

Chapter One

1.1: Introduction

Obstructive uropathy is a commonly encountered problem in clinical practice . It refers to structural impedance to the flow of urine anywhere along the urinary tract leading to pelvicalyceal dilatation . Renal parenchymal damage result from obstructive uropathy is termed “obstructive nephropathy” . Ultrasound provides a reliable morphological information on renal size, site, shape, texture and sometime orientation .It is particularly useful in obstructive uropathy , vesical and prostatic pathology. It is highly sensitive in the detection of renal and vesical calculi , more sensitive than plain radiography regardless of stone ureterical . However it is less satisfactory than the latter urethral stone (musty of mid part of ureter which is obscured by bowel gases) . (Murphy et al 1966)

. Obstructive uropathy is often secondary to anatomical pathologies of the urinary tract or the genital system . Obstructive uropathy is a known predisposing factor to urinary tract infection , urolithiasis and post- renal failure . The simultaneous evaluation of both kidney and bladder in details is considered and vantage of US over other competitive modalities .The speed and safety of US –guided biopsy or aspiration (diagnostic or therapeutic) is another benefits for US examination . ,(Platt et al 1989) .

In many cases of urinary tract obstruction no direct cause can be found , for stone formation , metabolic disorders should always be suspected , particularly in the presence of bilateral stone . Patient may be asymptomatic until the stone descends from the kidney into ureter , where may cause obstruction and result in renal colic. In sudan the problem of urinary tract (UT) calculi is increasing and studies were carries out to find the role of ultrasound in detecting the (UT) calculi, which is a highly reflective structure within the collecting system , ureter ,

Urinary bladder (UB) , pelvioureterical junction (PUJ) , ureterovesical junction (UVJ), which associated with posterior acoustic shadowing also the gold standard for diagnosing . The role of US is to detect the presence or absence of hydronephrosis , estimate the amount of residual cortex present and to detect the presence of a pelvic mass or other etiology . Ultrasound may also be used guidance for antegrade pyelography , and percutaneous nephrostomy , stent placement . (Murphy et al 1966)

1.2. Objectives :

1.2.1.General objective: The role of US is to detect the presence or absence of hydronephrosis , estimate the amount of residual cortex present and to detect the presence of a pelvic mass or stones ,other etiology to determine the urinary tract obstruction .

1.2.2.Specific objective :

To determine(UT) obstruction related to age in sudan

To determine (UT) obstruction related to sex in sudan

To estimate the ability of (US) in localization of obstruction

To determine the (UT) obstruction type.

1.3. Important of the study:

Due to the previous problems in the other modalities that was mentioned in the introduction,(US) is high technique that used to determine the degree of hydronephrosis and types of urinary tract obstruction . The importance of this study is to show the possibility of US application as optimal study for urinary tract obstruction.

Chapter Tow

Literature Review

2 .1 Anatomy of the urinary tract:

The urinary system consists of kidneys , ureter , urinary bladder and urethra **figure (2.1)**

.2.1.1.The kidneys :

The kidneys lie behind the peritoneum on the posterior abdominal wall . Each kidney is 12cm (4.5 in) long , 5cm (2in) wide , and 2.5 cm (1in) thick , and has cortex lateral surface and concave medial one the medial surface contains the hilum through which the renal vessels , the medial lymphatic and the ureter pass and each kidney also has an anterior and posterior surface and upper and lower pole.The medial border of the kidney shows a deep recess, the renal sinus , into which the hilum leads . The renal sinus contains the major and minor calyces , the former arise from the upper expanded portion of the ureter called the pelvis and the later arise from the major calyces . About three or four minor calyces usually arise from each major calyx . (Sub course)

2.1.1.1. structure of the kidneys :

The kidneys are enclosed by fibrous capsule which is surrounded by prerenal fat , if the kidney is divided vertically from side to side it well be seen to consist of a reddish – brown outer part of the cortex , and a paler inner portion of the medulla , which is composed of series of pyramids.The pyramids contain the collecting tubules , which open on the papilla , as the apices of pyramids are called . The papilla project into the minor calyces and there usually form one to three papilla in each minor calyces . (Sub course)

The essential functional unit of the kidney is the nephrons , this is a microscopic structure of which there are said to be a bout one million in each adult kidney , the nephrons consist of the

renal capsule . The renal capsule is about 0.2 mm in diameter and it is a filter for the excretion of fluid and dissolved material in the blood. It is composed of a central tuft of capillaries , the glomerulus , which invaginates an epithelial sac from which the uriniferous tubule leads. (Sub course)

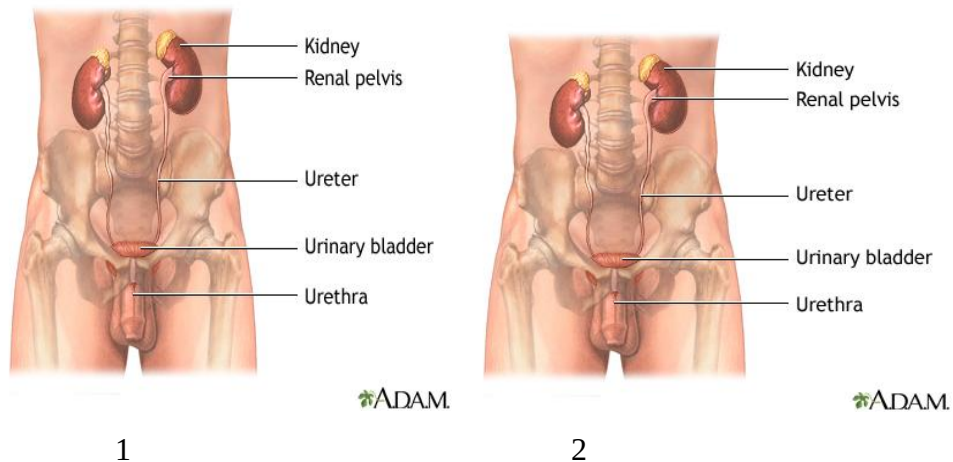


Figure (2.1)Anatomy of urinary tract. show to kidneys, ureters ,bladder,urethra (1.male , 2. female) (Web site)

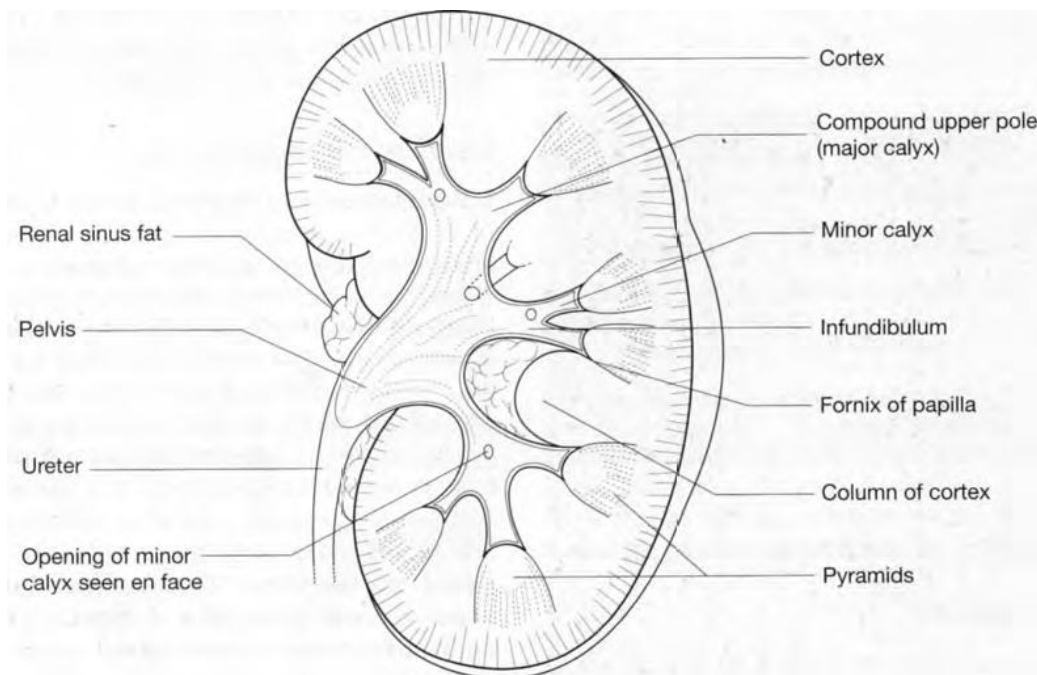


Fig. 2.2 shows coronal section Anatomy of the Kidney (Ryan,elat)

2.1.1.2.Relations for other structures :-

Posteriorly—the diaphragm (separating pleura), quadratus lumborum, psoas, transversus abdominis, the 12th rib and three nerves—the subcostal (T12), iliohypogastric and ilio-inguinal (L1). (Harold Ellis 2006)

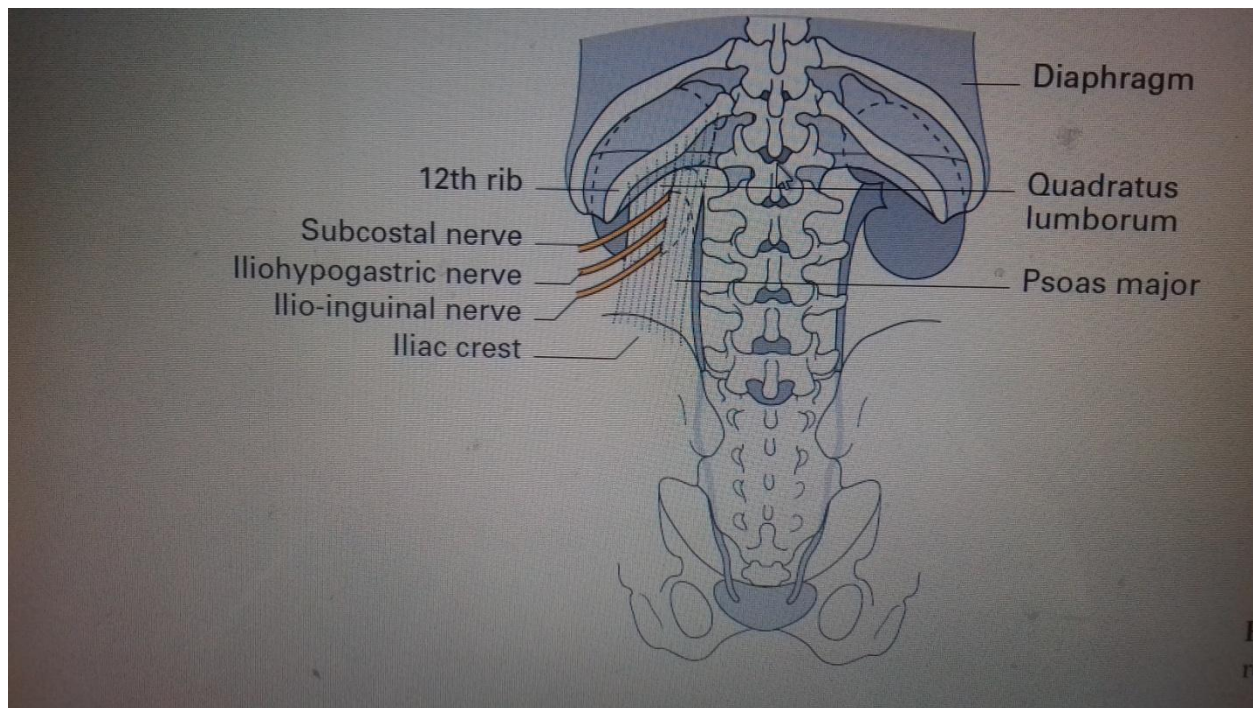


Fig. 2.3 The posterior relations of the kidney. (Harold Ellis 2006)

Anteriorly—the right kidney is related to the liver, the 2nd part of the duodenum (which may be opened accidentally in performing a right nephrectomy), and the ascending colon. In front of the left kidney lie the stomach, the pancreas and its vessels, the spleen, and the descending colon.

The suprarenals sit on each side as a cap on the kidney's upper pole.

The medial aspect of the kidney presents a deep vertical slit, the *hilum*, which transmits, from before backwards, the renal vein, renal artery, pelvis of the ureter and, usually, a subsidiary branch of the renal artery. (Harold Ellis 2006)

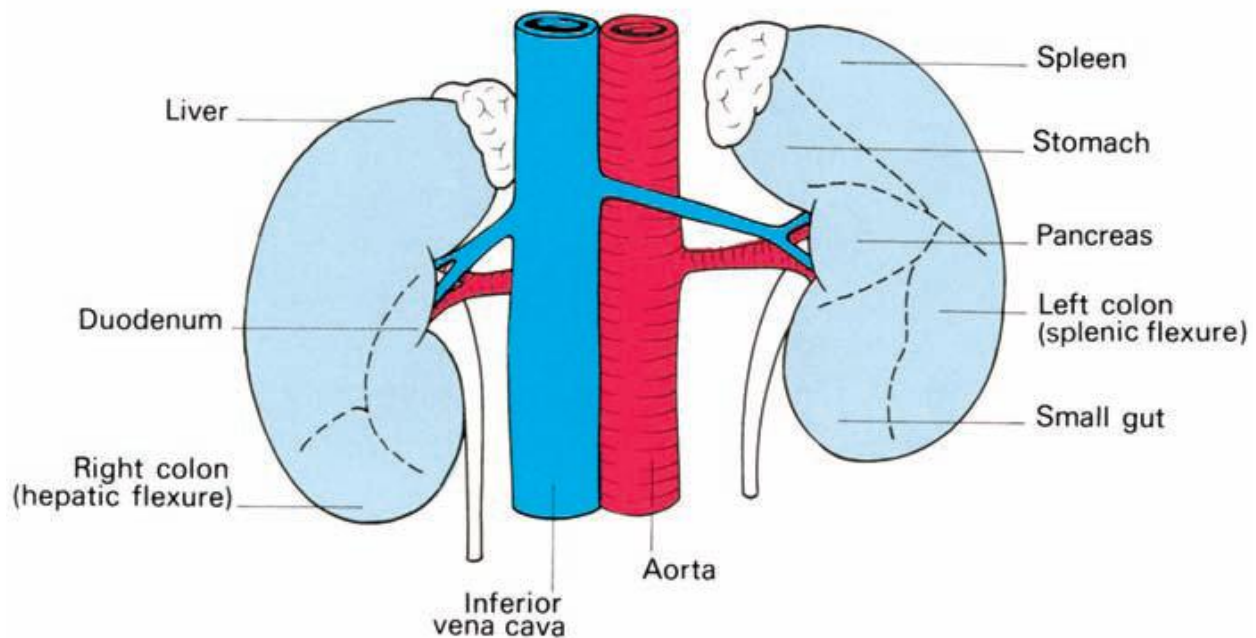


Fig. 2.4 The anterior relations of the kidneys. (Harold Ellis 2006)

2.1.1.3. Blood supply for kidneys

The *renal artery* derives directly from the aorta. The *renal vein* drains directly into the inferior vena cava. The *left renal vein* passes in front of the aorta immediately below the origin of the superior mesenteric artery. The *right renal artery* passes behind the inferior vena cava.

2.1.1.4. Lymph drainage for kidneys

Lymphatics drain directly to the para-aortic lymph nodes.

2.1.2. The ureter

The ureter is 10 in (25 cm) long and comprises the pelvis of the ureter and its abdominal, pelvic and intravesical portions. The *abdominal ureter* lies on the medial edge of psoas major (which separates it from the tips of the transverse processes of L2–L5) and then crosses into the pelvis at the bifurcation of the common iliac artery in front of the sacroiliac joint. Anteriorly, the right ureter is covered at its origin by the second part of the duodenum and then lies lateral to the

inferior vena cava and behind the posterior peritoneum. It is crossed by the testicular (or ovarian), right colic, and ileocolic vessels. The left ureter is crossed by the testicular (or ovarian) and left colic vessels and then passes above the pelvic brim, behind the mesosigmoid and sigmoid colon to cross the common iliac artery immediately above its bifurcation. The *pelvic ureter* runs on the lateral wall of the pelvis in front of the internal iliac artery to just in front of the ischial spine; it then turns forwards and medially to enter the bladder. In the male it lies above the seminal vesicle near its termination and is crossed superficially by the vas deferens (see Fig. 2.6). In the female, the ureter passes above the lateral fornix of the vagina 0.5 in (12 mm) lateral to the supravaginal portion of the cervix and lies below the broad ligament and uterine vessels. The *intravesical ureter* passes obliquely through the wall of the bladder for 0.75 in (2 cm); the vesical muscle and obliquity of this course produce respectively a sphincteric and valve-like arrangement at the termination of this duct. (Harold Ellis 2006)

2.1.2.1. Blood supply for ureters

The ureter receives a rich segmental blood supply from all available arteries along its course: the aorta, and the renal, testicular (or ovarian), internal iliac and inferior vesical arteries. (Harold Ellis 2006)

2.1.3. Urinary Bladder:

The urinary bladder is a muscular sac, which serves as a reservoir for urine and is located in the pelvic part of the abdomen. Its size varies with the amount of urine it contains. When empty, the bladder is shaped like a pear pointing downward; when moderately full (about 0.5 liter), it assumes an oval form. The urine enters from the two ureter at the back, and near the bottom of the bladder. The bladder empties through an opening at its midline. These three openings bound an area called the trigone. There are strong muscles in this central triangle of the bladder wall,

essential for proper voiding. The bladder is supplied with a number of arteries, veins, and lymphatic's, which are derived from abdominal blood vessels. (Sub course)

2.1.4. Urethra:

The urethra drains the urine from the bladder to the outside. It usually is about six to eight inches long in the male, extending from the bladder to the end of the penis. In the female, the urethra is about 1 1/2 inches long. There are two circular cut-off muscles, or sphincters that keep the urine from leaking. One is situated around the neck of the bladder, and the other is around the membranous part of the urethra. The urethra is composed of a mucous membrane that is supported by sub mucous tissue, which connects it with the various structures through which it passes. (Sub course)

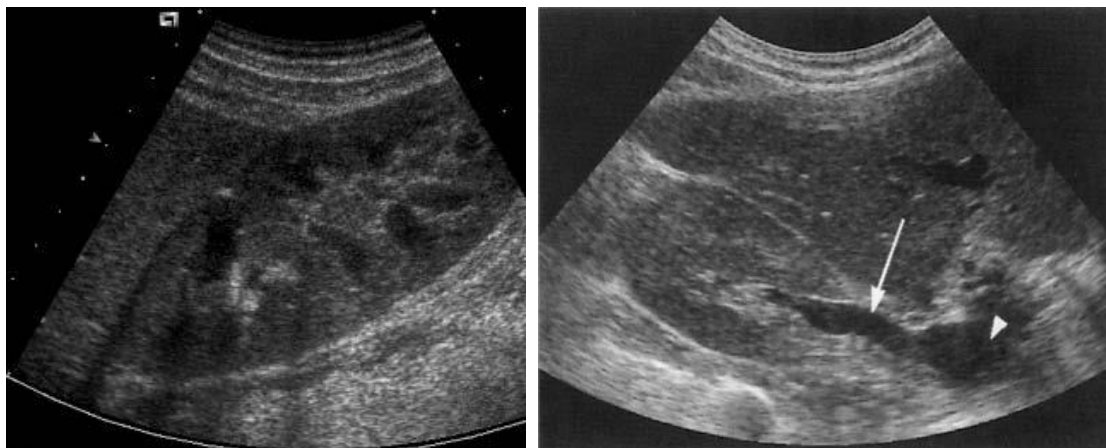
2.1.5 The Normal Renal Tract By Ultrasound

The sonographic appearance of the kidneys differs with age, and multiple variants may be noted with sonography . Neonatal and pediatric kidneys may appear lobulated, have prominent renal pyramids, and/or have subtle sonographic distinctions between the renal cortex and renal sinus. Normal adult kidneys are elliptical in shape in the longitudinal plane and rounded in the transverse plane. They typically measure approximately 8–13 cm in length, 2–3 cm in the anteroposterior dimension, and 4–5 cm in width.² The renal sinus is central in the kidney and has an echogenic appearance. The renal cortex appears as medium-to-low level echoes surrounding the central sinus. The normal cortex should be more hypoechoic than, or isoechoic to, the liver or spleen. It should measure more than 1 cm in thickness from the outer margin of the renal pyramids to the outer margin of the kidney.³ Increased echogenicity of the renal cortex suggests intrinsic renal disease.³ Within the cortex, the triangular shaped medullary pyramids may be noted separated by the **columns of Bertin**. Occasionally, the renal capsule

may be observed in some cases. It appears as a highly reflective hyperechoic line surrounding the kidney.(Steven)

2.1.5.1 Ultrasound technique

The right kidney is readily demonstrated through the right lobe of the liver. Generally a subcostal approach displays the (more anterior) lower pole to best effect, while an intercostal approach is best for demonstrating the upper pole (Fig.2.5). The left kidney is not usually demonstrable sagittally because it lies posterior to the stomach and splenic flexure. The spleen can be used as an acoustic window to the upper pole by scanning coronally, from the patient's left side, with the patient supine or decubitus (left side raised), but, unless the spleen is enlarged, the lower pole must usually be imaged from the left side posteriorly. Coronal sections of both kidneys are particularly useful as they display the renal pelvicalyceal system (PCS) and its relationship to the renal hilum (Fig.2.6b). This section demonstrates the main blood vessels and ureter (if dilated). (Jane 2004)



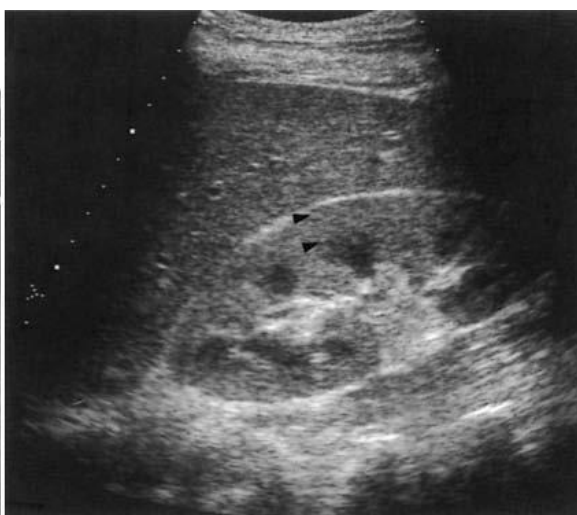
A

B

Fig (2.5) (A) Sagittal section through the normal right kidney (RK), using the liver as an acoustic window. The central echoes from the renal sinus are hyperechoic due to the fat content. The hypoechoic, triangular, medullary pyramids are demonstrated in a regular arrangement around the sinus. The cortex is of similar echogenicity to the liver.
(B) TS through the hilum of the RK, demonstrating the renal vein (arrow) draining into the inferior vena cava (IVC). (Jane 2004)



A



B

Fig (2.6) A Left kidney (LK) in coronal section. B The renal cortex lies between the capsule and the lateral margin of the medullary pyramid (Jane 2004)

2.2.. Physiology of the Urinary System:-

The kidneys are concerned with: -The excretion of waste products of protein metabolism such as uric acid . - The regulation of the fluid balance of body. - the control of the alkalinity of the blood . - The excretion of drugs ,toxins and even bacteria.

2.2.1. Fluid Dynamics :-

2.2.1.1. Volume of Blood Flow. Far more blood (25 percent of total cardiac output per minute) flows into the kidneys than is necessary for the provision of oxygen and nutrients to the kidney. In the kidney, the blood supplies not only the oxygen and nutrients but also a portion of blood is filtered by the kidney for processing. When severe stress is placed on the body due to hemorrhage, the blood flow to the kidneys is reduced, and very little urine is formed. The flow of blood is proportional to the quotient of the pressure drop and the vascular resistance.(Harold Ellis 2006)

2.2.1.2. Renal Clearance. A clearance value indicates the degree to which a substance is removed from the blood by excretion in the voided urine. Glomerular filtrate is practically identical to plasma, except that it contains very little protein. While 125 mL of glomerular filtrate is produced per minute, approximately 124 mL is reabsorbed by the renal tubules. Since none of the creatinine in the glomerular filtrate is reabsorbed, for example, we say that the plasma clearance of creatinine is 125 mL per minute. Another example follows: Less than 10 percent of the potassium ions is excreted (not reabsorbed); therefore, the clearance of potassium is said to be 12.5 mL per minute.

The formula is: .(Harold Ellis 2006)

Plasma clearance = Milligrams excreted in urine per minute

Concentration (mg/mL) in plasma

2.2.1.3. Glomerular Filtration. In humans, clearance tests are used to measure the rate of glomerular filtration. A substance is used that passes easily into the glomerular filtrate but is neither secreted nor reabsorbed by renal tubular cells. The concentration of such a material in the glomerular filtrate is approximately the same as the concentration of the material in the plasma. Knowledge of the rate of excretion of this material and the plasma concentration are the only factors necessary to compute the rate of glomerular filtration. .(Harold Ellis 2006)

2.2.2. Tubular Transport

2.2.2.1. Reabsorption. The principal activity of the kidney is to transport dissolved materials and water across the tubular cells. Transport of materials from the renal tubules to the interstitial fluid is called reabsorption. Most tubular reabsorption occurs in the proximal convoluted tubule. .(Harold Ellis 2006)

2.2.2.2. Secretion. The movement of dissolved materials and water from the interstitial fluid into the tubular lumen is called secretion. .(Harold Ellis 2006)

2.2.2.3. Passive Transport. Passive transport occurs by two methods. Bulk flow occurs when an entire solution moves through a membrane taking all parts of the solution with it. Diffusion occurs when only certain components of a solution move across a membrane. .(Harold Ellis 2006)

2.2.2.4 Active Transport. Active transport occurs when a dissolved material is forced across a rather impermeable membrane by a pumping mechanism. Most physiologically important solutes (glucose, amino acids, proteins, uric acid, and most electrolytes) are reabsorbed in this manner. .(Harold Ellis 2006)

2.2.3.Transport Of Specific Substance

2.2.3.1 Urea. Urea clearance test values are ordinarily about 70 mL per minute.

Therefore, only about 50% of the urea in the glomerular filtrate is reabsorbed. .(Harold Ellis 2006)

2.2.3.2. Glucose. Glucose reabsorption occurs in the proximal tubule and usually goes to completion at this point. Any glucose that is not reabsorbed in the proximal tubule is usually excreted. .(Harold Ellis 2006)

2.2.3.3 Sodium. The reabsorption of sodium is by active transport and is associated with the reabsorption of Cl^- and HCO_3^- . Sodium is reabsorbed in exchange for H^+ and K^+ . To preserve electrostatic equilibrium, it is necessary that for each Na^+ reabsorbed, there must be the reabsorption of an anion (Cl^- or HCO_3^-) or the secretion of a cation (H^+ or K^+). .(Harold Ellis 2006)

2.2.3.4. Chloride. Chloride is reabsorbed in the proximal tubule. Chloride reabsorption is always incomplete, but it increases as the filtered load increases. About 80 percent of the sodium that is reabsorbed is in association with chloride. .(Harold Ellis 2006)

2.2.3.5. Hydrogen. Hydrogen ions are secreted into the renal tubule. Hydrogen is secreted into the distal portion of the nephron in exchange as sodium is reabsorbed from the lumen. Hydrogen also serves to acidify the urine. H^+ secretion is an important pH regulatory mechanism. .(Harold Ellis 2006)

2.2.3.6 Potassium. Reabsorption of potassium is probably by active transport. As sodium is reabsorbed from the lumen, interstitial potassium is secreted. Reabsorption of

potassium occurs in the proximal tubule and secretion of potassium is into the distal tubule. .(Harold Ellis 2006)

2.2.3.7. Water. Most of the water filtered from the plasma is reabsorbed in the proximal convoluted tubule. The flow of urine and the concentration of solute particles in the urine may vary widely. The concentration of solute in the urine depends on the concentration of antidiuretic hormone (ADH) in the plasma and on the rate of urine flow. The amount of ADH that is released depends on the concentration of solutes in the plasma. If the concentration is high, the hypophysis (posterior pituitary) releases ADH into the blood. When this hormone reaches the kidney, water reabsorption begins. If the concentration of solutes in the plasma is low, no ADH is released and water reabsorption decreases. .(Harold Ellis 2006)

2.2.4. Integration OfTubular Functions

In the proximal convoluted tubule, the reabsorption of glucose and amino acids begins. Because of the active transport of sodium, chlorides and bicarbonate are reabsorbed. Approximately 90 percent of the sodium is reabsorbed in the proximal tubule. Water is reabsorbed in the proximal tubule as needed and determined by the concentration of solutes in the plasma. In the distal tubule, sodium is reabsorbed in exchange for hydrogen and potassium. The distal tubule is also permeable to water in the presence of ADH. When ADH is present, the collecting tubules also are permeable to water; but if ADH is not present, these tubules act only as conduits. .(Harold Ellis 2006)

2.2.5. Diuresis

A high rate of urine flow is called diuresis and there are two main types; water diuresis and osmotic diuresis. Water diuresis occurs when there are inadequate amounts of

ADH in the blood. Osmotic diuresis is caused by an increase in the rate of solute excretion. An increase in solute excretion causes an increase in the amount of water that is excreted with the urine. .(Harold Ellis 2006)

2.2.6. Endocrine Contorol

2.2.6.1. Antidiuretic Hormone. The effect of ADH on the permeability of water through the tubules is very rapid, and changes in the ADH concentration in the blood are only 10 to 15 minutes behind the change in the solute concentration. .(Harold Ellis 2006)

2.2.6.2 Renin and Aldosterone. When the sodium concentration in the blood falls to a very low point or when the blood pressure falls (for example, in hemorrhage), special cells in the nephron release a hormone called renin which acts upon a plasma protein (angiotensinogen) to form angiotensin–2. Angiotensin–2, in turn, acts upon the cortex of the adrenal gland to produce aldosterone. Aldosterone increases Na^+ reabsorption and thus increases water reabsorption. This increases the plasma volume and the blood pressure. .(Harold Ellis 2006)

2..3. Anomalies Of Structure and Function

2.3.1. Duplex kidneys

These occur in a spectrum of degrees, from two separate organs with separate collecting systems and duplex ureters, to a mild degree of separation of the PCS at the renal hilum . The latter is more difficult to recognize on ultrasound, but the two moieties of the PCS are separated by a zone of normal renal cortex which invaginates the kidney, a *hypertrophied column of Bertin* (see below). If duplex ureters are present (a difficult diagnosis to make on ultrasound unless dilatation is present) then a ureterocoele related to the upper moiety should be sought at or adjacent to the bladder. This may cause dilatation of the affected moiety.

The main renal artery and vein may also be duplicated, which can occasionally be identified using colour or power Doppler.(Jane , 2004)

2.3.2. Ectopic kidneys:-

The kidney normally ascends from the pelvis into the renal fossa during its course of development. During this 'migration' it rotates inwards so that the renal hilum faces medially. A failure of this mechanism causes the kidney to fall short of its normal position, remaining in the pelvis, that is, a pelvic kidney. Usually it lies on the correct side, however occasionally it can cross to the other side, lying inferior to its normally placed partner—*crossed renal ectopia*. Frequently it may fuse with the lower pole of the other kidney, *crossed fused renal ectopia*, resulting in what appears to be a very long, unilateral organ. (Jane 2004)

2.3.3. Horseshoe kidneys :-

In the horseshoe kidney, the kidneys lie one on each side of the abdomen but their lower poles are fused by a connecting band of renal tissue, or *isthmus*, which lies anterior to the aorta and IVC (Fig. 2.1.5.1). The kidneys tend to be rotated and lie with their lower poles medially.

It may be difficult to visualize the isthmus due to bowel gas anterior to it but a horseshoe kidney should always be suspected when the operator is unable to identify the lower poles of the kidneys confidently. When the isthmus can be seen, it is important not to confuse it with other abdominal masses, such as lymphadenopathy. CT is occasionally performed because of this but normally clarifies the findings.(Jane,2004)

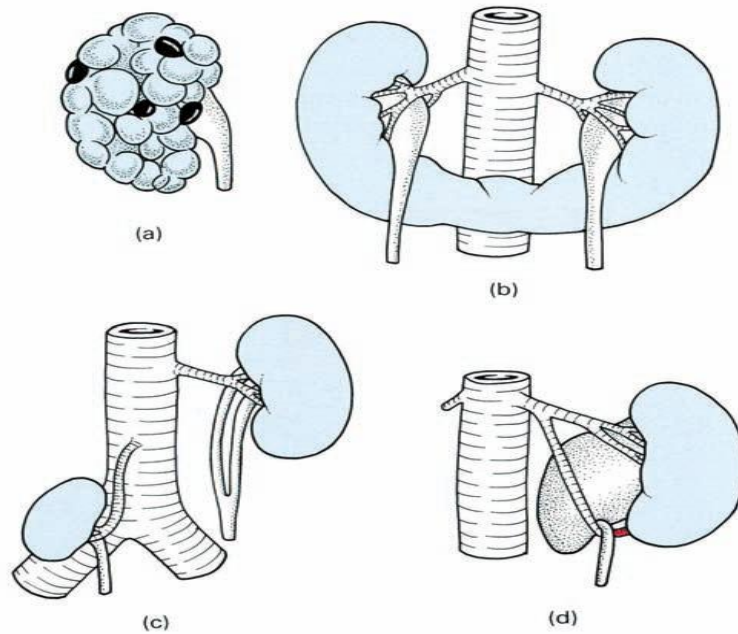
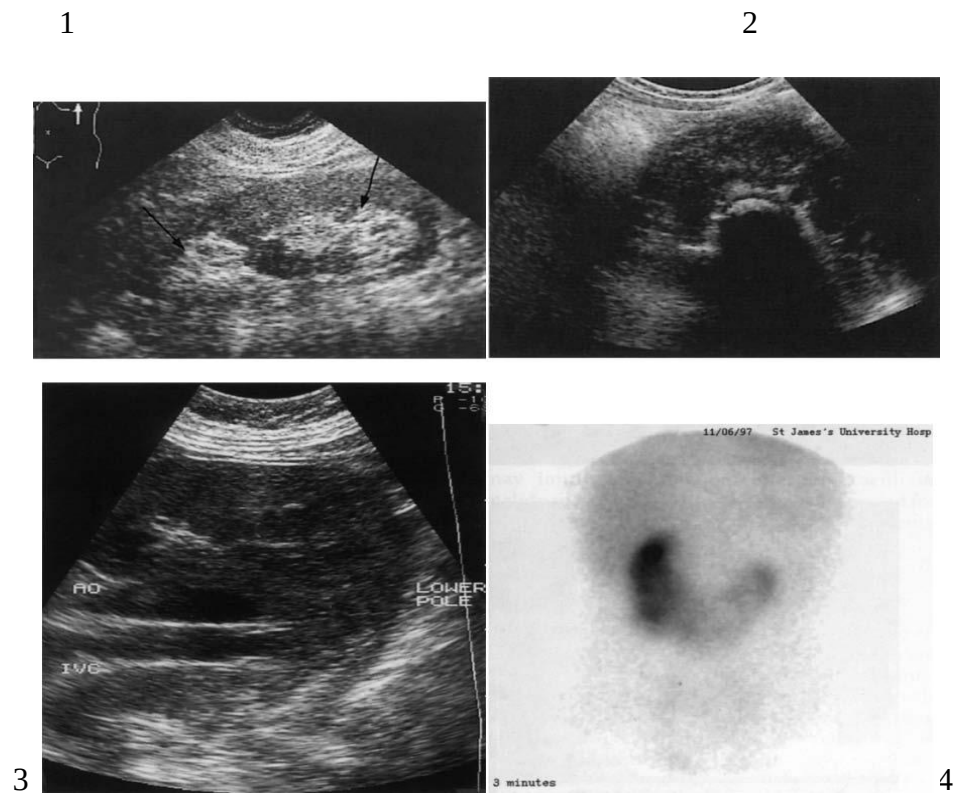


Fig. 2.7 Renal abnormalities. (a) Polycystic kidney. (b) Horseshoe kidney. (c) Pelvic kidney and double ureter.(d) Aberrant renal artery and associated hydronephrosis.(Harold Ellis 2006)



Fig(2.8)1.duplex kidney 2.,horseshoe kidney, (Jane , 2004)

2.3.4.Extrarenal pelvis

Not infrequently, the renal pelvis projects outside the kidney, medial to the renal sinus. This is best seen in a transverse section through the renal hilum. It is frequently ‘baggy’, containing anechoic urine, which is prominently demonstrated on the ultrasound scan (Fig. 2.8).

The importance of recognizing the extrarenal pelvis lies in not confusing it with dilatation of the PCS, or with a parapelvic cyst or collection. .) (Jane 2004)



Fig 2.9 Transvers section for US show Extrarenal pelvis (Jane 2004)

2.3.5. Hypertrophied column of Bertin

The septum of Bertin is an invagination of renal cortex down to the renal sinus. It occurs at the junctions of original fetal lobulations and is present in duplex systems (see above), dividing the two moieties. Particularly prominent, hypertrophied columns of Bertin may mimic a renal tumour. It is usually possible to distinguish between the two as the column of Bertin does not affect the renal outline and has the same acoustic characteristics as the adjacent cortex (Fig. 2.9.) (Jane 2004)



Fig 2.10 coronal section for US show Hypertrophied column of Bertin (Jane 2004)

2.3.6 . Dromedary Hump.

These are areas of renal cortex, which form a bulge in the renal outline. Like the hypertrophied column of Bertin, a hump may mimic a renal mass. Careful scanning can usually solve the dilemma as the cortex remains constant in thickness. The most usual manifestation is the *splenic hump* on the left kidney, which is a flattening of the upper pole with a lateral prominence just below the margin of the spleen. Humps are basically a variation in the shape of the kidney rather than an area of hypertrophied tissue. (Jane 2004)

2.3.7. (Persistent) Fetal Lobation

Normally lobation “disappears at birth or shortly thereafter.”² If it persists beyond this time, it is an inconsequential anatomic variant. Occasionally, if it is palpated, it may be misdiagnosed as cystic disease. This is easily identified with an ultrasound scan as prominent indentations on the surface of the kidneys with the remainder of the kidney appearing normal. (Jane 2004)

2.3.8. Unilateral Renal Agenesis

This is congenital absence of a kidney. There is an empty renal fossa and the adrenal gland appears flattened. The solitary kidney on the opposite side may be enlarged

due to compensatory hypertrophy. The differential diagnosis should include an ectopic kidney and a hypoplastic kidney. The development of the urinary system is closely associated with that of the genital system. Renal ectopia, agenesis, collecting system duplication and ectopic ureteral insertion are associated with cystic pelvic masses in both sexes, cryptorchism in the male and anomalies of the uterus and vagina in the female. Therefore, the diagnosis of renal ectopia, agenesis, duplication and ectopic ureteral insertion should lead to an investigation of the associated genital tract anomalies. Similarly diagnosis of genital anomalies should lead to an investigation of the associated urinary tract anomalies. (Jane 2004)

2.3.9. Junctional Parenchymal Defect

Each kidney is formed embryologically from upper and lower units of parenchyma that fuse along an oblique line. The junction points of these limits may persist as a prominent indentation of the cortical surface. The parenchymal defect is a triangular shaped echogenic focus best demonstrated on longitudinal scans. It commonly is located anteriorly, at the junction of the upper and middle thirds of the kidney . (Jane 2004)

2.3.10. Interrenicular Septum

The interrenicular septum is the site of fusion of the two embryological renal units. It is also called the **junctional line** and is more common in the right kidney.

“The interrenicular septum is seen in longitudinal view as an oblique, echogenic linear band through the medial aspect of the kidney connecting the junctional parenchymal defect to the renal hilum.” (Jane 2004)

2.3.11. Renal Sinus Lipomatosis

This is a heavy deposition of fat in the renal sinus. With increasing age, the amount of renal parenchyma decreases whereas the amount of renal sinus fat increases. The cortex will be thinner than in a younger adult and the highly echogenic sinus will be larger. The overall size of a kidney decreases with age. (Jane 2004)

2.3.12. Ureteropelvic Junction Obstruction (UPJ)

Congenital narrowing at the junction of the ureter and the renal pelvis is a common anomaly. It is twice as common in men and the left kidney is affected twice as often. It is bilateral in one third of patients. (Jane 2004)

Innocuous UPJ narrowing causes minimal pyelocaliectasis and is associated with normal renal parenchymal thickening and a normal sized kidney. The ureter is of normal caliber. There is an increased incidence of contralateral multicystic dysplastic kidney and renal agenesis. When a patient with UPJ narrowing becomes significantly obstructed, there will be moderate to severe urinary tract distention and parenchymal thinning. UPJ obstruction is the most common obstructive cause of renal pelvic dilatation. (Jane 2004)

2.4 . Pathology of Urinary System and Sonography appearance:

2.4.1 . Obstructive Uropathy:

Obstructive in urinary tract is common and important because it increases the susceptibility to infection and stone formation . Obstruction can occur in any age and in either sex. The cause of obstruction may lie at any level of the urinary tract (renal pelvis , ureter, urinary bladder, urethra). The obstruction may be intraluminal , intramural or extramural . The obstruction may be unilateral or bilateral , partial or complete . Complete bilateral obstruction may result in renal failure . Whereas long standing chronic partial obstruction may cause various functional abnormalities . (.Muir)

2.4.1.1. Causes of obstructive uropathy : - Calculi - Tumors (e.g. cancer of kidneys or bladder) - sloughed renal papilla - Blood clot- foreign body. (.Muir)

2.4.1.1.1. Intramural causes : - pelvi-ureteric –junction (PUJ) obstruction. - vesico-ureteric junction (VUJ) obstruction - Urethral valves. - Inflammation (e.g.cystitis) - Urethral stricture.- Neuromuscular dysfunction . (.Muir)

2.4.1.1.2.Extramural causes :

- Pregnant uterus . - Retroperitoneal fibrosis. - tumours (e.g. carcinoma of cervix , rectum, colon, caecum) - prostatic enlargement , prostatic carcinoma . - Trauma (.Muir)

2.4.1.2. Urolithiasis :

The most common and important cause of obstructive uropathy is urolithiasis .

Urolithiasis or formation of urinary calculi at any level of the urinary tract is common condition. Renal calculi are characterized clinically by colic pain (renal colic) as they pass down along the ureter and manifest by haematuria . There are 4 main types of urinary calculi – calcium containing , mixed (struvite) ,uric acid and cystine stone. There are three important anatomic

squeal of obstruction ,namely : Hydronephrosis, Hydroureter, and Hypertrophy of the bladder .
(.Muir)

2.4.1.2. 1. Hydronephrosis:

Is the dilatation of renal pelvis and calyces due to partial obstruction to the outflow of urine .
Hydronephrosis develops if one or both the Pelvi-ureteric sphincters are incompetent , as
otherwise there will be dilatation and hypertrophy of the urinary bladder but no hydronephrosis ,
Hydroureter nearly always accompanies hydronephrosis . Hydronephrosis may be unilateral or
bilateral . (.Muir)

2.4.1.2.1.1. Unilateral hydronephrosis:

This occur due to some form of ureteric obstruction at the level of Pelvi ureteric junction (PUJ)
the cause are Intraluminal e.g. calculi in the ureter or renal pelvis . - Intramural e.g. congenital
Pelvi – uretreic junction(PUJ) obstruction , atresia of ureter , inflammation stricture , trauma ,
neoplasm of ureter or bladder . - Extramural e.g .obstruction of upper part of ureter by inferior
renal artery or vein , pressure on ureter from outside such as carcinoma cervix ,prostate, rectum ,
colon , or caecum and retroperitoneal fibrosis (.Muir)

2.4.1.2.1.2. Bilateral hydronephrosis:

This is generally the result of some from of urethral obstruction. The causes are:-- **Congenital**
e.g Atresia of the urethral, congenital posterior urethral valve.- **Acquired** e.g bladder tumour
involving ureteric orifices, prostatic enlargement, prostatic carcinoma, bladder neck stenosis,
inflammatory of traumatic urethral stricture. (.Muir)

2.4.1.2.1.3. Sonographic appearances :-

2.4.1.2.1.3.1 Mild - th.ere is minimal dilatation of the collecting system, The calyces are

blunted but some pyramidal indentation remains. On ultrasound this appears as a single, ellipsoidal fluid collection spreading the central echo complex. Slight dilatation of the renal pelvis and calyces will be seen.(Amir)

2.4.1.2.1.3.2. Moderate - In drawing B the calyces are clubbed and there is no pyramidal indentation into the calyces. On ultrasound there is a lobulated fluid collection with a few septae between the distended calyces. The parenchymal thickness is preserved.

2.4.1.2.1.3.3. Severe - In drawing C the calyces are still discretely defined and separate from each other. The collecting system is markedly dilated with thinning of the parenchyma.

2.4.1.2.1.3.4. Extreme - In drawing D the calyces are so distended that they blend into one another except for residual margins that appear as thin septae. On ultrasound there are multiple rounded fluid containing structures which are the distended calyces. These distended calyces displace the central echo complex and totally replace the normal parenchyma.(Amir gailani)

2.4.1.2.2. Hydroureter appears as a fluid distended and often tortuous ureter .

2.4.1.2.3. megaureter is a congenitally dilated ureter.

2.4.1.2.4. Pyelocaliectasis of pregnant:- It is in pregnant female due to diminished ureteral stone secondary to elongation and widening of the ureter during pregnancy .

The kidney revert to normal flowing delivery . .(Amir gailani)

2.4.1.2.5. Over hydration:- It is a transient form of dilatation due to fullness of the renal collecting system . Once the patient voids , the dilated collecting system is no longer visible.

2.4.1.2.6. Pyonephrosis :- It is the serious complication of hydronephrosis that develops as a direct consequence of urinary stasis and secondary infection . It is defined as the presence of pus in a dilate collecting system . *ESCHERICHIA COLI* (E.Coli) is the most common infecting organism. appearance **On Ultrasound:-**Appear as a dilated pelvicalyceal system containing

internal echoes which may create urine –debris level in the dilated collecting system. Or appear dependent within the dilated collecting system. **Best technique** Coronal scanning with the patient lateral decubitus position enhance visualization of the urine –debris levels. - Aspiration under Ultrasound guidance may be performed to make definitive . .(Amir gailani)

2.4.1.3. Renal Calculus Disease:

Calculi can form in any part of the urinary tract but mostly form in the kidneys . Stones can occur within any part of the kidneys (renal cortex – medulla vessels – calyces – renal pelvis most calculi arise in the collecting system . Ultrasound demonstrated calculi as highly echogenic structures regardless of chemical composition shadow detection posterior to the stone depends on – stone size - transducer frequency – transducer focal zone . Tiny calculi (less than 5mm) will not shadow if they are smaller focal zone . They appear as densely echogenic structure within the renal sinus echoes . Decreasing the gain makes them stand out more against the background echogenicity of the renal sinus.**Types of calculus diseases: (Robbin et al seventh)**

2.4.1.3.1. collecting system stones :- Hydration of the patient may enables better visualization of the calculus verses the echogenic renal sinus . A staghorn calculus is a stone that completely fills the entire collecting system . It appears as curved echogenic structure in the renal sinus area . The acoustic shadow created by the calculus often hides any associated hydronephrosis .

2.4.1.3..2. Nephro-calcinosis :- It is the formation of calcium deposits in the renal parenchyma : Cortical 5% , Medullary 95% . **(Robbin et al seventh)**

2.4.1.3.3. Cortical nephrocalcinosis :- Hyper calcemia (high blood levels of calcium) leads to cortical nephro calcinosis . the most common causes of hyper calcimia are . Malignant neoplasm Hyper parathyroidism. Vitamin D intoxication or treatment . Acute cortical necrosis or axalosis.

On Ultrasound There are (focal or diffuse) punctuate or confluent densities in the cortex of the kidney producing a dense outline of the kidney . No acoustic shadowing is seen.+ It is usually diffuse and bilateral .(Gurashi)

2.4.1.3.4. Medullary nephrocalcinosis :-In adults the common causes are sponge kidney renal tubular actosis It is infants foresaid. **On Ultrasound** The cortical echogenicity is normal. There are focal areas of increased echogenicity corresponding to the renal pyramid .There may be acoustic shadowing associated with these dencities .

2.4.1.3.4. Renal vascular classification :- This type of calculi is caused by systemic disease which is associated with accelerated atherosclerotic disease. Such as chronic diabetes and ypertension

On Ultrasound Appear as pulsatile echogenic foci with shadowing in the area of renal sinus classification have also been demonstrated in the arcuate arteries of hypertensice children .(Gurashi)

.2.4.2 .Renal Cyst and Cystic Diseases :-

2.4.2.1. Simple cyst:-

The most common renal mass is a simple cyst which can be found in up to 50% of the population, the incidence increasing with age. Most cysts are asymptomatic and may be solitary or multiple. Generally they are peripheral but may occur within the kidney adjacent to the renal pelvis. A parapelvic cyst may be difficult to distinguish from pelvicalyceal dilatation, a calyceal diverticulum or an extrarenal pelvis and careful scanning is required to differentiate.

A parapelvic cyst may be the cause of a filling defect on intravenous urogram (IVU) and CT can differentiate a cyst from a diverticulum if necessary, as the latter will fill with contrast. Occasionally cysts can haemorrhage causing pain. Large cysts, particularly of the lower pole, may be palpable, prompting a request for an ultrasound scan. **On Ultrasound appearances**

Like cysts in any other organ, renal cysts display three basic characteristics: they are anechoic, have a thin, well-defined capsule and exhibit posterior enhancement. It can be difficult to appreciate the posterior enhancement if the hyperechoic perirenal fat lies distal to the cyst; scanning from a different angle (Fig. 2.10) may be helpful. Haemorrhage or infection can give rise to low-level echoes within a cyst and in some cases the capsule may display calcification. Whilst a solitary, simple cyst can almost certainly be ignored, cysts with more complex acoustic (Jane 2004)

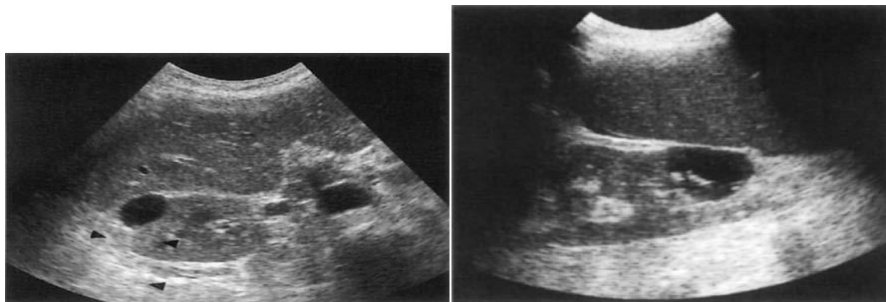


Fig (2.11) transvers section simple renal cyst(Jane 2004)

2.4.2.2. Autosomal dominant (adult) polycystic kidney disease (APKD)

This autosomal dominant disease has a wide spectrum of presentation. It is normally associated with progressive renal failure. A renal transplant offers a successful cure for many patients.

Although in some cases APKD may cause renal failure in early life, it is also possible to achieve a normal life span with no appreciable symptoms. In about 50% of cases, cysts are present in the liver; they are also found in the spleen and pancreas in a small proportion of patients.

Ultrasound screening for APKD is performed in families with a positive history, as patients may then be monitored and treated for hypertension. A negative scan does not entirely exclude disease, especially in the younger patient, and multiple examinations over years may need to be performed. **Ultrasound appearances** . The disease is always bilateral, causing progressively enlarging kidneys with multiple cysts of various sizes, many having irregular margins (Fig.2.11).

There is often little or no demonstrable normal renal tissue and the kidneys may become so large that they visibly distend the abdomen. APKD predisposes the patient to urinary tract infections and some of the cysts may contain lowlevel echoes as a result of infection or haemorrhage. The liver, spleen and pancreas should also be examined on ultrasound for associated cysts. A small but recognized increased incidence of tumour is recorded in patients with APKD. (Jane2004)



Fig (2.12)cross section for(US)show APKD female (Jane2004)

2.4.2.3. Autosomal recessive (infantile) polycystic kidney disease (PCKD)

This autosomal recessive condition may often be diagnosed prenatally on ultrasound. The disease carries a high mortality rate in early childhood, and is therefore rarely seen on ultrasound in children. Tiny cysts replace both kidneys, giving them a hyperechogenic appearance due to the multiple reflections from the cyst walls and the overall increased through-transmission. (Jane2004)

2.4.2.4. Acquired cystic disease

This condition tends to affect patients on long-term dialysis who may already have shrunken, end-stage kidneys. Its frequency increases with the duration of dialysis. Multiple cysts form in the kidneys, which may, like adult PCKD, haemorrhage or become infected. The disease tends to be

more severe the longer the patient has been on dialysis. The proliferative changes which cause acquired cystic disease also give rise to small adenomata and the ultrasound appearances may be a combination of cysts and solid, hypoechoic nodules. In particular, acquired cystic disease has the potential for malignancy^{3,4} and it is therefore prudent to screen native kidneys, even after renal transplantation has been performed. (Jane2004)

2.4.2.5 Multicystic dysplastic kidney (MCDK)

This is a congenital malformation of the kidney, in which the renal tissue is completely replaced by cysts. It is frequently diagnosed prenatally (although it is naturally a lethal condition if bilateral). The MCDK may shrink with age and, by adulthood, may be so small that it is difficult to detect and may be mistaken for an absent kidney. Contralateral renal hypertrophy is often present. MCDK can be associated with contralateral pelviureteric junction obstruction, which is also frequently diagnosed in utero. It is thought that MCDK occurs as a result of severe early renal obstruction during development in utero. Obstructed calyces become blocked off, forming numerous cysts which do not connect.(Jane 2004)

2.4.3. Neoplasm :

2.4.3.1. Benign lesions:

2.43.1.1. Angiomyolypoma (haematoma) :

It is solid containing fat, smooth muscle and blood vessels . It is the most highly echogenic of all renal mass. Unilateral solitary mass and multiple bilateral mass . (Jane2004)

2.4.3.1.2. Adenoma : It a benign tumour originate from the renal tubular epithelium, occur in older patient it is a sysmptomatic but can cause recurrent painless hematuria adenomas cannot be differentiated sonographically from other solid bengin or mailgant renal mass. There are another 2 type of benign tumors which are: . Haemangioma,. Hamangiopericytoma . (Jane2004)

2.4.3.2. malignant Lesions :Renal Cell Carcinoma (Hypernephroma, Grawitz's tumor) This is a primary tumor of the renal parenchyma thought to originate from the tubular epithelium Clinically,The most common complaints are:- Painless Hematoma ,Long – standing fever ,Dull flank pain and weight loss ,If the tumor is extensive , impaired or total renal dysfunction may occur ,Renal Cell carcinoma may produce , Non functioning Kidney , Obstructive of collecting system , Vascular thrombosis ,Renal vein occlusion **Sonographic Findings:-** Usually a spherical, solitary , unilateral tumor of variable size and echogenicity. The majority of tumors are either isoechoic or hypoechoic to the normal renal parenchyma, however approximately 4% are highly echogenic within the mass and may be focal or diffuse. The mass frequently distorts the collecting system. Hydronephrosis is not a common feature The renal vein, IVC and right atrium may contain tumor thrombi which generate intraluminal echoes Due to the invasive area, contralateral kidney vein, IVC, right atrium , para aortic nodes and the liver Is necessary to determine resectability and surgical approach (Jane2004)

2.4.3.2.1. Transitional Cell Carcinoma :- This is malignancy involving the renal collecting system, ureters or bladder occurs older age group mostly in males, it is usually unilateral and may be single or multiple .**On Ultrasound:-** Hypo echoic mass centrally located in the renal sinus ,It causes the separation of the central echo complex ,The differential diagnosis would be a parapelvic cyst or blood clots. (Jane2004)

2.4.3.2.2. Renal Lymphomas :- primary renal lymphomas are rare. Mostly metastatic in origin.Liver, spleen and paraortic nodes must be scanned for possible involvement with tumor . **On Ultrasound :-** A diffusely enlarged kidney with decreased parenchymal echoes.More commonly hypoechoic renal masses with low degree of attenuation . these masses must be

differentiated from cysts by either aspiration and cytology studies or a Galium scan. Perinephric hypo echoic mass.

2.4.3.2.3. Leukemia :- It is the carcinoma of the blood cells, it may cause diffuse enlargement of the kidney or occasionally focal hypoechoic or anechoic modular masses .

2.4.3.2.4.Nephroblastoma (Wilm's Tumor) :- kknown as Wilm's tumor Embroyoma or Embryonal carcinomas , it is the most common abdominal malignancy in children (5 years ols and younger). The present with Large abdominal mass Failure to thrive **In advance cases:-** Fever , Weight loss ,Anemia , Hypertension , Hematuria **On ultrasound** A solid mass with variable intensities , Later the tumor can develop sonolucent area, , Calcification may present It is bilateral in 5% of cases , Invades the renal vein IVC in 6% , Metastases is developed in the liver , adrenal glad, lymph nodes and retroperitonium (Jane2004)

2.4.4. Medical Renal Diseases

The terms describes renal disorders that initially treatable with medicine rather than surgery .in general patients with enlarge kidney (greater than 12 cm) medical renal disease was suspected if so they will require biopsy for definitive diagnostic of the underline abnormality . patients with renal length of less than 9 cm. are consider to have abnormality small, and stage kidneys, biopsy is usually require because the underlying renal disease is probably irreversible . the hallmark of parenchymal renal disease is diffuse increase in echogenicity throughout the parenchyma of both kidney, with medullary congestion, the pyramids become prominent and relatively hypoechoic. In order instances , the pyramids become less distinct and difficult to differentiate from the cortex. Any infiltrative process can increase sepal fitness, rendering the sinus echoes in homogenous and patchy , with fibrosis and atrophy , the loss of dispose tissue result in further loss of distinction between the renal sinus and parenchyma.

2.4.4.1 .Acute Renal Failure. (A.R.F)

Renal failure is consider acute it develops over days or weeks. and chronic if it spans months or years the acute or chronic renal failure may result from : Perirenal causes (Insufficient Renal Perfusion) Renal causes (Intrinsic Renal Disease) Post Renal causes (obstructive Uropathy)

2.4.4.1.1. Common cases :- Acute tubular necrosis which result of: Ischemia due to major trauma , Massive hemorrhage , Transfusion reaction , Cardiac , Aortic or Bilbray surgery Chemical toxic to kidneys **On ultrasound** Renal sonography is most often normal The main purpose of the study is to exclude hydronephrosis Renal size may be normal or enlarged The kidneys may have globular configuration , Cortical, parenchymal echogenicity is usually normal but it may be hypoechoic secondary to edema or hemorrhage .The cortico modularly boundary is usually well preserved. With ischemic renal damage, the kidney most frequently appeared sonographically normal . (Jane2004)

2.4.4.2. Chronic renal failure :

2.4.4.2.1 Common Causes : Glomerulonephritis. Chronic pyelonephritis. Renal vascular disease. Diabetes . Gout Polycystic renal disease **On Ultrasound** The cortical echogenicity is As the disease increased progresses the medulla is usually not identified In end – stage kidney , the kidneys are small and there is loss of distinction between the cortex , medulla and central sinus echoes ,There is no significant correlation between a specific sonographic appearance and the type of renal disease

2.4.4.2.3. Renal Infection :-

It is a general term referring to the presence of micro organisms in the urine . The predisposing factors for renal infection are . Contaminants from intestinal tract ,Instrumentation ,Stasis

,Vesico ureter reflux ,Hematogeneous infection **On Ultrasound** Examination of normal size
Detection of cysts Exclusion of any obstruction. (Jane2004)

2.4.4.2.3.1..Acute pyelonephritis (acute bacterial nephritis):-

This is most often caused by ascending Escherichia coli (E-Coli) infection coming from the bowel , it is more common in female **On Ultrasound** To rule out obstruction or abscesses
Kidney demonstrates no abnormalities, However edema may result in diffuse renal enlargement
Differential diagnosis includes acute renal vein thrombosis and renal infection

2.4.4.2.3.2..Emphysematous pyelonephritis.

It is fulminant necrotising form of pyonephritis caused by E-Coli. It is most common in .

2.5. Renal Sonography

2.5.1. Examination Technique

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 windows. 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 positions for the left kidney. Coronal longitudinal and transverse scans may also be obtained and are recommended for evaluating the renal pelvis and proximal ureter on hydronephrotic patients.

The highest frequency transducer permitting adequate penetration is used. This is usually in the 3 to 5 MHz range. A phased array sector probe with its small footprint permits subcostal and intercostal scanning.(Amer)

2.5.2. Normal Sonographic:- Capsule appears the hyperechoic. Cortex appears the hypoechoic. Medulla appears the almost anechoic . Sinus appears the hyperechoic Perirenal fat appears the hyperechoic. , Renal size : vary with age , height , weight and sex. Renal length 9-13 cm, RK & LK should be within 2cm in length.

2.5.3 . Sonographic appearances of the kinds obstruction:

2.5.3..1. Mild - there is minimal dilatation of the collecting system, The calyces are blunted but some pyramidal indentation remains. On ultrasound this appears as a single, ellipsoidal fluid collection spreading the central echo complex. Slight dilatation of the renal pelvis and calyces will be seen.

2.5.3.2. Moderate - In drawing B the calyces are clubbed and there is no pyramidal indentation into the calyces. On ultrasound there is a lobulated fluid collection with a few septae between the distended calyces. The parenchymal thickness is preserved.

2.5.3.3. Severe - In drawing C the calyces are still discretely defined and separate from each other. The collecting system is markedly dilated with thinning of the parenchyma.

2.5.3..4. Extreme - In drawing D the calyces are so distended that they blend into one another except for residual margins that appear as thin septae. On ultrasound there are multiple rounded fluid containing structures which are the distended calyces. These distended calyces displace the central echo complex and totally replace the normal parenchyma

2.5.3.5. Hydroureter appears as a fluid distended and often tortuous ureter .

2.5.3.6. megaureter is a congenitally dilated ureter.

2.6. Ultrasound :-

2.6.1 Basic physics instrumentation of ultrasound :-

Diagnostic(US) employs pulsed , high frequency sound that are reflected back from body tissues and processed by ultrasound machine to create characteristic images . Ultrasound is a form of mechanical energy which passes in wave form like sound waves and having a frequency waves the same type of wave as detected by the human ear , except the a frequency is higher Ultrasound imaging uses frequencies in the range from 1 to 20 Mhz at power from 0.01 to 200 mw/cm². (Bamber, et.al 1986)

The ultrasound is generated and received by piezoelectric transducers . Ultrasound can be aimed in a specific direction and obeys the laws of geometric optics with regard to reflection , transmission and refraction . When an ultrasound wave meets an interface of differing echogenicity , the wave is reflected , refracted and absorbed. Only reflected sound waves (echoes) can be sensed by the transducer and processed to generate an image . The transducer acts as a receiver over 99% of the time.(Goss, et.al 1978)

2.6.2. Transducer:-

Transducers convert electrical energy into mechanical energy to produce ultrasound and vice versa . The part of the transducer which does this work is a piezoelectric crystal . It can be synthetic or natural . They have an inherent property of vibrating when an electric current is applied and thus produce ultrasonic waves and conversely produce electric impulse when vibrated thus helping the acquisition of data for the formation of image. This effect is called “Piezoelectric effect “.(Ossoinig and KC 1979).

Quartz is a naturally occurring piezoelectric crystal . Synthetic ones are prepared from ceramics like zirconate and lead titanate. (Wild, et.al 1952).

The range of the velocities of ultrasound in body tissues is fortunately limited , so the at time of return of an echoe is a reliable indication of depth . Small variations give rise to geometrical distortions .(Ossoinig and KC1979)

different tissues have different attenuation coefficients and this determine the quantum of reflection . This property has helped in imaging , tissue characterization and appropriate diagnosis . The greater the mismatch in acoustic impedance between tow adjacent tissues the more reflective will be their boundary .(Ossoinig and KC 1979)

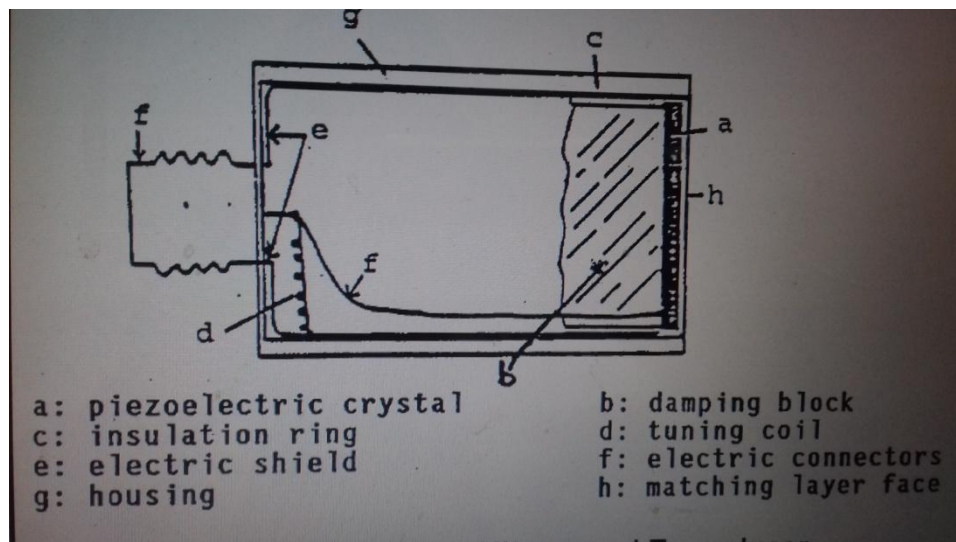


Fig 2.13:- Parts of a Typical Ultrasound Transducer (Burwin Institute notes)

2.6.3. Real time ultrasound:-

B-Scan produces a single image frame . A real time ultrasound transducer produces multiple images in a very short time i.e, at least 16 or more images (frames) per second , which gives us a impression as though we are seeing the moving structures in real . this quick presentation of images is possible by oscillating the piezoelectric crystals (Ossoinig)

2.6.4. Ultrasound artifacts:-

Artifacts are echoes that appear on the image that do not correspond in location or intensity to actual interfaces in the patient . They can be of tow types :-

2.6.4.1 good artifacts – which are helpful . Acoustic shadowing , Acoustic enhancement , Comet tail . (Ossoinig and KC)

2.6.4.2 Bad artifacts-

Refraction ,Reverberation , Mirror image artifact Beam width artifact , Movement artifact , Operator pressure artifact, (Ossoinig and KC)

2.6.5. Machine of ultrasound:-

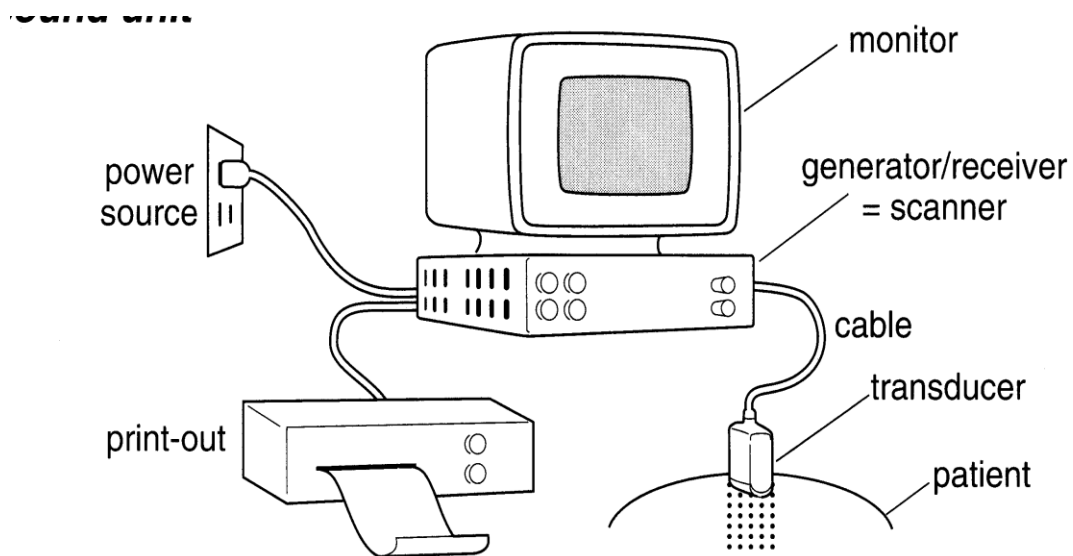


Fig 2.14 part of ultrasound machine .(Palmer .P.E.S.1995)

2.6.6.Type of the transducer:-

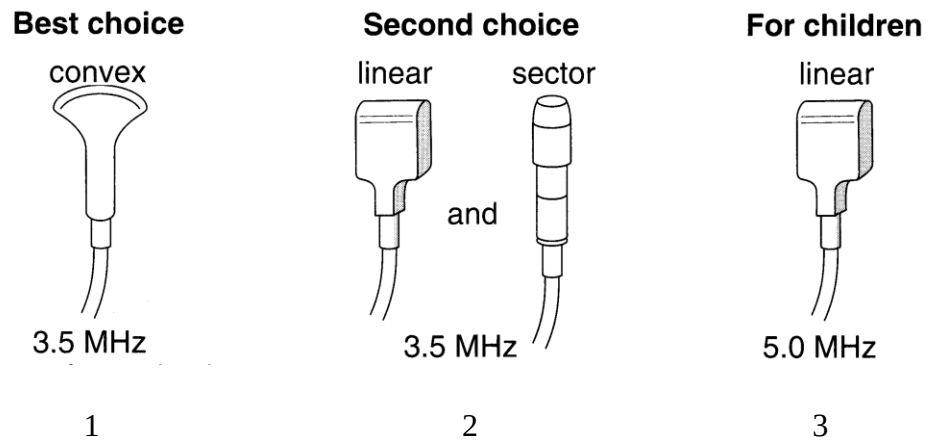


Fig 2.15 shows type of transducer 1. convex 2. Linear and sector for adult 3.linear for children.(Palmer .P.E.S.1995)

2.7.Previous Study:-

Z Ashraf, et al (2008) A prospective study was undertaken to compare the diagnostic accuracy of duplex Doppler ultrasonography (DDUSG) and intravenous pyelography (IVP) in detection of obstruction in the urinary tract. IVP could detect the cause of obstruction IN 68 out of 80 obstructed kidneys (sensitivity.85%) . hydronephrosis as a consequence of obstruction had sensitivity of 92.5% prior animal studies have shown that obstruction anywhere in the renal tract changes the vascular resistance and Doppler wave form and intrarenal arteries . This cause an increase in the renal resistive index (RI) RI is defined as : $\text{peak systolic velocity} - \text{peak diastolic velocity} / \text{peak systolic velocity}$ in a defined vessel . After confirming the obstruction on IVP , the above 80 kidneys were subjected to conventional sonography and then to DDUSG .DDUSG could detect obstruction in 70 out of 80 kidneys by detecting an increase in renal RI (sensitivity 87.5% subsequent preoperative detection of obstruction was also done .

(Fahmi ,2005) Role of Ultrasound for the diagnosis of obstructive , this study was collected from patients who were referred to the ultrasound department in general hospital Kingdom Saudi Arabia the total number were 70 patients who developed obstruction from different types of diseases . there are many diseases can causes obstructive uropathy stones ,tumor , urethra stricture , urinary bladder obstruction .was found that more than 60% will be detected by ultrasound .

Hammad , et al .2004 During the period of study 864 patient had ultrasound and (UHCT) for evaluation of the urinary tract in patients presenting with flank pain . Out of these 34 patients had both (UHCT) and (US) done within a span of one day and had serum creatinine of >1.8 mg/dl . Mean age was 48 ± 15.8 years and 59% of the patients were males. (UHCT) identified renal stones in 21 (62%) , whereas 17 of these were identified on US , with a sensitivity of 81% .

Chapter three

Materials and method

3.1 Materials

3.1.1 Population of the study

This descriptive study includes 100 Sudanese Patients total random sample of 66 male , 34 female . with signs are symptoms of obstruction all of this sample came to ultrasound department check up.

3.1.2 Area and duration of study :

The study is held in ultrasound department in Doctor,s clinic in Sudan from October 2015 to November 2015 .

3.1.3. Equipments

Sonography was carried out on each patient included in the study using Ultrasound machine Toshiba –power vision -6000, transabdominal convex linear transducers with frequency of 3.5 and 7.MHz ultrasound gel .

3.2. Method :-

3.2.1.Method of data collection:-

In this study hundred Sudanese patients came to abdominal and pelvis pain scanned by Transabdominal probe .After checking that the obstructive uropathy the hydronephrosis was estimated by calculate the ratio between the dilated PCS and the kidney.The data were collected by referred patient , questionnaire , investigations .

3.2.2 Technique :

Abdomen US coronal and transverse and longitudinal planes with patient either position supine , right lateral decubitus or left lateral decubitus to see any site possible for obstruction occur.

3.2.3. Data analysis :-

The result will be concluded from the processed data . and will be discussed in details to see the ultrasound accuracy in diagnosis the obstructive uropathy . the data is analyzed by using Statistical Package . The relation between dilated PCS and kidney

Chapter Four

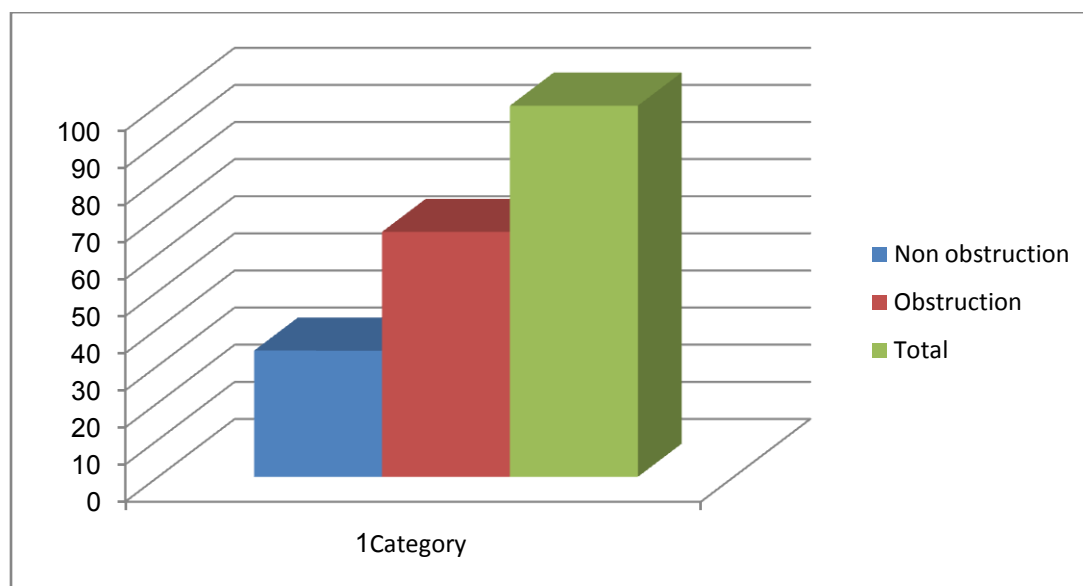
Result

4.1 Result and data Obstruction:

Table (4.1) shows distribution of obstruction and non obstruction

Item	Frequency	Percentage
Non obstruction	35	35%
Obstruction	65	65%
Total	100	100%

Fig (4.1) shows distribution of obstruction and non obstruction



Result:-

Table (4.2) show distribution of ages

Item	Frequency	Percentage
10-20	1	1%
21-30	4	6%
31-40	16	25%
41-50	9	14%
51-60	10	15%
61-70	21	32%
71-80	5	8%

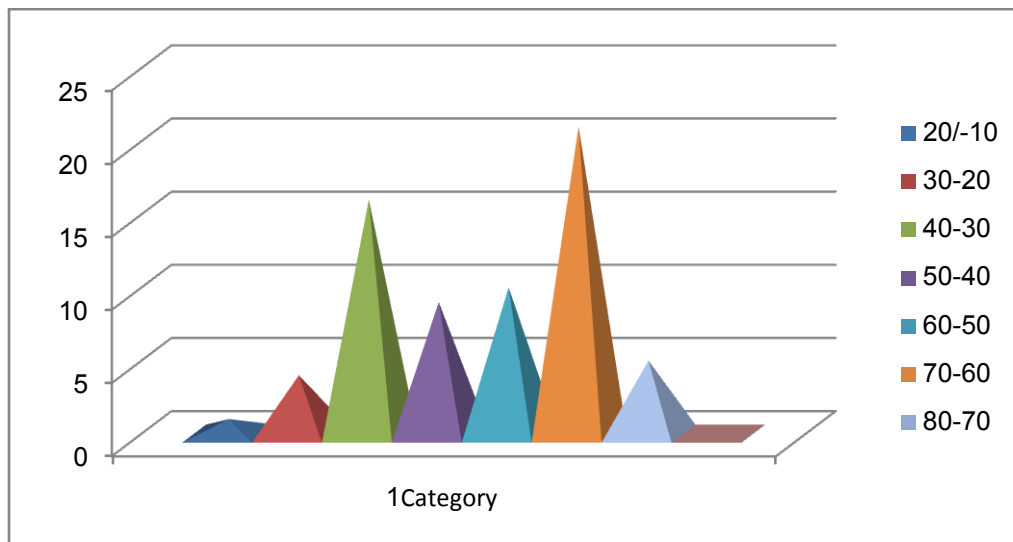


Fig (4.2) show distribution of ages

Table (4.3) show distribution of gender

Item	Frequency	Percentage
Male	40	62 %
Female	25	38 %
Total	65	100%

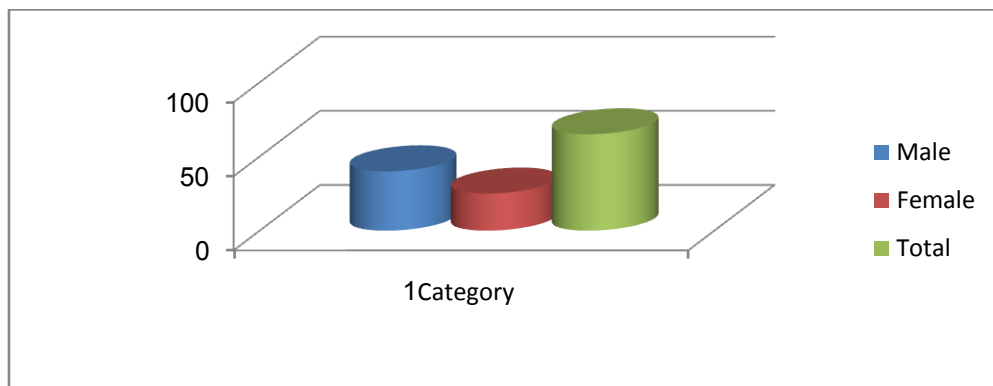


Fig (4.3) show distribution of gender

Table (4.4) :- Shows causes of obstruction – distribution

Item	Frequency	Percentage
Stone	48	75%
Mass	13	20%
Infection	4	5%

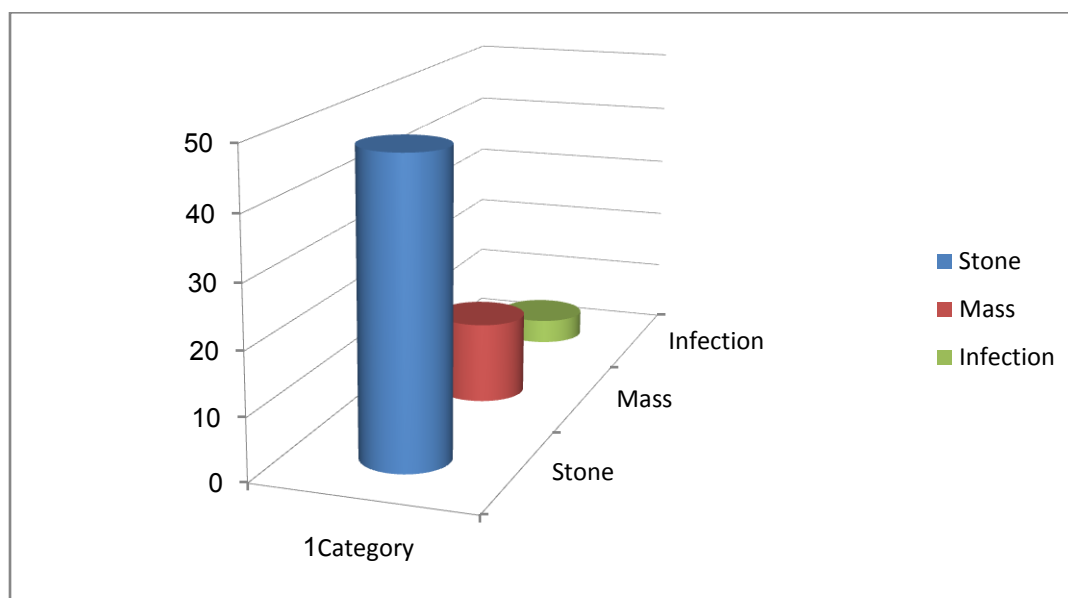


Fig (4.4) Shows causes of obstruction – distribution

Table (4.5) Shows Degrees (hydronephrosis) – distribution

Item	Frequency	Percentage
Mild	19	29%
Moderate	38	58%
Severe	8	13%

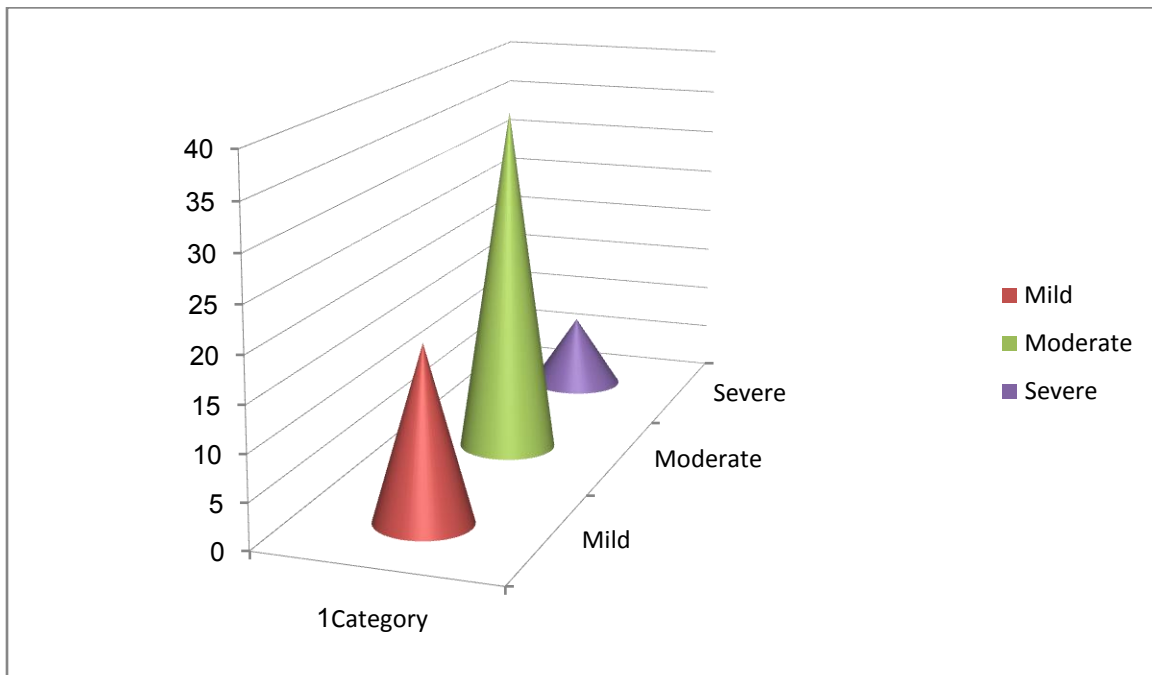


Fig (4.5) Shows Degrees (hydronephrosis) – distribution

Table (4.6) showing site of obstruction - distribution

Item	Site of obstruction	Percentage
KUB	48	62%
Urethra	18	38%
Total	65	100%

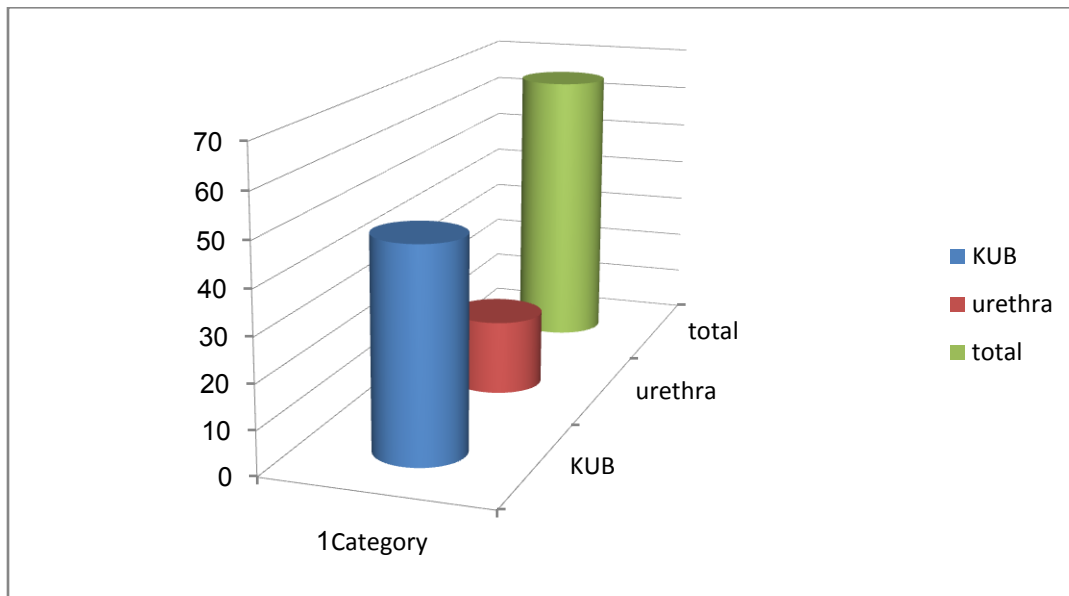


Fig (4.6) showing site of obstruction

Table (4.7) showing relation between causes and hydronephrosis (mild , moderate and severe) - distribution

Item	Mild	moderate	severe	Total
Stone	17	24	7	48
Mass	2	10	1	13
Infection	0	4	0	4

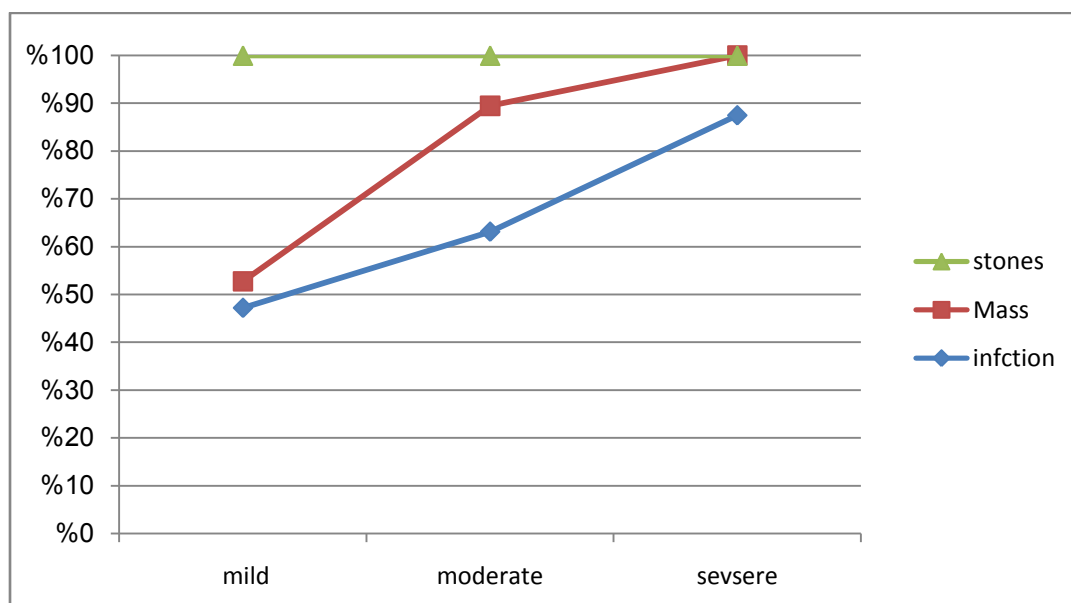


Fig (4.7) showing relation between causes and degree of the hydronephrosis (mild , moderate and severe)

Table (4.8) showing relation between stones and sites - distribution by US

Item	Kidney	Ureter	Bladder	total
Stones	40	20	5	48

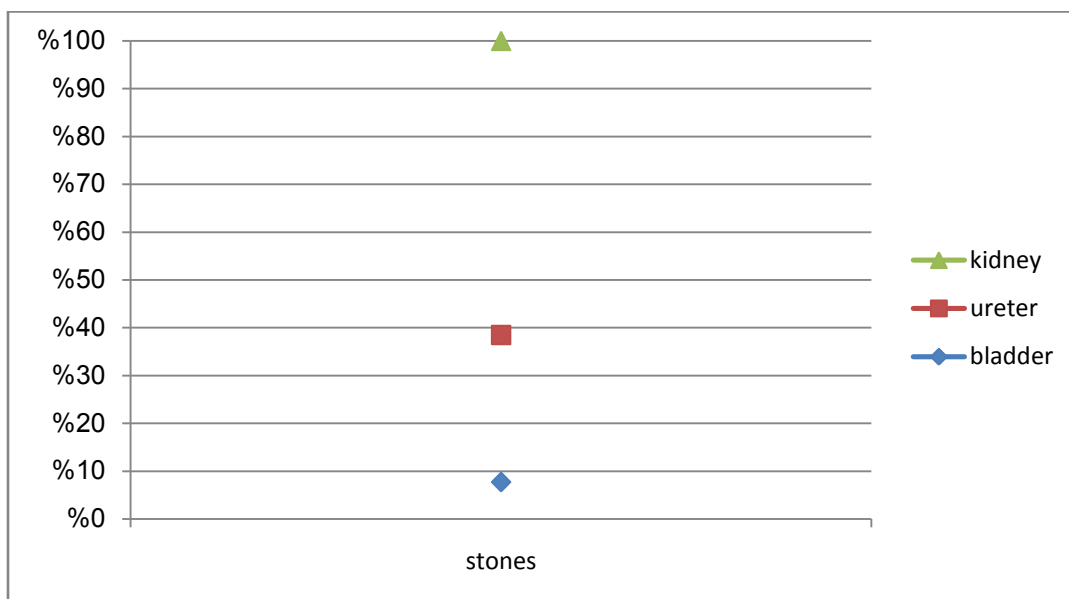


Fig (4.8) showing relation between stones and sites

Chapter Five

5.1 Discussion:-

This was statistical analysis for of obstruction uropathy 100 patients came to ultrasound department for check up , only 65 patients with obstruction uropathy . Which was 65% on this study we found that **(Table 4.1)** .

On this study we found that the most age group had obstruction uropathy, 21(61-70) which was 32% , then comes the age group 16 (31-40) which was 25% then comes the age group 10 (51-60) which was 15% then comes the age group 9 (41-50) which was 14% after that age group 5 (71-80) which was 8% and that age group 4 (21-30) the least age group 1 (10-20). That means the age group (61-70) attached group . **Table (4.2)**

On studying the gender we found that 40 males which was 62% , 25 females which was 38% . That showed that the male more affected than female this may be due to small sample volume collected . **Table (4.3)**

That main cause of obstruction uropathy was impaction of stones 48 out of 65 patients which was 75% include male(24) and female(24). This result was agree with (Hamad 2004) **Table (4.4)**

On this study we found that the most hydronephrosis had obstruction uropathy 38 moderate hydronephrosis which was 58% include male(24) and female (14). This result was agree with (Z. Ashraf 2008) . table (4.5) .

Out of 65patients there were 48 having Kidney Ureter Bladder (KUB) obstruction 75% and 17 having urethra obstruction (25%) the study reveal that the site of obstruction was more in the KUB . (table (4.6)

The main causes of degree hydronephrosis was impacted stonses **40**out of 48patients which was 83% include male 24 and female 14.this result was agree with (Z.Ashraf 2008) Table (4.7

Ultrasound is sensitive for renal stones, 40 out of 48 patients which was 83% and 100% include male 24 and female 14. Its sensitivity to pick ureteric stones 18 out of 48 which was 40% and 50% this result was agree with (Z. Ashraf 2008) Table (4.8)

This finding in table and fig {(4.1) , (4.2) , (4.3) , (4.4) , (4.5) ,(4.6),(4.7),(4.8),} show that US is information in differentiate between different type of the obstruction demonstration the cause of obstruction and degree the site of obstruction according to this finding US very sensitive and important imaging technology in diagnosis of different type of obstruction and it is causes.

5.2 Conclusion :

Ultrasound is sensitive and specific for renal stones , 83% and 100% for hydronephrosis , 83% and 100% , respectively . Its sensitivity to pick ureteric stones (40%) and to identify Hydroureter (50%) is low. Addition of Computer tomography (CT) KUB abdomen increases the sensitivity for ureteric stones to 100%.

5.3 Recommendation :-

5.3.1 Ultrasound examination of the abdomen should be used for all with abdomen pain and renal colic .

5.3.2 Any hospital and clinic must have(US) department to facilitate the early diagnosis of the obstruction and other disease

5.3.4 All sinologists and sonographers should take care to their patients and machines

5.3.5 Further studies regarding ultrasound of obstruction uropathy must be done.

5.3.6 Complete imaging departments with a system to keep information about the patients .help in follow up patients and make available data for researchers.

References:

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- 2- Anatomy and physiology related to clinical pathology. Edition 100 .
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- 4- Robbins and Cotran pathology basis of disease, seventh
- 5- Guidelines and protocols medical diagnostic ultrasound , Dr. Syed Amir Gilani M.B,B,S PHD
- 6- Essential of human anatomy & physiology , Elaine N .Marieb.
- 7- Ultrasonography of the Abdomen & Superficial scanning Merle Mekan ,BA,RTR,ACR RDMS ,RDCS.
- 8- Clinical sonography , Roger C,Sanders.
- 9- Text book of diagnostic ultrasonography .
- 10- Examination Review for ultrasound (abdomen , obstetric , gynecology)
- 11- Anatomy for diagnostic –Ryan . PDF
- 12- Abdomen ultrasound- how. why . when
- 13- C.K Warrick , basic anatomy and physiology 3rd Edition , Publisher Edward Arnold year 1969.
- 14- Murphy GP , Scott WW renal hemodynamic response to acute and chronic ureteral obstruction journal of urology 1966:636- 657.
- 15- Platt JF , Ellis JH , Ruben JM, Dupietrom : duplex Doppler USG of the kidneys , differentiation of obstructive and non obstructive dilatation , Radiology 1989 :171 :130.

Web sites :

- 1- WWW. Google. Com
- 2- <http://www.emedicine.com/> ultrasound .
- 3- <http://WWW.Emedicine.com/radio/topic734.htm>

Appendix

Images of the research

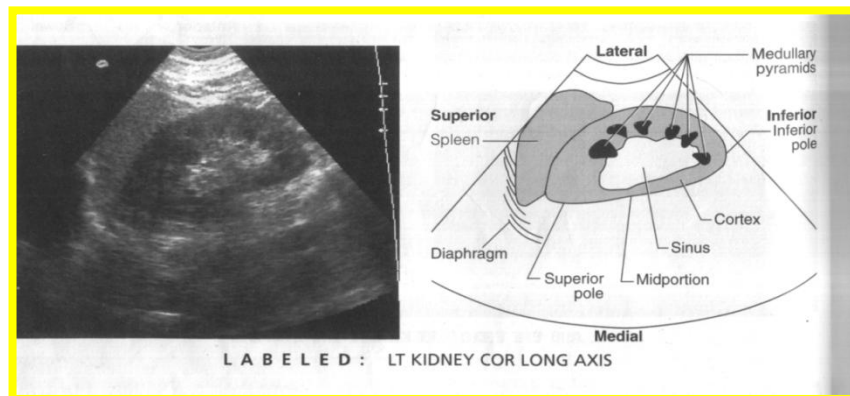


Fig (1) Showing Coronal long axis section of kidney

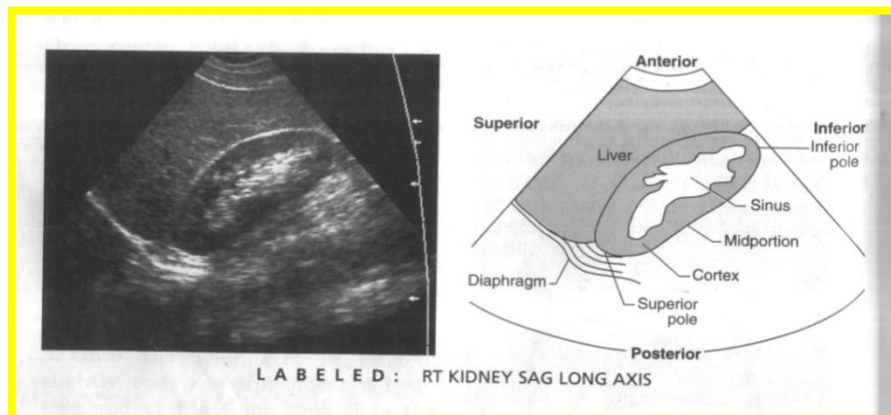


Fig (2) Showing sagittal long axis section of kidney



Fig (3) Showing Normal of the kidney

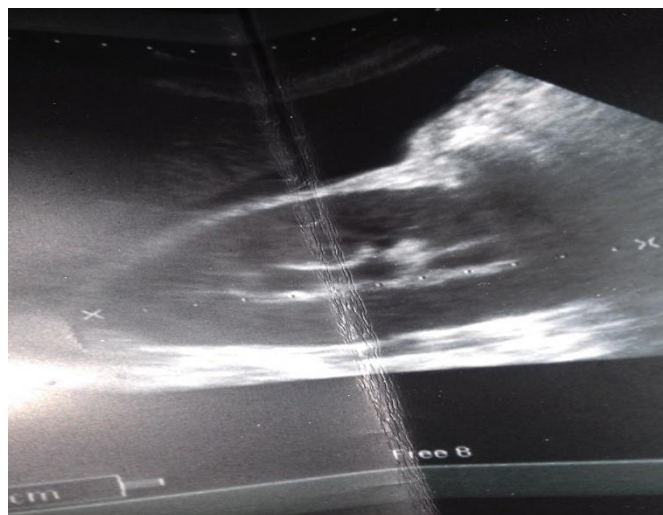


Fig (4) Showing Mild Hydronephrosis sagittal section of kidney



Fig (5) showing Moderate Hydronephrosis sagittal section of kidney

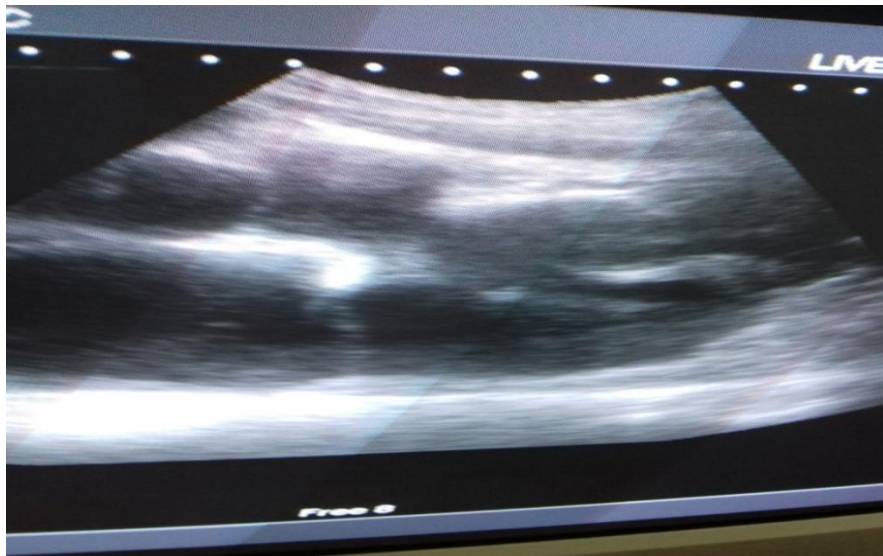


Fig (6) Showing Severe Hydronephrosis , sagittal section of kidney



Fig (7) Showing Mild, Moderate Hydronephrosis of coronal section



Fig (8) showing coronal section of (US) the kidney

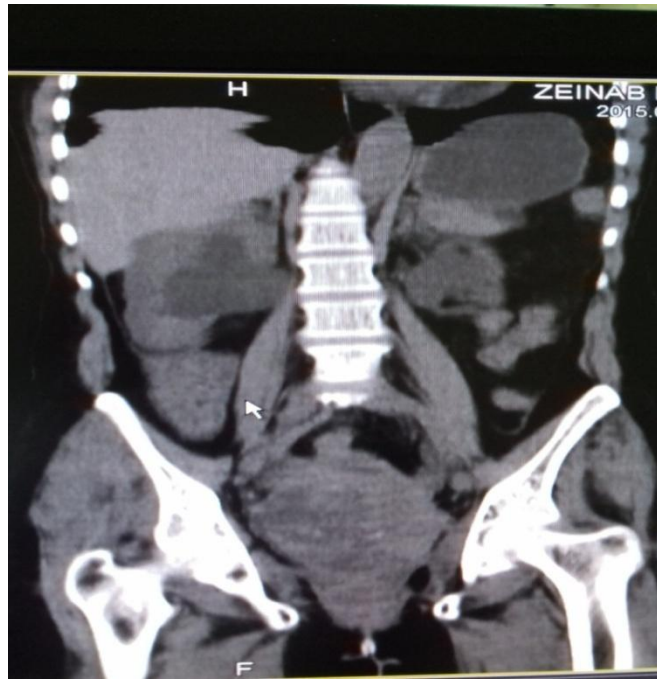


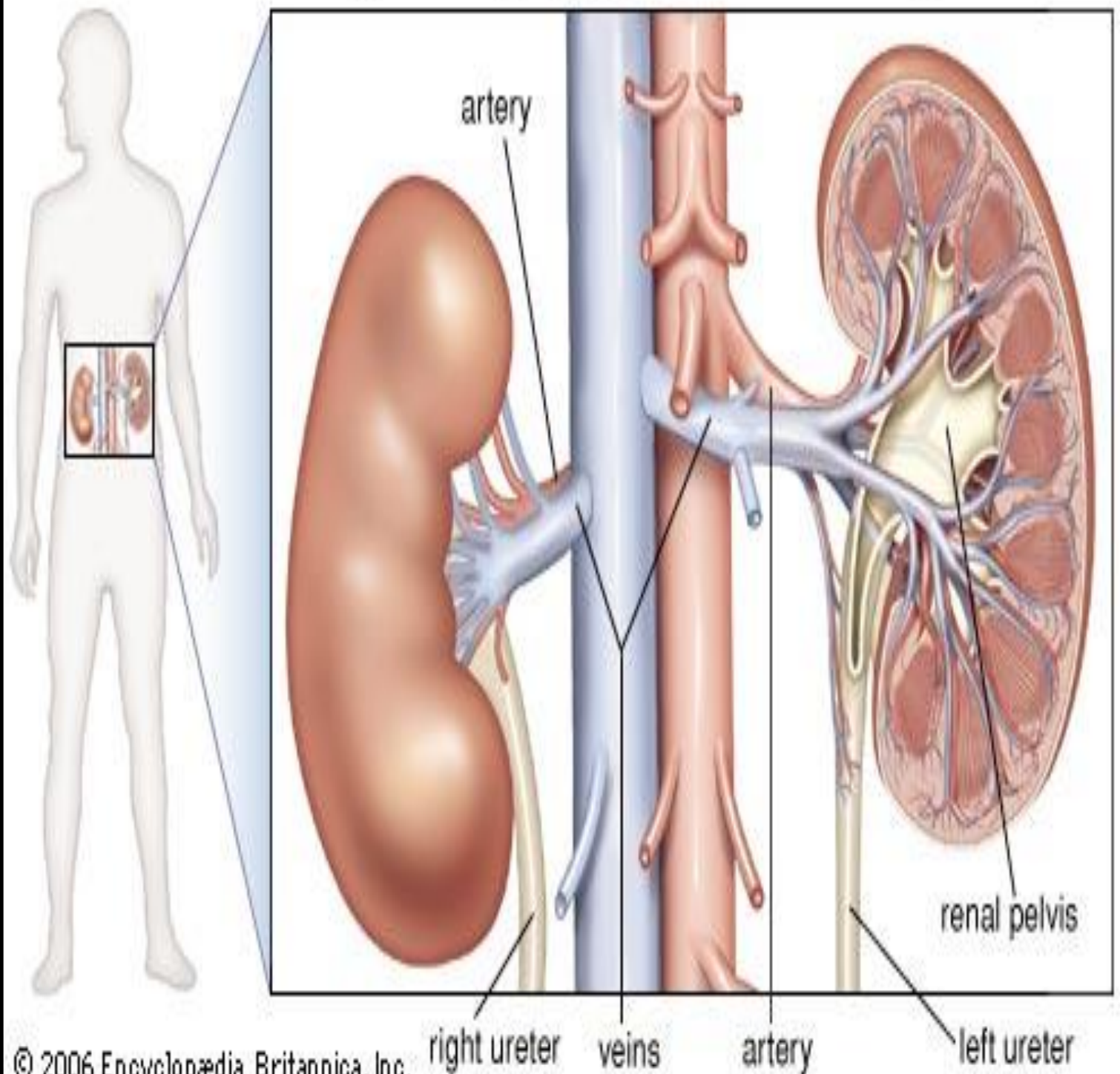
Fig (9) Showing coronal section of (CT) Moderate Hydronephrosis, StoneS (VUJ



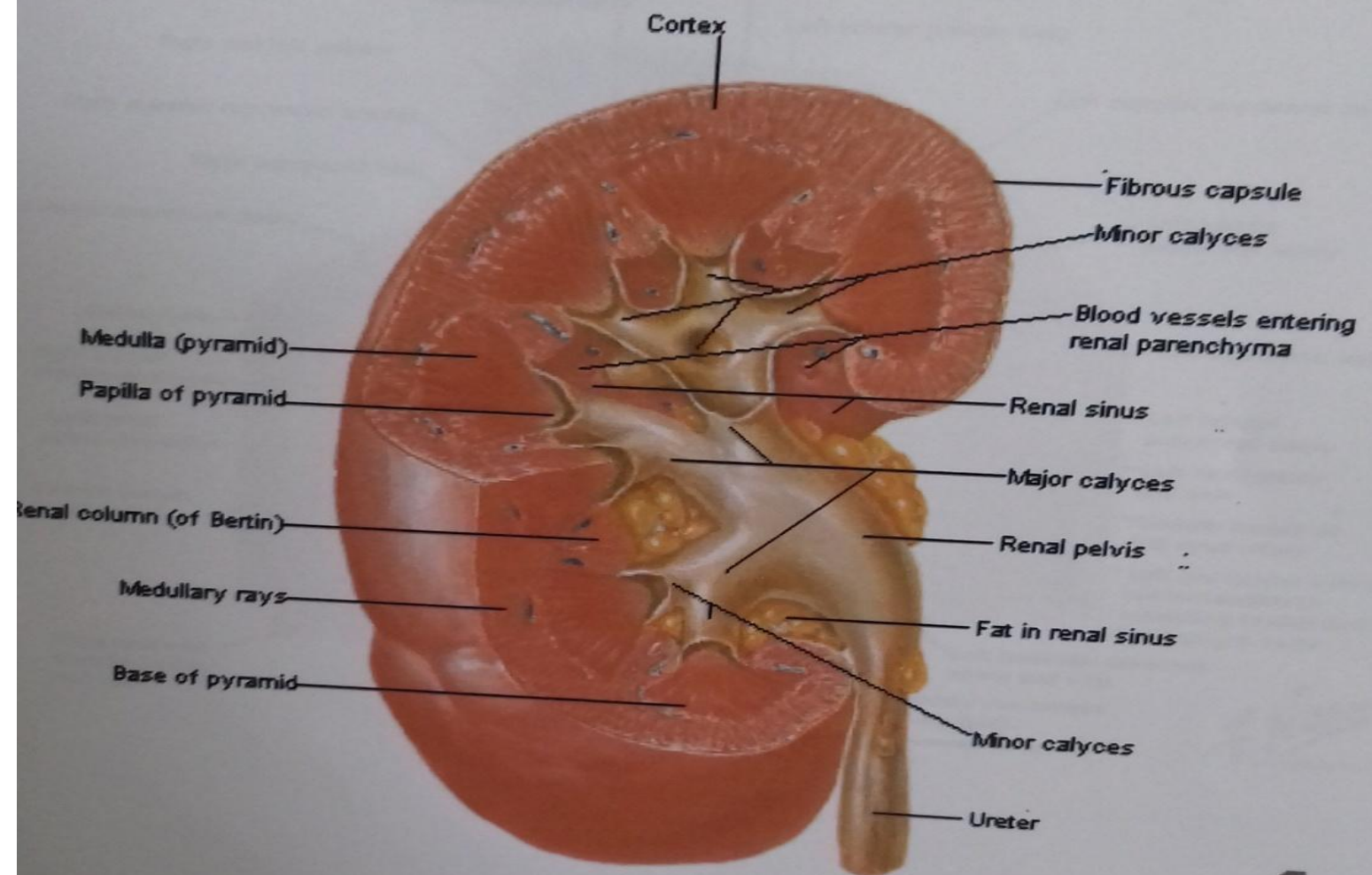
Fig (10) showing axial section (CT) Urinary Bladder

Right Kidney Outside View

Left Kidney Inside View

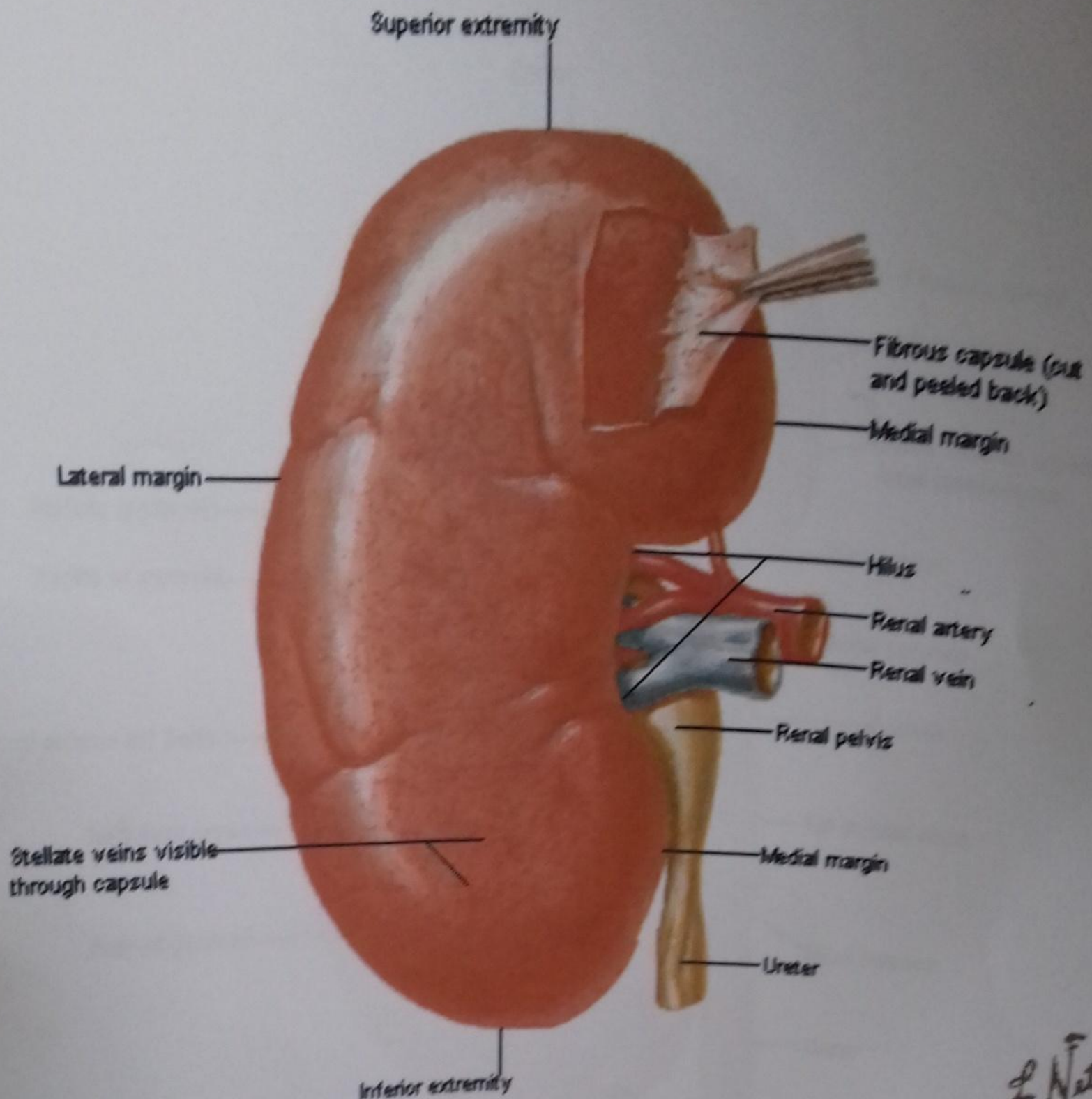


Right Kidney Sectioned in Several Planes



F. Netter M.D.
ANATOMICAL

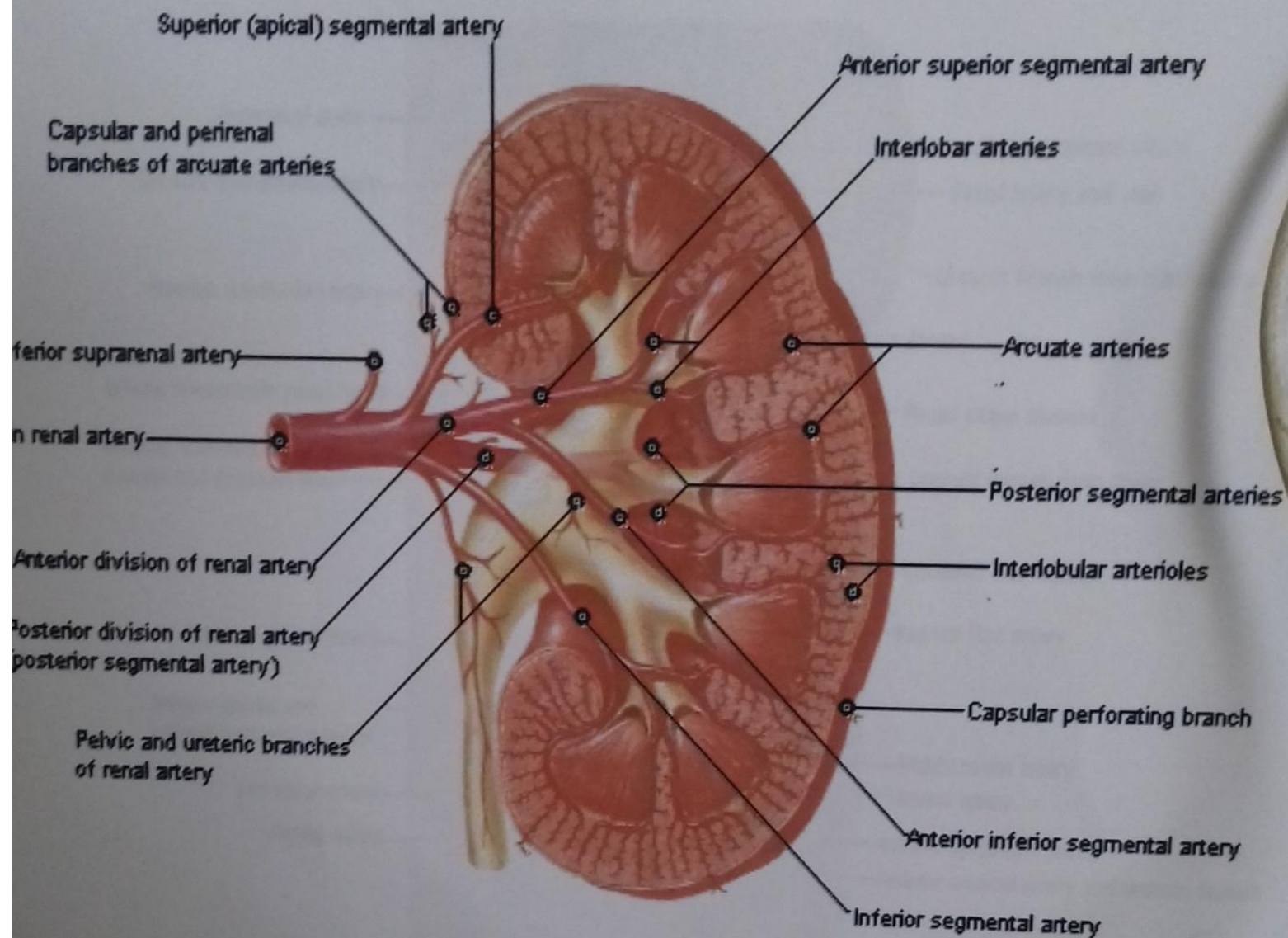
Anterior Surface of Right Kidney



F. N. S.
ARTIST

Intrarenal Arteries

Frontal Section of Left Kidney - Anterior View



بسم الله الرحمن الرحيم

Questionnaire

Role of U/S in evaluating present obstructive uropathy

Demographic data:

1. Patient no: 21 2. Patient Gender m
3. Patient age 32 x 4. Residence الكويت
5. Occupations..... طالب
4. Patient habits
.....
.....

Clinical History:

- 1- Is pain localized or referring?
2- Duration of pain 1 day
3- a symptom
4- Symptom pain
5- Associated
6- Diabetic Duration
7- Hypertensive Duration

Ultrasound Findings:

1. Dilatation : ☒ no
☐ Yes ☐ mild ☐ moderate ☐ severe dilatation
2. Stone ☐ with dilatation ☒ no dilatation
Site ☒ Kidney ☐ ureter ☐ bladder
Part of ureter ☐ mid ☐ upper ☐ lower
3. Mass ☐ No dilatation ☐ with dilation
Site ☐ Kidney ☐ ureter ☐ bladder
Part of ureter ☐ mid ☐ upper ☐ lower
4. Prostate size: ☐ Large ☐ normal
5. Other

