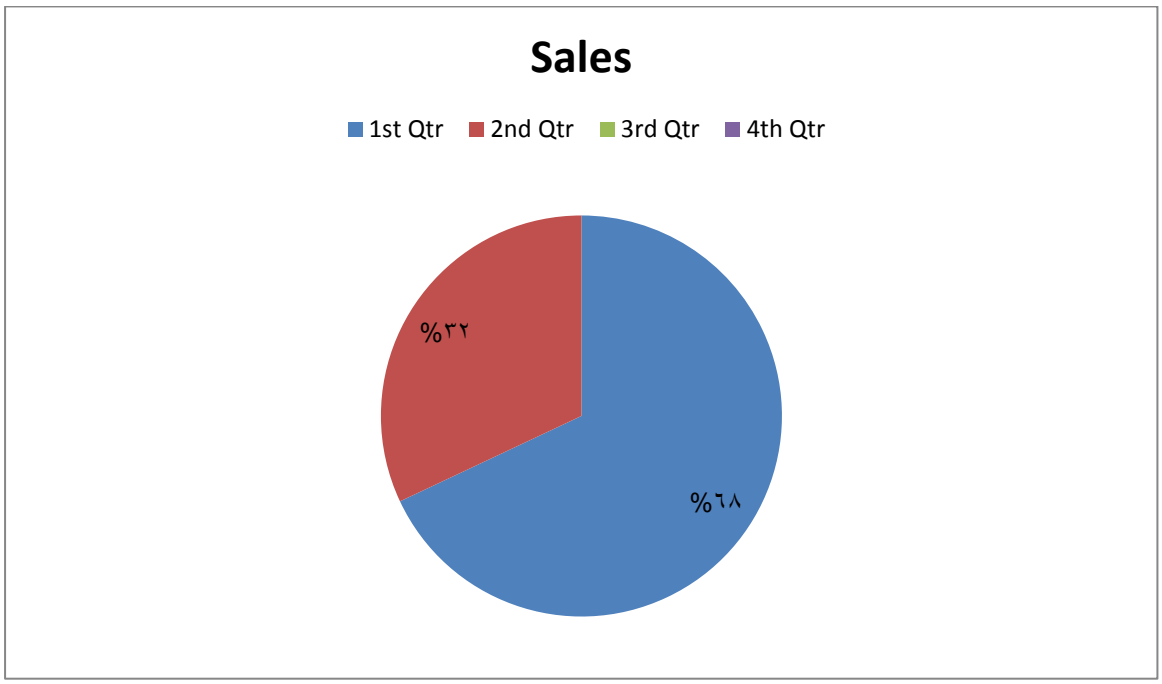
Percent	Frequency	Age Of Patient
24%	12	31-45y
32%	16	46-60y
29%	14	61-75y
15%	8	76-90y
100%	50	Total



Graph [4.1]. Showing the distribution of age.

Table [4.2]. Showing distribution of gender.

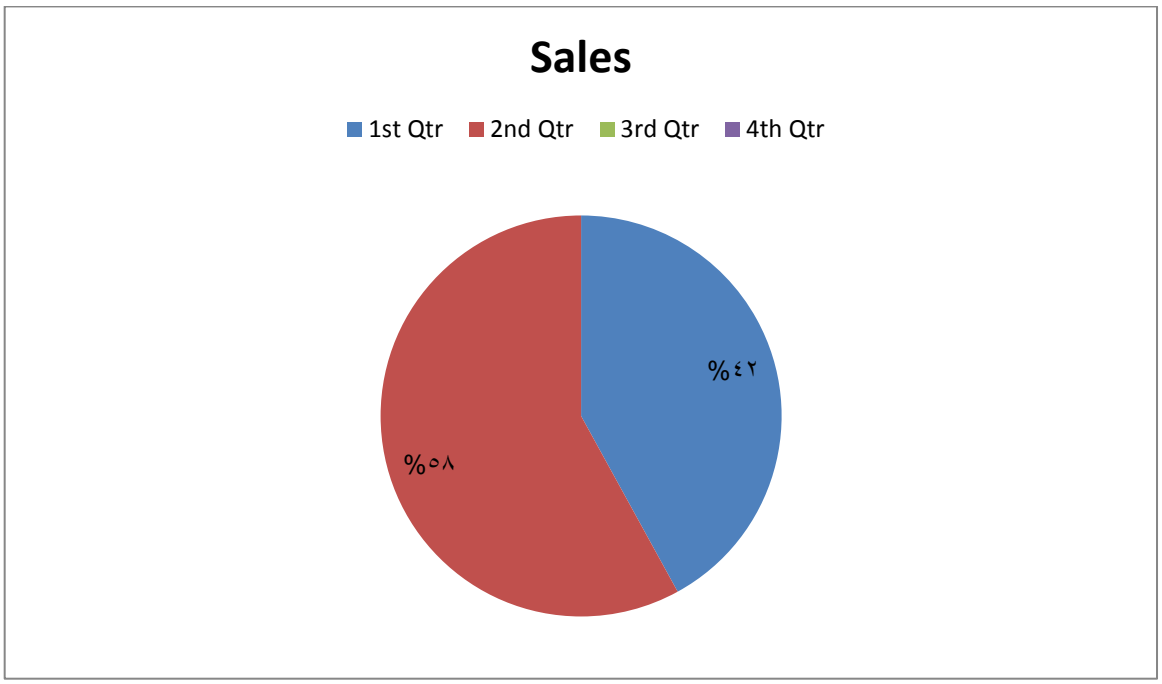
Percent	Frequency	Gender
68%	34	Male
32%	16	Female
100%	50	Total



Graph [4.2]. Showing distribution of gender.

Table [4.3]. Showing distribution of diabetic type.

Percent	Frequency	Type
42%	21	Type 1
58%	29	Type 2
100%	50	Total



Graph [4.3]. Showing distribution of diabetic type.

Table [4.4]. Showing change in measurement of diabetic kidney.

PERCENT OF VARIATION	MEAN OF DIABETIC KIDNEY	MEAN OF NORMAL KIDNEY	VARIABLE
1.2%	8.1 cm	9.8 cm	Length of RT kidney
1.2%	8.3 cm	10 cm	Length of LT kidney
1.5%	3.1 cm	4.8 cm	Width of RT kidney
1.5%	3.3 cm	5 cm	Width of LT kidney
1.2%	2.5 cm	3.0 cm	Thickness of RT kidney
1.2%	2.5 cm	3.0 cm	Thickness of LT kidney

Chapter Five

Discussion, Conclusion, Recommendation

5.1 Discussion

On this study we correlate finding of kidney in diabetic patient with frequency of the diabetic disease, type of diabetic and gender. Abdominal CT scan used to measure length, width and thickness of right and left kidneys, both gender male and female are taken on our study. We found the most frequent ages group are (46-60y) which was (32%), then the second age group (61-75y) which was (29%), then age group (31-45) which was (24%), less frequent age (76-90y) which was (15%) (Table 4.1) that mean age of patient affect in decrease kidney size, this result match with (Harish 2006). According to distribution of the gender male (68%) are more affected than female (32%) (Table 4.2) that mean also gender of patient affect in decrease kidney size, this result was agree with (Omer 2008). On our study we found the type of diabetic also had on effect of the size of the kidney, type (2) which was (58%) more than type (1) which was (42%) (Table 4.3) this result was same to (Omer 2008). We found there was different on measurement (length, width and thickness) of right and left kidneys between normal people and diabetic patient, this variation decrease by 1.2% on length, 1.5% on width and 1.2% on thickness. (Table 4.4) this was same to (Platt et.al 1994).

5.2 Conclusion

- This study were done for 50 diabetic patient (34 male and 16 female) all of them have diabetes mellitus type1 and type2 for more than many years, there age from 30-90 years, to evaluate nephropathy changes.
- More frequent ages affected by diabetic nephropathy (46-60y) which was (32%), male (68%) are more affected than female (32%). patient with type (2) (58%) more affected by disease than patient with type (1) (42%), according to kidney size result show decrease in kidney size in compare with normal.
- CT is the most common test to detect kidney shape, size and function of kidney, Superior, sensitivity and specificity over all of other modalities.
- US have begun to play secondary role in the evaluation of kidney function, in pregnant women or those who should avoid radiation exposure, US examination may be done to help establish the diagnosis.

5.3 Recommendations

- ❖ More study and researches are needed with Bigger sample.
- ❖ More study and researches needed to concern with every variable alone in separated study to obtain accurate results.
- ❖ More study and researches needed of same objective concern with controlled diabetic and non-controlled diabetic patients.

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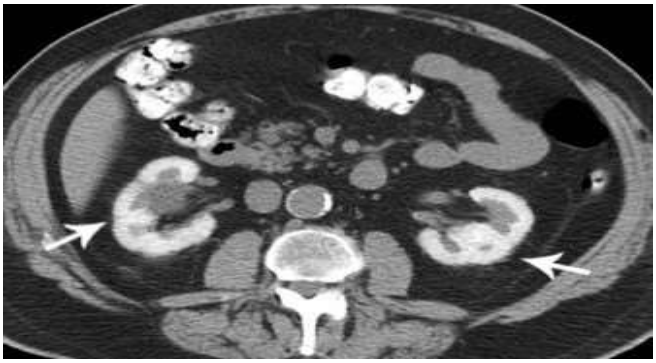
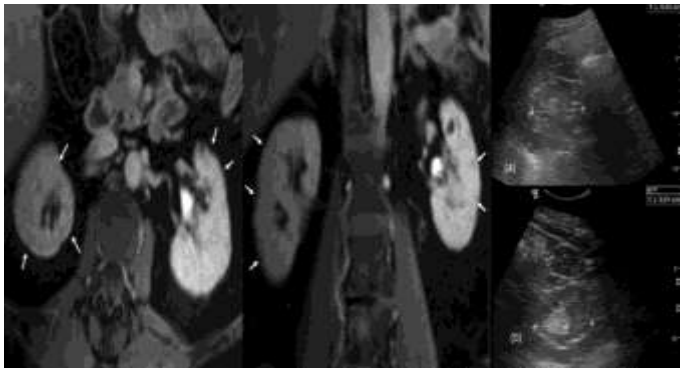
APPENDICES

APPENDICES (A)



CT image demonstrate diabetic nephropathy.



MRI image demonstrate diabetic nephropathy.

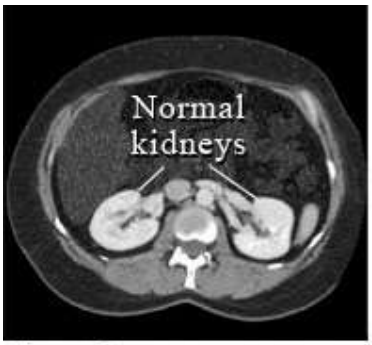


Figure 1

Figure 2

CT image demonstrate compare with normal and diseased kidney.