Sudan University of science and Technology

College of graduate Studies

Diagnosis of Male Infertility using Ultrasound

تشخيص العقم عند الرجال بواسطة الموجات فوق الصوتية

A thesis Submitted for partial fulfillment of the Requirement for the Awarded of the Degree of M.Sc.in Diagnostic medical ultrasound

By

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Dedication

- ***To my little and big family who surrounded me with love, support and time to complete this work.***
- ***To Professor. Caroline Edward for helping and guiding me.***

Acknowledgement

To my colleagues in department of andrology at Khartoum hospital for dermatology and venereology, special thanks to Dr. Essam Elghazali head of the department who help me in this work and data collection.

A lot thanks toTalal Ali AL-Qalah who participate in this work in data analysis .

Abstract

This study was carried out in Khartoum Dermatology and Venereology Teaching Hospital department of andrology during March 2017 to July 2017. This study done to diagnosis of infertile male patients using ultrasonography, to study common causes of male infertility.to study sonographic appearance of normal and pathology of the scrotum ,to correlate between pathological finding and seminal analysi to correlate between patients age and testicular size,to correlate between occupation and testicular pathology and to correlate between duration of infertility and testicular pathology.

Total of “60” patients, age between 20-65 years, have infertility diagnosed by semen analysis, all patients were examined by U/S scanning using E Cube ultrasound machine with high frequency linear transducer (7.5-10MHz).

Result: Most of the patients had Azoospeia 38.3%. 66% of them was workers, Varicocele was the most common sonographic abnormality in this study occurring in 61.7%, hydrocele 13.3%. ,(1.7%) of patients also had epididymal thickening a possible sequel to chronic epididymoorchitis, epididymal cysts 11.7% and microlithiasis 1.7%, calcification 3.3% and testicular cyst 1.7%. There is significant correlation between testicular size and seminal analysis results 15 patients out of 60 patients diagnosed as small size testis with azoospermia and correlation between work and infertility.

Conclusion: Testicular volume has a direct correlation with semen parameters. The measurement of testicular volume can be helpful for assessing fertility at the initial physical examination Also type of work with strong correlation most common pathology is varicocele.for that we recommended to do scrotal ultrasound to infertile male patients as rotine after semen analysis and hormonal profile because it reflect testicular function by measure testicular size.

الخلاصة

لقد أجريت هذه الدراسة بمستشفي الخرطوم التعليمي للأمراض الجلدية والتناسلية قسم أمراض الذكورة في الفترة من مارس إلى يوليو سنة ألفان وسبعة عشر بهدف تشخيص العقم عند الرجال باستخدام الموجات فوق الصوتية ، دراسة الأسباب الشائعة للعقم عند الرجال ،دراسة التغيرات المرضية في الخصية وإيجاد علاقة بين حجم الخصية والتغيرات في السائل المنوي ،إيجاد علاقة بين عمر المريض وحجم الخصية ،علاقة طبيعة العمل مع حجم الخصية ومدة عدم الإنجاب مع التغيرات المرضية في الخصية .

عدد المرضي الذين شاركوا في الدراسة ٦٠ مريض أعمارهم من ٢٠ إلى ٦٠ سنة تم تشخيصهم بالعقم بعد فحص السائل المنوي .كل المرضي تم الكشف عليهم بواسطة جهاز للموجات فوق الصوتية للخصيتين بمجس خطي عالي التردد(٧.٥ إلى ١٠ ميغاهيرتز)

النتائج:

٣٨.٣٪ انعدام الحيوانات المنوية في السائل المنوي ،٦٦٪ عمال ،دوالي الخصية هي الأكثر شيوعا بين الأمراض بنسبة ٦١.٦ ٪، قيلة مائية بنسبة ١٣.٣ ٪،تضخم في البربخ بنسبة ١.٧ ٪ نتيجة التهاب مزمن في البربخ والخصية ،كيس في البربخ بنسبة ٧.١١٪ ،كيس في الخصية بنسبة ١.٧٪ ،خصي صغيرة ١.٧ ٪ ،تكلس في الخصية ٣.٣ ٪ .توجد علاقة وثيقة بين حجم الخصية والتغيرات في السائل المنوي ١٥ مريض من إجمالي ٦٠ مريض تم تشخيصهم بانعدام الحيوانات المنوية وصغر حجم الخصيتان أيضاً توجد علاقة وثيقة بين طبيعة العمل والعقم .

في الختام حجم الخصية له علاقة مباشرة مع التغيرات في السائل المنوي لذلك عمل الموجات فوق الصوتية لمريض العقم أساسي كتقييم ابتدائي للحالة أيضاً طبيعة العمل لها علاقة مباشرة مع دوالي الخصية لذلك نوصي باعتماد الكشف بالموجات الصوتية لكل المرضي بالعقم كإجراء أساسي بعد تحليل السائل المنوي والهرمونات لأنه يعكس وظائف الخصيتان عن طريق قياس حجمهما.

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List of Abbreviations

ART	Assisted Reproductive Technology.
CDUS	Color Doppler Ultrasound.
CF	Cystic fibrosis.
CM	Centimeters.
CNS	Central Nervous System.
DHT	Dihydrotestosterone.
FSH	Follicle-Stimulating Hormone.
G	Gram.
GnRH	Gonadotropin-Releasing Hormone.
LH	Luteinizing Hormone.
M	Meter.
MHz	Megahertz.
Mm	Millimeter.
SFA	Semen fluid analysis.
SHBG	Sex Hormone–Binding Globulin.
TRUS	Transrectal Ultrasonography.

CHAPTER ONE

Introduction

CHAPTER ONE

2.4.Introduction

Infertility is a medical problem that affects more than 80 million people worldwide (Ochsendorf, 2006). Infertility is one of the indicators of lacking of reproductive health. It affects a vast proportion of the world's young population (10–15%) (Sakar et al, 2008). The inability to bear children seriously impacts the psychosocial and emotional lives of couples affected by this condition (Zegers et al, 2008). It is a threat to humans continued survival on earth (Cates et al. 1984). Infertility is defined as inability to conceive after one year of unprotected adequately time intercourse (Berek et al, 1996). It has two types: primary infertility, which is the term used for a couple who have never achieved a pregnancy.

Secondary infertility refers to a couple who have previously succeeded in achieving at least one pregnancy even if this ended in abortion. The prevalence and aetiology of infertility vary from place to others all over the universe; it may depend on the influence of religion and region (Jejeebhoy and Sathar, 2001).

The testes are the central organs for male fertility. Traditional evaluation of testicular function has included clinical evaluation, semen fluid analysis (SFA), vasography, scrotal ultrasonography (scrotal US) and testicular biopsy (Sabanegh and Agarwal, 2012). However, unlike vasography and testicular biopsy,scrotal US is non-invasive with no risk to either the patient or physician. Scrotal US has since become the primary imaging modality in the evaluation of testicular function (Sabanegh and Agarwal, 2012; Qublah, et al 2007).

Scrotal US is used to evaluate testicular size and location in addition to detection of subclinical varicocele, which have been reported to be associated with testicular atrophy (Kondoh, 1993). Assessment of testicular volume is also important as atypical

dimensions have been reported to be present in as many as 64% of men with infertility (Nashan, 1990).

2.5. Justification:

In sub- Saharan Africa, up to one-third of couples are infertile and of them approximately 52% suffer from acquired infertility, in contrast to Asia 23% and developed country 29% in which they have lowest percentage of infertility (Larsen, 2000; Cates et al, 1998).

In Sudan and other regions of Sub-Saharan Africa countries that lie in infertility belt, the problem would appear to most pronounce, one third of couples are primary and predominance secondary infertile. The WHO recommended that infertility need more studies to evaluate the incidence, risk factors, and prevention in all developing countries (Kasonde and John, 2012).no studies was done in sudan , more research help to formulate good guidlines to appropriate diagnosis and management.

2.6. Objectives:

2.6.1. General objectives

To diagnose infertile male patients using scrotal ultrasonography.

2.6.2. Specific objectives

- To study common causes of male infertility.
- To study sonographic appearance of normal and pathology of the scrotum.
- To correlate between pathological finding and seminal analysis.
- To correlate between patients age and testicular size.
- To correlate between occupation and testicular pathology.
- To correlate between duration of infertility and testicular pathology.

CHAPTER TWO

Literature Review

CHAPTER TWO

2.1.Literature Review

The male reproductive system is a network of external and internal organs that function to produce, support, transport, and deliver viable sperm for reproduction. Prenatally, the male sex organs are formed under the influence of testosterone secreted from the fetal testes; by puberty, the secondary sex organs further develop and become functional. Sperm is produced in the testes and is transported through the epididymis, ductus deferens, ejaculatory duct, and urethra. Concomitantly, the seminal vesicles, prostate gland, and bulbourethral gland produce seminal fluid that accompany and nourish the sperm as it is emitted from the penis during ejaculation and throughout the fertilization process (Faraj et al., 2017)

2.2.Anatomy and physiology

2.2.1.Scrotum

The scrotum is a fibromuscular pouch divided by a median septum (raphe) forming 2 compartments, each of which contains a testis, epididymis and part of the spermatic cord. Layers of the scrotum consist of skin, dartos muscle, external spermatic fascia, cremasteric fascia and internal spermatic fascia, which is in close contact with the parietal layer of the tunica vaginalis (Gray's Anatomy. 2008).

The skin and dartos layers of the scrotum are supplied by the perineal branch of the internal pudendal artery in addition to the external pudendal branches of the femoral artery. The layers deep to the dartos muscle are supplied by the cremasteric branch of the inferior epigastric artery. The veins of the scrotum accompany the arteries, eventually draining into the external pudendal vein and subsequently the greater saphenous vein. Lymphatic drainage of the skin of the scrotum is by the external pudendal vessels to the medial superficial inguinal lymph nodes (Gray's Anatomy, 2008).

The scrotum has a rich sensory nerve supply that includes the genital branch of the genitofemoral nerve (anterior and lateral scrotal surfaces), the ilioinguinal nerve (anterior scrotal surface), posterior scrotal branches of the perineal nerve (posterior scrotal surface), and the perineal branch of the posterior femoral cutaneous nerve (inferior scrotal surface) (Gray's Anatomy, 2008).

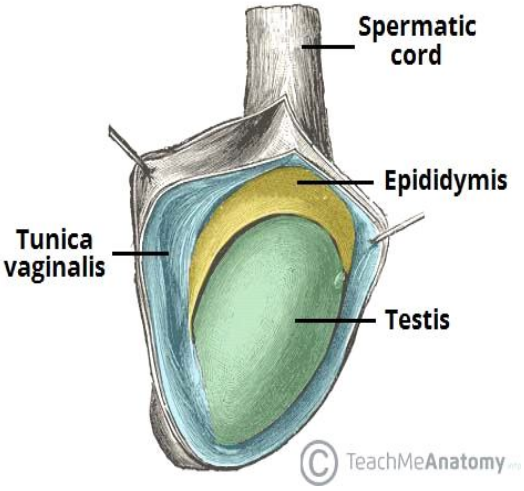

Figure 2.1: Scrotum, testis and epidermis (teach me anatomy 2017).

The scrotum acts as a "climate control system" for the testes. For normal sperm development, the testes must be at a temperature slightly cooler than body temperature. Special muscles in the wall of the scrotum allow it to contract and relax, moving the testicles closer to the body for warmth or farther away from the body to cool the temperature (Faraj et al., 2017).

2.2.2.Testes

The testes are the primary male reproductive organ and are responsible for testosterone and sperm production. Each testis is 4-5-cm long, 2-3-cm wide, weighs 10-14 g and is suspended in the scrotum by the dartos muscle and spermatic cord (Standring, 2008).

Each testis is covered by the tunica vaginalis testis, tunica albuginea, and tunica vasculosa. The tunica vaginalis testis is the lower portion of the processus vaginalis and is reflected from the testes on the inner surface of the scrotum, thus forming the visceral and parietal layers. Beneath the visceral layer of the tunica vaginalis is the tunica albuginea, which forms a dense covering for the testes. Internal to the tunica albuginea is the tunica vasculosa, containing a plexus of blood vessels and connective tissue. Bilateral testicular arteries originating from the aorta, just inferior to the renal arteries, provide arterial supply to the testes. The testicular arteries enter the scrotum in the spermatic cord via the inguinal canal and split into two branches at the posterosuperior border of the testis (Gray's Anatomy, 2008).

Additionally, the testes receive blood from the cremasteric branch of the inferior epigastric artery and the artery to the ductus deferens. The pampiniform plexus drains both the testis and epididymis before coalescing to form the testicular vein, usually above the spermatic cord formation at the deep inguinal ring. Lymphatic drainage via the testicular vessels passes into the abdomen, ending in the lateral aortic and pre-aortic nodes. The tenth and eleventh thoracic spinal nerves supply the testes via the renal and aortic autonomic plexuses (Gray's Anatomy, 2008).

The testes are divided into approximately 400 segments called lobules each of which is occupied by 2-4 seminiferous tubules, which are responsible for producing spermatozoa (Anson, 1966) Each testis has 600-1200 seminiferous tubules with a total length of 280-400-m (Ovalle and Nahirney, 2007). At the mediastinum testis, on the posterior border of the testis, the seminiferous tubules empty spermatozoa into the tubuli recti and rete testis, eventually coalescing to form 6-8 efferent ductules (Ovalle and Nahirney, 2007). The efferent ductules drain spermatozoa into the epididymisThe seminiferous tubule epithelium consists of proliferating spermatogenic cells and the sustentacular Sertoli cells. Spermatogenic cells are at various stages of spermatogenesis and Sertoli cells are columnar cells that extend from the basement membrane to the

lumen of the seminiferous tubule. Interstitial cells in the testis, including the Leydig cells, constitute 20-30% of the tissue in the gland and are found in between seminiferous tubules. The washed out cytoplasm of the Leydig cells is due a high lipid content in the form of cholesterol for synthesis of testosterone (Ovalle and Nahirney, 2007). The interstitium also contains, fibroblasts, lymphatics, blood vessels, and macrophages. Histologically, Leydig cells are polygonal with eosinophilic cytoplasm. Seminiferous tubules are made up of Sertoli cells and germ cells and are surrounded by peritubular and myoid cells (Ovalle and Nahirney, 2007).

Sertoli cells are columnar, with irregular basal nuclei that have prominent nucleoli and fine chromatin. They rest on the basement membrane and serve mainly to support, nourish, and protect the developing germ cells and to provide a blood-testis barrier to provide a microenvironment that facilitates spermatogenesis and maintains the germ cells in an immunologically privileged location. Sertoli cells also secrete inhibin, which provides negative feedback on the hypothalamus, and androgen-binding protein, which helps modulate androgen activity in the seminiferous tubules. In addition to FSH, Sertoli cell function is modulated by intratesticular testosterone and signals from peritubular myoid cells (Ovalle and Nahirney, 2007).

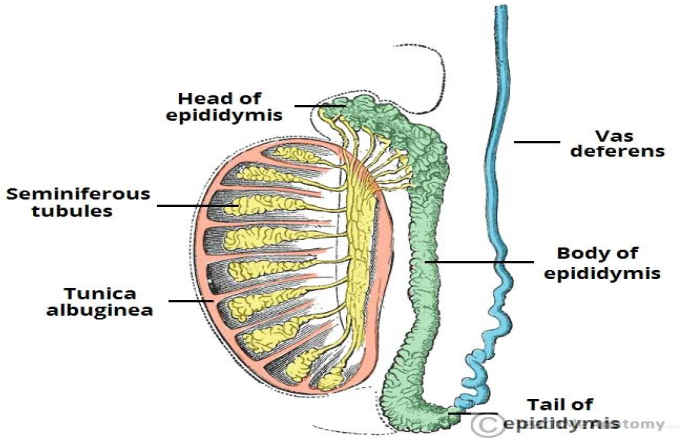

Figure 2.2: Structure of the testis (Teach me anatomy, 2017).

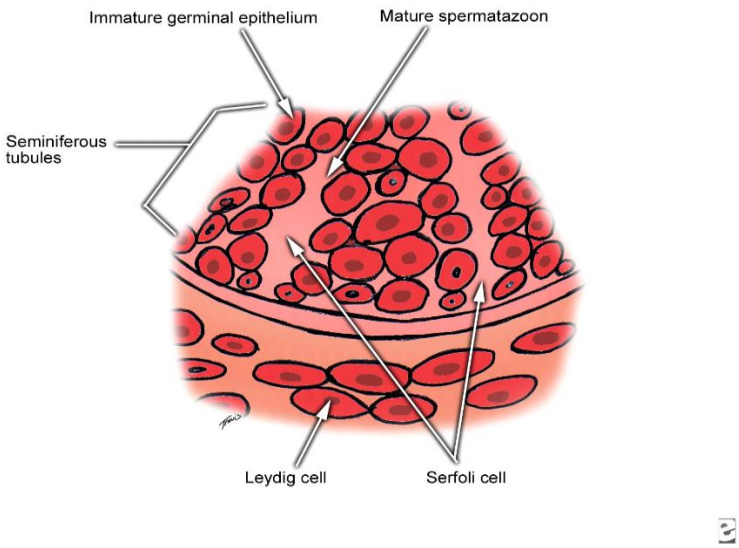

Figure 2.3: Testicular histology (Faraj et al., 2017).

2.2.3.Epididymis

The epididymis is a C-shaped structure lying intimately along the posterior border of each testis and includes an enlarged head, a body and a tail. The tunica vaginalis covers the epididymis except at the posterior border. Vasculature and innervation of the epididymis is the same as for the teste (Gray's Anatomy, 2008).

The main component of the epididymis is tightly packed tortous ducts approximately 6 m long, and 400m in diameter (Netter's Eseential Histologym 2007). The head consist of the most Dense pack coils of efferent ductules,which are lined with ciliated columnar epithelium.

For transport of spermatozoa through the epididymis ,it transport and store sperm cells that are produced in the testes. It also is the job of the epididymis to bring the sperm to maturity. Since the sperm that emerge from the testes are immature and incapable of fertilization. During sexual arousal, contractions force the sperm into the vas deferens (Faraj et al., 2017).

2.2.4.Ductus (vas) deferens

The ductus (vas) deferens is the continuation of the epididymis; it is 30-45-cm long and conveys sperm to the ejaculatory ducts (Standring., 2008; Anson., 1966). The convoluted portion of the ductus deferens becomes straighter (diameter, 2-3-mm) as it travels posterior to the testis and medial to the epididymis. Subsequently, the ductus ascends on the posterior aspect of the spermatic cord until it reaches the deep inguinal ring, where it participates in the formation of the spermatic cord and loops over the inferior epigastric artery. At this point, the ductus travels along the lateral pelvic wall, medial to the distal ureter, along the posterior wall of the bladder unti it reaches the seminal vesicles dorsal to the prostate. Each ductus deferens has an artery usually derived from the superior vesical artery (artery to the ductus), with venous drainage to the pelvic venous plexus. Lymphatic drainage of the ductus deferens is to the external and internal iliac nodes and innervation is mainly sympathetic from the pelvic plexus. The ductus deferens is composed of pseudostratified columnar epithelium including columnar cells and basal cells. The underlying lamina propria is dense with elastic fibers and the wall of the ductus contains three thick smooth muscle layers. The outermost layer of adventitia is rich in blood vessels and nerves. The vas deferens transports mature sperm to the urethra, the tube that carries urine or sperm to outside of the body, in preparation for ejaculation (Faraj et al., 2017).

2.2.5.Spermatic cord

The spermatic cord extends from the deep inguinal ring, through the inguinal canal to the testis. The layers of the spermatic cord include (from outward to inward): external spermatic fascia (derived from the deep fascia of the external abdominal oblique muscle), cremasteric fascia (derived from the internal oblique muscle), and internal spermatic fascia (derived from the transversalis fascia). The structures that form the spermatic cord include: (i) the ductus deferens and associated vasculature and nerves (posterior wall of the cord), (ii) the testicular artery, (iii) the pampiniform plexus,

ultimately forming the testicular vein, and (iv) the genital branch of the genitofemoral nerve (Gray's Anatomy, 2008).

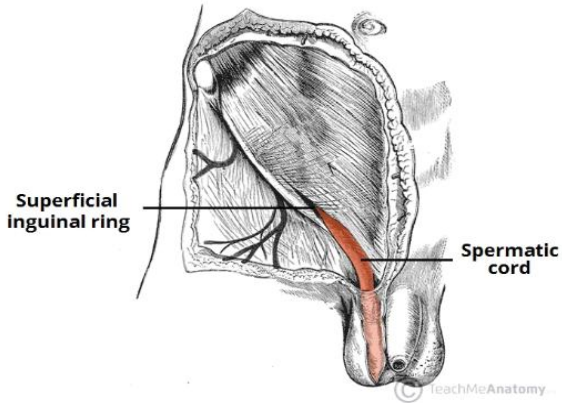

Figure 2.4: Anatomical course of the spermatic cord (Teach me anatomy, 2017).

2.2.6.Ejaculatory ducts

The ejaculatory ducts are 2-cm in length and derived from the union of the seminal vesicle and the ampulla of the vas deferens. Each duct starts at the base of the prostate and terminates at the seminal colliculus (verumontanum). The vasculature, innervation, and lymphatics of the ejaculatory ducts are the same as for the ductus deferens (Gray's Anatomy, 2008).

2.2.7.Seminal vesicles

The two seminal vesicles are located between the bladder and the rectum and measure approximately 5 cm in length. The anterior surface is in contact with the posterior wall of the bladder and the posterior surface is in contact with rectovesical (Denonvilliers) fascia. The ampulla of the ductus deferens lies medial to the seminal vesicles and the prostatic venous plexus lies laterally. Arterial blood supply to the seminal vesicles includes branches from the inferior vesical and middle rectal arteries, while venous and lymphatic drainage accompanies these arteries. The inferior division of the hypogastric plexus provides innervation to the seminal vesicle. The seminal vesicles are tubulosaccular glands consisting of connective tissue and secretory epithelium projecting into the lumen of the gland (Ovalle and Nahirney, 2007). The

epithelium is pseudostratified with basal and columnar cells, while the wall of the vesicle is consistent with a thick wall of smooth muscle during ejaculation. The seminal vesicles produce a sugar-rich fluid (fructose) that provides sperm with a source of energy to help them move. The fluid of the seminal vesicles makes up most of the volume of a man's ejaculatory fluid (Faraj et al., 2017).

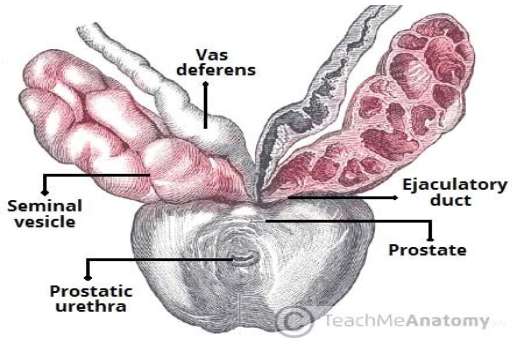

Figure 2.5. Position of seminal vesicles (Teach me anatomy, 201

2.2.8.Bulbourethral gland

The bilateral bulbourethal gland is 2 cm in diameter and lies to the membranes urethra and is enclosed by the external urethral sphincter. The execratory duct of the gland penetrates the perineal membranes and opens within the bulbar urethra vasculature lymphatic drainage and innervations are generally the same as for the seminal vesicles. These glands produced a clear slippery fluid that empties directly into the urethra. This fluid serves to lubricate the urethra and to neutralize any acidity that may be present due to residual of urine in the urethra (Faraj et al., 2017).

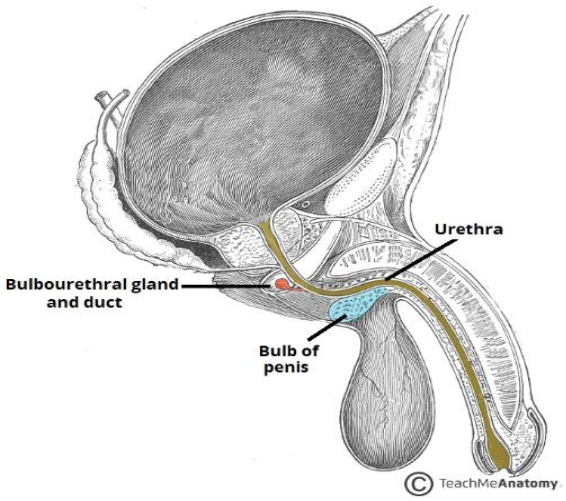

Figure 2.6. Bulbourethral gland (Teach me anatomy, 2017)

2.2.9.Prostate

The prostate gland is an avoid structure encompassing the portion of the urethra and is approximately 2.5-3.0 cm by normally weighting 20-25g. (Anson, 1966) The base of the prostate is in contact with the bladder. The apex is superior to the perineal membranes; the anterior is in contact with the vesicoprostatic plexus the posterior border is separated from the anterior surface of the rectum by the recto (Denonvilliers) fascia and the lateral border is in contact with the levator ani and the prostatic venous plexus. Fibers of the external urethral sphincter surround the prostate. The arterial supply to the prostate gland is derived from the inferior vesical artery and branches of the middle rectal artery. Venous drainage of the prostate forms the prostatic plexus, which eventually drains into the internal iliac vein and lymphatic drainage flows to the internal iliac nodes . Innervation is derived from the inferior portion of the hypogastric plexus ,primarily to the connective tissue surrounding the gland.

The prostate is traditionally divided into three concentric zones: (i) peripheral ,(ii) central and (iii) transitional. The peripheral zone constitutes 70% of the prostate and

contains the tubuloalveola gland, the central zone constitutes 25% transitional zone constitutes 5% of the prostate (Ovalle and Nahirney, 2007).

The tubuloalveolar glands are embedded in a fibrous stroma and open through branching ducts in the prostatic urethra. The secretory nature of the epithelium is evident as it consists of pseudostratified epithelium containing basal and secretory cells. The prostate gland contributes additional fluid to the ejaculateProstate fluids also help to nourish the sperm (Faraj et al., 2017).

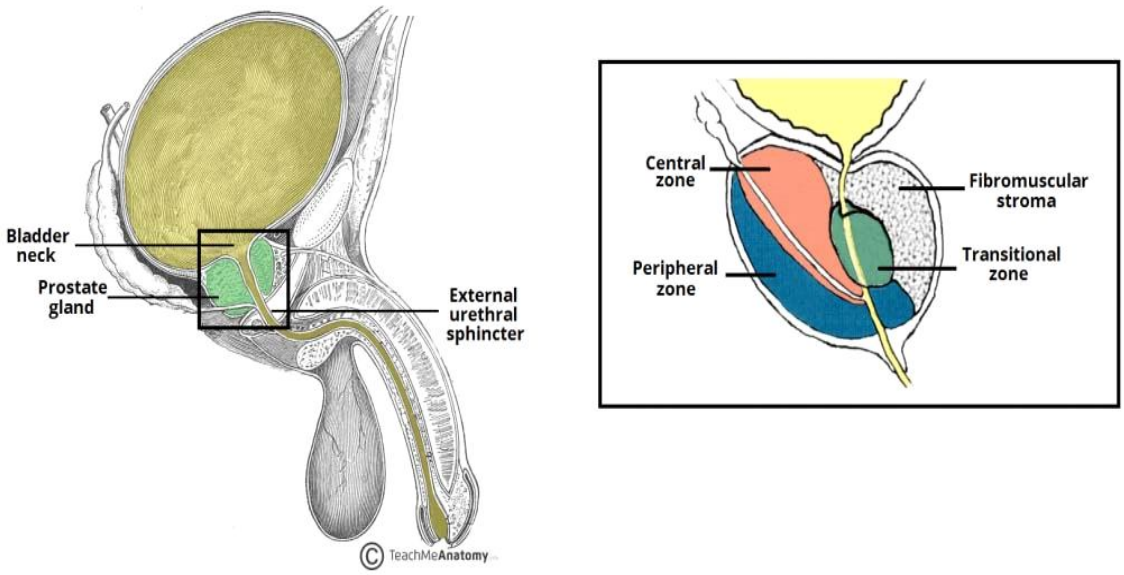

Figure 2.7: The anatomical position and zones of the prostate (Teach me anatomy, 2017).

2.2.10.Urethra

The urethra stretches from the bladder to the tip of the glans penis serving as a passage for urine and semen ,the prostatic urethra extends vertically from the bladder neck ,through the prostate before becoming the membranous urethra and before penetrating the perineal membrane ,the prostatic urethra contains the orifice of the ejaculatory duct as the membranous urethra enter the deep perineal space, the urethra is surrounded by fiber of the external urethral sphincter, eventually entering the bulb of the

corpus spongiosum, providing the orifice for the bulbourethral glands and becoming the penile urethra. When the urethra reaches the glans penis the diameter diminishes to that of the external ostium, the least dilatable portion of the urethral canal (Anson, 1966).

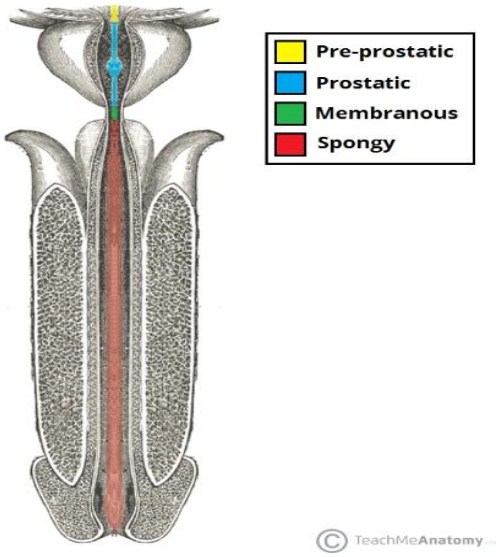

Figure 2.8: Coronal section of the penis, showing the four parts of the urethra (Teach me anatomy, 2017)

2.2.11.Penis

The penis is made up of an attached root and a pendulous body. The root consists of two crura and the bulb—3 bodies of erectile tissue attached to the pubic arch (crura) and perineal membrane (bulb).

Near the border of the pubic sypmphysis the bilateral crura continue as the corpora cavernosa throughout the body of the penis. The bulb lies between the two crura, narrows anteriorly and continues as the corpus spongiosum. The body of the penis contains the bilateral corpora cavernosa and the median corpus spongiosum. During penile erection, all three erectile bodies become engorged with blood. The corpora cavernosa are enveloped in a thick fibrous tunica albuginea, which is comprised of a

longitudinal running superficial fibers and a deep layer of circular oriented fibers. The corpus spongiosum is penetrated by the urethra as it traverses the body of the penis

The superficial penile fascia includes loose connective tissue intertwined with dartos muscle fibers. The deep penile fascia, or Buck's fascia, is a tough fascial layer that encompasses both corpora cavernosa and the corporus spongiosum. The skin of the penis is thin. The corona of the penis is where the skin folds to become the prepuce (foreskin), enveloping the glans penis. The vasculature of the penis is extensive. The perineal artery the posterior scrotal artery and the inferior rectal artery supply tissues from the bulb of the penis to the anus. The deep artery of the penis is one of two terminal branches of the internal pudendal artery other terminal branch of the internal pudendal artery is the dorsal artery of the penis. The erectile bodies of the penis are composed of fibroelastic connective tissue, smooth muscle and a network of vascular sinuses lined with endothelium (Ovalle and Nahirney, 2007). The sinuses are continuous with the arteries that supply them and the veins that drain them.

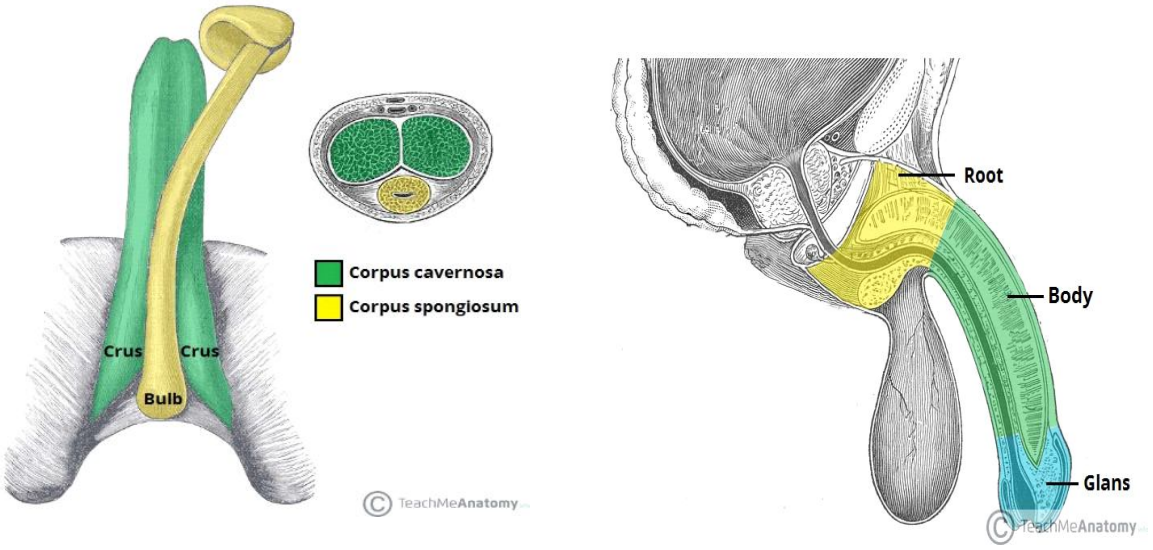

Figure 2.9: Parts of penis and erectile tissue of the penis (Teach me anatomy, 2017).

2.3.Sonographic Appearance

2.3.1.Technique

A high-frequency transducer (9-15 MHz) is usually used for evaluation of testicles and scrotum, except in certain circumstances (e.g. massive hydrocele), when a lower MHz transducer is used. patient is supine, patient upright for when looking for an inguinal hernia scrotum is supported on a towel laid over the thighs testicles should be evaluated in both long and short axes if a scrotal mass is found, one of the primary roles of ultrasound is to determine if it intratesticular or extratesticular colour and spectral Doppler parameters should be set for low flow power Doppler may be necessary to prove testicular torsion both a short axis grayscale and a colour Doppler Figure should be obtained which Figure both testicles at the same time ("buddy shot" or "sunglasses view"), to compare relative echogenicity and blood flow scrotum should be examined for extratesticular masses or proces (Radiopaedia, 2017).

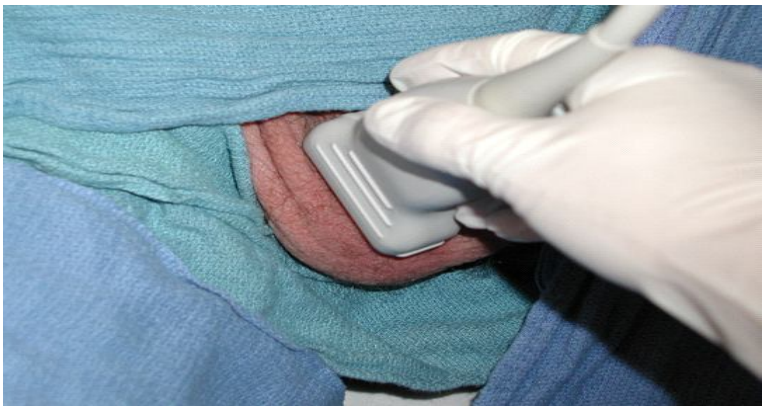

Figure 2.10: A properly exposed and draped patient with the scrotum supported in a sling of towels (Courtesy of Michael Blaivas).

2.3.2.Testis

Homogeneous echogenicity a prepubertal testis has a slightly decreased echogenicity relative to an adult mildly coarse echotexture adult diameter measures

between 3-5 cm, with a volume of ~20 ml the tunica (vaginalis/albuginea) appears as an echogenic outline of the testicle: the tunica invaginates to form the linear echogenic testicular mediastinum the rete testis can be identified in ~20% of patients hypoechoic region near the mediastinum more noticeable if dilated. Appendix testis: attached to upper pole of testicle, near the epididymis not usually seen unless torted spectral Doppler: the testis demonstrates a low-resistance arterial waveform (Radiopaedia 2017).

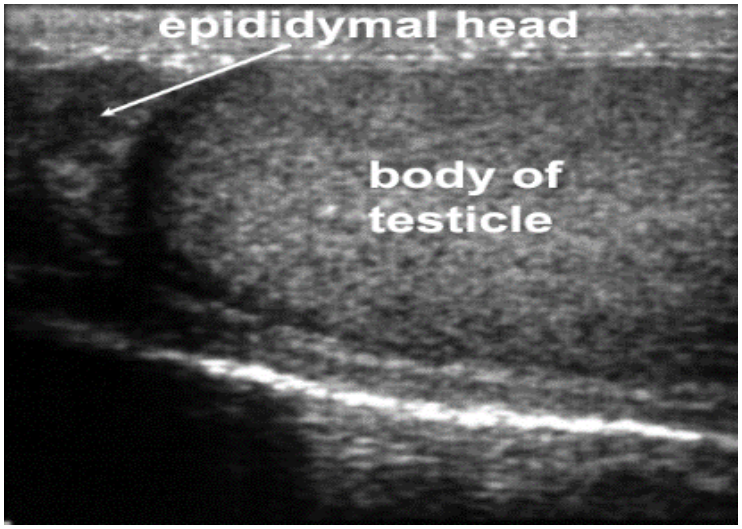

Figure 2.11: The normal testicle with the epididymal head on the left and body of testicle on the right (Courtesy of Michael Blaivas).2004

2.3.3.Epididymis

Epididymal head: round or long structure located near the superior pole of the testicle isoechoic or mildly hyperechoic relative to the testicle measures 5-12 mm epididymal body: extends down the posterior aspect of the testicle measures 2-4 mm. epididymal tail: curved structure at the inferior pole of the testicle and becomes the proximal ductus deferens measures 2-5 mm. Appendix epididymis: attached at the epididymal head not normally seen unless torsade (Radiopaedia, 2017). Spectral Doppler: epididymis demonstrates a low-resistance arterial waveform (Radiopaedia, 2017)

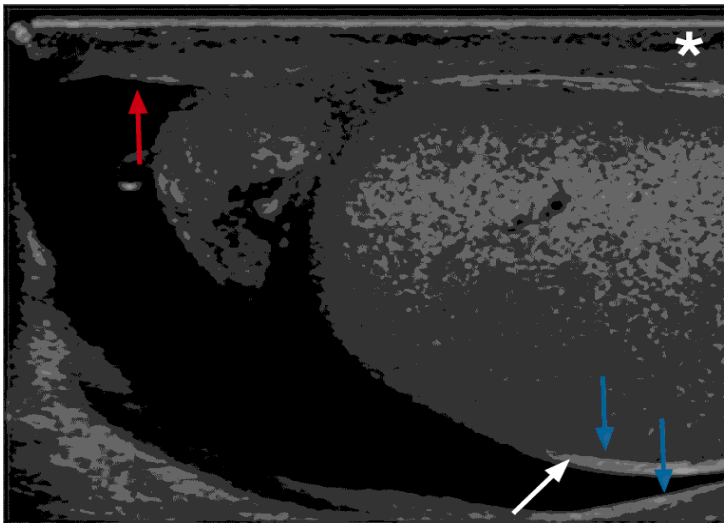

Figure 2.12: Scrotum. Normal scrotal skin thickness varies between 2-8 mm (radiopaedia2017). Sonogram of the testicle effectively demonstrates the tunica albuginea which envelopes the testicle (red arrow). The testicle with its tunica albuginea is covered by the visceral layer of the tunica vaginalis (white arrow). The inner aspect of the scrotal wall (asterisk) is covered by the parietal layer of the tunica vaginalis (blue arrows). Normally both layers of the tunica vaginalis are only separated by a small amount of fluid; however, in this case there is a moderate amount of fluid separating the two layers that allows a good demonstration of the anatomy (ultrasonoghraphy.org).

2.4.Infertility:

Infertility is defined as the inability to achieve pregnancy after one year of unprotected intercourse. (Berek et al., 1996) An estimated 15% of couples meet this criterion and are considered infertile, with approximately 35% due to female factors alone, 30% due to male factors alone, 20% due to a combination of female and male factors, and 15% unexplained. Conditions of the male that affect fertility are still generally underdiagnosed and undertreated. Causes of infertility in men can be categorized as obstructive or nonobstructive. Infertile men may have deficiencies in sperm formation, concentration or transportation (Faraj et al., 2017).

2.4.1.Pathophysiology:

Gonadal and sexual functions are mediated by the hypothalamic-pituitary-gonadal axis, The hypothalamus, the primary integration center, responds to various signals from the central nervous system (CNS), pituitary gland, and testicles to secrete gonadotropin-releasing hormone (GnRH) travels down the portal system to the anterior pituitary, to stimulate the release of the gonadotropins, luteinizing hormone (LH), and follicle-stimulating hormone (FSH).

FSH and LH are released into the systemic circulation and exert their effect by binding to plasma membrane receptors of the target cells. LH mainly functions to stimulate testosterone secretion from the Leydig cells of the testicle, while FSH stimulates Sertoli cells to facilitate germ cell differentiation.

Testosterone is secreted in a diurnal pattern, peaking a few hours after the man awakens from sleep. In the body, testosterone circulates 2% in the free form, 44% bound to sex hormone–binding globulin (SHBG), and 54% bound to albumin. Testosterone is converted to dihydrotestosterone (DHT) by the action of 5-alpha reductase, both locally and in the periphery, and to estrogen in the periphery. Testosterone and estradiol function as feedback inhibitors of gonadotropin release (Faraj et al., 2017).

2.4.2.Spermatogenesis

Germ cells are derived from the gonadal ridge and migrate to the testicle before testicular descent. In response to FSH stimulation at puberty, germ cells become spermatogonia and undergo an ordered maturation to become spermatozoa. The entire process of development from spermatogonium to spermatid takes 74 days and is described in 14 steps; as they mature the developing spermatids progress closer to the lumen of the seminiferous tubule. Spermatogonia rest on the basement membrane, stem cells differentiate into daughter cells every 16 days. Which mature into B spermatogonia, which then undergo mitotic division to become primary spermatocytes,

Primary spermatocytes undergo meiosis to become secondary spermatocytes. During this time, the cells cross from the basal to the adluminal compartments. The secondary spermatocytes undergo a second meiosis and become spermatids. This reduction division (i.e, meiosis) results in a haploid chromosome number. Therefore, a total of 4 spermatids are made from each spermatnnucleus (Faraj et al., 2017).

The spermatids undergo the process of spermiogenesis which involves the casting of excess cytoplasm away as a residual body, the formation of the acrosome and flagella, and the migration of cytoplasmic organelles to their final cellular location. The acrosome, surrounds the nucleus anteriorly and contains enzymes necessary to penetrate the ovum. The mature spermatid is then located adjacent to the tubule lumen, after their release from the Sertoli cells into the lumen of the seminiferous tubules, the spermatids successively pass through the tubuli recti, rete testis, ductuli efferentes, and, finally, the epididymis. As sperm move from the head to the tail, they mature and acquire fertilization capacity.

For conception, sperm must reach the cervix, penetrate the cervical mucus, migrate up the uterus to the fallopian tube, undergo capacitation and the acrosome reaction to digest the zona pellucida of the oocyte, attach to the inner membrane, and release its genetic contents within the egg (Faraj et al., 2017).

2.4.3. Prevalence

In American men, the risk correlates to approximately 1 in 25. Low sperm counts, poor semen quality, or both account for 90% of cases; however, studies of infertile couples without treatment reveal that 23% of these couples conceive within 2 years, and 10% more conceive within 4 years. Even patients with severe oligospermia (<2 million sperm/mL) have a 7.6% chance of conception within 2 years (Matorras et al., 1996).

International Patterns of male infertility vary greatly among regions and even within regions. The highest reported fertility rates are in Finland, while Great Britain

has a low fertility rate. A combination of social habits, environmental conditions, and genetics is suspected to contribute to this.

2.4.4. Mortality/Morbidity

Many patients who present with infertility as their primary symptom have a serious underlying medical disease, such as pituitary adenomas, hormonally active tumors, testicular cancer, liver and renal failure, and cystic fibrosis (CF). Evaluating patients for life-threatening or life-altering conditions during the workup is important (Faraj et al., 2017).

2.4.5.Causes:

2.4.5.1.Pretesticular causes of infertility

Pretesticular causes of infertility include congenital or acquired diseases of the hypothalamus, pituitary, or peripheral organs that alter the hypothalamic-pituitary axis.

Disorders of the hypothalamus lead to hypogonadotropic hypogonadism. If GnRH is not secreted, the pituitary does not release LH and FSH, Idiopathic hypogonadotropic hypogonadism syndrome (Bouloux et al., 2002), Prader-Willi syndrome and Laurence-Moon-Biedl syndrome

2.4.5.2.Other conditions

Various other lesions and diseases, such as CNS tumors, temporal lobe seizures, and many drugs (eg, dopamine antagonists) may interrupt the hypothalamic-pituitary axis at the hypothalamus.Both pituitary insufficiency and pituitary excess cause infertility. Pituitary failure may be congenital or acquired.Acquired causes include tumor, infarction, radiation, infection, or granulomatous disease. Nonfunctional pituitary tumors may compress the pituitary stalk or the gonadotropic cells, interrupting the proper chain of signals leading to pituitary failure. In contrast, functional pituitary tumors may lead to unregulated gonadotropin release or prolactin excess, interrupting the proper signaling. Prolactinoma, Isolated LH deficiency, Isolated FSH deficiency, Thalassemia and Cushing disease (Faraj et al., 2017).

2.4.5.3.Peripheral organ

The hypothalamus-pituitary axis may be interrupted by hormonally active peripheral tumors or other exogenous factors, due to cortical excess, cortical deficiency, or estrogen excess (Faraj et al., 2017).

2.4.5.4.Primary testicular causes of infertility

Primary testicular problems may be chromosomal or non-chromosomal in nature. While chromosomal failure is usually caused by abnormalities of the sex chromosomes, autosomal disorders are also observed (Faraj et al., 2017).

2.4.5.5.Chromosomal abnormalities

An estimated 6-13% of infertile men have chromosomal abnormalities (compared with 0.6% of the general population). Patients with azoospermia or severe oligospermia are more likely to have a chromosomal abnormality (10-15%) than infertile men with sperm density within the reference range (1%).(Rucker GB, et al. 1998), include, Klinefelter syndrome, XYY male, XX male (sex reversal syndrome), Noonan syndrome (46, XY) ,Mixed gonadal dysgenesis (45, X/46, XY) ,Androgen receptor dysfunction.(Aiman et al., 1979; Davis-Dao et al., 2007), Bilateral anorchia (vanishing testes syndrome,Y chromosome microdeletion syndrome (Vicdan et al., 2004) Down syndrome, Myotonic dystrophy and Nonchromosomal testicular failure.

Varicocele

A varicocele is a dilation of the veins of the pampiniform plexus of the scrotum. Although varicoceles are present in 15% of the male population, a varicocele is considered the most common correctable cause of infertility (30-35%) and the most common cause of secondary (acquired) infertility (75-85%). Varicoceles are observed more commonly on the left side than the right. Those with isolated right-sided varicoceles should be evaluated for retroperitoneal pathology.

Varicoceles are generally asymptomatic, and most men with varicoceles do not have infertility or testicular atrophy. However, varicoceles may lead to impaired

testicular spermatogenesis and steroidogenesis, potentially due to an increased intratesticular temperature, reflux of toxic metabolites, and/or germ cell hypoxia as potential causes of these changes, and this appears to be progressive over time.

Varicoceles lead to an increased incidence of sperm immaturity, apoptosis, and necrosis with severe disturbances in meiotic segregation compared to fertile men without varicoceles, and these parameters generally improve after repair.

Patients with a grade 1-3 varicocele (visible or palpable) associated with infertility should consider having the varicocele repaired. After repair, 40-70% of patients have improved semen parameters, while 40% are able to impregnate their partner without other interventions. In those with azoospermia and a varicocele, sperm may appear after repair in up to one third, but most of these men return to an azoospermic state within a few months. If sperm appears, these men should be offered cryopreservation (Faraj et al., 2017).

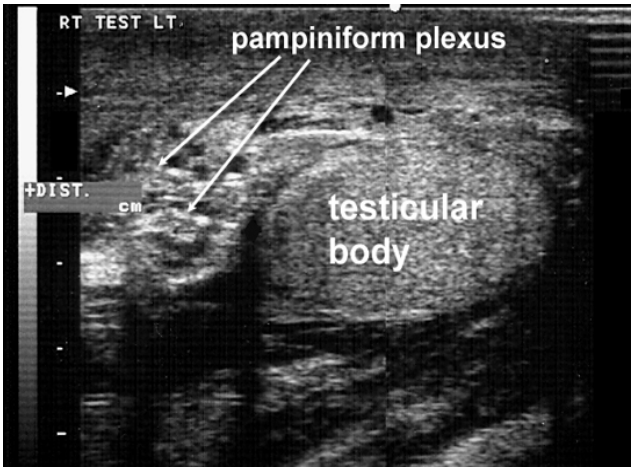

Figure 2.13: Longitudinal view of testicle with enlarged pampiniform plexus. Also note the thickening of the surrounding connective tissue secondary to scrotal inflammation after a failed penile implant (Courtesy of Beatrice Hoffmann, M.D.2004.)

Cryptorchidism

An estimated 3% of full-term males are born with an un-descended testicle, but less than 1% remain un-descended by age 1 year. Un-descended testicle may be isolated or may be observed as part of a syndrome such as prune belly syndrome. Patients are at increased risk of infertility, even if the testicle is brought down into the scrotum, as the testicle itself may be abnormal. The farther from the scrotum, and the longer duration that the testicle resides outside the scrotum, the greater the likelihood of infertility. Testicular histology typically reveals a decreased number of Leydig cells and decreased spermatogenesis. Cryptorchidism may be due to inherent defects in both testes because even men with unilateral cryptorchidism have lower than expected sperm counts (Faraj et al., 2017).

Human-beta defensin abnormalities

Causes of testicular failure also include the following: Granulomatous disease- Leprosy and sarcoidosis may infiltrate the testicle. Sickle cell disease- Sickling of cells within the testis leads to microinfarcts, Excessive use of alcohol, cigarettes, caffeine, or marijuana (Faraj et al., 2017)

Post-testicular causes of infertility:

Post-testicular causes of infertility include problems with sperm transportation through the ductal system, either congenital or acquired. Genital duct obstruction is a potentially curable cause of infertility and is observed in 7% of infertile patients. Additionally, the sperm may be unable to cross the cervical mucus or may have ultrastructural abnormalities. Congenital blockage of the ductal system, Cystic fibrosis. (Smith HC. 2010), Acquired blockage of the ductal system (Zahalsky MP, et al 2004), Antisperm antibodies, Defects in cilia, Ejaculatory duct obstruction (Purohit et al., 2004). Ejaculation issues, Anejaculation/retrograde ejaculation may be due to an open bladder neck or a lack of rhythmic contractions during ejaculation. (Faraj et al., 2017).

Trauma

Testicular trauma is the second most common acquired cause of infertility. The testes are at risk for both thermal and physical trauma because of their exposed positionm (Faraj et al., 2017).

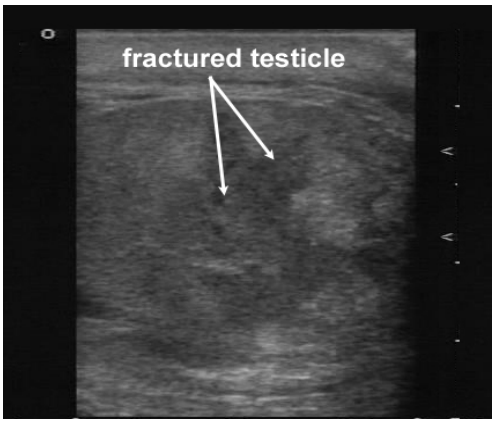

Figure 2.14: Testicular Fracture. Note the inhomgenicity of the testicular echotexture and fracture line. (Courtesy of Michael Blaivas, M.D.2004)

Sertoli-cell-only syndrome (germinal cell aplasia)

Patients with germinal cell aplasia have LH and testosterone levels within the reference range but have an increased FSH level. The etiology is unknown but is probably multifactorial. Patients have with small- to normal-sized testes and azoospermia, but normal secondary sex characteristics. Histology reveals seminiferous tubules lined by Sertoli cells and a normal interstitium, although no germ cells are present (Faraj et al., 2017).

Chemotherapy and Radiation therapy

Chemotherapy is toxic to actively dividing cells. In the testicle, germ cells (especially up to the preleptotene stage) are especially at risk. The agents most often associated with infertility are the alkylating agents such as yclophosphamide. For

example, treatment for Hodgkin disease has been estimated to lead to infertility in as many as 80-100% of patients (Faraj et al., 2017).

Orchitis

The most common cause of acquired testicular failure in adults is viral orchitis, such as that caused by the mumps virus, echovirus, or group B arbovirus. Of adults with who are infected with mumps, 25% develop orchitis; two thirds of cases are unilateral, and one third are bilateral. While orchitis develops a few days after the onset of parotid gland inflammation, it may also precede it. The virus may either directly damage the seminiferous tubules or indirectly cause ischemic damage as the intense swelling leads to compression against the tough tunica albuginea. After recovery, the testicle may return to normal or may atrophy. Atrophy is observed within 1-6 months, and the degree of atrophy does not correlate with the severity of orchitis or infertility. Normal fertility is observed in three fourths of patients with unilateral mumps orchitis and in one third of patients in bilateral orchitis (Faraj et al., 2017).

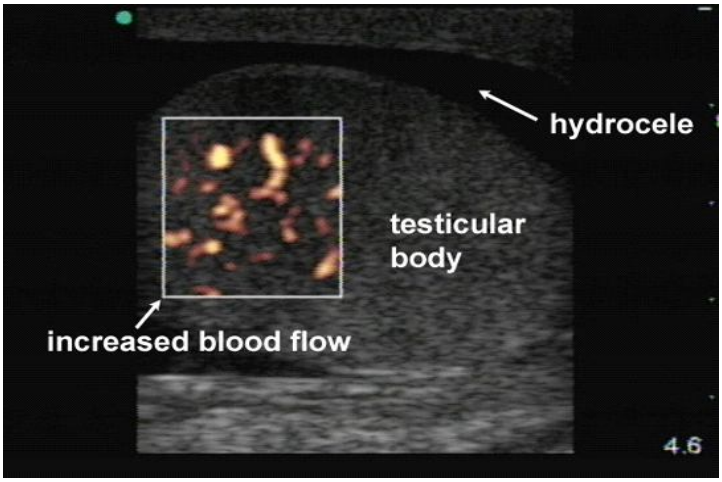

Figure 2.15: Orchitis. Marked increase in blood flow is seen along with a reactive hydrocele. (Courtesy of Michael Blaivas

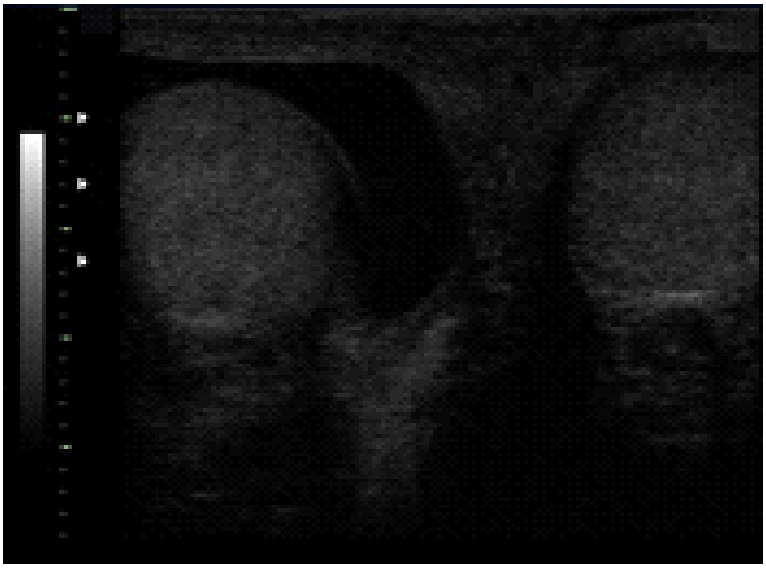

Figure 2.16: Right and left testicles with hydrocele (Courtesy of Michael Blaivas 2004.)

Diagnosis of infertility

Imaging Studies and Scrotal ultrasonography

Scrotal ultrasonography is used to evaluate the anatomy of the testis, epididymis, and spermatic cord. It is a useful adjunct for evaluating testicular volume, testicular and paratesticular masses, and the presence or absence of varicoceles.Color-flow ultrasonography is used to evaluate for varicocele using a 7- to 10-MHz probe. A varicocele is diagnosed on a sonogram if a spermatic vein is greater than 3 mm or vein size increases with Valsalva (Faraj et al., 2017).

Transrectal ultrasonography

TRUS is indicated in patients with azoospermia or severe oligospermia to evaluate for complete or partial ejaculatory duct obstruction. TRUS is also useful to evaluate for the presence or absence of the seminal vesicles. A 6.5- to 7.5-MHz probe is used with the bladder partially filled. Obstruction is suggested by enlarged seminal vesicles (>1.5 cm width) (Faraj et al., 2017).

Vasography

Is used to evaluate the patency of the ductal system.

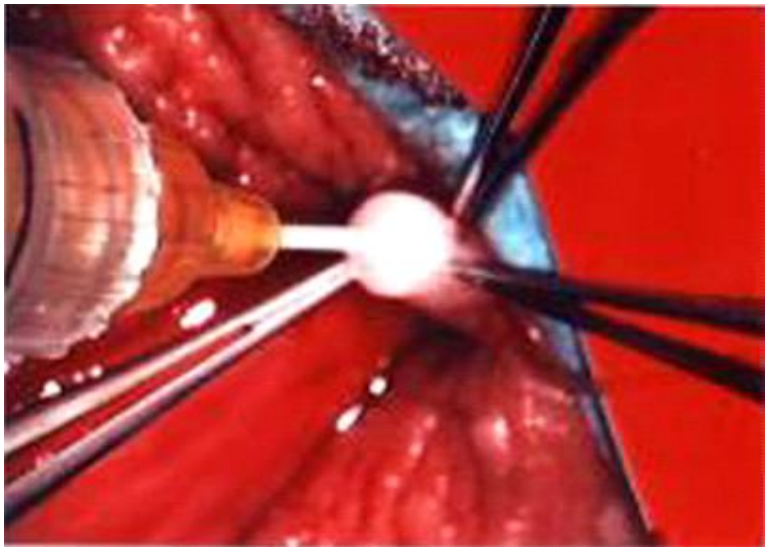

Figure 2.17. Technique of open vasoghraphy (Faraj et al., 2017).

Laboratory Studies include:

- Semen analysis.
- Antis-perm antibody test.
- Hormonal analysis.testosterone levels typically range between 250ng/dl and 850 ng/dl.(menshormonalhealth 2016). FSH level ,Age 0-7 years: <6.7 mIU/mL
- Age 8 years-adult: 1.3-19.3 mIU/mL.
- The reference range for luteinizing hormone (LH) is as follows:
- Prepubertal: 0.3-6.0 mIU/mL
- Adult: 1.8-12.0 mIU/L (emedicine 2016).

Pervious study

This study done by (Frank et al., 1999) Role of Imaging in the Evaluation of Male Infertility result in: The prevalence of scrotal abnormalities was 38%. Testicular tumor was found in 0.5%, varicocele in 29.7%, testicular cyst in 0.7%, testicular microlithiasis in 0.9%, epididymal cyst in 7.6% and hydrocele in 3.2% of the cases. Overall, 67% of

sonography findings were not evident on palpation, and only 1 of 7 testicular tumors was suspected. Of the varicoceles 60% were not found on physical examination. The rate of testicular tumors (1/200) was higher than that reported for the general European population (1/20,000). Concluded that routine scrotal ultrasound provides valuable information in the diagnostic evaluation of infertile men and substantially more pathological conditions are detected compared to clinical palpation. The high prevalence of testicular malignancies underlines the clinical relevance of routine scrotal ultrasonography in infertile men.

Another study done by Krishna Reddy SV (2014) Varicocele and Male Infertility: Current Issues in Management-A Review. Concluded that Varicocele is the most common correctable cause of male factor infertility. The role of varicocele in the etiology of male infertility is still controversial regarding to whom varicocelectomy should be done and the selection should be meticulous. With the recent advances in biomolecular and development of novel sperm functional tests, it has been possible to better understand the mechanism involved in damage provoked by varicocele and therefore, propose ways to reverse them. Clinical studies have shown that varicocele surgery can improve semen quality sufficient to downgrade the type of assisted reproductive technology (ART) procedure required. This reveiw discusses current concepts on the mechanisms for varicocele induced testicular damage and efficacy of varicocelectomy for treatment of infertility. We also review the current guidelines and need for proper case selection before surgery. The authors critically reviewed the cost effectiveness of the surgical treatment of a varicocele compared with assisted reproductive techniques.

A third study The value of ultrasound in diagnosis of male infertility done by Stojanović., et al 2004, he said that The number of male patients with clinical presentation of infertility, especially secondary infertility after infections, is increasing every day. Contemporary urological standards in defining male infertility include

ultrasound examination. Ultrasound examination of the scrotum using color doppler is of great importance.

Testicular atrophy, microlithiasis and varicocele are the most common causes of male infertility. Microlithiasis and classical testicular microlithiasis are not directly associated with infertility. Gray scale sonography is used in evaluation of the dilatation of the testicular veins, but color Doppler made a real contribution in revealing subclinical varicocele. Transrectal ultrasound is used in a number of pathological conditions of prostate, seminal vesicles and ducts. In cases of obstructive azoospermia it is important to find out the cause, such as focal prostatitis, cysts, ejaculatory ducts obstruction or absence of vas deferens.

Also Sonographic spectrum of scrotal abnormalities in infertile men done by Hussein., et al result in hundred thirty-four infertile men, including 176 oligospermic (sperm count < 10 × 106/ml), 58 azoospermic, and 150 normospermic men (control group) were evaluated prospectively for the presence of intra- and extratesticular abnormalities using high-frequency transducers and color Doppler imaging. Medical and surgical history, testicular volume, semen parameters, and hormonal levels were recorded.

Results. A statistically significant increase in the prevalence of abnormal scrotal findings detected with sonography was observed in the study group compared with controls. These included varicocele in 35.5% versus 16% ($p < 0.01$), hydrocele in 16.7% versus 8.7% ($p < 0.05$), testicular microlithiasis in 9.8% versus 2% ($p < 0.01$), epididymal enlargement in 9% versus 2.6% ($p < 0.05$), and epididymal cyst in 7.7% versus 2% ($p < 0.05$). Testicular tumor was not seen in either group. A statistically significant decrease in testicular volume, sperm concentration, normal morphology, and forward motility of the sperm was noted in the study group compared with controls ($p < 0.01$).

The correlation between Ultrasound Testicular Volume and Conventional Semen Parameters in Albanian Subfertile Males done by Kristo and Dani., 2014, Was conducted to evaluate the relationship between testicular volume measured by ultrasound and conventional sperm parameters (volume, concentration, total count, motility and morphology) in Albanian subfertile males and to determine a normal limit value of the testicular volume. A total of 500 males were observed for this study. The testicular volumes of all subjects were measured by ultrasonography. The semen samples were collected by the process of masturbation after 3-5 days of ejaculatory abstinence and were analyzed according to WHO criteria 2010, result in Testicular volume has a strong positive correlation with sperm count, total count and motility and a positive correlation with semen volume. CONCLUSION: Testicular volume has a direct correlation with semen parameters and the critical total testicular volume indicating normal testicular function, approximately 26.6 ml (the mean testicular volume 13.3 ml). The measurement of testicular volume can be helpful for assessing fertility at the initial physical examination.

Lastely Scrotal doppler ultrasound evaluation in Zaria, Nigeria done by Muhammad Zaria Ibrahim1., et al, a total of 115 patients were scanned. Nearly 55.6% presented on account of primary infertility. Varicocele (45), hydrocele (31), epididymo-orchitis (8), epididymal cyst (6), microlithiasis (6) and others (6) were frequent Doppler findings. Only 12 cases were normal scan. Overall sensitivity of CDUS in diagnosing varicocele and hydrocele was 100% each, respectively. Conclusion: Doppler ultrasonography is an excellent, safe and reliable method for evaluating patients with scrotal diseases. It is especially important in conditions such as varicocele and hydrocele where accurate diagnosis is required in the management of infertility.

CHAPTER THREE

Materials and Methods

CHAPTER THREE

Materials and Methods

Study design and area

This study was carried out in Al Khartoum Dermatology and Venereology Teaching Hospital during the peroid from March 2017 to July 2017. This study discusses the evaluation of infertile male patients by scrotal ultrasonography.

3.1. Materials

3.1.1. Inculosion and Exclusion criteria

A total of “60” persons were selected randomly; all those patients have age between 20-65 years, have infertility diagnosed by semen analysis and any age above than sixty five was excluded from this study.

All patients were subjected to be examined by U/S scanning using E Cube ultrasound machine with high frequency linear transducer (7.5-10MHz).

3.1.2.Ethical approval

An ethical approval for the study was obtained from the Ethics Committee, Faculty of radiological science-University of Sudan for Science and Technology. The study objectives and procedure were explained to participants, and verbally consent was obtained from each participant and the personal data will not publish.

3.1.3. Data collection

Using a special data collection sheet, sample of 60 persons were studied, the data collecting sheet was designed to cover the assessment of right and left testes ,their volume, echogenicity any pathology if found, demographic data, seminal analysis result.

3.1.4.Data analysis

Statistical analysis was carried-out using statistical package for social sciences (SPSS version 24, Chicago, IL, USA).

3.2. Methods:

All patients were subjected to be examined by U/S scanning using E Cube ultrasound machine with high frequency linear transducer (7.5-10MHz).

3.2.1.Scrotal ultrasonography

Scrotal ultrasonography is used to evaluate the anatomy of the testis, epididymis, and spermatic cord. It is a useful adjunct for evaluating testicular volume, testicular and paratesticular masses, and the presence or absence of varicoceles. Color-flow ultrasonography is used to evaluate for varicocele using a 7- 10-MHz probe. A varicocele is diagnosed on a sonogram if a spermatic vein is greater than 3 mm or vein size increases with Valsalva.

The patient lies supine. The scrotum is supported on a towel laid over the thighs Penis covered with towel and directed toward abdomen testicles should be evaluated in both long and short axes and volume was calculated.

Figure 3.1. Ultrasound machine in the hospital.

CHAPTER FOUR

Results

CHAPTER FOUR

4.1. Results

Table 1: Distribution of sample according to age.

Age Group	Frequency	Percent
25-35	30	50.0%
36-45	19	31.7%
46-55	8	13.3%
56-65	3	5.0%
Mean±SD	37.7±8.96	
Total	**60**	**100.0%**

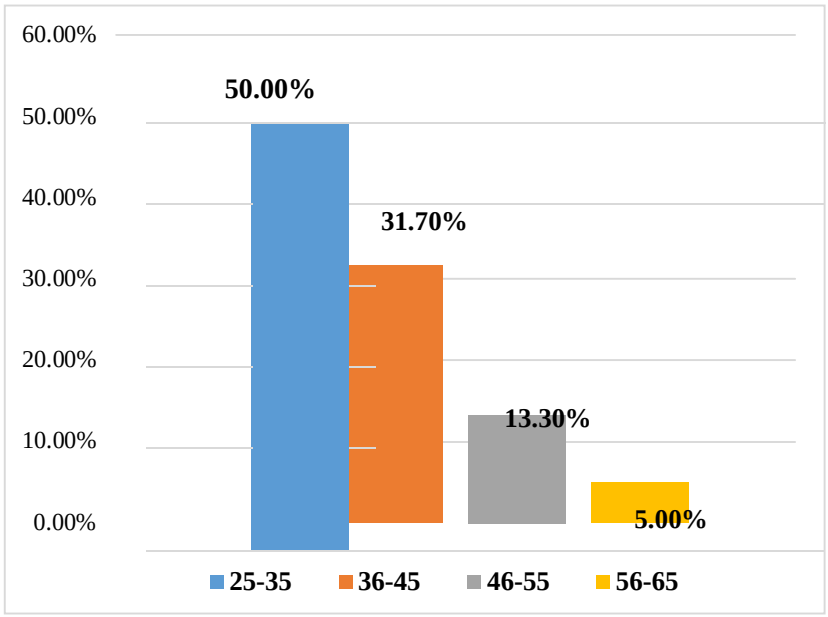

Figure 4.1: Distribution of sample according to age.

Table 4.2: Distribution of sample according to occupation.

Occupation	Frequency	Percent
Worker	40	66.7%
Police Man	5	8.3%
Farmer	6	10.0%
Teacher	7	11.7%
Driver	2	3.3%
Total	60	100.0%

Table 4.3: Distribution of sample according to duration of marriage.

Duration of Marriage	**Frequency**	**Percent**
1-5	29	48.3%
6-10	17	28.3%
11-15	12	20.0%
16-20	2	3.3%
Mean±SD	6.53±5.97	
Total	**60**	**100.0%**

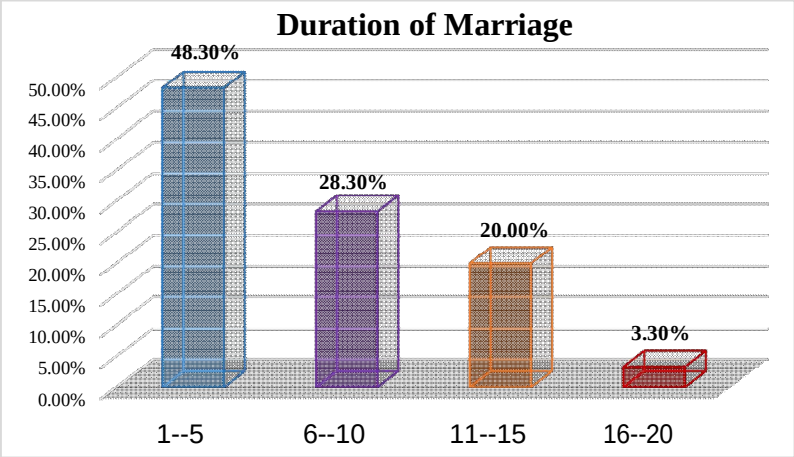

Figure 4.2: Distribution of sample according to duration of marriage.

Table 4.4: Distribution of sample according to seminal analysis results.

Seminal Analysis	Frequency	Percent
Azoospermia	23	38.3%
Oligoasthenozoospermia	21	35.0%
Asthenotratozoospermia	15	25.0%
Leukocytosis	1	1.7%
Total	**60**	**100.0%**

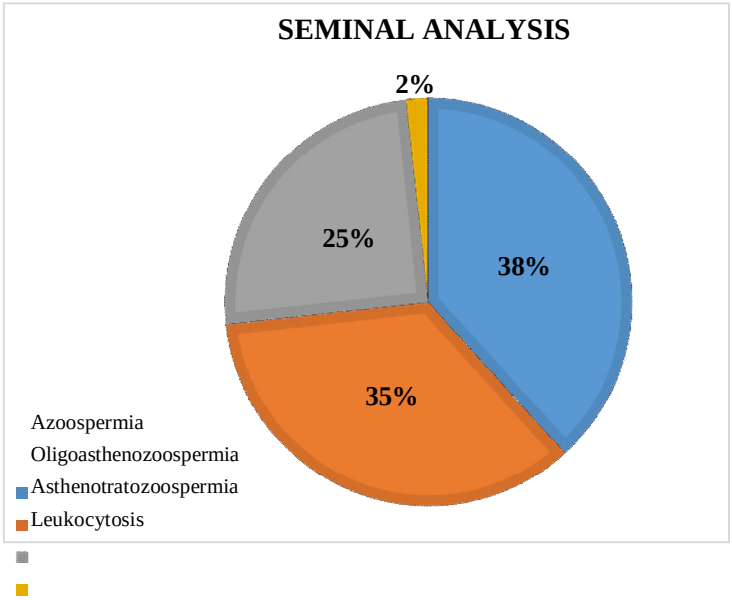

Figure 4.3: Distribution of sample according to seminal analysis results.

Table 4.5: Distribution of sample according to testes volume.

Testes Volume	Right Teste Volume				Left Teste Volume			
	N	Mean±SD	Min	Max	N	Mean±SD	Min	Max
1-5.9	16	3.14±1.72	1.22	5.18	16	3.48±1.49	1.40	5.57
6-10.9	34	8.70±1.66	6.20	10.89	28	8.56±1.67	6.20	10.89
11-15.9	9	13.44±1.32	12.10	15.10	13	13.34±1.66	11.28	15.90
16-20	1	19.214	19.21	19.21	2	17.33±1.61	16.19	18.46
Total	**60**				**59**			

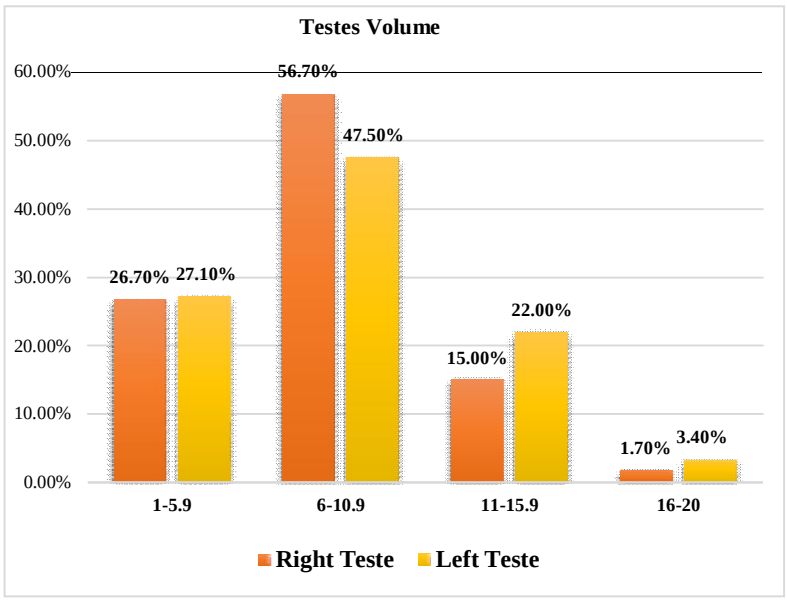

Figure 4.4: Distribution of sample according to testes volume.

Table 4.6: Distribution of sample according to size of testes.

Size of the Testes	Frequency	Percent
Normal	31	51.7%
Small	23	38.3%
Moderate	6	10.0%
Total	**60**	**100.0%**

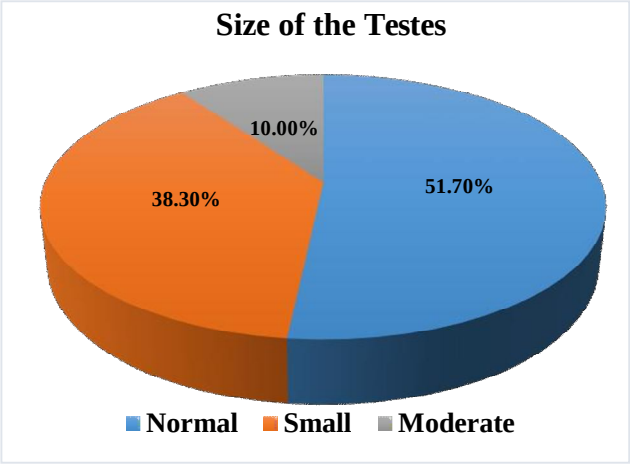

Figure 4.5: Distribution of sample according to size of testes.

Table 4.7: Distribution of sample according to varicocele.

Varicocele		Frequency	Percent
Cases	Yes	37	61.7%
	No	23	38.3%
Total		**60**	**100.0%**
Location	Unilateral	26	70.3%
	Bilateral	11	29.7%
Total		**37**	**100.0%**
Grade	I	9	24.3%
	II	18	48.65%
	III	10	27.0%
Total		**37**	**100.0%**

Table 4.8: Distribution of sample according to hydrocele.

Hydrocele		Frequency	Percent
Cases	Yes	8	13.3%
	No	52	86.7%
Total		**60**	**100.0%**
Location	Unilateral	7	87.5%
	Bilateral	1	12.5%
Total		**37**	**100.0%**

Table 4.9: Distribution of sample according to their final diagnosis.

Final Diagnosis	Frequency	Percent
Varicocele	37	61.7%
Hydrocele	8	13.3%
Epidemal Cyst	7	11.7%
Epidemal Tail Lesion	1	1.7%
Calcification	2	3.3%
Testicular Cyst	1	1.7%
Microlithiasis	1	1.7%

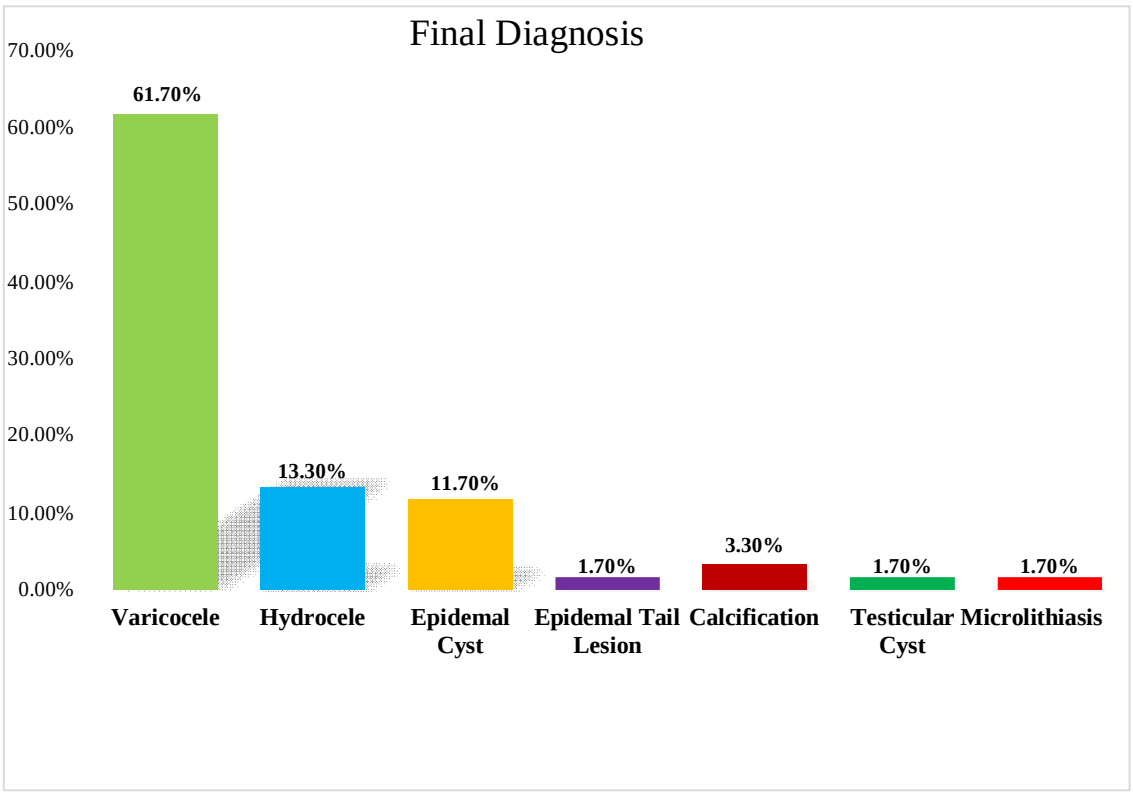

Figure 4.6: Distribution of sample according to their final diagnosis.

Table 4.10: Correlation between age and final diagnosis.

Final Diagnosis	Age Group				Total	Significant Test
	25-35	36-45	46-55	56-65		
Varicocele	17	13	4	3	**37**	
Hydrocele	4	3	1	0	**8**	
Epidemal Cyst	3	2	2	0	**7**	
Epidemal Tail Lesion	1	0	0	0	**1**	X^2=11.448
Calcification	1	0	1	0	**2**	P 0.953
Testicular Cyst	1	0	0	0	**1**	
Microlithiasis	1	0	0	0	**1**	
Total	**20**	**16**	**6**	**3**	**45**	

Table 4.11: Correlation between Final diagnosis and seminal analysis.

Final Diagnosis	Seminal Analysis				Significant Test
	Azoospermia	Oligoasthenozoospermia	Asthenotratozoospermia	Leukocytosis	
Varicocele	9	17	10	1	X=13.679 P0.883
Hydrocele	1	3	4	0	
EpidemalCyst	3	3	1	0	
EpidemalTail	0	1	0	0	
Calcification	0	1	1	0	
TesticularCyst	0	0	1	0	
Microlithiasis	0	1	0	0	

Table 4.12: Correlation between testes size and seminal analysis.

Size	Seminal Analysis				Significant Test
	Azoospermia	Oligoasthenozoospermia	Asthenotratozoospermia	Leukocytosis	
	Count	Count	Count	Count	
Normal	5	14	12	0	X=18.579 P0.005*
Small	15	6	1	1	
Moderate	3	1	2	0	

Table 4.13: Correlation between testes size and final diagnosis.

Final Diagnosis	Size			Significant Test
	Normal	Small	Moderate	
Varicocele	26	8	3	X=11.462 P0.649
Hydrocele	8	0	0	
Epidemal Cyst	5	2	0	
Epidemal Tail	1	0	0	
Calcification	1	0	1	
Testicular Cyst	1	0	0	
Microlithiasis	1	0	0	

Table 4.14: Correlation between age and testes size.

Age		Testes Size			Total	Significant Test
		Normal	Small	Moderate		
25-35	no	13	13	4	30	X^2=2.740 P 0.841
	%	43.3%	43.3%	13.3%	100.0%	
36-45	no	11	6	2	19	
	%	57.9%	31.6%	10.5%	100.0%	
46-55	no	5	3	0	8	
	%	62.5%	37.5%	0.0%	100.0%	
56-65	no	2	1	0	3	
	%	66.7%	33.3%	0.0%	100.0%	
Total	no	31	23	6	60	
	%	51.7%	38.3%	10.0%	100.0%	

Table 4.15: Correlation between occupation and final diagnosis.

Final Diagnosis	Occupation					Significant Test
	Worker	Police Man	Farmer	Teacher	Driver	
Varicocele	22	5	3	7	0	X^2=49.330 P 0.008*
Hydrocele	2	0	2	4	0	
Epidemal Cyst	5	0	1	0	1	
Epidemal Tail Lesion	0	1	0	0	0	
Calcification	1	0	1	0	0	
Testicular Cyst	0	0	1	0	0	
Microlithiasis	1	0	0	0	0	
Total	**31**	**6**	**8**	**11**	**1**	

Table 4.16: Correlation between duration of marriage and final diagnosis.

Final Diagnosis	Duration of Marriage Range				Significant Test
	1-5	6-10	11-15	16-20	
Varicocele	20	9	6	2	X^2=14.514 P 0.847
Hydrocele	4	3	1	0	
Epidemal Cyst	5	0	2	0	
Epidemal Tail Lesion	1	0	0	0	
Calcification	1	0	1	0	
Testicular Cyst	0	0	1	0	
Microlithiasis	1	0	0	0	

CHAPTER FIVE

Discussion

CHAPTER FIVE

5.4 Discussion

Study population was 60 patients between 20-60 year most of them between 25-35 year, diagnosed by semen analysis, most of them azoospeia 38.3%.66% of them was workers hence the job has a role in infertility.

Varicocele was the most common sonographic abnormality in this study occurring in 61.7% .Reports in literature have also described varicocele as the most common identifiable abnormality detected in infertile men on scrotal US. While varicocele has traditionally been reported to have an overall prevalence of 29– 40% in all infertile men (Qublah et al., 2007; Pierik et al., 1999; Mihmanlı et al., 2009; Agarwal et al., 2007; Chen., 2012; and Gat et al., 2004), more recently some authors have reported prevalence of 35–41% in men with primary infertility and 70–81% in men with secondary infertility (Agarwal et al., 2007; and Waltres et al., 2012). Most studies have reported varicoceles to be more common on the left in both sub-fertile men and normal population (Chen., 2012; and Gat et al., 2004; Waltres et al., 2012; and Fiogbe et al., 2013). Our findings were consistent with these. 70.3 %. About 29.7% of all varicoceles is bilateral.

The second most common scrotal abnormality found in this study was hydrocele 13.3%. Until recently, the effect of idiopathic hydrocele on the testis was poorly understood as it was thought to be completely harmless to testicular health, however Mihmanli et al. were able to demonstrate that idiopathic hydrocele may cause testicular enlargement and increased vascular resistance in the intratesticular arteries, thereby adversely affecting testicular function. (1.7%) of patients also had epididymal thickening a possible sequel to chronic epididymoorchitis an established cause of infertility (Mihmanli et al., 2004).

Other abnormalities like epididymal cysts 11.7% and microlithiasis 1.7%, and testicular cyst have also been reported to be associated with infertility.

Epididymal cysts are thought to cause obstruction while microlithiasis is thought to impair testicular function via an immunological mechanism (Qublah et al., 2007). Calcification 3.3% and epidedmal tail lesion sign for chronic infection 1.7%.

There is significant correlation between testicular size and seminal analysis results,p0.005. 15 patients out of 60 patients diagnosed as small size testis with Azoospermia (Kristo and Dani., 2014). No correlation between testicular size and testicular pathology (Kristo and Dani., 2014), 26 patients with varicocele was with normal size testis, also no correlation between testicular pathology and seminal results, 17 patient with oligoasthenozoospermia, 9 patients with azoospermia and 10 patients with asthenoteratozoospermia all these diagnosed as varicocele.

To Diagnosis testicular pathology we depend on these features: The testis is homogeneously hyperechoic and clearly demarcated from the layers of the scrotum. It measures about 3 cx 4 cm in the longitudinal plane. The upper pole of the testis is covered by the epididymis which extends along the surface of the testis. Its isoechoic or mildly hyperechoic relative to the testicle. Varicocele by dilatation of pampiniform plexus veins >2-3 mm diameter, flow reversal with the Valsalva manoeuvre Doppler ultrasound used to grade the degree of reflux ,and itis diagnostic for varicocele .

Hydrocele, it presents as anechoic simple fluid collection. It is avascular on Doppler evaluation. Orchitis or epididymitis shows edematous hypoechoic enlargement of the testis or epididymis as well as thickening of multiple layers of the scrotal wall and increased blood flow within the epididymis, testis or both. Microlithiasis appears as small non-shadowing hyperechoic foci ranging in diameter from 1-3 mm. These foci occur within the testicular parenchyma and although usually distributed uniformly. Epidedmal cyst and testicular cyst appear with anechoic signal (no internal echoes), smooth walls well-circumscribed shape and posterior acoustic enhancement.

5.5 Conclusion:

From the study scrotal ultrasound help in evaluation of infertile male, and diagnosis of different pathology, most common pathology is varicocele and increase with workers, significant correlation between testicular size and seminal analysis changes. In conclusion, Scrotal US is a valuable tool in the evaluation of infertile men.

5.6 Recommendation:

Scrotal ultrasound as a routine for infertile male, painless, harmless, cheap and fast so it is the best and first option for diagnosis male infertility.my recommendation is to research the testicular size and it is relation with semen parameters like count of sperm ,motility and morphology to be more specific and to increase sample size.

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Appendices

Appendix1

Data sheet

No	Age	Occupa	Duratio n of	Seminal	High of	Width	Length	Volume	Height	Width	Length	Volume	Other	Final

Appendix 2
Images

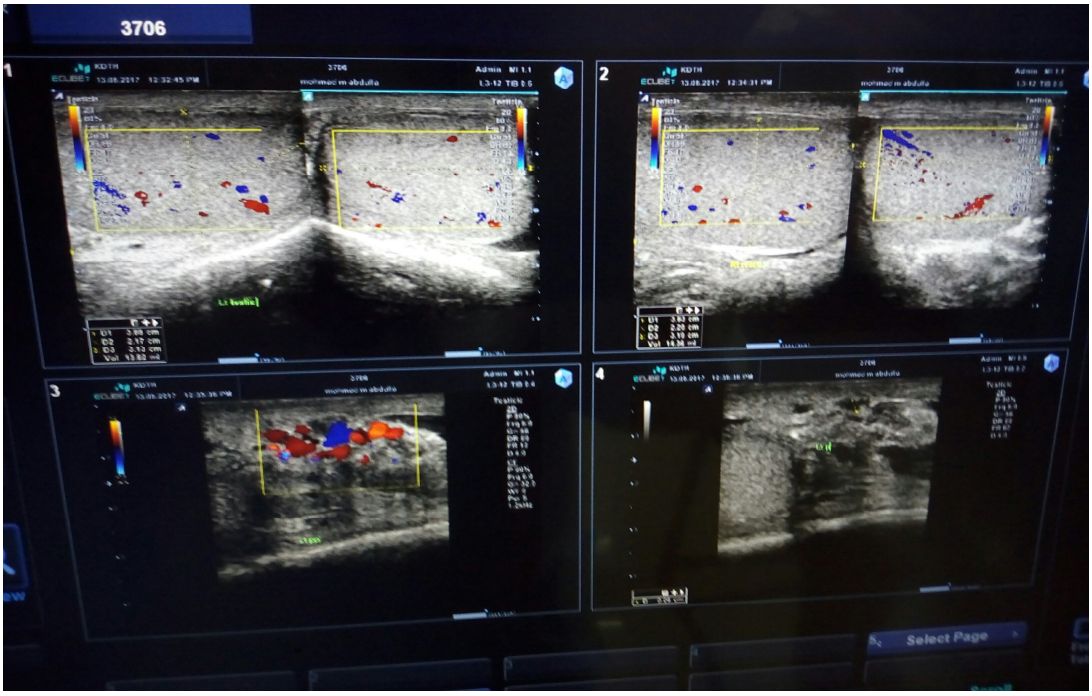

Image 1: 39 years old patient with normal size testis ,left varicocele grade 2 and mild bilateral hydrocele.

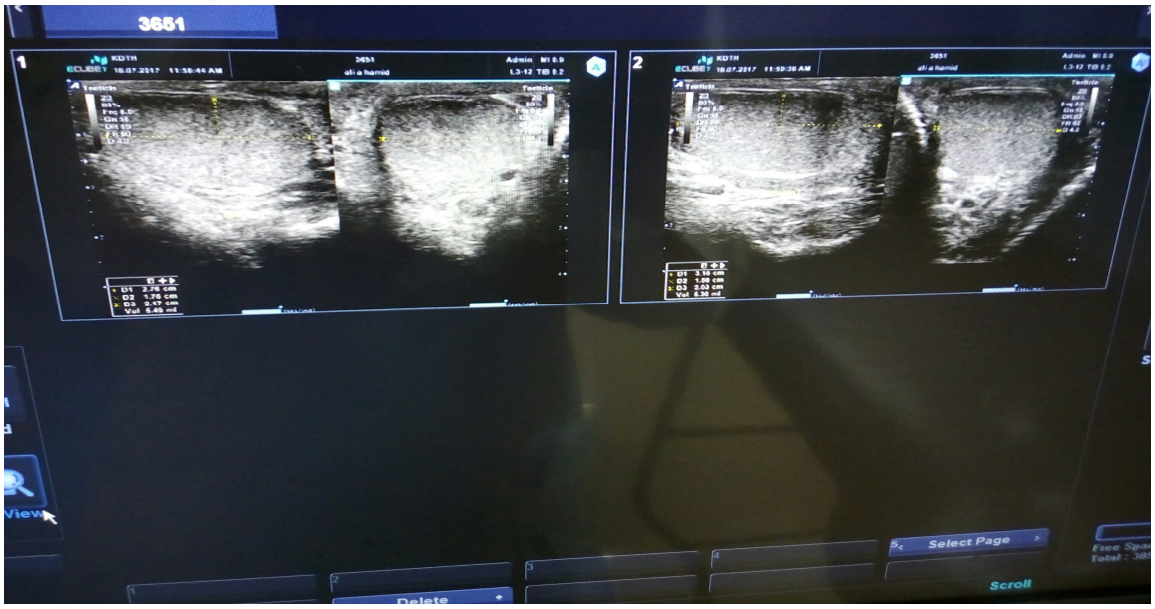

Image 2: 36 years old patient with bilateral small size testis

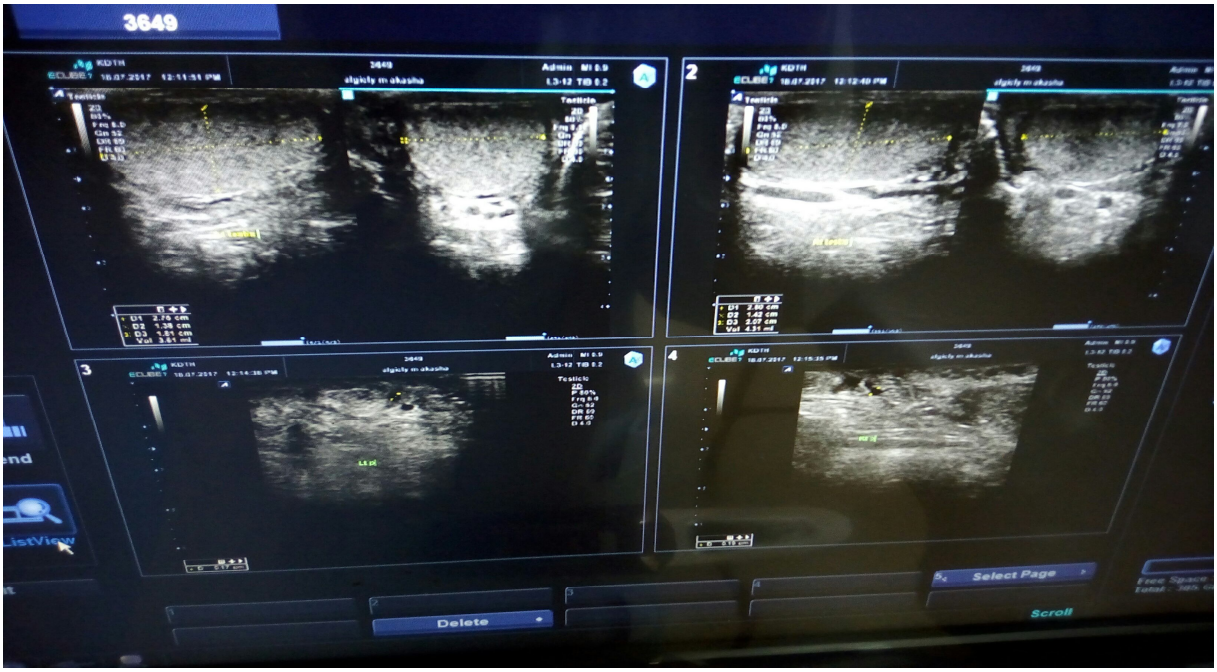

Image 3: 39 years old patient with very small testis

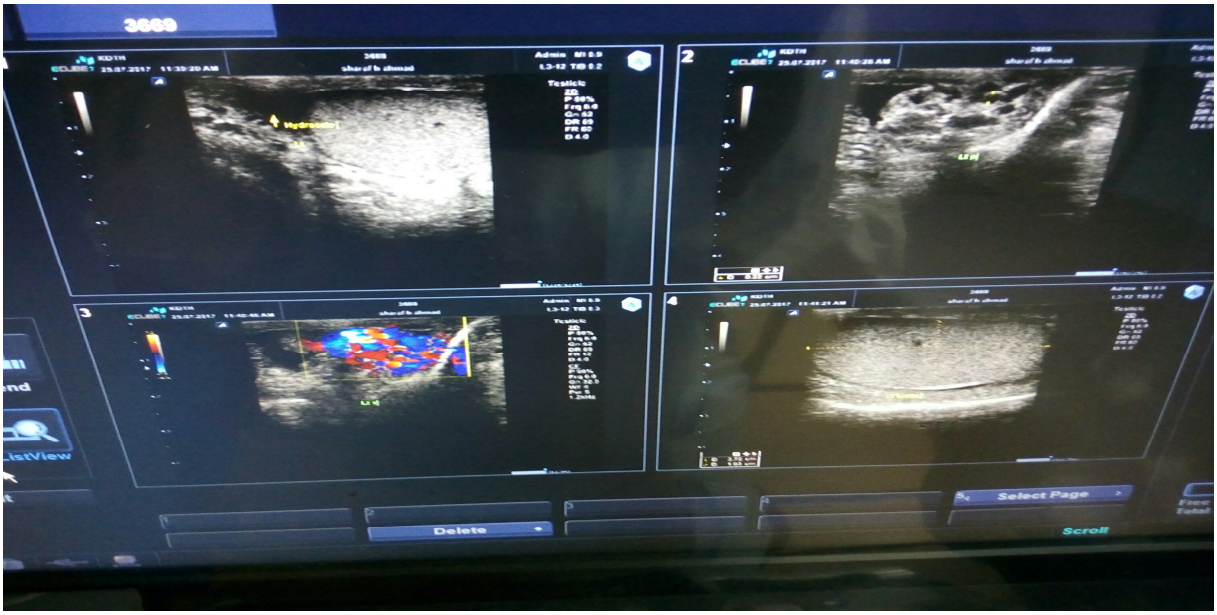

Image 4: 27 years old patient with left varicocele and bilateral mild hydrocele

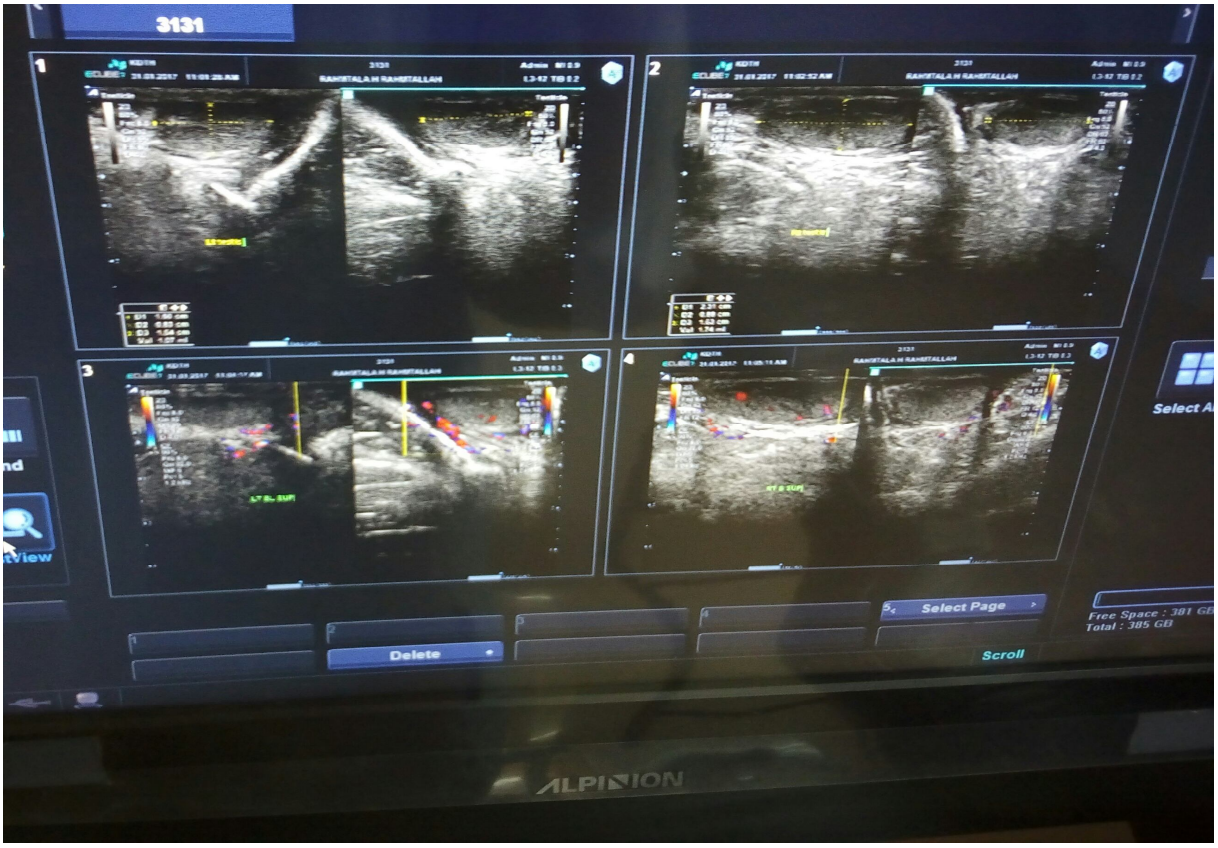

Image 5: 42 years old patient with normal size testis and varicocele grade 3 in left side.

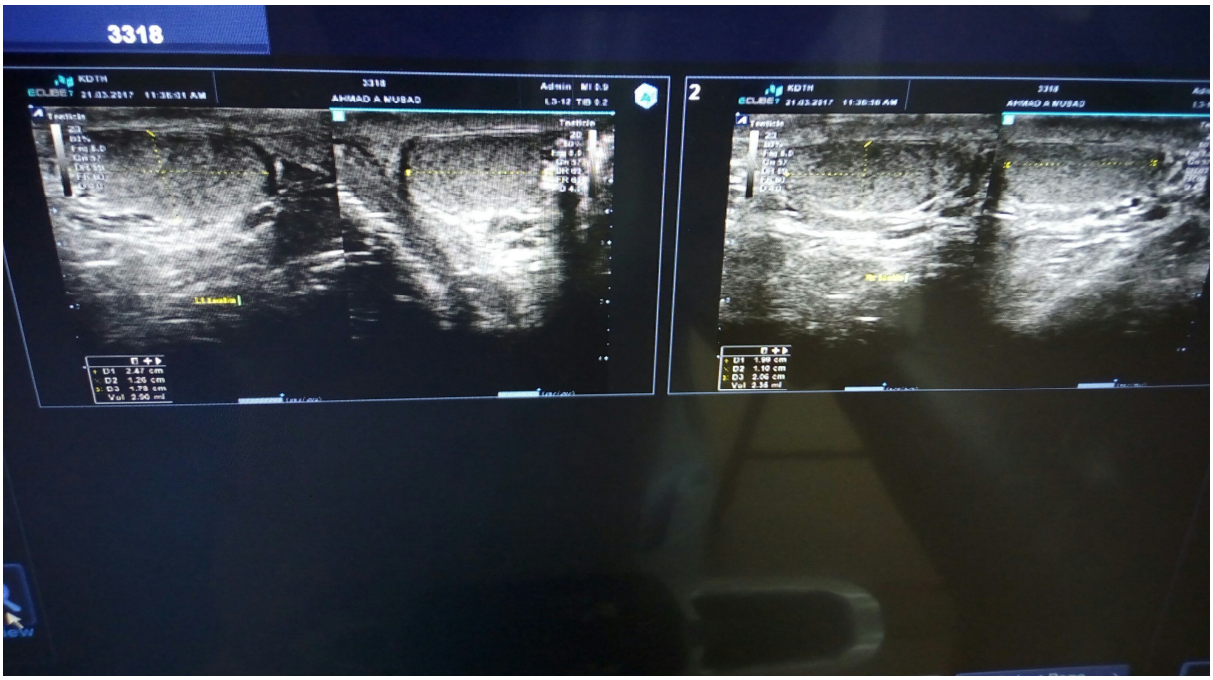

Image 5: 42 years old patient with normal size testis and varicocele grade 3 in left side.

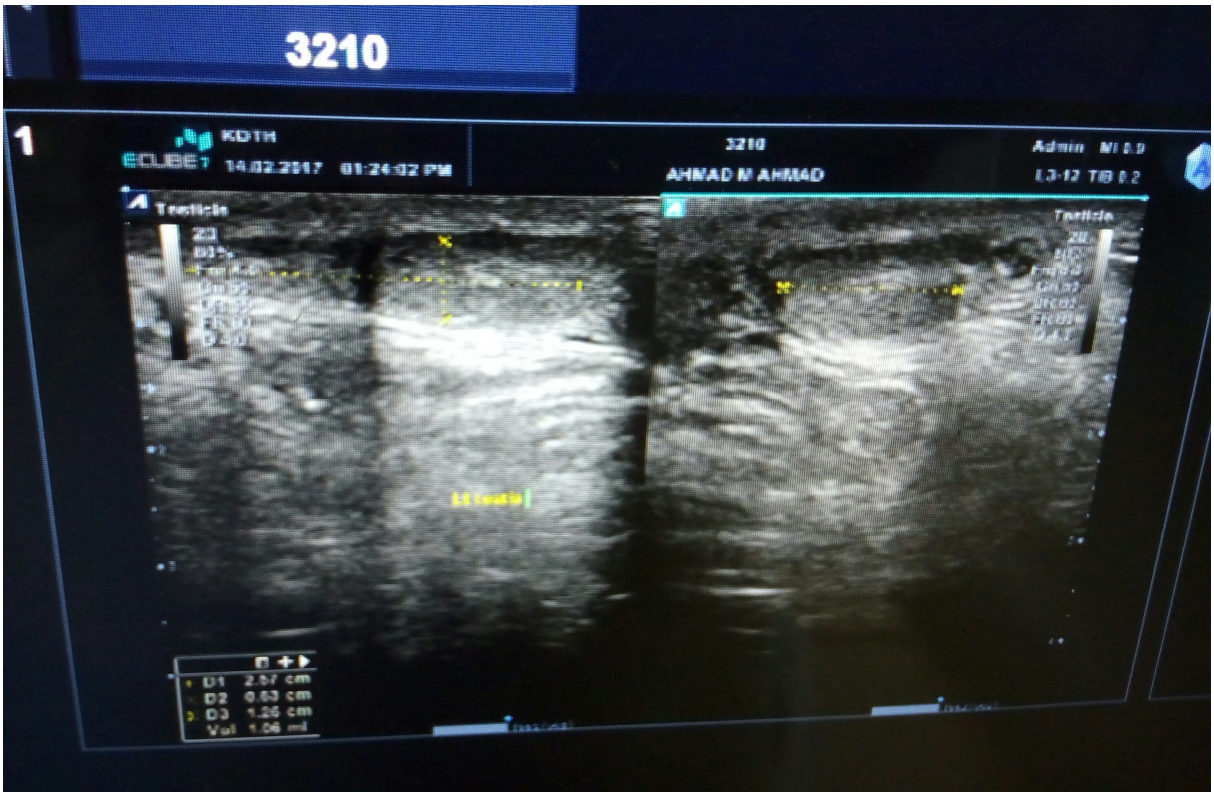

Image 6: 42 years old patient with very small size testis

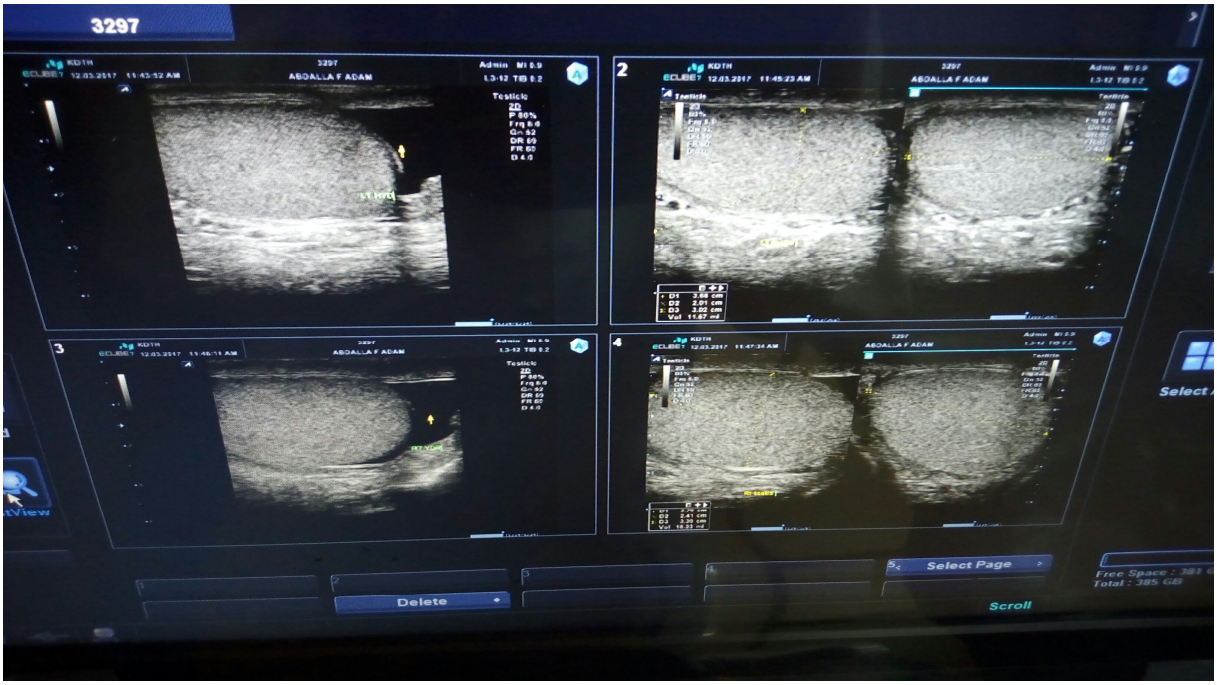

Image 8: 49 years old with normal size testis and left epididmal syst and bilateral mild hydrocele.

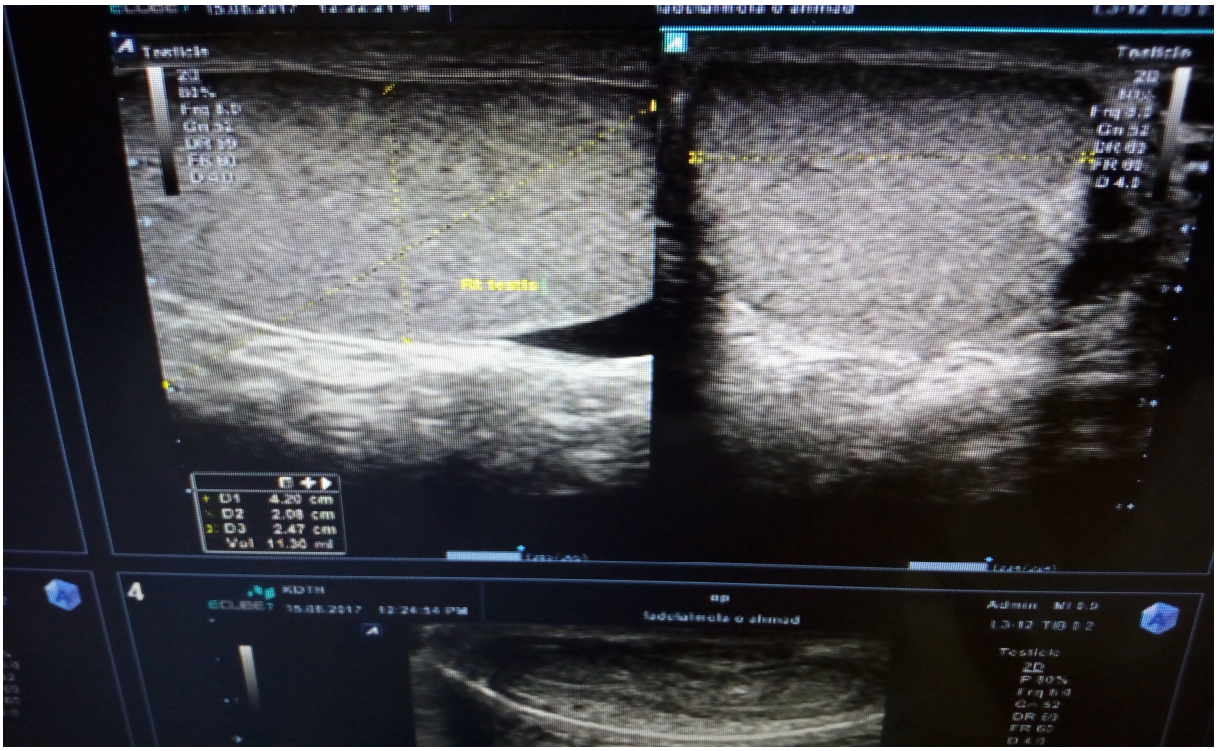

Image 9:30 years old with right side hydrocele.

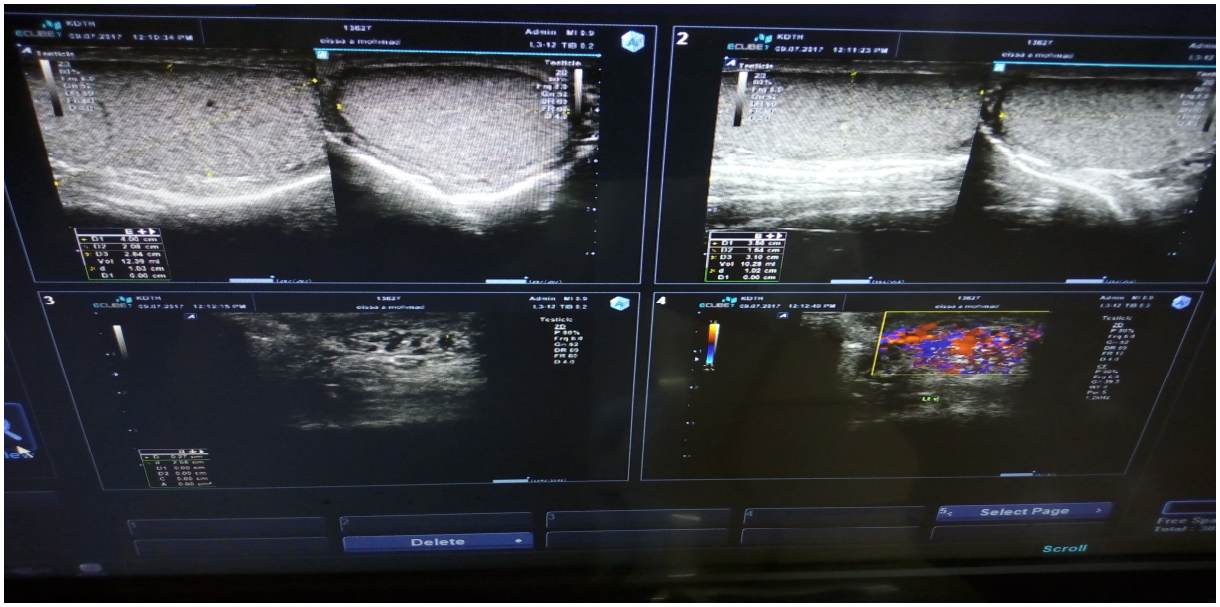

Image 10: 27 years old with left varicocele.

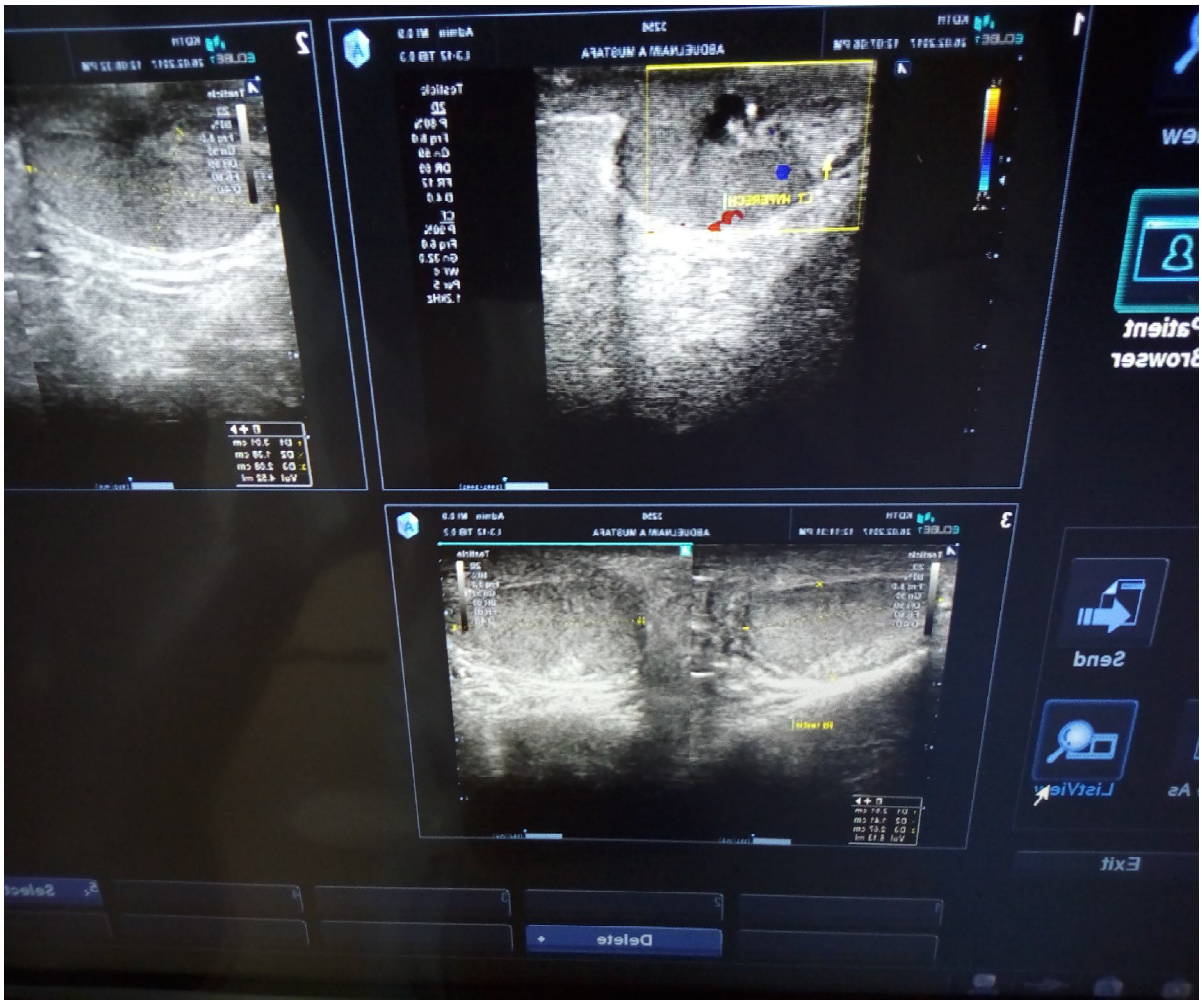

Image 11:44 years old patient with hetrogenous small testis ,chronic infection .

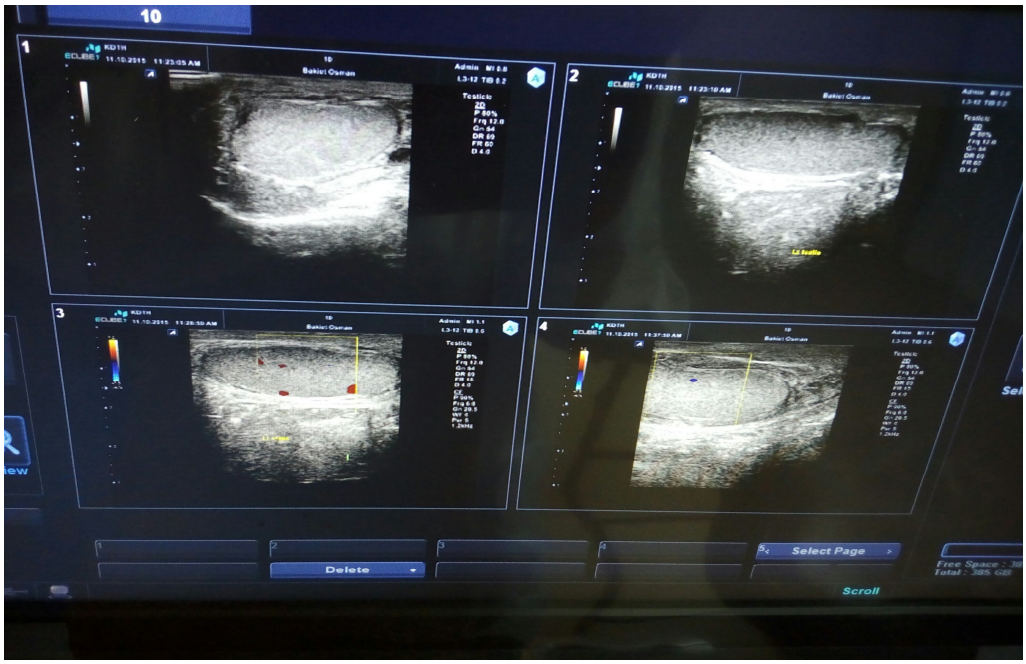

Image 12 : Moderate size testis with right epididmal syst.

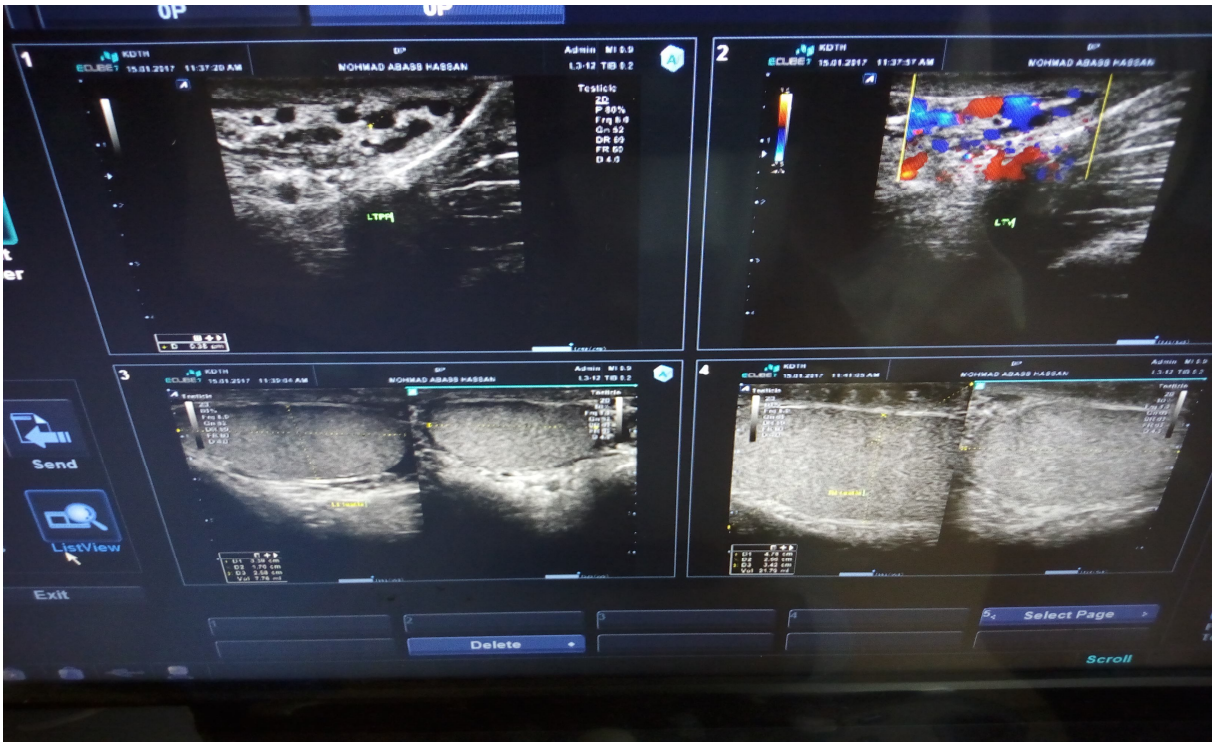

Image 13: Normal size testis with left varicocele .

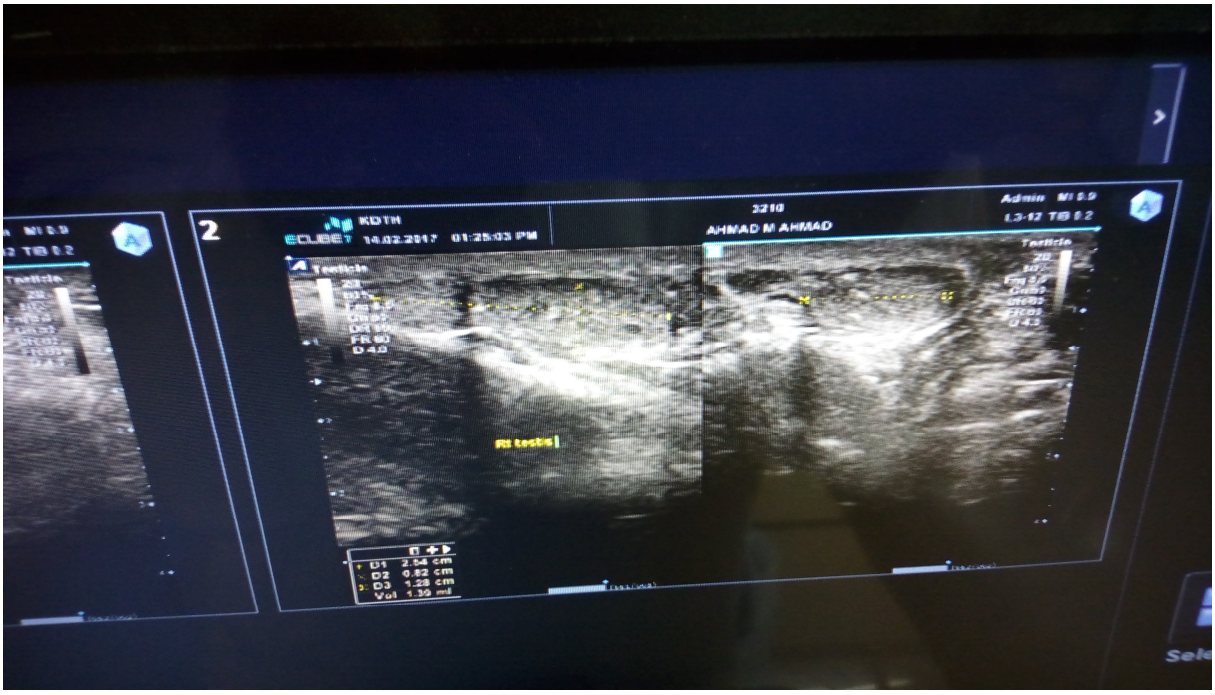

Image 14: Small size testis