Sudan University of Science and technology

College of graduate studies

A Study of Urinary Tract Problems Using Ultrasound Imaging

دراسة مشكلات الجهاز البولي بإستخدام الموجات فوق الصوتية

A thesis submitted in partial fulfillment for the requirements of M.Sc. Degree in Medical Diagnostic Ultrasound.

By:

Thekrayat Mohammed Ibraheem Shareef

Supervisor:

Dr. Carolin Edward Eyad

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الآيـة

بسم الله الرحمن الرحيم

قال تعالى:

(قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا ۖ إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ)

الآية 32 – سورة البقرة

Dedication

To whom I loved and they loved me much more than I did, hoping that tomorrow will be better, smiley and fruitful in spite of all the expected obstacles.

Acknowledgment

I here find it of equity to appreciate the supervision, guidance and advice provided by Dr. Carolin Edward "research supervisor, the assistance and extreme co-operation I found in contact with Dr. Sadiq Abdulqader of Raidan clinic specialised who facilitate data collection, Dr. Rowais of College of Medicine - Aden university who arrange with responsible of study area, Dr. Khalid Zain who provide advice and consultations on data analysis, I have to report my highest appreciation to Reyadh Abdullah Alawi who support me, miss yethreb Garada who revised the text language

To all of them and to everybody who provide any kind of support or encouragement.

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List of abbreviations

Abbreviation	Description
Mhz	Mega hertz
U/S	Ultrasound
BPH	Benign prostatic hyperplasia
KHz	Kilohertz
IVP	Intravenous pyelogram
NCCT	Non contrast computed tomography
CT	Computed tomography
MRI	Magnetic resonance imaging
MRU	Magnetic resonance urography
GFR	Glomerular filtration rate
RK	Right kidney
LK	Left kidney
ARPKD	Autosomal resistive polycystic kidney disease
ADPKD	Autosomal Dominant Polycystic Kidney Disease.
GI	Gastrointestinal
MCDK	Multi Cystic Dysplastic kidney
MSK	Medullary sponge kidney
RCC	Renal cell carcinoma
IVC	Inferior Vena Cava
TCC	Transitional Cell Carcinoma
AML	Angiomyolipoma
AIDS	Acquired immune deficiency syndrome
UTO	Urinary tract obstruction
RI	Resistive index
ATN	Acute tubular necrosis
PCS	Pelvicalyceal system

TA	Transabdominal
SPSS	Statistical package of social sciences
CMD	Cortico-medullary differentiation

Abstract

This study has been conducted at Raidan clinic specialist – Aden – Yemen to identify the ultrasound findings regarding changes in urinary tract in Yemeni patients with urinary tract problem. All the patients were examined by using convex probe of frequency 3.5 Megahertz, all examinations were performed in supine position. Data are collected with a record designed to fit the need.

Fifty-one cases have been collected during data collection period. Of which (37 males and 14 females) 6 of them within group of age (1-18 years) and 45 within (19 – 80 years).

The results of the study showed that the normal cases cover (5) which resembles 9.8% of the total sample, one of them within (1-18 years old) group whereas the other four within (19 – 80 years old), were abnormal cases are 46 of which 28 cases are hydronephrotic and of urinary stones resembled 54.9% , 4 cases of kidney cyst 7.8%, 2 cases are of pyonephrosis 3.9%, 5 cases of cystitis 9.8%,4 cases are of Benign Prostatic Hyperplasia (BPH) 7.8%, 3 cases involve the ectopic kidney, uterine fibroids and absent kidney 5.9%.

At the end of the study report the researcher recommends that it Would be better to do the ultrasound scan as a routine study in the urinary tract problems to detect the lesions as a cause of urinary tract problems, to confirm the positive laboratory results, the cause of hydronephrosis and follow up to help treatment and control of the disease.

ملخص الدراسة

أجريت هذه الدراسة في مستوصف ريدان التخصصي - عدن - اليمن لتحديد نتائج فحوصات الموجات الفوق صوتية المتعلقة بتغيرات الجهاز البولي عند المرضى اليمنيين الذين يشكون من مشاكل في الجهاز البولي، تم تقييم جميع الحالات المرضية بإستخدام جهاز موجات فوق صوتية ذو مجس محدب بتردد منخفض (3.5 ميجاهرتز) جمعت البيانات في جدول يلائم الحاجة.

تم جمع 51 حالة خلال فترة الدراسة،منها 37 ذكر شكلوا 72% تقريباً من إجمالي المفردات و 14 أنثى شكلوا 28%. 6 من إجمالي المفردات يقعون في الفئة العمرية (1- 18) سنة و 45 في الفئة العمرية (19- 80) سنة.

أظهرت نتائج الدراسة أن 5 مفردات تشكل 9.8% كانت ذات نتائج طبيعية إحداهن تقع في الفئة العمرية (1 – 18) سنة بينما وقعت المفردات الأربع الآخرى من الحالات الطبيعية في الفئة العمرية(19 – 80) **سنة.**

بينما شكلت الحالات الغير طبيعية 46 مفردة شكلت 28 منها مواه الكلى و الحصوات البولية 54.9% و 4 كيسات كلوية 7.8% و 2 صديد الكلى 3.9% و 5 مفردات إلتهاب المثانة 9.8% و 4 تضخم الموثة (البروستات) 7.8% كما شملت 3 مفردات الكلى المنتبذة و تليف الرحم و غياب الكلية بنسبة 5.9%.

في نهاية الدراسة أوصت الباحثة بضرورة إعتماد الفحص بالموجات الفوق صوتية كإجراء روتيني للمرضى الذين يعانون من مشاكل في الجهاز البولي للتحري عن أسباب آفات الجهاز البولي، لتأكيد النتائج الإيجابية للفحوص المعملية و لمتابعة الحالة للمساعدة في العلاج.

Chapter One

Introduction

Chapter One

1.1-Introduction: -

Ultrasound is the name given to high-frequency sound waves, over 20000 cycles per second (20KHZ) These wave, inaudible to humans. Can be transmitted in beams and are used to scan the tissues of the body. Sonographic evaluation of the kidneys is a noninvasive, relatively inexpensive, reproducible diagnostic test used to evaluate renal problems. Until recently, an intravenous pyelogram (IVP) was the initial diagnostic test performed on patients who presented with renal colic (flank pain). In patients who present with renal colic without a history of renal stones, a non-contrast computed tomography (NCCT) is typically performed. NCCT requires no patient preparation and is not operator or patient dependent. The main disadvantages of NCCT are cost and the use of ionizing radiation. Patients who present with a history of renal stones require a plain film x-ray, and a renal sonogram with Doppler is usually the first diagnostic test performed. In many areas where computed tomography (CT) is not readily available, an IVP is performed if the patient can tolerate the contrast agent used and does not have an allergic reaction to it. (Ansert, S. L.2012)

Magnetic resonance imaging (MRI) using magnetic resonance urography (MRU) is currently being investigated for diagnosing renal disease. MRU can assess renal function, similarly to an IVP, in addition to diagnosing obstructive uropathy. MRI can assess other abdominal organs for disease. A renal sonogram is able to demonstrate the acoustic properties of a mass, delineate an abnormal lie of a kidney resulting from an extrarenal mass, or determine whether hydronephrosis is secondary to renal stones. In addition, sonography can define perirenal fluid collections, such as a hematoma or abscess, determine renal size and parenchymal detail, detect dilated ureters and hydronephrosis, and image renal congenital anomalies. (Ansert, S. L.2012)

Ultrasound is not the imaging modality of choice to examine the bladder. Cystoscopy is usually used to examine the bladder because of its ability to diagnose early neoplasms. Transabdominal sonography will allow visualization of most lesions greater than 5 mm.

A transurethral intravesicular sonographic approach has been used to evaluate bladder tumors. (Ansert, S. L.2012)

A sonogram of the bladder is obtained with a distended bladder. A 3.5 MHz transducer is usually used. In very thin patients, a 5 MHz transducer may be used. If evaluation of the anterior bladder wall is indicated, a high-frequency, curved linear-array transducer will give a larger field of view than a sector transducer. Sonography is used to evaluate residual bladder volume in patients with outflow obstruction. The post void bladder is scanned in two planes: anteroposterior and transverse. Measurements are obtained in three planes: anterior-posterior, transverse, and longitudinal .A residue of less than 20 ml of urine is considered normal in an adult. Ureteral jets should be identified as flashes of Doppler color entering the bladder. (Ansert, S. L.2012)

1.2- Problem of the study:-

There is an increase in UT problems in Yemen (as infection, tumors, stones, cysts, etc.) But no study was done to evaluate the whole UT problem in Yemeni population.

1.3- Objectives: -

1.3.1-General Objective: -

To study the ultrasound findings regarding changes in urinary tract in Yemeni patients with urinary tract problem.

1.3.2 -Specific Objectives: -

- To evaluate Rt. kidney and Lt. kidney (length, width, echo texture, cortico medullary differentiations).
- To evaluate Rt. ureter and Lt. ureter.

- To evaluate urinary bladder (wall bladder thickening, features).
- To evaluate the urethra (post voiding).
- To find out the final diagnosis.
- To correlate the US findings with age, gender, and laboratory findings.

1.4 Thesis overview: -

This study consists of five chapter.

chapter one**:** Contains introduction, rational and objectives (general and specific).

chapter two: literature review in two parts; part one anatomy and normal sonographic appearance of urinary tract. Part two pathology of urinary tract.

Chapter three: contains the materials and methods.

Chapter four: contains the results presentation.

Chapter five**:** contains the discussion, conclusion and recommendations.

Chapter two

Literature review

Chapter two
Literature review

2.1Anatomy of urinary tract:

2.1.1 Kidney:

The kidneys excrete the end products of metabolism and excess water. These actions are essential for the control of concentrations of various substances in the body, maintaining electrolyte and water balance approximately constant in the tissue fluids. The kidneys also have endocrine functions, producing and releasing erythropoietin, which affects red blood cell formation; renin, which influences blood pressure; 1,25-di-hydroxycholecalciferol (the metabolically active form of vitamin D), which is involved in the control of calcium absorption and mineral metabolism; and various other soluble factors with metabolic actions. (Standring, S. 2008)

In the fresh state, the kidneys are reddish-brown. They are situated posteriorly behind the peritoneum on each side of the vertebral column and are surrounded by adipose tissue. Superiorly they are level with the upper border of the 12th thoracic vertebra, inferiorly with the third lumbar vertebra. The right is usually slightly inferior to the left, reflecting its relationship to the liver. The left is a little longer and narrower than the right and lies nearer the median plane(Fig.1). The long axis of each kidney is directed inferolaterally and the transverse axis posteromedially, which means that the anterior and posterior aspects usually described are in fact anterolateral and posteromedial. An appreciation of this orientation is important in percutaneous and endo urologic renal surgery.

Each kidney is typically 11 cm in length, 6 cm in breadth and 3 cm in anteroposterior dimension. The left kidney may be 1.5 cm longer than the right; it is rare for the right kidney to be more than 1 cm longer than the left.

2.1.2 Relations:

The superior poles of both kidneys are thick and round and each is related to its suprarenal gland. The inferior poles are thinner and extend to within 2.5

cm of the iliac crests. The lateral borders are convex. The medial borders are convex adjacent to the poles, concave between them and slope inferolaterally.In each a deep vertical fissure opens anteromedially as the hilum, which is bounded by anterior and posterior lips and contains the renal vessels and nerves and the renal pelvis. The relative positions of the main hilar structures are the renal vein (anterior), the renal artery (intermediate) and the pelvis of the kidney (posterior). Usually an arterial branch from the main renal artery runs over the superior margin of the renal pelvis to enter the hilum on the posterior aspect of the pelvis, and a renal venous tributary often leaves the hilum in the same plane. Above the hilum the medial border is related to the suprarenal gland and below to the origin of the ureter. (Standring, S. 2008)

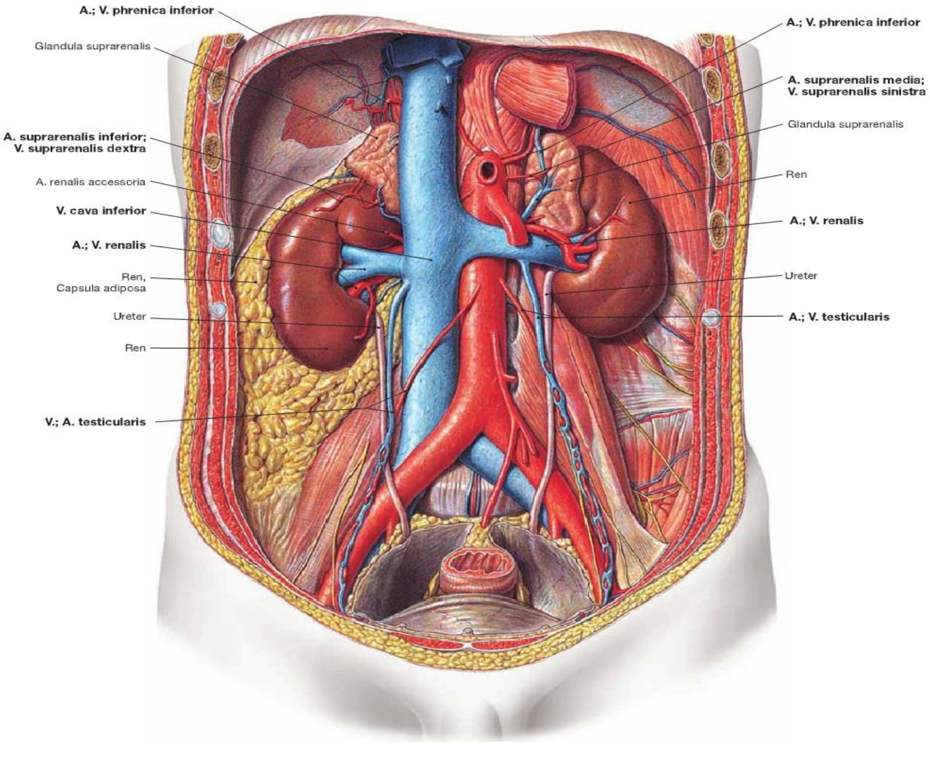


Fig.1 Relationships of the kidneys and ureters in the male retroperitoneum.

(Paulsen,F. and Waschke, J.2011)

The kidney itself can be divided into an internal medulla and external cortex. The renal medulla consists of pale, striated, conical renal pyramids, their bases peripheral, their apices converging to the renal sinus. At the renal sinus they project into calyces as papillae. (Standring, S. 2008)

The renal cortex is subcapsular, arching over the bases of the pyramids and extending between them towards the renal sinus as renal columns (Standring, S.2008)

2.1.3 Renal pelvis and calyces:

The hilum of the kidney leads into a central renal sinus, lined by the renal capsule and almost filled by the renal pelvis and vessels, the remaining space being filled by fat. Dissection into this plane can be challenging but is important in surgery on the renal pelvis, particularly open stone surgery. Within the renal sinus, the collecting tubules of the nephrons of the kidney open onto the summits of the renal papillae to drain into minor calyces, which are funnel-shaped expansions of the upper urinary tract, see fig.2. The renal capsule covers the external surface of the kidney and continues through the hilum to line the sinus and fuse with the adventitial coverings of the minor calyces. (Standring, S. 2008)

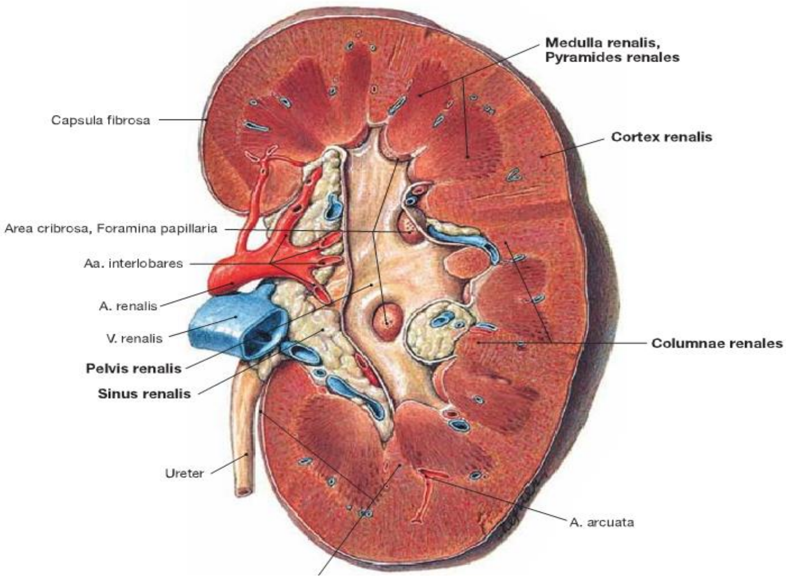


Fig.2 Left kidney, oblique vertical hemi section: normal macroscopic appearance of the renal cortex and renal medulla and the major structures at the hilum of the kidney. (Paulsen,F. and Waschke, J.2011)

2.1.4 Sonographic anatomy of kidney:

Both kidneys should be about the same size. In adults, a difference of more than 2 cm in length is abnormal.

- Length: up to 12cm and not less than 9 cm.
- Width: normally 4-6 cm but may vary a little with the angle of the scan.
- Thickness: up to 3.5 cm but may vary a little with the angle of scan.
- The central echo complex (The renal sinus) is very echogenic and normally occupies about one-third of the kidney (fig.3) (The renal sinus includes the pelvis, calyces, vessels and fat,)

In the newborn, the kidneys are about 4 cm long and 2 cm wide. The renal pyramids are poorly defined hypoechogenic areas in the medulla of the kidney. Surrounded by the more echogenic renal cortex. It is easier to see the pyramids in children and young adults.

When scanning it is important to identify the following:

- The renal capsule. This appears as a bright, smooth, echogenic line around the kidney.
- -The cortex. This is less echogenic than the liver but more echogenic than the adjacent renal pyramids.
- -The renal medulla. This contains the hypoechogenic, renal pyramids which should not be mistaken for renal cysts.
- -The renal sinus (the fat, the collecting system and the vessels at the hilus). This is the innermost part of the kidney and has the greatest echogenicity.
- -The ureters. Normal ureters are not always seen: They should be sought where they leave the kidney at the hilus. They may be single or multiple and are often seen in the coronal projection.

The renal arteries and vein. These are best seen at the hilus, they may be multiple and may enter the kidney at different levels. (Palmer, P.E.S 1995)

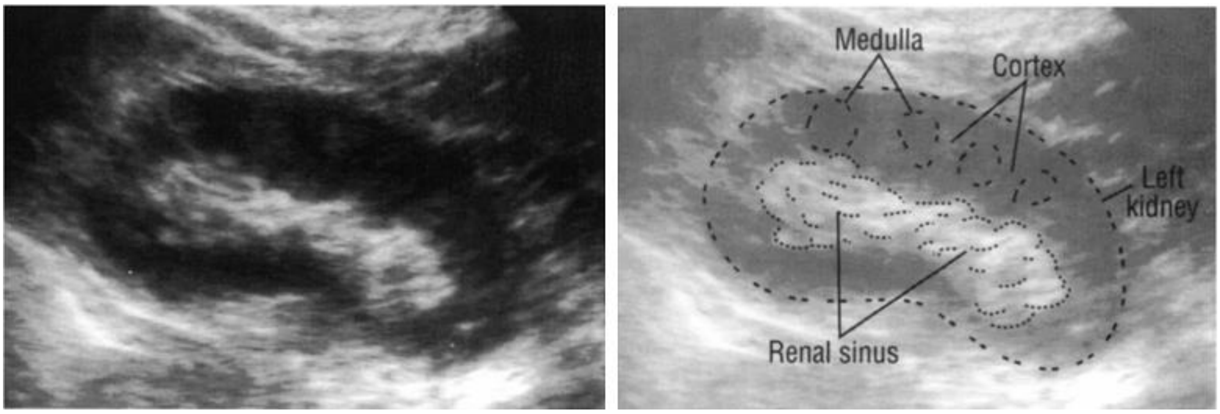


Fig3. Longitudinal scan of a normal left kidney. (Palmer, P.E.S 1995)

2.1.5 Vascular supply and lymphatic drainage: 2.1.5.1 Renal arteries:

The paired renal arteries take about 20% of the cardiac output to supply organs that represent less than one-hundredth of total body weight. They branch laterally from the aorta just below the origin of the superior mesenteric artery. (Standring, S. 2008)

2.1.5.2 Renal veins:

Interlobular veins pass to the cortico medullary junction and also receive some ascending vasa recta before ending in arcuate veins (which accompany arcuate arteries), and anastomose with neighbouring veins. Arcuate veins drain into interlobar veins, which anastomose and form the renal vein. (Standring, S. 2008)

2.1.5.3 Lymphatic drainage:

Collecting vessels from the intrarenal plexus form four or five trunks which follow the renal vein to end in the lateral aortic nodes; the subcapsular collecting vessels join them as they leave the hilum. The perirenal plexus drains directly into the same nodes. (Standring, S. 2008)

2.1.5.4 Innervation:

Rami from the coeliac ganglion and plexus, aorticorenal ganglion, lowest thoracic splanchnic nerve, first lumbar splanchnic nerve and aortic plexus form a dense plexus of autonomic nerves around the renal artery. (Standring, S. 2008)

2.1.5 Production of urine:

Glomerular filtration is the passage of water containing dissolved small molecules from the blood plasma to the urinary space in the glomerular capsule. Larger molecules, e.g. plasma proteins above 70 kilo Daltons and those with a net negative charge, polysaccharides lipids and cells, are largely retained in blood by the selective permeability of the glomerular basal lamina.

The assessment of glomerular filtration is fundamental to the diagnosis of renal glomerular pathology and the management of drug therapy w here clearance depends on the glomerular filtration, and in chronic kidney disease to facilitate timely management decisions. Measurements of glomerular filtration rate (GFR) are based on the renal clearance of a marker in plasma, expressed as the volume of plasma completely cleared of the marker per unit time. Markers used to measure GFR may be endogenous creatinine, urea) or exogenous (inulin, iothalamate) substances. The ideal marker is endogenous, freely filtered by the glomerulus, neither reabsorbed nor secreted by the renal tubule, and eliminated only by the kidney. (Standring, S. 2008)

2.1.7 Ureter:

The ureters are two muscular tubes whose peristaltic contractions convey urine from the kidneys to the urinary bladder. Each measures 25–30 cm in length, is thick-walled and narrow, and is continuous superiorly with the funnel-shaped renal pelvis.

Each descends slightly medially, anterior to psoas major, and enters the pelvic cavity w here it curves initially laterally, then medially, to open into the base of the urinary bladder. The diameter of the ureter is normally 3 mm, but is slightly less at its junction with the renal pelvis, at the brim of the lesser pelvis near the medial border of psoas major, and where it runs within the wall of the urinary bladder, which is its narrowest part. These are the commonest sites for renal stone impaction.

2.1.8 Relations:

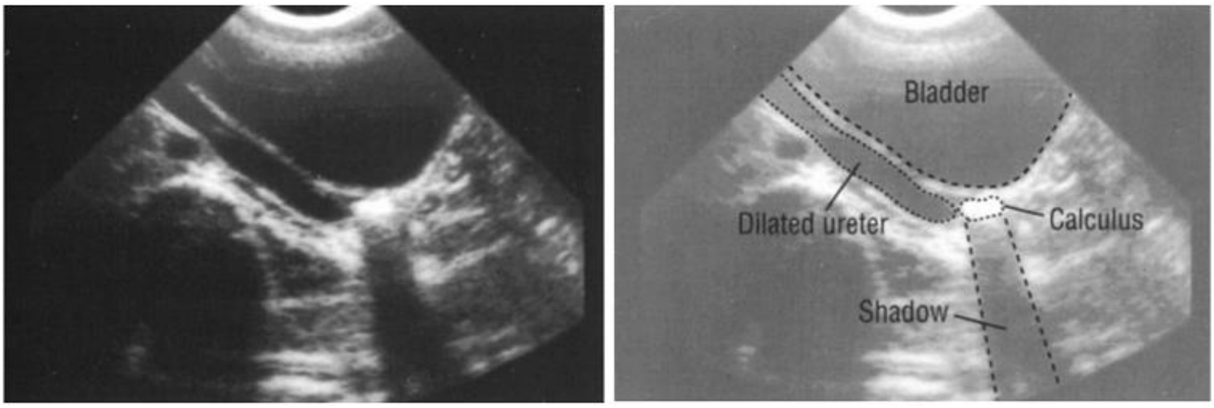
In the abdomen the ureter descends posterior to the peritoneum on the medial part of psoas major, which separates it from the tips of the lumbar transverse processes. During surgery on intraperitoneal structures, the ureter can be tented up as the peritoneum is draw n anteriorly, resulting in inadvertent ureteric injury. Anterior to psoas major it crosses in front of the genitofemoral nerve and is obliquely crossed by the gonadal vessels. It enters the lesser pelvis anterior to either the end of the common iliac vessels or at the origin of the external iliac vessels. (Standring, S. 2008)

2.1.9 Sonographic anatomy of ureter:

Because of their position behind the bowel, it is not easy to examine normal ureters by ultrasound. If dilated (e.g. by outlet obstruction due to an enlarged prostate or ureteral stricture, or due to vesico-ureteric reflux). They are easier to see, particularly near the kidney or bladder see fig.4.

The middle of the ureters is never seen easily and is much better demonstrate by intravenous urography. However, if thickened, as in schistosomiasis (sometimes with calcification). They can be recognized with ultrasound.

The lower end of the ureters can be observed by scanning through a full bladder, which provide a useful acoustic window. (Palmer, P.E.S 1995)



Fig,4 Dilatation of the lower end of the right ureter ,caused by acalculus.

(Palmer, P.E.S 1995)

2.1.10 Vascular supply and lymphatic drainage: 2.1.10.1 **Arteries:**

The ureter is supplied by branches from the renal, gonadal, common iliac, internal iliac, vesical and uterine arteries, and the abdominal aorta. 2.1.10.2 **Veins:**

The venous drainage of the ureters generally follows the arterial supply.

2.1.10.3 **Lymphatic drainage:**

Lymph vessels draining the ureter begin in submucosal, intramuscular and adventitial plexuses which all communicate. (Standring, S. 2008)

2.1.11 Urinary bladder:

The urinary bladder is a reservoir. Its size, shape, position and relations all vary according to its content and the state of neighbouring viscera. When the bladder is empty, it lies entirely in the lesser pelvis, but as it distends it expands anterosuperiorly into the abdominal cavity. An empty bladder is somewhat tetrahedral and has a base (fundus), neck, apex, a superior and two inferolateral surfaces. (Standring, S. 2008)

2.1.12 Relations

The base of the bladder is triangular and located posteroinferiorly. In females it is closely related to the anterior vaginal wall; in males it is related to the rectum although it is separated from it above by the rectovesical pouch, and below by the seminal vesicle and vas deferens on each side and Denonvillier's fascia. The neck, which is most fixed, lies most inferiorly, 3–4 cm behind the lower part of the symphysis pubis and just above the plane of the inferior aperture of the lesser pelvis. The bladder neck is essentially the internal urethral orifice, which lies in a constant position, independent of the varying positions of the bladder and rectum. In males the neck rests on, and is in direct continuity with, the base of the prostate; in females it is related to the pelvic fascia, which surrounds the upper urethra. In both sexes the apex of the bladder faces towards the upper part of the symphysis pubis. The median umbilical ligament (urachus) ascends behind the anterior abdominal wall from the apex to the umbilicus, covered by peritoneum to form the median umbilical fold (see fig.5). (Standring, S. 2008)

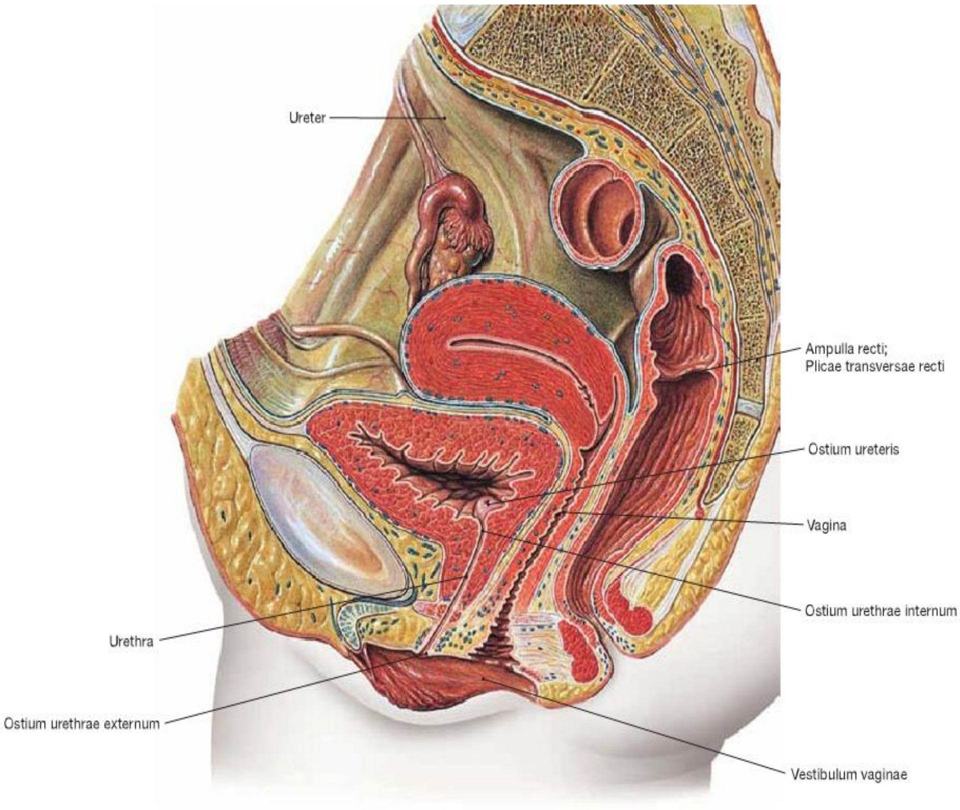


Fig.5 Relations of the female bladder, sagittal section of the pelvis. (Paulsen, F. and Waschke, J.2011)

2.1.13 Bladder interior:

The anteroinferior angle of the trigone is formed by the internal urethral orifice, its posterolateral angles by the ureteric orifices. The superior trigonal boundary is a slightly curved interureteric bar, which connects the two ureteric orifices and is produced by the continuation into the vesical w all of the ureteric internal longitudinal muscle. Laterally this ridge ex tends beyond the ureteric openings as ureteric folds, produced by the terminal parts of the ureters which run obliquely through the bladder wall. At cystoscopy the interureteric crest appears as a pale band and is a guide to the ureteric orifices. (Standring, S. 2008)

2.1.14 Trigone

The superficial trigonal muscle is relatively thin but is generally described as becoming thickened along its superior border to form the inter ureteric bar. Similar thickenings occur along the lateral edges of the superficial trigone. In both sexes the superficial trigone muscle becomes continuous with the smooth muscle of the proximal urethra, and ex tends in the male along the urethral crest as far as the openings of the ejaculatory ducts. (Standring, S. 2008) **2.1.15 Ureteric orifices**

The sit-like ureteric orifices are placed at the posterolateral trigonal angles (Fig. 5). In empty bladders they are approximately 2,5 cm apart, and 2.5 cm from the internal urethral orifice: in distension these measurements may be doubled. (Standring, S. 2008)

2.1.16 Internal urethral orifice:

The internal urethral orifice is sited at the trigonal apex, the lowest part of the bladder, and is usually somewhat crescentic in section. There is often an elevation immediately behind it in adult males (particularly past middle age) which is caused by the median prostatic lobe. (Standring, S. 2008)

2.1.17 Bladder outflow obstruction:

In progressive chronic obstruction to micturition, e.g. as a result of prostatic enlargement or urethral stricture, the muscle of the bladder hypertrophies. The muscle fasciculi increase in size and, because they interlace in all directions, a thick-walled trabeculated bladder' is produced. Mucosa between the fascicles forms ‘diverticula'. When outflow is obstructed, emptying is not complete: some

urine remains and may become infected. Back pressure from a chronically distended bladder may gradually dilate the ureters and renal pelvis and even the renal collecting tubules, which can result in progressive renal impairment. (Standring, S. 2008)

2.1.18 Sonographic anatomy of urinary bladder:

The full urinary bladder appears as a large, echo – free area arising out of the pelvis. Start by assessing the smoothness of the interior wall of the bladder and its symmetry in transverse section. The thickness of the bladder wall will vary with the degree of distention but should always be approximately the same all around the bladder. Any local area of thickening is abnormal. When distended, the normal bladder wall is less than 4 mm thick. After scanning the patient should be empty the bladder. Normally, there should be no residual urine: if there is, the quantity should be estimated. (Palmer, P.E.S 1995)

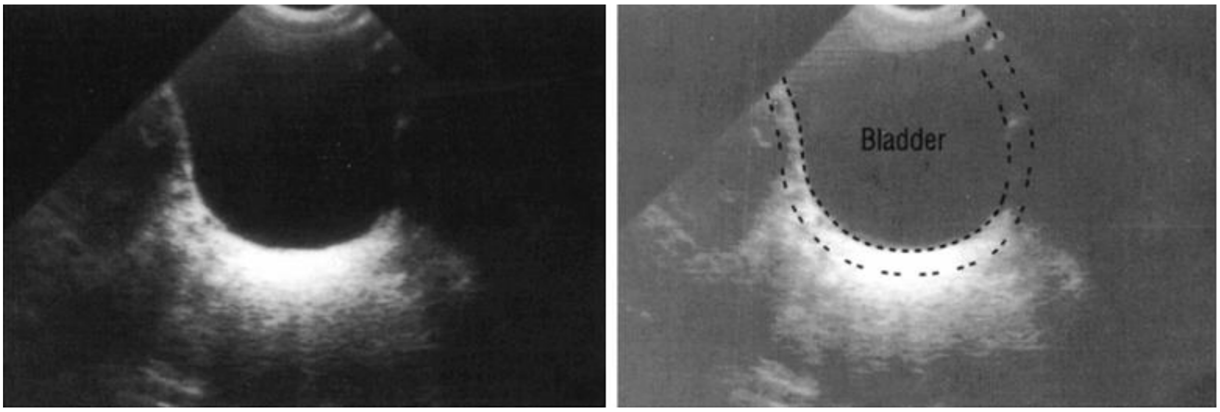


Fig.6 Transverse scan normal full bladder. (Palmer, P.E.S 1995)

2.1.19 Vascular supply and lymphatic drainage: 2.1.19.1 Arteries: The bladder is supplied principally by the superior and inferior vesical arteries. **2.1.19.2 Veins:** The veins which drain the bladder form a complicated plexus on its inferolateral surfaces and pass backwards in the lateral ligaments of the bladder to end in the internal iliac veins. (Standring, S. 2008)

2.1.19.3 Lymphatics:

Lymphatics which drain the bladder begin in mucosal, intermuscular and serosal plexuses. (Standring, S. 2008)

2.1.19.4 Innervations: The nerves supplying the bladder arise from the pelvic plexuses, which are a mesh of autonomic nerves and ganglia on the lateral aspects of the rectum, internal genitalia and bladder base. (Standring, S. 2008)

2.1.20 Male urethra:

The male urethra is 18–20 cm long, and extends from the internal orifice in the urinary bladder to the external opening, or meatus, at the end of the penis.

2.1.21 Vascular supply and lymphatic drainage: 2.1.21.1 artery:

The urethral artery arises from the internal pudendal artery or common penile artery just below the perineal membrane and travels through the corpus spongiosum, to reach the glans penis. (Standring, S. 2008)

2.1.21.2 Veins:

The venous drainage of the anterior urethra is to the dorsal veins of the penis and internal pudendal veins, which drain to the prostatic plexus. The posterior urethra drains into the prostatic and vesical venous plexuses, which drain into the internal iliac veins.

2.1.21.3 Lymphatic drainage:

Vessels from the posterior urethra pass mainly to the internal iliac nodes.

2.1.21.4 Innervation:

The prostatic plexus supplies the smooth muscle of the prostate and prostatic urethra. On each side it is derived from the pelvic plexus and lies on the posterolateral aspect of the seminal vesicle and prostate.

2.1.22 Female urethra

The female urethra is approximately 4 cm long and 6 mm in diameter. It begins at the internal urethral orifice of the bladder, approximately opposite the middle of the symphysis pubis, and runs anteroinferiorly behind the symphysis pubis, embedded in the anterior w all of the vagina. (Standring, S. 2008)

2.1.23 Vascular supply and lymphatic drainage:

2.1.23.1 artery:

The urethra is supplied principally by the vaginal artery, but also receives a supply from the inferior vesical artery. (Standring,S. 2008)

2.1.23.2 Veins:

The venous plexus around the urethra drains into the vesical venous plexus around the bladder neck, and into the internal pudendal veins. An erectile plexus of veins along the length of the urethra is continuous with the erectile tissue of the vestibular bulb. (Standring, S. 2008)

2.1.23.3 Lymphatic drainage:

The urethral lymphatics drain into the internal and external iliac nodes.

2.1.23.4 Innervations:

Parasympathetic preganglionic fibers arise from neurons in the second to fourth segments of the sacral spinal cord and run in the pelvic splanchnic nerves; they synapse in the vesical plexus in or near the bladder wall. (Standring, S. 2008)

2.1.24 Prostate

The prostate is a pyramidal fibromuscular gland which surrounds the prostatic urethra from the bladder base to the membranous urethra. It has no true fibrous capsule, but is enclosed by visceral fascia containing neurovascular tissue. The fascia is firmly adherent to the gland and is continuous with a median septum and with numerous fibromuscular septa which divide the glandular tissue into indistinct lobules. (Standring, S. 2008)

2.1.25 Vascular supply and lymphatic drainage: 2.1.25.1 Arteries:

The prostate is supplied by branches from the inferior vesical, internal pudendal and middle rectal arteries. (Standring, S. 2008)

2.1.25.2 Veins:

The veins run into a plexus around the anterolateral aspects of the prostate, posterior to the arcuate pubic ligament and the lower part of symphysis pubis, anterior to the bladder and prostate. (Standring, S. 2008)

2.1.25.3 Lymphatic drainage

Collecting vessels from the vas deferens drain into the external iliac nodes, while those from the seminal vesicle drain to the internal and external iliac nodes. Prostatic vessels end mainly in internal iliac, sacral and obturator nodes.

2.1.25.4 Innervations:

The prostate receives an abundant nerve supply from the inferior hypogastric (pelvic) plexus. The prostatic capsule is covered by numerous nerve fibers and ganglia posterolaterally, forming a crescenteric periprostatic nerve plexus.

2.1.26 Age changes in the prostate:

After 45–50 years the prostate tends to develop BPH: an age-related condition. If a man lives long enough then BPH is inevitable, although not always symptomatic. (Standring, S. 2008)

2.2 physiology of urinary tract: -

2.2.1 Functions of the kidney (Formation of urine): -

The kidneys form urine which passes through the ureters to the bladder for storage prior to excretion. The composition of urine reflects the activities of the nephrons in the maintenance of homeostasis. Waste products of protein metabolism are excreted, electrolyte balance is maintained and the pH (acid-base balance) is maintained by the excretion of hydrogen ions. There are three processes
involved in the formation of urine:

• simple filtration
• selective reabsorption
• secretion. (Waugh A. & Grant A. 2004)

2.2.2 Simple filtration

Filtration takes place through the semipermeable walls of the glomerulus and glomerular capsule. Water and a large number of small molecules pass through, although some are reabsorbed later. Blood cells, plasma proteins and other large molecules are unable to filter through and remain in the capillaries.

2.2.3 Autoregulation of filtration. Renal blood flow is protected by a mechanism called autoregulation whereby renal blood flow is maintained at a constant pressure across a wide range of systolic blood pressures (from 80 to 200mmHg). Autoregulation operates independently of nervous control; i.e. if the nerve supply to the renal blood vessels is interrupted, autoregulation continues to operate. It is therefore a property inherent in renal blood vessels; it may be stimulated by changes in blood pressure in the renal arteries or by fluctuating levels of certain metabolites, e.g. prostaglandins. (Waugh A. & Grant A. 2004)

2.2.4 Selective reabsorption:

Selective reabsorption is the process by which the com position and volume of the glomerular filtrate are altered during its passage through the convoluted tubules, the medullary loop and the collecting tubule. The general purpose of this process is to reabsorb into the blood those filtrate constituents needed by the body to maintain fluid and electrolyte balance and the pH of the blood. (Waugh A. & Grant A. 2004)

2.2.5 Secretion

Filtration occurs as the blood flows through the glomerulus. Substances not required and foreign materials, e.g. drugs including penicillin and aspirin, may not be cleared from the blood by filtration because of the short time it remains in the glomerulus. Such substances are cleared by secretion into the convoluted tubules and excreted from the body in the urine. Tubular secretion of hydrogen (H+) ions is important in maintaining homeostasis of blood pH.

2.2.6 Composition of urine

Water 96%,Urea 2%,Uric acid, Creatinine, Ammonia, Sodium, Potassium 2%Chlorides, Phosphates, Sulphates, Oxalates.

2.2.7 Water balance and urine output:-

Water is taken into the body through the alimentary tract and a small amount (called 'metabolic water') is formed by the metabolic processes. Water is excreted in saturated expired air, as a constituent of the faeces, through the skin as sweat and as the main constituent of urine. The amount lost in expired air and in the faeces is fairly constant and the amount of sweat produced is associated with the maintenance of normal body temperature. (Waugh A. & Grant A. 2004)

2.2.8 Ureter function

The ureters propel the urine from the kidneys into the bladder by peristaltic contraction of the smooth muscle.

2.2.9 The urinary bladder:

The urinary bladder is a reservoir for urine. It lies in the pelvic cavity and its size and position vary, depending on the amount of urine it contains. When distended, the bladder rises into the abdominal cavity. (Waugh A. & Grant A. 2004)

2.2.10 Micturition: -

The urinary bladder acts as a reservoir for urine. When 300 to 400 ml of urine have accumulated, afferent autonomic nerve fibres in the bladder wall sensitive to stretch are stimulated. In the infant this initiates a spinal reflex action and micturition occurs.

Micturition occurs when autonomic efferent fibres convey impulses to the bladder causing contraction of the detrusor muscle and relaxation of the internal urethral sphincter. (Waugh A. & Grant A. 2004)

2.3 Pathological features of urinary tract:

2.3.1 Simple Cysts

The most common renal mass lesion is a simple cortical renal cyst. Although the origin is unknown, these cysts are considered acquired lesions ,probably arising from obstructed ducts or tubules. The clinical findings usually asymptomatic, normal laboratory findings. Sonographic findings found anywhere in the kidney, but usually in cortex, round or ovoid in shape, anechoic, thin, well-defined walls, no color flow or Doppler in mass see fig.7. (Ansert, S. L.2012)

Fig.7 Simple renal cyst with posterior enhancement (arrowheads). (Bates.Jane.A)

2.3.2 Parapelvic Cysts:

The parapelvic cyst originates from the renal sinus and is most likely lymphatic in origin. These small cysts do not communicate with the collecting system.

Clinical findings usually asymptomatic may present with hypertension or obstruction (hilum cyst) pain, usually normal laboratory findings.

Sonographic findings found in the renal hilum or renal sinus, well-defined sonolucent mass with regular or irregular borders, good through-transmission, not connected to the renal collecting system. (Ansert, S. L.2012)

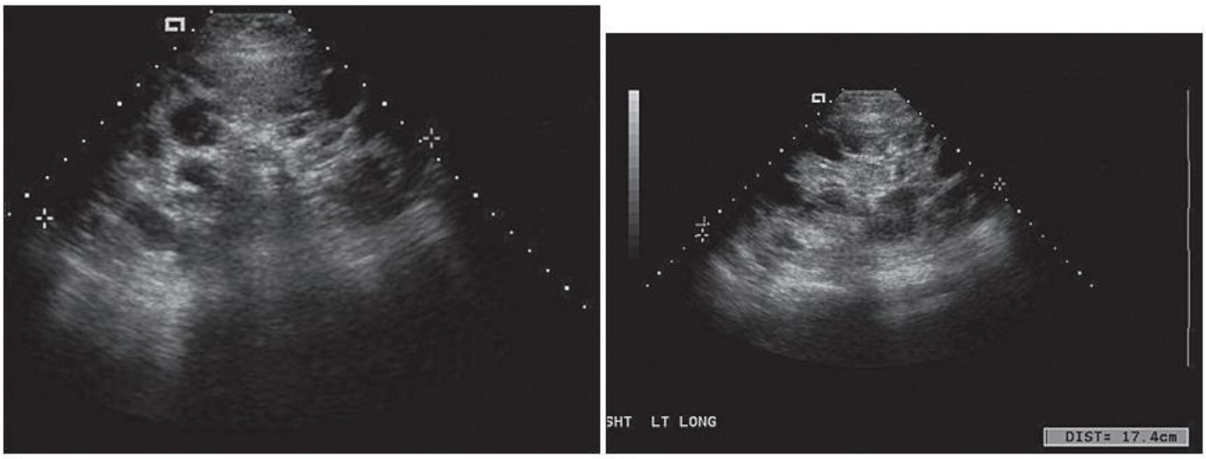
2.3.3 Tuberous Sclerosis Tuberous sclerosis is an autosomal dominant genetic disorder characterized by mental retardation, seizures, and adenoma sebaceum. Associated renal lesions include multiple renal cysts or angiomyolipomas and/or cutaneous, retinal, and cerebral hamartomas. This disease may be difficult to separate from adult polycystic kidney disease.

Clinical findings involve several body systems, patient usually presents with mental retardation, seizures, and cutaneous lesions. Sonographic findings multiple cysts or angiomyolipomas, Multiple organs involved. Multiple angiomyolipomas that may become large. (Ansert, S.L.2012)

2.3.4 Adult Polycystic Kidney Disease: Adult polycystic renal disease is a common genetic disease that occurs in both men and women. The severity of the disease varies depending on the genotype. It is a bilateral disease that is characterized by enlarged kidneys with multiple asymmetrical cysts varying in size and location in the renal cortex and medulla. The cysts may be asymmetrical.

Clinical findings are hypertension, renal failure, abdominal flank pain, Fever, chills (infection) Uremia, Palpable mass, Polycythemia, hematuria.

Sonographic findings are bilateral enlarged kidneys with multiple cyst of varied size. Kidneys lose their reniform shape; in the late, stages, no normal renal parenchyma may be identified, cysts may be atypical because of infection or hemorrhage, cysts may be found in liver, spleen, testes ,pancreas see fig 8.(Ansert, S.L.2012)



A B

Fig.8 A and B,Images of ayoung adulth male with polycystic renal disease,longitudinal scans of both kidneys show enlarged kidneys(RK. 15.2cm and LK.17,4 cm)with a variety of cyst sizes.

2.3.5 Infantile Polycystic Kidney Disease:

Autosomal recessive polycystic kidney disease (ARPKD)also called infantile polycystic disease, is a fairly rare genetic disorder. Dilatation of the renal collecting tubules causes renal failure, and in later forms of the disease, liver involvement is seen.

Clinical findings may be seen in utero, renal insufficiency, lung hypoplasia, usually fatal depending on the amount of renal function, In juvenile form Portal hypertension, hepatic fibrosis, GI hemorrhage.

Sonographic findings bilateral enlarged echogenic kidneys, cysts too small to be seen, no distinction between the corticomedullary region. In utero-ADPKD, dysplasia, glomerulocystic kidney disease. (Ansert, S.L.2012)

2.3.6 Multicystic Dysplastic Kidney Multicystic dysplastic kidney (MCDK) disease is a common nonhereditary renal dysplasia that usually occurs unilaterally, with the kidney functioning poorly, if at all.

Clinical findings most common palpable mass in neonates, restricted growth in children, polyuria, hypertension, infection, usually unilateral; bilateral is incompatible with life. (Ansert, S.L.2012)

Sonographic findings multiple cysts of varying size, no renal parenchyma surrounding the cyst, enlarged kidneys in children, small kidneys in adults, absence of renal vascularity.

Medullary Sponge Kidney Medullary sponge kidney (MSK) is a development anomaly that occurs in the medullary pyramids and consists of cystic or fusiform dilatation of the distal collecting ducts (ducts of Bellini) causing stasis of urine and stone formation. Because the medullary sponge kidney is an anatomic rather than a metabolic defect, the pathologic process may be unilateral or segmental.

Clinical findings Usually asymptomatic unless calculus is present, then hematuria and infections, Pain, hydronephrosis Infection. (Ansert, S.L.2012)

Sonographic findings normal or small kidneys with echogenic parenchyma (cysts too small to be resolved on a sonogram) or, Small cysts in medulla and corticomedullary region with ↑echogenicity see fig 9. (Ansert, S.L.2012)

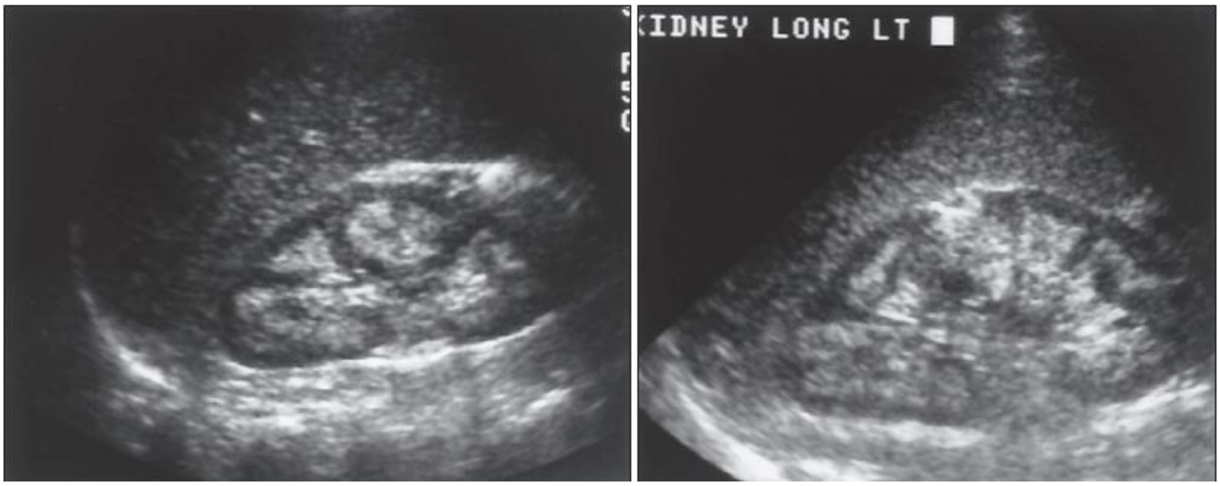


Fig.9 Longitudinal scan of a young patient with medullary sponge kidney. (Ansert, S.L.2012)

2.3.8 Medullary Cystic Disease:

Medullary cystic kidney disease is inherited disorder that eventually lead to end-stage renal disease. They are grouped together because they share many features. Pathologically, they cause cysts restricted to the renal medulla or corticomedullary border. (Ansert, S.L.2012)

Clinical findings are normal renal function, Anemia, Salt loss, Progressive azotemia, Polyuria, Pain, Infection.

Sonographic findings normal or small echogenic kidneys with, Widening of the renal sinus after 2 cm in the medulla or corticomedullary junction. Medullary sponge kidney small cysts under 2 cm. (Ansert, S.L.2012)

2.3.9 Renal Cell Carcinoma:

Renal cell carcinoma (RCC) also called hypernephroma, or Grawitz's tumor is the most common of all renal neoplasms and represents 85 % of all kidney tumors. It is twice as common in males as in females, usually in the sixth to seventh decade of life.

Clinical findings are hematuria, Weight loss, Fatigue, Fever, Flank pain, Palpable mass, Hypertension.

Sonographic findings cystic or complex mass that may have areas of calcifications, may displace renal pyramids and invade renal architecture, Irregular margins, Hypervascular, Renal vein or IVC thrombosis. (Ansert, S. L. 2012)

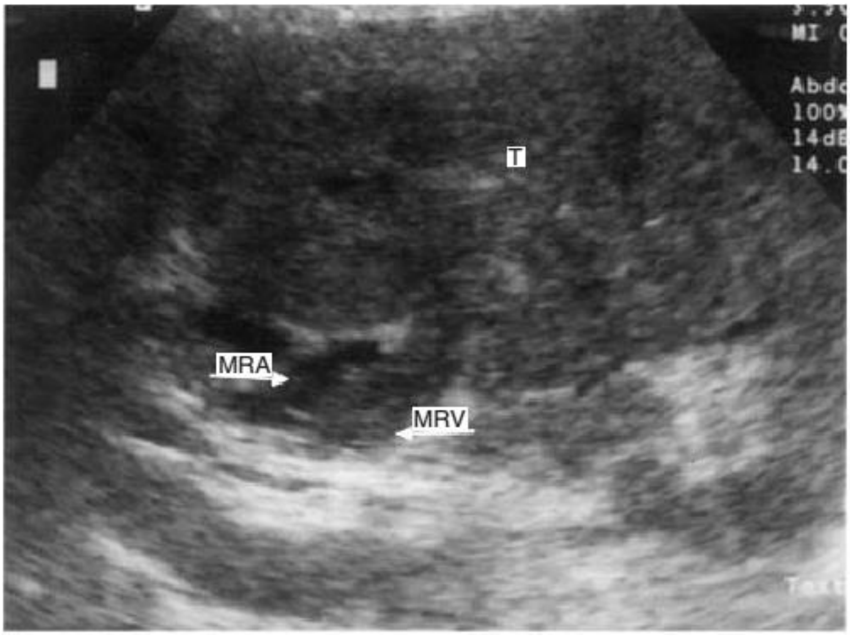


Fig.10 The RK is almost completely replaced by a large renal carcinoma (T). The main renal vein contains tumour thrombus which has spread into the IVC. The main renal artery is seen alongside. (Bates. Jane.A 2004)

2.3.10 Transitional Cell Carcinoma: Transitional cell carcinoma (TCC) accounts for 90% of malignancies that involve the renal pelvis, ureter, and bladder, and for up to 7% to 10% of all renal tumors. The tumor is often multifocal, with a 40% to 80% incidence. TCC occurs twice as often in men as in women, with a peak occurrence in the seventh decade.

Clinical findings are hematuria, weight loss, fatigue, fever, flank pain.

Sonographic findings manifested as solid hypoechoic mass, not well defined within the renal sinus, may be multiple. (Ansert, S. L. 2012)

2.3.11 Squamous Cell Carcinoma: Squamous cell carcinoma is a rare, highly invasive tumor with a poor prognosis.

Clinical findings are gross hematuria, History of chronic irritation, Palpable kidney if severe hydronephrosis is present. Sonographic findings are manifested in large bulky mass, Invasion of the renal vein and IVC see fig. 11

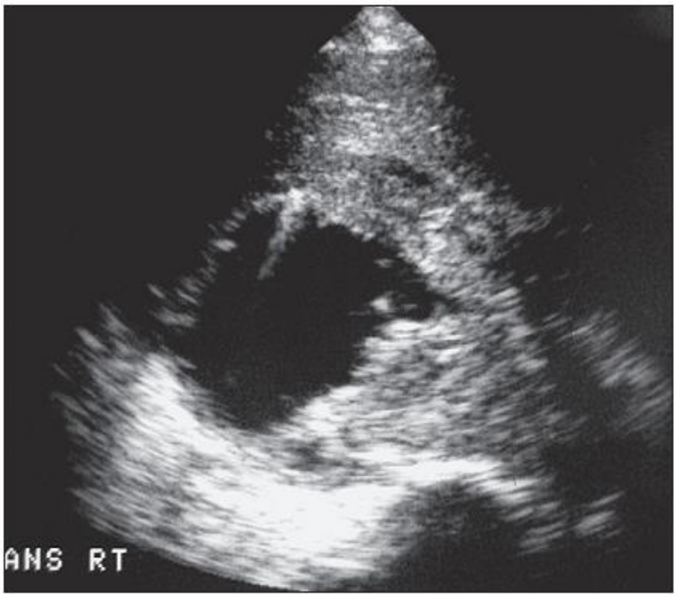


Fig.11 Transvers image of the sequamous cell carcinoma.

2.3.12 Renal Lymphoma: This form of lymphoma may occur as a hematogenous spread (90%) or as direct extension via the retroperitoneal lymphatic channels with a contiguous spread from the retroperitoneum. (Ansert, S. L. 2012)

Clinical findings not a primary site; usually caused by adjacent lymph involvement, more common in patients with non-Hodgkin lymphoma, usually no renal symptoms, asymptomatic, pain, hematuria.

Sonographic findings hypoechoic mass may be bilateral, enlarged kidney. (Ansert, S. L. 2012)

2.3.13 Wilms' Tumor:

Nephroblastoma or Wilms' tumor ,is the most common abdominal malignancy in children (7.8/100,000 younger than age 15) and the most common solid renal tumor in pediatric patients 1 to 8 years old. (Ansert, S. L. 2012)

Clinical findings palpable abdominal mass in children, abdominal pain, nausea and vomiting, hematuria.

Sonographic findings usually unilateral, may be bilateral, heterogeneous, look for extension into renal vein and inferior vena cava see fig 12.

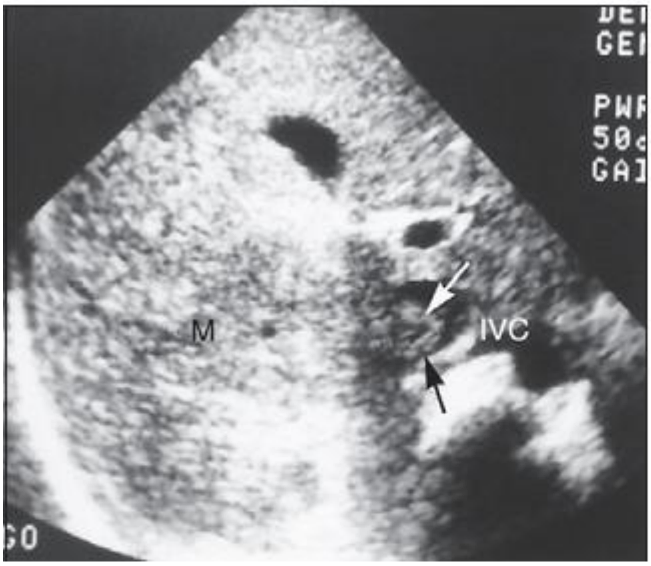


Fig.12 One of the complications of a wilms (M)is spread beyond the renal capsule into the renal vein and inferior vena cava(IVC). (Ansert, S. L. 2012)

2.3.14 Benign Renal Tumor: Benign renal tumors are rare .All renal tumors are treated as malignant until proven otherwise.

Clinical findings usually asymptomatic, may cause painless hematuria.

Sonographic finding is a well-defined mass—hyperechoic to hypoechoic.

2.3.15 Adenoma: Renal adenomatous tumors can be seen as nephrogenic adenofibroma or embryonal adenoma. Patients are usually asymptomatic . Incidental findings may be noted if the mass is large, or if intratumoral hemorrhage occurs. In some cases, these tumors may cause hematuria.

Clinical findings asymptomatic.

Sonographic findings is a well-defined mass with calcifications. (Ansert, S. L. 2012)

2.3.16 Angiolipoma: Renal angiomyolipoma (AML) is the most common benign renal tumor. It is composed of varying proportions of fat, muscle, and blood vessels.

Clinical findings usually asymptomatic, possible flank pain, normal laboratory values, hematuria if tumor hemorrhages.

Sonographic findings Usually echogenic homogeneous mass with well-defined borders, hemorrhagic neoplasm see fig 13. (Ansert, S. L. 2012)

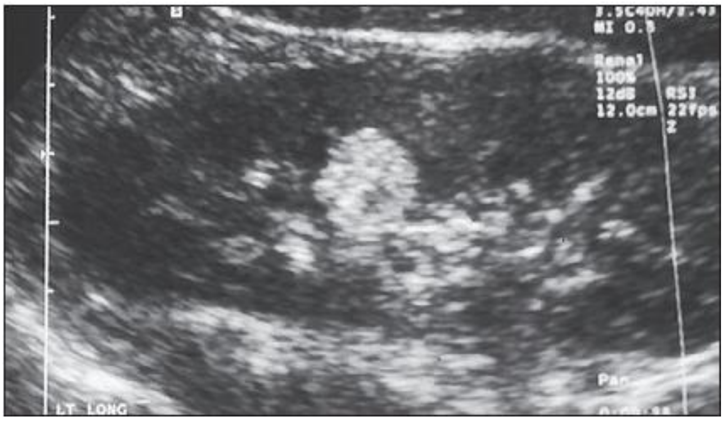


Fig.13 Angiolipomas are common benign tumors. (Ansert, S. L. 2012)

2.3.17 Lipoma: A lipoma consists of fat cells and is the most common of the mesenchymal type of tumors. This tumor is found more often in females than in males.

The patient is typically asymptomatic, but the tumor has been reported to cause hematuria.

Clinical findings usually asymptomatic, normal laboratory values. Sonographic finding is a well-defined echogenic mass. (Ansert, S. L. 2012)

2.3.18 Oncocytoma: Oncocytoma is another uncommon renal tumor that is usually benign. Incidence is increased in the middle-aged or elderly patient.

Clinical finding is asymptomatic.

Sonographic findings well-defined mass with spoke-wheel patterns of enhancement and central scar. (Ansert, S. L. 2012)

2.3.19 Acute Glomerulonephritis In acute glomerulonephritis, necrosis or proliferation of cellular elements (or both) occurs in the glomeruli. The vascular elements, tubules, and interstitium become secondarily affected; the end result is enlarged, poorly functioning kidneys.

Clinical findings nephrotic syndrome, Hypertension, Anemia, Peripheral edema.Sonographic findings ↑Cortical echoes. (Ansert, S. L. 2012)

2.3.20 Acute Interstitial Nephritis:

Acute interstitial nephritis has been associated with the infectious processes of scarlet fever and diphtheria.

Clinical findings Uremia, hematuria, rash, fever, eosinophilia.

Sonographic findings Enlarged kidneys with ↑cortical echoes. (Ansert, S. L.2012)

2.3.21 Lupus Nephritis: Systemic lupus erythematosus is a connective tissue disorder believed to result from an abnormal immune system. Females are affected more often than males, and incidence peaks between 20 and 40 years of age. The kidneys are involved in more than 50% of patients.

Clinical findings are hematuria, proteinuria, renal vein thrombus, renal insufficiency.

Sonographic findings ↑ Cortical echoes and renal atrophy. (Ansert, S. L.2012)

2.3.22 Acquired Immunodeficiency Syndrome(AIDS): Acquired immunodeficiency syndrome (AIDS) is a highly contagious disease, spread mainly by unprotected sexual activity or infected needles.

Clinical finding is renal dysfunction.

Sonographic findings kidneys are normal or enlarged, echogenic parenchyma, ↑Cortical echoes.

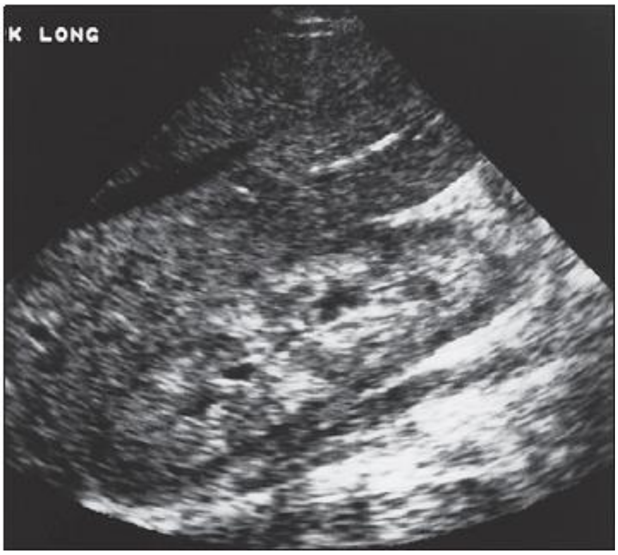


Fig.14 26-Year-old male with acquired immunodeficiency syndrome(AIDS).

2.3.23 Sickle Cell Nephropathy:

Renal involvement is common in patients with sickle cell disease. Clinical findings hematuria, Renal vein thrombosis.

Sonographic findings Varies—patients with acute renal vein thrombosis, enlarged kidneys with ↓echogenicity. (Ansert, S. L.2012)

2.3.24 Hypertensive Nephropathy:

Uncontrolled hypertension can lead to progressive renal damage and azotemia. Clinical finding is uncontrolled hypertension Sonographic findings Small kidneys with smooth borders may have distortion of intrarenal anatomy.

2.3.25 Papillary Necrosis:

Papillary necrosis occurs when the cells at the apex of the renal pyramids are destroyed. Clinical findings are hematuria, flank pain, hypertension, dysuria and acute renal failure. Sonographic findings are fluid-filled spaces at the corticomedullary junction, round or triangular, mimics calculi.

2.3.26 Renal atrophy:

Renal atrophy results from numerous disease processes. Intrarenal anatomy is preserved with uniform loss of renal tissue. Clinical finding is renal failure. Sonographic findings are small echogenic kidneys.

2.3.27 Renal Sinus Lipomatosis:

Renal sinus lipomatosis occurs secondary to renal atrophy. More severe lipomatosis results from a tremendous increase in renal sinus fat content in cases of marked renal atrophy caused by hydronephrosis and chronic calculus disease. Clinical finding asymptomatic. Sonographic findings enlarged kidneys with ↑echogenicity of renal sinus, hyperechoic areas↓renal parenchyma infection, atrophy, hydronephrosis. (Ansert, S. L.2012)

2.3.28Acute Renal Failure:

Acute renal failure may occur in pre renal, renal, or post renal failure stages. The pre renal stage is secondary to hypoperfusion of the kidney. The renal stages may be caused by parenchymal diseases (i.e., acute glomerulonephritis, acute interstitial nephritis, or acute tubular necrosis). They may also be caused by renal vein thrombosis or renal artery occlusion. In post renal failure, radiologic imaging plays a major role. This condition is usually the result of outflow obstruction and is potentially reversible. Post renal failure is usually increased in patients with malignancy of the bladder, prostate, uterus, ovaries, or rectum. Less frequent causes include retroperitoneal fibrosis and renal calculi.

Clinical findings renal insufficiency and ↓ Urine output. Sonographic findings are hydronephrosis, enlarged hypoechoic kidneys and renal artery stenosis. (Ansert, S. L.2012)

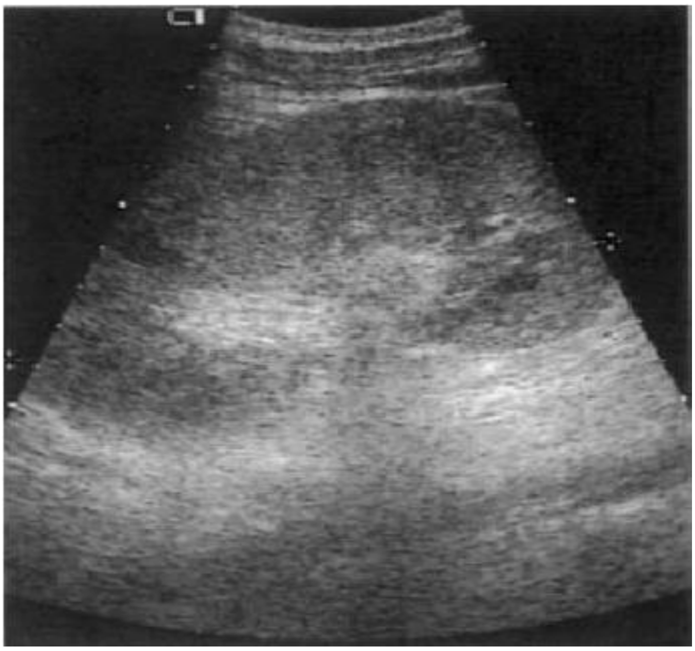


Fig.15 Acute renal failure demonstrating an enlarged, diffusely hyperechoic kidney with loss of corticomedullary differentiation. (Bates.Jane.A)

2.3.29 Obstructive Hydronephrosis:

Dilatation of the renal pelvis is just one factor present in patients with obstructive hydronephrosis. (Ansert, S.L.2012)

Clinical findings renal insufficiency, ↓ urine output, hypertension.

Sonographic findings are fluid-filled renal collecting system, thin parenchyma, hydroureter, ↓ or absent ureteral jets. In cases of acute urinary tract obstruction (UTO), the RI (resistive index) of the interlobar and arcuate intrarenal vessels may be greater than 0.7starting 6 hours after acute onset and up to 72 hours). The RI returns to normal value after 120 hours of obstruction. The value of the RI may be higher than 0.70 in some normal conditions, as in neonates and infants up to 6 years old and in elderly patients, and in some pathologic conditions related to intrinsic renal disease, diabetes, and/or hypertension. Use of nonsteroidal anti-inflammatory drugs may lower the value of the RI on the affected side, which decreases the sensitivity of Doppler ultrasound in identifying UTO .Level of obstruction is another important factor in elevation of the RI value. The resistive index is greater in patients with an obstruction in the proximal ureter or in the distal intramural ureteral portion. It is very important to measure and compare the resistive index in both kidneys, because a ΔRI is more useful for diagnosis of UTO than a solid value for RI. No ureteral jet will be seen on the affected side if the obstruction is complete, or the jet may be noted if obstruction is partial.

Classical sonographic findings in the diagnosis of UTO include the following: Grade I or II hydronephrosis; Doppler showing elevated RI or difference of ΔRI ;absence of the respective ureteral jet; and visualization of the dilated ureter and/or stone. Sonography can be normal in up to 50% of cases in the first 6 hours after acute onset, which means that the normal sonogram does not exclude acute urinary obstruction, and a noncontrast CT will be necessary. (Ansert, S. L. 2012)

Fig.16 Moderate to marked hydronephrosis of the right kidney.

(Bates.Jane.A)

2.3.30 Nonobstructive Hydronephrosis:

Dilatation of the renal pelvis does not always mean that obstruction is present.

2.3.30.1 False-Positive Hydronephrosis:

Many conditions may mimic hydronephrosis; these include extrarenal pelvis, parapelvic cyst, reflux, multicystic kidney ,central renal cyst, transient diuresis, congenital megacalyces, papillary necrosis, renal artery aneurysm (color can help distinguish that this enlargement, not the renal pelvis, is vascular), or an arteriovenous malformation (color can distinguish this abnormality) (Ansert,S.L.2012)

2.3.30.2 False-Negative Hydronephrosis: A dilated renal pelvis may be distinguished from other conditions by the use of other techniques. In patients with retroperitoneal fibrosis or necrosis, give liquids to see if the renal pelvis dilates. In patients with distal calculi, no obstruction can be seen unless the calculi have been there for several days.

Sonographic finding a staghorn calculus can mask an associated dilatation.

(Ansert, S. L.2012)

2.3.31 Renal Infarction

A renal infarction occurs when part of the tissue undergoes necrosis after cessation of the blood supply, usually as a result of artery occlusion. Renal function is usually normal. This may result from a thrombus, a tumor infiltration or obstruction, or it may be iatrogenic.

Clinical finding is asymptomatic.

Sonographic findings are irregular triangle masses in the renal parenchyma and Lobulated renal contour. (Ansert, S. L.2012)

2.3.32 Acute Tubular Necrosis: Acute tubular necrosis (ATN) is the most common medical renal disease to produce acute renal failure, although it can be reversible. Clinical findings are renal insufficiency, hematuria. Sonographic findings are bilaterally enlarged kidneys with hyperechoic pyramids.(Ansert, S. L.2012)

2.3.33 Chronic Renal Failure:

Chronic renal disease is the loss of renal function as a result of disease, most commonly parenchymal disease. Three primary types of chronic renal failure are known: nephron, vascular, and interstitial abnormalities. Glomerulonephritis, chronic pyelonephritis, renal vascular disease, and diabetes are a few of the diseases that lead to renal failure. Clinical findings are renal failure and hypertension. Sonographic findings are bilateral small echogenic kidneys. (Ansert, S. L.2012)

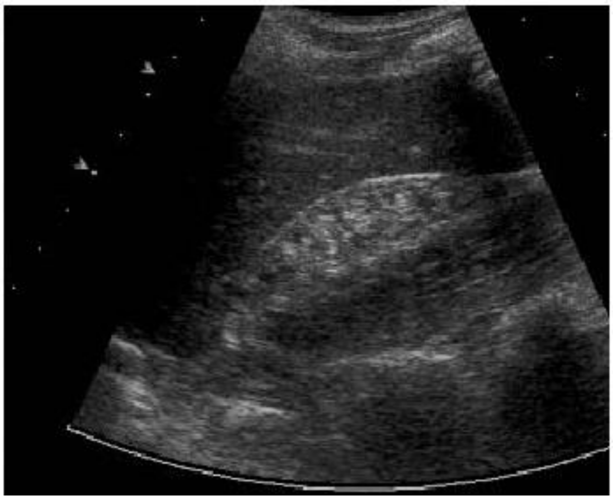


Fig.17 Chronic renal failure. The kidney is shrunken with only a thin rim of cortical tissue remaining. (Bates.Jane.A)

2.3.34 Pyonephrosis:

Pyonephrosis occurs when pus is found within the collecting renal system. Clinical findings are renal insufficiency and hematuria.

Sonographic findings Dilated collecting system with low-level echoes or ↓through transmission. (Ansert, S. L. 2012)

Fig.18 Pyonephrosis. Low-level echoes from pus can be seen in the dilated (Bates.Jane.A)

2.3.35 Xanthogranulomatous Pyelonephritis:

Xanthogranulomatous pyelonephritis is an uncommon renal disease associated with chronic obstruction and infection. Clinical findings are multiple infections and nonfunctioning kidneys. Sonographic findings "Staghorn appearance" destruction of renal parenchyma, ↑Echogenicity, ↑Renal size, dilated calyces. (Ansert, S. L.2012)

2.3.36 Kidney Stone (Urolithiasis):

A stone located in the urinary system is called urolithiasis. Most urinary tract stones are formed in the kidney and course down the urinary tract. Stones consist of a combination of chemicals that precipitate out of urine. Kidney stones are one of the most common kidney problems that can occur; they may cause obstruction, and this obstruction can be extremely painful. Stones that are large and fill the renal collecting system are called staghorn calculi.

Kidney stones that travel down the urinary system may obstruct the ureter in constricted areas.

Sonographic Findings Renal stones are highly echogenic foci with posterior acoustic shadowing. (Ansert, S. L. 2012)

Fig.19 A staghorn calculus fills the entire PCS of the kidney. (Bates.Jane.A)

2.3.37 Ureteric Stricture:

Ureteral narrowing due to fibrosis is a common form of ureteral stricture. Ureteral strictures may also result from inflammatory disease, tuberculosis, localized periureteral fibrosis, impacted ureteral stone, schistostomiasis, iatrogenic ureteral injury, or radiation therapy.and Other causes. (Ansert, S. L. 2012)

Sonographic finding if dilated (e.g. by outlet obstruction due to an enlarged prostate or ureteral stricture, or due to vesico-ureteric reflux). They are easier to see, particularly near the kidney or bladder. (Palmer, P.E.S 1995)

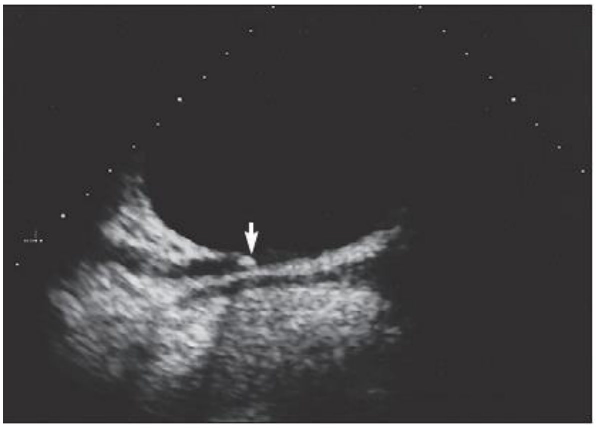


Fig.20 A longitudinal scan of the bladder shows a distal ureter with a small stone. (Hagen-Ansert, Sandra L. 2012)

2.3.38 Ureterocele:

A ureterocele is a cyst like enlargement of the lower end of the ureter caused by congenital or acquired stenosis of the distal end of the ureter.

Clinical finding: ureteroceles are usually small and asymptomatic, although they may cause obstruction and infection of the upper urinary system. If large, a ureterocele may cause bladder outlet obstruction. (Ansert, S. L.2012)

Sonographic finding large ureterocele may fill the urinary bladder and have the same sonographic appearance as diverticula. Ureteroceles are found more often in adults than in children and may be unilateral or bilateral. On sonography, a cobra head appearance is seen in sagittal view. (Ansert, S. L.2012)

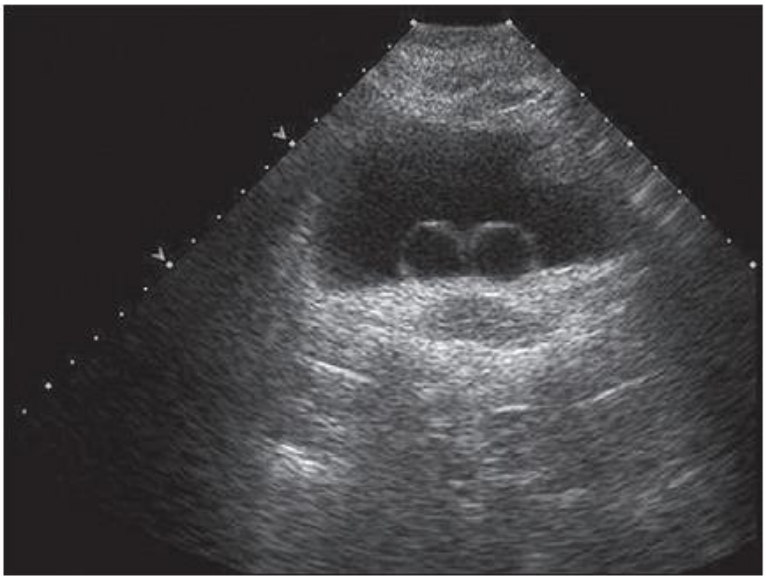


Fig.21 Longitudinal scan of a double ureterocele. (Hagen-Ansert, Sandra L. 2012)

Bladder

2.3.39 Conditions that cause incomplete emptying of the bladder:

Bladder calculi, Diabetes mellitus, Foley catheter, Inflammation. Neoplasms—benign or malignant, Neurogenic bladder, Postsurgical intervention, Pregnancy, Radiation therapy, Rectal or vaginal fistulas. Renal disease, Sexual intercourse, Trauma (blood clot), Tuberculosis (lower ureteric stricture) Urethral stricture.(Hagen-Ansert, Sandra L.2012)

2.3.39.1 Bladder Diverticulum:

A bladder diverticulum is a herniation of the bladder wall. These out pouchings may be singular or multiple and are thinner than the normal bladder wall. Diverticula can be congenital or acquired. An acquired bladder diverticulum is an outpouching of bladder mucosa between muscle bundles caused by increased intravesical pressure. A diverticulum lacks a muscular layer and has a neck, which usually is narrow .Acquired diverticula are commonly associated with calculi and are more prevalent in patients with chronic bladder outlet obstruction or neurogenic bladder. Congenital bladder diverticula are rare. They originate at the posterior angle of the bladder trigone and contain all components of the bladder wall. Clinical findings acquired diverticula are commonly associated with calculi and are more prevalent in patients with chronic bladder outlet obstruction or neurogenic bladder. The sonographic finding is a neck of varying size connecting the adjacent fluid-filled structure to the bladder. The diverticulum may still be filled with fluid after the patient empties the bladder .Urine stasis leads to recurrent infection and stone formation. (Ansert, S. L.2012)

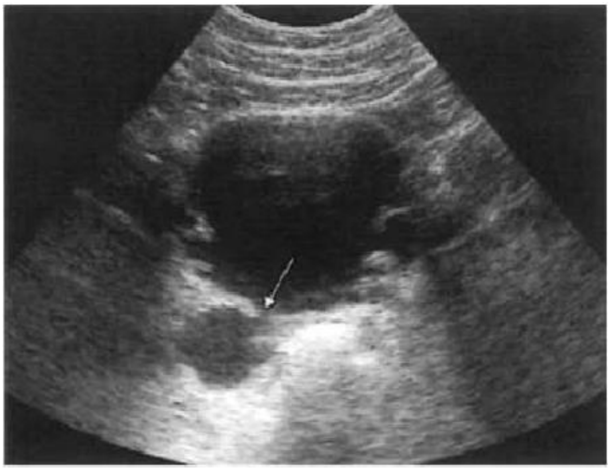


Fig.22A bladder diverticulum can be seen communicating with the bladder (arrow). The main bladder wall is trabeculated. (Bates.Jane.A)

2.3.39.2 Bladder Inflammation(Cystitis): Inflammation of the bladder has several infectious and noninfectious causes. Cystitis is usually secondary to another condition that causes stasis of urine in the bladder. Conditions that cause incomplete emptying of the bladder include urethral stricture, benign and malignant neoplasms, bladder calculi, trauma (blood clot), tuberculosis (lower ureteric strictures), pregnancy ,neurogenic bladder, and radiation therapy. Other causes of cystitis include Foley catheter, common rectal or vaginal fistulas, renal disease, sexual intercourse, poor hygiene, diabetes mellitus, and inflammation following surgical intervention. (Ansert, S. L.2012)

Sonographically, the bladder wall may appear normal in the early stages of inflammatory disease. As the duration of inflammation increases ,the smooth bladder wall will become diffuse or non-diffuse with hypoechoic thickening. As the inflammatory process progresses, the bladder wall will become fibrotic and scarred. The bladder wall will appear more echogenic on a sonogram.

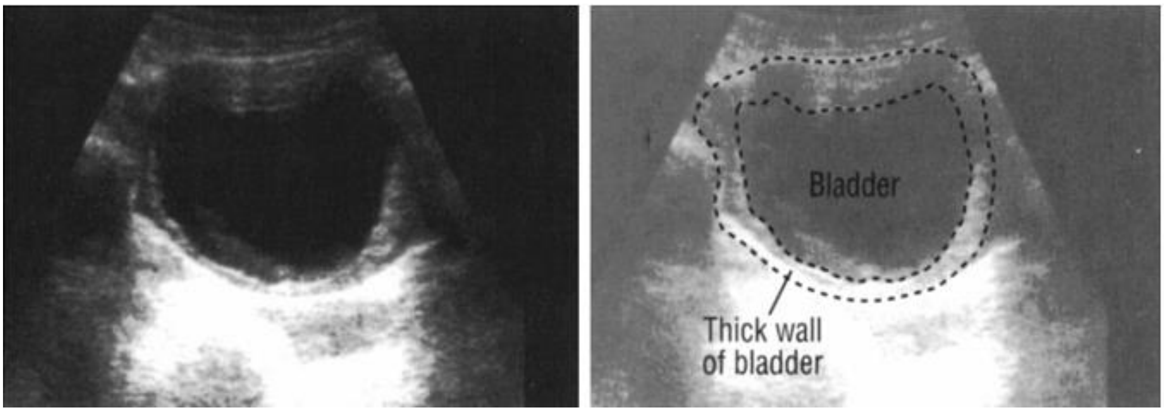


Fig.23 Chronic bladder infection (chronic cystitis). (Palmer, P.E.S 1995)

2.3.39.3 Bladder Tumors:

Most bladder tumors in adults (95%) are transitional cell carcinoma (TCC). Bladder tumors usually are not detected until they have become advanced. Sonography cannot distinguish between benign and malignant masses. A cystoscopy or a biopsy may allow differentiation between a benign and a malignant neoplasm. The bladder may be the secondary site of malignancy. The most common site is the prostate. Invasion of the bladder may result from colon, uterine, or ovarian carcinoma or endometriosis.

Clinical findings: Patients usually present with gross hematuria and may also present with dysuria, urinary frequency, or urinary urgency.

Sonographic Findings The sonographic appearance of bladder masses varies; they commonly appear as a focal bladder wall thickness. Sonography, CT, or MRI may be used to perform staging of bladder carcinoma .A transabdominal sonographic approach can detect intravesical lesions as small as 3 to 4 mm. Sonography is limited and is unable to detect a perivesical extension and pelvic wall involvement. A transrectal approach can be used to detect intravesicular involvement.

Benign tumors are typically hypoechoic when compared with malignant bladder tumors, but they may have the same echogenicity. Any bladder mass may cause outflow obstruction, and the kidneys should be evaluated for hydronephrosis. (Hagen-Ansert, Sandra L. 2012)

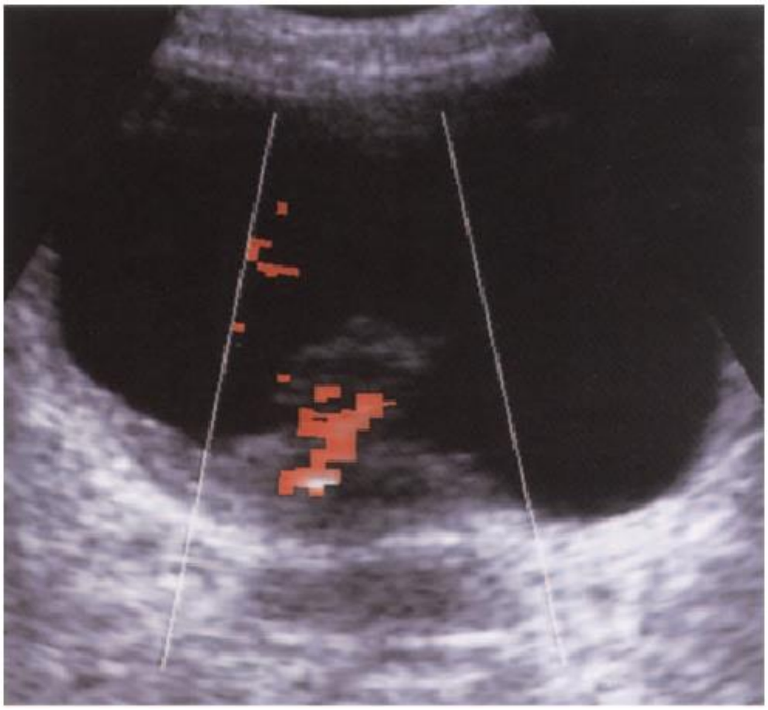


Fig.24 Transitional cell carcinoma in the bladder. (Bates.Jane.A)

2.4 Ultrasound imaging: -

2.4.1 Kidney and ureter: -

2.4.1.1 Preparation of the patient: -

No preparation is required. If the urinary bladder is to be examined, the patient should drink water.

2.4.1.2 Position of the patient: -

Start with patient lying on his/her back (supine). Cover the right upper abdomen liberally with coupling agent.

2.4.1.3 Choice of transducer: -

For adults, use a 3.5 MHz transducer. For children and thin adults use a 5.0 MHz transducer.

2.4.1.4 Scanning technique: -

The right kidney can be seen best with the patient supine, using the liver as acoustic window.

Scanning is always done in deep suspended inspiration. Aske the patient to take a deep breath and hold the breath in. do not forget to tell the patient to relax and breath normally again.

Start with a longitudinal scan over the right upper abdomen and then follow the transvers scan. Next rotate the patient to the left lateral decubitus position, to visualize the right kidney in this coronal view.

To visualize the left kidney apply coupling agent to the left upper abdomen.

2.4.2 The bladder: -

2.4.2.1 preparation of the patient: -

The bladder must be full. Give four or five glasses of fluid and examine after one hour (Don’t allow the patient to micturate).

2.4.2.2 Position of the patient: -

The patient should lie supine but may need to be rotated obliquely. The patient should be relaxed, lying comfortably and breathing quietly. Lubricate the lower abdomen with coupling agent.

2.4.2.3 choice of transducer: -

Use a 3.5 MHz transducer for adults. Use a 5.0 MHz transducer for children or thin adults.

2.4.2.4 Scanning technique: -

Start with transvers scans from the pubic symphysis upwards to the umbilicus, follow with longitudinal scans moving from one side of the lower abdomen to the other.

These scans will usually be sufficient but it is not always easy to see the position of the lateral and anterior walls of the bladder and patients may have to be turned $30\text{-}45^0$ to see an area more clearly. Any area that appears abnormal must be viewed in several projections.

After scanning should empty the bladder and should then be rescanned.

2-5 previous study:

In a previous study titled "The Role of Ultrasound in Renal Insufficiency" Conducted by Khati NJ, Hill MC, Kimmel PL, the study ended to the following

Results:

The echogenic kidney indicates the presence of parenchymal renal disease; in spite of the size the kidney may be normal or enlarged. The small kidney size suggests advanced stage chronic kidney disease. Polycystic kidney disease may be the cause of the patient's renal insufficiency with bilateral enlarged kidneys containing multiple cysts of various size. If hydronephrosis is present, the level and cause of obstruction should be sought. (Date of download: 15/11/2016)

Another previous study conducted by Dr. Peter Brown was titled "Ultrasound in Defuse renal disease" The conducted study reached to the following results:

Ultrasound is an essential initial investigation in a patient presenting with renal failure.

-Ultrasound gives immediate information on the presence, size and appearance of both kidneys and importantly assesses dilatation of the pelvicalyceal system, which may be due to obstruction.

-Renal ultrasound, distinguishes patients with obstructive renal failure allowing appropriate treatment and intervention.

-Ultrasound has an observable role in the assessment of patients with pre renal, and intrinsic renal failure.

-Ultrasound Can identify patients with intrinsic renal disease, and distinguish different diseases. Ultrasound can identify end stage kidneys and give prognostic information. (Date of download:23/11/2016)

A third study conducted by Islam Hashim Mergani was titled "characterization of the kidneys in patients with heamato-urea and pyuria using U/S" showed that all the individuals of the sample have loss of corticomedullary differentiation, and bright cortex. There was no significant change in the size of the kidneys of the affected patients.

U/S as a unique imaging is not enough for evaluating patients with suspected renal infection of different types.

A fourth study conducted by Ebtesam Abd Elrahman Abd allah was titled as "diagnosis of renal infection using U/S" showed that 18% of the sample which was 50 individuals was of large kidneys while the rest was of normal kidneys sizes and most likely the enlargement is referred to inflammatory process.

The fifth study conducted by Zainab Abdullah Hammad Ibrahim titled as "sonographic measurement of residual urine volume in benign prostatic hyperplasia" the study involved 50 patients aged 49-90 years of age, the results showed that there is a significant relation between prostate volume and patient's age and, the residual urine, cystitis and calcification.

The prostate enlargement is the main cause of obstruction of the bladder neck or narrowing of the urethral passage.

Chapter Three

Materials and methods

Chapter Three

Materials and methods

3-1 -Materials:

3-1-1-Machines:

US examination of the urinary tract was performed using US machines. Using transabdominal (TA) convex probe 3.5MHZ. And finally, Thermal paper printer was used.

3-1-2 Patients:

Fifty (n=51) participants (subjects) all of the are Yamani, 37 males and 14 females Their age are widely ranged 1- 80 years classified into two groups as (1-18 years of age) and (19-80 years of age), were recruited as volunteers for this study in Aden governorate in Republic of Yemen. The participants have lower urinary obstruction confirmed by laboratory test, there is no excluded age range and gender.

3-2 Methods:

3-2-1 Abdominal US technique:

The subjects had to be aware of the nature of the study and had to willingly, provide informed consent before entering the study.

US examination of the urinary tract was performed using transabdominal (TA) convex probe 3.5MHZ, subject was scanned abdomen with fullness bladder and post voiding. Ages and gender of subjects was recorded.

For purpose of this study the supine position was selected, imaging in two planes (sagittal, transvers). After visualization the maximal outline of urinary tract, the measurements will be taken for both kidneys dimeter with longitudinal plane, bladder wall thickness with transvers plane the measurements will be taken for fullness bladder volume with transverse and sagittal plane, and measurements will be taken for post voiding with transvers and sagittal plane.

All US findings will be recorded in case of bladder wall thickness the normal thickness is up to.4mm, in case of fullness bladder volume the normal volume is up to 25o ml.

3-2-2 Study design: Prospective descriptive study.

3-2-3 Study Area:

Aden –Republic of Yemen.

3-2-4 Study Period:

June 2016 to December 2016

3-2-5 Data analysis:

The collected data arranged in a master sheet and enter the computer and analyzed by SPSS and frequency tables and presented in forms of graphs, tables and figures.

3-2-6 The data storage:

The data was stored in my personal computer and flash.

Chapter four

Results

Chapter four

Results

Table 4.1: ages of patients in years

Age group	Frequency	Percent
1-18	6	11.8
19-80	45	88.2
Total	51	100.0

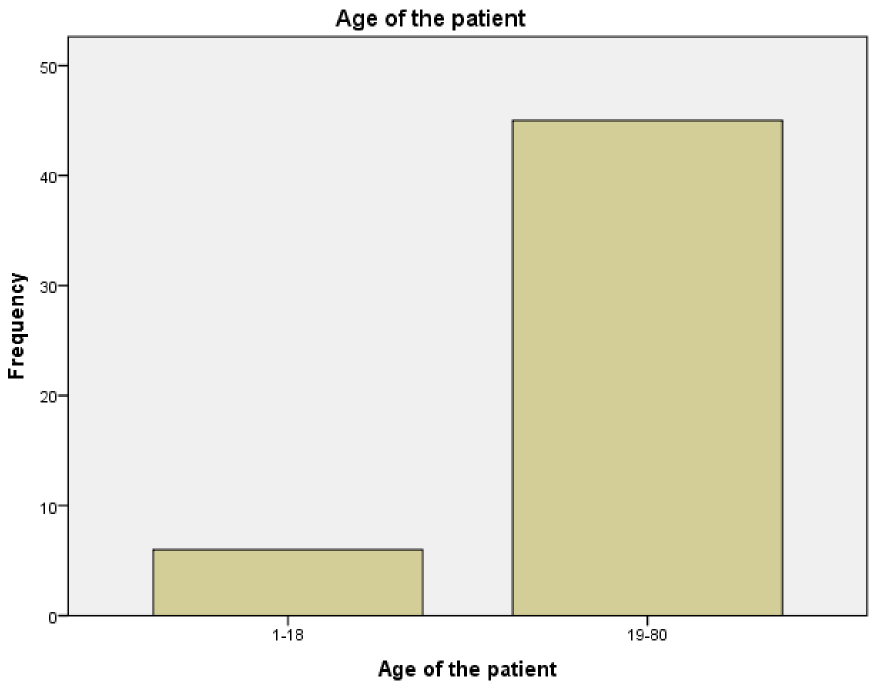


Fig. 4.1: ages of the patients

Table 4.2: gender of the patient

Gender	Frequency	Percent
Male	37	72.5
Female	14	27.5
Total	51	100.0

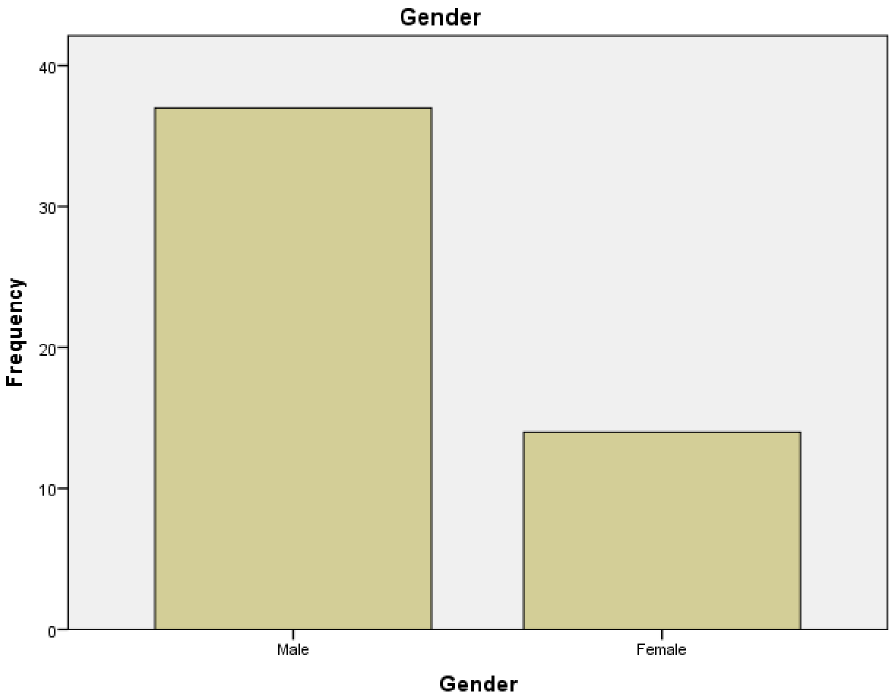


Fig. 4.2: Gender of the patient

Table 4.3: Length of right kidney in cm

Rt. kidney length	Frequency	Percent
6 - 8	7	13.7
9 - 12	43	84.3
13 - 16.6	1	2.0
Total	51	100.0

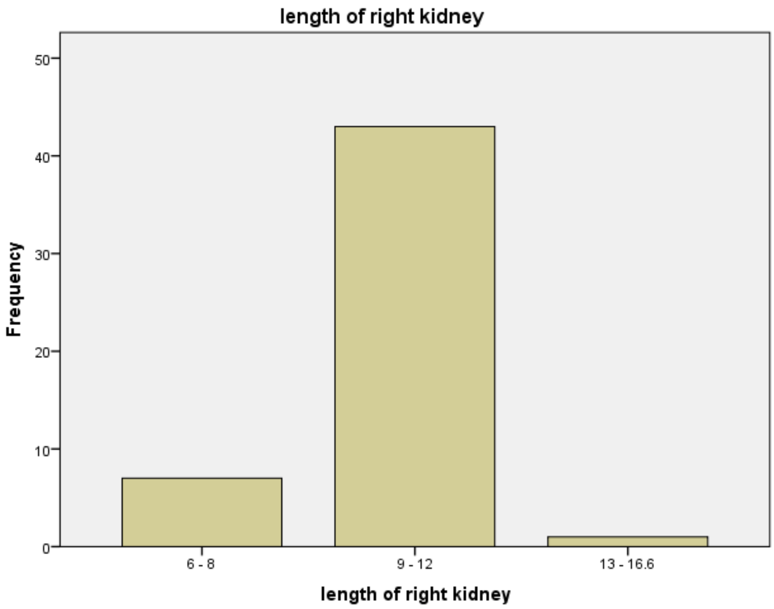


Fig.4.3: length of the right kidney

Table 4.4: width of the right kidney

Kidney width	Frequency	Percent
3 - 3.5	4	7.8
4 - 6	46	90.2
6.1 - 7	1	2.0
Total	51	100.0

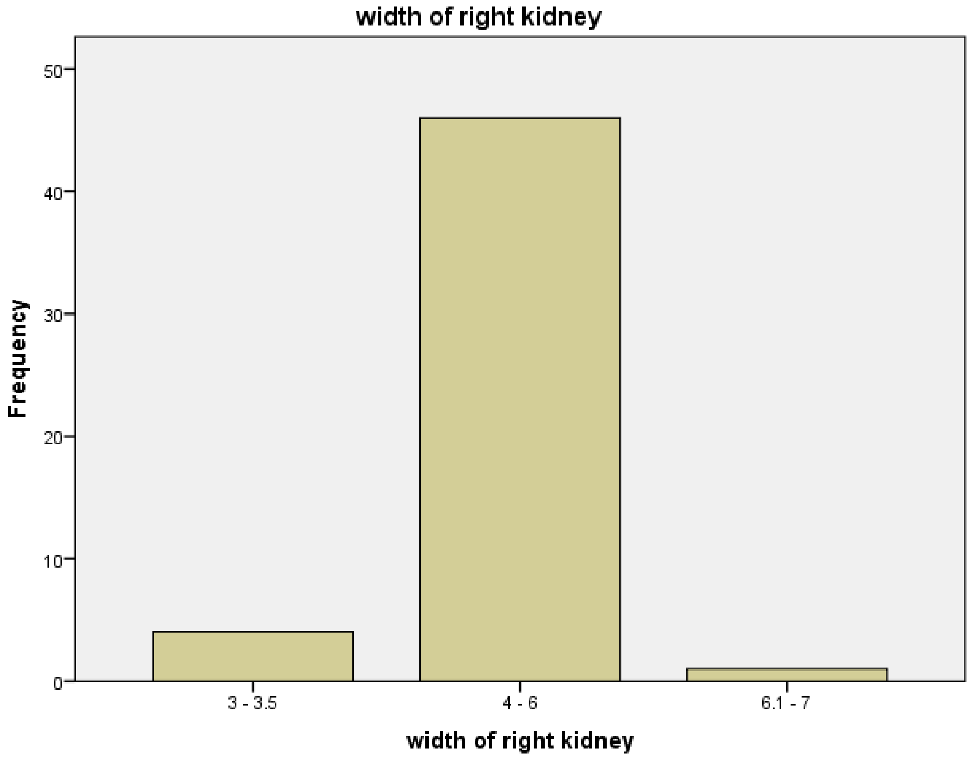


Fig.4.4: width of the right kidney

Table 4.5: Cortico-medullary differentiation of the Rt. Kidney

CMD	Frequency	Percent
Well	38	74.5
Ill	13	25.5
Total	51	100.0

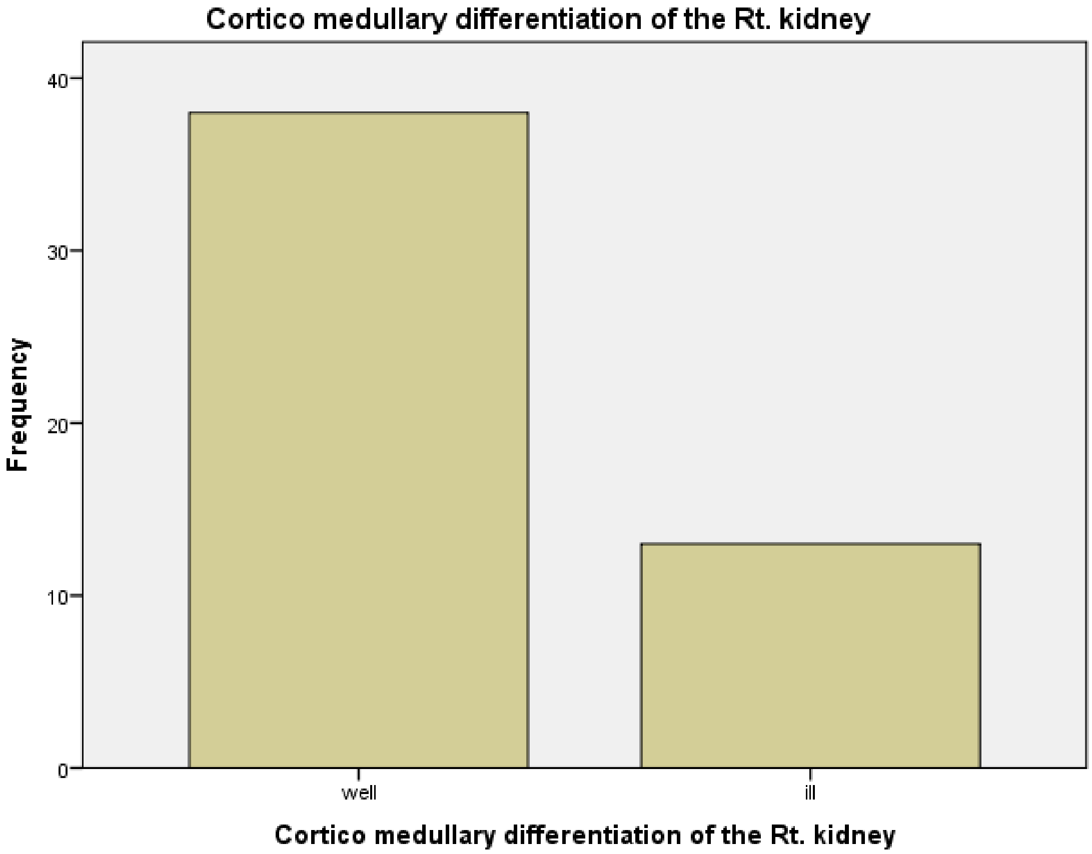


Fig. 4.5: Cortico medullary differentiation of the Rt. Kidney

Table 4.6: Echotexture of the Rt. Kidney

Echo. Of rt. kidney	Frequency	Percent
hypo	46	90.2
Hyper	5	9.8
Total	51	100.0

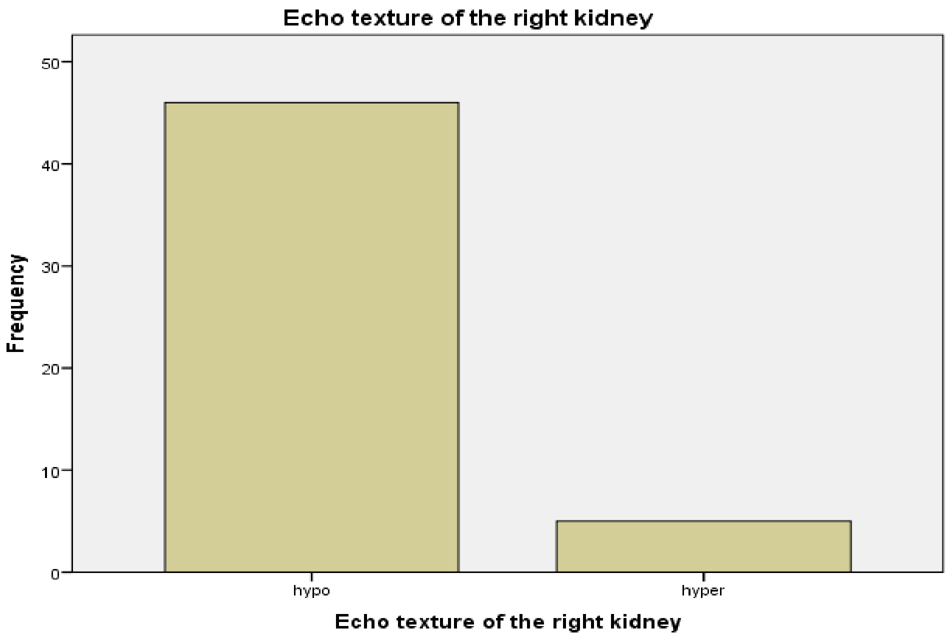


Fig.4.6: Echotexture of the Rt. Kidney

Table 4.7: Length of left kidney in cm

Groups of Lt. kidney length	Frequency	Percent
6-8	8	15.7
9-12	41	80.4
13-15.5	1	2.0
Absent kidney	1	2.0
Total	51	100.0

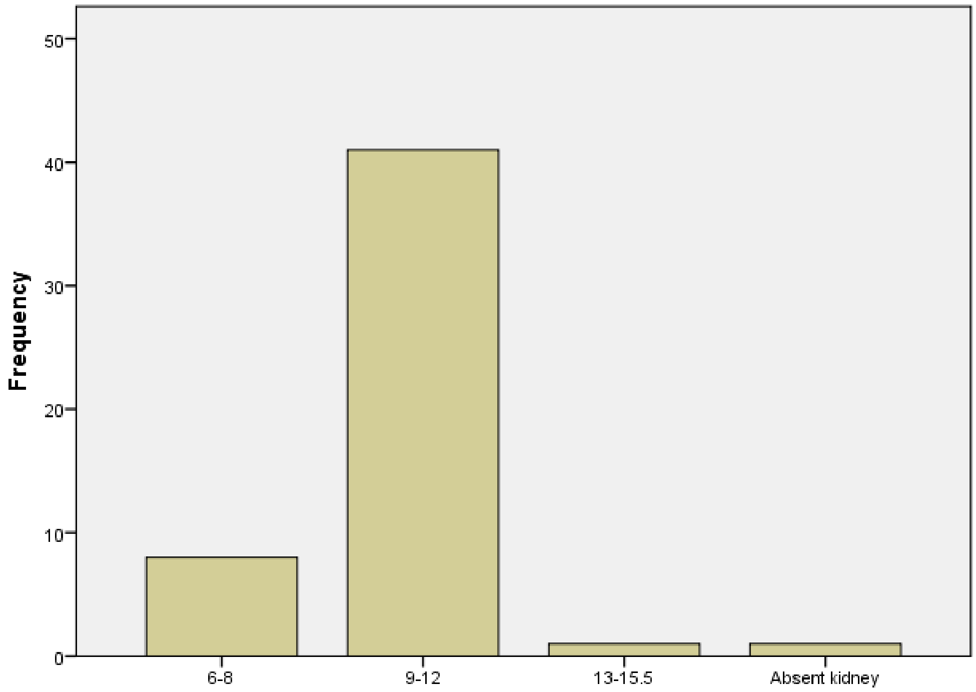


Fig. 4.7: length of left kidney in cm

Table 4.8: width of Left kidney

Width of Lt. kidney	Frequency	Percent
2.5 - 3.7	6	11.8
4 - 6	42	82.4
6.1 - 8	2	3.9
Absent kidney	1	2.0
Total	51	100.0

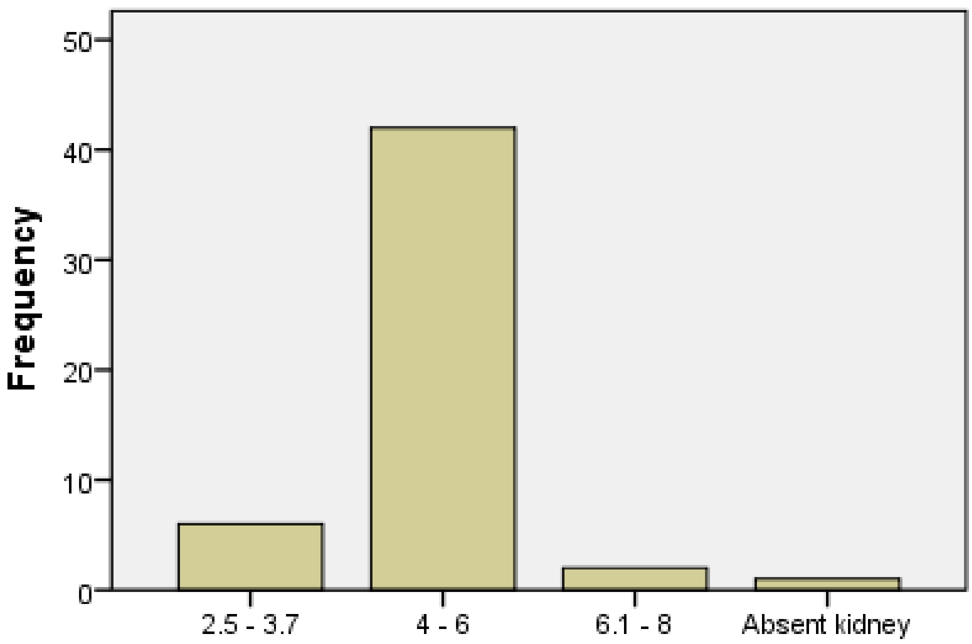


Fig.4.8: width of Left kidney

Table 4.9: Cortico medullary differentiation of the Lt. kidney

CMD	Frequency	Percent
well	31	60.8
ill	19	37.3
Absent Kidney	1	2.0
Total	51	100.0

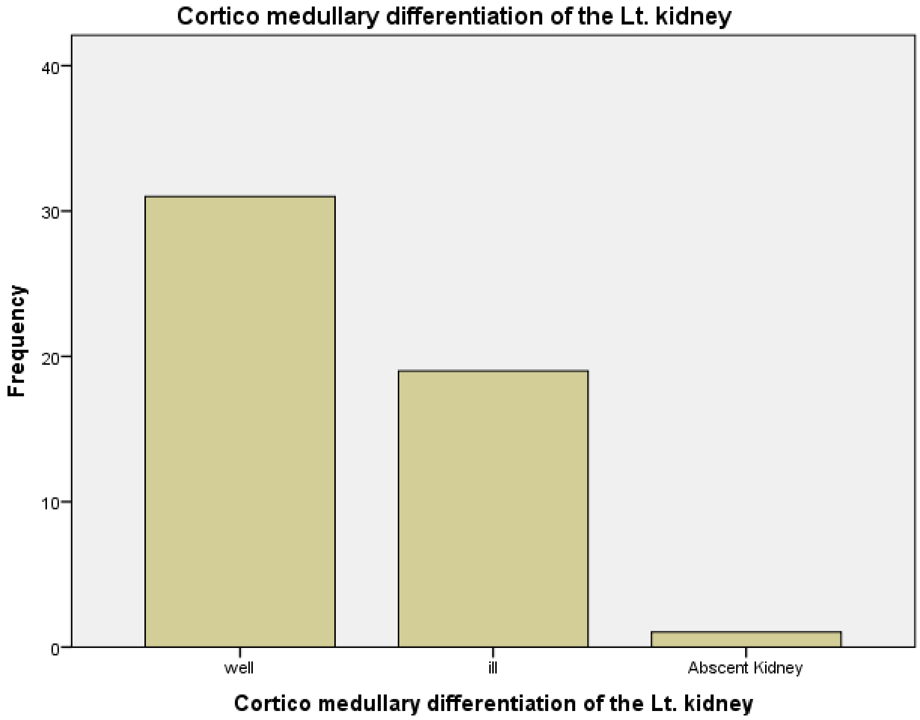


Fig. 4.9: Cortico medullary differentiation of the Lt. kidney

Table 4.10: Echo texture of the left kidney

Echotexture	Frequency	Percent
Hypo	46	90.2
Hyper	4	7.8
Absent kidney	1	2.0
Total	51	100.0

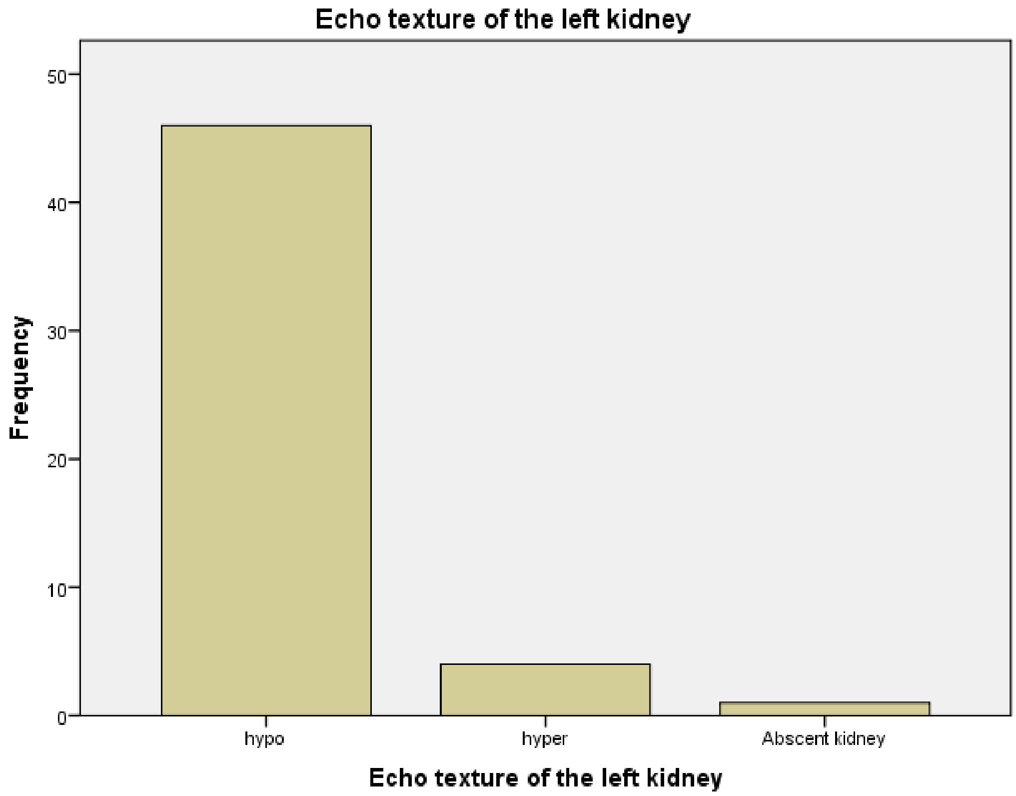


Fig: 4.10: Echo texture of the left kidney

Table 4.11: Rt. Ureter dilation

Ureter dilation	Frequency	Percent
Normal	44	86.3
Dilated	7	13.7
Total	51	100.0

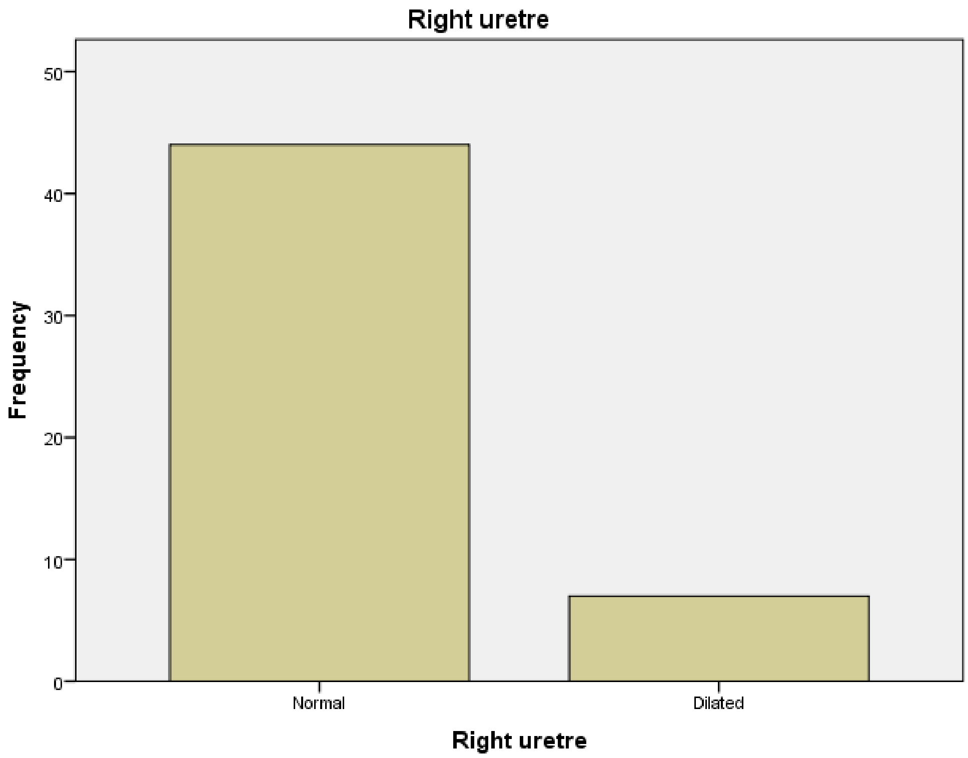


Fig. 4.11: Rt. Ureter dilation

Table4.12: Left ureter dilation

Feature	Frequency	Percent
Dilated	40	78.4
Normal	10	19.6
Absent ureter	1	2.0
Total	51	100.0

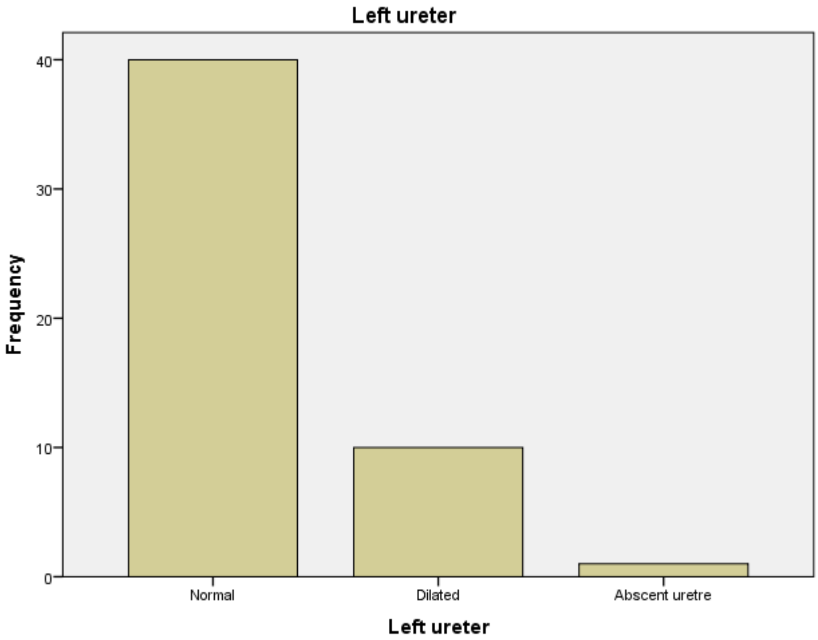


Fig.4.12: Left ureter dilation

Table 4.13: Bladder wall thickness in mm

Thickness in mm	Frequency	Percent
3 – 4	41	80.4
4.1<	10	19.6
Total	51	100.0

Fig. 4.13: Bladder wall thickness in mm

Table 4.14: Urinary bladder wall feature

Feature	Frequency	Percent
regular	37	72.5
irregular	14	27.5
Total	51	100.0

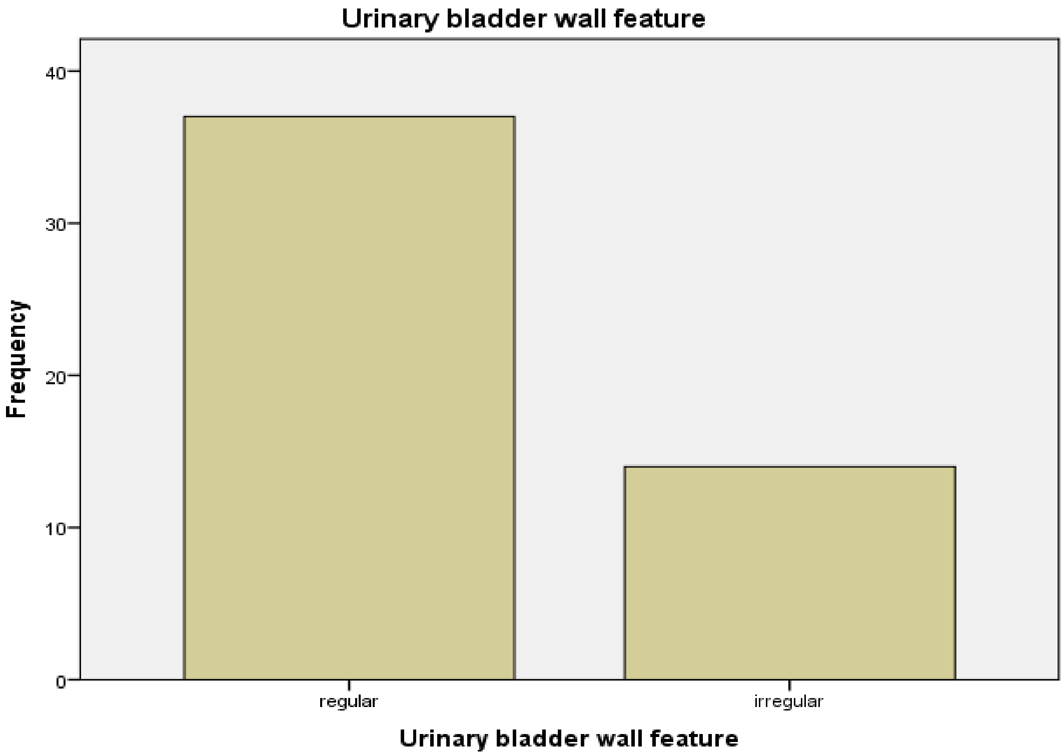


Fig. 4.14: Urinary bladder wall feature

Table 4.15 Residual urine post voiding That indicates to retention

Residual urine	Frequency	Percent
NO	33	64.7
Yes	18	35.3
Total	51	100.0

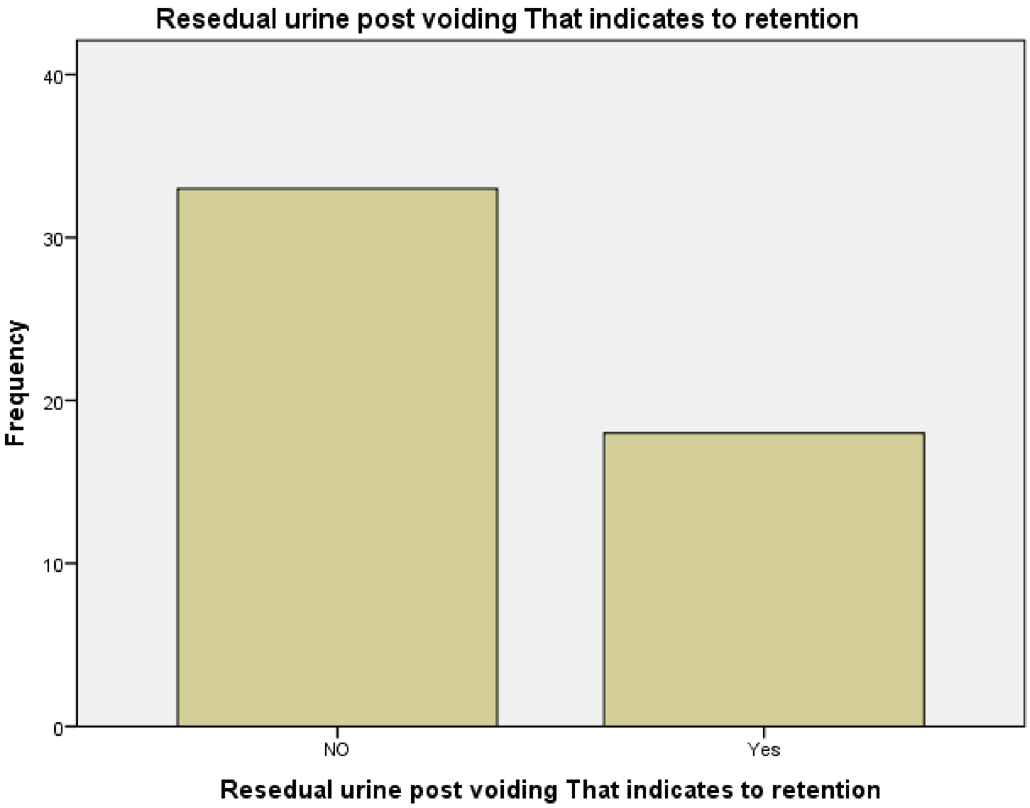


Fig.4.15 Residual urine post voiding That indicates to retention

Table 4.16: Quantity of residual urine post voiding in cc

Urine quantity	Frequency	Percent
0-20	33	64.7
23 – 364	18	35.3
Total	51	100

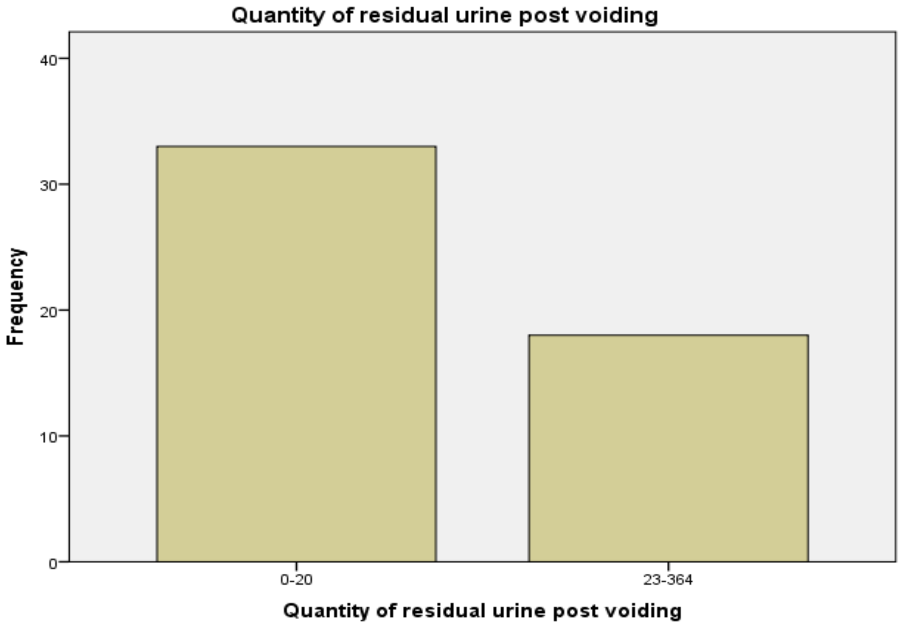


Fig. 4.16: Quantity of residual urine post voiding in cc

Table 4.17 case diagnosis

Case diagnosis	Frequency	Percent
Normal	5	9.8
hydronephrosis and urinary stone	28	54.9
Cyst	4	7.8
others(Ectopic kidney, uterine fibroid and Absent Kidney)	3	5.9
Pyonephrosis	2	3.9
Trabeculation and cystitis	5	9.8
BPH	4	7.8
Total	51	100.0

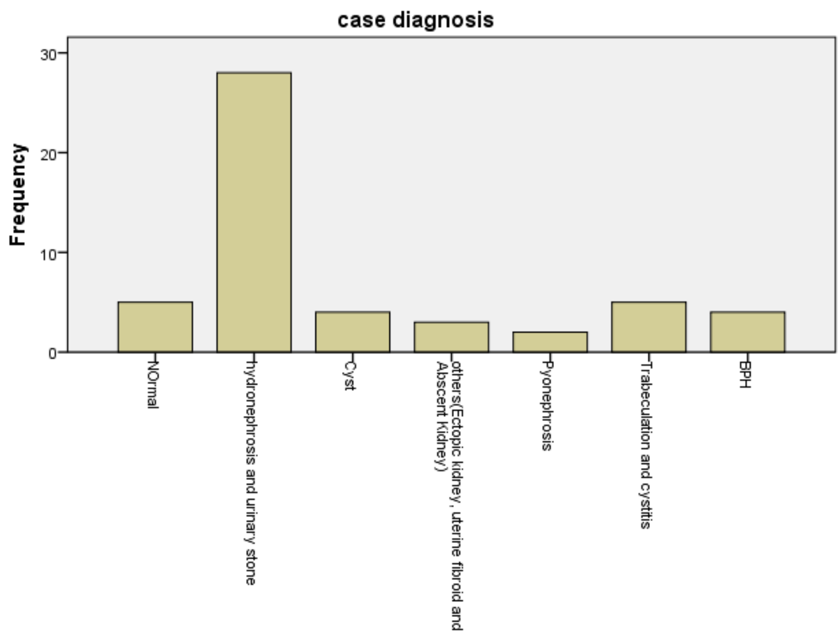


Fig. 4.17 Diagnosis of patients with urinary tract problems

Table 4.18 Correlations of age ,gender and laboratory test results with Rt. kidney.

Variable		Age	Gender	Laboratory test result	length of right kidney	width of right kidney	Echo texture of the right kidney	Cortico medullary differentiation of the Rt. kidney
Age	Pearson Correlation	1	-.115	-.082	.455**	.240	.008	.271
	Sig. (2-tailed)		.423	.569	.001	.090	.955	.055
	N	51	51	51	51	51	51	51
Gender	Pearson Correlation	-.115	1	-.203	-.157	-.025	-.055	-.158
	Sig. (2-tailed)	.423		.153	.271	.861	.701	.268
	N	51	51	51	51	51	51	51
Laboratory test result	Pearson Correlation	-.082	-.203	1	.172	.196	.090	.203
	Sig. (2-tailed)	.569	.153		.228	.168	.532	.154
	N	51	51	51	51	51	51	51
length of right kidney	Pearson Correlation	.455**	-.157	.172	1	.783**	-.246	-.056
	Sig. (2-tailed)	.001	.271	.228		.000	.082	.696
	N	51	51	51	51	51	51	51
width of right kidney	Pearson Correlation	.240	-.025	.196	.783**	1	-.366**	-.181
	Sig. (2-tailed)	.090	.861	.168	.000		.008	.204

	N	51	51	51	51	51	51	51
Echo texture of the right kidney	Pearson Correlation	.008	-.055	.090	-.246	-.366**	1	.412**
	Sig. (2-tailed)	.955	.701	.532	.082	.008		.003
	N	51	51	51	51	51	51	51
Cortico medullary differentiation of the Rt. kidney	Pearson Correlation	.271	-.158	.203	-.056	-.181	.412**	1
	Sig. (2-tailed)	.055	.268	.154	.696	.204	.003	
	N	51	51	51	51	51	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.19 Correlations of age ,gender and laboratory test results with lt. kidney.

Variable		Age	Gender	Laboratory test result	length of Lt. kidney	width of lt. kidney	Echo texture of the left kidney	Cortico medullary differentiation of the Lt. kidney
Age	Pearson Correlation	1	-.115	-.082	.339*	.109	-.311*	-.310*
	Sig. (2-tailed)		.423	.569	.017	.451	.026	.027
	N	51	51	51	49	50	51	51
Gender	Pearson Correlation	-.115	1	-.203	-.131	.127	-.087	-.087
	Sig. (2-tailed)	.423		.153	.371	.378	.544	.543
	N	51	51	51	49	50	51	51
Laboratory test result	Pearson Correlation	-.082	-.203	1	.193	.048	-.145	-.145
	Sig. (2-tailed)	.569	.153		.183	.741	.309	.310
	N	51	51	51	49	50	51	51
length of Lt. kidney	Pearson Correlation	.339*	-.131	.193	1	.734**	-.331*	-.045
	Sig. (2-tailed)	.017	.371	.183		.000	.020	.759
	N	49	49	49	49	49	49	49

width of lt. kidney	Pearson Correlation	.109	.127	.048	.734**	1	-.128	-.156
	Sig. (2-tailed)	.451	.378	.741	.000		.376	.281
	N	50	50	50	49	50	50	50
Echo texture of the left kidney	Pearson Correlation	-.311*	-.087	-.145	-.331*	-.128	1	1.000**
	Sig. (2-tailed)	.026	.544	.309	.020	.376		.000
	N	51	51	51	49	50	51	51
Cortico medullary differentiation of the Lt. kidney	Pearson Correlation	-.310*	-.087	-.145	-.045	-.156	1.000**	1
	Sig. (2-tailed)	.027	.543	.310	.759	.281	.000	
	N	51	51	51	49	50	51	51

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Chapter five

Discussion, conclusion & recommendations

Chapter five

Discussion, conclusion and recommendations

5.1-Discussion:

This research has been carried out to study the ultrasound findings regarding changes in urinary tract in Yemeni patients with urinary tract problem, 51 patients were enrolled in the study (37 males and 14 females) 6 of them within group of age (1-18 years) and 45 within (19 – 80 years).

It has been carried out in Raidan specialized clinic – Aden –Yemen during the period June – Dec. 2016.

The results of the study showed that the abnormal findings cover (46), whereas the other five patients were normal. One of them of the (1–18 years old) group was normal, while the other "4 patients" were of the (19 – 80 years old) group.

Most individuals are of normal kidney size, where enlarged and small kidney size is 2% and 4% respectively, which matches the results of the revised previous studies. a variety of cases involve ill cortico-medullary differentiation of both kidneys as an average percent is 31% this value is approximately matching the concerned value stated in the previous studies, hyperechoic kidney 18% which is not deviated from concerned results of the previous studies, dilated ureter 33% which is approximately matching the results of the previous studies, thick bladder wall 19.6%, irregularity 27.5% and residual urine post voiding 35.3% which are

all matching the results of the previous studies. The results concerning the quantity of residual urine post voiding record that 18 patients are of retention with urine quantity in the range of 23-364 cc where 33 patients record a lesser quantity in the range of 0-20 cc.

Variety of diagnosis as a result of U/S findings between normal (9.8 %), hydronephrosis and urinary stone (54.9%), cysts (7.8 %), pyeonephrosis (3.9

%) cystitis (9.8 %) benign prostatic hyperplasia and others (ectopic kidney, uterine fibroids and absent kidney) (5.9 %).

The study showed significant correlation between kidneys length, urinary bladder wall thickness and feature with patient’s age.

The study revealed that there is a negative correlation between left kidney echotexture and corticomedullary differentiation with age, a negative correlation is

also shown between corticomedullary differentiation with laboratory test results.

The study revealed significant correlation between Rt. ureter dilation with laboratory test results.

Both ureters dilation is negatively correlated with the patient’s age

The study revealed a negative correlation between Lt. ureter dilation and laboratory test results.

The study showed significant correlation between urinary bladder wall thickness and feature with quantity of residual urine post voiding.

5.2- Conclusion: -

This study has been carried out in Raidan Specialized clinic – Aden – Yemen. The goal of the study is to identify the ultrasound findings regarding changes in kidneys, ureters and urinary bladder in Yamani patients with urinary tract problems.

The results conclude that the common ultrasound findings regarding urinary tract problems are hydronephrosis, urinary stones, cysts, pyeonephrosis, cystitis, benign prostatic hyperplasia (BPH) and others (Ectopic kidney, uterine fibroiods and absent kidney).

Ultrasound findings are very important to detect the complications and signs of urinary tract problems and helpful in follow up to manage these critical complications.

5.3- Recommendations: -

After the enumeration of the results that related to the following thesis, there are some ideas which could help further in the field of research and better to be recommended as follow: -

- Would be better to do the U/S scan as a routine study in the urinary tract problems to detect the lesions as a cause of urinary tract problems.
- U/S is very important to patients with positive laboratory findings to confirm the results.
- It would be better to do the U/S scan to sought the cause of hydronephrosis.
- U/S scanning could be used as a routine checkup, follow up to help treatment and control of the disease.
- It would be better to do more studies in U/S findings in patients with urinary tract problems by large samples and further modalities.

5.4-References: -

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Case record showing age, gender and urinary tract Ultrasound findings for 51 patients

S.NO.	Age	Gender	Kidney length		Kidney width		Renal echo texture		CMD		Ureter		Urinary bladder	Laboratory test	Others
			Rt.	Lt.	Rt.	Lt.	Rt.	Lt.	Rt.	Lt.	Rt.	Lt.			