PATTERN OF SCROTAL DISEASE AS SEEN AT ULTRASONOGRAPHY AT KENYATTA NATIONAL HOSPITAL.

A DISSERTATION SUBMITTED IN PART FULFILLMENT FOR THE DEGREE OF MASTER OF MEDICINE IN DIAGNOSTIC RADIOLOGY.

UNIVERSITY OF NAIROBI.

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Declaration

Candidate:

This dissertation is my original work and has not been presented in any other University.

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Dedication

I wish to dedicate this work to my dear wife; -.

Sally Chepkoech

And our dear sons,

Rorry Kibiwot and **Ryan Kiplagat**.

Who are the roses of my heart and golden gifts from the Almighty God.

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Abbreviations

- U.O.N. - University of Nairobi
- K.N.H. - Kenyatta National Hospital
- U.S. - Ultrasound
- KEMRI - Kenya medical research institute
- DDR - Department of diagnostic radiology
- C.T - Computerized Tomography
- M.R.I - Magnetic resonance imaging
- R.N.I - Radionuclide imaging
- A.L.L - Acute lymphocytic leukemia
- N.H.L - Non Hodgkins Lymphoma
- AIDS - Acquired Immune Deficiency Syndrome
- HCG - Human chorionic gonadotrophin
- SPSS - Statistical package for social sciences

Abstract

Objective; To determine the pattern of scrotal disease among male patients presenting for scrotal ultrasonography at DDR and US department KNH.

Method; A cross sectional descriptive study was done. A total of 138 patients were reviewed over 6 month's duration from July 2004 to January 2005. The sample included all patients referred from wards, general and private clinics as well as hospitals. A few cases with inflammatory disease were followed up with repeat scanning.

Results; The patients examined were aged between 6 weeks and 90 years with a mean age of 30.1 years. Ultrasound demonstrated scrotal disease in 93.5%. Scrotal disease was most prevalent in the 20-40 age group constituting 50.7% of the total cases. The most common presenting complaint was scrotal swelling accounting for 28.3%. Scrotal mass was the most common finding at sonography,seen in 63% of cases. Sixty nine percent of scrotal masses were extra testicular. Inflammatory disease was the second commonest sonographic diagnosis(31.2%), followed by the undescended testes which accounted for 18.1%.

Conclusion; Scrotal disease is seen in all the age groups but most prevalent in the middle aged, who constitute more than 50% of the cases in this study. The incidence decreases as one approaches 50years and above. Extratesticular mass is the most prevalent scrotal disease at KNH. Ultrasound plays a vital role in evaluation of scrotal disease.

1.0 Introduction.

Scrotal sonography has proven to be accurate in the evaluation of many scrotal diseases. Its clinical application is on the increase owing to recent technical advances in high resolution real-time and colour Doppler imaging [1]. It is the primary imaging modality of the scrotum today. The other modalities like computerized tomography (CT), Magnetic Resonance Imaging (MRI) or Radionuclide Imaging (RNI) come secondary. Ultrasound has a high sensitivity of nearly 100% in the detection of intrascrotal mass and accuracy of 98 – 100% in differentiating intratesticular from extratesticular.[1,2] Extratesticular masses are largely benign while intratesticular are malignant [3]

Presentation of scrotal disease is varied, ranging from painless incidental finding during routine examination of the scrotum or at autopsy/orchidectomy, to fulminant disease accompanied by pain and swelling with or without constitutional symptoms of fever. Most scrotal masses present as painless unilateral or diffuse scrotal swelling[1].About 65-94% of patients with testicular neoplasms present with painless unilateral testicular mass or diffuse testicular enlargement.Approximately 4 – 14% present with symptoms of metastases [3,4,5].Hydrocele is the most common cause of painless scrotal swelling[6].Painful states of the scrotum are commonly caused by trauma, torsion or infection with a few neoplastic conditions mimicking inflammatory process [7].

At sonography, most malignant testicular neoplasms are hypoechoic relative to normal testicular parenchyma though areas of increased echogenicity may be seen owing to haemorrhage, calcification or fatty change that are often associated. Uniformly echogenic masses are often benign processes from infection or vascular abnormalities [1].

Literature review.

1.0 Sonographic anatomy of the scrotum

The scrotum is a sac divided internally by a septum into two chambers. Each chamber houses a testis and associated structures of epididymis, blood vessels, spermatic cord and lymphatics.

Scrotal wall is composed of six layers arranged from outwards to inwards as;

- Rugated skin
- Superficial fascia
- Dartos muscle
- External spermatic fascia
- Cremasteric fascia/muscle
- Internal spermatic fascia.

The inner surface of the scrotal wall is lined by the parietal layer of tunica vaginalis, which together with its visceral layer forms a closed sac that covers the testis on all surfaces except posteriorly. Its visceral layer is adherent to the surface of the testis. The testis is adherent to scrotal wall at its bare posterior aspect which forms the entry and exit point for blood vessels and testicular ducts. The potential space between the two layers of tunica vaginalis normally has about 1-2ml of clear fluid. Tunica vaginalis develops embryologically from processus vaginalis which is an evagination of peritoneum that migrates with the testis via inguinal canal during the later's descent from high abdominal site. The proximal portion of processus vaginalis degenerates leaving a closed sac.[1]

Normal testis develops in the coelium and descends to reach the scrotum by 36 weeks of gestation, guided by the contractile cord-like structure called the gubernaculum testis. The epididymis and ductus deferens develop from wolfian ducts.[9]

The testis is an oval gland measuring 3-5cm in length, 2-4cm in width and 3cm anteroposteriorly in the adult. The weight ranges from 12.5-19gm and size decreases with age [1,3]

Tunica albuginea is a dense fibrous capsule surrounding the testis beneath visceral layer of tunica vaginalis. Multiple septae radiate centrally from the inner surface of this capsule and converge to form the mediastinum testis, which supports entering, and exiting testicular vessels and ducts. The testicular parenchyma is divided by these septa into 250-400 wedge shaped lobules that contain seminiferous tubules. There are approximately 840 tubules per testis which converge as they move centrally to form 20 to 30 large ducts called tubuli recti which in turn enter the mediastinum. These tubuli recti, form a network of channels called rete testis that terminate in 10-15 efferent ductules that empty into epididymis at the superior pole of the mediasinum [1]

Sonographically, a normal adult testis has medium level echoes with homogenous granular echo texture, resembling that in the thyroid [9]. Mediastinum testis is seen as a linear echogenic band extending craniocaudally within the testis. However, its appearance may vary according to amount of fat and fibrous tissue present. It is best seen in those aged between 15 and 60 years.[1]

Tunica albuginea is not usually seen as a separate structure, but testicular septa arising from it may be seen as linear echogenic or hypoechoic structures. Rete testis when seen,are hypoechoic or septated cystic areas adjacent to the head of the epididymis [1]

Epididymis is composed of a head, body and tail. The ducts arising from its tail continue as the vas deferens in the spermatic cord. It lies superiolaterally along the posterior aspect of the testis. The head is the most cephalad , while the tail is the most caudad. [9]

At sonography, the epididymal head is best seen in the longitudinal plane. It is isoechoic or slightly hypoechoic to the testis, with medium level echoes. Although the tail may be seen in healthy individuals, the body is not usually visible [9]. They are easily demonstrated along with, appendix epididymis and testis in the presence of hydrocele. Scrotal wall measures 2 – 8mm depending on state of contraction of cremasteric muscle.

Primary vascular supply to the testes is by the right and left testicular arteries, arising from abdominal aorta just below the renal arteries. They reach the posterior surface of the testis via spermatic cord which it joins at the deep inguinal ring.They penetrate the tunica albuginea to form capsular arteries that run through tunica vasculosa located beneath tunica albuginea.

Capsular arteries give rise to centripetal branches that carry blood towards mediastinum where they divide to form recurrent branches, which supply the rest of the testis. A transmediastinal artery, which is a branch of testicular artery may be evident in 50% of normal testicles. It runs through the mediastinum to supply capsular arteries and is usually accompanied by a large vein. [12,13.]

The differential artery, a branch of superior vesicle artery and cremasteric artery, a branch of inferior epigastric artery, supply epididymis, vas deferens and peritesticular tissues. Several anastomoses exist in a variable manner between testicular artery and its branches and between differential and cremasteric arteries. Branches of pudental artery supply the scrotal wall. Venous drainage is via pampiniform plexus formed around the upper half of the epididymis , and continues as testicular vein through deep inguinal ring. Right testicular vein empties into inferior vena cava while the left empties into left renal vein [12].

Blood flow within the scrotum is evaluated using colour Doppler, power Doppler and spectral Doppler ultrasound. Colour Doppler reliably demonstrates intratesticular flow. Power Doppler uses integrated power of Doppler signal to detect presence of blood flow. This allows higher power gains compared with ordinary colour Doppler thus giving higher sensitivity in detecting blood flow [3]. Power Doppler is invaluable in the scrotum because of its higher sensitivity to low flow states. Intratesticular arteries are characteristically of low resistance with mean RI of 0.62 [12].

The velocity waveforms of the normal capsular and tesicular arteries show high levels of antegrade diastolic flow throughout the whole cardiac cycle. This reflects the low vascular resistance of the testis.[3]

The spermatic cord consists of vas deferens, differential, cremasteric and testicular arteries. Other components include:-

Pampiniform plexus, lymphatics and testicular nerves. It lies beneath the skin and thus difficult to demonstrate sonographically. However it can be demonstrated within the scrotum in the presence of hydrocele or by use of colour Doppler.

2.0 sonographic pathology of the scrotum

Scrotal lesions are broadly classified into intra and extratesticular. Most intratesticular lesions are malignant while extratesticular lesions are benign. [1,12]

2.1 Extratesticular lesions

Extratesticular lesions include the following

- Scrotal wall lesions
- Scrotal hernias
- Hydroceles

- Hematoceles
- Pyoceles
- Epididymal lesions e.g epididymitis, epididymo-orchitis, sperm granuloma, and epididymal cysts.
- Conditions of spermatic cord.

2.1.1 Scrotal wall lesions.

Scrotal wall is affected by both inflammatory and non-inflammatory lesions . Non-inflammatory lesions largely present as scrotal swelling and the main causes include;

- Heart failure
- Idiopathic lymphoedema
- Liver failure
- Lymphatic and venous obstructions.

At sonography, thickened scrotal wall shows alternating hypo and hyperechogenic layers simulating an onion ring.[12.]

The most common inflammatory scrotal wall lesions are cellulitis and Fourniers gangrene. Cellulitis presents with local inflammatory signs and symptoms with or without constitutional symptoms of fever. It is commonly seen among the obese, diabetic and immuno-compromised patients. Ultrasound shows increased wall thickness with hypoechoic areas and increased blood flow at colour Doppler. Loculated areas with irregular walls and low level internal echoes suggest abscess formation.

Fourniers gangrene is defined as polymicrobial necrotizing fascitis of the scrotum, frequently extending to lower abdominal wall. The pathogens commonly isolated from Fourniers gangrene include:-

- Klebsiella
- Proteus

- Streptococcus
- Staphylococcus
- Peptostreptococus
- Escherichia coli
- Clostridium perfringens.

Fourniers gangrene is a clinical emergency with a high mortality rate of a bout 75%. Its diagnosis is primarily clinical and with imaging in equivocal cases. Subcutaneous gas within scrotal wall is the hallmark at sonography, seen as numerous hyperechoic areas with reverberation artifacts. This can also be demonstrated using plain radiography or CT scan. Other features include thickened scrotal wall with normal testis and epididymis. Inguinoscrotal hernia with gas in the gut, is a common differential of Fourniers gangrene .

Malignant scrotal wall lesions are rare and only sporadic cases like malignant melanoma, and metastatic lung or renal carcinoma are encountered. Most are hypoechoic at US [12].

2.1.2 Scrotal hernias

Inguinal hernias are common causes of both inguinal and scrotal swellings. Depending on their relationship to inferior epigastric artery, inguinal hernias can be either direct or indirect. The most common contents include bowel and omentum. Other contents are rare and include Meckel's diverticulum, and urinary bladder. Clinical history and physical examination are the mainstay of diagnosis with ultrasound being helpful in equivocal cases. Sonographic findings include air or fluid filled loop of bowel in the scrotum. Peristalsis may be seen at real time and is usually diagnostic of the presence of bowel. Hyper-echoic areas corresponding to fat are indicative of herniated omentum. Strangulated bowel is seen as an a kinetic and dilated loop. Hyperemia

of scrotal soft tissues and bowel wall are indicative of strangulation with a high sensitivity (90%) and specificity (93%) [12].

2.1.3. Hydrocele, hematocele, and pyocele.

Hydrocele is abnormal collection of serous fluid between the layers of tunica vaginalis and is the commonest cause of painless scrotal swelling. It can be congenital or acquired. Congenital results from patent processus vaginalis allowing passage of peritoneal fluid into scrotal sac. Acquired hydroceles on the other hand, are either idiopathic or develop in association with other scrotal diseases like , trauma, infection, testicular torsion or tumor. They result from trauma in 25-50% of cases. Large hydroceles result occasionally from neoplasms. Congenital hydroceles are more common in children compared to acquired, which are usually found in adults, in associated with intrascrotal pathology [1,12]

At sonography, hydroceles are anechoic fluid sorrounding anterolateral aspect of the testis with good sound transmission. Low level echoes may be seen due to high protein or cholesterol content.[12.]

Hematoceles and pyoceles are rare and are similar at sonography. They present as complex cysts with septations and loculations. They however differ aetiologically, hematoceles resulting from trauma compared to pyoceles complicating an infective process.[1, 12.]

2.1.4 Spermatic cord lesions

Varicocele

Varicoceles are abnormally dilated veins of spermatic cord resulting from incompetent valves of internal spermatic vein. They are found in about 15% of adult men, and can be idiopathic (primary) or secondary. Idiopathic varicoceles are more common on the left compared to the right and usually found in men aged 15-25 years. They become prominent in

erect position and during valsalva manoeuvre.Upto 70% of Primary varicoceles are bilateral.[1,11,14]

The higher prevalence on the left side is thought to be related to:

- Left testicular vein being longer
- Left testicular vein entering the left renal vein at a right angle
- Left testicular artery in some men arches over the left testicular vein thus compressing it.
- The descending colon overlying the left testicular vein may compress it particularly with fecal loading.

Varicoceles are associated with infertility, being demonstrable in a third of men with infertility.It is the most common correctable cause of infertility in men. US shows multiple, hypoechoic and serpiginous tubular structures of varying sizes but usually larger than 2mm in diameter. They are best seen at the superolateral aspect of the testis. low level internal echoes may be seen due to low flow within the dilated veins. Colour Doppler confirms the venous flow pattern with phasic variation and retrogate filling during valsalva maneuver with nearly 100% diagnostic sensitivity.[12, 15, 16]

Secondary varicoceles arise from increased pressure on spermatic vein, resulting from various causes including;

- Hydronephrosis
- Cirrhosis
- Abdominal neoplasm (like retroperitoneal masses)

Abdominal neoplasm is the most common cause of non compressible varicocele in men over 40 years [6, 7]

Tumors of spermatic cord

Lipoma is one of the commonest benign tumors of spermatic cord. Most malignant tumors on the other hand are sarcomas and

rhabdomyosarcomas. They occur predominantly in infants and young children, presenting as large solid masses. Smooth muscle tumors occur mainly in patients aged 40-70 years, 70% being leiomyomas. Others include leiomyosarcomas, liposarcomas, myxochondrosarcomas and malignant fibrous histiocytoma [1,12].

2.1.5. Epididymal lesions

Epididymo-orchitis

Epididymo-orchitis is one of the most common causes of acute scrotal pain in adolescent boys and young adults. It represents 75% of acute inflammatory scrotal disease, presenting clinically with pain that is characteristically relieved by elevating the scrotum over the pubis, also known as "prehn sign." This differentiates it from pain due to torsion in which it is usually negative.

Epididymitis.

Acute epididymitis is usually caused by sexually transmitted organisms including Chlamydia, Neisseria Gonorrhoea, Escherichia coli and Proteus. It is more prevalent among adolescent boys and middle aged adults. [1,9.]

Other rare causes include:

- Sarcoidosis
- Brucellosis
- Mumps
- Tuberculosis and
- Cryptococcus
- Drugs eg amioderone chloride.

Epididymitis may complicate with;

- Chronic pain

- Infarction
- Abscess formation
- Infertility
- Atrophy
- Pyocele
- Orchitis.

Sonographic findings of epididymitis include enlarged hypoechoic or hyperechoic epididymis with or without indirect signs of inflammation such as reactive hydrocele, pyocele or scrotal wall thickening. The epididymis is primarily involved in most cases with orchitis complicating afew as a result of direct spread of infection. Involved testicle is enlarged with inhomogeneous echotexture. Hyperemia of the epididymis and/ or the testis is the hallmark of epididymitis or orchitis at colour doppler US with nearly 100% sensitivity[3]. Measurements of resistive index (R.I.) in the testis is also a useful indicator of orchitis as it indicates the reduced vascular resistance associated with inflammation in which case R.I. is markedly reduced. Reversal of flow in peak diastole is suggestive of venous infarction in association with epididymo-orchitis [9,12].

Chronic Epididymitis

Chronic epididymitis is characterized by persistent scrotal pain, and may be due to either granulomatous or non granulomatous causes.Granulomatous epididymitis may be caused by tuberculosis, brucellosis, leprosy, and syphilis. Non granulomatous on the other hand may complicate acute disease usually as aresult of failed treatment. Sonographic features include increased echogenicity with or without calcifications and moderate increase in vascularity.

Sperm granuloma

Sperm granuloma is a form of chronic epididymitis otherwise called epididymitis nodosa. It occurs secondary to inflammation, trauma, or vasectomy. It is a granulomatous reaction to extravasated sperm cells. Sonographically, it appears as well defined hypoechoic intraepididymal cysts with epididymal enlargement.

Epididymal masses

Spermatoceles and simple epididymal cysts are the most common epididymal cystic masses, presenting as unilocular or multilocular. A spermatocele is a cystic dilatation of efferent tubules in the head of epididymis. Simple cysts are similar to spermatoceles at sonography but can occur anywhere in the epididymis compared to spermatoceles with predilection to the head. US shows well defined hypoechoic lesion with posterior acoustic enhancement.

Other rare epididymal masses include adenomatoid tumours, papillary cystadenomas, leiomyoma, lipoma, rhabdomyoma, lymphoma and lymphangioma.

2.2 Testicular pathology

2.2.1 Testicular torsion

This is a surgical emergency presenting with acute scrotal pain and swelling as a result of venous and arterial obstruction caused by twisting of spermatic cord. This can occur at any age, but more common among adolescent boys.

In testicular torsion, venous obstruction occurs first, followed by arterial and finally testicular ischaemia. Extent of ischaemia depends on the

degree of torsion ranging from 180 – 720 degrees . Testicular salvage rate depends on degree of torsion and duration of ischaemia. This is time rated as 100% salvage within 6 hours, 70% within 6-12 hours and 20% within 12-24 hours [12]

There are two types of torsion:

- Extravaginal
- Intravaginal

Extravaginal torsion occurs outside tunica vaginalis with the testis and gubernaculum being free to rotate. This occurs almost entirely in newborns. Clinically, it presents with a discoloured and swollen scrotum on the affected side with a firm painless mass representing infarcted or necrotic testis. US demonstrates an enlarged heterogeneous testis, ipsilateral hydrocele, skin thickening and no colour Doppler signal in the testis or spermatic cord[12].

Intravaginal torsion occurs within tunica vaginalis, in the presence of a long and narrow mesentry or "a bell-clapper" deformity in which the tunica vaginalis completely encircles the epididymis, spermatic cord and testis. It is usually bilateral and the most common form of torsion, occurring more commonly at puberty. The patient usually presents with acute onset of pain associated with nausea, vomiting and low grade fever. Unlike epididymitis, pain due to torsion is not relieved by elevation of scrotum over the symphysis pubis. On examination, the scrotum is usually tender and swollen on the affected side [1].

Like extravaginal torsion, intravaginal shows no blood flow with colour Doppler. US findings in testicular torsion vary with duration and degree of rotation of spermatic cord.At 4-6 hours there is testicular swelling with reduced echogenicity while at 24 hours the testis shows heterogeneous

echotexture owing to vascular congestion, haemorrhage and infarction. Normal testicular echogenicity in the presence of torsion is an indication of testicular viability along with presence of thickened scrotal wall and reactive hydrocele. The absence of testicular flow at colour and power Doppler US is diagnostic of ischaemia as long as it is optimized for low flow. On the other hand, the presence of colour signal on power Doppler in a patient with clinical manifestation of torsion does not exclude it. [12]

2.2.2 Primary orchitis

This condition occurs rarely in isolation, and commonly caused by mumps. It is unilateral in most cases and the affected testis is usually enlarged with decreased echogenicity and easily detected venous flow at US. It complicates epididymal infection in up to 25% of the cases.

2.2.3 Non palpable testis.

A non palpable testis may be congenitally absent, cryptorchid, atrophic, retractile or ectopic. Cryptorchidism is arrested descent of testis along the normal path from lower pole of the kidney to the scrotum. Inguinal canal is the commonest site of cryptorchid testicles accounting for upto 60%. It is generally smaller and less echogenic compared with normal testis. Ectopic testis can be found in the perineum, femoral canal, superficial inguinal pouch or contralateral hemiscrotum. Cryptorchidism is associated with malignant degeneration of the testis, infertility, torsion and indirect hernia[7].

2.2.4 Testicular calcification

Testicular calcifications include both micro and macrocalcifications. Microcalcifications are uncommon and usually found incidentally at sonography. They appear as multiple echogenic foci with no acoustic shadowing. They are largely considered normal findings in the testis, although there has been association with intratubular germ cell neoplasia in some cases (IGCN). They are usually bilateral.

Macrocalcifications can be extra or intratesticular. Epididymal calcifications are usually secondary to inflammatory conditions or trauma. Scrotal calcification also called scrotoliths are calcifications within the scrotum and are of no clinical significance. They may be loose bodies from torsion of appendix testis or epididymis.

2.3 Benign testicular lesions.

Benign intratesticular lesions are less common compared to extratesticular and majority are cystic. [12]

2.3.1 Cysts of tunica albuginea.

They are thought to be of mesothelial in origin and range in size from 2-5mm.They are often detected in association with a palpable mass and can be unilocular or multilocular.

2.3.2 Simple cysts.

Simple cysts are usually found incidentally in men over 40 years and range in size from 0.2-1cm. They are usually located adjacent to the mediastinum and can be solitary or multiple.They are often associated with spermatoceles and show anechoic centre with sound transmission and imperceptible wall at sonography.

2.3.3 Epidermoid cysts.

These are tumors of germ cell origin ranging in size from 1-3cm. and presenting in patients aged 20-40 years .Sonographic features include;.

- Target appearances, which is a hollow with central area of increased echogenicity.
- A sharply defined mass with rim of calcification
- Solid mass with echogenic rim and
- Classic appearance of an "onion ring" pattern with alternating hyper and hypoechoic layers.

2.3.4 Tubular ectasia of rete testis.

This is a benign condition resulting from obstruction of efferent ducts causing dilation/ectasia of rete testis. US show fluid filled tubular structures occurring bilaterally in men over 55years.

2.3.5 intratesticular spermatocele.

This is a cystic intraparenchymal lesion attached to mediastinum and communicates with seminiferous tubules as opposed to tubular ectasia. They contain spermatozoa.

2.3.6 intratesticular varicoses.

They occur in association with extratesticular varicocele or indepenedently. US shows multiple serpiginous, tubular structures of varying sizes. Colour Doppler US shows venous flow pattern with characteristic spectral waveform increasing during valsalva manoeuvre.

2.3.7 intratesticular abscess.

Occurs usually secondary to epididymo-orchitis, but may also be a result of mumps, trauma or testicular infarction. US show shaggy irregular walls within the testis with low level echoes and at times hypervascular margins.

2.4 Malignant lesions of the testis.

Testicular cancer contributes 1% of all malignancies in men and is 4-5 times more common in white men than blacks. It is the most common cancer among white men aged 20-34 years. Patients with cryptorchidism are 2.5-8 times more likely to develop testicular cancer. Increased incidence is also associated with Klinefelters syndrome, and gonadal dysgenesis.[12]

It presents clinically as a painless scrotal mass with a few (about 10%) presenting with acute scrotal symptoms. US accurately distinguishes between intra and extratesticular tumors with nearly 100% sensitivity in detecting intratesticular tumours. Colour Doppler demonstrates increased vascularity in the majority of malignant tumors.

Common testicular tumours fall into the following categories:

Germ cell tumours

- Seminomas
- Non-seminomas

Gonadal stromal cell tumours (sex-cord tumours)

- leydig cell tumours
- sertoli cell tumours
- granulosa cell tumours

Others

- Lymphoma
- Leukemia

- Metastases.

Metastases are usually limited within tunica albuginea and rarely extend to paratesticular structures. Metastases elsewhere may be evident at presentation.

Non-seminomatous tumors usually have mixed cell patterns with varying proportions of the various cell types e.g teratoma and embryonal cell carcinoma. Predominant cell type determines US appearance. They commonly have inhomogenous echotexture with ill-defined margins as well as echogenic foci and cystic components.[1, 12.]

2.4.1 Embryonal Carcinoma

It occurs commonly in men aged 30 years and more aggressively than seminomas. They occur in pure form in a small proportion of the cases and in 45% of the mixed forms. US shows hypoechoic lesions with poorly defined margins and inhomogenous echotexture.

2.4.2 Choriocarcinoma.

This is a highly malignant testicular tumor commonly occurring in a mixed form and rarely in pure form. It is associated with elevated HCG and exhibits early metastasis to the lungs. US demonstrates extensive hemorrhagic necrosis in central portion of the tumor, appearing as cystic and solid areas.

2.4.3 Teratoma

It can occur at any age group and in pure form is the most common testicular tumor in prepubertal boys. It is seen in 50% of mixed cell tumors. Mature teratoma is often malignant in adult and benign in children. They are composed of the three germ cell layers. US shows

inhomogenous mass with echogenic foci representing calcification, cartilage, immature bone and fibrosis.[12]

2.4.4 Burned-out germ cell tumour

This is usually a teratocarcinoma or choriocarcinoma that occurs as a result of rapid growth out-weighing blood supply and resulting in tumor regression to only fibrosis and scar tissue. US reveals a small echogenic foci or hypoechoic mass corresponding to the tumor.

2.4.5 Stromal tumors

They represent 4% of testicular tumors and are typically small being discovered incidentally at US. They are of three types: leydig cell tumors, sertoli cell and granulosa cell tumors. They are non-specific at US and appear as well defined hypoechoic lesion.[1]

2.4.6 Lymphoma

Lymphoma constitutes 5% of testicular tumours and almost invariably non-hodgkins lymphoma (NHL) of B cell type .Approximately 1-3% of NHL involves the testis. Lymphoma is the most common testicular neoplasm in men aged more than 60 years. Increased incidence has been found in patients with AIDS. Enlargement of testis is the most common presentation and synchronous involvement of the contralateral testis is more common compared to other testicular tumours. US shows homogenously hypoechoic testis or multifocal hyphoechoic areas. Colour Doppler shows increased vascularity .[1,12]

2.4.7 Leukemia

Both acute and chronic forms of leukemia have been shown to infiltrate the testes. Testicular involvement by ALL is reported in 5-10% of

patients mostly during remission of clinical features. There is usually persistence of leukemic cells in the testis after remission following treatment particularly of ALL, owing to presence of a blood – testis barrier limiting access of chemotherapeutic agents. Approximately 25% of patients with chronic leukemia have testicular involvement. Sonographic appearance simulates that of lymphoma, appearing homogenously hypoechoic or as multifocal hypoechoic lesions of varying sizes.[12,18,19]

2.4.8 Plasmacytoma

Involvement of testes by multiple myeloma is a very rare occurrence and US shows hypoechoic mass with marked hypervascularity.

2.4.9 Metastases to the testis

They are very rare occuring only in patients with advanced malignant disease. Common primary sites include , prostatic , lung , melanoma, colon and renal tumors.

Broad objective.

To determine the sonographic pattern of scrotal disease among patients referred for scrotal ultrasonography at department of diagnostic radiology and ultrasound Department, Kenyatta National Hospital.

Specific objectives.

(1) To determine the pattern of scrotal disease, among patients referred for US at KNH.

(2) To determine the prevalence of the various scrotal diseases among patients at KNH.

JUSTIFICATION

Despite the fact that scrotal disease affects a significant proportion of the male population, no study has been done in Kenya to determine the pattern and spectrum of scrotal disease using ultrasound as a diagnostic modality. This study could not have been done at a better time than this when ultrasound is increasingly becoming accessible and affordable to the majority of the population in Kenya. It is hoped that this study will lay the foundation and open a new chapter in the diagnosis and management of scrotal diseases.

Research question

What is the pattern of scrotal disease among patients presenting at Kenyatta National Hospital as seen at ultrasonography?.

Study design, methodology, materials & sample size determination.

Study design.

This was a cross-sectional descriptive study.

Study site.

The study was carried out at both KNH Radiology department and Department of diagnostic Radiology UON between July 2004 and January 2005.

study population.

This consisted of the residents of Nairobi city and its environs.

Sample size estimation

All patients who presented for scrotal ultrasonography during the study period were included in the study. Every consecutive patient was included in the sample. One hundred and thirty eight patients were examined.

The sample size was calculated using the following formula;

$$n = \frac{Z^2_{1-\alpha 2}\, P(1-P)}{d^2}$$

where;

n= sample size

p= prevalence of the most common scrotal disease, taken as 10%.

d= absolute precision (5%).

z= standard errors from the mean corresponding to 95%.

1-α2= 2 tailed = 1.96

calculated sample size, n= 138.

Inclusion and exclusion criteria.

Inclusion criteria.

Inclusion criteria included;

- All patients presenting for scrotal sonography during the study period.
- Male patients of all ages.
- All patients who consented to the study.

Exclusion criteria.

- All those who did not consent to the study.

Equipment used.

Patient examination was carried out using the following machine models;

- Phillips US machine – model SD 800.
- HP image point HX US machine
- GE - LOGIC 5 machine -with image archiving and retrieval capability.

Images were acquired using sony thermo-printing paper.

Patient preparation and examination procedure.

- Patients were examined as they presented with no prior booking. They were explained of the study and where applicable, signed consent form.
- Examination was done with the patient in supine position and scrotum exposed and supported. Privacy was maintained by covering the rest of the genitalia.
- Imaging was done in standard sagittal and axial planes. Additional images were acquired in oblique, coronal and with patient in erect position or performing valsalva maneuver.
- Both colour and power Doppler as well as grey scale US modes were applied.

- Throughout examination high frequency transducers (7-10 MHz) were used with occasional use of lower frequencies(3.5 MHz) in such cases as large hydroceles.
- Comparison was always made with the normal side.
- During the examination the following features of the scrotum were evaluated and documented;
    - Normal scrotal anatomy and its alteration.
    - Blood flow within the scrotal structures.
    - Testicular parenchyma and its alteration.
    - Presence or absence of scrotal /testicular masses.

Data management.

Data collection and recording.

This was done by the researcher using a structured data entry form. Patients demographic, clinical and sonographic information inclusive of the final diagnosis were recorded. Interpretation of the final sonographic diagnosis was done with the help of consultant radiologist.

Data entry, quality control and statistical analysis.

Data was entered and analysed using SPSS programme.

Coding was done for open ended questions, and validation done before analysis. Descriptive statistics were used in the analysis and included variance, mean, standard deviation and median for continuous data.

Frequency distribution was used for categorical data.

Presentation was done using frequency tables and bar graphs.

Study limitations.

Some of the limitations in the study included;

- Some patients declined to consent for the study.

- The study was based on one diagnostic modality and thus its results could not be proved by a better diagnostic modality like MRI or biopsy.
- The number of cases were too few in some scrotal conditions to establish a trend.
- The study proved to be too broad and thus limiting thorough evaluation of scrotal disease.

Ethical consideration

The patients were explained of the study and only those who consented were included in the study. Confidentiality was ensured by concealing the name in the data collection sheet and using only registration number. The examination was always done in the presence of a chaperon.

The results of the examination were used as part of patient work-up in the management and reports were therefore sent to referring clinician. Where follow-up was deemed necessary, it was done at no extra cost to the patient.

Ultrasound has not been associated with any harmful side effects to those used on. It is a safe, quick, non-invasive and acceptable diagnostic tool. Consent before examination was sought.

Results

During the period of study between July 2004 and January 2005, one hundred and thirty eight patients were examined sonographically for scrotal disease. The information was gathered from both clinical summary on the request form and sonographic findings.

The findings were categorized into demographic, clinical and sonographic findings.

Demographic data.

All consecutive patients who presented for scrotal examination during the study period were recruited. Their ages ranged from 6weeks to 90 years, with a mean age of 30.1. The minimum and maximum ages were 0.12 and 90 years respectively, with a range of 89.88. The age mode and median were 32.00 respectively with a variance of 339.188 and standard deviation of 18.417.

They were grouped in to age groups as shown in figure one below.

The patients were found in all the age brackets, with the majority aged below 40years.

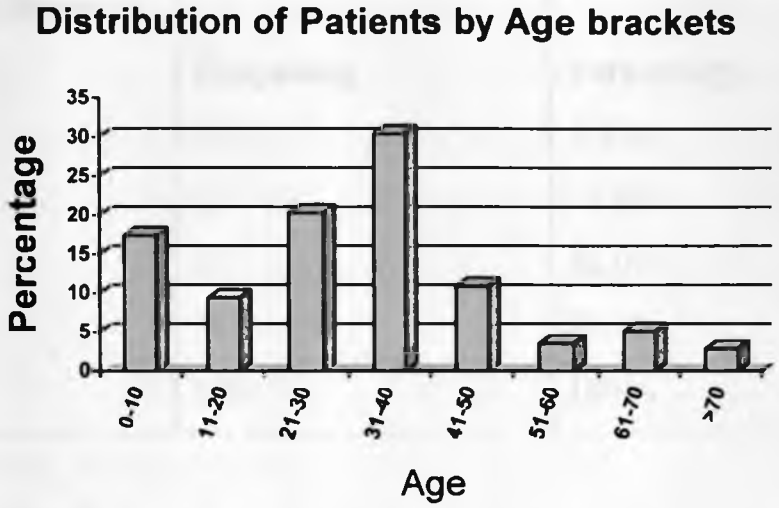
The highest number of cases were found in the 31-40 year age bracket followed by 21-30 years, together accounting for more than 50% of all the cases.

Few cases were aged more than 50years contributing about 10% of the cases.

Significant number of cases were found in the 0-10 age bracket accounting for 17.4%, and third most frequent.

The figure below illustrates the demographic distribution of cases.

Figure 1



Clinical information

Scrotal swelling was the most frequent complaint (28.3%), followed by pain (25.4%). Twenty three percent of patients presented with both swelling and pain. Other presentations in order of frequency included undescended testicles 18.1%, infertility 3.6% and testicular atrophy 1.4%.

Duration of illness at presentation.

The highest number of cases presented between 4-52 weeks (42.o%), followed by more than 52 weeks (26.8%) and 1-4weeks (23.9%) respectively. Those with less than 1 week duration were the least (7.2%).

The table below shows distribution of cases according to duration of illness.

Table 1 Duration of illness versus frequency of cases.

Duration of illness in weeks	Frequency	Percentage
<1 week	10	7.2 %
1-4 weeks	33	23.9%
4-52 weeks	58	42.0%
>52 weeks	37	26.8%
Total	**138**	**100%**

Clinical diagnosis.

The most frequent clinical diagnosis made was extratesticular mass accounting for 22.5%. It was followed by undescended testicles and inflammatory disease in18.8% and 16.7% respectively. Torsion was diagnosed in 13% of cases while testicular and epididymal masses were each suspected in 4.3% of cases. Infertility and scrotal wall lesions were the least with 2.2% and 0.7% respectively.

Table 5 below illustrates frequency of patients with clinical diagnosis.

Table 2 Provisional diagnosis.

Clinical diagnosis	Frequency	Percentage
Acute/missed torsion	18	13
Undescended testis	26	18.8
Inflammatory disease	23	16.7
Scrotal wall disease	1	0.7
Extratesticular masses	31	22.5
Epididymal mass lesions	6	4.3
Infertility	3	2.2
Testicular mass lesions	6	4.3
No clinical diagnosis	24	17.4
Total	**138**	**100%**

Sonographic findings

Scrotal disease was found in 93.5% of cases, and normal findings in the remaining 6.5%. They were distributed as, extratesticular masses (69.6%), inflammatory disease (31.2%), undescended testicles (18.1%), and torsion (7.2%). Testicular masses accounted for (5.8%). Other rare diagnoses included spermatic cord and scrotal wall lesions together constituting 1.4%.

Inflammatory scrotal diseases

Inflammatory scrotal disease was categorized into acute or chronic epididymitis, epididymo-orchitis and granulomatous epididymo-orchitis. This was based on duration of disease at presentation as well as sonographic and clinical features. Acute presentation was considered for cases that presented within 10 days of onset and chronic for those that presented after 10 days.

Fourty three patients were diagnosed as inflammatory disease at sonography. They were aged between 10-72 years, with a mean age of 30.86 and a mode of 32 years.

Acute epididymitis was the most common inflammatory disease (27.9%), followed by acute epididymo-orchitis (25.6%). Chronic epididymitis was the next most common (23.3%), followed by chronic epididymo-orchitis(14.0%) and granulomatous epididymo-orchitis(9.3%) respectively.

There were 12 cases with acute epididymitis. The factors considered in the diagnosis included, suggestive clinical history of pain, less than 10days duration and sonographic features of increased vascularity at colour Doppler, epididymal enlargement and distortion of echoparttern. Epididymal enlargement was demonstrated in 11 cases and normal size in one case. The echoparttern was variable, heterogenicity

and hypoechogenicity being seen in 7 cases. There were associations of hydrocele and focal hypoechoic areas in 3 and 1 cases respectively.

There were 10 cases of chronic epididymitis. Diagnostic features considered were pain, more than 10 days duration and increased vascularity at colour Doppler. Epididymal enlargement and echoparttern were variable. Eight patients had increased blood flow at colour Doppler. Six had epididymal enlargement. The echoparttern was variable with heterogenicity in 6, and 2 each with increased and decreased echogenicity. There was one case with thickened scrotal wall and 5 cases with hydrocele.

There were 11 cases with acute epididymo-orchitis. Like acute epididymitis, they presented with pain and less than 10 days duration. All the patients had increased vascularity while 8 had testicular enlargement. Heterogenous and hypoechoic echopartterns were demonstrated in 7 and 6 cases respectively. Five cases had associated hydrocele.

Six cases demonstrated features of chronic epididymo-orchitis including pain, more than 10 days duration, moderate increase in vascularity, and variation of both size and echoparttern. Testicular enlargement with increased vascularity was demonstrated in 4, while atrophy with reduced blood flow was seen in 2 cases. All the six cases had heterogenous echopattern with relative hypoechogenicity in 2. Hydrocele was found in 2 cases and focal hypoechoic areas in 1 case.

There were 4 cases of granulomatous epididymo-orchitis with suggestive features at both clinical and sonography. They presented with longer duration compared with other forms of inflammation, (exceding 2 weeks), and indolent scrotal pain. Sonographic features included increased vascularity in 4,testicular enlargement in 3, and heterogenous echoparttern in all the 4 cases. Focal hypoechoic areas were seen in all

the cases, microcalcifications in 1 and thickened skin in 2. One case had discharging skin sinus. Three cases showed no significant change on follow up after conventional antibiotic treatment.

Testicular torsion/infarction.

There were 10 cases of torsion diagnosed by sonography, 6 subacute and 4 chronic. Of these, 9 had been suspected clinically. Nine of the clinically suspected cases of torsion were not confirmed by ultrasound.The patients with torsion were aged 8-44 years with a mean age of 25.7 and mode of 16 years. Fifty percent of the cases were aged below 20years.

Sonographic features considered in the diagnosis of torsion included acute onset of pain clinically, absent vascularity (optimized for low flow with power Doppler), and changes in the echopattern. Based on duration at presentatoin, torsion was classified into acute, subacute and chronic forms, having presented at 0-24hrs, 1-10days and more than 10days respectively.

At sonography, all subacute cases showed enlarged testis while chronic showed atrophic testis.The testis showed absent vascularity at both colour and power Doppler. The echopattern was variable. Of the subacute cases, the echoparttern was heterogenous in 5 and hypoechoic in 4 cases. Focal hypoechoic areas suspicious of necrosis were evident in 4 cases.Three of the subacute cases had hypoechoic scrotal collections suggestive of haematoma. Thickened scrotal wall was demonstrated in 2 cases . All the chronic cases had heterogenous echopattern with features of necrosis.

Undescended/non palpable testicles

Clinically, 26 cases were suspected to have abnormal descent of testicles. Twenty five cases were confirmed at sonography to have either retractile or undescended testes. All these had been suspected clinically.

One clinically diagnosed patient was not confirmed by ultrasound. They were retractile at upper scrotum in 4 and undescended in 21 cases. Sixteen cases of the undescended were located at the inguinal canal, representing 64% of cases. Five cases were not identified at sonography. The undescended testicles were bilateral in 13, right sided in 8 and left sided in 4 cases.

Sonographic features were variable. Nine cases were hypoechoic and atrophic in size while 3 were heterogenous. Normal sonographic features were found in 14 cases inclusive of the retractile and some of those located in inguinal canal.

Other associated findings included 4 scrotal hernias, 1 hydrocele, 1 case of scrotal varices and 1 with ectopic kidney.

Scrotal mass lesions

Eighty seven patients (63.0%) showed scrotal mass lesions at sonography. Of these, about 92.3% were extratesticular while the remainder 7.7% were testicular.

Testicular masses

There were 8 testicular mass lesions. Two cases were suggestive of abscesses, 3 of infiltrative processes, and 2 with testicular calcifications. One case had intratesticular cyst.

Extratesticular mass lesions

Fifty extratesticular masses were hydroceles. Others were 17 epididymal, 15 scrotal varices, 8 scrotal hernias, 4 hematomas, and 1 each of spermatic cord and scrotal wall cysts.

Solitary hydroceles were found in 23 cases while 19 were associated with inflammatory disease. They were found with epididymal cysts in 6 and with varices in 4 cases. Three hydoceles had complex features of

septations and debris, while 2 were communicating with peritoneal cavity.

Epididymal masses were all cystic and solitary in 10 cases. Two cases had complex features and could not be differentiated from spermatoceles and abscesses. Six were associated with hydroceles while two coexisted with varices. The number of masses in each epididymis varied from single to multiple.

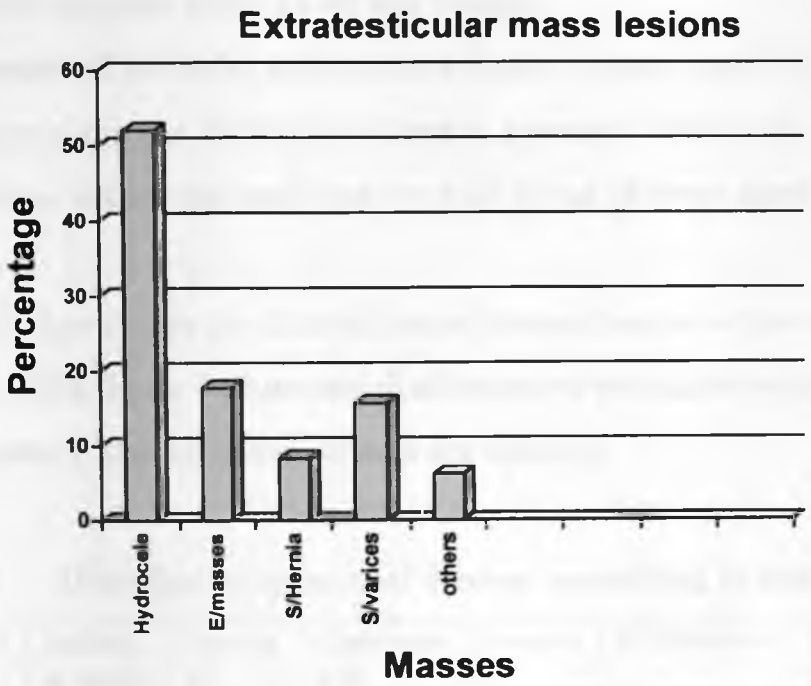
There were 8 cases of hernia, 6 inguino-scrotal and 2 inguinal. Sonographic features of hernias included bowel gas, peristaltic motion, and compressibility. The hernias were associated with undescended testicles in 4 cases and hydrocele in 3 cases.

Scrotal varices were diagnosed in 15 patients at sonography. Six of these were solitary, 4 associated with hydrocele, 6 with testicular atrophy and 2 with epididymal masses.They were diagnosed based on suggestive clinical history, multiple hypoechoic/cystic lesions(measuring more than 2mm in diameter) and with colour flow at Doppler.

The other rare scrotal masses were 4 hematomas and one each of scrotal wall and spermatic cord cyst. The hematomas had suggestive history of trauma and torsion.

The figure (2) below illustrates distribution of extratesticular mass lesions.

Figure 2



Overall distribution of sonographic diagnoses according to age brackets.

Table 3 below shows overall distribution of scrotal diseases in the various age groups. Hydrocele was the most common scrotal lesion followed by inflammatory. They were found in all the age groups with predominance in those aged 20-50yrs. Most undescended testicles were in patients aged less than 10 years. The slight increase in cases aged 21-30yrs included the late presentations associated with infertility. Scrotal varices were most prevalent between 20-40years.

Two peaks were observed for testicular torsion, one at 11-20 years and the other at 31-40 years.

The majority of cases with epididymal lesions were aged between 21-50yrs with the peak in the 31-40 age bracket.

Fifty percent of testicular masses were found in those aged 21-30 years.

Other scrotal masses inclusive of hernia, spermatic cord cyst, hematomas, and scrotal wall cyst were all found in those aged less than 50years.

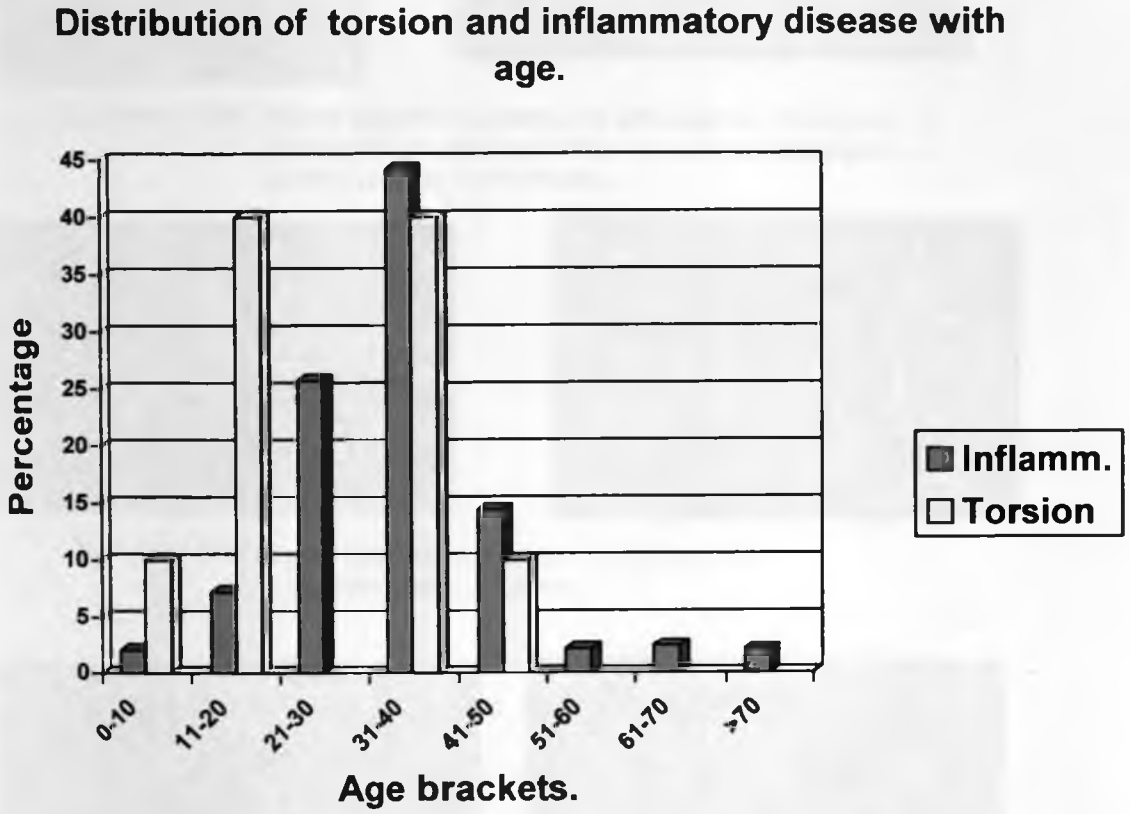
Table 3 below shows the distribution of scrotal disease in the various age groups, while figure 3 illustrates distribution of testicular torsion and inflammatory disease in the various age brackets.

Table 3 Distribution of scrotal disease according to age brackets.

up	Normal	Inflam m atory	Torsio n	Undescen ded	S/varice s	Hydroceles	E/masse s	Testicular
)	11%	2.0%	10%	64%		14%		
20	11%	7.2%	40%	12%	6.7%	2%		
30	22%	25.7%		16%	40%	16%	23.5%	50%
40	56%	44.2%	40%	8%	40%	28%	35.3%	12.5%
50		14.4%	10%		6.7%	16%	17.6%	12.5%
60		2.1%				8%		
70		2.4%			6.7%	14%	17.6%	
		2.1%				2%	5.9%	25%
tal es	9	43	10	25	15	50	17	8

The graph below illustrates distribution of inflammatory scrotal disease and torsion in the various age brackets.

Figure 3



ILLUSTRATIONS

Illustration 1 a&b; Normal tesicular and epididymal echopatterns of a 25 year old patient who presented with on and off mild scrotal pain. US demonstrated normal findings.

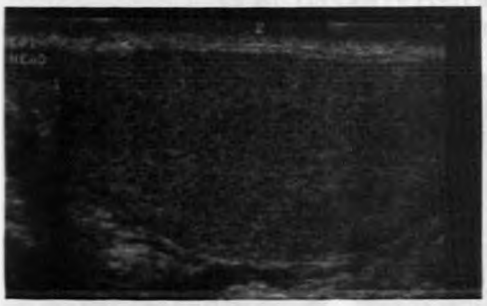


Illustration2 a&b; Normal testicular echopattern of a 32 year old being investigated for infirtility

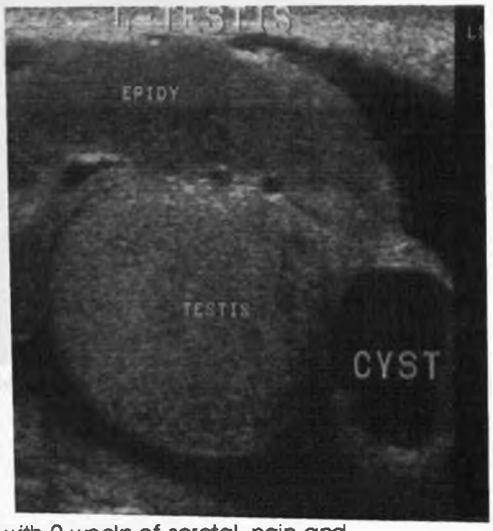


Illustration 3 a&b; 28 year old patient, presented with 2 weeks of scrotal pain and swelling. US showed features of epididymitis with enlargement and hypervascularity. An epididymal cyst was also seen.

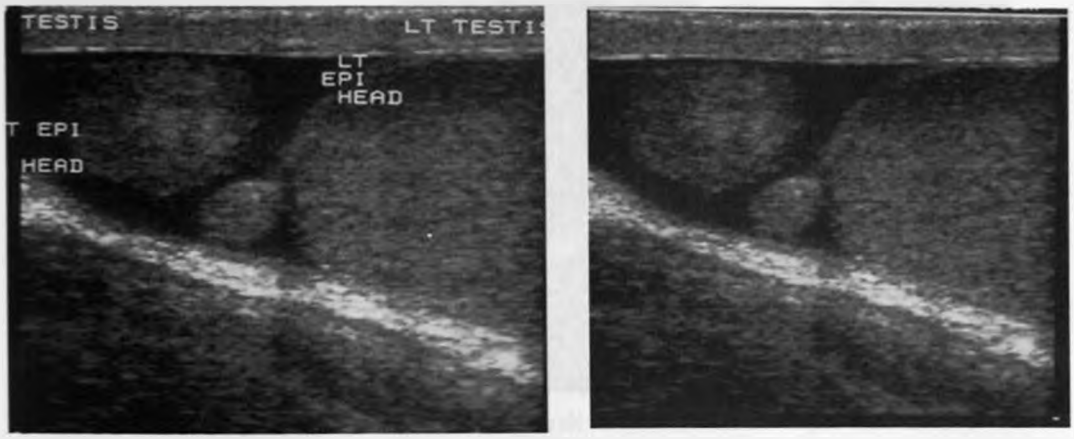


Illustration 4 a&b; 25 year old patient with 8 day history of trauma and scrotal pain. US demonstrated appendix testis incidentally, in association with mild bilateral hydrocele.

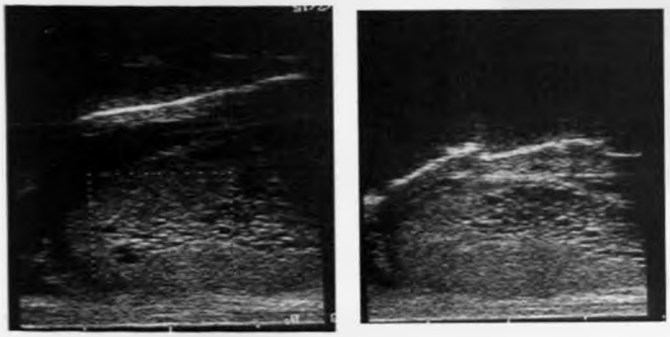


Illustration 5 a&b; Intratesticular tubular ectasia of rete testis in a 32 year old patient with 3 months of scrotal pain. Mild hydrocele was demonstrated.

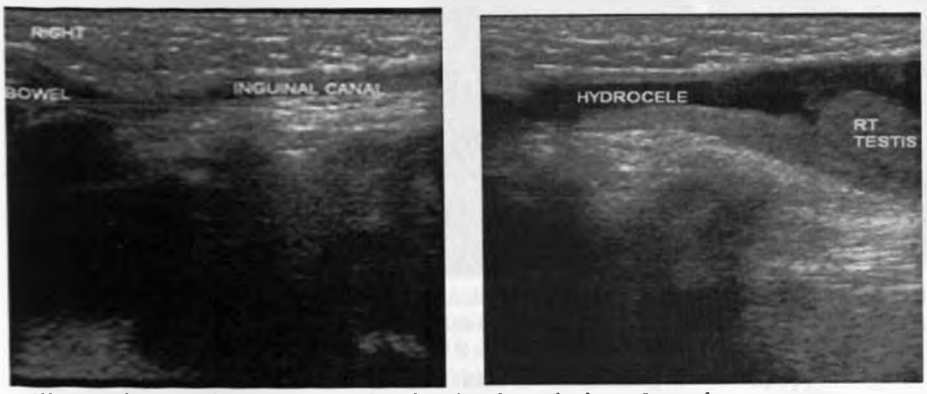


Illustration 6 a&b: Communicating hydrocele in a 6 week old baby with fluctuant scrotal swelling.

II

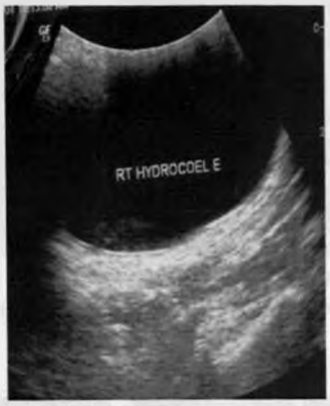


Illustration 4: 54 year old with painless scrotal swelling. US demonstrated bilatera non-communicating hydrocele. more on the right.

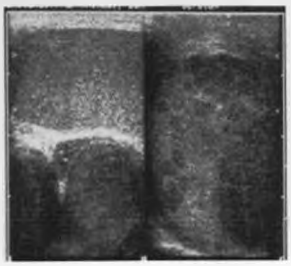


Illustration 5: 24 year old patient with 4 week history of scrotal pain and swelling. US showed subacute epididymo-orchitis with focal hypoechoic areas. It showed increased vascularity at colour doppler.

Illustration 6: Granulomatous epididymorchitis in a 25 year old with 6 weeks of scrotal pain, swelling and discharging skin sinus. US showed increased vascularity with focal hypoechoic areas and a sinus track communicating with skin surface.

III

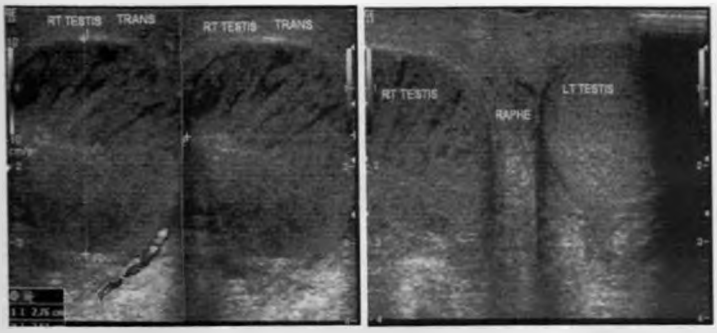


Illustration 10 a, b &c;14 year old with 3 week history of trauma and acute onset of scrotal pain. US demonstrated Subacute/missed torsion with necrotic areas. There was no flow at colour doppler.

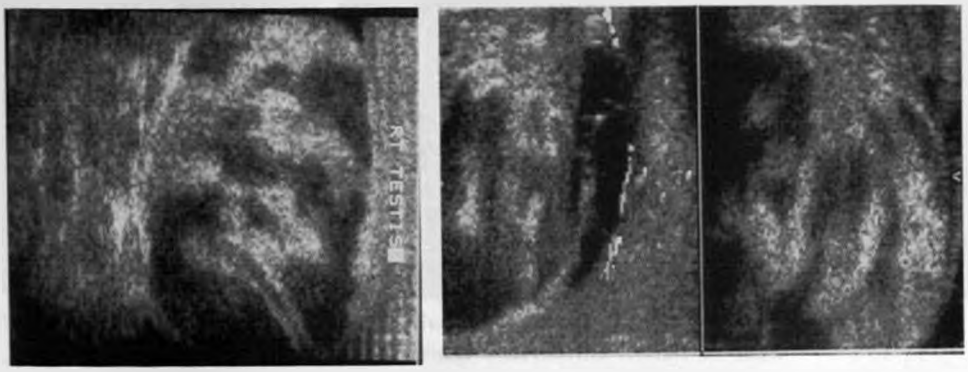


Illustration 11 a&b; 32 year old with 4 week h/o s/pain and swelling followed by atrophy.US showed features of chronic torsion /infarction with heterogeneinity and no vascularity.

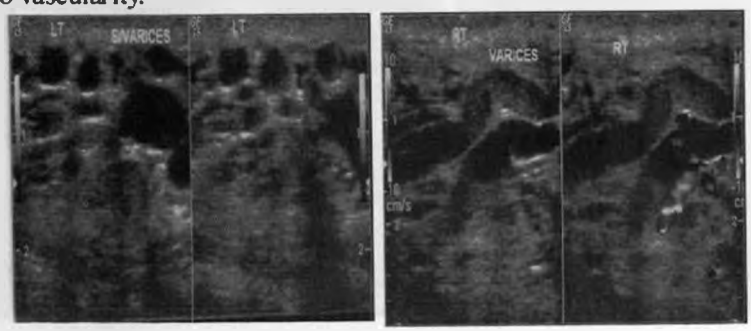


Illustration 12; 24 year old with 3 months of Scrotal swelling and mild pain. US demonstrated bilateral s/varices. They showed increase in size with valsalva maneuver and positive flow at colour doppler.

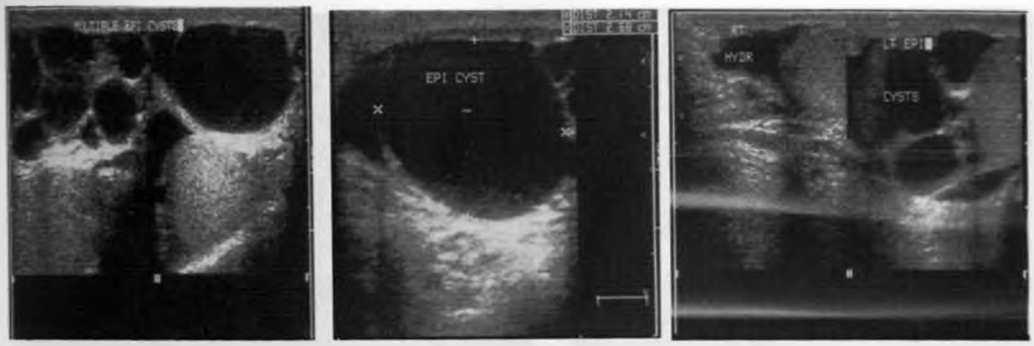


Illustration 13; Multiple bilateral epididymal cysts in a 42 year old patient with 3 years of scrotal swelling. Mild hydrocele was found in association.

Illustration 14; 37 year old with more than one year of painless scrotal swelling. US showed hypoechoic extratesticular mass with normal testis ? tumour.

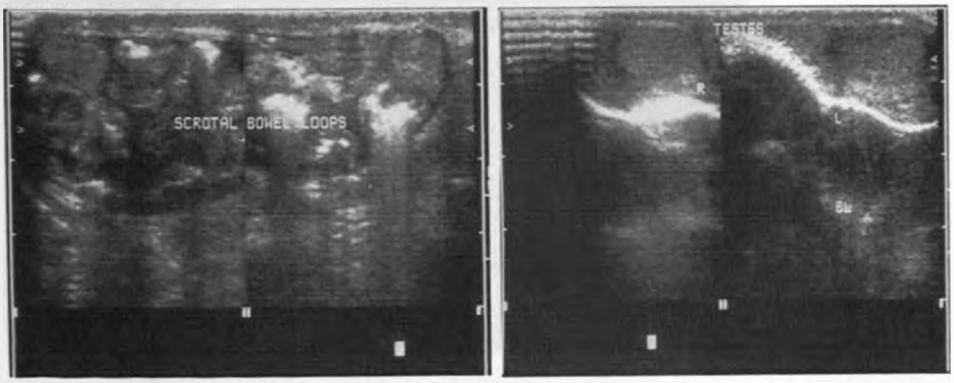


Illustration 15; 3 month old baby with bilateral scrotal swelling since birth. US demonstrated scrotal hernia with gas in the bowel.

V

Illustration 16; 18 year old with 6 days of acute onset of scrotal pain. US demonstrated Subacute torsion with heterogenous extratesticular collection ? S/hematoma.

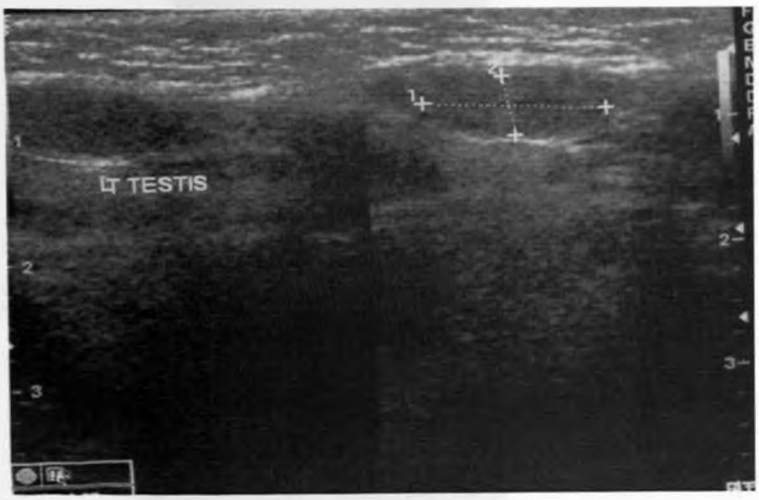
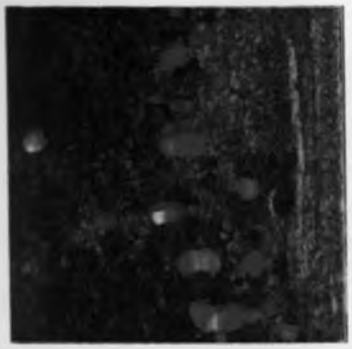


Illustration 17; 2 year old with bilateral undescended testes.
US showed atrophic and hypoechoic testes in inguinal canal.



Sub acute epididymo-orchitis with increased vascularity at colour doppler in a 24 yr old with 4 week history of pain and swelling..

Missed torsion with no flow at colour doppler in a 14 yr old with 3 week history of trauma and acute pain.

Scrotal varices with flow at colour doppler, in a 24 yr old with 3 month of scrotal pain & swelling.

Vii

Discussion

One hundred and thirty eight patients were examined over a period of 6 months, from July 2004 to January 2005.

Their ages ranged from 6 weeks to 90 years with a mean age of 30.1 years. Similar findings were found in studies done elsewhere. At Mulago Hospital Uganda, James Opiyo[23] found a range of 6 months to 85 years with a mean age of 31.2 years in those presenting with scrotal pain. E. Alert et al[22] found a range of 6 to 73 years and a mean age of 30 years, in patients with extratesticular masses.

These studies show that scrotal disease affects people of all ages irrespective of their geographical variation. The similarity is possibly due to common disease determinants. Scrotal disease was most prevalent in the 20- 40 years age group, which accounted for 50.7% of all the cases (figure 1). Opio's study[23] of scrotal pain in Uganda found the highest frequency in the 19–39 years age groups. These age groups represent the most sexually active in the society with increased risk of scrotal disease.

A significant number of cases were noted among those less than 10years accounting for 17.4% of all the cases. The majority had undescended testicles constituting 64% of all the cases in this age bracket. The predominance of these cases in this age bracket can be explained by their congenital nature.

Ninety three percent of the 138 patients had abnormal scrotal sonographs. In Nedan Yagan's study, 89% of the cases showed abnormalities, which is almost similar to this study.

Clinical findings

Presenting complaint, duration of illness, and nature of onset.

Scrotal swelling was the most frequent complaint at presentation, accounting for 28.3%. This was followed by pain (25.4%). A combination of pain and swelling was the third most common presentation (23.2%). Other clinical presentations were undescended testicles 18.1%, infertility 3.6% and testicular atrophy 1.4 %.

Duration of illness varied. However the majority of patients presented with symptoms lasting between two month and one year (42.0%)(table 1). Painful lesions presented earlier compared to those with no pain. Late presentations may be due to patients seeking treatment in lower level hospitals and clinics and only being referred for investigation when empirical treatment fails. A few other patients shy away from treatment because of the social stigma attached to urogenital conditions.

The majority of cases (77.5%), had insidious onset of illness. Acute onset was reported by only 21.5% of cases. The painless lesions presented insidiously while those with pain presented acutely.

Clinical diagnosis

Extratesticular mass lesions including epididymal masses was the most frequent clinical diagnosis accounting for 26.8% of the cases.

Undescended testicles were the next most common clinical diagnosis accounting for 18.15%.The third commonest clinical diagnosis was inflammatory scrotal lesions contributing 16.7%. Other diagnoses included torsion 13%, testicular mass 4.3%, and infertility 2.2%.

Evaluation of scrotal disease is often incomplete without a good history and physical examination. A tentative diagnosis is usually made based on clinical history and physical examination. This is made easier in cases presenting with painless scrotal disease allowing thorough examination of the scrotum.

Clinical evaluation however is limited in the characterization of scrotal lesions into either testicular or extratesticular, especially when there is pain.

It is usually difficult to differentiate clinically between infective and non infective lesion like torsion presenting with pain, unless one is provided with a good history.

Clinical history and physical examination findings are complimented and at times confirmed by sonography. The three approaches namely clinical history, physical examination and ultrasound therefore should be applied in the evaluation of scrotal disease.[21]

Sonographic findings

Inflammatory diseases

In this study, inflammatory disease accounted for 31.2% of the patients studied. The age bracket most commonly involved was 31–40 years (44.25%), followed by 21-30 years (25.7%)(table 3). Similar findings were documented by Opio[23]. He found the highest frequency among the 19–29 age bracket followed by 30–39 bracket.

These two age brackets represent the most sexually active people in the society and thus are at a higher risk of scrotal disease.

Inflammatory scrotal disease is one of the most common causes of scrotal pain not only in our study but also in others [1, 9, 12].

Based on clinical features and sonographic findings inflammatory scrotal disease was categorized into both acute and chronic epididymitis , acute and chronic epididymo-orchitis and granulomatous epididymo-orchitis. Acute epididymitis was the most frequent inflammatory scrotal disease accounting for 27.9%, followed by acute epididymo-orchitis (25.6%) and chronic epididymitis (23.3%) respectively. Chronic epididymo-orchitis was the next most common

(14.0%), while granulomatous epididymo-orchitis was the least common inflammatory disease (9.3%).

Epididymitis is often the most common cause of painful scrotum and primarily affected in epididymo-orchitis [9,17]. V.S. Dogra in his review of epididymitis found it as the commonest cause of acute scrotal pain and that it may be complicated by orchitis in 20 – 40% of cases . Both acute and chronic epididymitis accounted for 52% of the causes of scrotal pain at Mulago Hospital Uganda, as shown by Opio's study.

Sonographic features of inflammatory disease are varied and often non specific with overlap between the various forms. Significant overlap is also seen with scrotal masses.

Increased vascularity was a constant finding in acute cases and a high proportion of both chronic and granulomatous forms. Reduced blood flow was demonstrated in only 2 cases of chronic epididymo-orchitis. Cases of testicular ischaemia and even infarction following inflammatory process are attributed to edematous swelling compromising the vascular supply. [12, 17]

Testicular enlargement was demonstrated in a high proportions of all inflammatory conditions. Only 2 cases showed atrophy and reduced blood flow. All the forms demonstrated highly variable echopatterns. Heterogenicity and hypoechogenicity were common findings in all the cases with increased echogenicity being demonstrated only in 2 cases of chronic epididymitis.

Testicular enlargement results from edema and increased blood flow in the acute and sub acute forms. These reduces with time, resulting in either normal or atrophic changes seen in chronic forms. The inflammatory changes in the testis vary with time and correspond to changes in echopattern. Acute cases are enlarged and generally hypoechoic with hypervascularity. Chronic cases show normal or

moderate increase in blood flow and enlargement. Intermediate changes are seen in sub acute forms.

Hydrocele complicated some inflammatory cases (44.2%). It has been demonstrated in earlier studies to be a non specific feature occurring in association with virtually any scrotal pathology. Hydroceles may be idiopathic. However when hydroceles show significant debris or septations, they may suggest association with inflammatory process.

Focal hypoechoic areas within the testes were demonstrated more commonly in chronic forms and were larger in granulomatous inflammation simulating hypoechoic mass lesions. These could represent focal areas of necrosis or abscess formation which are known to occur with inflammation. Sonography could not differentiate abscess from necrosis. Focal hypoechoic areas of inflammation are indistinguishable at sonography from testicular tumors like leukaemic infiltration and necrotic areas of torsion[17].

Other sonoghraphic findings included thickened scrotal wall, seen in both chronic epididymitis and granulomatous inflammation. Testicular microcalcifications were found in the later.

Scrotal wall changes are frequently associated with inflammatory disease and may also be seen in both torsion and traumatic lesions as part of the inflammatory change.

Sonographic features without other supportive evidence of inflammation are not helpful in the diagnosis of inflammatory scrotal disease [17]. This is because there is great overlap with non inflammatory lesions at sonography . However increased vascularity detected at colour and power Doppler is a sensitive indicator of inflammation, although it can be seen in some malignant infiltration of the testis by tumor. On the other hand, the later is usually not associated with pain[12].

Enlargement is not a specific feature for inflammation. It is also found in other conditions like testicular tumors or torsion. This in the absence of other features is indeterminate for inflammation. Detorsed testicle or partial torsion may simulate inflammation, demonstrating reactive hypervascularity and enlargement due to edema. [17]

Testicular calcification is a non specific feature being seen in old infection and more commonly as an incidental finding. However caution needs to be exercised as it has been associated with intratesticular neoplastic changes, specifically intratubular germ cell neoplasia (IGCN).

V.S. Dogra in his review of epididymitis found combination of enlarged size, altered echopattern at gray scale(hypoechogenicity, hyperechogenicity or heterogenicity) and increased vascularity with or without reactive hydrocele to be diagnostic[9].

Testicular torsion

Ten cases of torsion were documented. They were either sub acute or chronic having presented after 24 hours. Non was found in the acute state. Classification of torsion is based on duration into acute (0-24hrs), sub acute or missed (1-10 days) and chronic or infarcted (more than 10 days). The changes with time correspond with the sonographic findings.[17]

The age range was 8 – 44years. Five of the 10 cases were younger than 20 years. This compares with findings in earlier studies, which have demonstrated higher frequency among adolescent boys [9, 12, 17]. Opio at Mulago hospital also found similar results.

Only 9 of the 18 patients with a clinical diagnosis of torsion were confirmed by ultrasound. One case seen at ultrasound had not been suspected clinically. The clinically misdiagnosed cases constituted 50%

of the suspected cases. This compares with the observation made by Opiyo at Mulago hospital in which 50% of cases were erroneously managed for torsion. The significant variation between clinical and sonographic diagnosis reflects the overlap of clinical signs between inflammatory disease and torsion.

Salvageability of torsed testicle is related to duration and degree of rotation [9, 12]. A nearly 100% salvage rate exists within 6 hrs. However this study failed to capture acute torsion probably due to over reliance by clinicians on clinical evaluation and the urgency of intervention in acute torsion.

Absence of blood flow in both sub acute and chronic forms, of torsion was a constant feature at sonography. Both echo texture (heterogeneity) and echopattern (hypoechogenecity) as well as necrosis constituted the non specific features for both subacute and chronic torsion. These features are also demonstrated in inflammatory scrotal disease.[1,12] The overlap in these sonographic features can also be attributed to changes following torsion representing a continuum of events as opposed to time dependent classification.

Scrotal haematoma and thickened scrotal wall were respectively demonstrated in 50% and 33% of the sub acute cases.

Testicular atrophy was found invariably in chronic torsion and enlargement in subacute forms. This reflects the changes in sonographic features with time.[17] Infarcted testis undergoes necrosis and reduces in size with time.

Due to late presentation coupled with inaccurate clinical information, it was not possible to distinguish lack of vascularity as due to torsion proper or due to an inflammatory process with vascular compromise.

Maldescended testicles (undescended testicles)

Absent testicles from the scrotum can either be cryptorchid, absent or ectopic. Cryptorchidism is arrest of the normal descent between the lower pole of the kidney , the site of origin and external inguinal ring.[17]

Twenty six out of the 138 cases were clinically suspected to have either unilateral or bilateral absent testicles from the scrotum. Out of the suspected cases, one was found normally located in the scrotum. Sixty four percent of the patients with maldescended testes were less than 10 years of age.The remaining 36% fell within the age bracket of 11 – 40 years representing the late clinical presentations. Thirteen patients had bilateral maldescended testes, 8 were right sided, and 4 left sided. Four cases were retractile, located in the upper scrotal sac and below external inguinal canal, with the remaining 21 cases, lying above external inguinal ring.

Sixteen out of the 21 cases, were located within inguinal canal representing 64% of undescended cases. This is lower than findings in earlier studies which have demonstrated 75 – 80% of cases in inguinal location.[17]

Sonography is able to locate the testis within the inguinal canal, evaluate its size and echopattern. It has sensitivity of 97% and 75% in detecting palpable and non palpable testicles respectively[17].

Maldesended testicles are usually hypoechoic and atrophic, making their evaluation for malignant infiltration difficult despite being more liable to malignant degeneration. Most malignancies are hypoechoic and are therefore masked by the hypoechogenicity. The testicles are known to be complicated by malignant degeneration, infertility, torsion and indirect inguinal hernia. Because of the close relationship between testicular descent and processus vaginalis, hernial sac resulting from

persistent processus vaginalis is demonstrated in upto 90% of patients with undescended testis [17].

Sonography is limited in detecting undescended testicles above deep inguinal canal which could be located anywhere along the path from the lower pole of the kidney. It could also be ectopic or congenitally absent. MRI and RNI have demonstrated higher sensitivity compared to US in locating cryptorchid testicles above deep inguinal ring.[12]

Sonographic features vary from normal in the majority of those located in inguinal canal and retractile in upper scrotum, to atrophic with either hypoechoic or heterogenous echopattern.

Atrophy was demonstrated in 9 testicles being more in the older age group and appearing hypoechoic. Normal echopattern was found in 14 testicles comprising the retractile in upper scrotal sac and some of those in inguinal canal. The majority of these were found in the young.

One testicle showed heterogenous echopattern and could not be differentiated from infarcted testis.

The abnormal sonographic changes and increased propensity to malignant degeneration is thought to result from their abnormal location and poor response to hormonal stimulation.[1]

The findings in this study did not detect features suggestive of malignant degeneration although this could not be ruled out owing to inherent hypoechogenecity.

Abnormal descent is often associated with other congenital abnormalities. Among associated abnormalities found included, inguino-scrotal hernia found in 4 cases, hydrocele 4 cases, scrotal varices 1 case and ectopic kidney found in 1 case.These findings could have been directly related to the abnormal descent of testicles or incidental findings as they can occur with normally located testicles.

Scrotal mass lesions

Scrotal mass lesions were demonstrated in over 75% of all the cases. Testicular mass lesions, accounted for 5.8% of sonographic diagnoses while extratesticular accounted for 69.6%. Considered alone, 92.4% were extratesticular while 7.7% were Intratesticular. The Majority of testicular masses were cystic. Three were simple cysts, while 2 had features suggestive of abscesses with irregular walls and echogenic debris.

Focal intratesticular masses suggestive of testicular neoplastic infiltration were demonstrated. There were two cases of intratesticular calcification found incidentally.

Scrotal mass lesions are the commonest causes of painless scrotal swelling. At sonography they are broadly classified into extra and intratesticular with a high degree of accuracy, nearly 100%[9, 12]. Categorization into these two compartments is important as it bears important implications in their management. The majority of extratesticular mass lesions are benign while intratesticular are malignant.[1]

While sonography is highly accurate in differentiating extratesticular from testicular, it is less accurate in determining benign and malignant masses. Other modalities including biopsy with histology would therefore be required for definitive diagnosis.

Microcalcifications have been found to be non specific in the testis and largely benign except for the small proportion associated with intratubular germ cell neoplasia in which case biopsy is considered for definitive diagnosis.

Extratesticular mass lesions were distributed as shown in figure 2. Hydrocele was the most common extratesticular mass accounting for 52% of the total. Hydroceles are usually painless at presentation and

are the commonest cause of a painless scrotal swelling[17]. They are found in association with many scrotal lesions, but may be idiopathic. For this study, 23 were solitary. Nineteen were associated with inflammatory processes. Two cases were found in the young with intraperitoneal communication. Six cases co-existed with epididymal cysts and 4 with scrotal varices.

There are two forms of hydroceles. Non-communicating seen in older age group and communicating seen in newborns with patent processes vaginalis. Certain features suggest the associated condition at examination. Echogenic debris with septations suggest pyocele complicating inflammatory process.

Epididymal mass lesions were demonstrated in 17 cases. The majority were cystic and difficult to differentiate from spermatoceles at examination. They were benign in appearance. E. Alert et al,[22] found 15 out of 17 epididymal masses (88%) to be benign following histology and concluded that spermatoceles are more common than simple epididymal cysts. Sonography is useful in defining their cystic nature and extratesticular location but can not distinguish between the two.

Their location within the epididymis is often helpful in their differentiation. Simple cysts can occur anywhere in the epididymis whereas spermatoceles are almost exclusively located in epididymal head.[17]

Other causes of epididymal mass lesions include inflammatory processes with focal micro- abscesses. These are however easy to delineate as they are often associated with other findings in the epididymis to support their infective nature.

Scrotal hernia is an uncommon cause of scrotal mass compared to hydrocele, epididymal cysts or scrotal varices. They were detected in

8 cases accounting for 8.3% of extratesticular masses. Six were inguino-scrotal while 2 were inguinal. They were associated with hydrocele in 3 cases and undescended testicles in 4. As has been mentioned , there is a recognized association with undescended testes especially with patent processus vaginalis. Characterization into either direct and indirect depends on identification of inferior epigastric artery at US. However , this could not be determined in this study.
Scrotal varices were demonstrated in 15(10.9%) cases and distributed as follows; 6 solitary, 4 associated with hydroceles and 6 with testicular atropy.
Scrotal varices are common and usually found incidentally in upto15% of adult male population with the highest frequency between 15 - 25 years. There is strong evidence of being more common on the left due to anatomic difference in the vanous drainage.[17]
They are strongly associated with infertility being demonstrated in upto a third of infertile males. However , there was poor correlation in this study probably because there were few cases of infertility at presentation to establish a trend. A proportion of these cases were chance findings in the presence of other scrotal conditions.
Other scrotal findings included scrotal haematomas found in association with torsion and one each of scrotal wall and spermatic cord cysts. The later were incidental findings.
Two cases of appendix testis and one case of intratesticular tubular ectasia were found as incidental findings. They are usually asymptomatic, though on rare occasions appendix testis may undergo torsion and simulate inflammatory process or testicular torsion.

Conclusion.

Scrotal disease affects males of virtually all age groups with predominance in the middle aged.

Extra testicular scrotal mass is the most common scrotal finding at KNH.

Testicular mass lesions were found in a small proportion of cases.

Inflammatory scrotal disease affects a significant proportion of patients, the majority in their active sexual life.

Maldesended testes is the main scrotal disease in the young

Recommendations.

1. US is a useful investigative tool with high sensitivity and specificity and therefore should be utilized widely in our region for the evaluation of scrotal diseases.
2. There is a need to incorporate histological analysis for definitive diagnosis of suspected scrotal tumors at US.
3. Radiologists should appraise themselves with ultrasound features of scrotal disease, to raise index of suspicion and increase accuracy of diagnosis.

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APPENDIX

Appendix I: DATA COLLECTION SHEET

Part I General Information

1. X-Ray / US No._____
2. Study Number: _____
3. Date of imaging:_____

Part II Patient particulars

4. Age in years: ☐

Part III Clinical Data

5. Presenting Complain
   a) Scrotal pain Unilateral ☐ Bilateral ☐
   b) Scrotal swelling Unilateral ☐ Bilateral ☐
   c) Scrotal Discomfort Unilateral ☐ Bilateral ☐
   d) Scrotal pain & swelling Unilateral ☐ Bilateral ☐
   e) Others (Specify):_____

6. Duration of presenting complain. ☐

7. Associated History
   Trauma ☐ Born with ☐ Associated function ☐

   Others explain_____

8. Nature of onset
   Acute ☐ Insidious ☐

9. Progression

Progressive ☐ Non- progressive ☐

Part IV Signs and symptoms

10. Scrotum

a) Scrotal mass Unilateral ☐ Bilateral ☐

b) Scrotal Tenderness Unilateral ☐ Bilateral ☐

c) Tender mass Unilateral ☐ Bilateral ☐

d) Others (specify) _____

_____

_____

11. A. Testicular

a) Testicular mass Unilateral ☐ Bilateral ☐

b) Testicular Tenderness Unilateral ☐ Bilateral ☐

c) Testicular mass & tenderness Unilateral ☐ Bilateral ☐

d) Others (specify) _____

_____

_____

Part V Clinical Diagnosis

12. A. Extratesticular

a) Torsion Unilateral ☐ Bilateral ☐

b) Epididymitis Unilateral ☐ Bilateral ☐

c) Scrotal Mass (Hematoma) Unilateral ☐ Bilateral ☐

d) Scrotal Mass (Hydrocele) Unilateral ☐ Bilateral ☐

e) Scrotal Mass (Hernia) Unilateral ☐ Bilatreral ☐

f) Others (specify) _____

_____

_____

B. Intratesticular

a) Testicular Mass (solid) Unilateral ☐ Bilateral ☐

b) Testicular Mass (cystic) Unilateral ☐ Bilateral ☐

c) Orchitis Unilateral ☐ Bilateral ☐

d) Epididymorchitis Unilateral ☐ Bilateral ☐

f) Others (specify) _____

_____

_____

Part VI Ultrasound Diagnosis

13. Ultrasound Diagnosis

a) Hydrocele Unilateral ☐ Bilateral ☐

b) Scrotal hernia Unilateral ☐ Bilateral ☐

c) Scrotal hermatoma Unilateral ☐ Bilateral ☐

d) Torsion Unilateral ☐ Bilateral ☐

e) Testicular cyst Unilateral ☐ Bilateral ☐

f) Orchitis Unilateral ☐ Bilateral ☐

g) Epididymitis Unilateral ☐ Bilateral ☐

h) Epididymorchitis Unilateral ☐ Bilateral ☐

i) Testicular Mass (solid) Unilatera ☐ Bilateral ☐

j) Others _____

_____

_____