Sudan University of Science and Technology

College of Graduate Studies

Evaluation of the Renal System in Patients with Haematuria Using Ultrasonography

تقويم الجهازالبولي للمرضى ذوي البول الدموي باستخدام الموجات الفوق صوتية

Thesis submitted for partial Fulfillment of

M. Sc. Degree in Ultrasound

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Table of contents

List of figures

List of tables

DEDICATION

This Research is dedicated to my father soul, my respective mother and my husband who have been my constant source of inspiration. They have given me the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been !!!.…possible

Acknowledgment

First and foremost thanks are due to Allah the .most beneficent and merciful

I am so grateful most appreciative to the effort of . Dr. Caroline Edward

Ward cannot express what I owe for her endless .patience and continuous advice and support

Finally, I am deeply thankful and idebated to my mother, sisters, my mother in low and Mohammed for their support and love which allowed me the .completion of this study

Abstract

Haematuria is a common symptom (macroscopic) or sign (microscopic) which forms a considerable burden within primary and secondary (urological) care. The risk of this being a manifestation of significant underlying disease varies according to the age, gender and laboratory .investigations

The aim of this study is evaluation the urinary system in patients with haematuria using ultrasonograph. The sample size 30 cases (presented with haematuria),6 female and 24 male were include the patients in Military hospital in ultrasound department,20-75 years old. Ultrasound machine used curvilinear transducer with high frequenct(5 MHz), kidneys length, width were calculated in longitudinal scan. The kidney length was measured from the end of upper pole to the end of lower pole and the width from superior border to inferior border. The UB wall thickness was calculated in cross section scan in the posterior wall. The unit of .measurements used was metric all was done ideal protocol (Berwin)

Lab investigations include RBCs (Red Blood Cell counts) and pus cell .collected from the patients requested by abdominal ultrasound

The result shows the stone is most type of pathology to cause haematuria frequency was (46.7%), the high gender distribution was in male frequency was (80%) and the result of this study found that the LT kidney is most site of pathology causes haematuria. The cystitis recorded as one of a common disease that appears in our study resulting from increased in pus cell and causing haematuria. The result found increasing in the RBCs count in urine by lab investigation increasing the possibility of causing renal stones so this study recommended using the lab investigations as a .complementary for the ultrasonography to evaluate the haematuria

ملخص البحث

يعتبر البول الدموي من الأعراض والعلامات الشائعة ذات الأهمية لامراض الجهازالبولي التي تشكل تحديا في طب المسالك البولية. تنبع هذه الأهمية من كونه مؤشرا لمختلف الأمراض مع الوضع في عين الاعتباركلا من عمرالمريض, جنسه والفحوصات المختبرية.

الهدف من هذه الدراسة تقييم مرض البول الدموي للجهازالبولي باجراء فحص الموجات الفوق صوتية . اجريت هذه الدراسة في مستشفى السلاح الطبي ,وادرجت حجم عينة 30 حالة (جميع الحالات مصابة بالبول الدموي للجهاز البولي), 6 من الاناث و 24 من الذكور عن عمريتراوح بين 20 -75 عاما تم تحويلهم الى قسم الموجات الفوق صوتية نتيجة للفحوصات المختبرية التي اظهرت ارتفاعا في تعداد كريات الدم الحمراء وخلاياصديدية في البول .تم اجراء الموجات الفوق صوتية باستخدام مسبار منحني الاضلاع ذوالتردد العالي (5 ميغا هيرتز) للكلية اليمنى والكلية اليسرى بوضوح مع اتباع البروتوكول لحساب ابعادهما (المقطعين السهمي والعرضي) كما تم قياس سمك جدار المثانة البولية.

من نتائج هذه الدراسة ان الحصاوي التي تحدث في الكلية هي اكبر مسبب للبول الدموي للجهاز البولي بنسبة تبلغ (46.7%) وان اكثر اصابة للرجال بنسبة (80%) . كما اوضحت الدراسة ان النسبة الاعلى بالاصابة بالبول الدموي للجهازالبولي هي في الكلية اليسرى .وتم تسجيل عدد من الحالات المصابة بالتهاب المثانة البولية نتيجة لوجود خلايا صديد في البول. واوضحت الدراسة ان ازدياد تعداد كريات الدم الحمراء في البول التي يتم الكشف عنها بالفحص المختبري يزيد من احتمالية الاصابة بالحصاوي في الكلى لذا نقترح اجراء المزيد من الفحوصات المخبرية كمتمم لفحص الموجات الفوق صوتية لتقييم البول الدموي للجهاز البولي.

Chapter one

Chapter one

Introduction

Introduction 1.1

Haematuria have a wide range of causes including calculi, infection, neoplasm, trauma drug toxicity, coagulopathy and avaries many imaging modalities have been used in evaluation of patients with haematuria .(Grossfeld, 2001)

Historically, IVU has been the primary method of imaging in these patients (Amis,1999).Previously, the examination that are commonly used to evaluate patients with haematuria include IVU, ultrasonogrphy (U/S), computed tomography (CT), magnetic resonance (MRI) , cystography .and other modalities (Grossfeld 2001)

Ultrasound is an imaging technology that uses high frequency sound waves to characterize the tissues .It useful and flexible modality in medical imaging and even provides additional or unique characterization tissues compared with other modalities such as conventional radiography .or CT (Peter, 2004)

The ultrasound uses non-ionizing radiation sound waves and not has been associated with carcinogenesis, examination less expensive, the real – time nature of ultrasound imaging useful for evaluation physiology as well as anatomy (e.g. Fetal heart rate), the Doppler evaluation of organs .and vessels adds a dimension of physiology data (Peter, 2004)

Ultrasonography as the initial imaging study for selected patient with haematuria .It is believed to have moderately high sensitivity with respect to the wide range of abnormalities that may be encountered, including urinary tract neoplasm of all sort , stones, inflammatory processes, vascular lesions and obstruction from a wide variety of lesions. .(Peter, 2004)

:Problem of the study 1.2

The high incidence encountered in practical field and difference of .etiological factors of haematuria

:General objective of the study 1.3

To determine the different causes which make the haematuria in high risk .in patient with urinary tract problem

:Specific objectives 1.4

To determine kidneys length and width measurement, cortico- -1 medullar differentiation, urinary bladder wall thickness and ultrasound .finding

. To correlate between lab investigations and dimensions-2

.To correlate between the lab investigation and ultrasound finding-3

.To determine the common pathological type -4

:Overview of the study 1.5

.Chapter one including introduction

.Chapter two shows theoretical background and previous studies

.Chapter three explains material and method

.Chapter four shows results

.Chapter five discusses conclusion and recomondation

Chapter two

Chapter two

Literatures review

Anatomy of the urinary tract 2-1

2.1.2The kidneys

The kidneys are paired retroperitoneal structures confined within the perirenal space that extends on each side of the spine between the T12 and L3 vertebral levels. The right kidney is located slightly more .inferiorly than the left kidney due to the position of the liver

The kidneys are not rigidly fixed to the abdominal wall but are in direct contact with the diaphragm and thus move with respiration (Urban & .Scwarzenberg, 1987)

The kidneys are bean-shaped with convex side of each organ located laterally and the concave side of the kidney, known as the renal hilum, provides a space for the renal artery, renal vein and ureter to enter the .kidney (Urban & Scwarzenberg, 1987)

A thin layer of fibrous connective tissue forms the renal capsule surrounding each

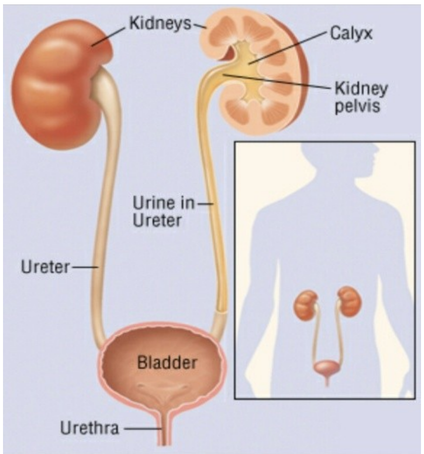


Figure 2.1 normal urinary tract

Kidney. The renal capsule provides a stiff outer shell to maintain the .shape of the soft inner tissue (Urban & Scwarzenberg, 1987)

Deep to the renal capsule is the soft, dense, vascular renal cortex .Seven cone-shaped renal pyramid from the renal medulla deep to the renal cortex. The renal pyramids are aligned with their bases facing outward toward the renal cortex and their apexes point inward toward the center of .the kidney (Urban & Scwarzenberg, 1987)

Each apex connects to minor calyx, a small hollow tube that collects urine. The minor calyces merge to form 3 larger major calyces, which further merge to form the hollow renal pelvis at the center of the kidney. The renal pelvis to exits kidney at renal hilus, where urine drains into the .ureter (Urban & Scwarzenberg, 1987)

The Nephron 2.1.2

Each kidney contain around 1 million individual nephrons, the kidneys' microscopic functional units that filter blood to produce urine .The nephron is made of 2main parts: the renal capsule and renal tube .(Romanes GH, 1972)

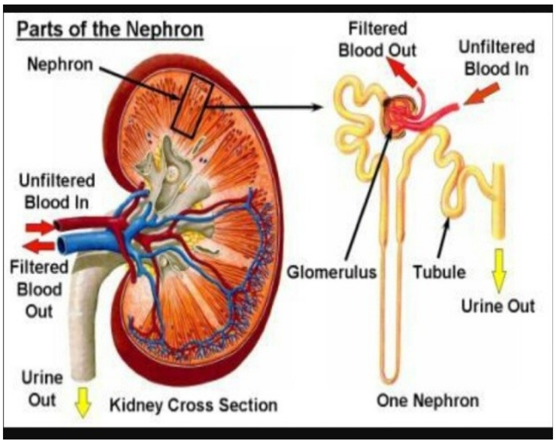


Figure 2.2 the nephron

The ureters 2.1.3

The ureters are a pair of tubes that carry urine from the kidneys to the urinary bladder .The ureters are about 10 to 12 inches long and run on the left and right sides of the body parallel to the vertebral column. Gravity and peristalsis of smooth muscle tissue in the walls of the ureter move urine toward the urinary bladder. The ends of the ureters extend slightly into the urinary bladder and are sealed at the point of the entry to the bladder by the ureterovesical valves. These valves prevent urine from .flowing back towards the kidneys (Romanes GH, 1972)

Urinary Bladder 2.1.4

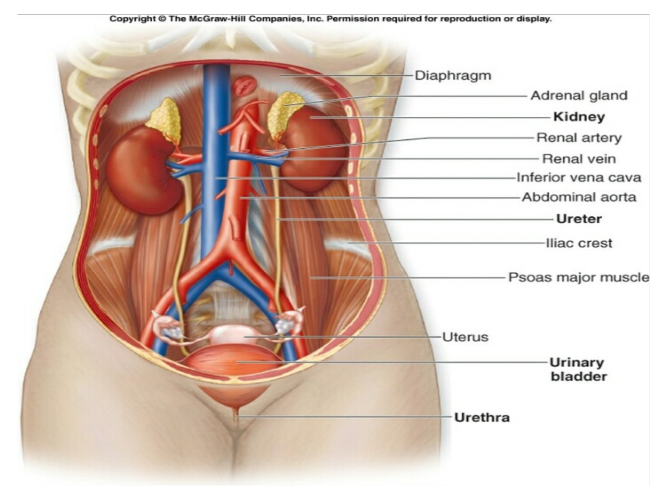
The urinary bladder is a sac-like hollow organ used for the storage of the urine .The urinary bladder is located along the body's midline at the inferior end of the pelvis. Urine entering the urinary bladder from the ureters slowly fills the hollow space of the bladder and stretches its elastic walls. The walls of the bladder allow it to stretch to hold anywhere from 600 to 800 milliliters of urine. The normal thickness of UB wall measured .(3mm) (Romanes GH, 1972)

Renal Arteries 2.1.5

The renal arteries usually arise from the aorta at the level of L2 below the origin of the superior mesenteric artery. The renal arteries enter the renal hilum anterior to renal pelvis. The main renal arteries divide into segmental arteries next to renal hilum , the first branch usually is posterior branch , following this branch anterior segmental (i.e., apical ,upper ,middle and lower) arteries are visible. The segmental arteries divide into the lobar arteries. Further divisions are the interlobar, arcuate and interlobar arteries. Doppler U/S clearly demonstrates the .interlobar artery level of the renal arterial anatomy (Ercan, 2005)

Renal veins 2.1.6

The renal cortex drains into the arcuate and interlobar veins. The lobar veins join to form the main renal vein. The renal veins usually are anterior to the renal artery. The left renal veins are approximately three .times longer than the right renal veins (Urban, 2001)



.Figure 2.3 Renal system blood supplies

Physiology of urinary tract 2.2

Excretion of wastes 2.2.1

The primary function of the kidneys is the excretion of waste product resulting from protein metabolism and muscle contraction. Ammonia, uric acid, urea and creatinine all accumulate in the body over time and need to be removed from circulation to maintain homeostasis (Graff, .2002)

Filtration, Reabsorption and Secretion 2.2.2

Inside each kidney are around million tiny structures called nephrons. The nephron is the functional unit of the kidney that filters blood to produce urine .The cell surrounding the tubules selectively absorb water and substance from the filtrate in the tubule and return it to the blood in the capillaries .At the same time, waste products present in the blood are secreted into the filtrate .By the end of this process, the filtrate in the tubule has become urine containing only water, waste product and ions .(Graff, 2002)

Production of Hormones 2.2.3

The kidneys produce and interact with several hormones that involved in .the control of systems outside of the urinary system

.**Calcitriol**: calcitirol is the active form of vitamin D in the human body.

Erythropoietin: erythropoietin is a hormone that is produce by the . .kidneys to stimulate the production of red blood cells

.Others (Graff, 2002)

Maintenance of Homeostasis 2.2.4

The kidneys maintain the homeostasis of several important internal conditions by controlling the excretion of substance out of the body .(Graff, 2002)

Sonograohic features of normal urinary system 2.3

A coronal view of kidney outlines its convex lateral border and concave medial border. Each kidney also has an upper and lower pole as well as anterior and posterior surface. On the medial border is an indentation (hilum) where the upper ureter, renal pelvis, vessels, and nerves enter or .exit the kidney (Kovac A, 1984)

In cross section, the kidney appears as a distinct ovoid structure lying adjacent to the vertebral column and along the psoas major muscle .(Kovac A, 1984)

In the sagittal plane , the kidney appears songraphically as an elongated homogeneous structure with a central echogenic region consisting of the renal pelvis , infundibulum , minor , calices, renal vessels , lymphatic ,fat and fibrous tissue . The normal length of kidney average between (8-12 . cm) and normal width average between (4-6 cm) (Kovac A, 1984)

Corticomedullary differentiation is the visualization of the difference between the cortical (the peripheral tissue) and medulla (central to cortex).On ultrasound scan, the cortex should look whiter (more .echogenic) than the medulla

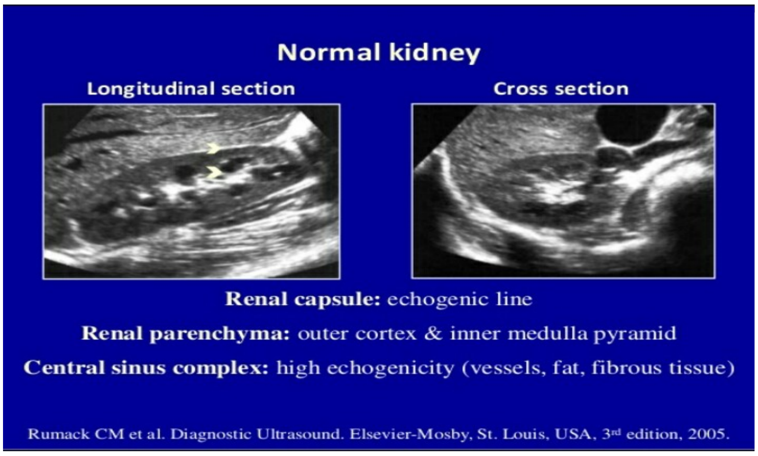


Figure 2.4 normal kidney ultrasound in longitudinal and cross .section

The urinary bladder in a sagittal plane and cross section appears as a hollow anechoic homogeneous organ with echogenic regular wall. The normal volume of UB measured by the formula V=length*width*AP*0.49 and the normal range of voided volume between (120- 456 ml) and pre voided less than 1000 ml (Kovac A, .1984)

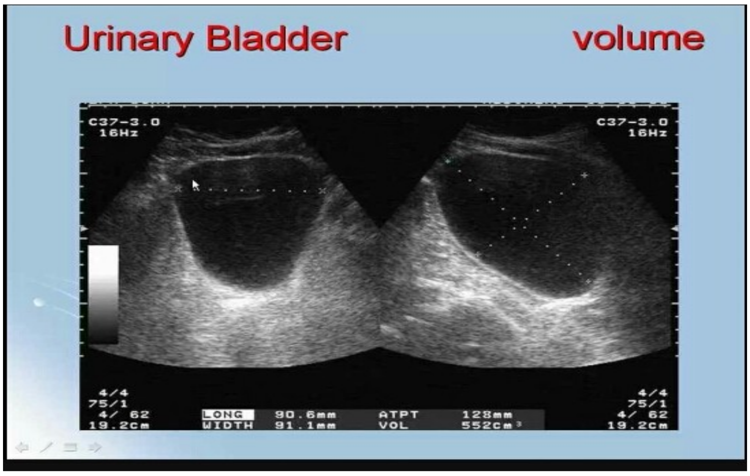


Figure 2.6 normal urinary bladder ultrasound in sagittal and cross .section

Etiology of Haematuria and is Evaluation 2-4

Blood in the urine is a common problem that can be a sign of a number of benign and malignant underlying diseases. Haematuria may be macroscopic (visible on gross examination) or microscopic (Bergstein, .2005)

The American Urological Association defines microscope haematuria as 3 or more red blood cell (RBCs) per high – power field (HPF) on microscopic analysis of 2 or 3 properly collected urine specimens (Grossfeld – 2001). Although other definitions range from 1 to 10 RBCs .per high power field (Cohen, 2003)

:2.4.1Etiology of haematuria

The cause of haematuria can be broadly categorized into renal and extra-.renal, renal cause can subdivided into glomerular and non- glomerular

:**Renal-**

:Glomerular-

.Thin basement membrane disease (benign familial haematuria)

.IgA nephropathy

.Alport's syndrome

.Other glomerulonephritis

:Non-glomerular -

.Polycystic kidney disease

.Medullar sponge kidney

.Papillary necrosis

.Pyelonephritis

.Renal cell carcinoma

.Renal vascular disease

:Extra – renal-

:Upper urinary tract-1

.Nephrolithiasis

.Uretral cancer

:Lower urinary tract-2

.Cystitis

.Bladder cancer

.Bladder ulcer

.Bladder stones

.Prostate cancer

.Schistosomiasis

.Urethral causes e.g.truma, infection

:Other

.Vigorous exercise

.Coagulation related

.False haematuria

.(Bernard, 2007)

Evaluation of haematuria (history, laboratory and imaging 2.4.2 :studies)

A detailed history is essential in elucidating the cause of haematuria and a family history should not be over looked. Laboratory evaluation is also important as microscopic examination of the urine can confirm that blood is actually present in the urine and may help in determining whether the source of blood is glomerular or non-glomerular (Jaffe,2001).Further investigation with imaging studies may be warranted in some disease .processes

:2.4.1History

In evaluating haematuria , several question should always be asked and the answers will enable the urologist to target the subsequent diagnostic .evaluation efficiently(Glenn,2007)

:Gross versus microscopic haematuria

The significance of gross versus microscopic haematuria is simply that the chances of identifying significant pathology increase with the degree of haematuria .Thus, it is uncommon for patient with gross haematuria not to have identifiable underlying pathology whereas it is quite common for patient with minimal degrees of microscopic haematuria to have a .negative urologic evaluation (Glenn, 2007)

:Timing of haematuria

The timing of haematuria during urination frequently indicates the site of origin. Initial haematuria usually secondary to inflammation. Total haematuria is most common and indicates that the bleeding is most likely coming from the bladder or upper urinary tract. Terminal haematuria occurs at the end of micturation and is usually secondary to inflammation in the area of the bladder neck or prostatic urethra. It occurs at the end of micturition as the bladder neck contract, squeezing out the last amount of .urine (Gleen, 2007)

:Association with pain

Haematuria, although frightening is usually not painful unless it is associated with inflammation or obstruction. Thus, patient with cystitis and secondary haematuria may experience painful urinary irritative symptoms but the pain is usually not worsened with passage of clot. More commonly , pain in association with haematuria usually results from upper urinary tract haematuria with obstruction of ureters with clot , passage of these clot may be associated with sever , colicky flank pain similar to that produced by a ureteral calculus and this helps identify the .source of haematuria (Gleen, 2007)

:Presence of clots

The presence of clots usually indicates a more significant degree of haematuria and according the probability of identifying significant .urologic pathology increases (Gleen, 2007)

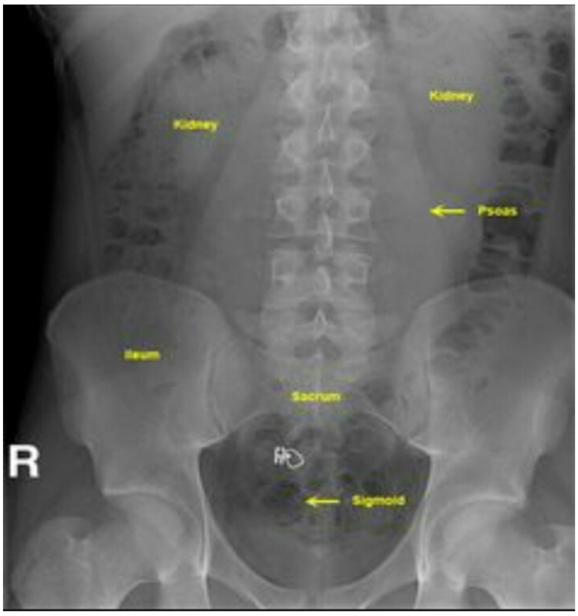
A detailed family history is important in screening for familial diseases that cause haematuria, such as Alport's, polycystic kidney diseases, .benign familial haematuria and bleeding diathesis (Voulgarelis, 2005)

:Laboratory evaluation 2.4.2

The first question in the laboratory evaluation of the patient with haematuria is whether blood is actually in the urine. Urine analysis can usually differentiate a renal from a urologic source of bleeding. The presence of RBCs casts is diagnostic for a glomerular source of haematuria. Non glomerular haematuria is characterized by RBCs that have an appearance similar to those seen on peripheral smear and are uniform in size and shape, while in glomerular haematuria the RBCs have a dysmorphic appearance and are smaller than non- glomerular RBCs .(Kincaid- Smith, 2005)

:Imaging studies evaluation 2.4.3

Plain abdominal film: KUB for evaluation of haematuria, the **-** abdominal plain film is often of little help by itself. It sometime useful if a kidney or ureteral calculus is suspected (up to 85% of symptomatic urinary calculi can be seen on a KUB although sometimes other calcification. But a KUB does not really show much detailed anatomy .with respect to upper urinary tract. (Mark, 2004)



.Figure 2.7 plain abdominal x-ray

:Intravenous Urography (IVU)-

Traditionally, the IVU has been the method of choice for evaluating upper urinary tract (kidney and ureter). The plain film helps assess bony structure and discern any calcification .The nephrogram enables gross assessment of renal function. In general IVU unable to differentiated cyst from solid mass or tumor, a little or no value if patient has serum creatinine above 2.0 because the visualized of kidney will be poor, however IVU is unable to assess extra renal pathology , time consuming .sometime 24 hours, although its coast wise(Mark 2004)

Figure 2.8 the IVU

:Magnetic Resonance Imaging (MRI)-

This modality has been shown to demonstrate certain genitor-urinary lesion with far better clarity than other available radiographic imaging techniques. Because an MRI produces a very powerful magnetic field ,it cannot be used with good clarity in patient with metallic objects(surgical clips) in the area of study and it also cannot generally be used in patients .with cardiac pacemakers.(Mark,2004)

Figure 2.9 Example of MRI

:Multi-slice CT of urinary tract (CTU)-

CT urography has become useful imaging test of the urinary tract .It provide a single non- invasive examination of kidney, ureter and urinary bladder in one s test. But it coast wise and can be toxic or allergic when .using contrast (Michael, 2004)

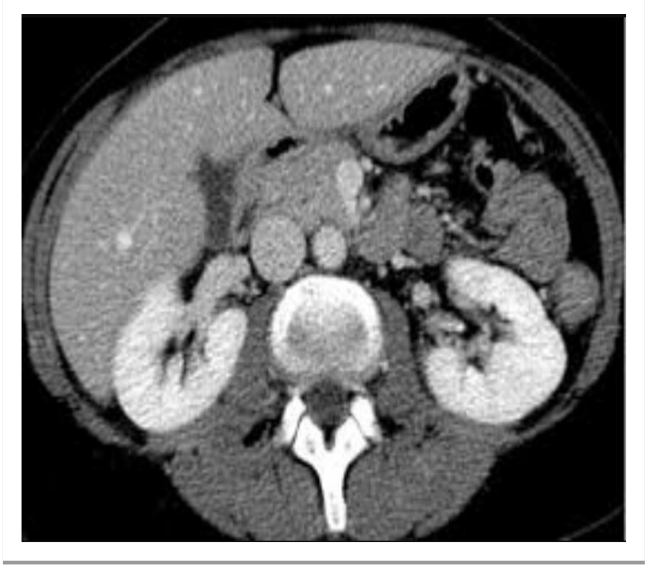


Figure 2.10 example of CTU

:Urinary tract Ultasonography (U/S)-

Urinary tract ultrasound imaging can be very helpful for evaluating the kidneys, urinary bladder and is especially useful for differentiating a solid mass from a cyst. Ultrasonography has advantage of being totally non-invasive (no radiation that might injure a fetus if female is pregnant, no contrast and thus, no chance of toxicity or contrast allergy) and relatively in- expensive .The sonogram can exclude biologically significant renal masses, hydronephrosis and other pathology. With Doppler imaging, measurement of renal blood low can be obtained and compared (Mark, .2004)

A kidney ultrasound is diagnostic exam that produce image, which are used to assess the size, and location of the kidney. Ultrasound may also be .used to assess blood flow to the kidneys (Mark, 2004)

Ultrasound uses a transducer that sends out ultrasound waves at a frequency too high to be heard. The ultrasound transducer is placed on the skin, and the waves move through the body to the organs and the structure within. The sound waves bounce off the organs like an echo and return to transducer .The transducer processes the reflected waves, which are then convert by computer into an image of the organs or tissues being .examined (Powis, 1978)

The sound waves travel at different speeds depending on the type of tissue encountered –fastest through bone tissue and slowest through air. The speed, at which the sound waves are returned to transducer, as well as how much of the sound waves returned, is translated by the transducer .as different types of tissues (Powis, 1978)

An ultrasound gel is placed on the transducer and the skin to allow for smooth movement of the transducer over the skin to eliminate air between the skin and the transducer for the best sound conduction (Powis, .1978)

:Scanning parameters (Adjusting the control) 2.5

Frequency: Frequency is generated by transducer that transforms -1 .electrical energy to ultrasonic energy

Depth: Depth increasing allows deeper structure to be viewed, but -2 .reduces the scale and slow frame rate

.**Gain**: The overall brightness of the image can be adjusted-3

TGC (Time Gain Compensation): Gain can also be adjusted selectively-4 .at different depth

Foucs: The pulse of ultrasound can be manipulated to be at its -5 .narrowest at a particular depth

.**Zoom**: This takes a portion of screen and magnifies-6

Measuring: Cursers are available on all modern machines and are -7 .calibrated

.**Taking Pictures and Labeling and other**. (Powis RL, 1978)-8

:2.6Technique

Patient preparation 2.6.1

EAT/DRINK: Drink a minimum of 24 ounces of clear fluid at least one hour before the appointment. The patient should not empty the bladder prior to the procedure .Generally, no prior preparation, such as fasting or .sedation is required

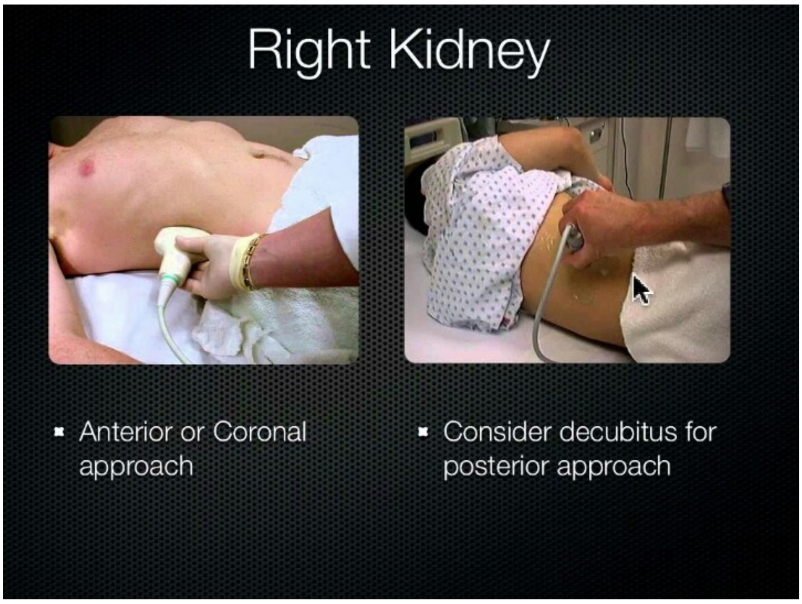
Based upon the patient medical condition, the physician may request .other specific preparation (Speets AM, 2006)

:Patient position 2.6.2

:Kidneys

An examination of native or transplanted kidneys should include along-axis and transverse views of the kidneys. The cortices and renal pelvises should be assessed. A maximum measurement of renal length should be recorded for both kidneys. Supine, decubitus, prone, or upright positioning may provide better images of native kidneys. When possible, renal echogenicity should be compared to adjacent liver or spleen. The kidneys and perirenal regions should be assessed for abnormalities .(Hagen-Ansert SL2011)

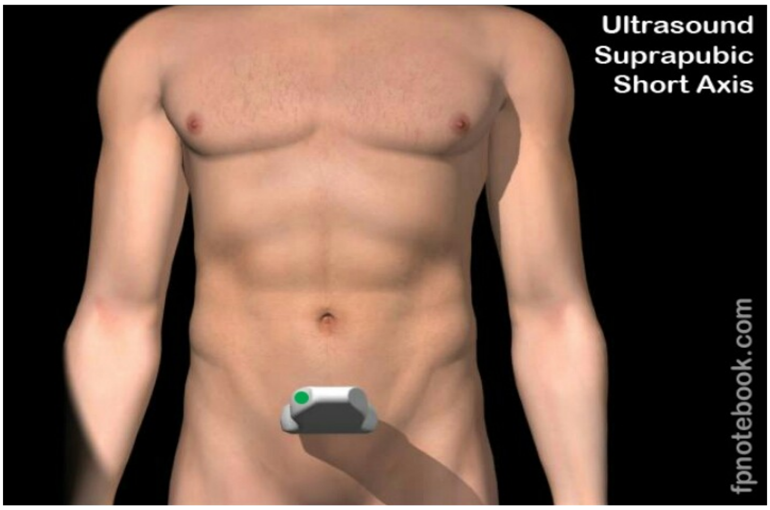
For a vascular examination of native or transplanted kidneys, Doppler imaging can be used to assess renal arterial, venous patency and to .evaluate suspected renal artery stenosis (Hagen-Ansert SL2011)



.Image 2.11 RTK ultrasound examinations

:Urinary bladder-

When performing a complete ultrasound evaluation of the urinary tract, transverse and longitudinal images of the distended urinary bladder and its wall should be including, if possible. Bladder lumen or wall abnormalities should be noted. Dilatation or other distal ureteral abnormalities any postvoid residual, which may quantitied and reported .(Hagen-Ansert SL2011)



.Figure 2.12 Urinary bladder ultrasound examinations

:Sonographic features of different causes of haematuria 2.7

:2.7.1Stones

A kidney stone is a hard, pebble-like deposit form in the kidney. It may be as small as a grain of sand or large as pearl. A stone may be smooth, irregular in shaped or jagged. Most are yellow or brown in color. There is :different type of kidney stone

A-Calcium stones : most common type and the calcium not used by the body goes to kidneys and normally flushed out with the urine.In some people the calcium that stays behind bonds with other waste product to .the stone

B-Struvite stones: contain the mineral magnesium and the waste product .ammonia

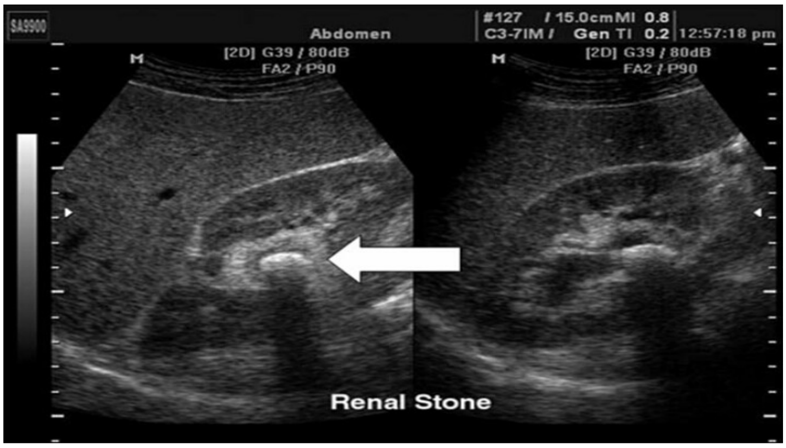
.**C-Uric acid stones:** form when there too much acid in urine

.**D-Cystine stones:** are rare. The form of the diseases runs in families

: Sonographic features-

Highly reflective structure within the collecting system that associated -1 .with posterior acoustic shadowing

Smaller stones may be suggested by the strong curvilinear echoes that -2 they produce. Dilatation of the collecting system enhances the detection .of stones(Cosby,2006)



.Figure 2.13 Solitary large stone in RTK

:2.7.2Renal cyst (simple or complex)

A renal cyst is a fluid collection in the kidney.There are several type based on Bosniak classification.The majority are benign,simple and some .are cncerouse or suspicious for cancer(Curry NS,2000)

Peripheral, smooth, hypoechoic, posterior enhancement and with or .without internal echoes; multiple in polycystic disease (Cosby,2006)

.Figure 2.14 Solitary simple cyst in RTK

:2.7.3Urinay tract infection

Urinary tract infections (UTIs) are infections in any part of the urinary tract. They are a common health problem that affects millions of people .each year (Curry NS,2000)

:A UTI may affect any part of the urinary tract causing

A .Pyelonephritis: This infection of the kidneys is most type of infection .has spread up the urinary tract or blockage the tract

B .Cystitis: This is infection in the bladder from germs that have moved .up from the urethra

c. Abscess: A collection of pus along the course of the urinary tract .(Curry NS 2000)

:Sonographic features

A. Is most commonly normal, but may found hypoechoic cortex and loss of demarcation between the outer cortex and middle pyramids .(Cosby,2006)

.B. Wall bladder thickening >3mm and irregular (Middletone WD, 2004)

C .Appear as hypoechoic area within the cortex or in corticomedullary parenchyma. It shows internal echoes within and associated diffusely .hypoechoic kidney (Ahuja AT,2007)

:Renal vascular disease 2.7.4

Renal vascular disease affects the blood flow into or out of the kidneys. It may cause kidney damage, failure and high blood pressure (Redermacher .J, 2001)

:Sonographic features

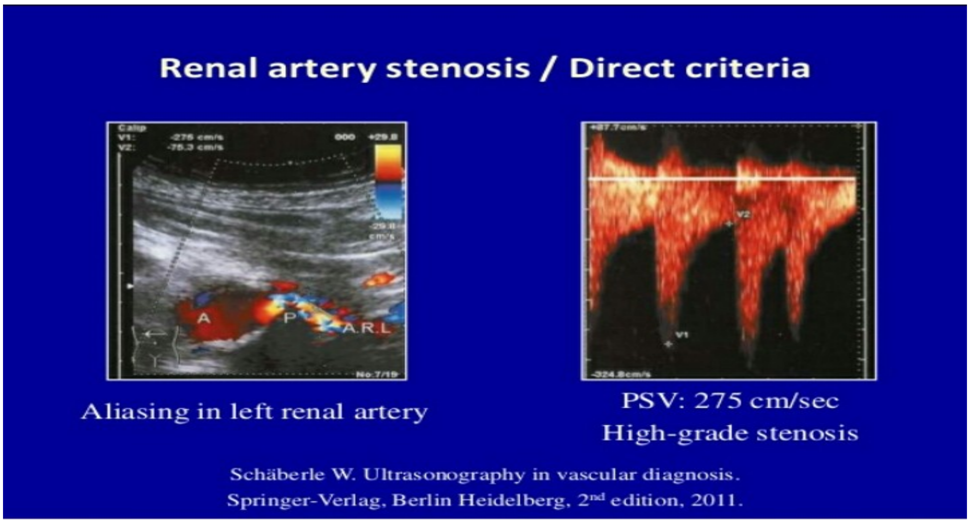
:By Doppler ultrasound renal vascular disease can measure the follow

.Renal arterial resistive index (RI)-

.Peak systolic velocity (PSV)-

.Renal –interlobar ratio (RIP)-

.Turbulent flow in post stenotic area (Ahuja AT, 2007)-



.Figure 2.15 LT renal artery stenosis

:Renal cell carcinoma (RCC) 2.7.5

The exact cause of renal cell cancer is unknown. However, there are :certain risk factors that are linked to it. These risk factor, are as follows

.Smoking: Smoking increasing risk of kidneys cancer-

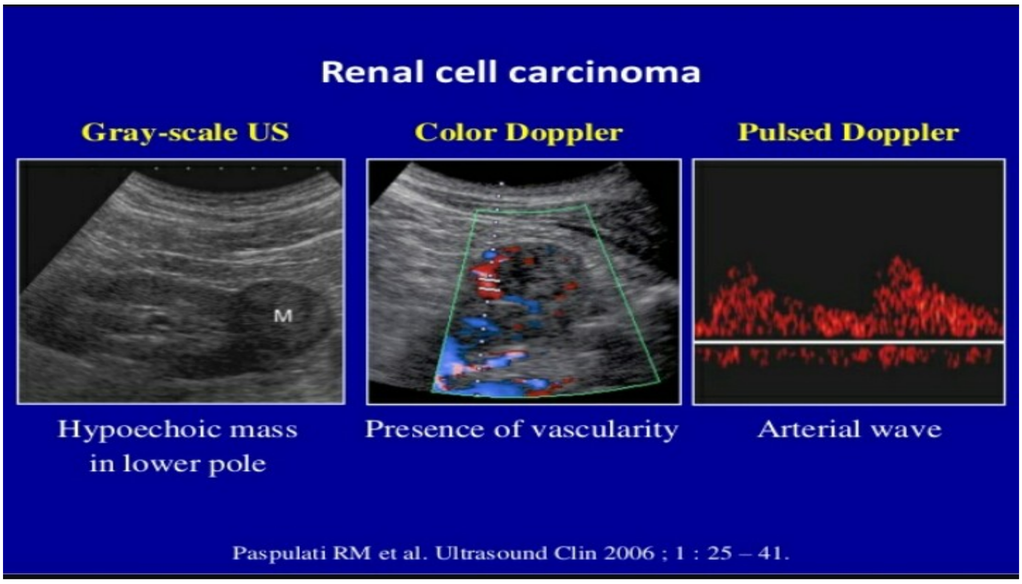
.Asbestos: Studies show a link between the asbestos and kidney cancer-

Family history: Family history of kidney cancer increases the personal's - .risk

Von Hipple-Lindau syndrome: This disease caused by a gene mutation - .that increases the chance of renal cell cancer

.Obesity: Obesity increases a person's risk factor-

.High blood pressure: Increase risk factor(Curry NS,2000)-



.Figure 2.16 present renal cell carcinoma

:Urinary bladder carcinoma 2.7.6

Bladder cancer is a type of cancer that begins in bladder –a balloon-.shaped organ in pelvic area that store urine

Bladder cancer begins most often in the cells that line the inside of the bladder. Bladder cancer typically affected older adults, though it can .occur at any age (Curry NS, 2000)

:Sonographic features

.A-Thickening of the bladder wall

.B-Mass protruding in the wall

.C-Increasing vascularity of the mass by Doppler u/s(Ahuja AT, 2007)

Chapter two-section two

Previous study 2.8

Dr SN Datta, had done study in Urinary tract ultrasonography in the -.evaluation of haematuria

Over a 5-year period, 1007 patient with haematuria were investgated , 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 on cystoscopy, suspicious or malignant cytology, previous

investigation for haematuria ,on-going haematuria at time of their clinic visit, a history of flank plan or hydronephrosis on ultrasonography .Of this series,840 male (83%)had visible haematuria,158female (15%)had microscopic or chemical haematuria and 9(0.9%) had unspecified haematuria .A total of 133 bladder transitional cell tumours,21 renal cell cancer and 2 upper tract transitional cell cancer(TCC)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 or unspecified haematuria was 3.3.No upper tract tumours were missed using this investigation protocol .An ultrasonography –based protocol could miss fewer upper tract TCCs than stander IVU- based service would miss renal cell cancer. Provided there is no history of flank pain, no malignant cytology, no hydronephrosis and no previously investigated haematuria , .IVU could be safely omitted

Dr Mokuis JA study renal ultrasound performed in the patient with --.microscopic haematuria and normal excretory urogram

The result was: Of the 101 patients with microscopic haematuria and normal IVP, renal ultrasonography was abnormal in 20%.All finding were ultimately proved to be of no clinical significance , although 6 of 21 patients required a total of 10 additional studies , including 9 .computerized tomography scans and 1 renal arteriogram

Lokken RP, Sadow CA had done study about: Diagnostic yield of CT -.urography in evaluation of young adults with haematuria

A clinically significant source was found in 83 of 375 examinations (22.1%), including 42 of 142(29.6%) for gross haematuria, 29 of 181 (16.0%) for microscopic haematuria, and 12of 52 (23.1%) for haematuria of unspecified subtype. The most common clinically significant finding was renal or ureteral calculi 73 (75.3%), four malignancies were also .detected

.Luyao Shen study Evaluation of microscopic haematuria-

The ultrasound has a role in the initial workup of haematuria to search for bleeding urinary tract lesion. It is especially useful in radiation-sensitive population, such as children and pregnant or child-bearing age women, to detect renal calculi and renal masses. In patients in whom glomerular disease is the cause of haemauria. US can examine the renal parenchyma and follow disease progression .US can evaluate length,quantitive,echogenicity,cortical thickness and parenchymal thickness. On study showed that echogenicity correlated the strongest with histological parameters that include glomerular sclerosis, tubular atrophy,intersisial fibrosis and interstitial inflamation.In prospective study, US had higher sensitive (96% versus 25%) and negative predictive value (98% versus 91%) than IVU in detecting abnormalities of the upper urinary tract in patients present with haematuria.Therefore ,US should replace IVU for frist -line screening of the upper tracts in radiation-sensitive population and patients with glomeular disease as the cause of .haematuria

Jeremy L. McKay,Harvared Medical school year III was study: -Radiological Assessment of the kidney in patient with Haematuria

Retrospective study of 100 patients with haematuria most common cause are 41% neoplasia , 26.6% infection,13.6 nephrolithiasis,3.6%congenital abnormalities,2% trauma and 12% no identifiable cause. The ultrasonography best to exclude urinary obstruction can diagnose the hydronephrosis and its cause and should perform in all patients presenting .with renal failure of unknown etiology

Chapter three

{**Material and Methods**}

Material 3.1

:Study sample 3.1.1

Analytical descriptive study was carried out of (30) patients whose undergone abdominal ultrasound, 24 adult male and 6 adult female in .different ages

Following information about patients was reported: age, gender, kidneys .length and width, urinary bladder wall thickness and clinical finding

:Area, duration and data analysis 3.1.2

The study takes place in Khartoum state with permission from Military Hospital. The study was conducted in November 2015.The data were .analyzed using excel program and simple frequency tables

:Ultrasound machine characteristics 3.1.3

.Esaote S.p.A ultrasound machine

.Via di Caciolle, 15 Frinze – Italia

.A523 REF 9600156000

SN
35465

.Probe: curved array   C 3-5 MHz

.Linear array L 7.5 MHz

.Probe used in the study: Curve array C3-5 MHz

Methods 3.2

Drink a minimum of 24 ounces of clear fluid at least one hour before the appointment. The patient should not empty the bladder prior to the procedure .Generally, no prior preparation, such as fasting or sedation is .required

:Methods of scanning 3.2.1

The examination begins with the patient in the supine position. Scans are performed in the sagittal and transverse planes from the anterior approach using the liver and spleen as acoustic window. Various maneuvers may enhance demonstration of the kidneys: left lateral decubitus or lateral oblique positions for the right kidney and right lateral decubitus or lateral oblique position for the left kidney. Coronal longitudinal and transverse scans may also be obtained and recommended for evaluating the renal .pelvis and proximal ureter

The highest frequency transducer permitting adequate penetration is used (5MHz).A curvilinear array probe used for scanning in subcostal and .intercostals area

:Methods of measurement 3.2.2

Kidneys length, width were calculated in longitudinal scan. The kidney length was measured from the end of upper pole to the end of lower pole and the width from superior border to inferior border. The unite of .measurements used was metric

The UB wall thickness was calculated in cross section scan in the .posterior wall

Chapter four

Chapter Four

{Results}

The following tables and figures presented the data obtained from 30 patients who were examined by ultrasound. The abdomen was scanned, the kidneys and urinary bladder were also diagnosed, and most of the patients were examined for laboratory test for urine RBCs and Pus cells.

Table 4.1 presented the gender distribution.

Gender			
		Frequency	Percentage%
Valid	Female	6	20.0
	Male	24	80.0
	Total	30	100.0

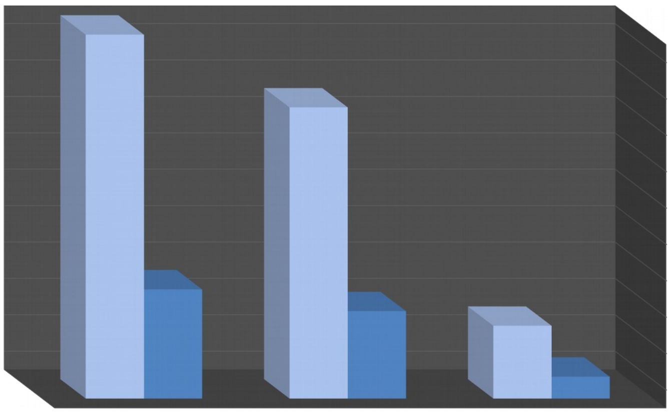


Figure 4.1 presented the gender distribution.

Table 4.2 presented the RT Kidney dimension (Length X Width) distribution.

RT K Dimension			
		Frequency	Percentages%
Valid	15-32	3	10.0
	33-50	17	56.7
	51-68	8	26.7

	69-86	0	0
	˃87	1	3.3
	Total	29	96.7
Missing	System	1	3.3
Total		30	100.0

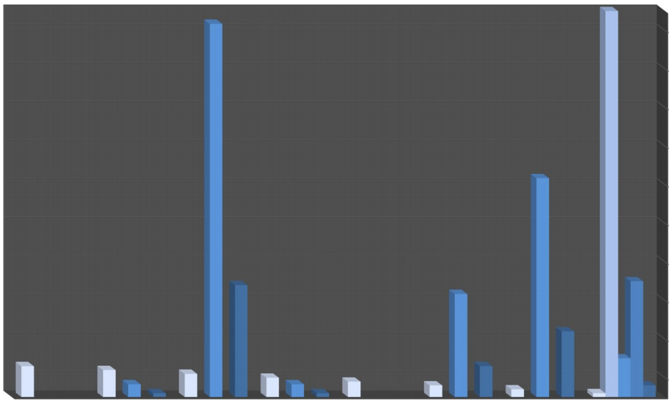


Figure 4.2 presented the RT Kidney dimension (Length X Width) distribution.

Table 4.3 presented the LT Kidney dimension (Length X Width) distribution.

		Frequency	Percentages%
Valid	21-31	1	3.3
	32-42	9	30.0
	43 -53	11	36.7
	54-64	7	23.3
	65-75	2	6.7
	Total	30	100.0

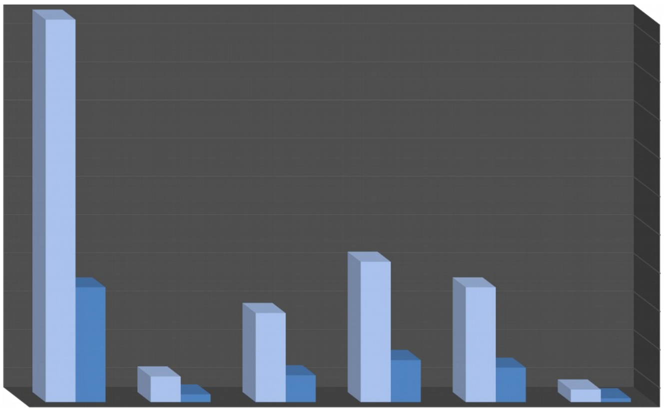


Figure 4.3 presented the LT Kidney dimension (Length X Width) distribution.

Table 4.4 presented the RT Kidney cortical modularly differentiated.

CMDRT			
		Frequency	Percentages%
Valid	Normal Differentiated	21	70.0
	Good Differentiated	5	16.7
	Poor Differentiated	3	10.0
	Total	29	96.7
Missing	System	1	3.3
Total		30	100.0

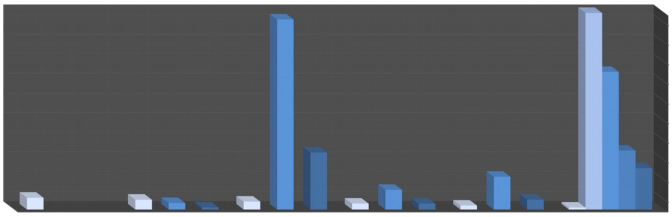


Figure 4.4 presented the RT Kidney cortical modularly differentiated.

Table 4.5 presented the LT Kidney cortical modularly differentiated.

		Frequency	Percentages%
Valid	Normal Differentiated	21	70.0
	Good Differentiated	6	20.0
	Poor Differentiated	3	10.0
	Total	30	100.0

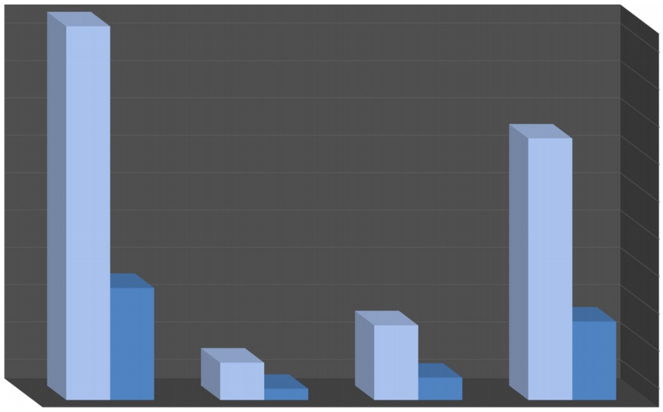


Table 4.5 presented the LT Kidney cortical modularly differentiated.

Table 4.6 presented the UB Wall Thickness.

		Frequency	Percentages%
Valid	Normal	24	80.0
	Thick	6	20.0
	Total	30	100.0

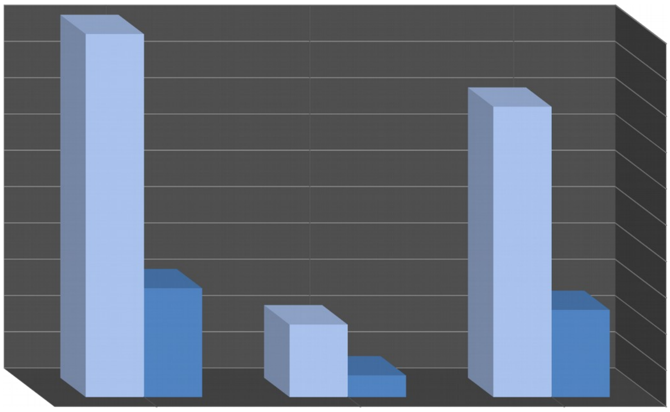


Figure 4.6 presented the UB Wall Thickness.

Table 4.7 presented the Diagnosis.

Diagnosis			
		Frequency	Percentage%
Valid	stone	14	46.7
	cyst	8	26.7
	cystitis	3	10.0
	pyelonephritis	5	16.7
	Total	30	100.0

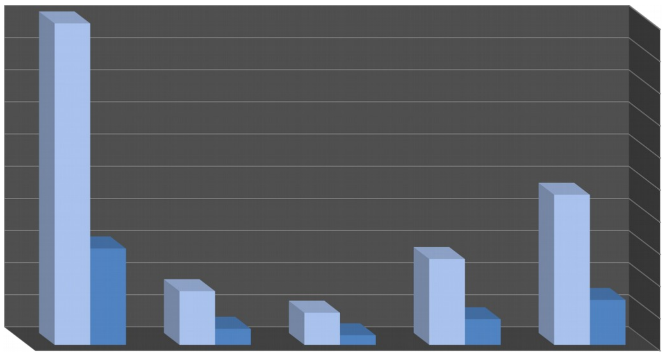


Figure 4.7 presented the Diagnosis.

Table 4.8 presented the Site.

Site			
		Frequency	**Percentage%**
Valid	**LT kidney**	**14**	**46.7**
	RT kidney	**9**	**30.0**
	Vesical	**3**	**10.0**
	Bilateral	**4**	**13.3**
	Total	**30**	**100.0**

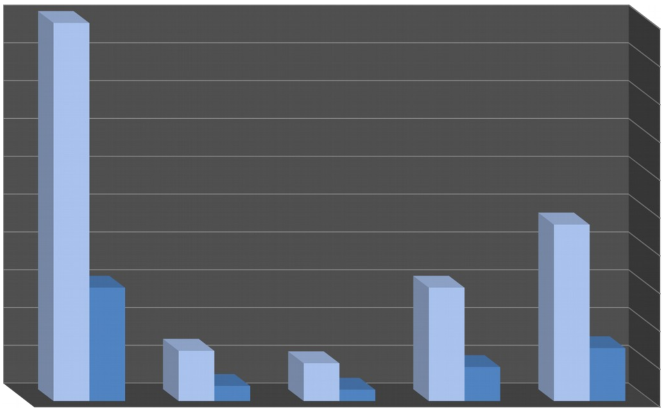


Figure 4.8 presented the Site.

Table 4.9presented the RBCs.

		Frequency	Percentages%
Valid	Uncountable	13	43.3
	More Than 25	2	6.7
	Less Than 25	10	33.3
	Normal	5	16.7
	Total	30	100.0

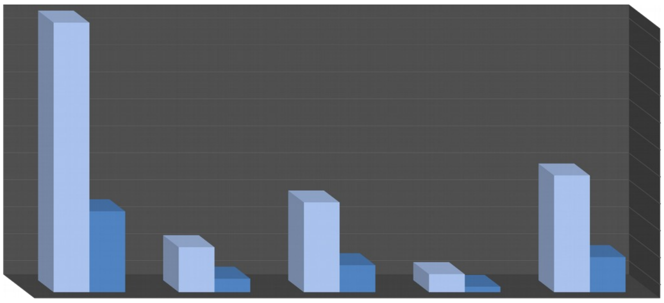


Figure 4.9presented the RBCs.

Table 4.10presented the Pus.

Pus			
		Frequency	Percentage%
Valid	Normal	23	76.7
	Uncountable	1	3.3
	More Than 12	2	6.7
	Less Than12	4	13.3
	Total	30	100.0

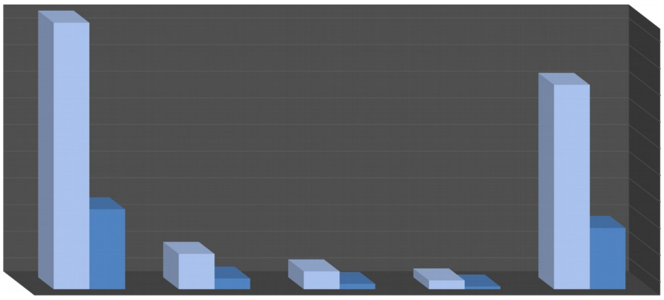


Figure 4.10presented the Pus.

Table 4.11presented the cross tabulation between RBCs and RT K Dimension.

Cross tab						
		RBCs				Total
		uncountable	more than 25	less than 25	normal	
RTK Dimension	15-32	0	1	1	1	3
	33-50	9	0	6	2	17
	51-68	3	0	3	2	8
	69-86	0	0	0	0	0
	≥87	0	1	0	0	1
Total		12	2	10	5	29
Chi-Square Tests		Linear-by-Linear Association		0.604		

Table 4.12presented the cross tabulation between Pus and RT K Dimension.

Cross tab						
		Pus				Total
		normal	uncountable	more than 12	less than12	
RTK Dimension	15-32	1	1	1	0	3
	33-50	13	0	1	3	17
	51-68	7	0	0	1	8
	69-86	0	0	0	0	0
	≥87	1	0	0	0	1
Total		22	1	2	4	29
Chi-Square Tests		Linear-by-Linear Association		0.397		

Table 4.12presented the cross tabulation between RBCs and LT K Dimension.

Cross tab						
		RBCs				Total
		uncountable	more than 25	less than 25	normal	
LTK Dimension	21-31	0	0	1	0	1
	32-42	5	0	2	1	8
	43-53	4	2	3	3	12
	54-64	2	0	4	1	7
	≥64	2	0	0	0	2
Total		13	2	10	5	30
Chi-Square Tests		Linear-by-Linear Association		0.838		

Table 4.13presented the cross tabulation between Pus and LT K Dimension.

Cross tab						
		Pus				Total
		normal	uncountable	more than 12	less than12	
LTK Dimension	21-31	0	0	1	0	1
	32-42	7	0	0	1	8
	43-53	9	1	1	1	12

	54-64	6	0	0	1	7
	≥64	1	0	0	1	2
Total		**23**	**1**	**2**	**4**	**30**
Chi-Square Tests		**Linear-by-Linear Association**		**0.984**		

Table 4.14presented the cross tabulation between RBCs and RT CMD.

Cross tab						
		RBCs				**Total**
		uncountable	**more than 25**	**less than 25**	**normal**	
CMDRT	**Normal Differentiated**	**10**	**2**	**5**	**4**	**21**
	Good Differentiated	**0**	**0**	**4**	**1**	**5**
	Poor Differentiated	**2**	**0**	**1**	**0**	**3**
Total		**12**	**2**	**10**	**5**	**29**
Chi-Square Tests		**Linear-by-Linear Association**		**0.821**		

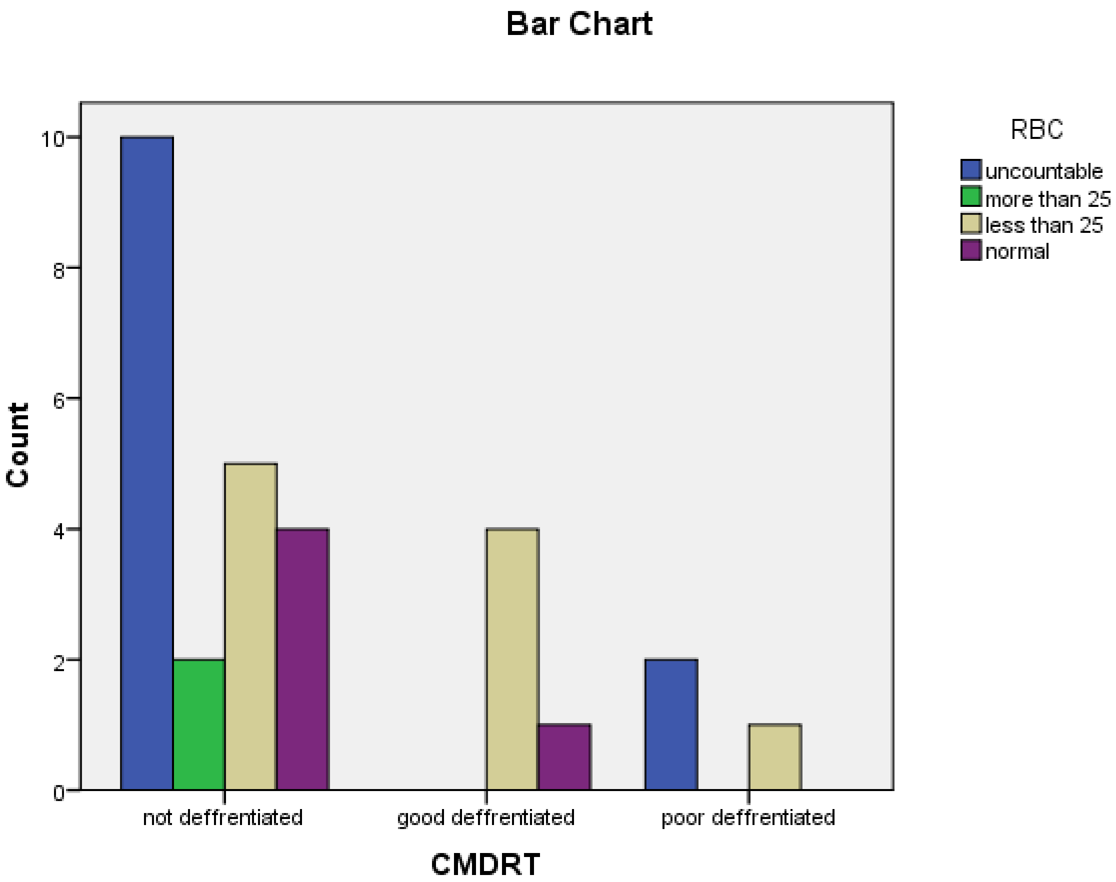


Figure 4.11presented the cross tabulation between RBCs and RT CMD.

Table 4.15presented the cross tabulation between Pus and RT CMD.

Cross tab						
		Pus				Total
		normal	uncountable	more than 12	less than12	
CMDRT	Normal Differentiated	16	1	1	3	21
	Good Differentiated	3	0	1	1	5
	Poor Differentiated	3	0	0	0	3
Total		22	1	2	4	29
Chi-Square Tests		Linear-by-Linear Association		0.718		

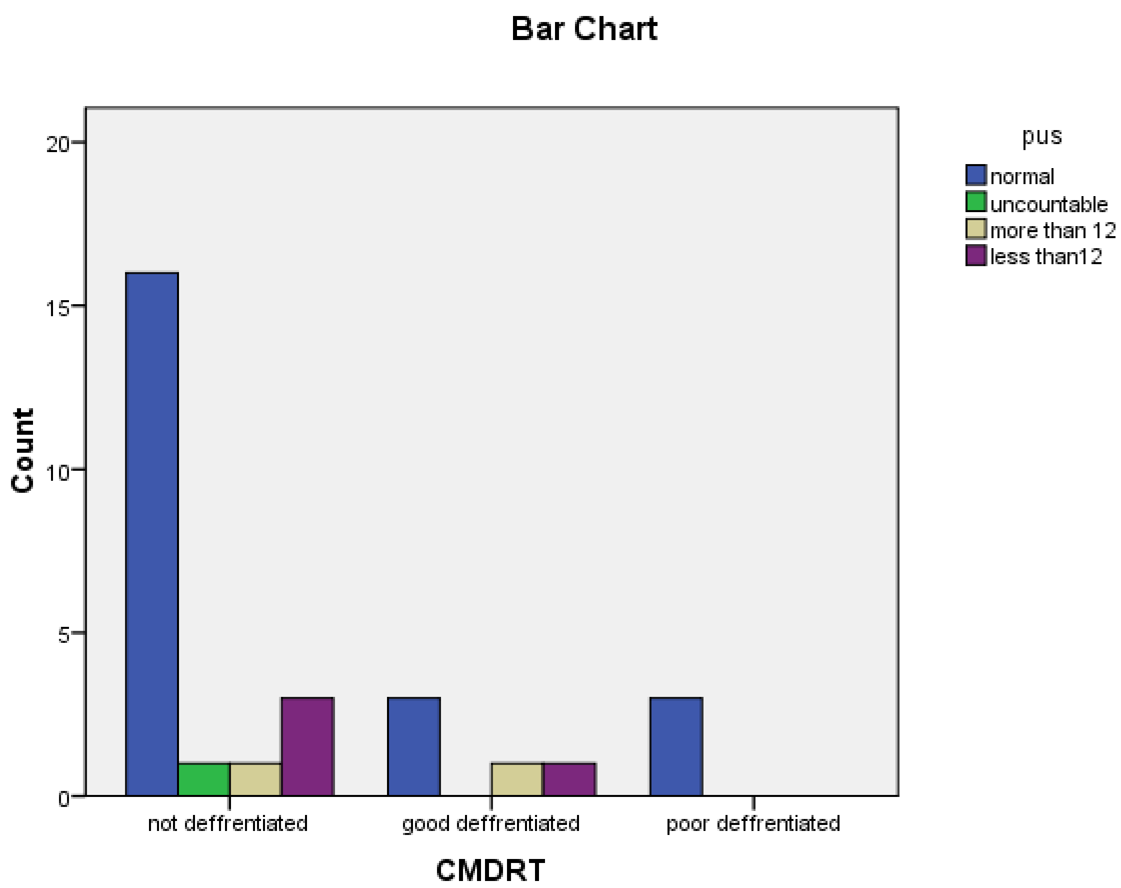


Figure 4.12 presented the cross tabulation between Pus and RT CMD.

Table 4.16presented the cross tabulation between RBCs and LT CMD.

Cross tab						
		RBCs				Total
		uncountable	more than 25	less than 25	normal	
CMDLT	Normal Differentiated	10	2	5	4	21
	Good Differentiated	1	0	4	1	6
	Poor Differentiated	2	0	1	0	3
Total		13	2	10	5	30
Chi-Square Tests		Linear-by-Linear Association		0.963		

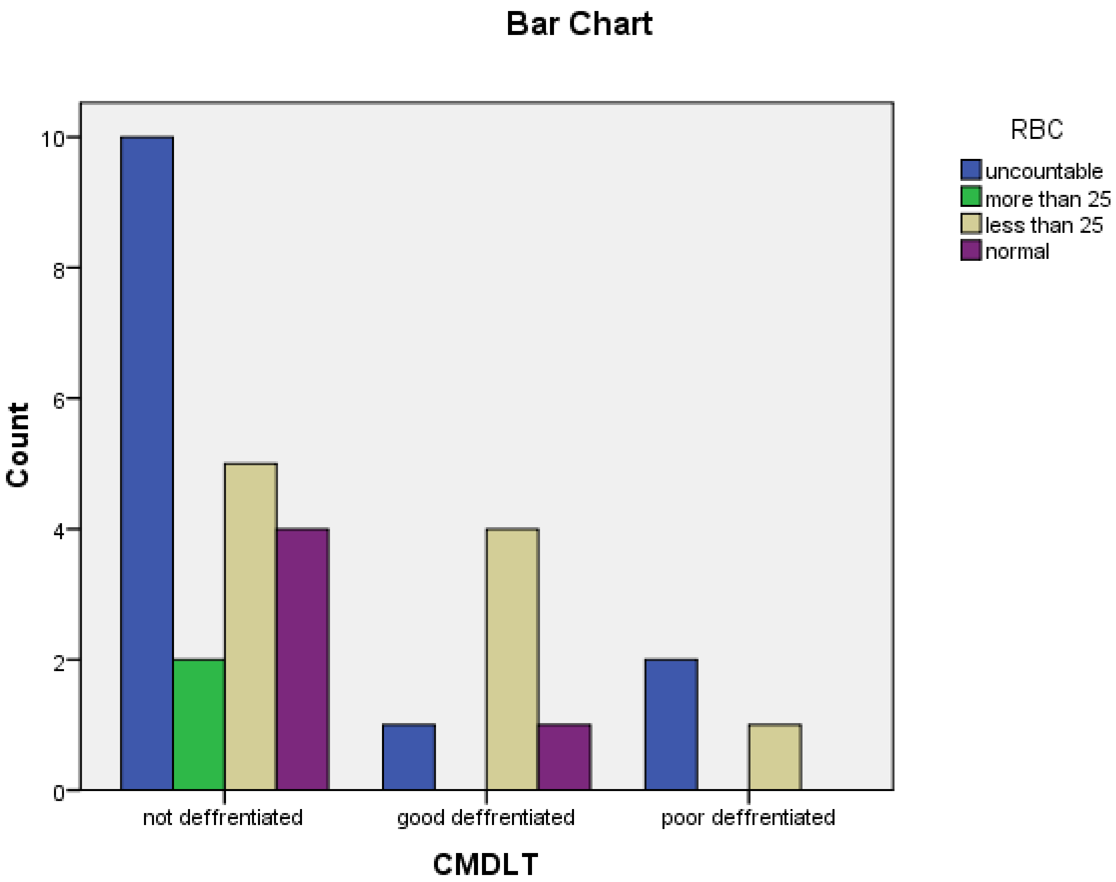


Figure 4.13 presented the cross tabulation between RBCs and LT CMD.

Table 4.17presented the cross tabulation between Pus and LT CMD.

Crosstab						
		Pus				Total
		normal	uncountable	more than 12	less than12	
CMDLT	Normal differentiated	16	1	1	3	21
	Good differentiated	4	0	1	1	6
	Poor differentiated	3	0	0	0	3
Total		23	1	2	4	30
Chi-Square Tests		Linear-by-Linear Association		0.654		

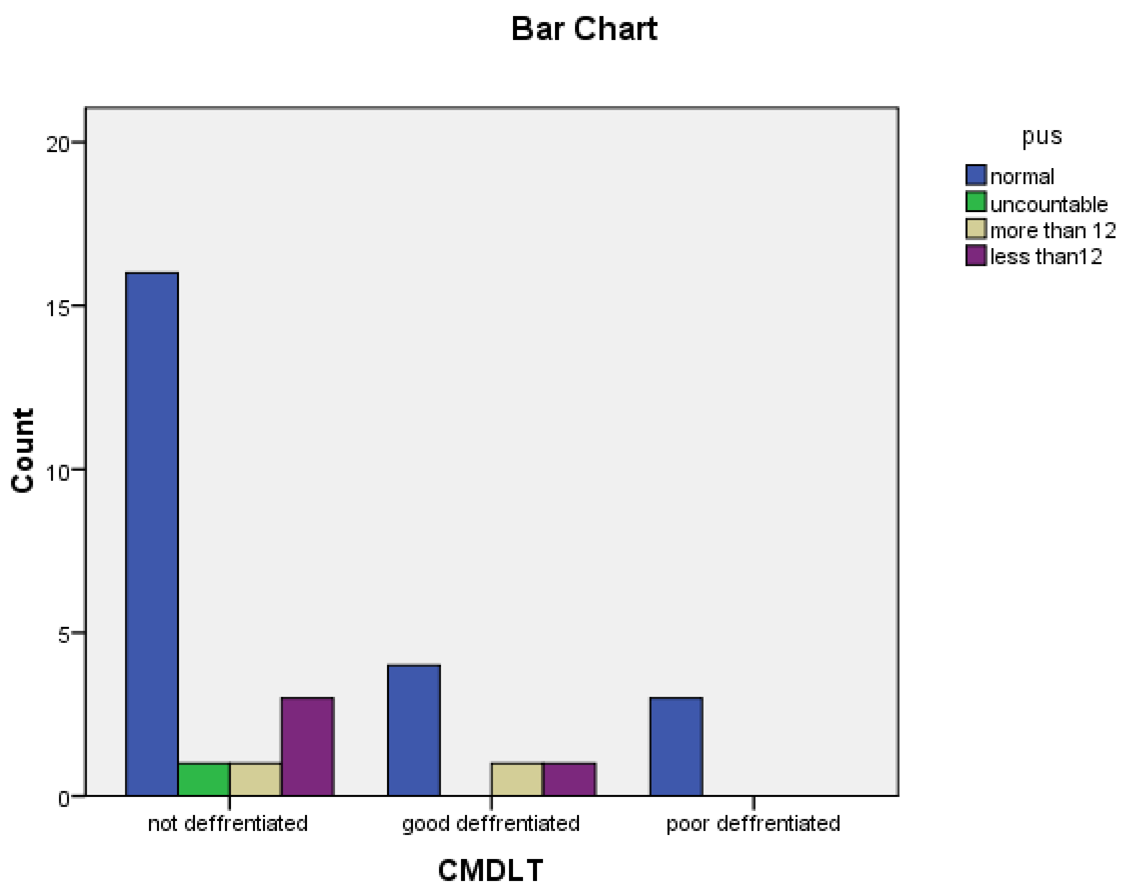


Figure 4.14presented the cross tabulation between Pus and LT CMD.

Table 4.18presented the cross tabulation between RBCs and UB Wall Thickness.

Cross tab						
		RBCs				Total
		uncountable	more than 25	less than 25	normal	
UB Wall Thickness	Normal	11	2	6	5	24
	Thick	2	0	4	0	6
Total		13	2	10	5	30
Chi-Square Tests		Linear-by-Linear Association		0.819		

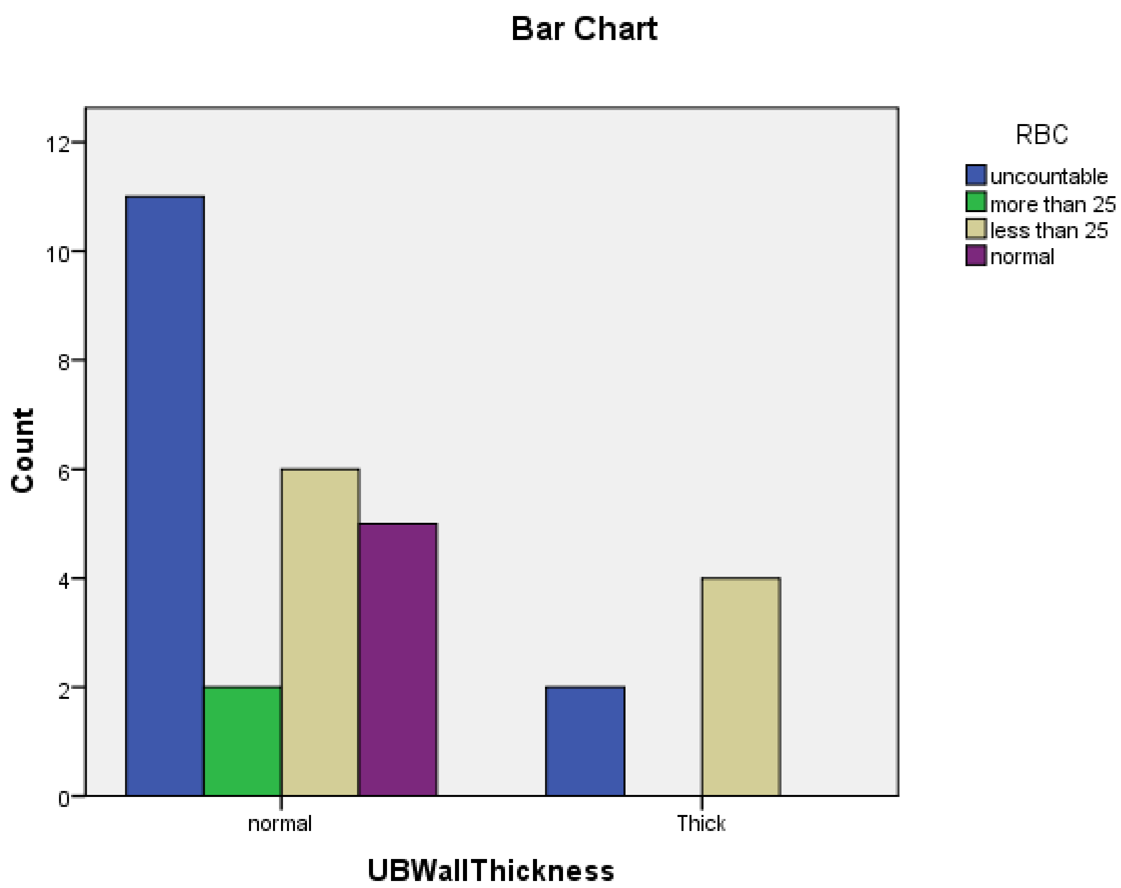


Figure 4.15presented the cross tabulation between RBCs and UB Wall Thickness.

Table 4.19presented the cross tabulation between Pus and UB Wall Thickness.

Cross tab						
		Pus				Total
		normal	uncountable	more than 12	less than12	
UB Wall Thickness	normal	19	1	1	3	24
	Thick	4	0	1	1	6
Total		23	1	2	4	30
Chi-Square Tests		Linear-by-Linear Association		0.508		

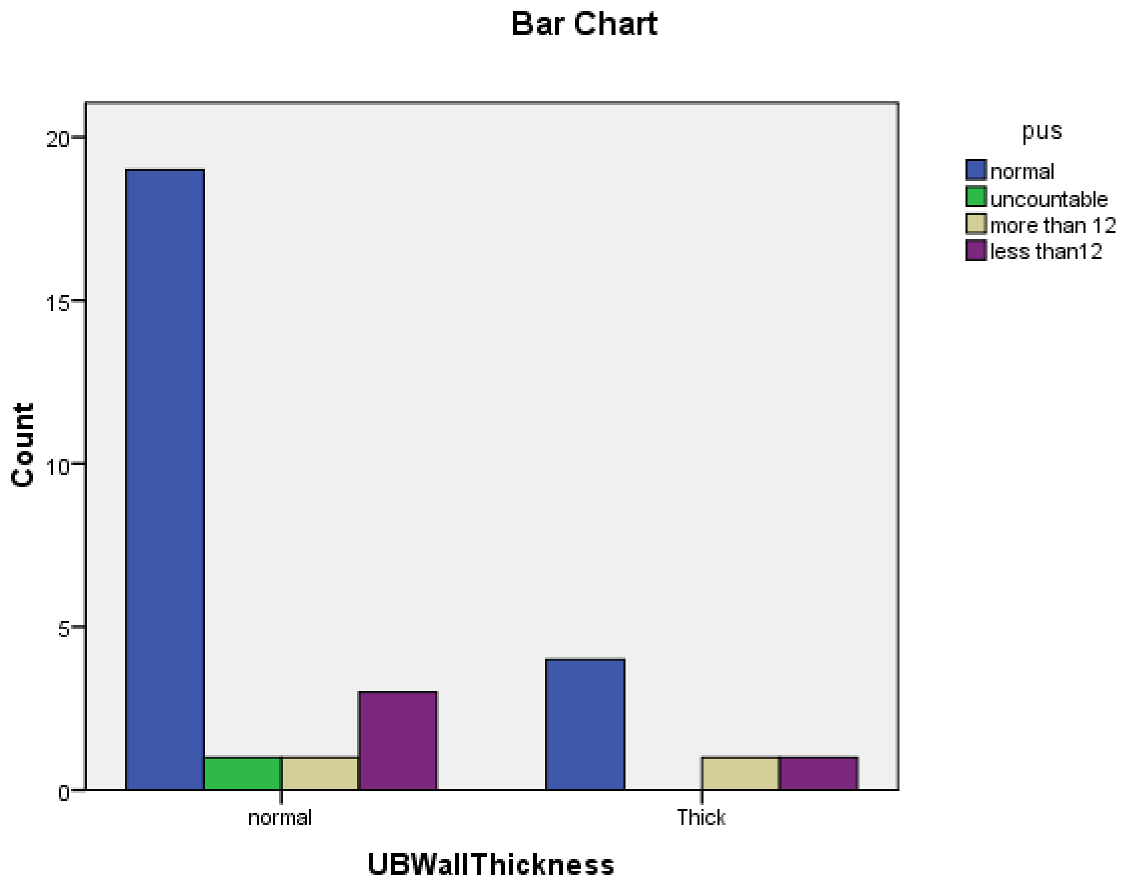


Figure 4.16presented the cross tabulation between Pus and UB Wall Thickness.

Table 4.20presented the cross tabulation between Diagnosis and RT Kidney Dimension.

Cross tab						
		Diagnosis				Total
		stone	cyst	cystitis	pyelonephritis	
RTK Dimension	15-32	1	0	1	1	3
	33-50	8	3	3	3	17
	51-68	3	4	0	1	8
	69-86	0	0	0	0	0
	≥87	1	0	0	0	1
Total		14	7	3	5	29
Chi-Square Tests		Linear-by-Linear Association		0.269		

Table 4.21presented the cross tabulation between Diagnosis and LT Kidney Dimension.

Crosstab						
		Diagnosis				Total
		Stone	cyst	cystitis	pyelonephritis	
LTK Dimensions	21-31	0	0	1	0	1
	32-42	5	1	1	1	8
	43-53	5	5	0	2	12
	54-64	3	1	1	2	7
	≥64	1	1	0	0	2
Total		14	8	3	5	30
Chi-Square Tests		Linear-by-Linear Association			0.761	

Table 4.22presented the cross tabulation between Diagnosis and CMD RT Kidney Dimension

Cross tab						
		Diagnosis				Total
		stone	cyst	cystitis	pyelonephritis	
CMDRT	Normal Differentiated	10	6	2	3	21
	Good Differentiated	3	0	1	1	5
	Poor Differentiated	1	1	0	1	3
Total		14	7	3	5	29
Chi-Square Tests		Linear-by-Linear Association		0.563		

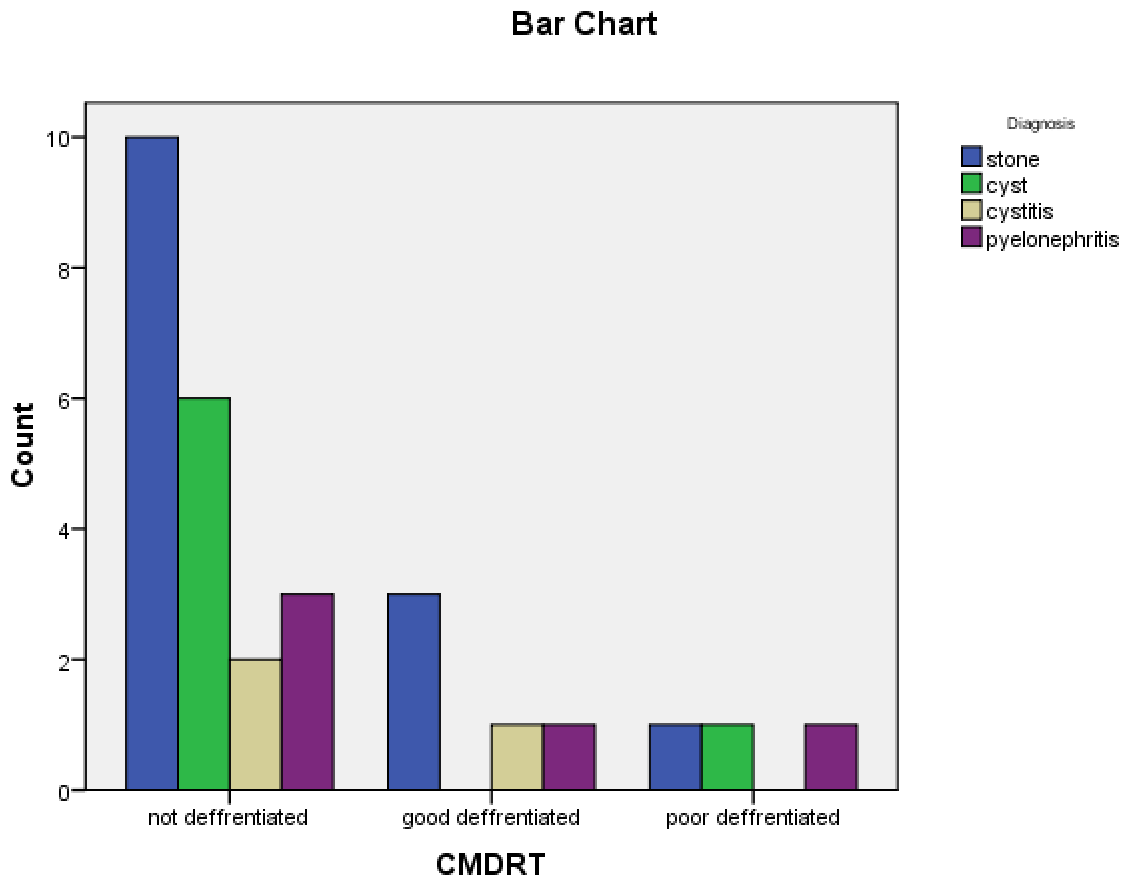


Figure 4.17presented the cross tabulation between Diagnosis and CMD RT Kidney Dimension.

Table 4.23presented the cross tabulation between Diagnosis and CMD LT Kidney Dimension.

Cross tab						
		Diagnosis				Total
		stone	cyst	cystitis	pyelonephritis	
CMDLT	Normal Differentiated	10	6	2	3	21
	Good Differentiated	3	1	1	1	6
	Poor Differentiated	1	1	0	1	3
Total		14	8	3	5	30
Chi-Square Tests		Linear-by-Linear Association		0.558		

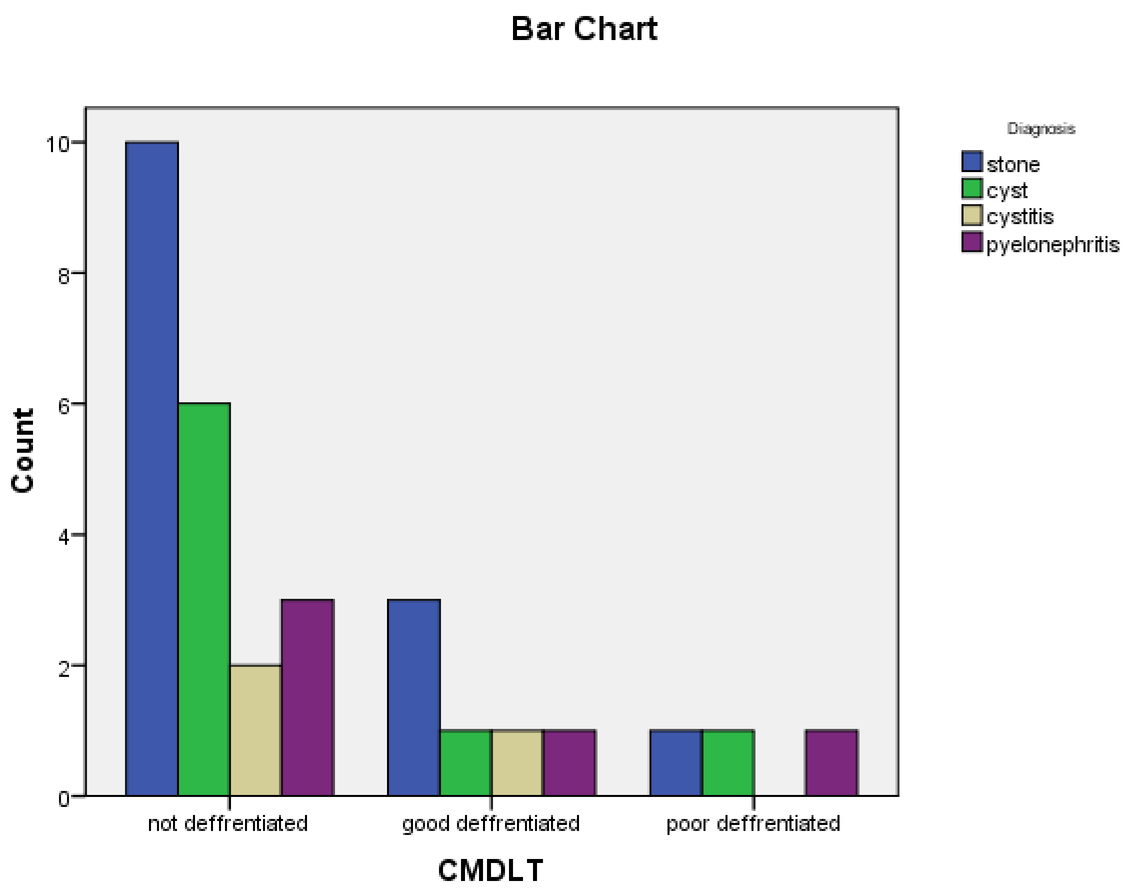


Figure 4.18presented the cross tabulation between Diagnosis and CMD LT Kidney Dimension.

Table 4.24presented the cross tabulation between Diagnosis and UB Wall Thickness.

Crosstab						
		Diagnosis				Total
		stone	cyst	cystitis	pyelonephritis	
UB Wall Thickness	normal	12	7	0	5	24
	Thick	2	1	3	0	6
Total		14	8	3	5	30
Chi-Square Tests		Linear-by-Linear Association			0.628	

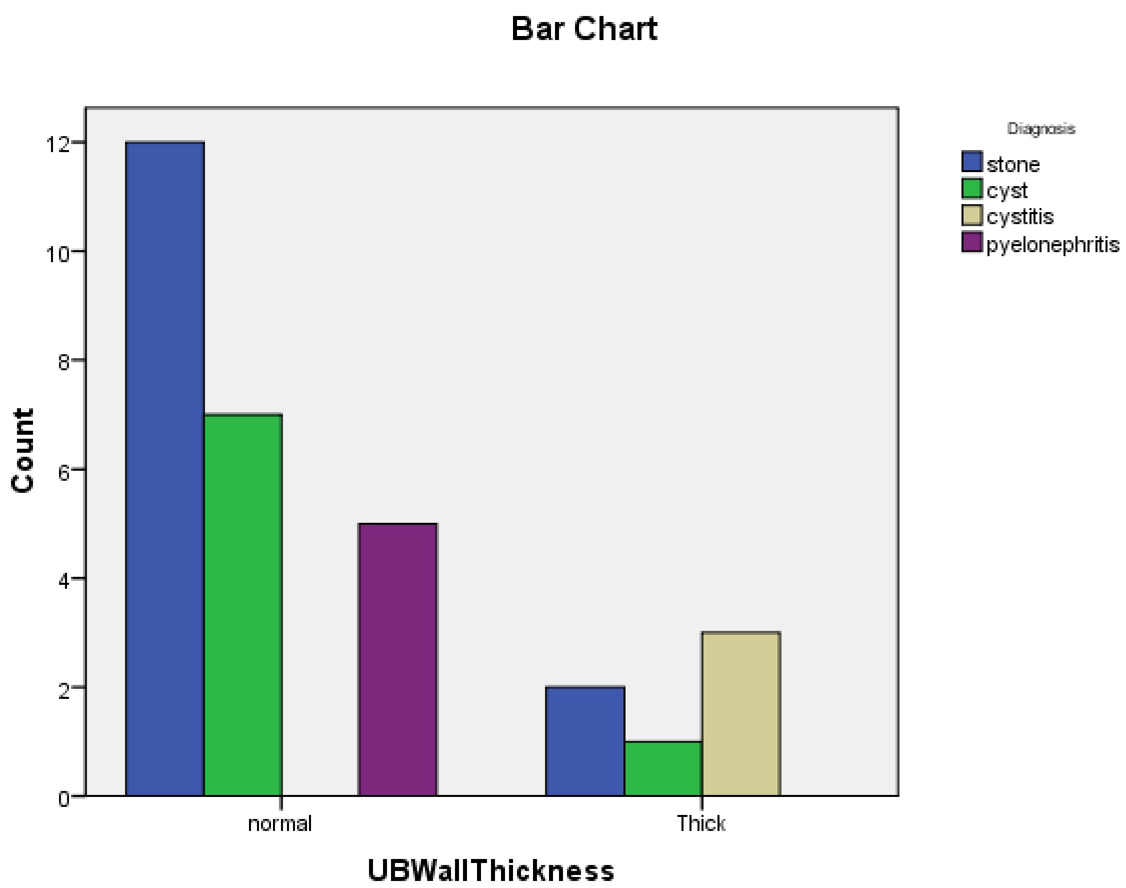


Figure 4.19presented the cross tabulation between Diagnosis and UB Wall Thickness.

Chapter five

Chapter five

{Discussion, conclusions and recommendation}

Discussion 5-1

In the results of the present study in figure (4.1) shows the frequency of haematuria in male (80%) more than female (20%) these result agree with result from previous study .Dr SN Datta, (158 women and 840 .men)

In figurer (4.2 & 4.3) shows the frequency of the dimensions (length & width) in both kidneys average between (33-53) with present (56% in RTK & 36.7 % in LTK) which effected by haematuria this result within the normal dimension in our study between (32-72) this fact make the dimensions of kidney not effected and this agree with result from .previous study Dr SN Datta

The study shows the same percentage (70%) in both RT CMD and LTK CMD according to our result which is measured by observation and experience to evaluate the difference in echognicity between the cortex(whiter) and medulla this percentage is the highest frequency with normal corticomedullary differentiation and this appear in figure .(4.4&4.5)

In figure (4.6) shows the frequency of UB wall thickness normality (80%) more than abnormalities (20%) just four patients in our data have cystitis which is type of inflammations in urinary bladder make the wall of it thick (more than 3mm)(Berwin) . Our study has similar result to Luyao .Shen whom study the infection caused by haematuria

In figure (4.7) shows that the stones present the high frequency with percentage of (46.7%) more than the other causes of haematuria our result agree with Lokken RP, Sadow CA study by CT which detected calculi in .kidneys and ureter

In figure (4.8) shows the LT kidney is most site of pathology causes haematuria in the urinary system more than the RTK and urinary bladder with percentage of (46.7%) this result have the same result was done by . Mohammed Abdalgader in renal system haematuria by CT

In figure (4.9) shows the effected of the RBCs in the urinary system and the high frequency in patients with uncountable RBCs (43.7%) this result agree with our result because the stone the most common cause of .haematuria

A stone is a solid piece of material that forms in a kidney when substances that are normally found in the urine become highly concentrated. A stone may in the kidney or travel down the urinary tract. A small stone may pass on its own causing little pain or no pain. A large stone stuck along the tract and block the flow of urine causing severe pain and bleeding resulting from injuries in tissues (Berwin). Our result has .the same result from the previous study Lokken RP, Sadow CA

In figure (4.10) shows the high frequency of the of the pus cell which is normal frequency with percentage of (76.7%) this result may not accurate because we don’t know the duration time of the infection take and build-up of pus in kidney may leading to formation abscess this make the effect of pus on renal tract need more investigation and studies. Our result disagree with study was done by Jeremy L. McKay and his result .improve that the infection effected in renal tract more than the stones

Conclusion 5-2

Many different imaging modalities have been used in the evaluation of patients with haematuria, and patients frequently require multiple .examinations for work up

The study concludes that the stones are the most common cause of .haematuria and mainly in the LT kidney

.The study found that the male effected by haematuria more than female

The study showed relationship between lab investigations and the injuries .by haematuria in urinary tract

The study also showed that the cystitis is a common cause of the .haematuria

Abdominal ultrasound imaging can demonstrate a wide spectrum of disease in urinary system and provides optimal detection of calculi, a .most cause of haematuria in the study

Recommendations 5-3

:The study ends within the following recommendations

Further studies in evaluation renal dimensions with larger sample of . .population for more accurate results

Further studies must achieve bearing in mind the body weight and . .height

Race must take a place in further studies, for differentiation between . black and white people in kidney measurement regarding to their .environment

.Further studies in evaluation heamaturia by lab investigation.

Appendix

NO	RBCs CELL	PUS CELL
1	UNCONTABLE	
2	UNCONTABLE	
3	UNCONTABLE	
4	20-25	UNCOUNTABLE
5	10-12	
6	UNCONTABLE	
7	20-22	10-12
8	UNCONTABLE	2-5
9	UNCONTABLE	
10	UNCONTABLE	2-5
11	10-12	
12	10-12	
13	22-25	
14	6-8	10-12
15	UNCONTABLE	
16	UNCONTABLE	
17	10-12	
18	5-10	
19	UNCONTABLE	
20	UNCONTABLE	
21	20-22	
22	1-2	
23	UNCONTABLE	5-10
24	UNCONTABLE	
25	10-12	
26	0-1	
27	Non	1-2
28	Non	
29	0-1	
30	Non	