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High Frequency USG and Colour Doppler USG in Scrotal Swelling

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Introduction

Acute scrotum is described as "acute onset of scrotal discomfort and swelling that necessitates emergency surgery or specialized medicinal care".[1] Scrotal swellings are most prevalents in both children and adults.

Acute scrotum can be caused by a multitude of factors. Torsion of the testis, torsion of the appendix testis, epididymo-orchitis, scrotal wall abscess, Fournier's gangrene, scrotal haematoma, testicular tumor, and a variety of other diseases such as "idiopathic scrotal oedema, scrotal fat necrosis, Henoch Schonlein purpura, ischemic orchitis, Because of their incidence and severity, testicular torsion, epididymo-orchitis, and Fournier's gangrene need special attention.

Both testes are located on the surface of the scrotum in a cutaneous bag. Though it is easily accessible for clinical examination, it is difficult to distinguish benign from malignant swellings, as well as intra-testicular from extratesticular swellings, and hydrocele complicates determining the status of the underlying testis.

Clinical indications and symptoms are frequently ambiguous, changeable, and deceptive. As a result, visualizing is extremely useful for problem solving. Clinical assessment of scrotal contents was limited to palpation and trans-illumination until the mid-1970s.

Since Murray Miskin and Jerald Bain published their first report in 1974 on using diagnostic ultrasound to investigate scrotal pathologies, advances in instrumentation and transducer design have progressed to the point where high frequency US is now the modality of choice for investigating scrotal and testicular pathology.[2]

CT and MRI are the most used imaging techniques for other body regions, although both have limits in scrotal disorders. High-resolution sonography offers good anatomic information of the scrotal wall, testis, and epididymis; testicular perfusion can be evaluated using color Doppler and power Doppler imaging. Sonography is a non-ionizing, non-invasive imaging technique that is quick, simple, affordable, and widely available. For both acute and non-acute scrotal disorders, high resolution and color Doppler Sonography is now universally regarded as the method of choice for screening and diagnosis.[3]

Aims and Objectives

Until the advent of ultrasonography and its application to scrotal imaging, diagnosis of scrotal pathologic conditions traditionally has been based upon the clinical history and physical examination. Definitive diagnosis is not always possible with clinical examination, especially in patients with a marked inflammatory reaction and it is often difficult to decide whether a palpable scrotal abnormality arises from testicle itself or from extra testicular elements in scrotum.

This study will be an effort in establishing the role of High frequency Ultrasound as an investigating modality in accurately distinguishes between testicular and extra testicular pathology of scrotum.

High frequency gray scale ultrasonography enables only in, identification of morphological alterations that are associated with scrotal disorders. This study will also be an effort in establishing the role of Color Doppler Sonography in evaluation of scrotal pathology.

Objectives of the Study

- To evaluate scrotal pathology with reference to
- Assess the role of High frequency real time ultrasonography in accurately distinguish between Testicular and Extra testicular scrotal masses.
- Assess the role of Color Doppler sonography in evaluation of scrotal pathologies.

Materials and Methods

Study Design: Prospective observational study

Study settings: Department of Radiodiagnosis Katihar Medical College & Hospital, Katihar.

Place of study: Katihar Medical College & Hospital, Katihar.

Study period: November 2019 to October 2021.

Study population: During the study period, all eligible candidates with scrotal swelling who came to the Department for scrotal USG or Color Doppler USG and met the inclusion criteria were included in the study.

Sample Size: Following ethical committee approval and informed written agreement, the proposed randomised trial was conducted on at least 50 patients with scrotal swelling who came to the Department for scrotal USG or Color Doppler USG throughout the study period and met the inclusion criteria.

Sample Design: The patients were selected randomly only after getting the following;

- Institutional ethical committee clearance.
- Written and informed consent from the patients' side who were fully explained about the study procedure.

Inclusion Criteria:

- Hydrocele
- Pyocele
- Testicular and appendage torsion
- Complete inguinal hernia
- Epididymo Orchitis
- Idiopathic scrotal swelling
- Varicocele
- Intrascrotal mass

Exclusion Criteria:

- Cellulitis
- Sexually transmitted diseases such as gonorrhoea and syphilis

Study Tool: In this work, a 4 to 18 MHz linear transducer was used to do high-resolution real-time grey scale ultrasonography and a Doppler investigation of the scrotum, while a 1 to 5.0 MHz convex curved array transducer of the PHILIPS EPIQ 5G was used to perform abdominal ultrasonography.

Methodology: After receiving clearance and approval from the Institutional Ethics Committee of Katihar Medical College & Hospital, the current study was carried out. The patients' written informed consents were obtained. This prospective observational study was undertaken in the Department of Radiodiagnosis, Katihar Medical College & Hospital, Katihar. The study

was conducted out between November 2019 and October 2021. During the study period, 50 instances of scrotal swelling presented to the Department for scrotal USG or Color Doppler USG, all of which met the study's inclusion criteria.

Patients were submitted to an ultrasound examination and patient data, as well as a full physical assessment, prior to being subjected to the procedure. All of these patients had colour Doppler sonography done on a regular basis. Following that, these cases were followed up on and histopathology reports, fine needle aspiration cytology results, surgical findings, and treatment response were all compared. When clinically indicated, follow-up scans were performed in a small number of instances. In cases of undescended testis, abdominal ultrasound scans were used in conjunction with scrotal scans to look for ectopic testis, tubercular Epididymo orchitis cases to look for abdominal tuberculosis, testicular malignancy cases to look for associated pathology, and varicoceles cases to look for any cause of testicular vein obstruction. Wherever indicated, conventional radiography was performed.

Technique for Scanning: After raising the scrotum with a towel wrapped over the thighs and placing the penis on the patient's abdomen and covering it with a towel, scanning was commonly performed in the supine position. In transverse, saggital, and oblique planes, both hemiscrotums were evaluated. Scanning was also performed while the patient was upright and undergoing the Valsalva manoeuvre. In the event of an undescended testis, an encysted hydrocele of the cord, or a varicocele, further scans of the spermatic cord in the scrotal neck and inguinal canal region were obtained.

The following parameters were examined on a regular basis during an ultrasound scan:

- Testicular dimension and size.

Testicular contour
Normal
Diffuse enlargement
Focal enlargement

- Testicular echogenicity

Normal
Focal abnormality
Hypoechoic
Hyperechoic
Heterogenous Diffuse abnormality Hypoechoic
Hyperechoic
Heterogenous

- Epididymis

Enlargement -- Diffuse
Focal --- Head
Body
Tail
Echogenicity Focal abnormality Hypoechoic
Hyperechoic
Heterogenous
Diffuse abnormality Hypoechoic
Hyperechoic
Heterogenous

- Scrotal wall thickness
- Presence or absence of any collection in scrotal sac
- Presence or absence of any dilated veins
- Doppler assessment of Testes, Epididymis and vascular structures
- Presence of any anomalies in scrotum.

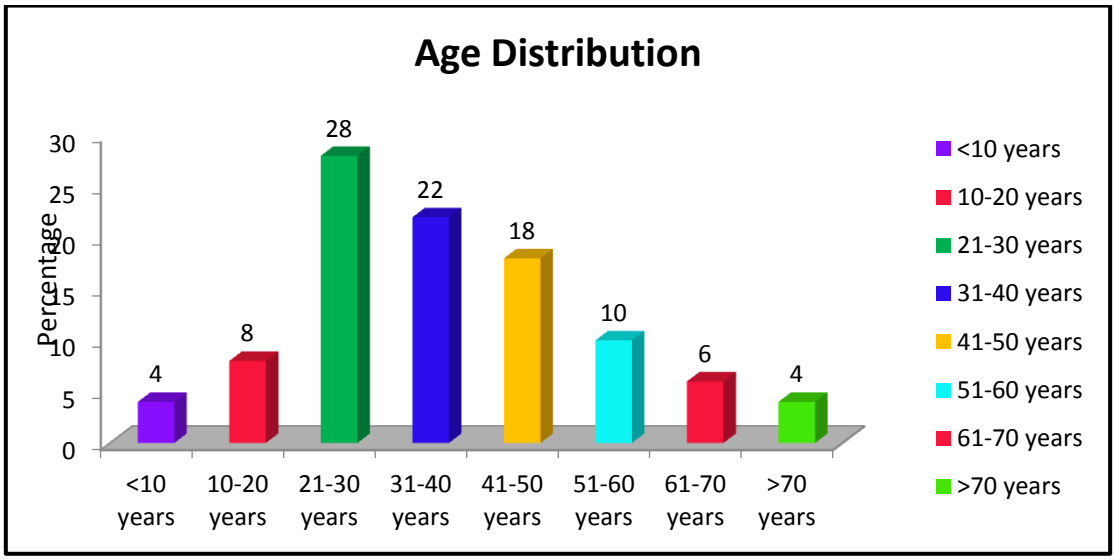
Statistical Analysis: Data was double-checked for accuracy and completeness before being coded and entered into version 23.0 of the Statistical Package for the Social Sciences for analysis. Frequency tables, cross tabulations, and figures are used to present the findings. Categorical data is expressed as a percentage of a frequency. The mean and standard deviation of continuous data with a normal distribution was shown.

Results and Observations

Table 1: Age Distribution

Age Group	Frequency	Percentage
<10 years	2	4.0
10-20 years	4	8.0
21-30 years	14	28.0
31-40 years	11	22.0
41-50 years	9	18.0
51-60 years	5	10.0
61-70 years	3	6.0
>70 years	2	4.0
Total	50	100.0
Mean Age	37.7±15.89	

Figure 1: Age Distribution

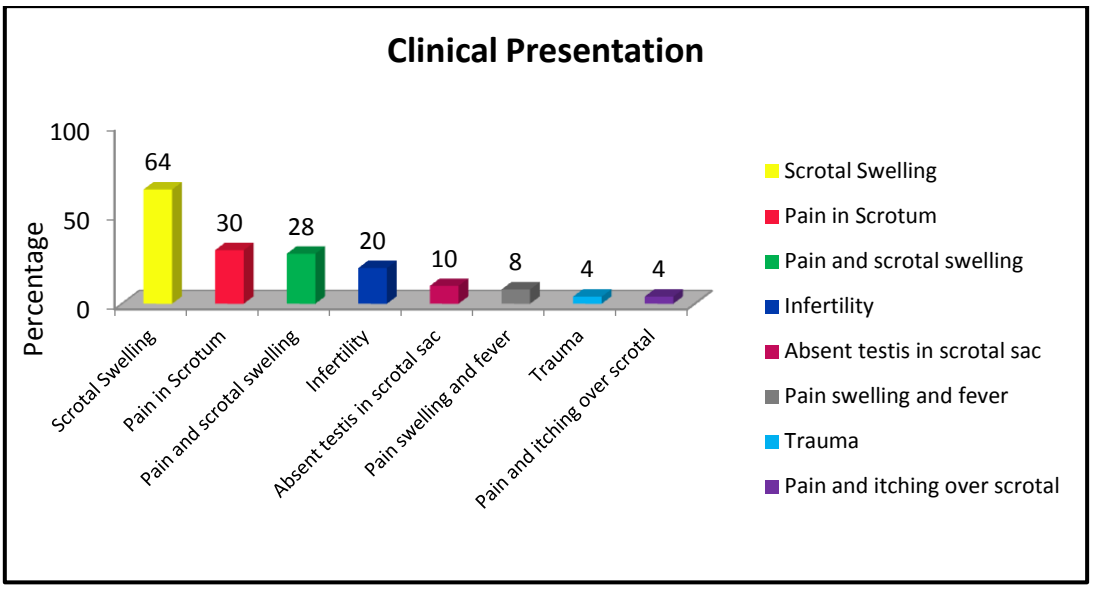


Age distribution of the study participants is presented in **Table 1**. In our study the highest numbers of patients were in their second and third decade of life. Majority of the study subjects were in the age group of 21-30 years (28%) and 31-40 years (22%). Next common age group was 41-50 years constituted 18% patients while 51-60 years age group constituted 10% patients. The mean age of the study subjects was 37.7 years.

Table 2: Clinical Presentation

Clinical Presentation	Frequency	Percentage
Scrotal Swelling	32	64.0
Pain in Scrotum	15	30.0
Pain and scrotal swelling	14	28.0
Infertility	10	20.0
Absent testis in scrotal sac	5	10.0
Pain swelling and fever	4	8.0
Trauma	2	4.0
Pain and itching over scrotal	2	4.0

Figure 2: Clinical Presentation

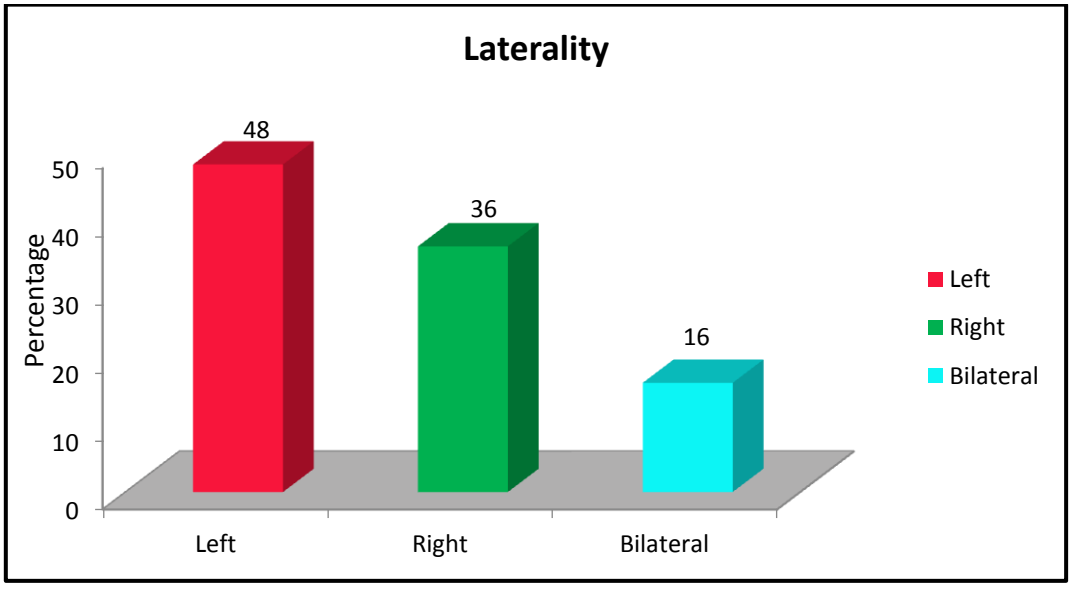


The cases presented with various clinical presentations with frequency are depicted in **Table 2**. Commonest clinical presentation was scrotal swelling (32 cases -64%), followed by only scrotal pain (15 cases - 30%) and then pain and scrotal swelling both in 14 cases (16%), infertility was found in 10 cases (20%). The other clinical presentations were absent testis in scrotal sac (10%), pain swelling and (fever (8%), trauma (4%) and pain and itching over scrotal (4%).

Table 3: Laterality

Laterality	Frequency	Percentage
Left	24	48.0
Right	18	36.0
Bilateral	8	16.0
Total	50	100.0

Figure 3: Laterality

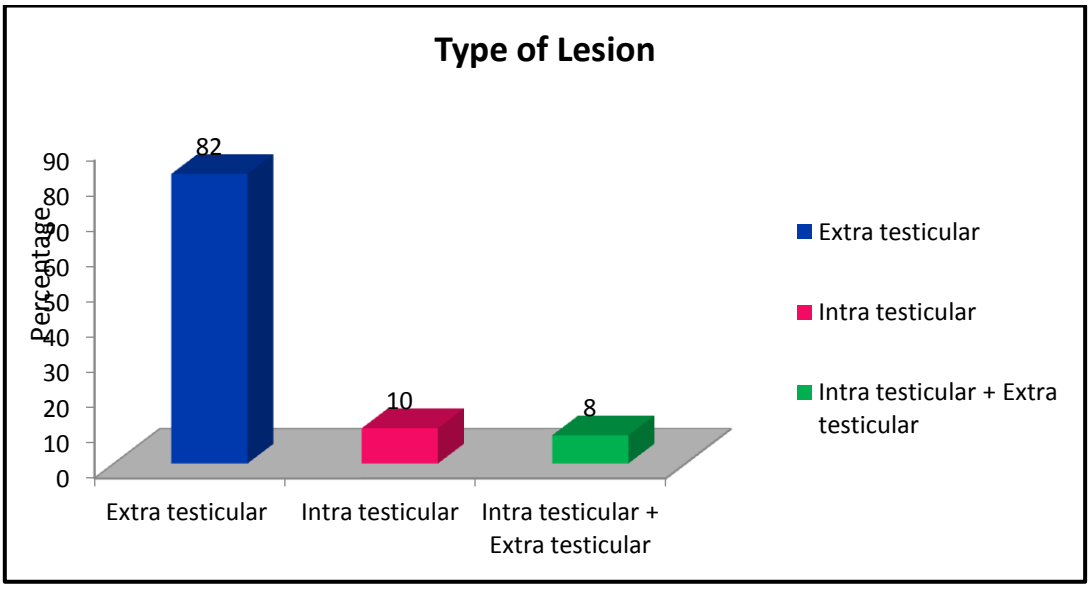


Regarding the laterality of the lesion the number of scrotal lesions seen on the left side were 24 (48%), on the right side were 18 (36%) and in bilateral locations were 8 (16%). Data is provided in **Table 3**.

Table 4: Type of Lesion

Type of Lesion	Frequency	Percentage
Extra testicular	41	82.0
Intra testicular	5	10.0
Intra testicular + Extra testicular	4	8.0
Total	50	100.0

Figure 4: Type of Lesion

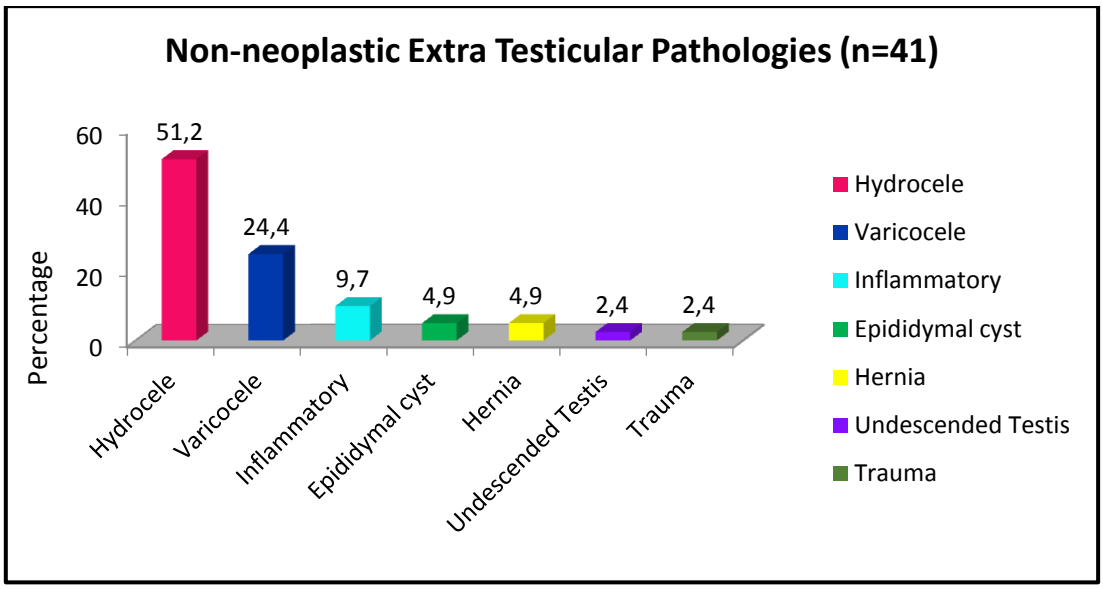


In the present study there were 41 (82%) extra testicular and 5 (10%) intra testicular lesions. In 54 (8%) cases, abnormality was noted in both intra- and extra testicular regions. Data regarding the above is depicted in **Table 4**.

Table 5: Non-neoplastic Extra Testicular Pathologies (n=41)

Pathology	Frequency	Percentage
Hydrocele	21	51.2
Varicocele	10	24.4
Inflammatory	4	9.7
Epididymal cyst	2	4.9
Hernia	2	4.9
Undescended Testis	1	2.4
Trauma	1	2.4
Total	41	100.0

Figure 5: Non-neoplastic Extra Testicular Pathologies (n=41)

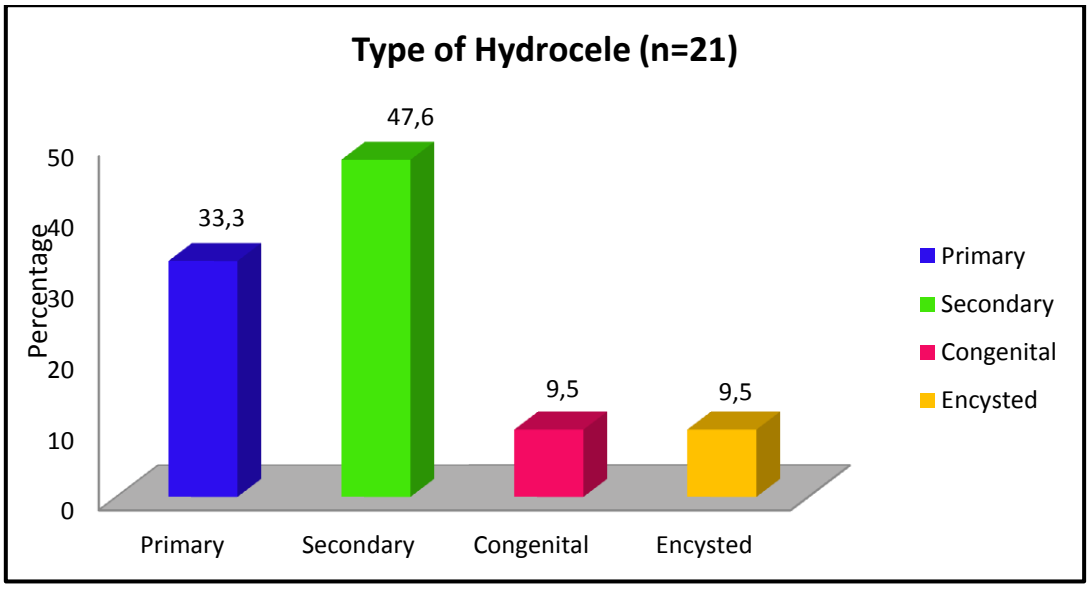


Among 41 non-neoplastic scrotal swellings, hydrocoele is the commonest pathology noted in 21 cases (51.2%) followed by varicocele found in 10 (24.4%) cases. inflammatory lesion was seen in 4 (9.7%) cases while epididymal cyst and hernia was present among 4.9% (4) patients. Data is presented in **Table 5**.

Table 6: Type of Hydrocele (n=21)

Type of Hydrocele	Frequency	Percentage
Primary	7	33.3
Secondary	10	47.6
Congenital	2	9.5
Encysted	2	9.5
Total	21	100.0

Figure 6: Type of Hydrocele (n=21)

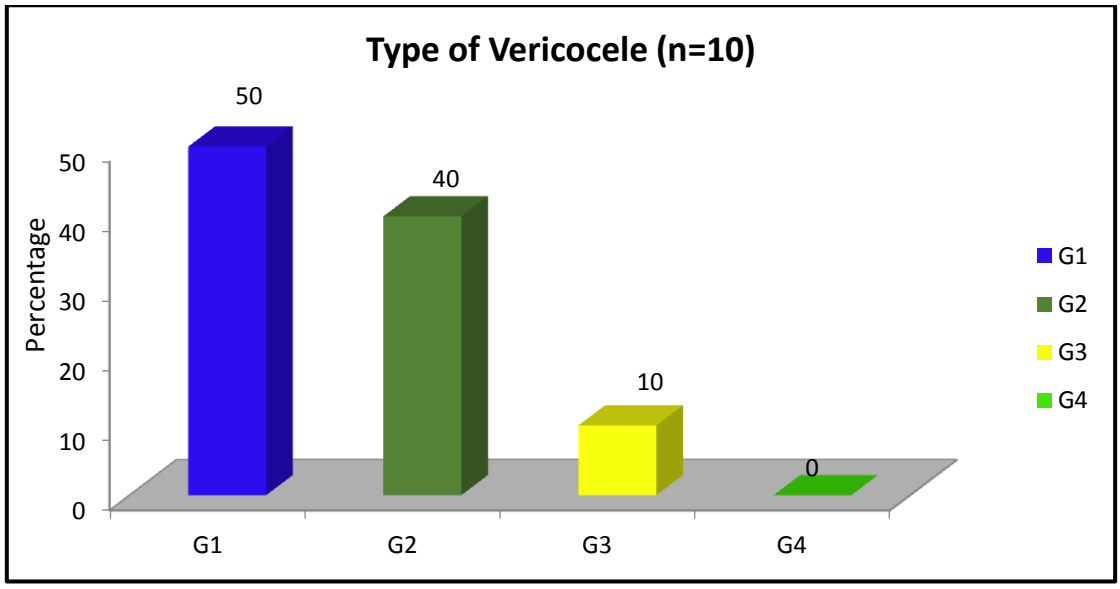


The spectrum of hydrocele is shown in **Table 6**, totally 21 cases of hydroceles found in 41 cases of total scrotal pathologies, out of which secondary hydrocele was commonest (10cases, 47.6%), followed by 7 (33.3%) cases of primary hydrocele and 2 (9.5%) cases of congenital hydrocele and 2 (9.5%) cases of encysted hydrocele of cord.

Table 7: Type of Vericocele (n=10)

Type of Vericocele	Frequency	Percentage
G1	5	50.0
G2	4	40.0
G3	1	10.0
G4	0	0.0
Total	10	100.0

Figure 7: Type of Vericocele (n=10)

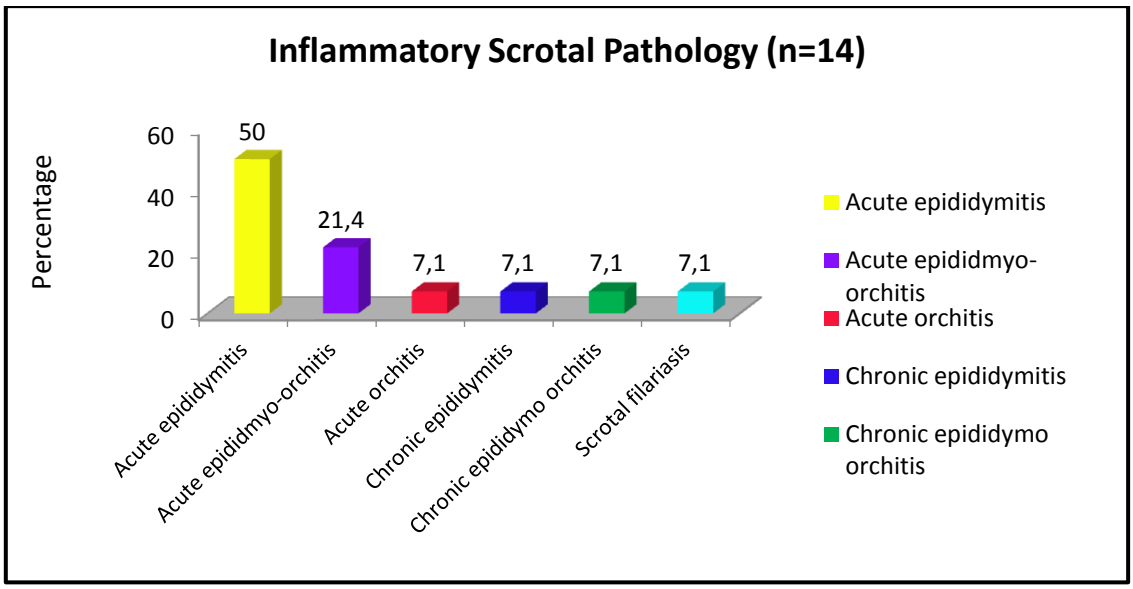


The spectrum of varicocele distribution is depicted in **Table 7**. Varicoceles noted in 10 out of 41 cases of scrotal pathology (24.4%). Out of 10 cases, Grade 1 varicocele was noted in 5 cases (50 %), Grade 2 varicocele was found in 4 (40%) cases and Grade 3 varicocele in 1 (10%) case.

Table 8: Inflammatory Scrotal Pathology (n=14)

Inflammatory Scrotal Pathology	Frequency	Percentage
Acute epididymitis	7	50.0
Acute epididmyo-orchitis	3	21.4
Acute orchitis	1	7.1
Chronic epididymitis	1	7.1
Chronic epididymo orchitis	1	7.1
Scrotal filariasis	1	7.1
Total	14	100.0

Figure 8: Inflammatory Scrotal Pathology (n=14)



In our study, out of 50 cases, 14 cases were detected to have inflammatory scrotal pathology on high frequency US and Doppler study. Acute epididymitis was the commonest inflammatory pathology detected noted in 7 cases (50%). Next, most frequent inflammatory pathology detected was acute epididymo-orchitis noted in 3 cases (21.4%). Other detected inflammatory pathology includes, scrotal filariasis 1 case, acute orchitis 1 case, chronic epididymitis 1 case and chronic epididymo-orchitis in 1 case. Data regarding the above is provided in **Table 8**.

Table 9: High Resolution Ultrasonographic findings of Inflammatory Scrotal Pathology

Findings	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Chronic Epididymo-Orchitis
Hyperechoic	1	0	0	0	0
Hypoechoic	4	1	2	0	0
Isoechoic	0	0	0	0	0
Heterogenous	2	0	1	1	1
Epididymal Calcification	0	0	0	0	0
Total	7	1	3	1	1

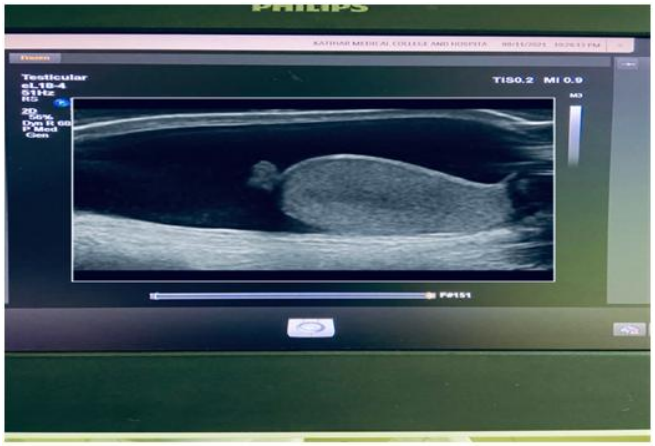
High frequency US findings of inflammatory scrotal pathology are depicted in **Table 9**. In acute epididymitis we found hypoechogenecity in 4 acses and hyperechognecity in 1 case. In acute epididymitis orchitis hypogenecity was found in 2 cases and heterogenous echotexture in 1 case.

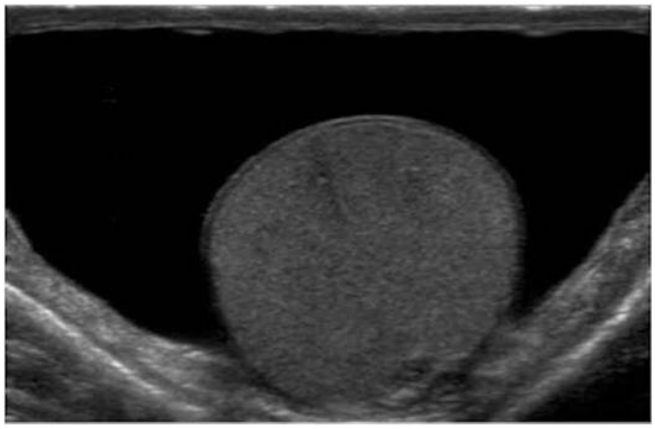
Table 10: Colour Doppler findings of Inflammatory Scrotal Pathology

Findings	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Chronic Epididymo-Orchitis
Focal increase in vascularity	4	1	1	0	0
Diffuse increase in vascularity	3	0	2	1	0
Focal decrease in vascularity	0	0	0	0	0
Diffuse decrease in vascularity	0	0	0	0	0
Normal Vascularity	0	0	0	0	1
Total	7	1	3	1	1

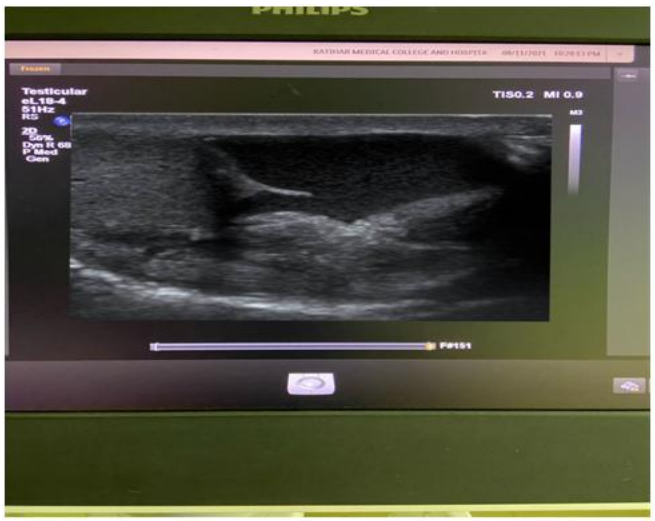
Colour findings of inflammatory scrotal pathology are depicted in **Table 10**. In acute epididymitis we found focal increase in vascularity in 4 acses and diffuse increase in vascularity in 3 cases. In acute epididymitis orchitis we found focal increase in vascularity in 1 case and diffuse increase in vascularity in 2 cases.

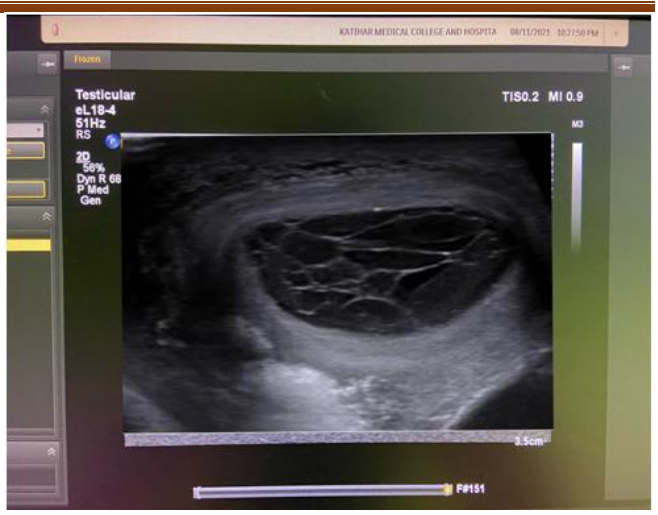
Illustrations



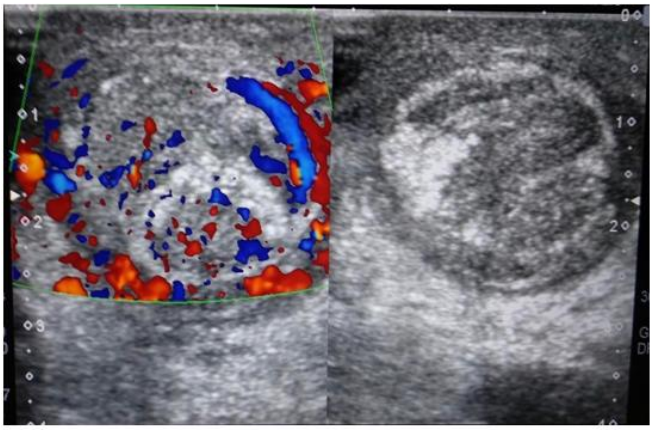


Case of hydrocele

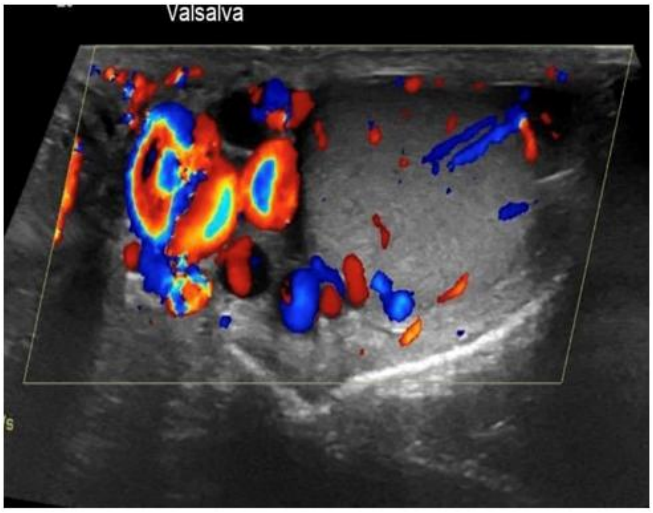




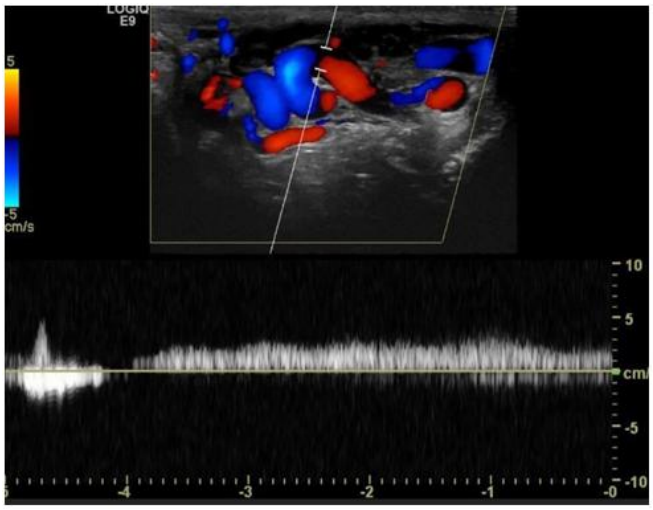
Case of pyocele

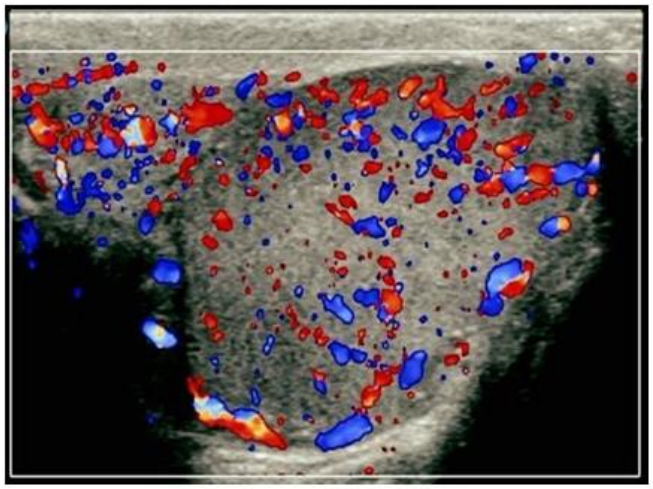


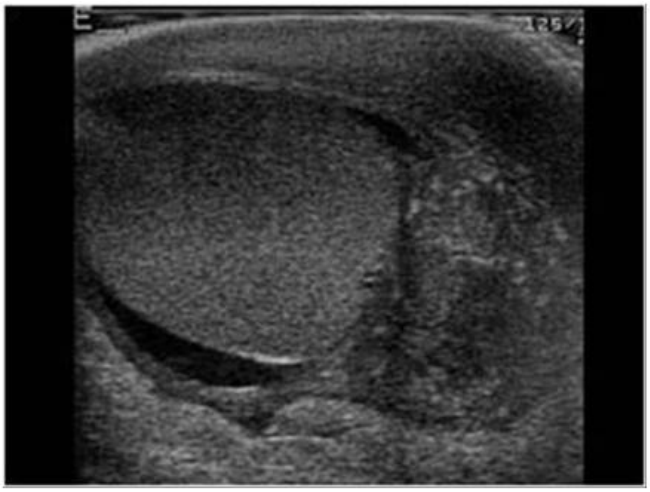
Case of testicular and appendage torsion



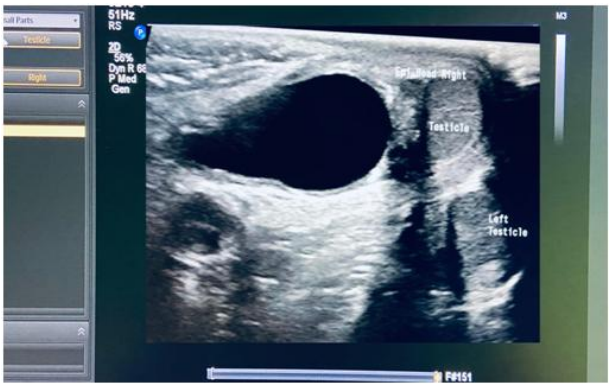
Case of varicocele

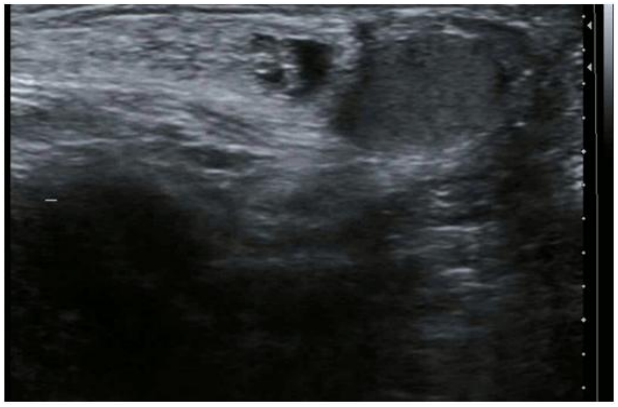




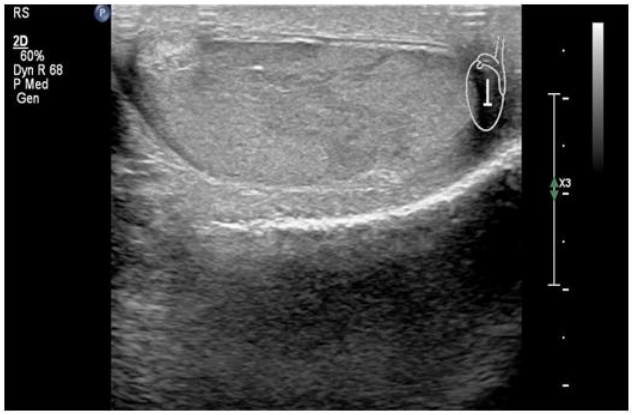


Case of Epididymo Orchitis

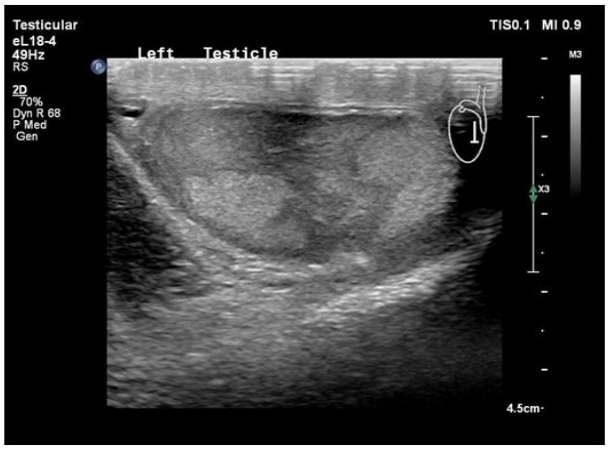




Case of complete inguinal hernia



Case of intrascrotal mass



Discussion

Physical examination alone may be insufficient in the clinical examination of scrotal edema due to discomfort, swelling, or extensive distortion of scrotal contents. Clinical indications and symptoms are frequently ambiguous, changeable, and deceptive. [4] In some patients with a big hydrocele when the testis cannot be palpated and the condition of the testis cannot be determined after a clinical examination, the reason of the patient's symptom may remain a mystery. Transillumination testing can easily diagnose hydrocele, however the cause of hydrocele, whether idiopathic, infective, or linked to malignancy, cannot be determined. [5]

Scrotal edema has two types of causes: acute and non-acute. Torsion, trauma, abscess, and orchitis are all examples of acute causes. Hydrocele, scrotal hernia, lymphocele, and other non-acute causes include these. Testicular and extratesticular scrotal lesions are two types of scrotal lesions. Torsion, trauma, neoplasms, and inflammatory diseases are the most prevalent testicular lesions. The spermatic cord, epididymis, and scrotal wall are all examples of extratesticular lesions. Extratesticular masses are nearly generally benign, however intratesticular solid masses might be cancerous.

Prompt diagnosis is necessary to separate surgically correctable lesions from lesions that can be managed medically. To identify these processes, high-resolution ultrasonography and Color Doppler Ultrasonography are very useful. **Murray Miskin, Martin Buckspan, and Jerald Bain** published the first report on using diagnostic ultrasound to investigate scrotal pathologies. Since then, advances in instrumentation and transducer design have progressed to the point where high frequency US is the modality of choice for investigating scrotal and testicular pathology. [6,7]

A quick development of scrotal pain could indicate a dangerous condition such as testicular torsion or epididymitis. Torsion may require surgery, whereas epididymitis requires antibiotic treatment. Torsion can cause lasting injury to the testis if left untreated, and if it is inflammatory, it can lead to abscess formation. [8] We can detect whether a scrotal mass is Intratesticular or Extratesticular using sonography in patients with scrotal masses. It is also possible to determine whether the tumour is cystic, solid, or complicated. Non-invasive, easy reproducibility, rapid assessment with real-time examination capability, easy availability, inexpensive, and radiation-free are all advantages of ultrasonography in the evaluation of scrotal disorders.

Computed tomography has the disadvantage of exposing the gonads to ionising radiation, necessitating the use of contrast media, and being a somewhat expensive method. Magnetic Resonance Imaging (MRI) is both costly and difficult to get, despite the fact that it delivers better cross-sectional information. As a result, USG is the indisputable first line of defence for scrotal diseases. [9]

Ultrasound with Color Doppler, magnetic resonance imaging, testicular angiography, and radioisotope tests are now the most common first-line investigations for scrotal diseases.[10]

The creation of a sonogram using a high-frequency linear transducer and colour Doppler is a significant step forward in scrotal pathology evaluation. The testicles are exposed to radiation during computed tomography, and MRI is not widely available. [11] Ultrasound with colour Doppler is therefore the best method for assessing scrotal diseases. It's a straightforward, non-invasive, repeatable, widely available, and very inexpensive test that doesn't expose the testes to radiation.[12]

As a result, the current study was carried out with the goal of determining the utility of high frequency grey scale US and colour Doppler study in the diagnosis of various scrotal diseases. During the study period, 50 cases instances of scrotal edoema presented to the Department for

scrotal USG or Color Doppler USG, all of which met the study's inclusion criteria.

The majority of patients in our study were in their second and third decades of life. The majority of the study participants were between the ages of 21 and 40 years old (28 percent) and 31 and 40 years old (31 percent) (22 percent). The next most common age group was 41-50 years, which accounted for 18% of patients, and 51-60 years, which accounted for 10% of patients. The average age of the participants was 37.7 years.

Thinyu et al. found a similar age group distribution of scrotal diseases in their research of 110 cases.[13]

The similar study was reported by **Prasad B et al.** In their research, they foundThe age range of 30 to 40 years old is the most usually involved (38 percent). The age range of 0-10 years had the smallest number of patients (4 percent). [14]

Borah K et al. reported in their study that The age group of 31 to 40 years old had the most cases (29 cases, or 29 percent), followed by 21 to 30 years old (27 cases - 27 percent). Sixty-six percent of the population is between the ages of 21 and 40. [6]

In their study on age groups, **Navale S et al** observed that the age distributions of cases in their study ranged from 1 to 90 years. The age group of 21 to 30 years old had the most cases (18 cases, or 36 percent), followed by 31 to 40 years old (9 cases, or 18 percent). As a result, the age range of 21 to 40 years accounts for 54% of our patients. [15]

Patients presented with a variety of clinical symptoms. Scrotal swelling was the most common clinical manifestation (32 cases, or 64 percent), followed by scrotal pain (15 cases, or 30 %), discomfort and scrotal swelling combined in 14 cases (16 %), and infertility in 10 cases (20 %). Other clinical manifestations were missing testis in the scrotal sac (10%), discomfort swelling and fever (8%), trauma (4%), and soreness and itching over the scrotal area (4%).

Swelling, soreness, fever, and infertility were all prevalent symptoms in the **study by Prasad B et al,** with swelling being the most common.[16]

The most prevalent clinical presentation in the study by **Borah K et al** was a combination of symptoms such as pain and scrotal edoema, which occurred in 34 instances (34%), and a combination of discomfort, swelling, and fever in four cases (4 %).

In a research conducted by **Navale S et al.,** the most common clinical presentation was scrotal edoema (17 cases, 34%), followed by just scrotal pain (15 cases, 30%), and then infertility in 8 instances (16%).[17]

Scrotal lesions were seen on the left side 24 % of the time, on the right side 18 percent of the time, and in bilateral locations 8 percent of the time (16 %).

Prasad B et al found that 45 percent of scrotal lesions were identified on the left side, 35 percent on the right side, and 20 percent in bilateral locations (16.67 %).[18]

There were 41 extra testicular lesions (82%) and 5 intra testicular lesions (10%) in this study. Anomalies were found in both the intra- and extra-testicular areas in 54 (8%) of the cases.

Borah K et al found 82 additional testicular and 10 testicular lesions in their investigation. Anomalies were found in both the intra- and extra-testicular areas in eight of the instances. [19]

Non-neoplastic scrotal swellling was observed in 41 of the 50 cases studied. Hydrocoele is the most prevalent pathology among 41 non-neoplastic scrotal swellings, accounting for 21 (51.2%) of the total, followed by varicocele in 10 (24.4%) of the cases. Inflammatory lesions were seen in 4 (9.7%) of the cases, whereas epididymal cysts and hernia were found in 4.9 percent (4) of the cases.

A prospective investigation of 20 patients was undertaken by **Donald P Orr et al.** Hydrocele was the most common diagnosis (34.2 %) among the 21 abnormal testes, followed by epididymoorchitis. [84]

In a study of 62 individuals, Arger et colleagues discovered the following pathologies: inflammation in 16 cases (26%), and non-inflammatory swellings in 45 cases (67 %).[20]

Richie et al observed inflammatory lesions in 31 instances (243 testicles) and non-inflammatory swellings in 75 cases in their ultrasonography investigation of 124 patients (243 testicles).[21]

Secondary hydrocele was the most prevalent type of hydrocele (10 instances, 47.6%), followed by 7 (33.3%) cases of original hydrocele, 2 (9.5%) cases of congenital hydrocele, and 2 (9.5%) cases of encysted hydrocele of cord. These findings are comparable to those of **Arger et al. and Willscher et al.** in prior research. [22,23]

In a retrospective analysis of 72 cases of extra testicular lesions and 48 cases of intratesticular lesions to determine the causes of intra-scrotal disease, **Arjhansari K, Vises N, et**[al] found that hydrocele was the most common pathology.[24]

Dohrethy FJ found minute particles in 62 percent of hydrocele patients in a study of 70 individuals. These were insignificant cholesterol crystals. [25]

In their investigation, Borah K et al discovered that the most common pathology observed in this study was hydrocele, which was seen in 40 individuals (40 percent of cases). In 30 patients, it was found unilaterally, while in 10 patients, it was found bilaterally. [26]

Navale S et al found 14 cases of hydrocele, the most prevalent of which was secondary hydrocele (7 cases, 50%), followed by 5 cases of original hydrocele and one case of congenital hydrocele/ encysted hydrocele of the cord. The majority of hydroceles have clear anechoic collections, the majority of secondary hydroceles have internal echoes, and only a few have septations. [27]

Prasad B et al. reported, Hydrocele was the most common cause of scrotal pathologies (n=31, 25.83 %), followed by epididymal cyst (n=20, 16.67 %), epididymo-orchitis (n=16, 13.33%), epididymitis (n=9, 7.5%), funiculitis (n=8, 6.67%), varicocele (n=7, 5.83%), pyocele (n=6, 5%), [82]

If the high-frequency grey scale US showed 2 or more, a varicocele was evident. When retrograde flow was found inside the pampiniform plexus spontaneously and/or during Valsalva manoeuvre, colour Doppler US was used to determine if a varicocele was present. [28] Patients exhibiting symptoms such as scrotal enlargement, discomfort, and infertility were found to have varicocele. Varicoceles were found in 10 of the 41 cases of scrotal disease studied (24.4 %). Grade 1 varicocele was detected in 5 (50%) of the 10 cases, Grade 2 varicocele in 4 (40%) of the cases, and Grade 3 varicocele in 1 (10%) of the cases.

Navale S et al found that different grades of varicocele were seen in 6 instances, with grade 1 varicocele being the most common (3 cases–50%). Two patients demonstrated pathological abnormalities in semen analysis in the form of Oligospermia or Aesthenospermia, out of six HRCD confirmed cases of varicocele. [29] These findings matched those of prior studies. [29-30]

In our investigation, 14 individuals out of 50 were found to have inflammatory scrotal disease on high-resolution US and Doppler imaging. The most frequent inflammatory pathology found in 7 patients was acute epididymitis (50 %). The most common inflammatory pathology found was acute epididymo-orchitis, which was found in three patients (21.4%). Scrotal filariasis was identified in one instance, acute orchitis in another, chronic epididymitis in another, and chronic epididymo-orchitis in another.

In a study of 45 individuals, **Horstman Middleton and Nelson et al** discovered acute epididymitis in 25 cases (56 %), acute epididymo-orchitis in 19 cases (42 percent), and acute orchitis in 1 case (2 %). There was no evidence of chronic epididymo-orchitis. [31]

Lerner et al identified acute epididymitis in three patients (60%) and acute epididymo-orchitis in two patients in their small series of five cases of acute inflammatory disorders of the scrotum (40%).[32]

Farriol et al identified epididymitis in 11 instances (44%), epididymo-orchitis in 10 cases (40%), orchitis in 2 cases (8%), and funiculitis in 2 cases in their research of 25 cases of acute inflammatory disease of the scrotum utilising high-resolution grey scale and power Doppler sonographic analysis (8 %).[33]

Borah K et al found that out of 100 individuals, 26 had inflammatory scrotal disease on high frequency US and Doppler imaging. In 13 patients, acute epididymitis was the most prevalent inflammatory disease found (50%). The most common inflammatory pathology found was acute epididymo-orchitis, which was found in 5 patients (19.2 %). Scrotal filariasis was discovered in two cases, acute orchitis in two cases (7.7%), chronic epididymitis in two cases (7.7%), and chronic epididymo-orchitis in two cases (7.7%). [34]

In cases of acute epididymitis, ultrasonographic findings revealed hypoechogenecity in four cases and hyperechogenecity in one. Hypogenecity and heterogeneous echotexture were detected in two cases of acute epididymitis orchitis. In acute epididymitis, we identified a localised increase in vascularity in four cases and a widespread rise in vascularity in three cases, according to colour doppler findings of scrotal diseases. We discovered a localised increase in vascularity in one case and a widespread increase in vascularity in two cases with acute epididymitis orchitis. The findings of high-frequency US sonography and colour Doppler sonography are similar to those of **Kim S H et al.** [35]

Borah K et al detected diffuse hypoechogenicity with diffuse increase in vascularity and size of epididymis in their research of cases of acute epididymitis,[36]. These findings are comparable to Horstman et al in their analysis of 45 patients (51 hemiscrotum) and Farriol et al5 in their investigation of 11 cases.[36]

In four cases of acute epididymo-orchitis, they found diffuse hypoechogenicity with diffuse increases in vascularity, one case had heterogeneous echotexture, one case had focal increases in vascularity, and the epididymis size was raised in all four cases. Horstman et al. found similar results in a study of 45[36] patients (51 hemiscrotum) and Farriol et al. found similar results in a study of 11 instances.

According to Navale S et al, the most common inflammatory pathology detected was acute epididymo-orchitis with funiculitis and acute epididymitis, which were found in 4 cases each (40%), followed by chronic epididymo-orchitis with funiculitis and chronic epididymitis, which were found in 1 case each (10%), and funiculitis in 1 case. The most prevalent result on high-resolution US and colour Doppler appearance is heterogeneous echo-pattern of epididymis in acute epididymitis (4 cases out of 10) and heterogeneous echo pattern of testis and epididymis in acute epididymo-orchitis (4 cases out of 10). (3 cases out of 10). Its findings are comparable to those of other studies. [37]

Conclusion

At the end of the study we come to the conclusion that:

- High resolution USG and color Doppler both are considered as noninvasive, cheap and rapid. It is also repeatable and has no radiation. It is an accurate diagnostic imaging modality which is suitable for both diagnostic proposes and for follow up of various scrotal pathologies.
- In acute scrotal inflammatory pathology when it is difficult to diagnose clinically, high frequency sonography along with colour Doppler studies helped by demonstrating the altered morphology in diseased scrotum. Both intratesticular as well as extra testicular mass can be differentiated by high frequency real-time sonography with colour Doppler studies with high accuracy and sensitivity.

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