



Sudan univeRSity of Science and Technol ogy



College of Graduate Studies

Assessment of Renal System in Patients with Haematuria Using Ultrasonography

تقويم الجهاز البولي لمرضى البول الدموي بإستخدام
التصوير بالموجات فوق الصوتية

*Thesis Submitted for Partial Fulfillment of M.sc Degree in Medical Diagnostic
Ultrasonography*

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2017

Dedication

This work is dedicated to my

Mother ,my sisters

*My god bless them for all their have
given over the years,*

to my kids

mona & matab

*for their unconditional love, and
to my friends, who I was happy to face
life alongside me*

Acknowledgment

The author would like to acknowledge and give thanks

To Allah firstly and To

Dr.Mohamed Elfadil for his continuous support and

assistance throughout the duration of this project,

and every one else to offered help or advice.

Abstract

This was a descriptive cross section study to assess renal system in patients with haematuria. Study was conducted in Gezera state, Sudan, at different ultrasound departments of Gezera hospitals carried out during the period from April to August 2017.

This study conducted on 50 patients ,30 females and 20 males had Red blood cells in their urine by routine transabdominal ultrasound. The main objective of this study was to assess renal system in patients with haematuria using data collection sheet. This study was classified and analyzed by statistical package for social science software.

The result showed that the kidneys dimensions within the normal range ,with the mean length, width and depth 9.65, 4.28 and 4.14cm respectively for Right kidney .And for the left kidney was 9.78, 4.41 and 4.26 cm for mean length, width and depth respectively. The mean urinary bladder wall thickness was 2.9mm.

Most common finding was normal (58%) ,renal stone (18%), cystitis (12%), The rest of findings included renal cyst (8%), and other finding like Benign prostatic hyperplasia (4%), and Chronic kidney disease (2%).

This study concluded that ultrasound can assess renal system and provides sufficient details about the findings in patients.

ملخص البحث

هذه دراسة وصفية مقطعية لتقييم المرضى ذوي البول الدموي . أجريت الدراسة علي 50 مريض ،30 من الاناث و 20 من الذكور بواسطة الموجات فوق الصوتية بطريقة جدار البطن الروتينية.اجريت دراسه خلال الفترة من ابريل-اغسطس 2017 وقد تم اجراء الدراسة في ولاية الجزيرة،السودان ،في اقسام الموجات فوق الصوتية المختلفة من مستشفيات الجزيرة.

الهدف الرئيسي من هذه الدراسة هو تقييم الجهاز البولي باستخدام جمع البيانات . وقد صنفنا الدراسة وتم تحليلها بواسطة الحزمة الإحصائية للعلوم الاجتماعية (SPSS) والبرمجيات. وقد رأنا النتيجة ان ابعاد الكليتين في المستوي الطبيعي مع متوسط الطول والعرض والسك , 4.28, 9.65 و4.14 سم علي التوالي بالنسبة للكلية اليمين.وبالنسبة للكلية الشمال لمتوسط الطول والعرض والسك 4.41 , 9.7, و4.26 سم علي التوالي وكان متوسط سمك جدار المثانة البولية 2.9سم.

كانت النتيجة الأكثر شيوعا طبيعية (58%)، حصوي الكلي (16%)، التهاب المثانة(12%) بقية النتائج شملت اكياس الكلي (8%) ، تضخم غدة البروستات الحميد (4%) ومرض الكلي المزمن(2%).

وخلصنا الدراسة إلى أن الموجات فوق الصوتية يمكنها تقييم الجهاز البولي،وتقدم تفاصيل كافية عن النتائج في المرضى.

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List of abbreviations

BPH	Benign prostatic hypertrophy
CT	Computerizing tomography
D	Depth
IVU	Intravenous Urography
L	Length
LTK	Left Kidney
MRI	Magnetic Resonance Imaging
RTK	Right Kidney
UB	Urinary Bladder
US	Ultrasound

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Hematuria or haematuria refers to the presence of red blood cells in the urine. The source of bleeding may be anywhere along the genitourinary tract. When visible to the naked eye, it is termed 'gross'. When evident only with magnification, it is termed microscopic. The presence of blood in the urine, regardless of the quantities, warrants further investigation. A small percentage of people may lose several blood cells per high-power field via leaking glomeruli. Likewise, many benign conditions and anticoagulant use may cause haematuria. No matter the circumstance, however, haematuria may be the only sign of serious underlying pathology and should not be deemed (Grossfeld2001).

Patient history is key in identifying the cause of bleeding. Haematuria can be total throughout the urine stream, and has a source from the bladder or higher in the urinary tract. It can be terminal, or only at the end of voiding, and usually originates from the prostate in males. Initial haematuria, which clears as voiding continues, often originates in the urethra, prostate, or external genitalia. A history of trauma or other symptoms, such as lower pain or dysuria, can also help identify the cause. Likewise, other items in the history may point to a diagnosis. These may include smoking or family history of urological disease to name a few. Microscopic haematuria is usually asymptomatic and found by urinalysis (Grossfeld2001)..

The most common causes of hematuria are urinary tract infection (with bacteria), nephrolithiasis, polycystic kidney disease, trauma, cancer of the kidney, prostate or bladder, benign prostatic hyperplasia and indwelling urinary catheter (Grossfeld GD2001).

Examinations that are commonly used to evaluate patients with hematuria include IVU, ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI), cystography (Grossfeld2001).

Ultrasound imaging and Doppler ultrasound are based on the scattering of sound energy by interfaces of materials with different properties through interactions governed by acoustic physics. The amplitude of reflected energy is used to generate ultrasound images (Rumack2011).

Ultrasound has provided a wealth of knowledge in diagnostic medicine and has greatly impacted medical practice, particularly obstetrics. Millions of

sonographic examinations are performed each year, and ultrasound remains one of the fastest-growing imaging modalities because of its low cost, real-time interactions, portability, and apparent lack of biologic effects (bio-effects). No casual relationship has been established between clinical applications of diagnostic ultrasound and bio-effects on the patient or operator(Rumack2011).

1.2 Problem of the study

Hematuria is a serious problem which might indicate sever disease ,therefore easy and fast method of investigations is required , where laporatory is one of them but it does not give indication of the causes of haematuria. Therefore ultrasound might give clear indication of haematuria causes.

1.3 General objective of the study

The general objective of this study was to assess the renal system in patients with haematuria using ultrasound.

1.4 Specific objectives of the study

- To measure the kidneys dimension (the length, width ,depth), corticomedullary differentiation , and urinary bladder wall thickness.
- To assess the echogenicity, texture and out line of renal system.
- To assess the renal pathology(diagnosis).
- To correlate lab investigations with ultrasound findings.

1.5 Over view of the study

Chapter one including introduction.

Chapter two shows theoretical background and previous studies.

Chapter three explains material and method.

Chapter four shows result.

Chapter five including discussion, conclusion and recommendations.

CHAPTER TWO
THEORETICAL
BACKGROUND
&
PREVIOUS STUDIES

2.1 Urinary system anatomy

Urinary system consists of two kidneys, two ureters, the bladder and the urethra. Working together, these structures remove wastes from the body, help governing acid-base balance by retaining or excreting hydrogen ions, and regulate fluid and electrolyte balance (Asghar 2014).

2.1.1 Kidneys

Is retroperitoneal and extends from L1-L4 in the erect position/The right kidney lies a little lower than the left. owing to the large size of the right lobe of the liver, and usually is related to ribs 11 and 12 posteriorly (Chung 2000).

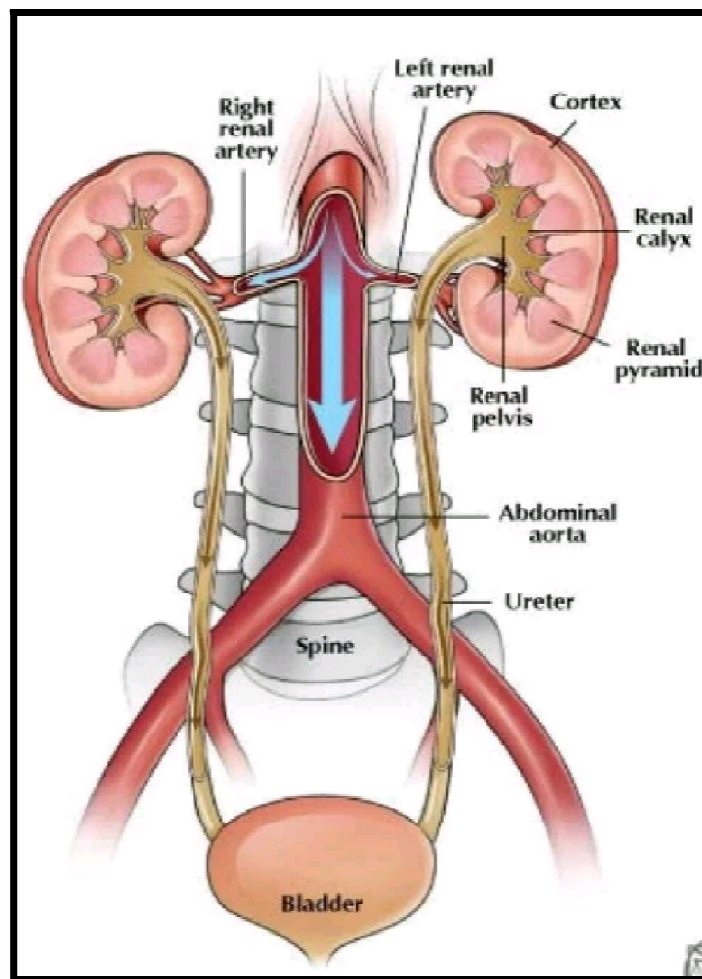


Figure (2-1) shows urinary system part (Reyan Coskun 2017).

During respiration, both kidneys move down ward in a vertical direction by as much as 1 in (2.5cm). On medial concave border of each kidney a vertical slit that is bounded by thick lips of renal substance and is called the hilum. The hilum extends into a large cavity called the renal sinus. The hilum transmit, from the front to backward, the renal vein, two branches of the renal artery, the ureter, and the third branch of the renal artery. Lymph vessels and sympathetic fibers also pass through the hilum (Sato2007).

2.1.1.1 The relations of the kidneys

Each kidney lies on the ventral surface of the quadratus lumborum muscle, just lateral to the psoas muscle and vertebral column. Both lie against the inferior surface of the diaphragm postero-superiorly and are capped by an adrenal gland antero-medially (April1996).

The right kidney is lower than the left (2-8cm). Posteriorly, it is related to the twelfth rib. Anteriorly, it is related to the liver, duodenum, and hepatic flexure of the large bowel (April1996)..

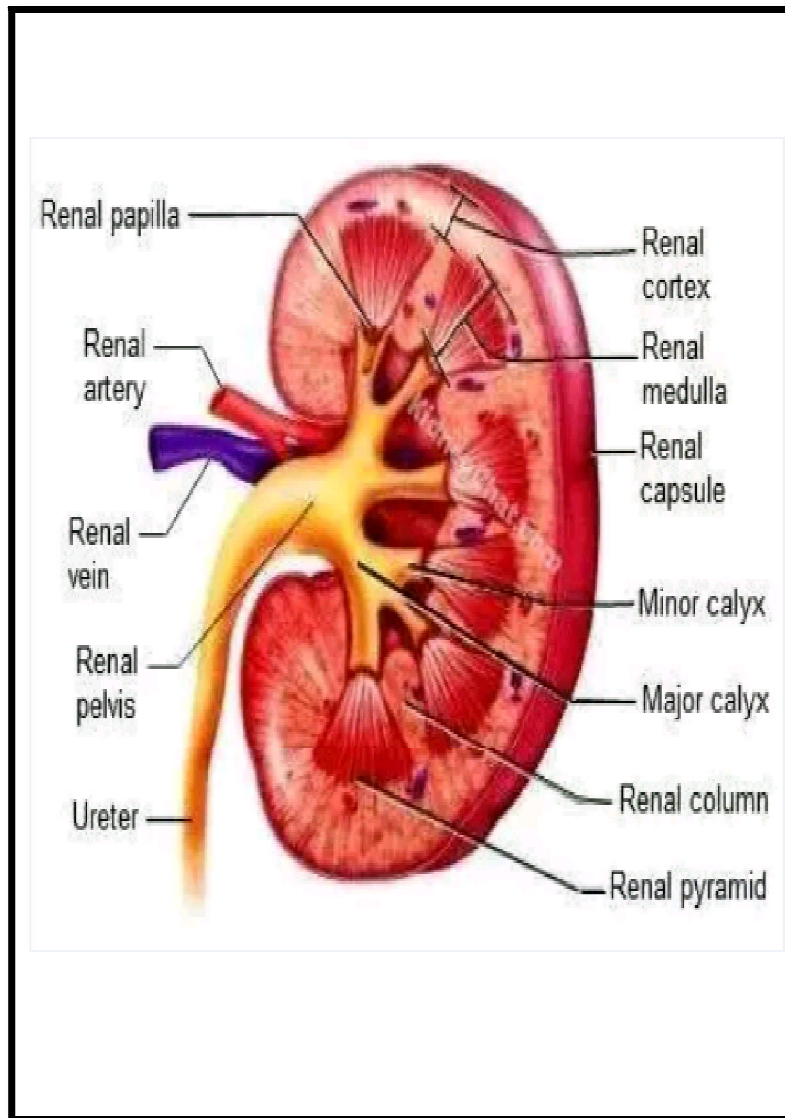
The left kidney is related posteriorly to the eleventh and twelfth ribs. Anteriorly, is related to the pancreas, spleen, and splenic flexure of the large bowel (April1996).

2.1.1.2 The renal fascia

It is a discrete fascial layer that surrounds each kidney. It divides the fat associated with the kidney into two distinct regions, perirenal (perinephric) fat, and pararenal (paranephric) fat (April1996).

2.1.1.3 Renal structure

Each kidney has a dark brown outer cortex and a light brown inner medulla. The medulla is composed of about a dozen renal pyramids. Each having its base oriented toward the cortex and its apex, the renal papilla projecting medially. The cortex extend into the medulla between adjacent pyramids as the renal columns. Extend from the base of the renal pyramids into the cortex are striations known as medullary rays (Sato2007).



Figure(2-2) shows internal structure of the kidney(Kidneychat com(2006).

The renal sinus, which is the space within the hilum, contains the upper expanded end of the ureter, the renal pelvis. This divides into two or three major calyces ,each of which divides into two or three minor calyces. Each minor calyx is indented by the apex of the renal pyramid, the renal papilla(Sato 2007).

2.1.1.4 Blood supply:

Blood enters the kidney from the renal artery and returns to general circulation through the renal vein (Asghar2014).

2.1.2 The ureters

The two ureters are muscular tubes that extend from the kidneys to the posterior surface of urinary bladder. Each ureter measures about 10 in (25cm) long and less than 1/2 in (1.5cm) in diameter (Sato2007).

At its upper end, the ureter is expanded to form a funnel called renal pelvis. Each ureter runs down the lateral wall of the pelvis to the region of the ischial spine and turns forward to enter the lateral angle of the bladder (Sato2007).

The arterial supply to the ureter is as follows: upper end: renal artery, middle portion: testicular or ovarian artery, the lower end: superior vesical artery. The venous blood drains into veins that correspond to the arteries (Sato2007).

2.1.3 Urinary bladder

The urinary bladder is situated immediately behind the pubic bone. In the adult, the bladder has a maximum capacity of about 500 ml. Its shape and relations vary according to the amount of urine that it contains. The empty bladder lies entirely within the pelvis; as the bladder fills, its superior wall rises up into hypogastric region. The empty bladder is pyramidal, having an apex, a base, and a superior and two infero-lateral surfaces, it also has a neck (Sato2007).

The apex of the bladder points anteriorly and lies behind the upper margin of symphysis pubis, while the base faces posteriorly and is triangular. The supero-lateral angles are joined by ureters and the inferior angle gives rise to the urethra (Sato2007).

The urinary bladder receives blood from the superior and inferior vesical arteries (and from vaginal artery in the female). Its venous blood is drained by the prostatic (or vaginal) plexus of veins, which empties into internal iliac veins (Chung 2000).

2.1.1.4 Urethra

The urethra is a small tube leading from the neck of the bladder to the exterior(Sato2007).

The male urethra is about 8 in.(20cm) long and extends from the neck of bladder to the external meatus on the gland penis. It is divided into three parts: prostatic, membranous, and penile(Sato2007)..

The female urethra is about 1.5 in.(3.8cm)long. It extends from the neck of the bladder to the external meatus ,where it opens into vestibule about 1 in.(2.5cm) below the clitoris(Sato2007).

2.2 Renal physiology

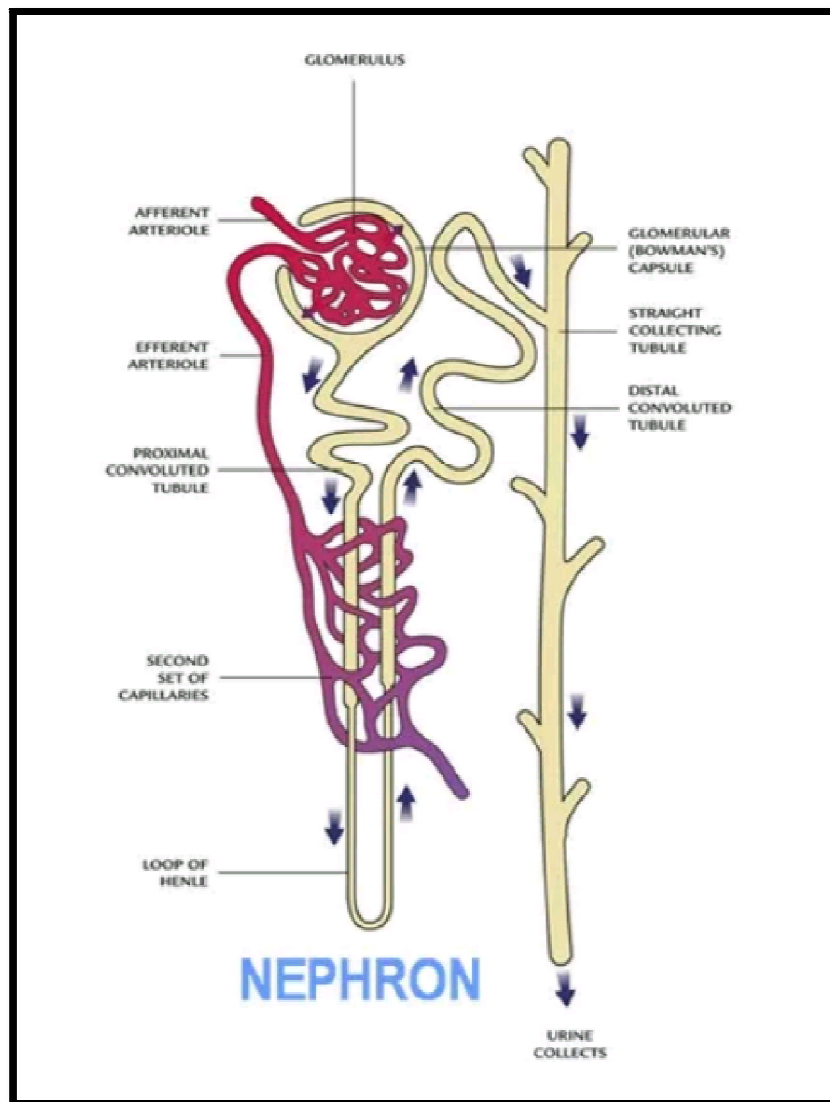
The kidney possesses a system of tubules that consist of nephrons and collecting ducts. Nephrons form structural and functional units of the kidney and consist of a renal corpuscle and its associated renal tubule .About 2.4 million renal corpuscles of the two kidneys lie in the renal cortex and contain the glomerular filter, which filters the glomerular filtrate from the blood (Asghar2014).

The glomerular filter acts like a sieve, and the size of its pores determines its permeability to molecules of different sizes (mechanical filter).Hence ,water and substances with small molecules(e.g., urea, glucose, salts, amino acid, sodium chloride) can pass through the filter unhindered, while large protein molecules(albumins and globulins) as well as blood cells do not normally penetrate. Since the glomerular filtration barrier carries many negative charges (glycol-proteins),it provides an electrical as mechanical filter(Asghar2014).

The glomerular filtrate is altered fundamentally during its passage through the several segments of the tubules. During this process the major portions of dissolved components(e.g., inorganic and organic ions, glucose, amino acids) and 99% water reabsorbed(Asghar2014).

The kidney can excrete a concentrated or a dilute urine as needed to regulate the water balance. For instance , maximally concentrated urine contain four times as many dissolved particles as extracellular fluid. Such urine is called hypertonic. If on other hand, the organism must get rid of excess fluid intake, it can excrete urine that is diluted to a concentration one-six of that of extracellular fluid(hypotonic urine)(Asghar2014).

Renal water excretion is regulated by anti-diuretic hormone (ADH, vasopressin), which is excreted in the hypothalamus and stored in the neuro-hypophysis (Asghar2014).



figure(2-3) shows nephron parts (WHA 2015).

In 24 hours an adult excretes about 0.5-2 liters of urine, which is composed of about 95% water. The urine passes out of the body by a process called micturition, which is a simple spinal reflex that is subject to both conscious and unconscious control from the higher brain (Asghar2014).

2.3 Renal pathology

2.3.1 Uremia (renal failure)

It is a clinical syndrome characterized by failure of renal excretory function and metabolic and endocrine alterations resulting from renal damage (Danish2010).

Uremia may be classified in three groups ;pre-renal uremia resulting from hypoperfusion of the kidneys ,renal uremia resulting from renal diseases, and post-renal uremia resulting from obstruction of the urinary tract (Danish2010).

2.3.2 Acute proliferative glomerulonephritis

Also called acute post streptococcal or infectious glomerulonephritis. It is one of the most common renal diseases in childhood .It less common in adult. It characterized by uniform increased cellularity of the glomerular tufts affecting all glomeruli (Danish2010). .

2.3.3 Chronic glomerulonephritis

It is the final stage of the glomerular diseases characterized by scarring of the glomeruli and bowman,s space and some time complete hyalization of the glumeruli (Danish2010)

2.3.4 Acute pyelonephritis

It is an acute suppurative inflammation of the kidney caused by bacterial infection .Obstruction in urinay passage and incompetence of vesicouretric orifice are the most common predisposing factors for disease (Danish2010).

2.3.5 Chronic pyelonephritis

Chronic pyelonephritis is a morphological entity in which predominantly interstitial scarring of the renal parenchyma is associated with grossly visible scarring and deformity of the pelvis and calyces. It result from repeated attacks of inflammation and healing (Danish2010).

There is two type of chronic pyelonephritis:

-Chronic obstructive pyelonephritis

In this type of chronic pyelonephritis the urinary tract obstruction predisposes recurrent boats of renal infection and inflammation which leads to scarring. The

disease can be bilateral, as with congenital, as with congenital anomalies of the urethra, or unilateral, such as occurs with calculi and unilateral obstructive anomalies of the ureter (Danish2010).

-Chronic reflux-associated pyelonephritis

The more common form of disease results from superimposition of urinary tract infection on congenital vesico-uretric reflux (Danish2010).

2.3.6 Acute tubular necrosis

It characterized by destruction of tubular epithelial cells. It is the most common cause of acute renal failure. According to the causes ATN classified into two types; ischemic ATN, which associated with shock, resulting from hemorrhage, burns, trauma and incompatible transfusion .Second type of ATN is the nephrotoxic ATN, it caused by a variety of poisons including heavy metals, organic solvents and some drug (Danish2010).

2.3.7 Hypertensive renal diseases

The hypertensive renal changes are always associated with hyaline arteriosclerosis .The narrowing of the lumen of arterioles and small arteries results in markedly decreased blood flow through the affected vessels and thus produces the ischemia in the organ served (Danish2010).

2.3.8 Diabetic kidney disease

Diabetic kidney disease or nephropathy is the most common cause of chronic renal failure. The kidney may be damaged by diabetes in three main ways: Diabetic glomerulosclerosis, ischemic lesions, and Infective lesions (Danish 2010).

2.3.9 Polycystic kidney disease

It is a hereditary disease characterized by multiple expanding cysts of both kidneys.

-Polycystic disease of childhood(Autosomal recessive)

It is a rare disease with autosomal recessive inheritance.It also called infantile polycystic disease and characterized by presence of full blown cysts at birth.

Serious manifestations are usually present at birth and infant may die due to renal failure. Cysts are present in both kidneys , in almost all cases cysts are also present in liver .Patients who survive infancy develop liver cirrhosis(Danish2010).

-Adult polycystic kidney disease (Autosomal dominant)

In this form the cysts are not present at birth and develop slowly throughout subsequent years. It characterized by multiple expanding cysts of both kidneys that ultimately destroy the renal parenchyma(Danish2010).

-Medullary sponge kidney

It is an autosomal dominant disorder that is relatively common and benign disorder present at birth but not diagnosed until the fourth or fifth decade. Kidney have a marked irregular enlargement of the medullary and inter papillary collecting ducts producing medullary cysts giving a swiss cheese appearance. There is decreased urinary concentrating ability and nephrocalcinosis (Danish2010).

2.3.10 Urolithiasis

The stones have three types:

Calcium oxalate stones; most common type(70%)containing calcium oxalate or calcium oxalate mixed with calcium phosphate .

Triple phosphate stones;(15%) composed of magnesium ammonium phosphate.

Urate stones; about (10%) composed of uric acid.

Cystine stones; (1-2%) made up of cystine(Danish2010).

2.3.11 Renal cell carcinoma

The renal cell carcinoma is the most common tumor of the kidney representing 81-90% of all malignant tumors of the kidney and 2% of all cancers in adults. The tumors arise from tubular epithelium and are therefore also called renal cell adenocarcinoma (Danish2010).

2.3.12 Wilms cell carcinoma

It is a tumors of children under the age of 10 years (mostly between 2-5 years) characterized by a variety of cells and tissue components, all derived from mesoderm. It is an inherited tumor and may be associated with other congenital anomalies. It is bilateral in 10% of cases (Danish2010).

2.3 .13 Cystitis

Bacterial cystitis is a common infection of the urinary bladder. Bladder infection is considered uncomplicated in the absence of anatomical abnormalities, catheters or other urological implants or urological procedures. In the early stages of acute cystitis the bladder wall shows hyperemia, edema and infiltration by neutrophil granulocytes. In the late stages, the mucosa is replaced by easily vulnerable granulation tissue. Small ulcers may develop. The lamina muscularis is usually not involved by the inflammation, without treatment, hemorrhage and necrosis is possible (Fihn, Krieger 2003).

2.3.14 Cancer of urinary bladder

Transitional cell carcinoma is the most common cancer of the urinary bladder (more than 90%), it is more common in males between the ages 50-70 years. Most common sites are the trigone and diverticulum. The better differentiated tumors commonly project into the bladder lumen, while the poorly differentiated tumors are solid, ulcerative lesions that show evidence of infiltration of the bladder wall (Danish2010).

2.4 Previous studies

-M.H. Khadra et al., (2000) had done a study about; Prospective Analysis of 1,930 Patients with Hematuria to Evaluate Current Diagnostic Practice.

The evaluation consisted of basic demographic, history and examination, routine blood tests, urinalysis and cytology. All patients underwent plain abdominal radiography, renal ultrasound, IVP and flexible cystoscopy. Their results showed that a total of 1,194 males and 736 females with a mean age of 58 years (range 17 to 96) were included in the study. Overall, 61% of patients had no basis found for haematuria, 12% had bladder cancer, 13% had urinary tract infection and 2% had stones. Kidney and upper tract tumors were noted in 14% patients (0.7%), including 4 who presented with microscopic haematuria.

-Jeremy L. McKay, et al. (2005) were study: Radiological Assessment of the Kidney in Patients with Haematuria.

Retrospective study of 100 patients with haematuria, all patients investigated by U/S, CT scan, MRI, and plain film of the abdomen. The result was:41.8% neoplasia:19% BPH, 9% bladder neoplasia, 6% kidney neoplasia, and 6% prostate neoplasia .26.6% infection, 13.6% nephrolithiasis, 3.6% congenital abnormalities, and 12% no identifiable causes.

-Study had done by Abrar. Abdullah (2016) about: evaluation of renal system in patients with Haematuria .

30 patients presented with haematuria were undergone abdominal U/S 24 adult male and 6 adult female, patients information and kidney dimensions and U/B thickness were reported. The result shows the stones is most type of pathology with frequency (46.7%) , the high gender distribution was in males (80%) , and the result found that Lt kidney is the most site of pathology causes haematuria with frequency (46.7%).The cystitis recorded as one of a common disease that appears in study 4 patients(13.3%).

-Dr SN Datta ,et all.(2002) had done study about; urinary tract ultrasonography in the evaluation of haematuria a report of over 1,000 cases.

Over a 5 years period, 1007 patients with haematuria were investigated, using a protocol based on ultrasonography as the upper tract imaging modality of choice. Intravenous urography (IVU) was only used in selected individuals, including those patients with bladder cancer suspected in cystoscopy, suspicious or malignant cytology, previous investigation for haematuria, on-going haematuria at time of their clinic visit, a history of flank pain or hydronephrosis on ultrasonography. A total of 133 bladder transitional cell tumors, 21 renal cell cancer and 2 upper tract transitional cell were diagnosed. The sensitivity of ultrasound with respect to bladder cancer was (63%) and the specificity (99%) . The odds ratio of diagnosing cancer in patients with visible haematuria compared to microscopic haematuria was 3.3. No upper tract tumors were missing using this investigation protocol.

-TJ Edwards, et al(2006) had done study about; A prospective analysis of the diagnostic yield resulting from the attendance of 4020 patients at a protocol-driven haematuria clinic.

In a two-tier protocol, as a part of first-line investigation , all 4020 patients attending the clinic had US and flexible cystoscopy .IVU was used where indicated following abnormal first-line test and in patients with persistent

haematuria where no abnormality had been detected. In all 2627 men and 1393 women presented with microscopic (53.2%) or macroscopic(46,8%.) haematuria. The overall prevalence of malignant disease was 12.1%, but for macroscopic haematuria it was 18.9% and for microscopic haematuria 4.8%. Age and sex also influenced the observed rates of disease. Of the upper tract tumors, 70 were identified after abnormal US , with three cases of transitional cell carcinoma identified on IVU after normal US.

Study provides a rationale for the appropriate investigation of all patients, moderated by the age, sex and degree of haematuria and the ubiquitous use of US with selective IVU based on age, sex and degree of(and persistence of) haematuria.

- Spencer J, et al.(1990) had done study about; Ultrasonography compared with intravenous urography in the investigation of adult with haematuria.

155 consecutive adult patients (aged 18-93) with a history of haematuria were investigated ultrasonography and with intravenous urography concurrently. The *investigations* were performed independently

81 patients (52%) had normal findings on urography and ultrasonography. Overall , the findings of ultrasonography concurred with those of urography in 144 cases (93%). Among the discrepant findings of the two investigations ultrasonography missed two ureteric calculi. Ultrasound examination alone detected four bladder tumors not visible on urography. Ultrasonography detected all the 22 neoplastic lesions discovered in the study 20 bladder, 2 renal. Ultrasonography clarified the nature of renal masses evident in three urograms(renal cyst).

When combined ultrasonography with single plain abdominal radiograph ,it proved to be superior to urography as a primary imaging study in the series. No urothelial tumors of the upper urinary tract were found in the series, reflecting their rarity

-Study had done by Islam.Mergani(2014) to study the kidneys in patients with uncountable bus and RBCs in urine using ultrasound. The study was collected from 50 cases presented with uncountable bus and RBCs in their urine using questionnal includes patients personal data plus ultrasound findings. The ultrasound findings that almost normal kidney size, with mean volume 103 for the right kidney, and 110 for the left kidney. With only 18% above normal

upper limit, and most likely the enlargement contributed to the inflammatory process. On the other hand 22% of patients had renal stones, 8% in the right kidney, 10% on the left kidney, and 4% have bilateral renal stones. In addition founded that 18% had hydronephrosis,6% in each side, and 6% bilaterally.56% of patients with hydronephrosis had renal stones. Ultrasound scanning is very important to diagnose the causes of haematuria and pyuria and their complications. Hydronephrosis without intra renal cause of obstruction , is most likely due to ureteric obstruction, it so difficult to trace ureterultrasonography.

CHAPTER THREE
MATERIALS & METHODS

3-1 Material

3.1.1 Population of the study

All patients who presented with RBCs in their urinalysis test, from both sexes.

3.1.2 Sample size and type

The data of this study was collected from 50 patients with hematuria selected conventionally from those who visit ultrasound clinic during the study period.

3.1.3 Duration and place

The study carried out in the period from April 2017 to August 2017 in Sudan, Gezera state at different hospitals.

3.1.4 Machines

The data of this study was collected using a gray scale real time portable U/S SONOSCAPE A5 machine fitted with convex probe (3.5-5 MHz). SIUI Apogee 1200 portable machine fitted with convex probe (3.5-5 MHz), and computer device for data analysis.

3.2 Method

3.2.1 Preparation

The patient should drink 3-4 glasses of water. Start with patient lying in supine position, cover the abdomen with coupling agent. For adult use a 3.5 MHz transducer, for thin patient and child use a 5.0 MHz transducer. Adjust the correct gain.

3.2.2 Scanning technique

Scanning always done in deep suspended inspiration. Start with a longitudinal scan over the right upper abdomen and then follow with a transverse scan. Next rotate the patient to the left lateral decubitus position to visualize the right kidney in this coronal view. Then apply coupling gel to the left upper abdomen and scan left kidney in a similar sequence. Then start with transverse scans from the pubic symphysis upward to the umbilicus follow with longitudinal scans, moving from one side of the lower abdomen to other.

3.2.3 Variables of the study

Data Collection sheet which was designed to include all variables to satisfy the study, including ; age ,gender, lab test, kidneys dimensions , echogenicity , ech texture, CMD, U/B wall thickness ,and pathology detected .

3-7-2 Data analysis

The data have been analyzed by SPSS by using the various statistic computerize methods.

3-2-8 Data presentation

For data presentation tables and figures has been used.

3-2-9 Data storage:

Patient's data sheets kept in locked cabinet, and all data stored on personal computer.

3-2-10 Ethical consideration:

Justice and human dignity was observed by treating selected patients equally when telling them to participate in the research as sample of this study. The patients were free to decide whether to participate or not.

CHAPTER FOUR

RESULTS

Table (4-1): Statistical parameters for all patient

	Mean	STD	Min	Max
Age	46	11.75	22	75
RBC Counts	13	6.85	5	25
Rt length	9.560	0.37	7.6	11
Lt length	9.78	0.74	8.3	11.3
Rt width	4.28	0.37	3.3	5.3
Lt width	4.41	0.43	3.4	5.5
Rt depth	4.13	0.47	3.4	5.2
Lt depth	4.26	0.50	3	5.3
UB Wall thickness	2.91	0.94	2.1	6

Table(4-2) : Frequency distribution of patients according to gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Female	30	60.0	60.0	60.0
Male	20	40.0	40.0	100.0
Total	50	100.0	100.0	

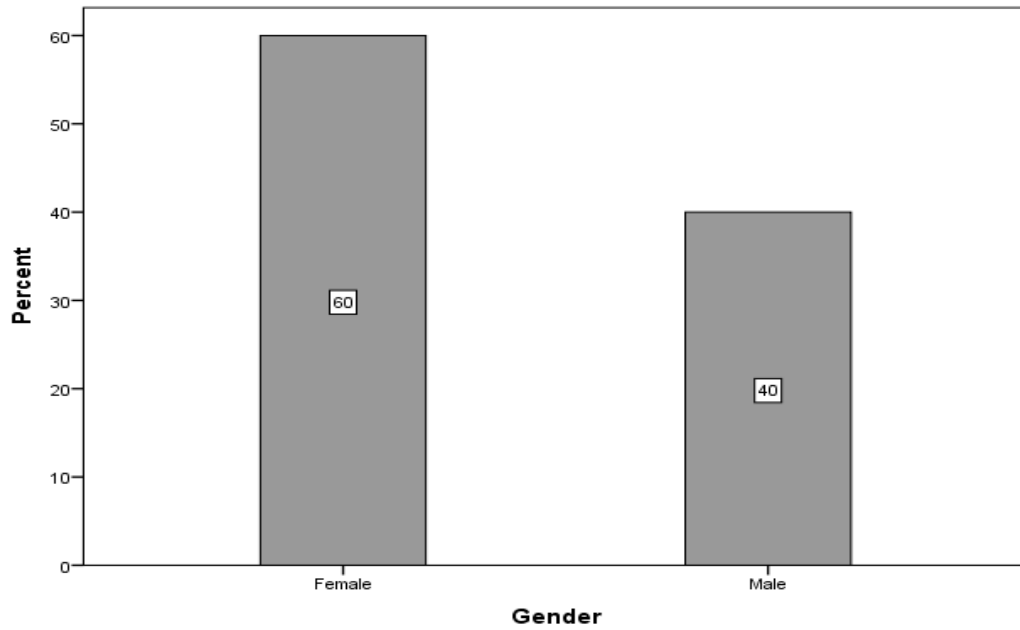
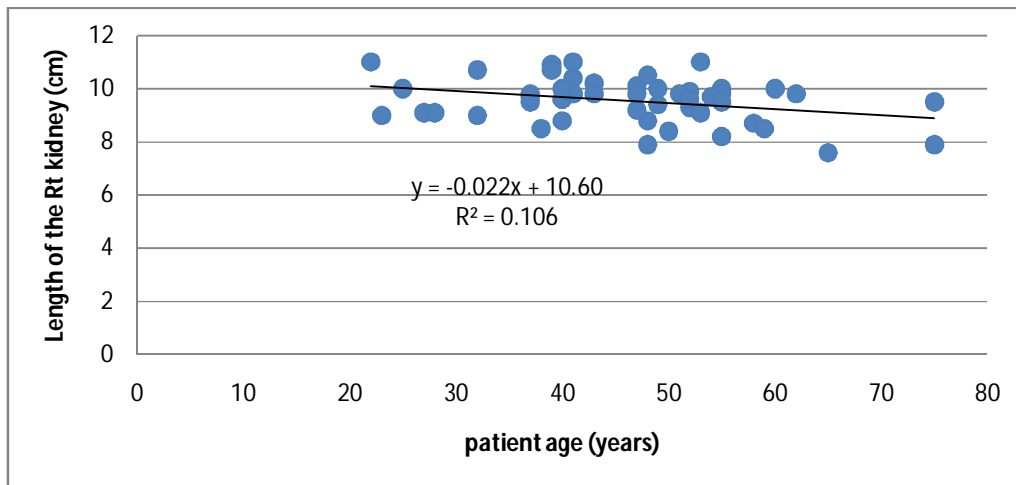


Figure (4.1) show frequency distribution of patients according to gender



Figure(4-2) show correlation between age and length of the Rt kidney

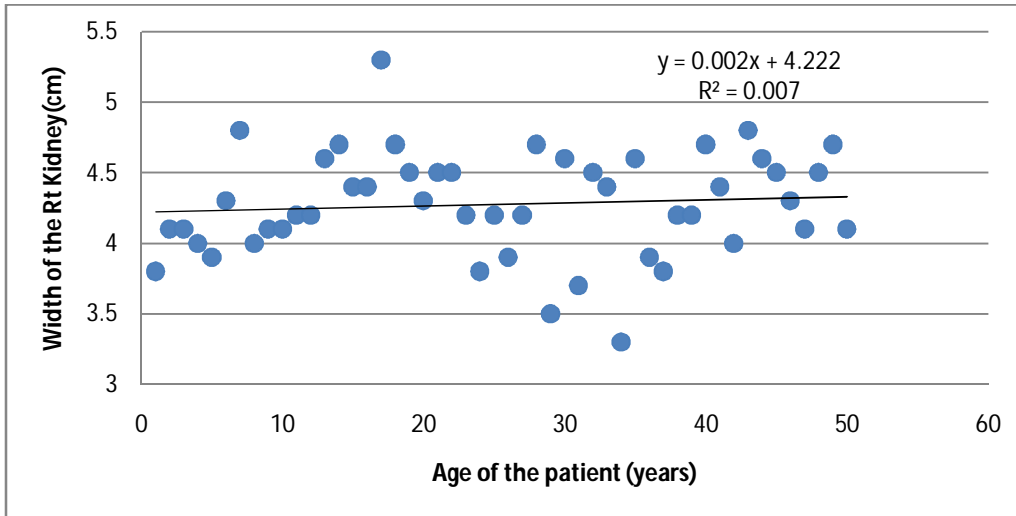
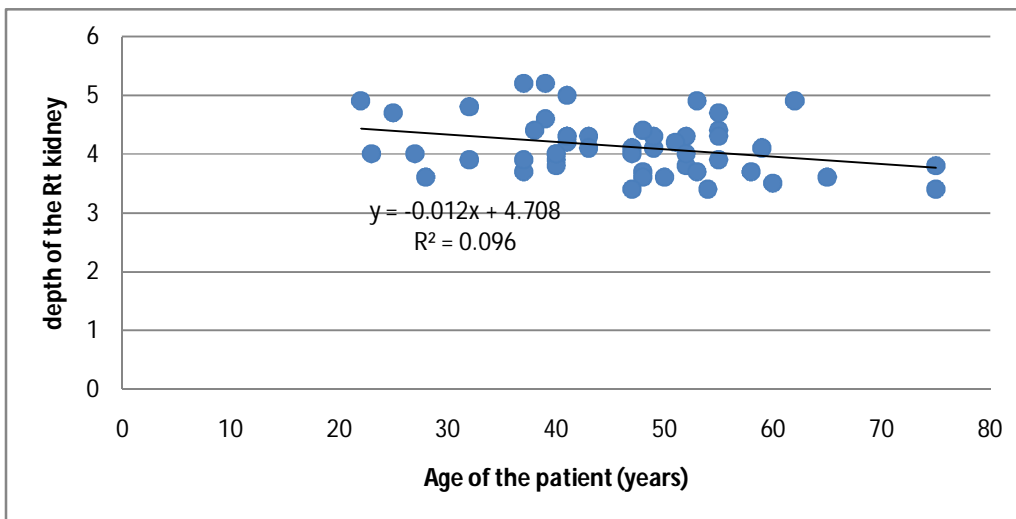
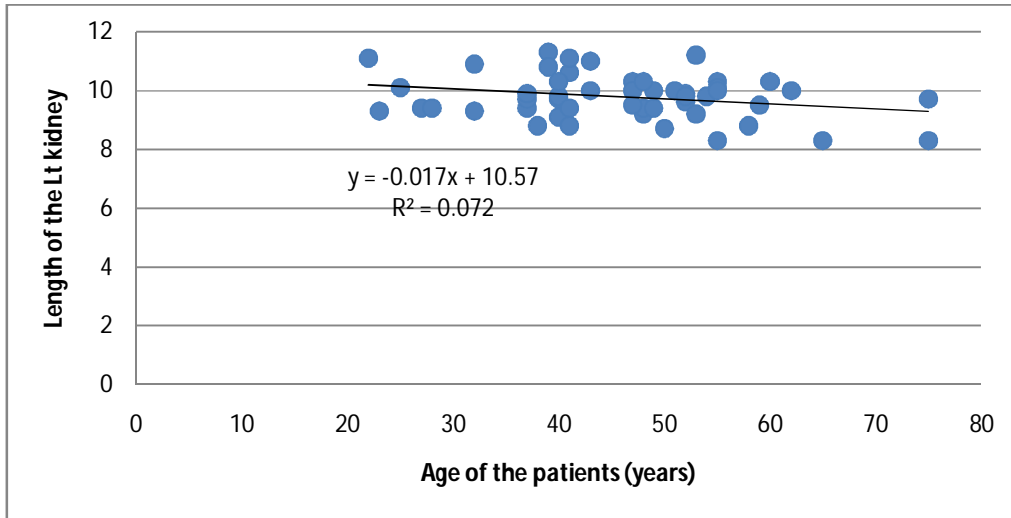


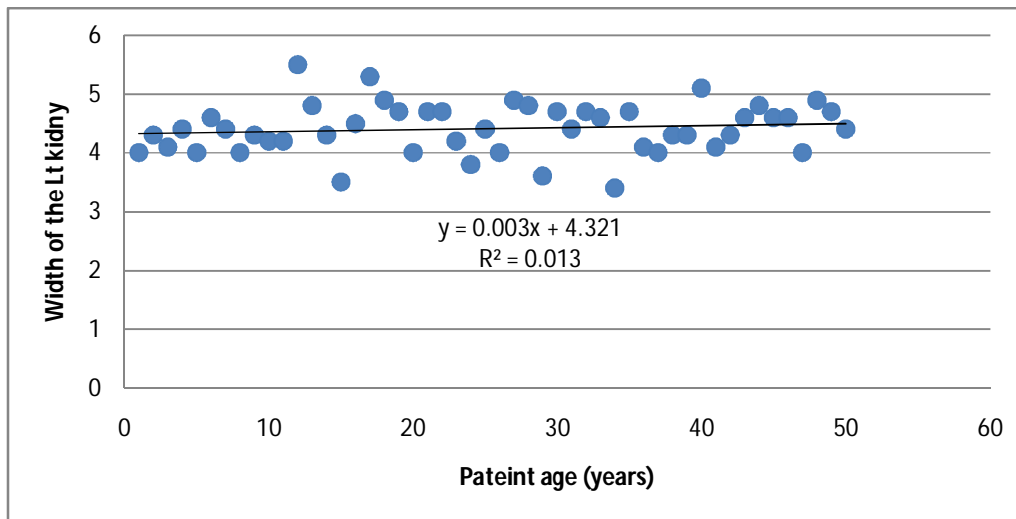
Figure 4-3 show correlation between age and width of the Rt kidney



Figure(4-4) show correlation b/w age and depth of the Rt kidney



Figure(4-5) show correlation b/w age and length of the Lt kidney



Figure(4-6) show correlation b/w age and width of the Lt kidney

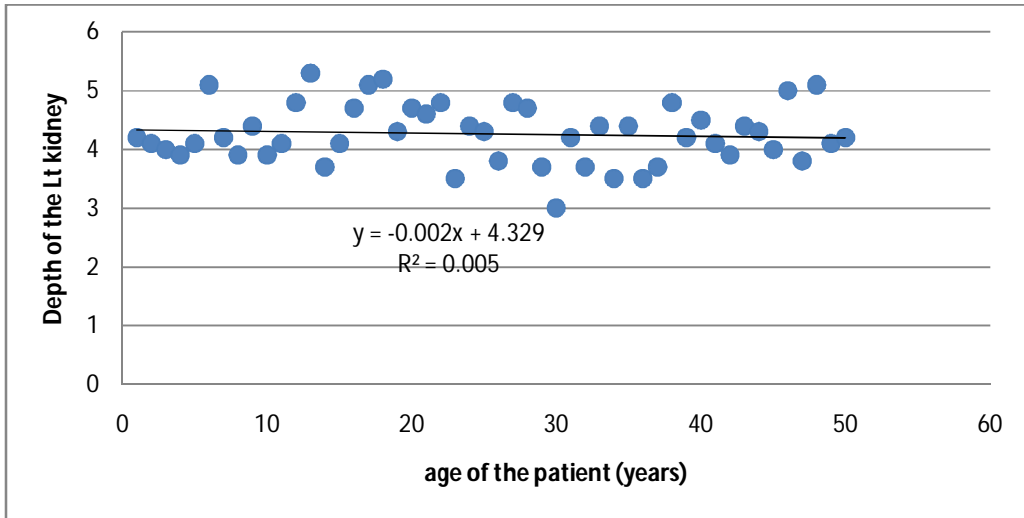
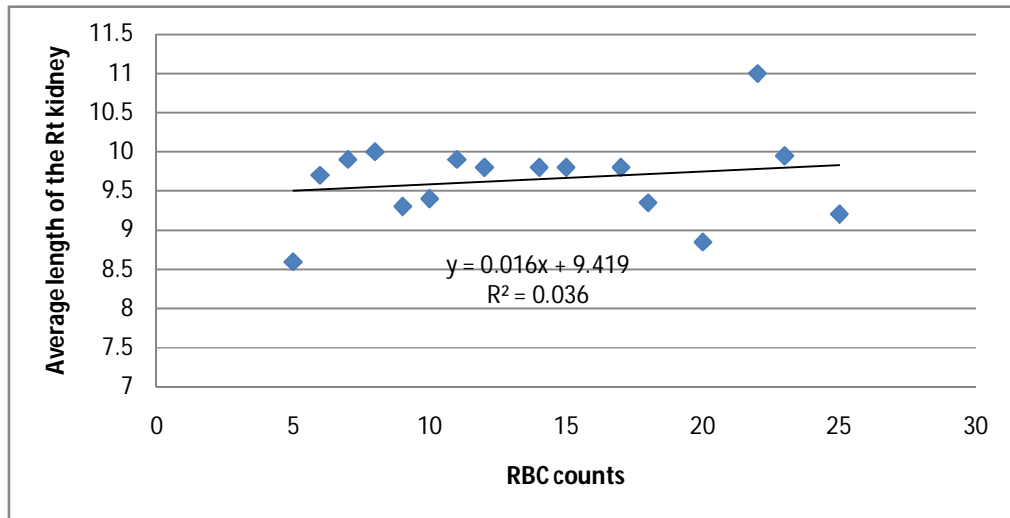
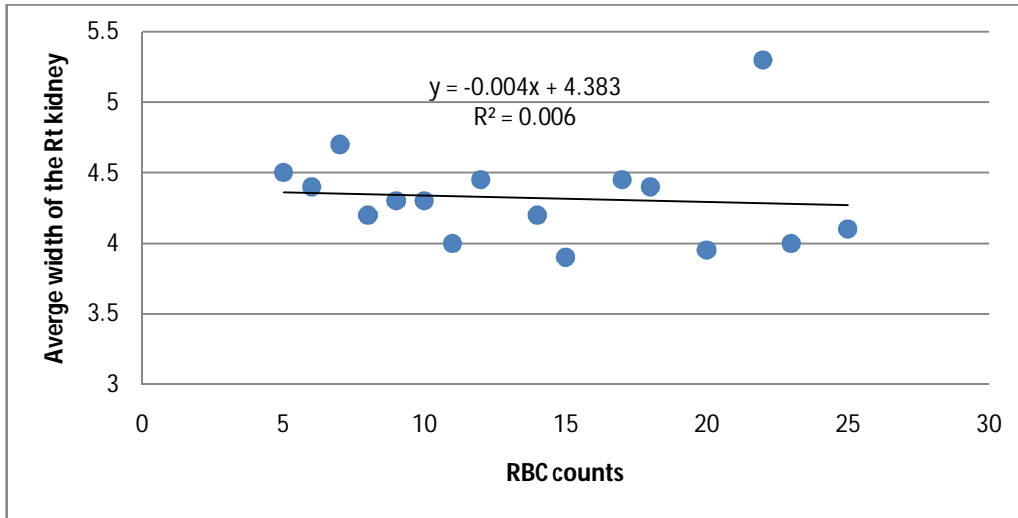


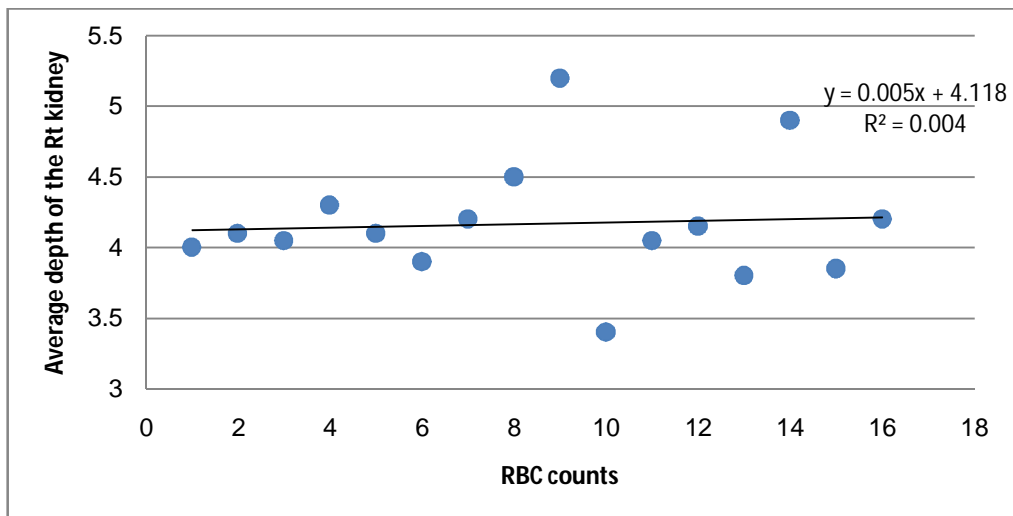
Figure 4-7 show correlation b/w age and depth of the Lt kidney



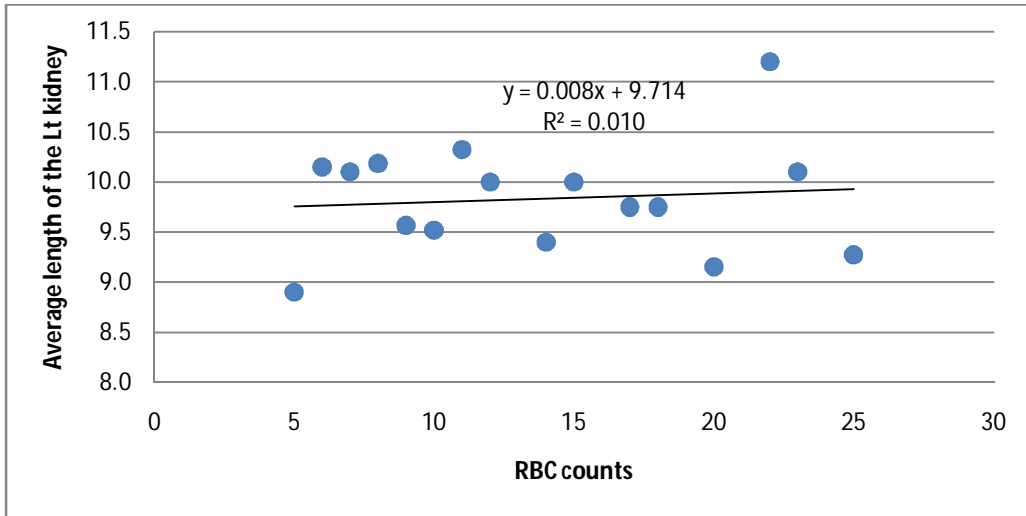
Figure(4-8) show correlation b/w RBC counts and length of the Rt kidney



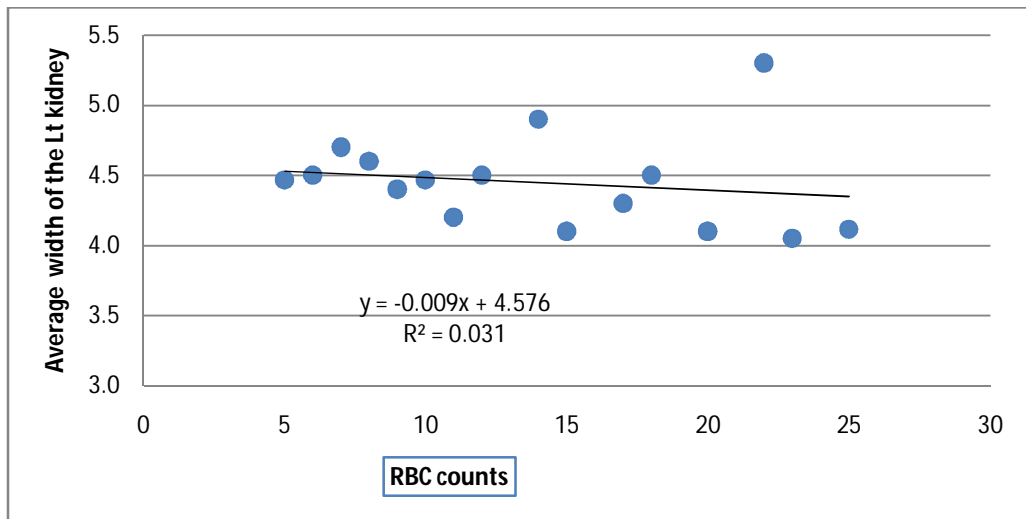
Figure(4-9) show correlation b/w RBC counts and width of the Rt kidney



Figure(4-10) show correlation b/w RBC counts and depth of the Rt kidney



Figure(4-11) show correlation b/w RBC counts and length of the Lt kidney



Figure(4-12) show correlation b/w RBC counts and width of the Lt kidney

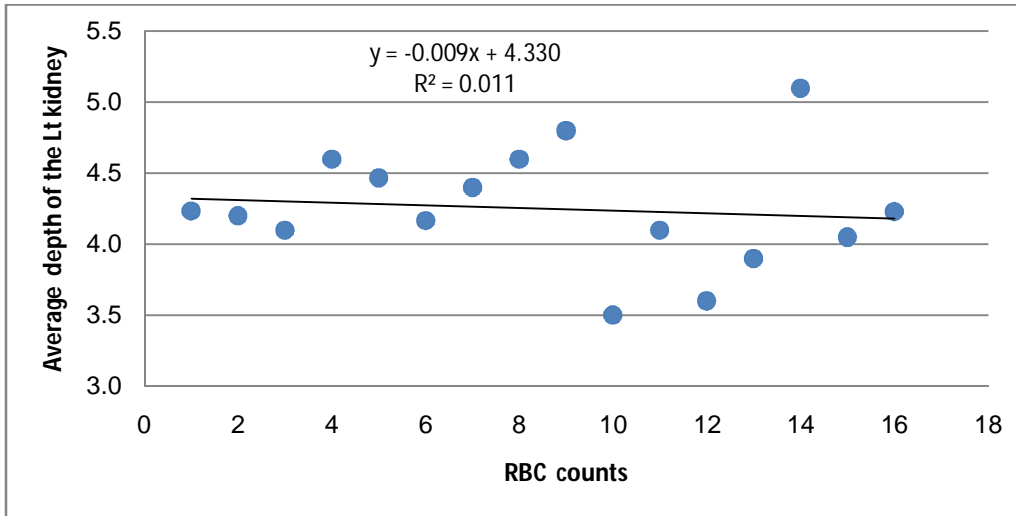


Figure (4-13) show correlation b/w RBC counts and depth of the Lt kidney

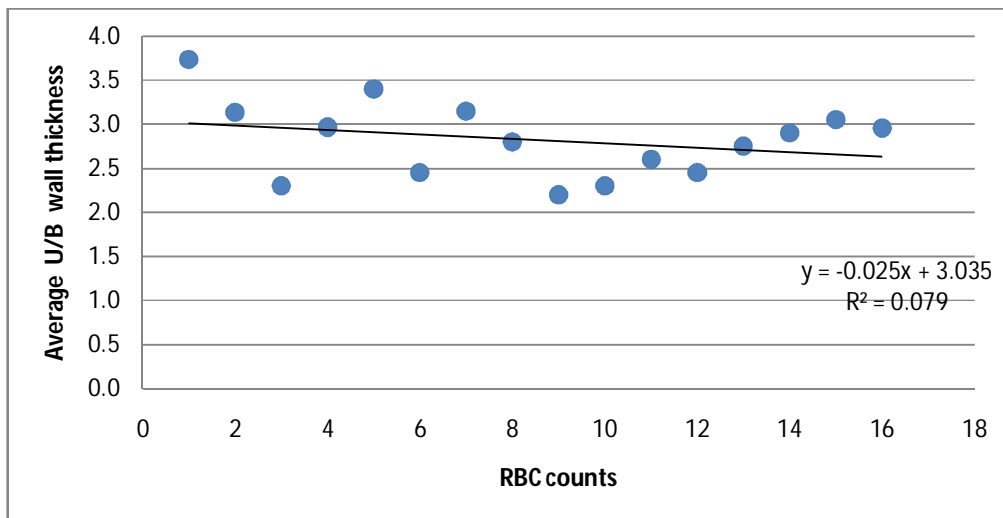
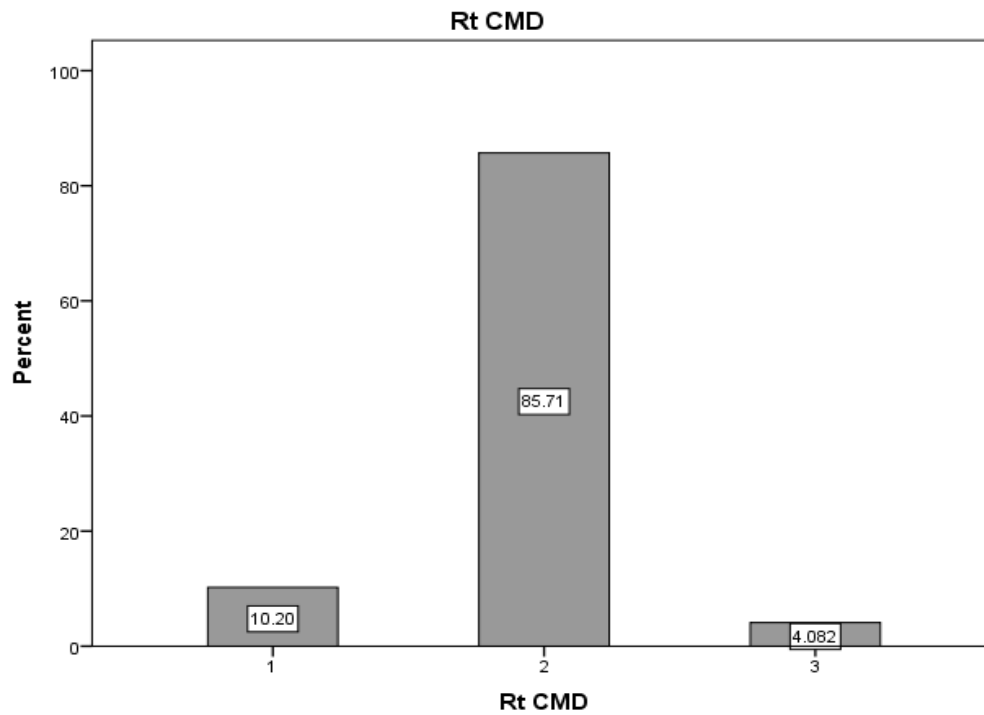


Figure (4-14) show correlation b/w RBC counts and U/B wall thickness

Table (4-3): Frequency distribution of patients according to right CMD

Rt CMD	Frequency	Percent	Valid Percent	Cumulative Percent
Good	5	10.0	10.2	10.2
Medium	42	84.0	85.7	95.9
Poor	2	4.0	4.1	100.0
Total	49	98.0	100.0	



Figure(4.15) show frequency distribution of patients according to right CMD

Table(4-4) :Frequency distribution of patients according to left CMD

Lt CMD	Frequency	Percent	Valid Percent	Cumulative Percent
Good	5	10.0	10.0	10.0
Medium	41	82.0	82.0	92.0
Poor	4	8.0	8.0	100.0
Total	50	100.0	100.0	

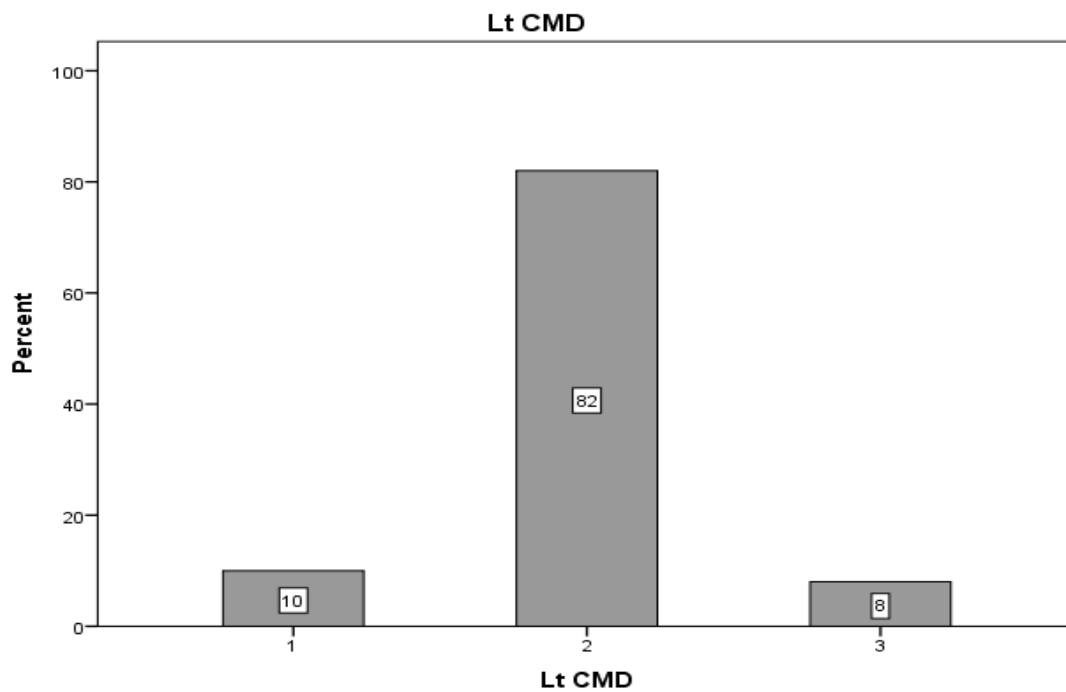


Figure (4.16) show frequency distribution of patients according to left CMD

Table (4-5) :Frequency distribution of patients according to final finding

final finding	Frequency	Percent	Valid Percent	Cumulative Percent
Normal	29	58.0	58.0	58.0
Stone	8	16.0	16.0	74.0
Cystitis	6	12.0	12.0	86.0
Cyst	4	8.0	8.0	94.0
BPH	2	4.0	4.0	98.0
CKD	1	2.0	2.0	100.0
Total	50	100.0	100.0	

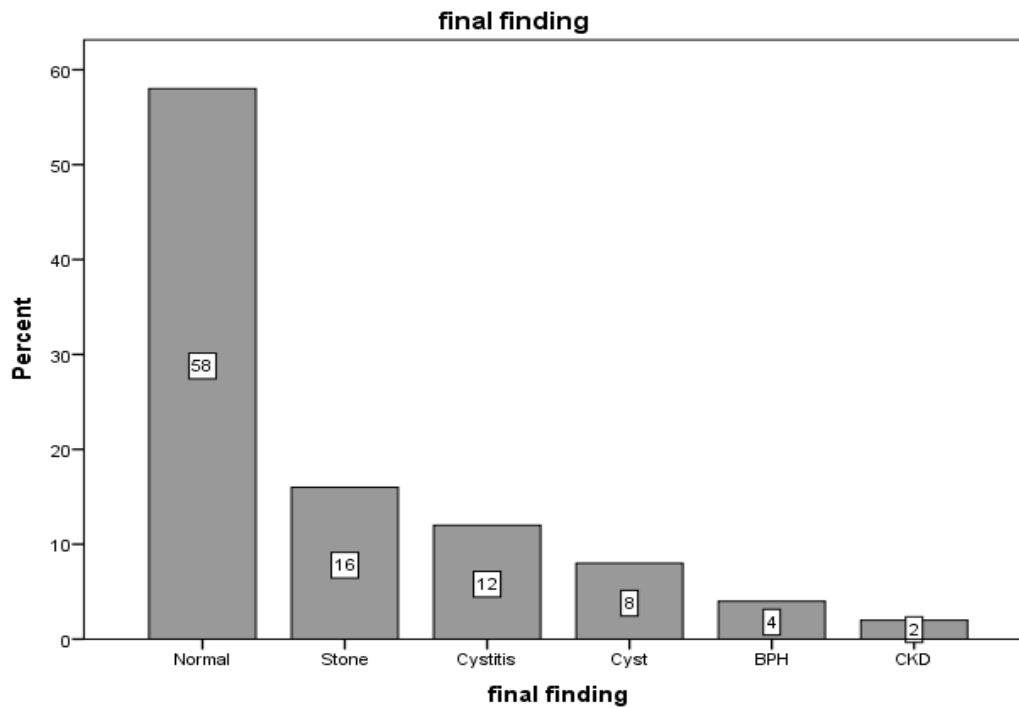


Figure 4.17 show frequency distribution of patients according to final finding

Table(4-6): Cross tabulation between final finding and Gender

Final Finding	Gender		Total
	Female	Male	
Normal	20	9	29
Stone	3	5	8
Cystitis	4	2	6
Cyst	2	2	4
BPH	0	2	2
CKD	1	0	1
Total	30	20	50

Table(4-7) : Cross tabulation between RBC Counts and final finding

RBC Counts	Final Finding						Total
	Normal	Stone	Cystitis	Cyst	BPH	CKD	
5	2	0	1	0	0	0	3
6	5	0	1	0	0	0	6
7	2	0	0	0	0	0	2
8	5	0	1	0	0	0	6
9	2	0	1	0	0	0	3
10	6	0	0	0	0	0	6
11	2	1	1	0	0	0	4
12	2	0	0	0	0	0	2
14	0	0	0	1	0	0	1
15	0	1	0	0	0	0	1
17	2	0	0	0	0	0	2
18	1	0	0	1	0	0	2
20	0	1	0	1	0	0	2
22	0	0	0	1	0	0	1
23	0	1	0	0	1	0	2
25	0	4	1	0	1	1	7
Total	29	8	6	4	2	1	50

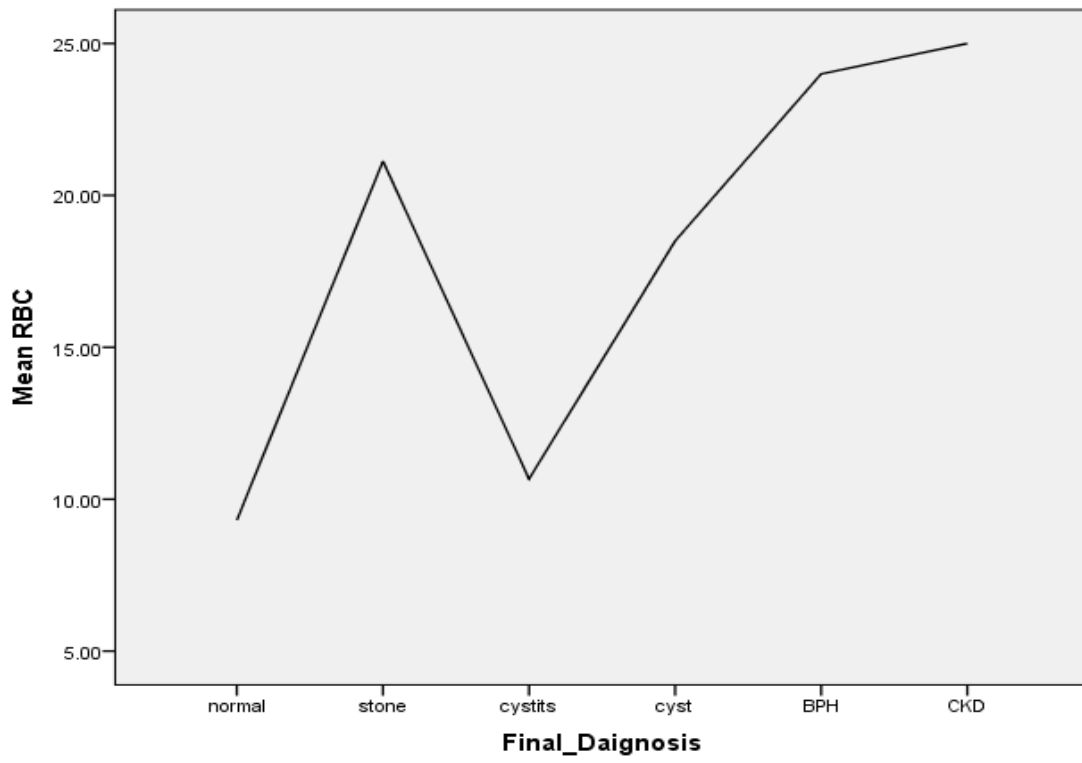


Figure 4-18 show Correlation between final diagnosis and RBC accounts

CHAPTER FIVE
DISSCISON, CONCLUSION
& RECOMMENDATIONS

5-1. Discussion

This study was done to assess renal system in patient with haematuria using ultrasound. It used sample of 50 patients 30 females, and 20 males who was selected randomly and information collected by clinical data collection sheet, their age range from 22—75years with the mean age was 46years.

As shown in table(4-1) the length of the right kidney average between (7.6-11)cm with mean 9.65cm, while the length of the left kidney average between (8.3-11.3)cm with mean9.7cm.

The width of the right kidney average between (3.3-5.3)cm with mean 4.28cm, while the width of the left kidney average between (3.4-5.5)cm with 4.41cm as shown in table(4-1).

The depth of the right kidney average between (3.4-5.2)cm with mean 4.26cm, while the depth of the left kidney average between (3.0-5.3)cm with 4.14cm as shown in table(4-1).

The length of the right kidney has inverse linear relationship with the age ,as the age increase the kidney length decrease by 0.023cm/year starting from 10.6.cm as shown in the figure (4-2), while the length of the left kidney has inverse linear relationship with the age ,as the age increase the kidney length decrease by 0.017cm/year starting from 10.6.cm as shown in the figure (4-5).

The width of the right kidney has direct linear relationship, as the age increase the kidney width increase by 0.002cm/year starting from 4.2cm as shown in figure(4-3),while the width of the left kidney has direct linear relationship, as the age increase the kidney width increase by .0034cm/year starting from 4.3cm as shown in figure(4-6).

The depth of the right kidney has inverse linear relationship with the age ,as the age increase the kidney depth decrease by 0.012cm/year starting from 4.7cm as shown in the figure (4-4), while the depth of the left kidney has inverse linear relationship with the age ,as the age increase the kidney depth decrease by 0.026cm/year starting from 4.3cm as shown in the figure (4-7).

The length of the right kidney has direct linear relationship with the RBC counts, as the RBC counts increase the kidney length increase by 0.016cm/cell starting from 9.4cm as shown in the figure (4-8), while the length of the left kidney has direct linear relationship with the RBC counts, as the RBC counts increase the kidney length increase by 0.009cm/cell starting from 9.7cm as shown in the figure (4-11).

The width of the right kidney has inverse linear relationship with the RBC counts, as the RBC counts increase the kidney width decrease by 0.004cm/cell starting from 4.4cm as shown in the figure (4-9), while the width of the left kidney has inverse linear relationship with the RBC counts, as the RBC counts increase the kidney width decrease by 0.009cm/cell starting from 4.6cm as shown in the figure (4-12).

The depth of the right kidney has direct linear relationship with the RBC counts, as the RBC counts increase the kidney depth increase by 0.006cm/cell starting from 4.1cm as shown in the figure (4-10), while the depth of the left kidney has inverse linear relationship with the RBC counts, as the RBC counts increase the kidney width decrease by 0.009cm/cell starting from 4.3cm as shown in the figure (4-13),

The thickness of the urinary bladder has inverse linear relationship with the RBC counts, as the RBC counts increase the urinary bladder wall thickness decrease by 0.025mm/cell starting from 3.0 mm as shown in figure(4-14).

.Regarding CMD , Rt CMD was 10.2% good , 85.7% medium, and 4.1% poor CMD. For Lt CMD was 10% good, 82%medium, and 8% poor CMD as shown in figure (4-15), (4-16).

.Concerning of the ultrasound finding 58% of cases had normal finding and 42% had positive ultrasound finding, this result agree with M.H Khadra , he

report that 61% of patients has no basis finding in ultrasound. Also agree with Spencer J, et al was reported that (52%) had normal findings on urography and ultrasonography.

Concerning the ultrasound finding most of them had renal stone 38% This finding agrees with study done by by Abrar Abdellah (2016) who reported that renal stone is most common finding (46%) of positive findings on ultrasound.

Concerning the ultrasound finding the cystitis is a second most common pathology seen with frequency (12%) of all cases and represent about (28%) of positive finding that agree with M.H Khadra(2003) and Abrar Abdellah(2016), they reported that (13%)was urinary tract infection. .

5-2conclusion

study done from April to August 2017, in Gezira state hospitals. 50 patients presenting with haematuria were investigated and assess their renal system by ultrasonography which is non-invasive, economic, simple an easily available.

The goal of this research was to study kidneys dimensions and most likely the causes of haematuria and their effect on the kidney and bladder .

The study found that most patients their kidneys in normal range that reflects there was no significant affect of kidneys size and volume except in Chronic kidney disease the kidney size was small and CMD was lost and . The renal stone and cystitis is prominent findings. Most of renal stones cases were in male gender, while the female gender, more affected with cystitis Other finding renal cyst, benign prostatic hypertrophy, chronic kidney disease .

The study concluded that ultrasound scanning is very important in diagnosing the underlying causes of haematuia and their complications , therefore, it fasting the management of patients and play big role in planning of treatment.

5-3 Recommendations

- More training programmed should be planned for sonographers in the field of ultrasound to give accurate results.
- The research studies should be done with expanding period of time and include more sample data for more precise and accurate results.
- Other imaging modalities such as CT and IVU are recommended as a complementary methods with U/S to assess the ureters to avoid miss diagnosis.

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Urinary system parts Diagram. avialable from :
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Appendix 1

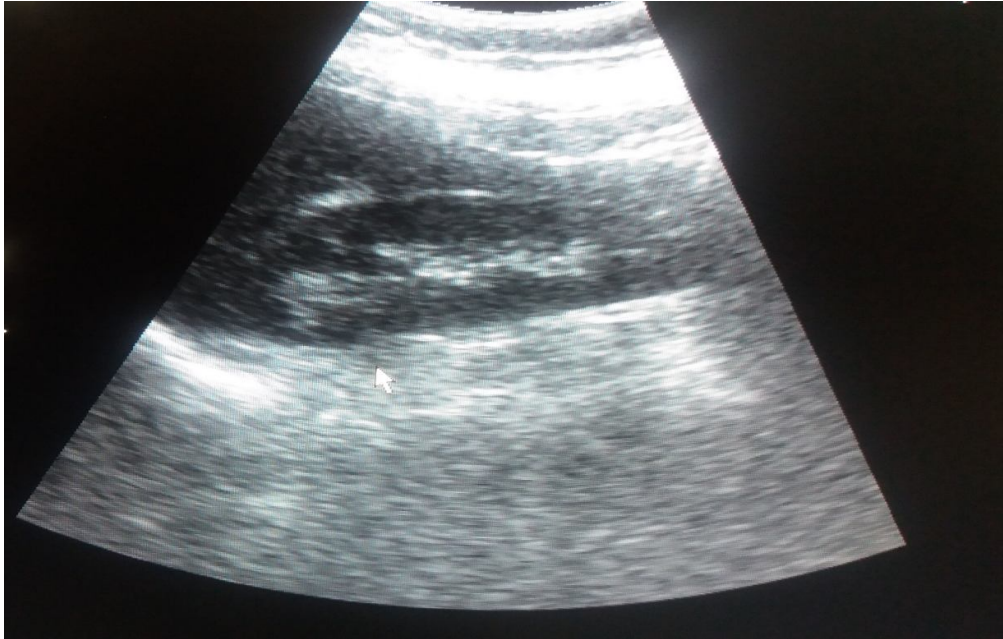


Image1:Ultrasound of 42y female showing normal Rt kidney.

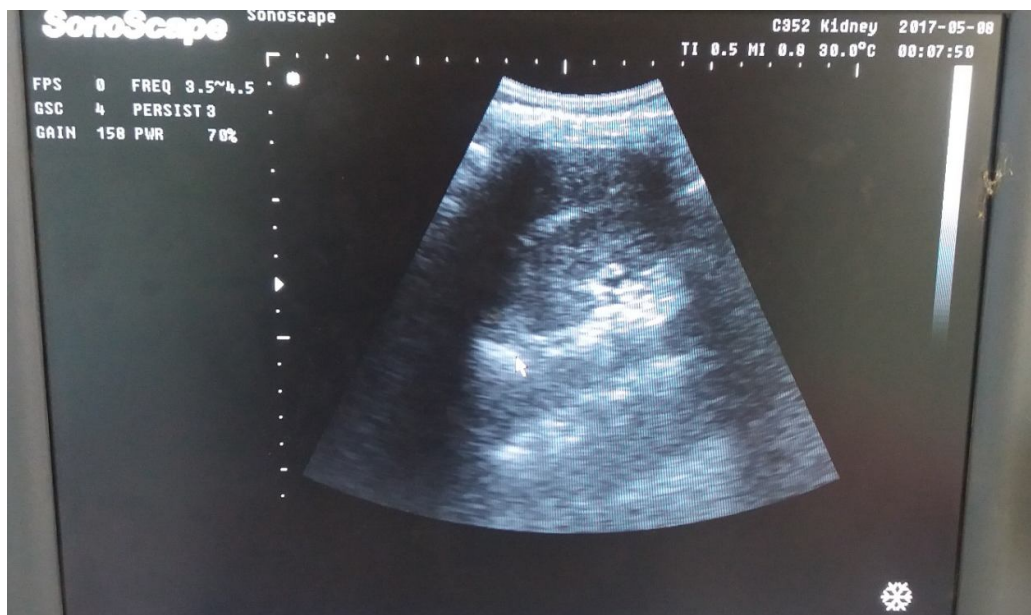


Image2;Ultrasound for 63Y male showing renal stone.



Image3:Ultrasound of 48y male showing renal stone.

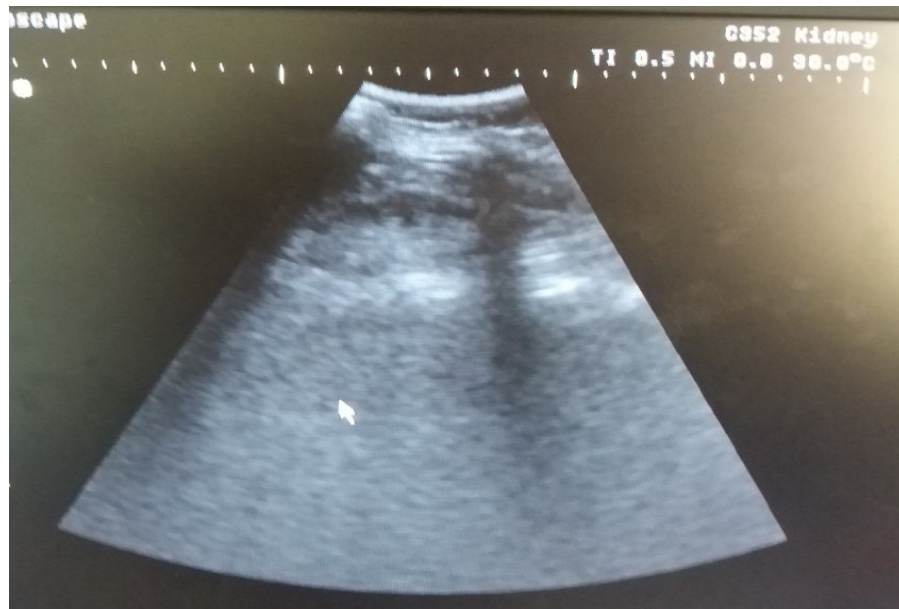


Image4:Ultrasound of 41y female showing thinning of parenchyma (CKD).

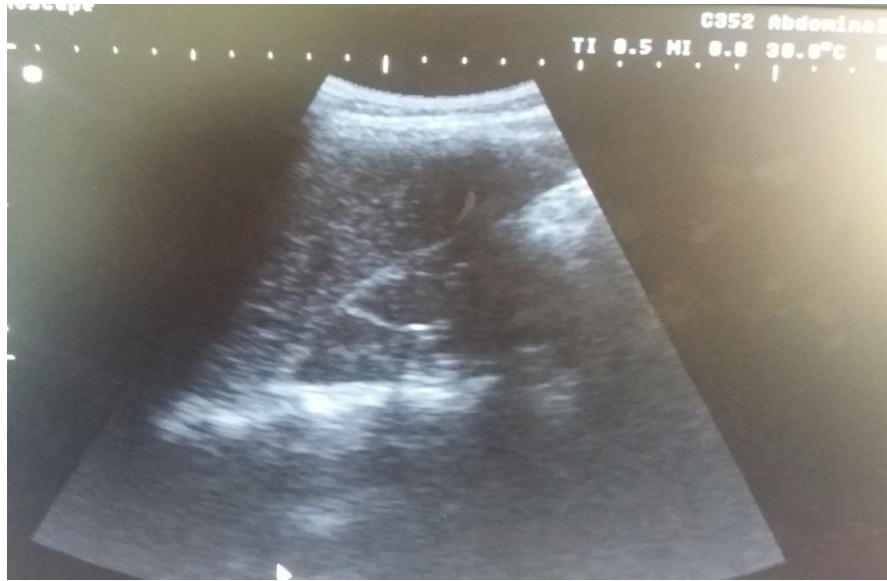


Image5:Ultrasound of 26y male showing renal stone.

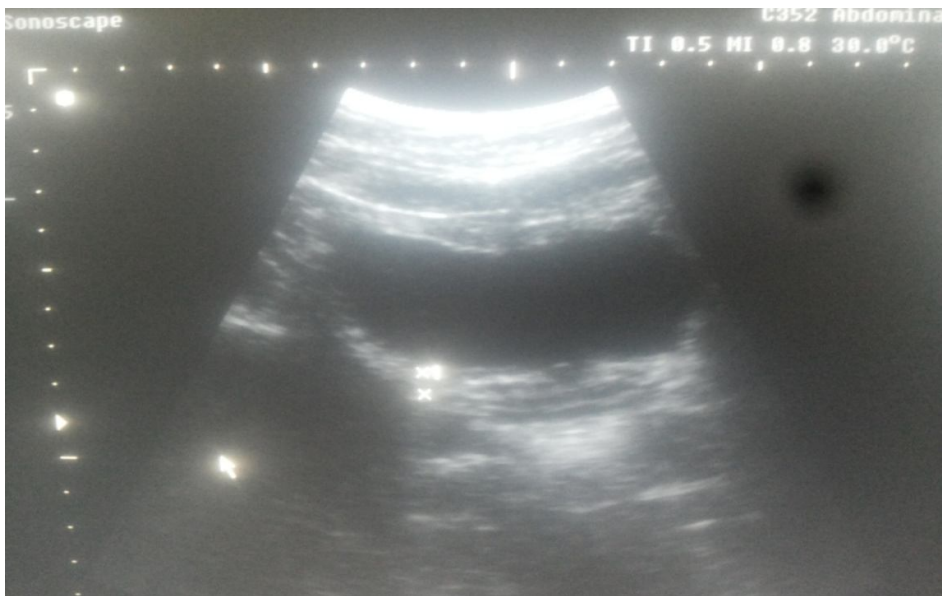


Image6:Ultrasound of 28y female showing cystitis.



Image7:Ultrasound of42y female showing cystitis.

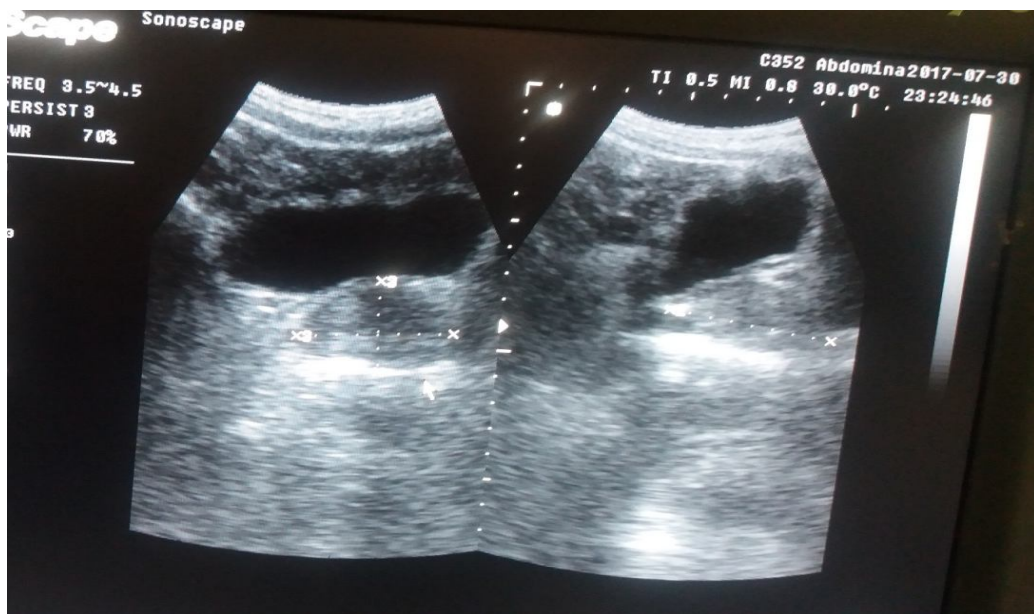


Image8:Ultrasound of72y male showing BP

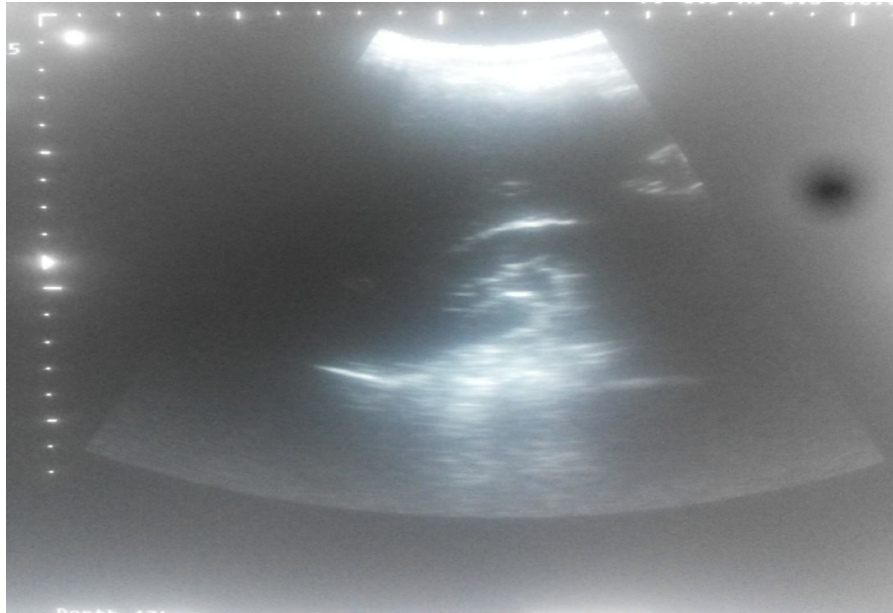


Image9: Ultrasound of 55y female showing obstructive renal stone with hydronephrosis.

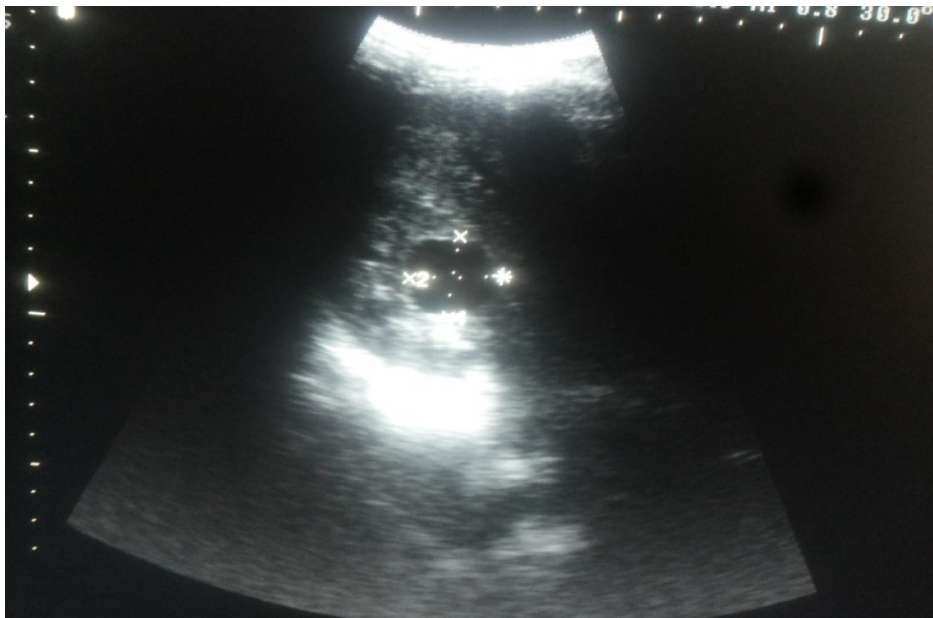


Image10:Ultrasound of 49y male showing renal cyst.

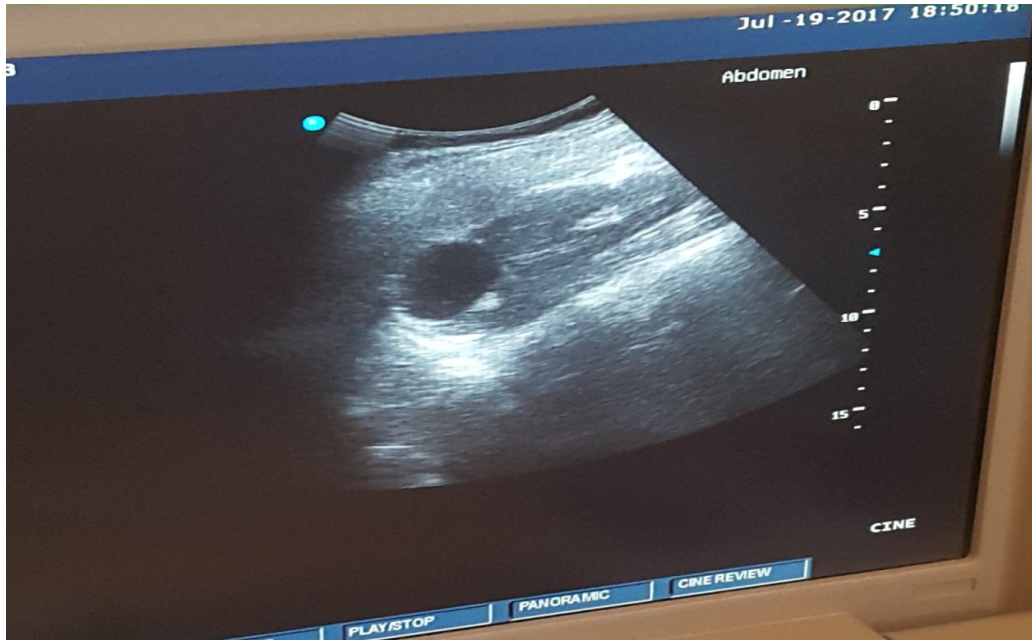


Image1:Ultrasound of 72y female showing renal cyst.

بسم الله الرحمن الرحيم

Appendix2

SUDAN UNIVERSITY
Faculty of Graduate Studies

**Assessment of renal system in patients with haematuria using
ultrasonography
Data Collection Sheet**

Patient No: -----

Patient Identification:

Age:

Gender:

RBC account:

RTK:

Echogenicity:

Hyper() Normal () hypo()

-Echotexture:

homogenous () heterogenous ()

-CMD:

good () medium () poor ()

-Dimensions(cm):

L () W () D ()

LTK:

Echogenicity:

Hyper() Normal () hypo()

-Echotexture:

homogenous () heterogenous ()

-CMD:

good () medium () poor ()

-Dimensions(cm):

L () W () D ()

UB:

WTH:()mm

Final Diagnosis.....