

**Sudan University of Science and Technology**

**College of Graduate Studies**

**Study of Renal Disease using Computed  
Tomography**

دراسة امراض الكلي باستخدام الاشعة المقطعية

A Thesis Submitted for Partial Fulfillment for the Requirements of Msc  
Degree in Diagnostic Radiological Technology

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

## الآية

قَالَ تَعَالَى:

أَعُوذُ بِاللَّهِ مِنَ الشَّيْطَانِ الرَّجِيمِ

﴿ بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ ① الْحَمْدُ لِلَّهِ رَبِّ الْعَالَمِينَ ②  
الرَّحْمَنِ الرَّحِيمِ ③ مَلِكِ يَوْمِ الدِّينِ ④ إِيَّاكَ نَعْبُدُ وَإِيَّاكَ  
نَسْتَعِينُ ⑤ اهْدِنَا الصِّرَاطَ الْمُسْتَقِيمَ ⑥ صِرَاطَ الَّذِينَ أَنْعَمْتَ  
عَلَيْهِمْ غَيْرِ الْمَغْضُوبِ عَلَيْهِمْ وَلَا الضَّالِّينَ ⑦ ﴾

الفاتحة: (١ - ٧)

# **Dedication**

To my father, mother, sisters, Brothers,  
Friends, colleagues and my teachers.

## **Acknowledgments**

First of all thank to Almighty Allah for giving me the Knowledge and strength to complete this Dissertation.

I would like to express my deep gratitude to my

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I'm sincerely thanking all those who helped me specially my lovely Extended family.

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## **Abstract**

The study was a descriptive study of characterization of renal disease using computed tomography imaging which conducted in Khartoum state of Sudan in radiology department of Asia Hospital and Alamal Hospital, from Sept 2016 to Febr 2017, the problem of the study was increase number of patient suffering from renal lesions which interface in the texture and shape and whether it's malignant or benign, as routinely differentiate between them using biopsy which is an invasive procedure and the study was aimed to characterize the renal lesion using computed tomography ,classify the renal diseases (cystic and solid), measure size, site and CT number for each case and to identify the relation between CT finding and patient's age and gender. The data was collected from 70 patients classified and analyzed using SPSS . The study found that the most common lesion of renal was cyst , stones , tumors 52.8% , 35.7%,11.4% respectively, and the most effected age group is 20 - 40 year forming about 35.7% and female 51.4% are more affected than male 48.6% , the common site is renal pelvic, both upper and lower pole,cortex and medulla 34.4% ,32.9 % 21.4% 11.4% respectively.The study recommended that CT scan should be applied as a tool for diagnosing renal lesions, so it is provide measurement, CT number, texture and shape of the lesions .

## الخلاصة

هذه دراسة وصفية لدراسة امراض الكلى باستخدام الاشعة المقطعية تمت هذه الدراسة في ولاية الخرطوم بالسودان في اقسام الاشعة بكل من مستشفى أسيا ومستشفى الامل في الفترة من سبتمبر 2016 حتى فبراير 2017 وتكمن مشكلة الدراسة في ازدياد معاناة اعداد المرضى من امراض الكلى والتداخل بين الشكل والبنية وتصنيفها حميدة او خبيثة حيث يتم التمييز بينها عادة باستخدام الخزعة التي تمثل طريقة اجتياحية للمريض وهدفت الدراسة لتوصيف اعتلال الكلى باستخدام الاشعة المقطعية المحوسبة وتصنيف هذا الاعتلال لجيبي وصلب وقياس الحجم والموضع والرقم المحوسب وتعريف العلاقة بين الاعتلال وعمر المريض ونوعه وقد تم جمع البيانات من 70 مريض صنف وحلت نتائجهم باستخدام التحليل الاحصائي العلمي وقد وجدت الدراسة ان الاعتلالات الكلوية الاكثر شيوعا هي الجيوب، الحساوي والاورام بالنسبة 52.8% و 35.7% و 11.4% على التوالي والفئة العمرية الاكثر عرضة للاصابة باعتلال الكلى هي الفئة من 20-40 عام حيث مثلت حوالي 35.7% من البيانات وكانت الاناث اكثر عرضة للاصابة من الذكور بنسبة 51.4% و 48.6% على التوالي حيث كان الموضع الاكثر تائرا بالاعتلال حوض الكلى، القطب العلوي والسفلي، القشرة واللب بالنسبة 34.4%، 32.9%، 21.4% و 11.4% على التوالي وقد اوصت الدراسة باستخدام الاشعة المقطعية كاداة لتشخيص امراض الكلى يحث توفر القياسات والرقم المحوسي والشكل والبنية لكل مرض.

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# Chapter One

## 1.1 Introduction

The increasing indication for abdominal CT, MRI, and US has led to increased incidental detection of small solid renal masses. With this increase in the number of smaller tumors discovered, there has been concomitant increase in the rate of benign and malignant lesions encountered. When a solid renal mass is encountered, the first step is to exclude angiomyolipoma by identifying region of fat within the mass with unenhanced CT (Bosniak, 1988).

If no fat is detected on CT scans, numerous causes are possible, but the main one is the presence of a malignant lesion, such as renal cell carcinoma (RCC) (clear cell, papillary, and chromophobe subtypes), metastasis, or lymphoma, or of a benign lesion, such as oncocytoma, angiomyolipoma with minimal fat, granuloma, or an inflammatory lesion. Contrary to past trends whereby all enhancing solid renal masses were treated as RCC and proof of malignancy was obtained after nephrectomy, biopsy of renal tumors is now largely used in the evaluation of small renal tumors and has been found safe, accurate, and cost-effective. Biopsy also is recommended as an aid in differentiating benign from malignant tumors (Ramzi, 2009).

A major reason for deciding on renal tumor biopsy is that imaging alone is often insufficient for differentiating the benign versus malignant nature of solid renal tumors without fat. However, studies have shown that some imaging features and the degree of enhancement on CT imaging are helpful in differentiating renal cortical tumor subtype, despite overlap (Zhang, 2007). And that some CT findings can be used to characterize benign tumors. Segmental enhancement inversion in the corticomedullary and excretory phases has been found to be a characteristic

enhancement pattern of oncocytoma, and homogeneous and prolonged enhancement or a sufficient percentage of voxels and pixels with negative attenuation at histogram analysis has been found useful for characterizing angiomyolipoma without visible fat at CT (Bosniak, 1988).

## **1.2 Problem of the study**

Increase the number of patients suffering from renal diseases interface in the texture and shape and whether it's malignant or benign, as routinely differentiate between them using biopsy which is an invasive procedure.

## **1.3 Objectives**

### **1.3.1 General objective**

To study the renal disease using computed tomography

### **1.3.2 Specific objectives**

1-To classify the renal diseases (cystic and solid)

2-To measure size, site and CT number for each case

3-To identify relation between CT finding with patient age, gender, clinical finding

# Chapter Two

## **Chapter Two**

### **Background and literature review**

#### **2.1 Anatomy of the Kidneys**

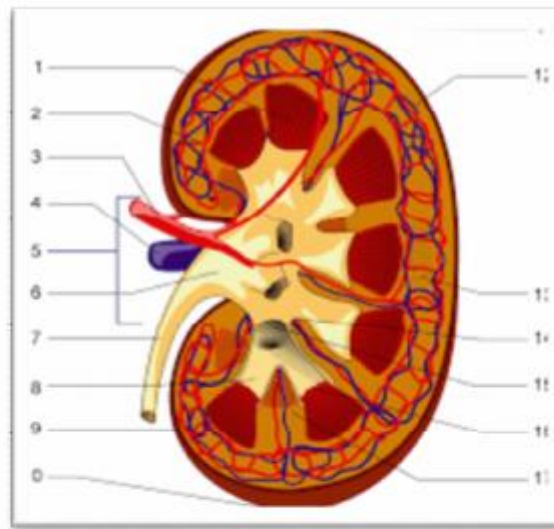
##### **2.1.1 Location**

The kidneys are a pair of organs found along the posterior muscular wall of the abdominal cavity. The left kidney is located slightly more superior than the right kidney due to the larger size of the liver on the right side of the body. Unlike the other abdominal organs, the kidneys lie behind the peritoneum that lines the abdominal cavity and are thus considered to be retroperitoneal organs. The ribs and muscles of the back protect the kidneys from external damage. Adipose tissue known as per renal fat surrounds the kidneys and acts as protective padding (Gervais, 2010).

##### **2.1.2 Structure**

The kidneys are bean-shaped with the convex side of each organ located laterally and the concave side medial. The indentation on the concave side of the kidney, known as the renal hilus, provides a space for the renal artery, renal vein, and ureters to enter the kidney. A thin layer of fibrous connective tissue forms the renal capsule surrounding each kidney. The renal capsule provides a stiff outer shell to maintain the shape of the soft inner tissues. Deep to the renal capsule is the soft, dense, vascular renal cortex. Seven cone-shaped renal pyramids form the renal medulla deep to the renal cortex (Gervais, 2010).

The renal pyramids are aligned with their bases facing outward toward the renal cortex and their apices point inward toward the center of the kidney. Each apex connects to a 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 exits the kidney at the renal hilum, where urine drains into the ureters (Gervais, 2010).



**Figure 2.1 : shows cross section renal anatomy**

- |                        |                            |
|------------------------|----------------------------|
| 1. Renal pyramid       | 10. Inferior               |
| 2. Interlobular artery | 11. Superior renal capsule |
| 3. Renal artery        | 12. Interlobular vein      |
| 4. Renal vein          | 13. Nephron                |
| 5. Renal hilum         | 14. Minor calyx            |
| 6. Renal pelvis        | 15. Major calyx            |
| 7. Ureter              | 16. Renal papilla          |
| 8. Minor calyx         | 17. Renal column           |
| 9. Renal capsule       |                            |

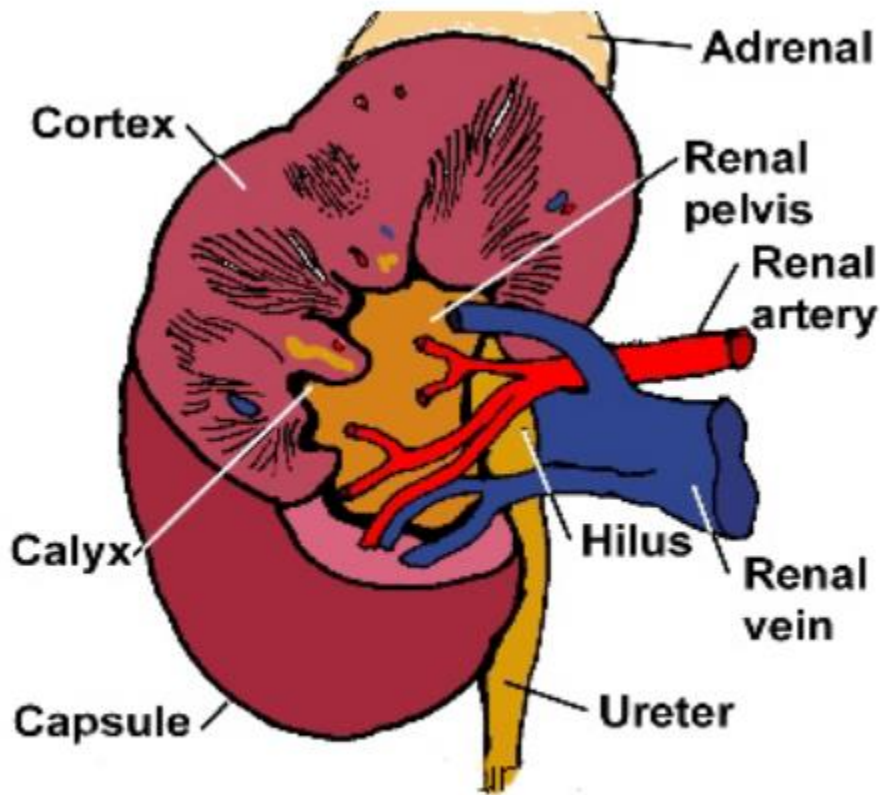


Figure 2.2 show renal site and cross section anatomy

### 2.1.3 Blood Supply

The renal arteries branch directly from the abdominal aorta and enter the kidneys through the renal hilus, Inside our kidneys, the renal arteries diverge into the smaller afferent arterioles of the kidneys Each afferent arteriole carries blood into the renal cortex, where it separates into a bundle of capillaries known as a glomerulus. From the glomerulus, the blood recollects into smaller efferent arterioles that descend into the renal medulla, The efferent arterioles separate into the per tubular capillaries that surround the renal tubules. Next, the per tubular capillaries merge to form veins that merge again to form the large renal



vein Finally, the renal vein exits the kidney and joins with the inferior vena cava, which carries blood back to the heart (Gervais, 2010).

#### **2.1.4 The Nephron**

Each kidney contains around 1 million individual nephrons, the kidneys' microscopic functional units that filter blood to produce urine. The nephron is made of 2 main parts: the renal corpuscle and the renal tubule. Responsible for filtering the blood, our renal corpuscle is formed by the capillaries of the glomerulus and the glomerular capsule (also known as Bowman's capsule). The glomerulus is a bundled network of capillaries that increases the surface area of blood in contact the blood vessel walls (Gervais, 2010).

Surrounding the glomerulus is the glomerular capsule, a cup-shaped double layer of simple squamous epithelium with a hollow space between the layers. Special epithelial cells known as podocytes form the layer of the glomerular capsule surrounding the capillaries of the glomerulus. Podocytes work with the endothelium of the capillaries to form a thin filter to separate urine from blood passing through the glomerulus. The outer layer of the glomerular capsule holds the urine separated from the blood within the capsule. At the far end of the glomerular capsule, opposite the glomerulus, is the mouth of the renal tubule. A series of tubes called the renal tubule concentrate urine and recover nonwaste solutes from the urine. The renal tubule carries urine from the glomerular capsule to the renal pelvis (Gervais, 2010).

The curvy first section of the renal tubule is known as the proximal convoluted tubule. The tubule cells that line the proximal convoluted tubule reabsorb much of the water and nutrients initially filtered into the urine. Urine next passes through the loop of Henle, a long straight tubule that carries urine into the renal medulla

before making a hairpin turn and returning to the renal cortex. Following the loop of Henle is the distal convoluted tubule. Finally, urine from the distal convoluted tubules of several nephrons enters the collecting duct, which carries the concentrated urine through the renal medulla and into the renal pelvis. From the renal pelvis urine from many collecting ducts combines and flows out of the kidneys and into the ureters (Gervais, 2010).

### **2.2.1 Physiology of the Kidneys**

**Excretion of Wastes** The primary function of the kidneys is the excretion of waste products resulting from protein metabolism and muscle contraction. The liver metabolizes dietary proteins to produce energy and produces toxic ammonia as a waste product. The liver is able to convert most of this ammonia into uric acid and urea, which are less toxic to the body. Meanwhile, the muscles of our body use creatine as an energy source and, in the process, produce the waste product creatinine. Ammonia, uric acid, urea, and creatinine all accumulate in the body over time and need to be removed from circulation to maintain homeostasis (Gervais, 2010).

The glomerulus in the kidneys filters all four of these waste products out of the bloodstream, allowing us to excrete them out of our bodies in urine. Around 50% of the urea found in the blood is reabsorbed by the tubule cells of the nephron and returned to the blood supply. Urea in the blood helps to concentrate other more toxic waste products in urine by maintaining the osmotic balance between urine and blood in the renal medulla (Gervais, 2010).

### **2.2.2 Filtration, Reabsorption, and Secretion**

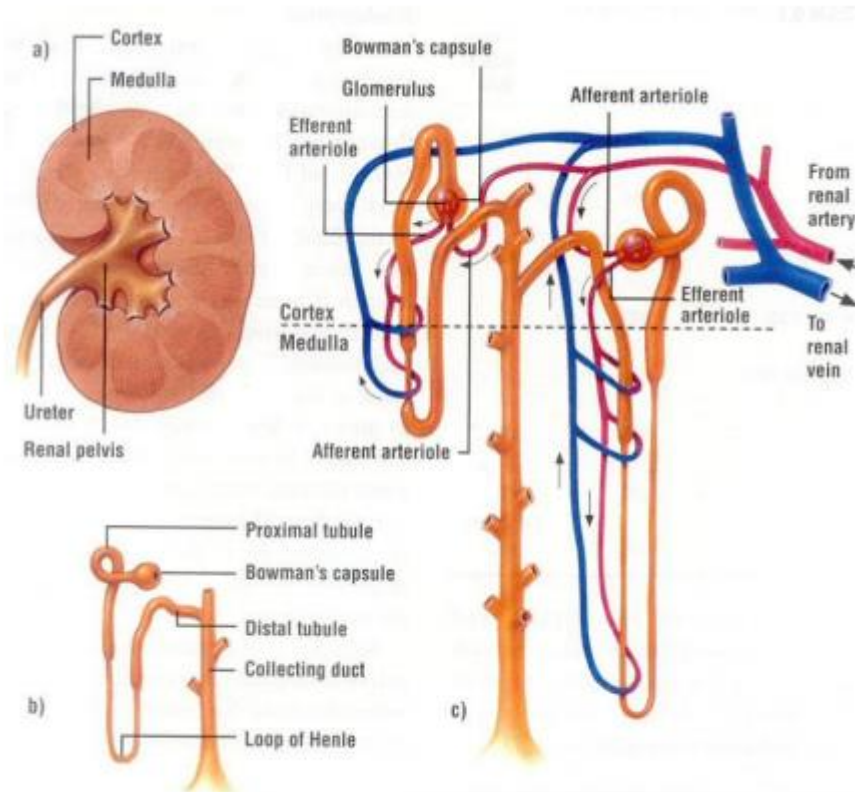
The kidneys filter blood as it passes through the capillaries that form the glomerulus. Blood pressure forces most of the blood plasma through the lining of the capillaries and into the glomerular capsule. Blood cells are too large to pass through the capillary lining and so remain within the capillaries along with some residual plasma. The filtered plasma, now known as tubular fluid, begins to flow out of the glomerular capsule and into the proximal convoluted tubule. At the same time, the concentrated blood that remains inside the capillaries of the glomerulus moves into the efferent arterioles and on to the peritubular capillaries surrounding the proximal convoluted tubule (Gervais, 2010).

Epithelial cells lining the tubule actively reabsorb valuable molecules of glucose, amino acids, and ions from the filtrate and deposit them back into the blood. These cells also absorb any waste products remaining in the blood (such as ammonia and creatinine) and secrete these chemicals into the filtrate. While these solutes are being exchanged, osmotic pressure pushes water from the dilute, hypotonic filtrate back into the concentrated, hypertonic blood. From the proximal convoluted tubule, the tubular fluid next enters the loop of Henle, where water and ions are reabsorbed. The descending limb of the loop of Henle is permeable to water and carries the filtrate deep into the medulla of the kidney (Gervais, 2010).

Tissues in the medulla surrounding the tubule contain a high concentration of ions and very little water compared to the filtrate. Osmotic pressure between the hypotonic filtrate and hypertonic medullary cells pushes water out of the filtrate and into the cells. The cells of the medulla return this water to the blood flowing through nearby capillaries (Gervais, 2010).

Filtrate next passes through the ascending limb of the loop of Henle as it exits the medulla. The tissues surrounding the ascending limb are not permeable to water but are permeable to ions. The filtrate is very concentrated after passing through the descending limb, so ions easily diffuse out of the filtrate and into the cells lining the ascending limb. These ions are returned to the blood flowing through nearby capillaries (Gervais, 2010).

Tubular fluid exiting the loop of Henle next passes through the distal convoluted tubule and the collecting duct of the nephron. These tubules continue to reabsorb small amounts of water and ions that are still left in the filtrate. The tissues surrounding the collecting duct actively absorb excess potassium and hydrogen ions from the nearby capillaries and secrete these excess ions as waste into the filtrate. When filtrate reaches the end of the collecting duct, almost all of the valuable nutrients, ions, and water have been returned to the blood supply while waste products and a small amount of water are left to form urine (Gervais, 2010). The urine exits the collecting duct and joins with urine from other collecting ducts in the renal pelvis (Gervais, 2010).



**Figure 2.4 show the physiology of kidney**

### 2.2.3 Water Homeostasis

The kidneys are able to control the volume of water in the body by changing the reabsorption of water by the tubules of the nephron. Under normal conditions, the tubule cells of the nephron tubules reabsorb (via osmosis) nearly all of the water that is filtered into urine by the glomerulus. Water reabsorption leads to very concentrated urine and the conservation of water in the body. The hormones antidiuretic hormone (ADH) and aldosterone both increase the reabsorption of water until almost 100% of the water filtered by the nephron is returned to the blood. ADH stimulates the formation of water channel proteins in the collecting ducts of the nephrons that permit water to pass from urine into the tubule cells and on to the blood. Aldosterone functions by increasing the reabsorption of  $\text{Na}^+$  and  $\text{Cl}^-$  ions, causing more water to move into the blood via osmosis (Gervais, 2010).

In situations where there is too much water present in the blood, our heart secretes the hormone atrial natriuretic peptide (ANP) in order to increase the excretion of  $\text{Na}^+$  and  $\text{Cl}^-$  ions. Increased concentration of  $\text{Na}^+$  and  $\text{Cl}^-$  in urine draws water into the urine via osmosis, increasing the volume of urine produced (Gervais, 2010).

#### **2.2.4 Acid/Base Homeostasis**

The kidneys regulate the pH level of the blood by controlling the excretion of hydrogen ions ( $\text{H}^+$ ) and bicarbonate ions ( $\text{HCO}_3^-$ ). Hydrogen ions accumulate when proteins are metabolized in the liver and when carbon dioxide in the blood reacts with water to form carbonic acid ( $\text{H}_2\text{CO}_3$ ) (Gervais, 2010).

Carbonic acid is a weak acid that partially dissociates in water to form hydrogen ions and bicarbonate ions. Both ions are filtered out of the blood in the glomerulus of the kidney, but the tubule cells lining the nephron selectively reabsorb bicarbonate ions while leaving hydrogen ions as a waste product in urine. The tubule cells may also actively secrete additional hydrogen ions into the urine when the blood becomes extremely acidic. The reabsorbed bicarbonate ions enter the bloodstream where they can neutralize hydrogen ions by forming new molecules of carbonic acid. Carbonic acid passing through the capillaries of the lungs dissociates into carbon dioxide and water, allowing us to exhale the carbon dioxide (Gervais, 2010).

#### **2.2.5 Electrolyte Homeostasis**

The kidneys maintain the homeostasis of important electrolytes by controlling their excretion into urine. Sodium ( $\text{Na}^+$ ): Sodium is a vital electrolyte for muscle function, neuron function, blood pressure regulation, and blood volume regulation. Over 99% of the sodium ions passing through the kidneys are reabsorbed into the

blood from tubular filtrate. Most of the reabsorption of sodium takes place in the proximal convoluted tubule and ascending loop of Henle (Gervais, 2010).

Potassium ( $K^+$ ): Just like sodium, potassium is a vital electrolyte for muscle function, neuron function, and blood volume regulation. Unlike sodium, however, only about 60 to 80% of the potassium ions passing through the kidneys are reabsorbed. Most of the reabsorption of potassium occurs in the proximal convoluted tubule and ascending loop of Henle (Gervais, 2010).

Chloride ( $Cl^-$ ): Chloride is the most important anion (negatively charged ion) in the body. Chloride is vital to the regulation of factors such as pH and cellular fluid balance and helps to establish the electrical potential of neurons and muscle cells. The proximal convoluted tubule and ascending loop of Henle reabsorb about 90% of the chloride ions filtered by the kidneys (Gervais, 2010).

Calcium ( $Ca^{2+}$ ): Calcium is not only one of the most important minerals in the body that composes the bones and teeth, but is also a vital electrolyte. Functioning as an electrolyte, calcium is essential for the contraction of muscle tissue, the release of neurotransmitters by neurons, and the stimulation of cardiac muscle tissue in the heart. The proximal convoluted tubule and the ascending loop of Henle reabsorb most of the calcium in tubular filtrate into the blood. Parathyroid hormone increases the reabsorption of calcium in the kidneys when blood calcium levels become too low (Gervais, 2010).

Magnesium ( $Mg^{2+}$ ): Magnesium ion is an essential electrolyte for the proper function of enzymes that work with phosphate compounds like ATP, DNA, and RNA. The proximal convoluted tubule and loop of Henle reabsorb most of the magnesium that passes through the kidney (Gervais, 2010).

## **2.2.6 Blood Pressure Homeostasis**

The kidneys help to control blood pressure in the body by regulating the excretion of sodium ions and water and by producing the enzyme renin. Because blood is mostly made of water, an increased volume of water in the body results in an increase in the volume of blood in the blood vessels. Increased blood volume means that the heart has to pump harder than usual to push blood into vessels that are crowded with excess blood. Thus, increased blood volume leads to increased blood pressure. On the other hand, when the body is dehydrated, the volume of blood and blood pressure decrease (Gervais, 2010).

The kidneys are able to control blood pressure by either reabsorbing water to maintain blood pressure or by allowing more water than usual to be excreted into urine and thus reduce blood volume and pressure. Sodium ions in the body help to manage the body's osmotic pressure by drawing water towards areas of high sodium concentration. To lower blood pressure, the kidneys can excrete extra sodium ions that draw water out of the body with them. Conversely, the kidneys may reabsorb additional sodium ions to help retain water in the body (Gervais, 2010).

Finally, the kidneys produce the enzyme renin to prevent the body's blood pressure from becoming too low. The kidneys rely on a certain amount of blood pressure to force blood plasma through the capillaries in the glomerulus. If blood pressure becomes too low, cells of the kidneys release renin into the blood. Renin starts a complex process that results in the release of the hormone aldosterone by the adrenal glands. Aldosterone stimulates the cells of the kidney to increase their reabsorption of sodium and water to maintain blood volume and pressure (Gervais, 2010).



### **2.2.7 Hormones**

The kidneys maintain a small but important endocrine function by producing the hormones calcitriol and erythropoietin. Calcitriol is the active form of vitamin D in the body. Tubule cells of the proximal convoluted tubule produce calcitriol from inactive vitamin D molecules. At that point, calcitriol travels from the kidneys through the bloodstream to the intestines, where it increases the absorption of calcium from food in the intestinal lumen, erythropoietin (EPO) is a hormone produced by cells of the peritubular capillaries in response to hypoxia (a low level of oxygen in the blood) (Gervais, 2010).

EPO stimulates the cells of red bone marrow to increase their output of red blood cells. Oxygen levels in the blood increase as more red blood cells mature and enter the bloodstream. Once oxygen levels return to normal, the cells of the peritubular capillaries stop producing EPO. Several hormones produced elsewhere in the body help to control the function of the kidneys (Gervais, 2010).

Antidiuretic hormone (ADH), also known as vasopressin, is a hormone produced by neurosecretory cells in the brain's hypothalamus. These cells extend into the posterior pituitary, which stores and releases ADH. ADH production is stimulated by a decrease in blood volume and increased blood osmolarity. ADH helps the body retain water by increasing the number of water channels in the cells of the collecting ducts of the kidneys. These water channels allow water remaining in urine to be reabsorbed into the blood, resulting in extremely concentrated urine (Gervais, 2010).

Angiotensin II is a hormone made in the liver and activated by the enzymes renin and angiotensin-converting enzyme. Once activated, angiotensin II increases the reabsorption of sodium and chloride ions in the proximal convoluted tubule,

leading to an increased reabsorption of water as well. Aldosterone is a hormone produced in the adrenal cortex in response to Angiotensin II. Aldosterone binds to target cells in the walls of the nephron's collecting ducts. These cells reabsorb additional sodium and chloride ions that would have been excreted as urine. The target cells also remove potassium ions from the blood and excrete it into urine. Atrial natriuretic peptide (ANP) is a hormone produced by cardiac muscle cells in the atria of the heart. These cells produce ANP in response to high levels of sodium in the blood or increased blood pressure (Gervais, 2010).

In the kidneys, ANP increases the glomerular filtration rate so that more blood plasma is forced into the glomerular capsule and into the renal tubules. ANP also removes some solutes from the cells of the renal medulla, making the loop of Henle less efficient in reabsorbing water and ions from the filtrate. The net result of ANP is that more sodium and water end up being excreted into urine, blood volume decreases, and blood pressure decreases as well (Gervais, 2010).

## **2.3 Pathology**

### **2.3.1 Congenital**

- Congenital hydronephrosis
- Congenital obstruction of urinary tract
- Duplex kidneys , or double kidneys , occur in approximately 1% of population. This occurrence normally causes no complication , but can occasionally cause urine infections.
- Duplicated ureter occurs in approximately one in 400 live births.
- Nutcracker syndrome.

## **-Polycystic kidney disease:**

I. Autosomal dominant polycystic kidney disease afflicts patients later in life. Approximately one in 1000 people will develop this condition

II. Autosomal recessive polycystic kidney disease is far less common, but more severe, than the dominant condition. It is apparent in utero or at birth.

## **-Renal agenesis**

Failure of one kidney to form occurs in approximately one in 750 live births. Failure of both kidneys to form is invariably fatal (Gervais, 2010).

-Renal dysplasia

-Unilateral small kidney

-Multicystic dysplastic kidney occurs in approximately one in every 2400 live births.

-Ureteropelvic Junction Obstruction or UPJO ; although most cases appear congenital, some appear to be an acquired condition (Gervais, 2010).



**Figure 2.5 :shows horseshoe kidney**



**Figure 2.6 shows multicystic kidney**

### **2.3.2 Acquired**

-Diabetic nephropathy.

-Glomerulonephritis .

-Hydronephrosis is the enlargement of one or both of the kidneys caused by obstruction of the flow of urine.

-Interstitial nephritis

-Kidney stones (nephrolithiasis) are a relatively common and particularly painful disorder.

-Kidney tumor :I.Wilms tumor. II.Renal cell carcinoma.

-Lupus nephritis.

-Minimal change disease.

-In nephritic syndrome, the glomerulus has been damaged so that a large amount of protein in the blood enters the urine. Other frequent features of the nephritic syndrome include swelling, low serum albumin, and high cholesterol (Gervais, 2010).

-Pyelonephritis is infection of the kidneys and is frequently caused by complication of a urinary tract infection (Gervais, 2010).

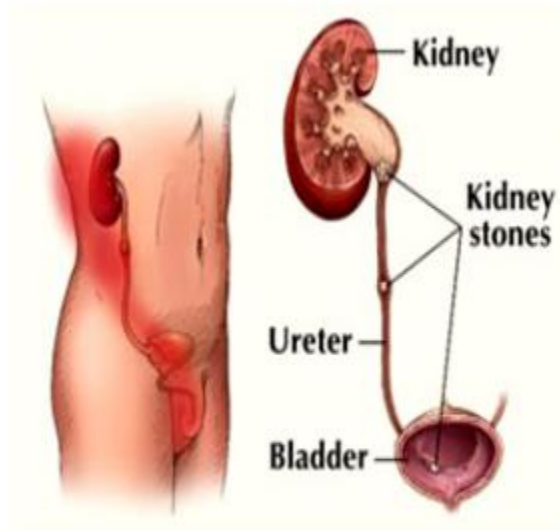


Figure 2.7: shows kidney stones

## 11. Renal failure:

I. Acute renal failure. II. Stage. II. Chronic kidney disease.

### 2.3.3 Kidney failure

Generally , humans can live normally with just one kidney, as one has more functioning renal tissue than is needed to survive. Only when the amount of functioning kidney tissue is greatly diminished does one develop chronic kidney disease. Renal replacement therapy, in the form of dialysis or kidney transplantation, is indicated when the glomerular filtration rate has fallen very low or if the renal dysfunction leads to severe symptoms (Gervais, 2010).

## **Previous study**

According to European society of Radiology 2011 Recent studies shows that the most common lesion detect are ‘‘ Cyst’’ in up to 27% of the patients over 50 years. CT masses are classified as solid or complex cystic. 85% of expansive solid masses are malignant therefore, a solid, enhancing mass must be considered malignant unless proven otherwise. Renal cell carcinoma (RCC) is the most common malignant tumor with a rising incidence of about 3% per year since 1975. The most common type of RCC is the clear cell RCC with 65% of renal cortical tumors. Further subtypes are papillary (basophilic and eosinophilic) Clear –cell RCC causes 90% of metastases of all renal malignancies. Other malignant masses include transitional cell carcinoma (TCC), lymphoma, metastases from carcinoma and primary /secondary sarcoma. Primary tumors of the lung, breast and gastrointestinal tract are the most common sources of renal Metastases.

# Chapter three



## **Chapter three**

### **Material and method**

#### **3. 1 Materials**

This study is a descriptive study which evaluates and characterizes the renal diseases using CT imaging. This study was conducted at Khartoum state, from September 2016 to February 2017 and include All patient with any disease in the renal.

##### **3.1.1 Study group**

This study consists of 70 patients, 36 males and 34 females.

##### **3. 1.2 Equipment used**

The CT images were conducted using Multi-detector CT scanner . The scan parameters (thin section 5mm or less ,120 KV, 200MA 1.5 pitch ) Features of CT scanner: Largest couch capacity is 180 kg CT machine in Teaching Asia Hospital and Alamel Hospital .

#### **3.2 Methods**

##### **3.2.1 Technique used**

The patient lays supine on the CT scanner couch, arm elevated, scout view is obtained usually in AP projection. Pre contrast images of kidney are obtained to demonstrate calcifications and density of renal masses followed by dynamic IV contrast enhanced images with thin section through the kidneys, extending through the abdomen. Frequently the pelvis is also imaged to see the entire urinary tract

and look for adenopathy (enlarged of lymph node). Because scanning is so fast , dynamic images of kidneys show the arterial phase of enhancement, making it use full to obtain a third set of image through kidneys to better asses of the parenchyma . Exception in transitional carcinoma the exam is extended in to the pelvis with delayed views of the bladder 3-5 minute delay image .

### **3.2.2 Images interpretation**

All images were diagnosed by radiologist

### **3.2.3 Ethical consideration**

Study cases were selected from patient underwent to CT KUB department.

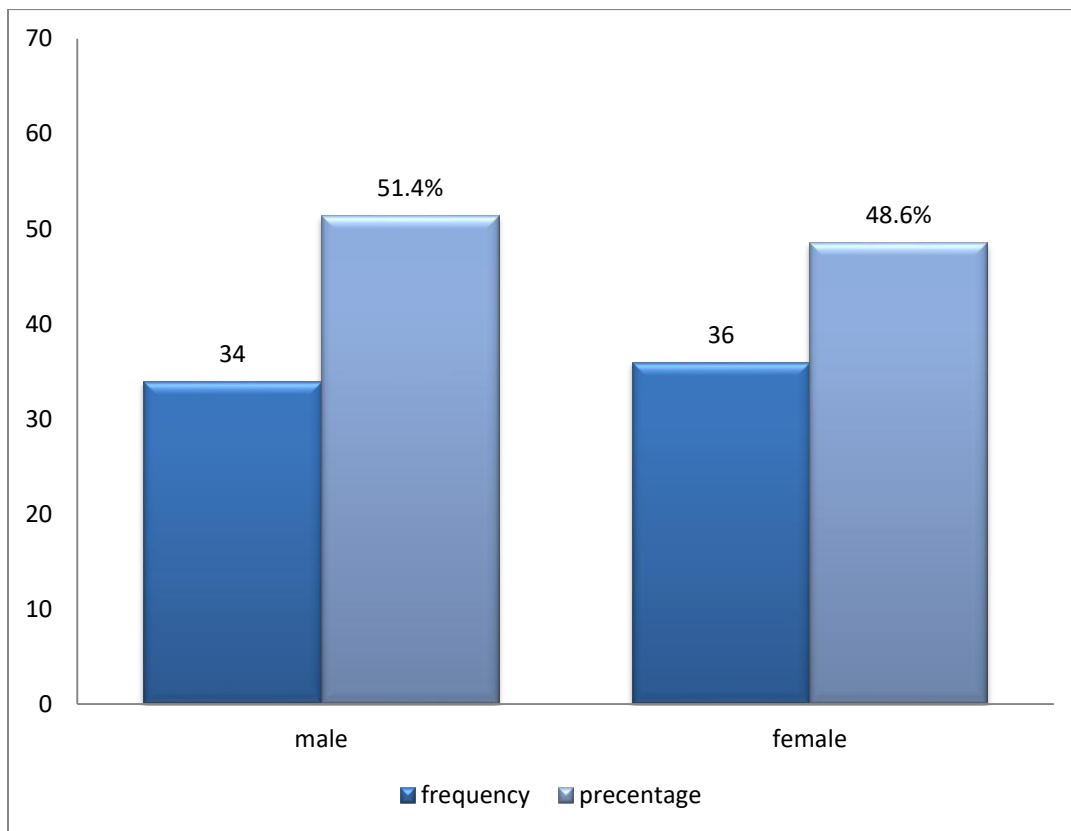
# Chapter Four

# Chapter Four

## 4.1 Result

Table(4-1): frequency distribution table of patients gender

Gender	Frequency	Percentage
Male	34	48.6%
Female	36	51.4%
Total	70	100%



Figure(4.1): frequency distribution figure of patients gender

Table(4-2): frequency distribution table of patients age

Age	Frequency	Percentages
Less than 20	8	11.4%
20 - 40	25	35.7%
41-60	18	25.7%
More than 60	19	27.1%
Total	70	100%

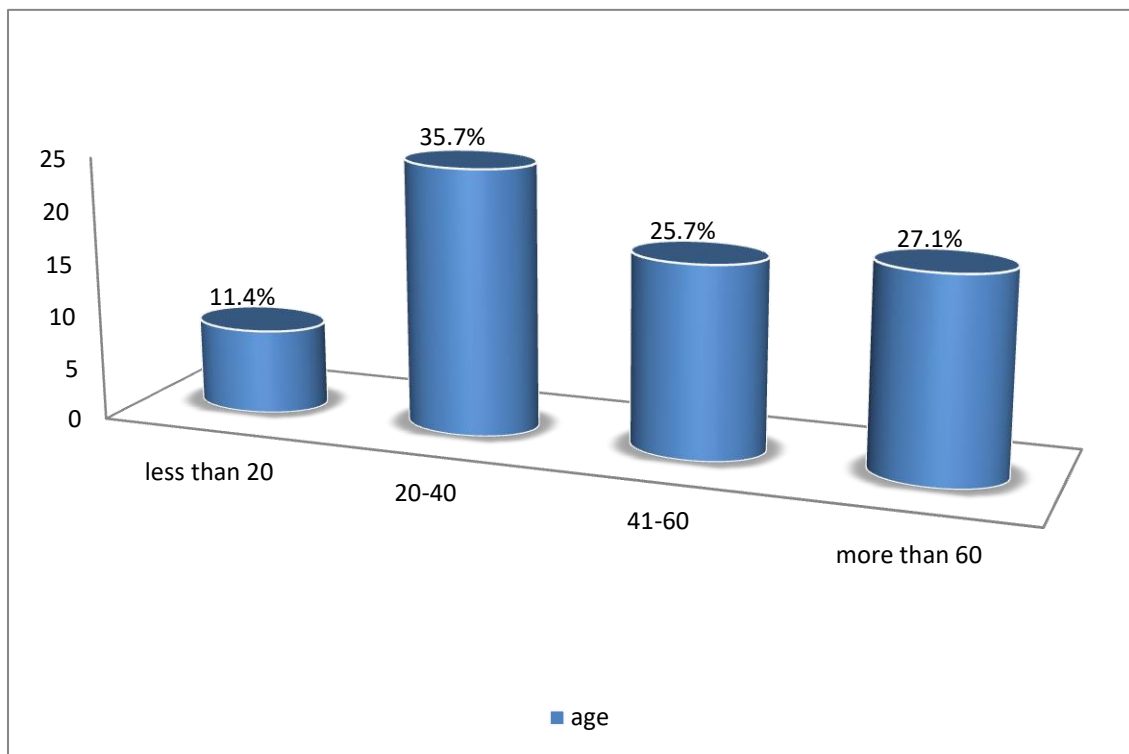


Figure (4.2):frequency distribution figure of patient's age

Table (4- 3): frequency distribution table of patient’s pathological findings

<b>Finding</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Female</b>	<b>Male</b>
Stones	25	35.7%	12	13
Cysts	37	52.8%	20	17
Tumors	8	11.4%	4	4
Total	70	100%	36	34

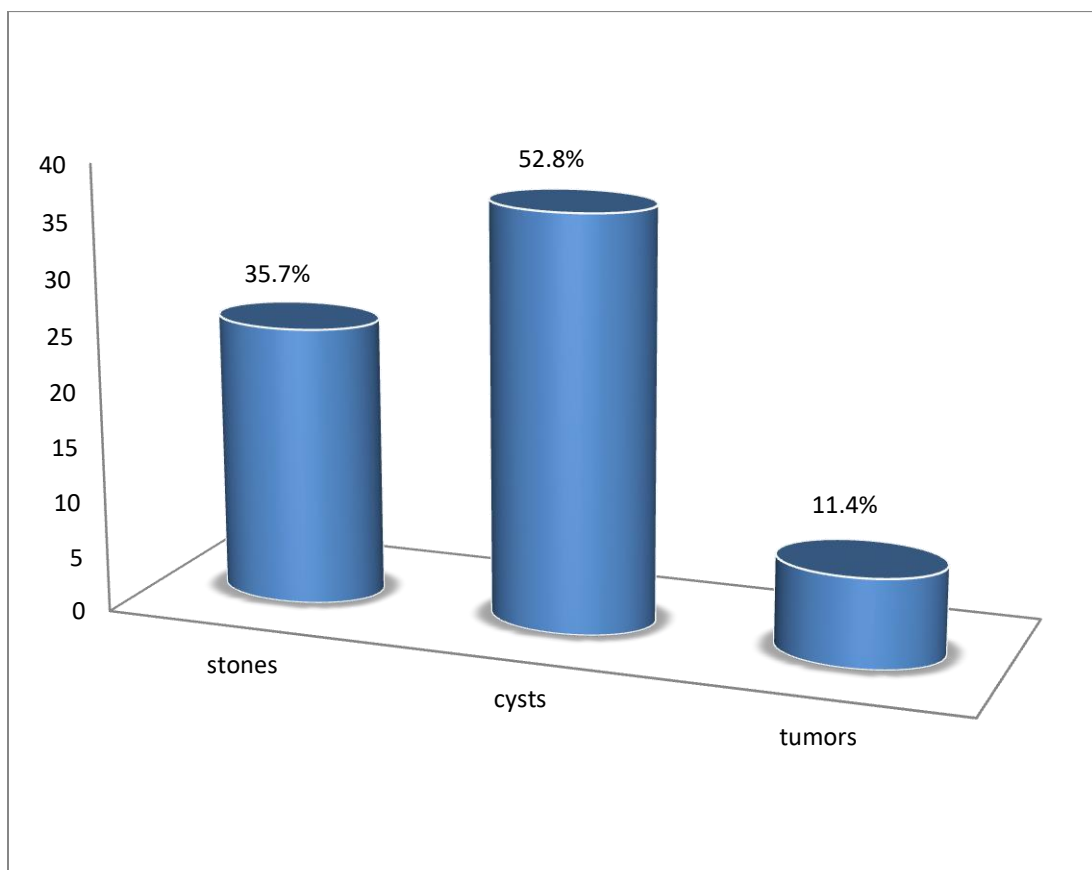


Figure (4.3): frequency distribution figure of patient’s pathological findings

Table (4-4): frequency distribution table of patient's pathological findings site.

The site	Frequency	Percentage
Cortex	15	21.4%
Medulla	8	11.4%
Both upper lower pole	23	32.9%
Renal pelvic	24	34.3%
Total	70	100%

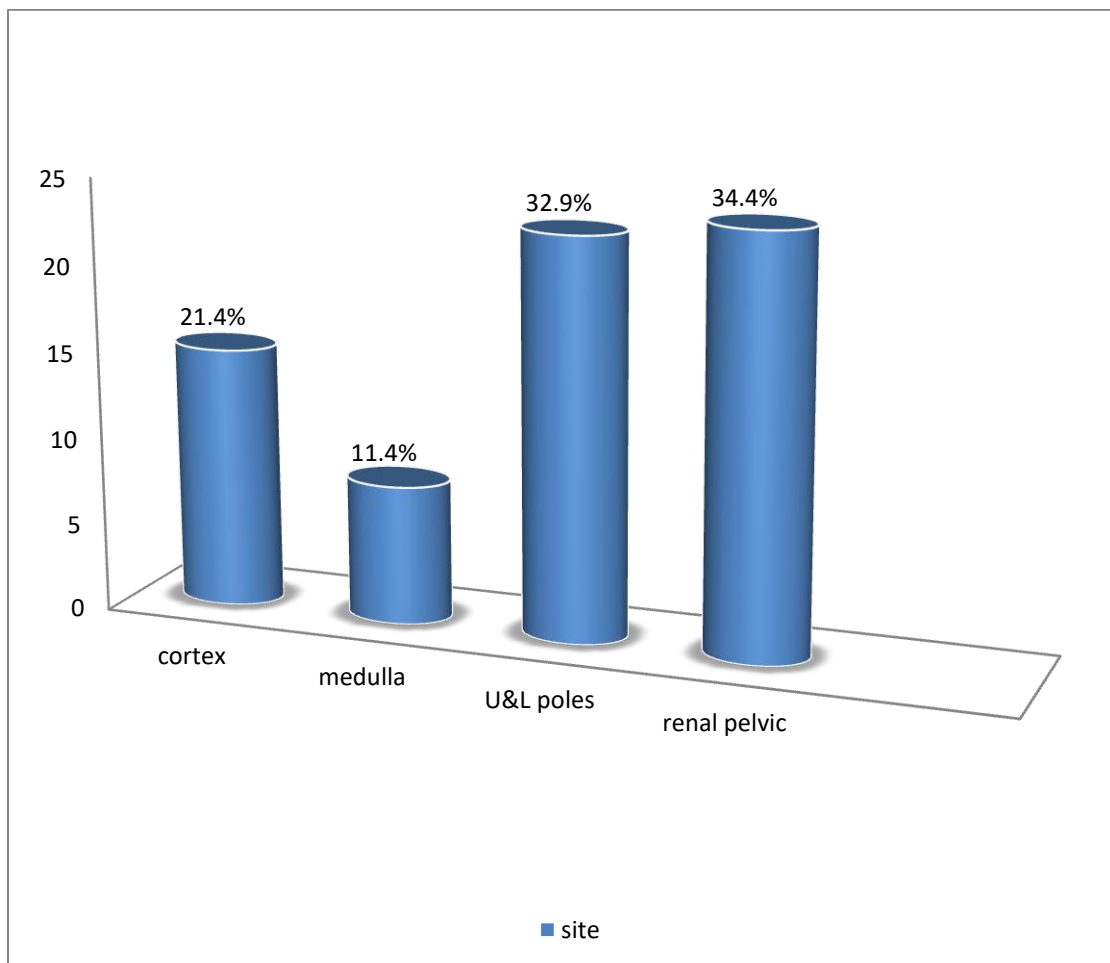


Figure (4.4): frequency distribution figure of patient's pathological findings site.

# Chapter Five



## **Chapter Five**

### **Discussion, conclusion and recommendation**

#### **5.1 Discussion:**

This study includes 70 patients of different age examined using CT scan showed ,regarding figure (4-1) the gender distribution in the majority of the sample under study were females (36) forming the incidence of 51.4% and the male (34) forming a48.6and regarding figure (4-2) the study showed that the age group between 20-40 were most affected by renal lesions and age group of less than 20 have had the lowest frequency, and regarding figure (4-3) study show that the most common pathological finding of CT is cystic lesion of percentage of 52.8% and stones of 35.7% and tumors by percentage of 11.4% and regarding figure (4-4) the study showed that the most site for lesions is renal pelvic of 34.3% and upper and lower pole of 32.9% and cortex of 21.4% and medulla of 11.4%.

This study agree with the study done by European society of Radiology 2011 Recent studies shows that the most common lesion detect are ‘‘ Cyst’’ in up to 27% of the patients over 50 years. CT masses are classified as solid or complex cystic.

## **5.2 conclusion**

The study concluded that renal disease most common in female ,and Cyst classify as the most common lesion and age group between 20-40 most affected and renal pelvic is the most affected site, complex cystic and solid lesions can be characterized further. Therefore Radiological examination alone is most suitable in order to diagnose the normal and abnormal appearance and structure.

### **5-3 Recommendations:**

1-further studies should be done by large sample size

2-CT should apply as the best tool to diagnose the renal lesions, because it provides: The measurement, CT number, texture and type of the lesions.

3-Three images planes (axial ,coronal and sagittal) should be done .

## 5-4 References

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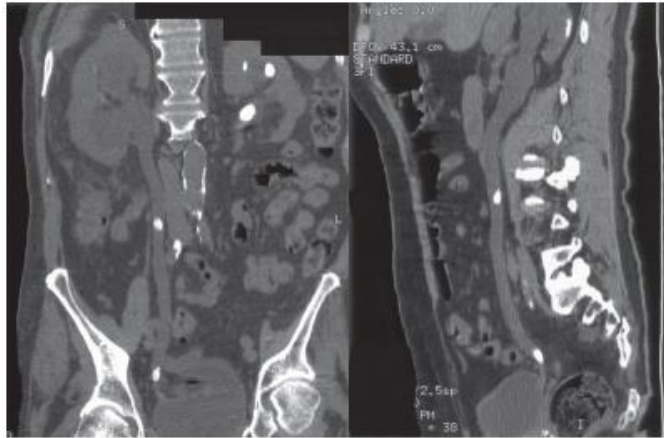
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Zhang J, Lefkowitz RA, Ishii NM, et al. Solid renal cortical tumors: differentiation with CT. *Radiology* 2007; 244:494-504

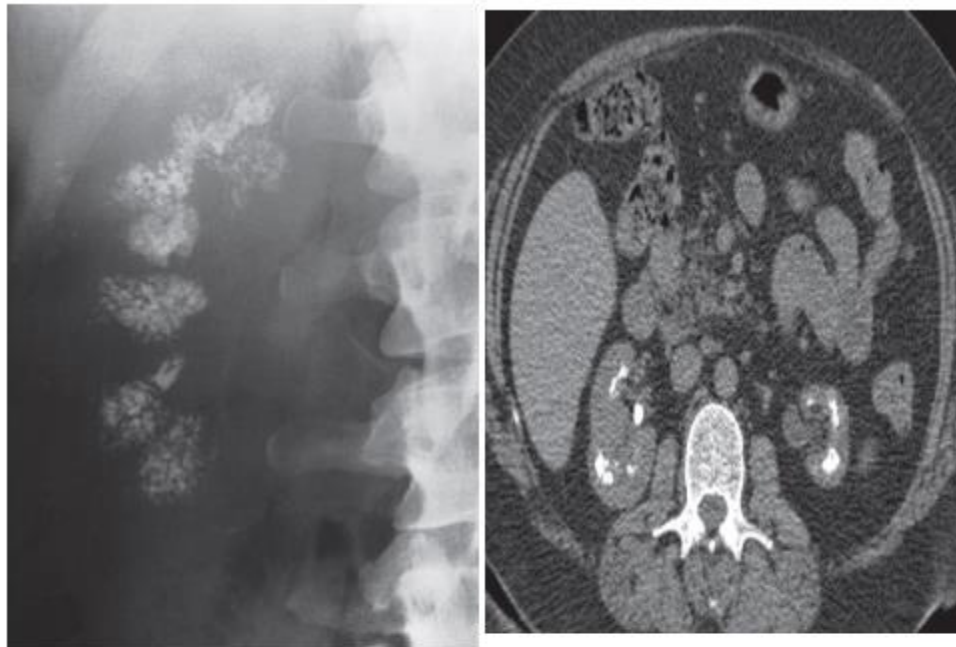
# Appendices

## Appendix (A)

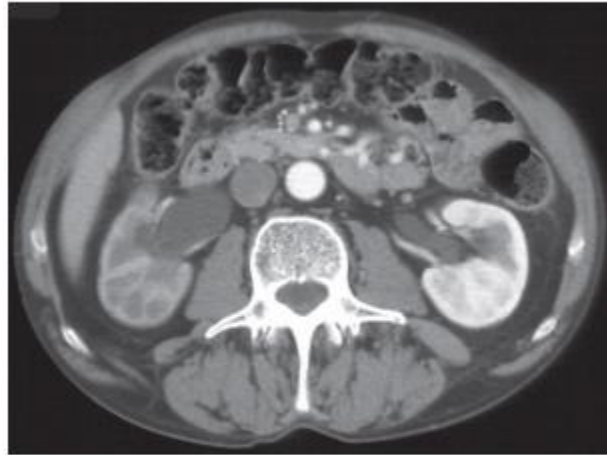
1



Cronal and Saggital CT Images for Male 52years old Hydronephrotic right kidney (RK) and two stones in the dilated right ureter .The patient also has kidney stones in the left pelvicaliceal system.



Plain Film and Axial CT Mages of Male 40years old Nephrocalcinosis. On plain filmbilateral renal parenchymal calcifications are demonstrated on CT KUB.



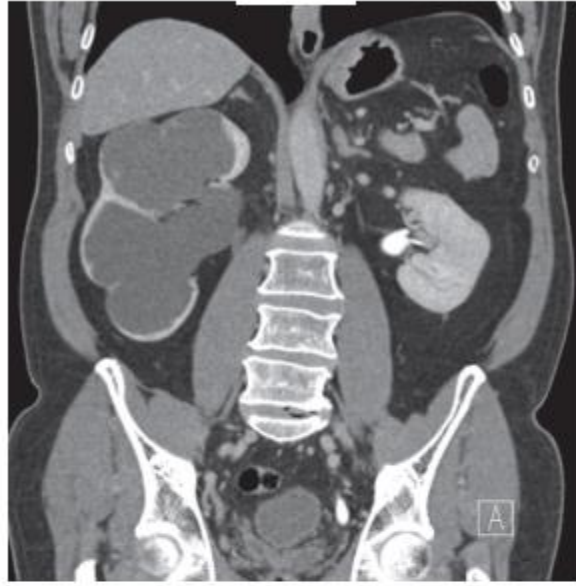
Axial CT Mages of Female 49 years old at the corticomedullary phase of enhancement.

There is obstruction of the right kidney with dilatation of the pelvicaliceal system

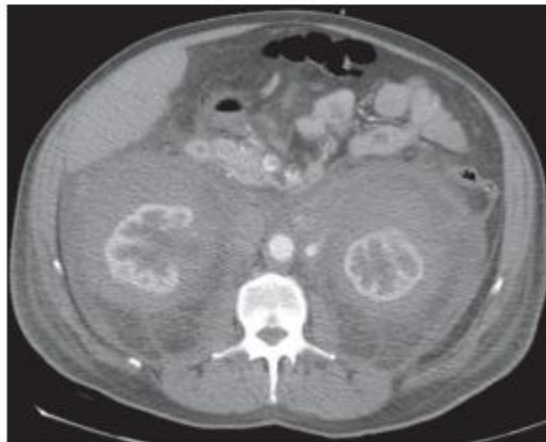


CT at the delayed phase of enhancement.

Intravenous contrast is seen in the left renal pelvis but not in the obstructed right renal pelvis.

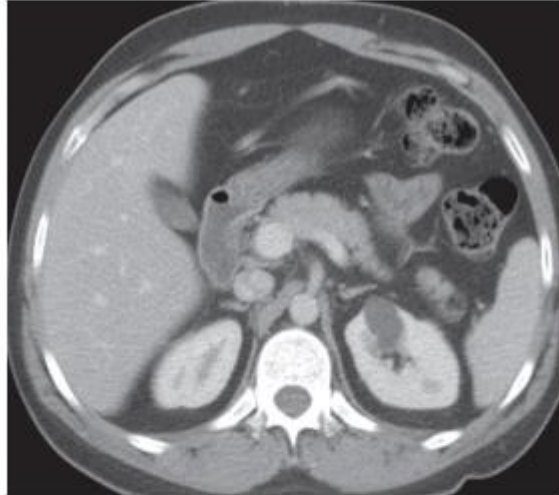


Cronal CT Images of male 60years old Intrinsic PUJ obstruction. The pelvicaliceal system is considerably dilated.



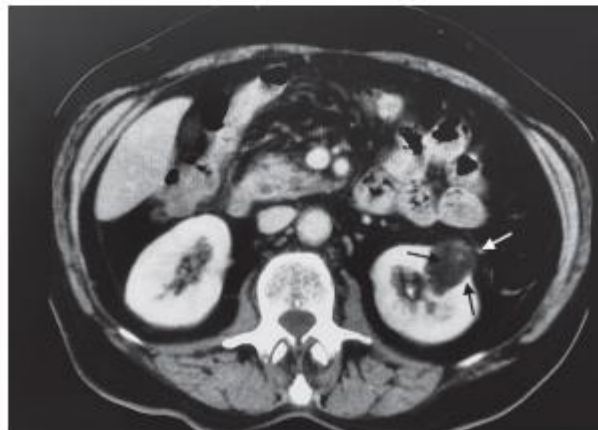
Axial CT Images Shows Mild hydronephrosis on the right. Both kidneys are surrounded by dense fibrosis.





Axial CT Images of Male 50 years old Cyst in the left kidney on CT showing a well-defined edge

6



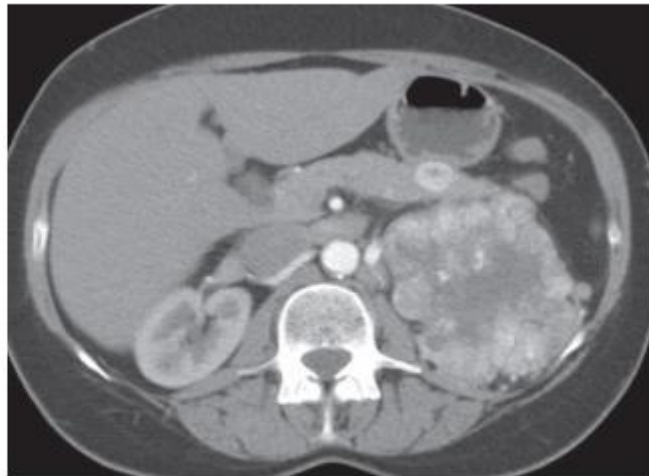
Axial CT Images of female 53 years old Angiomyolipoma seen as a well-defined mass of fat density on CT.

1

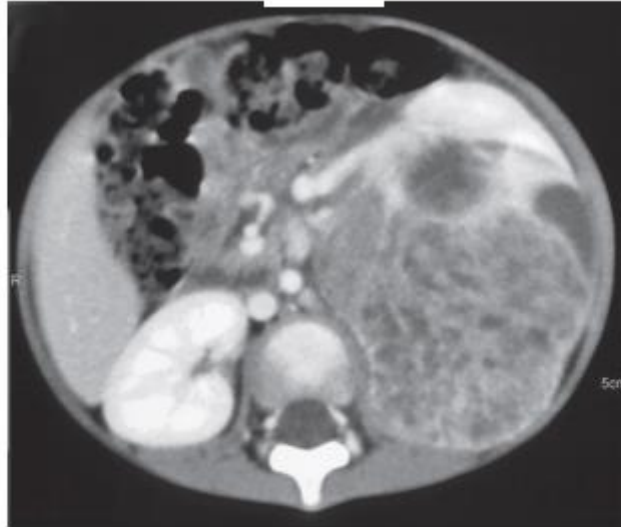


Axial CT Images of Male 63 years old Renal cell carcinoma. The mass in the right kidney shows substantial enhancement and is invading the anterior wall of the right renal vein

8



Axial CT Images of female 58 years old Staging renal carcinoma in CT scan showing a large tumour in the left kidney.



Axial CT Images of male 48 years old Wilms' tumour. A large heterogeneously enhancing Mass.

10

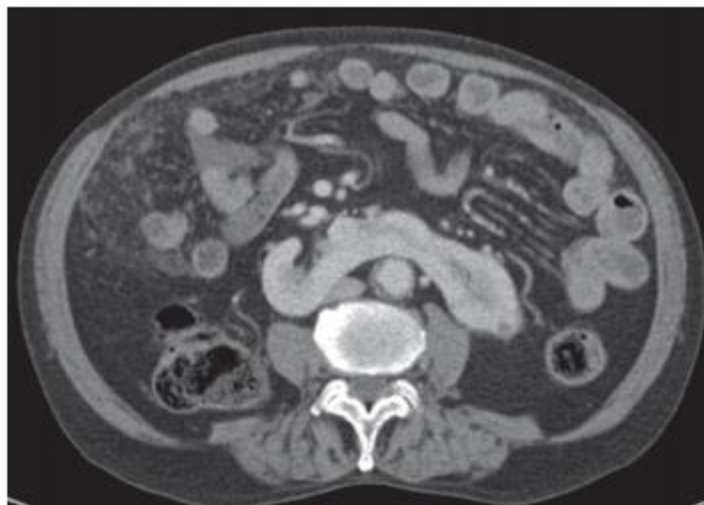


Axial CT Images of Female 43 years old with intravenous contrast demonstrating multiple low attenuation fluid collections in the right renal cortex, consistent with multiple renal abscesses.



Axial CT Images of Male 51 years old Perinephric abscess. CT scan showing loculated fluid with a thick enhancing wall surrounding the left kidney.

12



Axial CT Images of Female 35 years old Horseshoe kidneys.