



بسم الله الرحمن الرحيم

Sudan University for Science and Technology



Study of Kidney Diseases in Children Using Ultrasonography

دراسة أمراض الكلى عند الأطفال باستخدام الموجات فوق الصوتية

*A Thesis Submitted for Partial Fulfillment Requirement of M.Sc.
Degree in Medical Diagnosis Ultrasound*

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الآية

الْوَالِدِينَ الَّذِينَ خَلَقَ السَّمَاوَاتِ وَالْأَرْضَ بِقَادِرٍ عَلَىٰ أَنْ يَخْلُقَ
مِثْلَهُمْ بَلَىٰ وَهُوَ الْخَلَّاقُ الْعَلِيمُ

صدق الله العظيم

سورة يس الآية [81]

Dedication

To my parents and husband

To my brothers and sisters

To my friends

Acknowledgement

After thanking Allah Almighty thanks all who contributed and helped out in this research, special to **Dr.Mona Ahmed**, and all the patients who agreed to participate in this study.

Abstract

Kidney diseases (glomerulitis, pyelonephritis, acute renal failure and polycystic kidney disease) in children is an irreversible condition affecting the kidney which eventually progresses to end stage.

50 children with chronic renal disease aged 1-18 years (26 male by 52% and 24 female by 48%) presenting at the ultrasound department at Omdurman hospital for checkup. The cases are collected in this hospital by scanning both kidney (Rt and Lt) longitudinal, transfer, coronal and prone position by using ESAOT pie Medical Aguilamachin and 3.5-5 MHz.

The study found the causes of kidney disease parenchymal disease, acute renal failure 46%, glomerulitis 24%, renal stones 22%, pyelonephritis 4% and polycystic kidney disease also 4%. The stones case some hydronephrosis, the means of CKD of length Rt kidney is 6.2cm, Lt kidneys 6.6cm, width of Rt 3cm and width of Lt 3.2cm cause

The age of chronic disease was found to be at any age from birth onwards.

Congenital cause tend to appear earlier in life. The peak age in this study was found between 10 and 15 years of age because of chronicity of the disease which worsens as the child get older.

المستخلص:

امراض الكلى المزمنة تصعب معالجتها عند حدوثها وقد تتطور لتسبب الفشل الكلوي او ما يسمى بالقصور الكلي لوظائف الكلى, والتي تطرقت لها هي التهابات الكلى الحاد واكياس الكلى المزمنة والحصاوي واعراضها والتهابات انسجة الالكلى وحوضها من الاهدافالرئيسية لهذا البحث معرفة الاسباب والاعراض .

الطريقة المتبعة لخمسون طفلا تم الكشف عليهم بالموجات الصوتية,تتراوح اعمارهم ما بين السنة الى الثامنة عشر نسبة الذكور 52% والاناس 48% عددهم 26 و24 على التوالي هؤلاء الاطفال اتو الى مستشفى الاطفال التعليمي للمتابعة والعلاج وتم عمل الموجات الصوتية لهم في قسم الموجات فوق الصوتية;وجدنا الاتى اعلى نسبة التهابات الكلى الحاد 46%,التهاب انسجة الكلى 24%,حصاوي الكلى 22%التهابات حوض الكلية4% كذلك اكياس الكلى 4%.ايضا عملنا قياس لطول الكلية اليمنى 6.2سم,وعرضها 3سم وطول الكلية اليسرى 6.6سم وعرضها 3.2سم

امراض الكلى ممكن تحدث في اي عمر ونسبة الامراض المكتسبة اعلى من الخلقية وفي الذكور اعلى من الاناس في هذا البحث.

الكشف المبكر بالموجات فوق الصوتية ان يكون ضمن برنامج الرعاية الصحية الاولى للاطفال حتى يتم الكشف المبكر للعيوب الخلقية او الحصاوي او غيرهم في وقت مبكر مما يساعد على ايجاد الحلول المناسبة في الوقت المناسب .

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Abbreviations

CKD:	Chronic Kidney Disease
PCKD:	Polycystic Kidney Disease
ESRF:	End Stage Renal Failure
CAKUD:	Congenital Abnormalities kidney urinary Tract
SD:	Systemic Disease
CPU:	Center ProcessingUnit
CMD:	CorticoMudallaryDiffrenciated
PKD:	Polycystic Kidney Disease
SPSS:	StatisticalPacksforSocial Science

Chapter one

Introduction

Chapter one

Introduction

1.1 Introduction

Chronic kidney disease (CKD) is a major health problem worldwide with increasing incidence and prevalence that is threatening to bring on the onset of a real epidemic. Independent of initial cause, CKD is a clinical syndrome characterized by a gradual loss of kidney function over time. (www.espn-reg-index-jsp)

In particular, the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines have defined CKD as abnormalities of kidney structure or function, present for more than 3 months with implication to health.

Childhood CKD presents clinical features that are specific and totally peculiar to the pediatric age, such as impact of disease on growth. In addition, some of pediatric CKD, such as the etiology or cardiovascular complication, represent variables, not only influencing the health of the patient during childhood, but also having an impact. (www.espn-reg-index-jsp).

On the life of the adult that this child will become. Moreover, CKD has a great psychosocial impact, both on the patients and his family.

Therefore, we must be aware that the increasing survival of pediatric patients with CKD, due to the improvement in the clinical and therapeutic management, will lead to a large number of affected adults facing problems that are specific to CKD that have started during childhood.

The incidence and prevalence of CKD is greater in males than females because of the higher frequency of congenital abnormalities of the kidney and urinary tract (CAKUT). Finally, race is another factor specifically affecting the epidemiology of CKD. (www.espn-reg./index.jsp)

1.2 General Objectives:

To study the cause of chronic renal disease in children using ultrasound.

1.3 Specific objectives

- To determine the relation between chronic renal disease and age of patient.
- To determine the relation between chronic renal disease and gender
- To detect the gain of texture of kidney according to pathology

1.4 Problem of the Study

Renal diseases is a major social health problem. Defining the etiology of the chronic renal failure in children and adolescents could be with the management or delay the development of end stage renal disease.

Chapter two
Literature Review

Chapter two

Literature Review

2.1 Theoretical Background

2.1.1 Anatomy of the kidney

In humans the kidneys are located in the abdominal cavity, and lie in a retroperitoneal position. There are two, one each of the vertebral column, the asymmetry within abdominal cavity caused by the liver typically results in the right kidney being slightly lower than the left, and left kidney being located slightly more medial than the right. The left kidney is approximately at the spine level T12 to L1 and the right slightly lower. The right kidney sits below the diaphragm and posterior to the liver, the left is below the diaphragm and posterior to the spleen. Each adult kidney weighs between 125 and 170 grams in male and 115 to 155 gram in females.

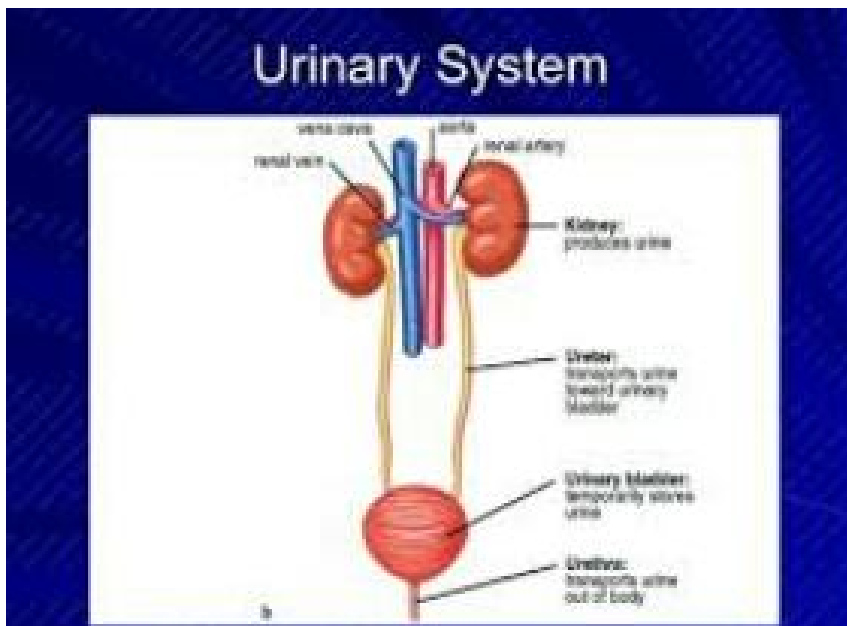


Figure (2.1) Anterior view of urinary system (Basic Anatomy 2004)

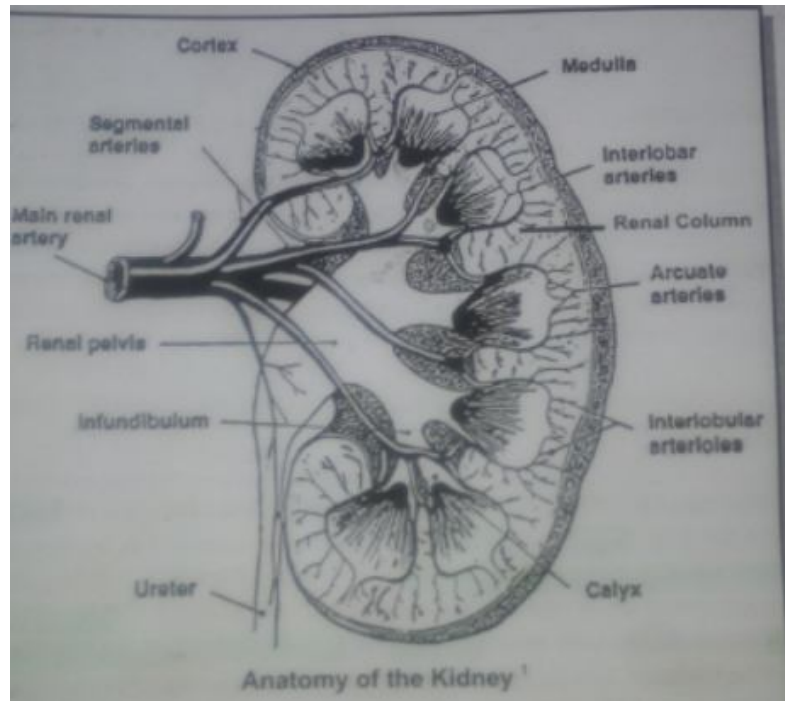


Figure (2,2) Diagram of renal artery. (Bruwiler 2001)

The superior border of the right kidney is adjacent to the liver, and the spleen for the left kidney. The kidney is approximately 11-14cm in length, 6cm in width and 4cm thick. The substance, or parenchyma, of the kidney is divided into two major structures; superficial is renal cortex and deep is renal medulla. Generally, these structures take the shape of 8 to 18 cone-shaped renal lobes, each containing renal cortex surrounding a portion of medulla called renal pyramid [of Malpighi]. Between the renal pyramids are projections of cortex called renal columns [of Bertin]. Nephrons, the urine-producing functional structures of the kidney, span the cortex and medulla, (Sumaira -2011).

The initial filtering portion of a nephron is the renal corpuscle, located in the cortex, which is followed by a renal tubule that passes from the cortex deep into the medullary pyramids. Part of the renal cortex, a medullary ray is a collection of the renal tubules that drain into a single collecting duct. The tip, or papilla, of

each pyramid empties urine into minor calyx, that drain into major calyces and into the renal pelvis, which becomes the ureter, (Sumaia -2011).

The kidney has a bean shaped structure, each kidney has concave and convex surface, the renal hilum, is the point at which the renal artery enters the organ, and the renal vein and ureter leave. The kidney is surrounded by tough fibrous tissue, the renal capsule, which is itself surrounded by perinephric fat, renal fascia and paranephric fat. The anterior border of these tissues is peritoneum, while the posterior border is transversalis fascia, (Sumaia - 2011).

2.1.1.1 Blood supply of the kidney

The kidneys receive blood from the renal arteries, left and right which branch directly from abdominal aorta. Despite their relatively small size, the kidneys receive approximately 20 percent of the cardiac output.

Each renal artery branches into segmental arteries divided further into interlobar arteries which penetrate the renal capsule and extend through the renal columns between the renal pyramids. The interlobar arteries then supply blood to the arcuate arteries that run through the boundary of the cortex and medulla. Each arcuate artery supplies several interlobular arteries that feed into the afferent arterioles that supply the glomeruli.

The interstitium is functional space in the kidney beneath the individual filters [glomeruli] which are rich in blood vessels. The interstitium absorbs fluid recovered from urine. Various conditions can lead to scarring and congestion of these areas, which can cause kidney dysfunction and failure. After filtration occurs the blood moves through a small network of venules that converge into interlobular veins. As with the arteriole distribution the veins follow the same pattern, the interlobular provide blood to the arcuate veins then back to the

interlobar veins which come to form the renal vein exiting the kidney for transfusion for blood, (Maten,2007).

2.1.1.2 Nerve supply of the Kidney

The kidney and nervous system communicate via the renal plexus, whose fibers course along the renal arteries to reach the kidney. Input from the sympathetic nervous system triggers vasoconstriction in the kidney, thereby reducing renal blood flow, the kidney is not thought to receive input from the parasympathetic nervous system. Sensory input from the kidney travels to T10-11 levels of the spinal cord and is sensed in corresponding dermatome. Thus, pain in the flank region may be referred from the kidney. (Hopking et al-1993)

2.1.2 Physiology of the kidney

The kidneys are an organ that has several functions. They are an essential part of the urinary system and also several homeostatic functions such as the regulation of electrolytes, maintenance of acid-base balance, and regulation of blood pressure. They remove wastes which are directed to the urinary bladder. In producing urine, the kidneys excrete wastes such as urea and ammonium; the kidneys are responsible for the reabsorption of water, glucose and amino acids. The kidneys produce hormones including calcitriol, renin and erythropoietin. (Born et al, 2004)

2.1.2.1 Function Of the kidney

The kidney participates in whole-body homeostasis, regulating acid-base balance, electrolyte concentration, extracellular fluid volume, and regulation of blood pressure. Various endocrine hormones coordinate these; these include renin, angiotensin II, aldosterone, antidiuretic hormone, and atrial natriuretic peptide, among others (Ahmed Zade -2002)

2.1.2.2 Excretion of wastes

The kidneys excrete a variety of waste products produced by metabolism. These include the nitrogenous wastes urea, from protein catabolism, and uric acid, from nucleic acid metabolism, (Boron et al., 2004).

2.1.2.3 Acid-base homeostasis

Two organ systems, the kidney and lungs, maintain acid-base homeostasis, which is the maintenance of pH around a relatively stable value. The kidneys contribute to acid-base homeostasis by regulating bicarbonate [HCO_3^-] concentration. The kidneys have two important roles in the maintaining of acid-base balance; to reabsorb bicarbonate from and excrete hydrogen ions into urine. (Nafar M., 2008).

2.1.2.4 Osmolality regulation

Any significant rise in plasma osmolality is detected by the hypothalamus. Which communicates directly with the posterior pituitary gland. An increase in osmolality causes the gland to secrete antidiuretic hormone [ADH], resulting in water reabsorption by the kidney and an increase in urine concentration. The two factors work together to return the plasma osmolality to its normal levels, (Boron et al., 2004).

ADH binds to principal cells in the collecting duct that translocate aquaporins to the membrane allowing water to leave the normally impermeable membrane and be reabsorbed into the body by vasa recta, thus increasing the plasma volume of the body. There are two systems that create a hyperosmotic medulla and thus increase the body plasma volume; urea recycling and the single effect. (Berg et al., 2009)

Urea is usually excreted as a waste product from the kidneys. However, when plasma blood volume is low and ADH is released, the aquaporins that are opened

are also permeable to urea. This allows urea to leave the collecting duct into the medulla creating a hyperosmotic solution that attracts water. Urea can then re enter the nephron and be excreted or recycled a gain depending on whether ADH is still present or not.

The single effect describes the fact that the ascending thick limb of the loop of Henle is not permeable to NaCl. This means that a countercurrent system is created whereby the medulla becomes increasingly concentrated setting up an osmotic gradient for water to follow should the aquaporins of the collecting duct be opened by ADH. (Francisco-2010)

2.1.2.5 Blood pressure regulation

Long-term regulation of blood pressure predominantly depends upon the kidney. This primarily occurs through maintenance of the extracellular fluid compartment, the size of which depends on the plasma sodium concentration. Although the kidney can not directly sense blood pressure, changes in the delivery of sodium and chloride to the distal part of the nephron alter the kidney's secretion of the enzyme renin. When the extracellular fluid compartment is expanded and blood pressure is high, the delivery of these ions increases and renin secretion decreases. Similarly, when the extracellular fluid compartment is contracted and blood pressure is low, sodium and chloride delivery decreases and renin secretion is increased in response, (Tariq Hakim-2009).

Renin is the first in a series of important chemical messengers that comprise the renin-angiotensin system. Change in renin ultimately alters the output of this system, principally the hormones angiotensin II and aldosterone. (Tariq Hakim-2009)

Each hormone acts via multiple mechanisms, but both increase the kidney's absorption of sodium chloride, thereby expanding the extracellular fluid

compartment and raising blood pressure, conversely. When renin levels are elevated, the concentration of angiotensin² and aldosterone levels decrease, contracting the extracellular fluid compartment, and decreasing blood pressure, (Dr. Tariq Hakim-2009).

2.1.2.6 Hormone secretion

The kidneys secrete a variety of hormones, including erythropoietin, calcitriol, and renin. Erythropoietin is a response to hypoxia [low levels of oxygen at tissue level] in the renal circulation; it stimulates erythropoiesis [production of red blood cells] in the bone marrow. (Hopkins et al 1993)

Calcitriol, the activated form of vitamin D, promotes intestinal absorption of calcium and the renal reabsorption of phosphate, part of the renin-angiotensin-aldosterone system. Renin is an enzyme involved in the regulation of aldosterone levels. (Hopkins et al 1993)

2.1.3 Renal pathology

Most kidney diseases attack the nephrons, causing them to lose their filtering capacity. Damage to the nephrons can happen quickly, often as the result of injury or poisoning. But most kidney diseases destroy the nephron slowly and silently. Only after years or even decades will the damage be apparent. Most kidney diseases attack both kidneys simultaneously. People with a family history of any kind of kidney problem are at risk for the kidney disease. (Ayans, 1995).

2.1.3.1 Glomerular diseases

Several types of kidney disease are grouped together under this category, including autoimmune disease, infection, related disease, and sclerotic disease. As the name indicates, glomerular diseases attack the tiny blood vessels or glomeruli, within the kidney. (Carol Rumak, 2005).

The most common primary glomerular diseases include membranous nephropathy, IgA nephropathy, and focal segmental glomerulosclerosis. The first sign of glomerular disease is often proteinuria, which is blood in urine, some people may have both proteinuria and hematuria. Glomerular diseases can slowly destroy kidney function. Blood pressure control is important with any kidney disease. Glomerular diseases are usually diagnosed with biopsy.

Treatments for glomerular disease may include immunosuppressive drugs or steroids to reduce inflammation and proteinuria, depending on the specific disease. (Ahmed, Zada- 2012).

2.1.3.2 Inherited and congenital kidney disease

Some kidney diseases result from hereditary factors. Polycystic kidney disease [PKD], for example, is a genetic disorder in which many cysts grow in the kidney. PKD cysts can slowly replace much of the mass of the kidneys, reducing kidney function and leading to kidney failure. Some kidney problems may show up when a child is still developing in the womb. Examples include autosomal recessive PKD, a rare form of PKD, and other developmental problems that interfere with normal formation of the nephrons. The signs of kidney disease in children vary. A child may grow unusually slowly, vomit often, or have back or side pain, some kidney diseases may be silent- causing no signs or symptoms –for months or years. If a child's doctor should find it during a regular checkup, The first sign of kidney problem may be high blood pressure ; a low number of red blood cells, called anemia ; proteinuria or hematuria. If the doctor finds any of these problems, further tests may be necessary, including additional blood and urine tests or radiology studies, in some cases, the doctor may need to perform a biopsy. Some hereditary kidney diseases may not be detected until adulthood. The most common form of PKD was once called adult PKD because the symptom of high blood pressure and

renal failure usually do not occur until patient are in their twenties or thirties, But with advances in diagnostic imaging, technology, doctors have found cysts in children and adolescents before any symptoms appear (Gulatis, et al -1999).

Chronic kidney disease has four stages depending on the glomerular filtration rate [GFR]. patient would be quite normal during the first and second stages. Symptoms start to appear when the kidney lose two thirds stage of their physiological function. Diagnosis of chronic kidney disease is established when the patient presents to the medical care center complaining of symptoms like failure of thrive or chronic ill health. When there is chronic insult and damage to the kidneys, fibrosis occurs, replacing the normal parenchymal tissue. this is detected by ultrasound as increase echogenicity when the kidney are fibrosed they loss their function and become small. This is detected by decrease in size of the kidney. (Almousawi, 2002).

2.1.3.3 Medical Renal Diseases

This include a group of diseases that cause alteration in ;Renal size and parenchymal echogenicity that its are includes acute inflammatory diseases like; nephritis, acute glomerulitis, acute pyelonephritis, acute renal failure, chronic renal pyelonephritis, (Carol M, Rumac. 2005).

In all acute inflammatory disease except glomerulonephritis the kidney are enlarge and the renal parenchymal echogenicity is reduce due to inflammation and edema, (Carol M, Rumac. 2005).

-In case of glomerulonephritis the kidneys are enlarge in size, increase cortical echogenicity and prominent pyramids.

-Acute pyelonephritis is a tubulointerstitial inflammation of the kidney, Most adult present with ;flank pain, fever and can be diagnosed clinically with the acid of laboratory studies, (Burwin, 2001).

-chronic pyelonephritis is an interstitial nephritis often associated with vesicoureteric reflux

Reflux nephropathy is believed to cause 10 -30percent of all cases of end stage renal disease [ESRD].Usually begins in childhood and more common in women.(Carol ,M Rumac).

2.1.3.4 Acute renal failure [acute renal disease]

Is consider acute if is develops over days or weeks, and chronic if it spans month or years. Main purpose of the ultrasound is to exclude hydronephrosis, (Carol M, Rumac 2005)

2.1.3.5 Chronic Renal failure

Gradual loss of kidney function is called chronic kidney disease [CKD] or chronic insufficiency, people with CKD may go on to develop permanent kidney failure.(Carol M, Rumac 2005)

2.1.3.6 Renal cysts

Simple cysts ;The incidence increase with age,more common over the agesixty years.One half of all adult'sorder than age 50 have simple renal cystsThese cysts are true and have a serous epithelial lining and fluid filled,is benign and cortical massAcquiredrenal cysts Can associated with tuberous sclerosis and dialysis diseaseCongenital cysts disease; There are two main congenital cystsof thekidney -Adult Polycystic kidney disease [APKD]-Infantile Polycystic disease.(Burwin 2001)

2.1.3.7Stages of CKD

A person'swith GFR is the best indicator of how well the kidneys are working.An with GFR of 90 or above considered normal.A person's whose with GFR remains below 60 for 3 months or longer has CKD.As kidney function declines, the risk of complications rises,(Nafar.M2008).

2.1.2.3.8 Kidney failure [GFR less than 15].

When the kidneys do not work enough to maintain life, dialysis or a kidney transplant will be needed, (Nafar.M2008).

2.1.2.3.9. Management ofCKD

People in early stages of CKD may be able to make their kidneys last longer by taking certain steps,(Sumia – 2011).

Controlling Blood Pressure; control their blood pressure with an ACE inhibitor or an ARB. Many people require two more types of medication to keep their blood pressure below 130/80. A diuretic is an important addition. When the ACE inhibitor or ARB does not meet the blood pressure goal. Protein is important to the body, it helps the body repair muscles and fight disease. Healthy kidneys take waste out of the blood but leave in the protein impaired the kidneys. People with CKD can work with a dietitian to create the right food plan,(Sumia – 2011).

cholesterol; High levels of cholesterol in the blood may result from a high fat diet. Cholesterol can build up on the inside walls of the blood vessels. The build up in the vessels makes it harder for the heart and can cause heart attacks and strokes, (Sumia – 2011).

Sodium; is a chemical found in salt and other food. Sodium in the diet may raise a person's blood pressure, so people with CKD should limit foods that contain high levels of sodium,(Sumia – 2011).

Potassium; is a mineral found naturally in many fruits and vegetables. Diseased kidneys may fail to remove excess potassium. With very poor kidney function, high potassium levels can affect the heart rhythm.

2.1.3.10 Preparing for End stage Renal Disease[ESRD]

A person needs to make several decisions. people in later stage of CKD need to learn about their options for treating the last stage of the kidney failure so they can make an informed choice between hemodialysis, peritoneal dialysis, and transplantation, (Sumia – 2011).

2.1.3.11 Chronic Renal failure

Most kidney problems, happen slowly. A person may have silent kidney disease for years. Gradual loss of kidney function is called chronic kidney disease. people with CKD may go on to develop permanent kidney failure, (Hopking.1995).

2.1.3.12 Renal cysts

Simple cysts, The incidence increase with age over sixty years.

Acquired renal cysts, associated with tuberous sclerosis and dialysis.

Congenital cystic disease, there are two ;Adult polycystic kidney disease [APKD] and Infantile Polycystic kidney disease' or Autosomal recessive polycystic kidney disease. Divided into 4 type; Perinatal, neonatal, infantile and juvenile. Multicystic Dysplastic kidney. (Burwin 2001).

2.1.3.13 End –stage renal disease

Total or nearly total and permanent kidney failure is called end stage renal disease [ESRD] people with ESRD must under go dialysis or transplantation to stay a live Some sign, swelling in face or feet, feel itchy or numb, get muscle cramps. (Sumia – 2011).

As the cortex develops the pyramidal cortical proportions gradually assume the adult proportions, this is accomplished during the first year of life. The sinus is poorly echogenic because it contains little fat, the fat accumulation occurs gradually and sinus echogenicity achieves.

Normal renal measurements in adult the size is affected by age sex [greater in men than women]and body size, (Sumia – 2011).

2.1.3.14 Medical tests to detect kidney disease

Three simple tests to screen for kidney disease; a blood pressure measurement, a spot check for protein or albumin in the urine and calculation of glomerular filtration rate [GFR]based on a serum creatinine measurement. Measurementurea nitrogen in the blood provides additional informationIf blood and urine tests indicate reducedkidney function, a doctor may recommend additional tests to help identify the cause of the problem, (.Ayan – 2004)

2.1.3.15 Kidney biopsy

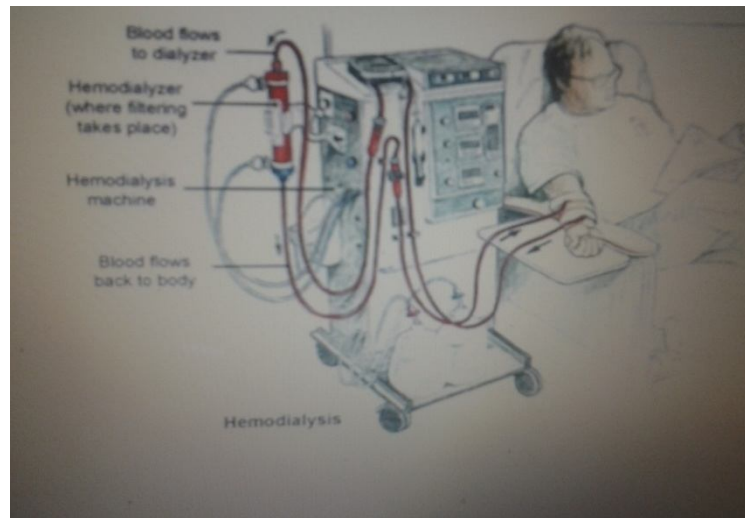
Itis a hospital procedure in which the doctor inserts a needle through the patient's skin into the back of the kidney, (Pryia–2002).

2.1.3.16. Dialysis

The two major forms of dialysis are hemodialysis and peritoneal dialysis

2.1.3.1.17 Hemodialysis

Hemodialysis uses a special filter called dialyzer that function as an artificial kidney to clean the blood. The dialyzer is a canister connected to the hemodialysis machine, during treatment the blood run from tube to dialyzer, which filters out wastes, extra salt and extra water. Then the clean blood flows through another tubes back into the body. This treatment take about center three times per week for 3to 4hour.,(Awadallh-2016).



Figure(2-3)diagram of hemodialysis (Medical Ultrasound, Wikipedia)

2.1.3.18 Peritoneal Dialysis

In peritoneal dialysis use a fluid called dialysis solution is put into the abdomen, this fluid captures the waste products from a person's blood after a few hours when the fluid is nearly saturated with wastes. The fluid is drained into the catheter and a fresh bag of fluid is put into the abdomen to continue the cleansing process.(Faridi MA- 2003)

2.1.3.19 Transplantation

A donated kidney may come from an anonymous donor who has recently died or from a living person, usually a relative.

The kidney must be a good match for the patient's body, the sonography plays an important role in the initial and long term follow-up of renal transplants, (Burwin – 2001)

2.1.3.4 Normal Renal Sonographic Appearance in pediatric

Children's kidneys appear different from adults

Infant kidneys are large compared to overall body size –typically 4to 5 cm long at birth, Theechogenicity of the renal cortex exceed normal liver echogenicity usually for the first 3 years of life,The renal pyramids appear large because the cortex is relatively thin and hyperechoic.



Image (2-4) longitudinal view of Normal Renal Apparent (Medical Ultrasound, Wikipedia)

2.1.3.5 Renal sonographic pathology

2.1.3.5.1 glomerulitis

In case of glomerular disease,both kidneys are affected and size may range from normal to markedly enlarged.

The echo pattern of the cortex is altered with medullary spring and may normal hypoechoic or hyperechoic.

Chronic glomerulonephritis is characterized pathologically by varying degrees of glomerular scarring that is always accompanied by cortical tubular atrophy,interstitial fibrosis,interstitial infiltrationby chronic inflammatory cells and arteriosclerlosis.



Image (2-5-)glomerulitissumia -2011

2.1.3.5.2.Renalcalculi

The stone in the kidney is visible as anechogenic focus with posterior shadow and variable in sizes ranging from 4mm to more than 4cm, whenever a stone is seen a detail survey should be done to exclude associated calculi in same or opposite site kidney and signs of obstruction. Stone in the renal pelvis will usually cause hydronephrosis, long standing of stone can be cause chronic kidney disease and many patients reached end stage renal disease and went for dialysis Signs and symptoms (FBecherucci 2016).

The most common sign of kidney stone in older children and teens is sudden onset of pain in the back or side. The pain is usually constant and severe, and often causes nausea and vomiting. This pain may move into the groin area as the stone passes down the urinary tract. Most of the time, this causes blood to appear in the urine. Often this is only detectable by testing the urine for blood but sometimes it is visible to the naked eye. (FBecherucci 2016).



Fig(2-6).Show left kidney stone,causing moderat hydnonephrosis(Medical Ultrasound, Wikipedia)



Fig (2-7).Show right kidney stone(Medical Ultrasound, Wikipedia)

Causing of kidney stones

In most children and teens, kidney stones are due to the diet and/or amount of fluid the child drinks. In some children, however, they are the result of a: Specific inherited problem, Blockage of urine flow and kidney infection. (Priya et-al, 2014).

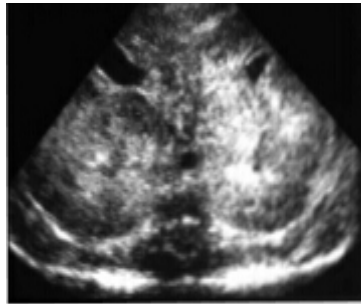
2.1.3.5.3 Polycystic kidney disease

Polycystic kidney disease, a disorder that can be diagnosed in adult and pediatric patients, is an inherited disease that involves bilateral renal cyst without dysplasia. The condition is broadly divided into 2 forms: autosomal recessive polycystic kidney disease, previously known as infantile polycystic kidney

disease, and autosomal dominant polycystic kidney disease, previously known as adult polycystic kidney disease.(Priya,2014).

2.1.3.5.4 Autosomal recessive polycystic kidney disease

Autosomal recessive polycystic kidney disease is characterized by cystic dilatation of renal collecting ducts associated with hepatic abnormalities of varying degrees, including biliary dysgenesis and periportal fibrosis.(Pryia,2014)



Fig(2-8) Show autosomal recessive polycystic kidney disease

2.1.3.5.5 Autosomal dominant polycystic kidney disease

Autosomal dominant polycystic kidney disease is the most common inherited kidney disease in humans. It is a multisystem disorder characterized by progressive cystic dilatation of both kidneys.



Fig(2-9). Autosomal dominant polycystic kidney disease

2.1.3.5.6 Pyelonephritis

Is an infection of the kidney tissue, calyces and renal pelvis, it is commonly caused by bacterial infection that has spread to the urinary tract or travelled through the blood stream to the kidney. (Priya, 2014)

Classification

Acute pyelonephritis

Acute pyelonephritis is an exudative purulent localized inflammation of renal pelvis (collecting system) and kidney. The kidney parenchyma in the interstitium abscesses (suppurative necrosis), consisting in purulent exudate (pus): neutrophil, fibrin, cell debris and central germ colonies (hematoxylinophilic). Tubules are damaged by exudate and may contain neutrophil casts. In the early stages, the glomerulus and vessels are normal. Gross pathology often reveals pathognomonic radiations of bleeding and suppuration through the renal pelvis to the renal cortex. (Priya, 2014).

Chronic pyelonephritis Chronic pyelonephritis implies recurrent kidney infection and can result in scarring of renal parenchyma and impaired function, especially in the setting of obstruction. (Priya Verghese, 2014).



Figure 2.10 pyelonephritis (Dr. Ahmed et-al).

2.1.4 Technique:

Physics and Equipment

Mechanical wave (sound wave) is the propagation of energy through a medium by cycle pressure vibration. It requires a deformable medium for propagation. (Dr Asafi, 2015).

Interaction of ultrasound with tissue, in diagnostic ultrasonography the recorder image is based on the reflected echoes is generated by a transducer and then directed to the body organs. The ultrasound waves interact with body tissues similar to light wave behavior. Types of an interactions include; reflection, scattering, diffraction, divergence, interference and absorption. (Dr Alsafi, 2015).

Transducer: Is a device that converts energy from one form to another. Usually a transducer converts a single energy in one form of energy to a single in another. (Agarwal, Anat, 2005) Components of the transducer include; the case, the piezoelectrical crystal, the Backing material and matching layer. The case is usually plastic its normally sealed and can not be open unless at the manufacturer's laboratory, Electrical insulation is particularly important to protect operator from the accidental shock. The piezoelectrical crystal is the heart of the transducer. The backing material is found behind the piezoelectrical crystal, the main function is to damp the ultrasound pulse. The matching layer is called quarter wave impedance matching layer its improves the sensitivity to detect very weak echoes and provide effective transmission of sound wave from the element to soft tissue and vice versa. (Dr Alsafi, 2015), A central processing unit (CPU), include a monitor, a keyboard with control knobs, disk storage devices and a printer, all of them to display image. (Dr, Alsafi 2015).

The basic ultrasound machine used in most settings is the transabdominal it uses a transducer to send out high-frequency sound waves that bounce off the

structures inside the body. Before beginning the scanning we use the gel on the body for the acoustic impedance of air when an ultrasound beam traveling perpendicular strikes the air, tissue interface almost the entire beam is reflected. (Thomas et al, 2015).

2.2.Previous Studies

- Somia was found the chronic kidney disease in children to be more common in boys than girls with a ratio of 1:8:1 in 2011.

-Congenital cause tend to appear earlier in life.The peak age of presentation in this study was found between 11 and 12 years of age because chronicity of disease which worsens as the child gets older.

-The cause of chronic kidney disease in this study was found to be as follows:

44% were have chronic parenchymal disease possibly due to chronic glumeronephritis, or other cause unknown , 20% of cause of obstruction due to stones, 8% cause by systemic disease, 14% cause by posterior urethral valve, 4% cause by congenital dysplastic kidney, 2% cause bladder outlet obstruction and 27.7% of males in this study were found to have posterior urethral valve.

-Analyzing the location, we found that 28% of patients were from stat of khartum, 18% from darfor, 16% from kurdufan, 12% from Aljazeera, 8% from north state, 6% from waite Nile, and 2% from red Nile.

-No patient from the south.

-The kidney size is reduce in case of chronic parenchymal disease and increase in case of hydronephrosis.(Somia.2011).

F. Becrucci, found CKD is a sly disease. Although relatively uncommon in children, CKD can be a devastation illness with many long-term consequences (figure 3). In fact, the mortality rate for children with ESRD receiving dialysis therapy is 30-150 times higher than in the general paediatric population and the life expectancy for a child on dialysis is -50 years less than a healthy child [9,19,105.]. Kidney transplantation is characterized by a significant improvement in prognosis and is the best therapeutic option of children with ESRD. However, most of the complication of this

clinical syndromes have consequences on the patients' health well before kidney function is irreversibly lost, even when it is maintained stable over time with conservative therapy. On the other hand, clinical and laboratory findings of kidney disease in adult may find an explanation in kidney function and/or structural abnormalities that already existed during infancy and childhood but that may have been missed or underdiagnosed because of being clinically silent. Therefore, nephrologists, should have a global vision of their patients, regardless of whether the patient with CKD is a child or adult. In addition, despite similarities to the adult, CKD in children presents unique features and challenges that are not usually faced by adult patients and that make paediatric CKD a stand-alone nosologic entity.

In summary, nephrologists, whether caring for children or for adult with CKD, should have a global vision of their patients: the first with a look towards the future, and the other to the past. (F Becherucci, 2016).

BAwardy assessed the children with CKD comprise a very small but important portion of the total CKD population. Whereas disorders associated with its development are well delineated, the availability of valid and widespread information regarding the epidemiology of the CKD in children requires additional efforts, such as the *italkid* project, in which early identification and longitudinal follow-up are key practices. This information will, in turn, serve as the basis upon which to judge the impact that observational trials such as CKD and interventional trials such as *ESCAPE* have on the evolution of CKD during childhood. (BAwardy, 2007).

Vijay kumar M, studied a large number of clinicopathological conditions can produce renal damage in children. Anticipation, early recognition and institution of preventive measures can reduce the morbidity, mortality and the economic burden due to CKD. In a country like India, where dialysis and

transplantation care is not within the reach of many children, steps should be taken to prevent the onset and progression of CKD in childhood.(Vijaya kumar,2004).

Chapter three

Materials and Methods

Chapter three

Material and Methods

3.1 Materials

3.1.1 Patient

This research carried out in 50 patients 26(50%) male and 24(48%) female with age between 1-18 years.

Inclusion done for patient diagnosis by chronic renal diseases.

Any case of acute KD and any case of chronic renal disease aged more than 18 years.

3.1.4 Study Area

This study conducted in Khartoum state at Omdurman hospital.

3.1.5 Duration of Study

This study conducted in period from February 2017-july 2017.

3.1.6 Variaton of Study

Age, gender, length, and weight of the patient.

3.1.7 Machine Used

ESAOTE Pie Medical

Aguila, Modelnr:40853, Rev:A, Ser.nr:06170012, malns:220-240k.

3.2 Methods Study design and ultrasonographic examination.

3.2.1 Technique Used.

-Investigation protocols.

The following technique was applied to allow visualization of both kidneys and proximal ureter, so that I used trans abdominal probe (3.5-5MHs) curvi-linear.

- patient proration: none

The patients were placed and examined in supine and prone positions, and the two kidneys were scanned during suspended respiration. Gel is used for acoustic impedance of air when an ultrasound beam travelling perpendicularly strikes the air. Two images (longitudinal and transverse) were taken of each kidney.

3.2.2 Data Analysis.

Data were analyzed and displayed statistically in tables and SPSS.

Chapter four

Results

Chapter four

Results

Table [4-1], Showing distribution of Age

	Frequency	Percentage	Valid Percentage
0-5	7	14.0	14.0
5-10	11	22.0	22.0
10-15	21	42.0	42.0
>15	11	22.0	22.0
Total	50	100.0	100.0

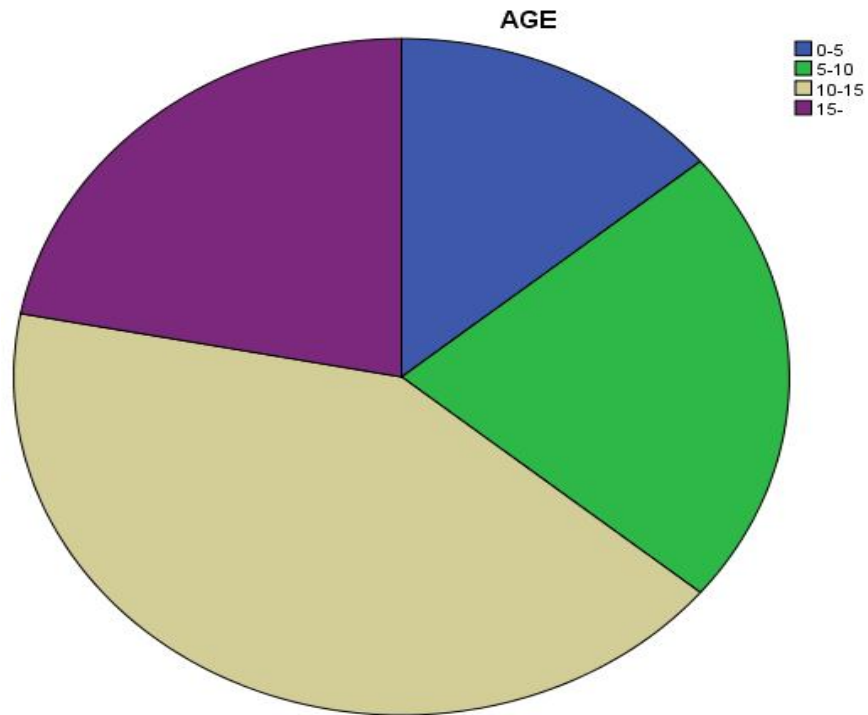


Table [4-2], Showing distribution of Gender

	Frequency	Percentage	Valid Percentage
male	26	52.0	52.0
female	24	48.0	48.0
Total	50	100.0	100.0

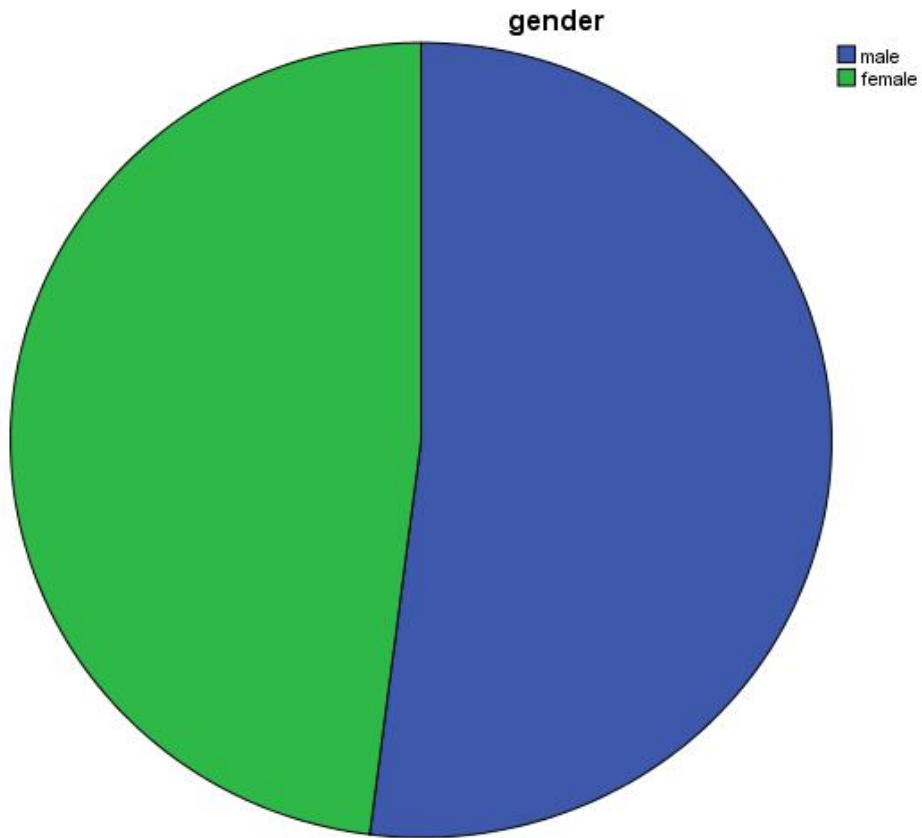


Table [4-3], Showing distribution of pathology

	Frequency	Percentage	Valid Percentage
Acute Renal Failure	23	46.0	46.0
Renal Stones	11	22.0	22.0
Glumerulitis	12	24.0	24.0
pyelonephrosis	2	4.0	4.0
Polycystic	2	4.0	4.0
Total	50	100.0	100.0

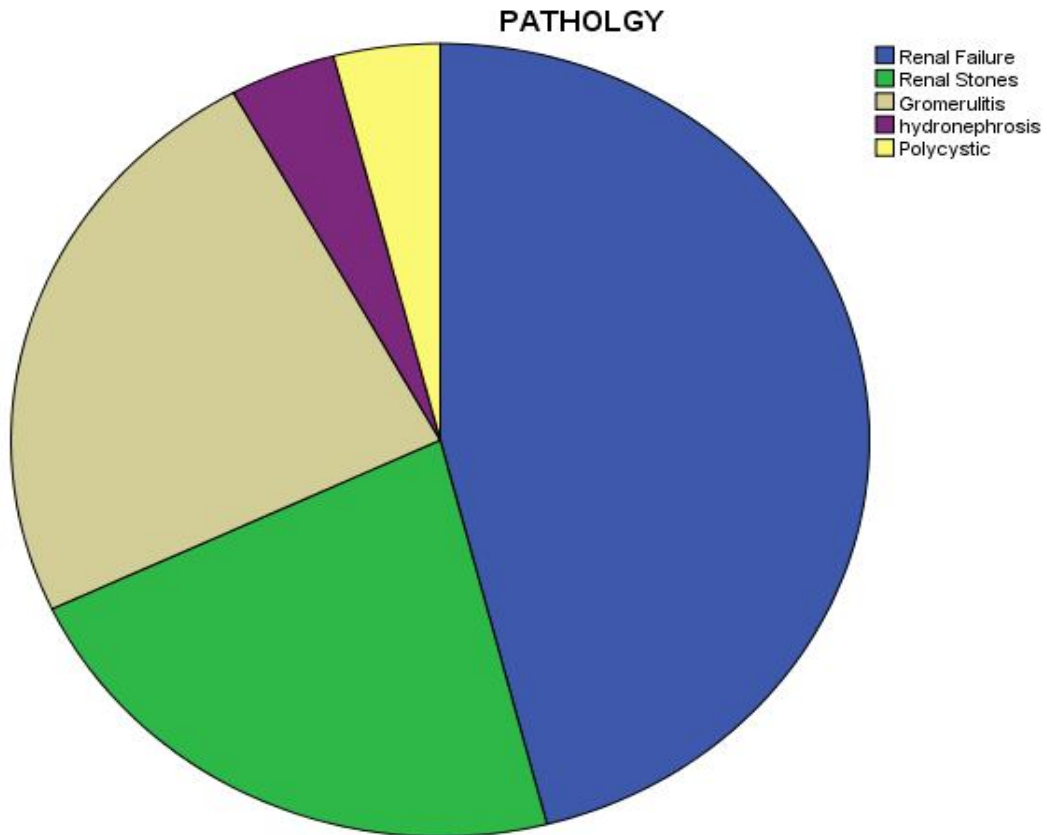


Table [4-4], Showing the distribution of texture

	Frequency	Percentage	Valid Percentage
Hyperechogenic	20	40.0	40.0
Hypoechoogenic	27	54.0	54.0
Isoechoic	3	6.0	6.0
Total	50	100.0	100.0

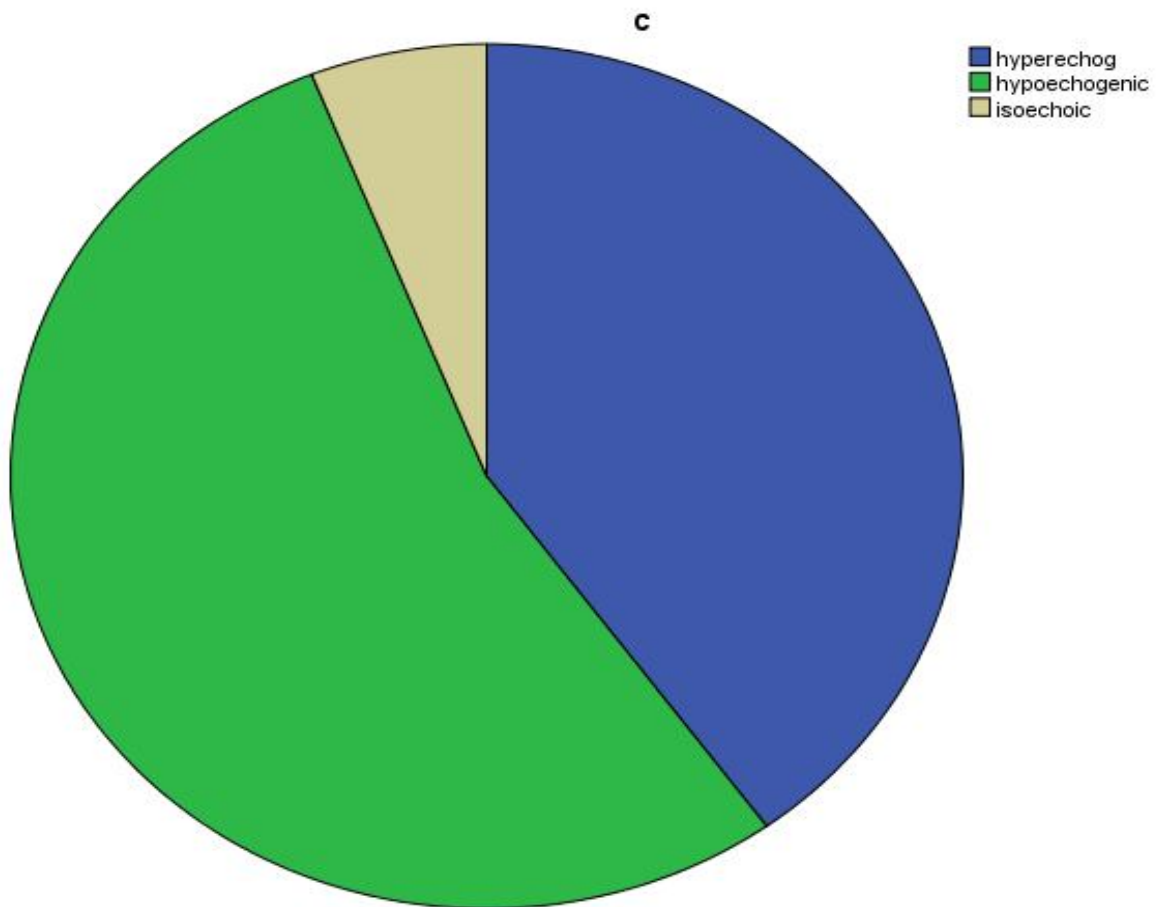
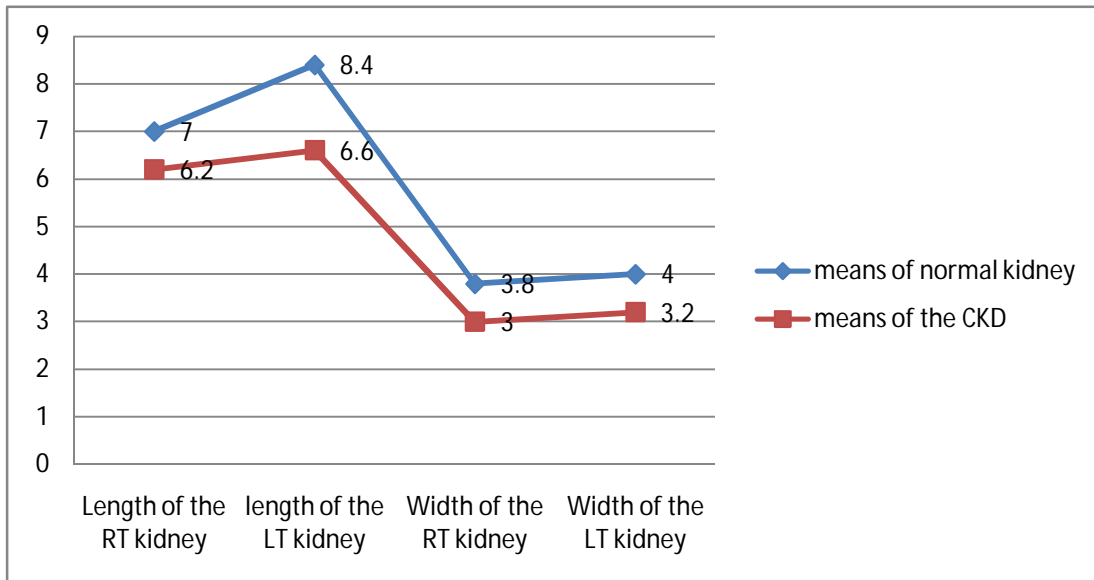
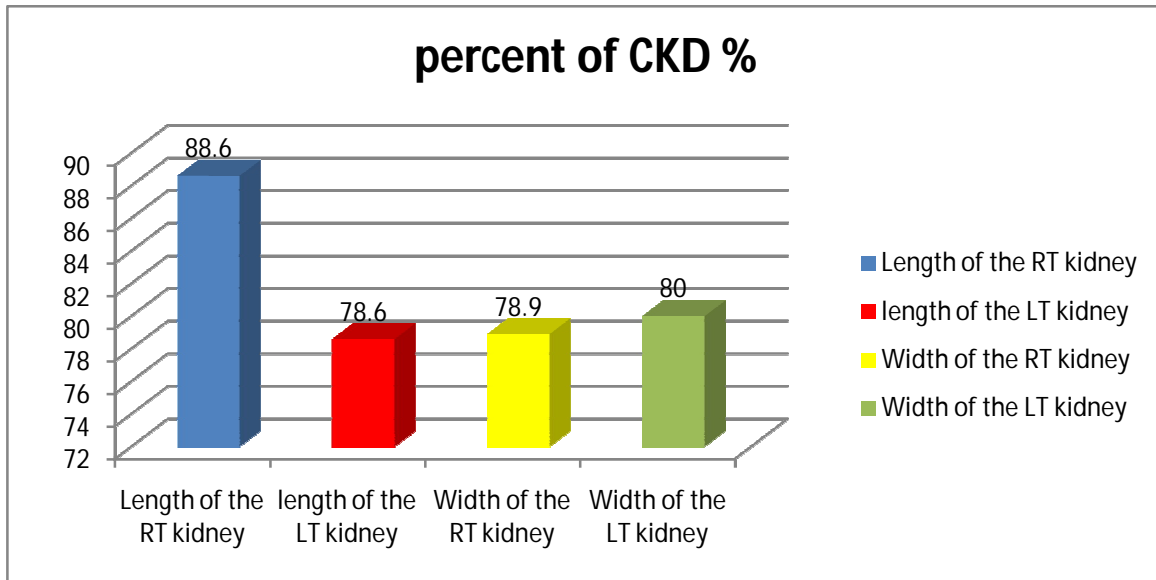


Table [4-5], Means of CKD:

CKD	means of normal kidney	means of the CKD
Length of the RT kidney	7	6.2
length of the LT kidney	8.4	6.6
Width of the RT kidney	3.8	3
Width of the LT kidney	4	3.2





Chi-Square Tests

Sig.(P.value)	Chi-Square (χ^2)	df
0.028	4,817	1

From the previous table, the value of P-value is 0.028 (2.8%) and is less than 5%. Therefore, we reject the null hypothesis that there is an independence between height and weight. We accept the alternative assumption that weight and height are not independent.

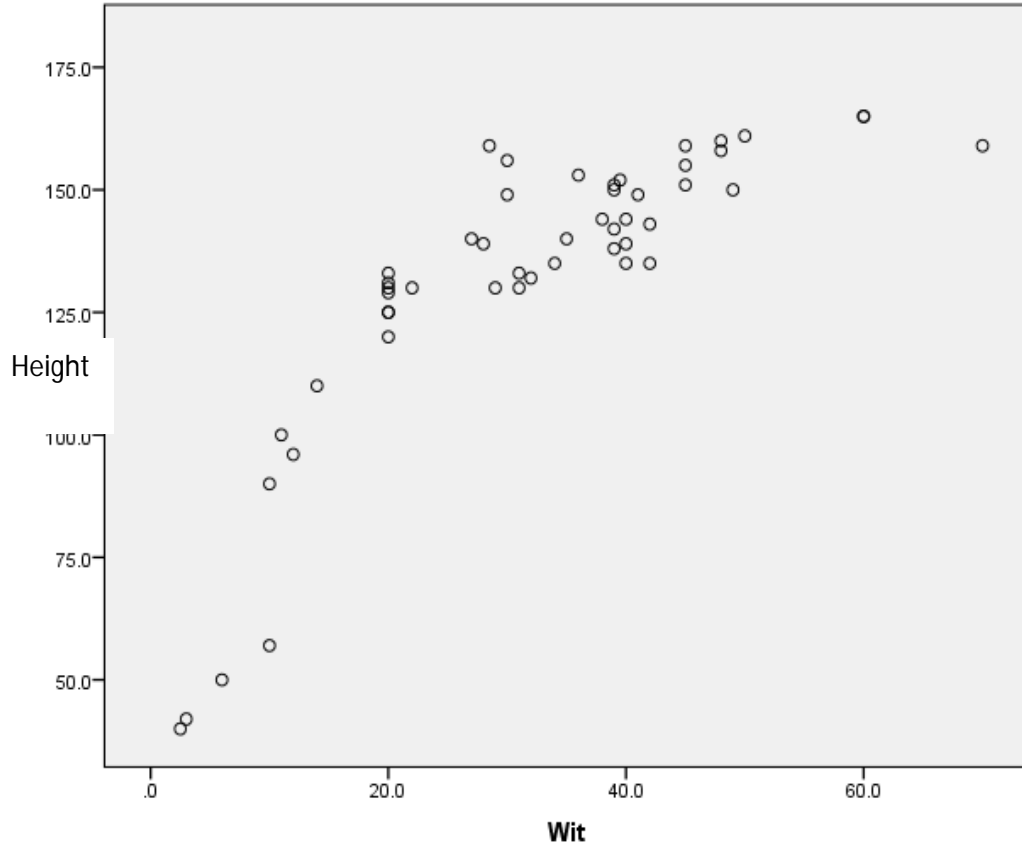


Figure [4-6], Showing the relation between the height and wight

Chapter Five

Discussion, Conclusion and Recommendations

Chapter Five

Discussion ,Conclusion and Recommendations

5.1 Discussion

The majority of sample under study were males 26patient (52%) and females 24 patients forming the 48%. A likely decrease in size of the kidney due to damage and or shrinking Graphic representation of the data showed some variability of the kidney size. Height and weight.

Previous study showed that the longitudinal measurement of the kidney were best correlated only with body height (sumia.2011). On the other hand studies of Indian children and Iran children males found no correlation between body height (Vijay kumar, 2004 and al mousawi 2002).

This study measured the kidney length and width, the mean value of right kidney length and width (6.2 cm and 3cm).and left kidney were (6.6cm and 3.2cm).This data of present result is similar to sumia only in sudanes population and different to the other previous study.

In summary we consider that these discrepancies could be a result of such factor like, genetic variability, nutritional status, socioeconomic status and demographic variable including age, weight and height. Moreover, we found that all dimensions were greater in males than female. Kidney length and width decrease with increasing in age in both gender and become hyper ecogenicity .in end stage the kidney become similar to the muscle around them and become more difficulties to differentiation between the kidney and muscle.

5.2 Conclusion

-The study concluded that ultrasound is valuable, noninvasive method and the least expensive imaging modality and can be provide good information about presenc of kidney diseases.

-The vast majority of patient in this study were males (52%) and femals were (48%) there was association between patient weight and kidney diseases.

-There is also relationship between kidney diseases and cystic of kidney disease due to dialysis and texture of the kidney.

-The study showed that of kidney disease involved in the age group (15) years.

-The study showed the texture of the kidney diseases is hypoecogenic with cases of acute renal diseases.

5.3 Recommendations

-Abdominal ultrasound scanning is significant for relevant findings relating causes, sign and symptoms of kidney diseases, in order to improve patient care and save hospital resources.

- Ultrasound is an operator dependant investigation so that operators should updated their knowledge about technique and any information that will improve their skills.

-Doppler ultrasound should be performed because we can early detect the possibility of kidney disease failure.

-We recommended that we should make available data for researchers ;This will be achieved by making an ideal ultrasound department with modern system saving all patients data.

-Further researches should be done like that we can reach to quick diagnosis and decisions.

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Appendix (1)



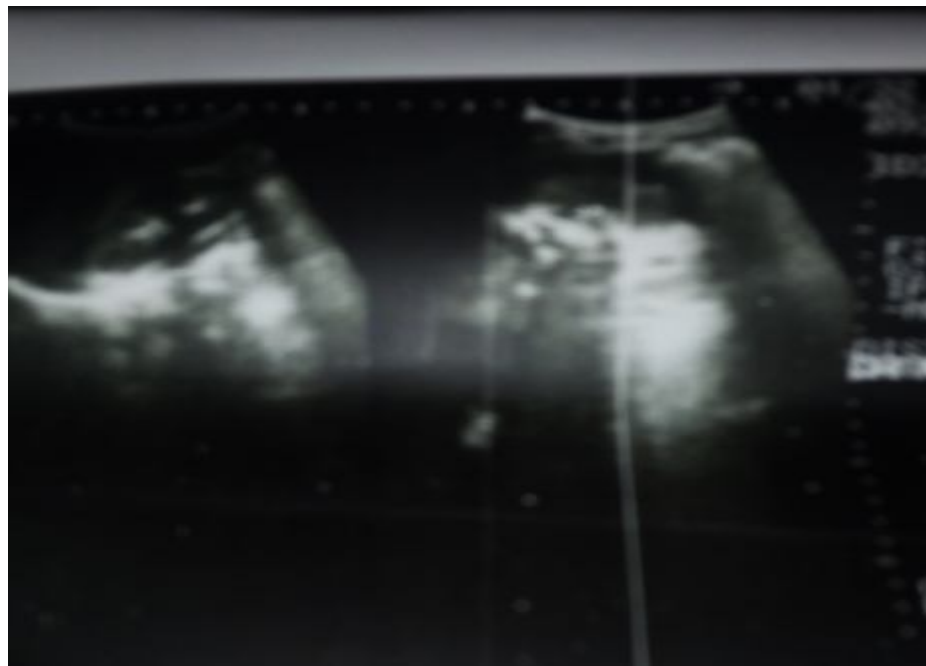
Image(1) longitudinal U/S of right kidney for male in 11 years age ,138cm height ,weight 39,showing pyelonephrosis.



Image(2):longitudinal U/S of left kidney for female in 14 years age ,155cm and 45kg ,showing glumerulitis.



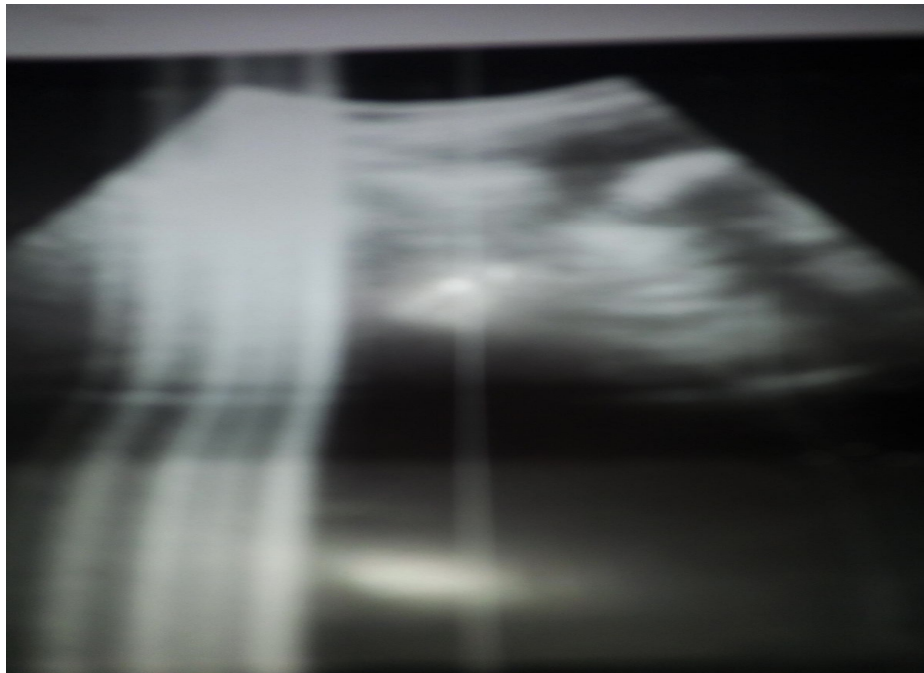
Image (3):sagittal U/S image of right kidney for male in 10 years age ,32weight,132 height ,showing acute kidney disease .



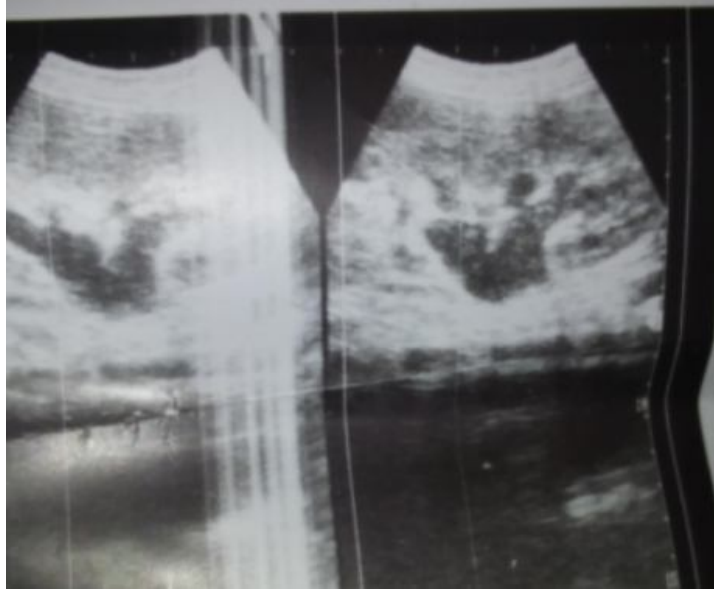
Sagittal and longitudinal U/S image Of right kidney for male in 4 years age 12kg weight ,96cm height, showing stone



Longitudinal u/s for male in 9 years age ,20kg weight,129cm height ,showing acute KD



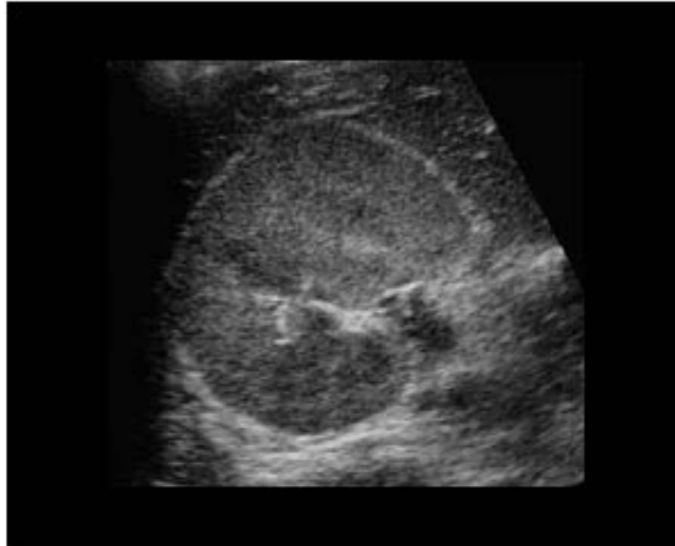
Transverse U/S image for male in 3 years 10kg weight ,90cm height ,showing large stone.



Image(7) longitudinal U/S for male in 17 years ,49kg weight,150cm height,showinghydronephrosis.



Image (8) of U/S in 15 years ,45weight,151cm height and showing giomerulitis



Right kidney transverse

Right kidney transverse in 14 years showing acute kidney disease.



Left kidney in 18 years male 70kg weight, 159cm height, showing hydronephrosis.

Appendix (2) Data sheet

Sudan University of Science and Technology

College of Radiologic Science

Study of Kidney Diseases in Children using Ultrasonography

Data sheet

Patients Data

Gender:.....

Age:.....

Demographic Parametrs

Height(cm)	
Weight(kg)	

Ultrasound measurement of Kidney

Length(cm)	
Width(cm)	

Comment.....
.....
.....

