

A Study of Role of Ultrasonography in Evaluation of Scrotal PathologiesJay M. Chaudhari¹, Kavita U. Vaishnav², Zaryab M. Qureshi³, Hetavi B. Patel⁴, Rutvik G. Patel⁵, Maitry Talavia⁶¹Second Year Postgraduate, Department of Radio-Diagnosis, Narendra Modi Medical College, LG Hospital, Ahmedabad²Professor (Higher Grade), Department of Radio-Diagnosis, Narendra Modi Medical College, LG Hospital, Ahmedabad³Assistant Professor, Department of Radio-Diagnosis, Narendra Modi Medical College, LG Hospital, Ahmedabad⁴3rd Year Postgraduate, Department of Radio-Diagnosis, Narendra Modi Medical College, LG Hospital, Ahmedabad⁵Second Year Postgraduate, Department of Radio-Diagnosis, Narendra Modi Medical College, LG Hospital, Ahmedabad⁶Second Year Postgraduate, Department of Radio-Diagnosis, Narendra Modi Medical College, LG Hospital, Ahmedabad

Received: 01-09-2025 / Revised: 16-10-2025 / Accepted: 08-11-2025

Corresponding Author: Dr. Zaryab M. Qureshi

Conflict of interest: Nil

Abstract**Aims and Objectives:** The aim of this study is to use ultrasonography (USG) to examine various scrotal diseases and to diagnose and identify different disorders utilizing high-resolution ultrasound and color Doppler.**Materials and Methods**

- The study will be initiated after obtaining approval from the Institutional Review Board.
- The written informed consent will be taken from patients and confidentiality of patients will be maintained.
- All patients fulfilling the inclusion criteria will be enrolled in the study.
- Ultrasonography will be conducted only by expert consultant.
- After the collection of data, it will be entered to Microsoft excel sheet.
- Statistical analysis will be carried out by using appropriate statistical significance test.

Result: Out of all 100 patient, hydrocele was seen in 22 cases, 20 cases of inflammatory pathology, scrotal hernia in 15 cases, varicocele in 9 cases, undescended testis in 5 cases, scrotal filariasis cases 1, torsion cases 2, etc. in acute painful scrotal diseases ultrasonography and color doppler study successfully differentiate between acute inflammatory condition and torsion.**Conclusion:** High resolution ultrasonography and color doppler study have good sensitivity and specificity in assessing and detecting scrotal pathology. Lack of ionising radiation, simplicity, wide availability and cost efficiency make it highly important method for scrotal diseases.**Keywords:** Color Doppler Ultrasound, Epididymis, Testies, Scrotal Pathology, High Resolution Ultrasonography.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The scrotum is a fibromuscular cutaneous bag that contain the testicles, epididymis, and the lowest half of the spermatic cord. Pathological conditions affecting these structures include congenital, simple inflammatory, and neoplastic diseases[1]. The first lines of imaging modalities for scrotal disorders include ultrasound (US) with color Doppler and testicular vascularity. Patients who present with significant scrotal pain, edema, or both require prompt diagnosis in order to differentiate the lesions that require emergency surgical treatment from the lesions that may be treated

medically [2]. The introduction of a sonogram with a high-frequency linear transducer and color Doppler is a significant step forward in assessing scrotal diseases.

Testicles is directly expose to radiation in CT scan, and MRI is not widely accessible [3].

Though the clinical examination of testis is possible, However in acute scrotum is a tough diagnostic challenge due to the nonspecific character of symptoms and the difficulties in fully assessing the sensitive, swollen scrotum. The

clinical history may be essential in determining the etiology of acute scrotal illnesses[4]. Although epididymitis is the most common cause of acute scrotal discomfort, testicular torsion is the most critical diagnosis to establish since it needs rapid surgical correction to maintain testicular viability and function. As a result, assessing testicular perfusion is the essential prerequisite for any imaging modality employed in this clinical setting [5].

Due to its ease of use, lack of ionizing radiation exposure, noninvasive nature, reproducibility, low cost, and ease of accessibility, ultrasound (US) is the preferred imaging modality for evaluating scrotal disease. High-resolution ultrasound and color Doppler better highlight scrotal and testicular diseases because of the scrotum's superficial anatomy. The genital organs are subjected to damaging ionizing radiation during CT, while MRI is both costly and uncommon.

Ultrasonography (USG) has been shown to be an excellent gold-standard diagnostic technique for a variety of scrotal diseases and disorders. It offers 100% sensitivity in diagnosis and can discriminate a range of disorders affecting the testis, epididymis, and scrotum with comparable clinical symptoms because of its great spatial resolution. USG in grayscale in conjunction with color or power Doppler imaging is a widely used tool for evaluating scrotal lesions and testicular perfusion.

USG is an excellent tool for studying the scrotum and its contents. Sonography is simple to conduct, quick, noninvasive, affordable, easily repeatable, and generally available, and it does not need gonad irradiation. To identify testicular torsion, an emergency scrotal Doppler scan is sometimes necessary [6].

Aims and Objectives: The aim of this study is to use ultrasonography (USG) to examine various scrotal diseases and to diagnose and identify different disorders utilizing high-resolution ultrasound and color Doppler.

Study Type: Prospective observational cross sectional single centred study.

Sample Size: 100 cases over a period of 6 months.

Plan for data analysis: Data will be analyzed using appropriate statistical test like proportions, percentage, etc. & will be depicted in the form of tables and charts.

Materials and Methods

- The study will be initiated after obtaining approval from the Institutional Review Board.
- The written informed consent will be taken from patients and confidentiality of patients will be maintained.
- All patients fulfilling the inclusion criteria will be enrolled in the study.
- Ultrasonography will be conducted only by expert consultant.
- After the collection of data, it will be entered to Microsoft excel sheet.
- Statistical analysis will be carried out by using appropriate statistical significance test.

Equipment: MINDRAY RESONA I9 ULTRASOUND machine.

Technique: Patients were asked to lie supine with legs slightly separated. A towel sling is placed beneath the scrotum for support. Penis was elevated onto the anterior abdominal wall and was covered by a drape. The gel was applied to the scrotum inadequate amount to avoid pressure and pain and served as the coupling agent. Scrotum was scanned from an anterior, lateral and posterior wall in longitudinal and transverse planes both.

The examination was continued further to examine groin region. To see varicocele patients were examined in supine and erect posture with Valsalva maneuver. Scrotal masses were imaged in multiple planes and documented. Comparison with contralateral testis was helpful to demonstrate subtle changes in echotexture

Result

- In present study conducted, a total of 100 cases were enrolled who fulfilled the inclusion criteria.
- In table 1 and graph 1 shows age distribution of cases. The highest number of case seen in 31 to 40 years age group(25 cases, 25%), followed by 21 to 30 years age group (22 case, 22%). The age group of 21 to 40 years constitute 45%.

Table 1: Age Distribution

Age (Years)	No. of cases	Percentage
0-10	8	8 %
11-20	5	5 %
21-30	22	22 %
31-40	25	25 %
41-50	10	10 %
51-60	10	10 %
>61	20	20 %
Total	100	100 %

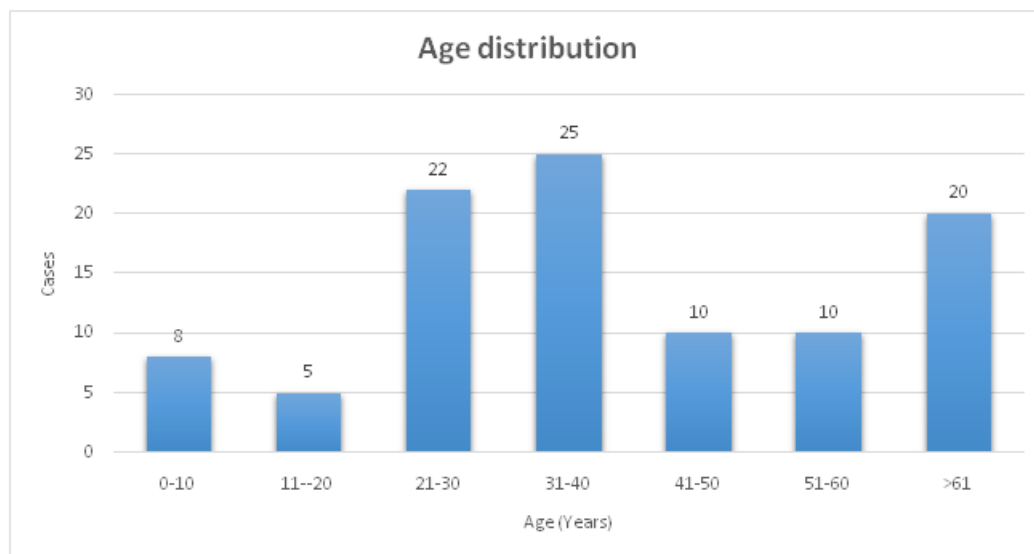


Figure 1: Age Distribution

In our study, 20 cases were detected with inflammatory scrotal pathology out of 100 cases on ultrasound and color doppler study. In all inflammatory pathology acute epididymo-orchitis was the common inflammatory diseases detected, noted (10 case, 50%). 2nd common inflammatory pathologies are acute epididymitis and testicular abscess, both have 3, 3 cases and 15%, 15% respectively.

Table 2: Inflammatory Pathology

Pathology	No. of cases	Percentage
Acute epididymo-orchitis	10	50 %
Acute epididymitis	2	10 %
Acute orchitis	3	15 %
Funiculitis	2	10 %
Testicular abscess	3	15 %
Total	20	100 %

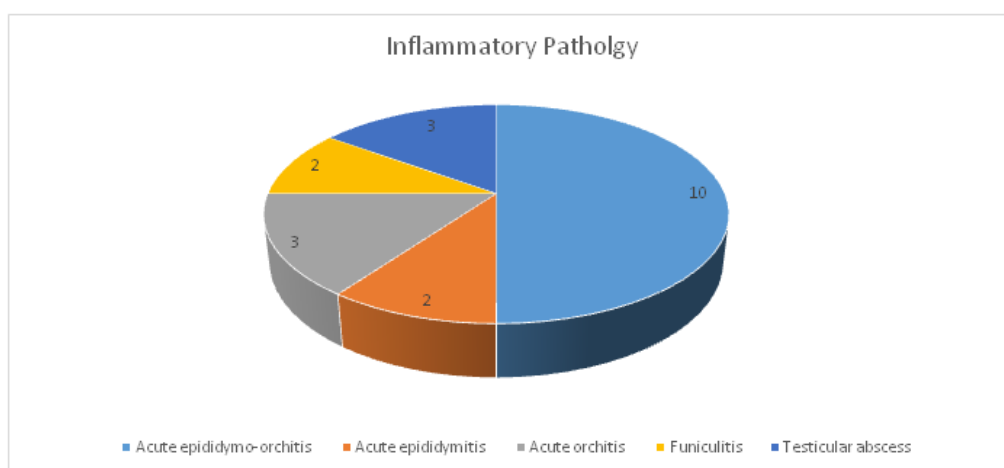


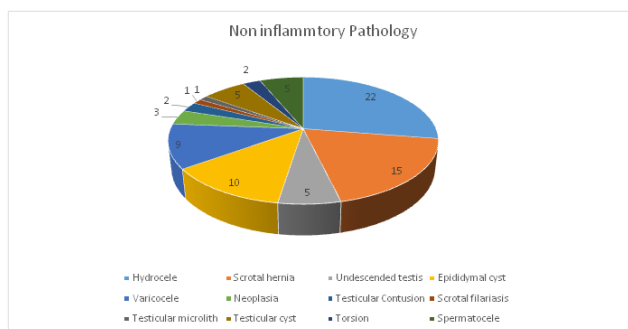
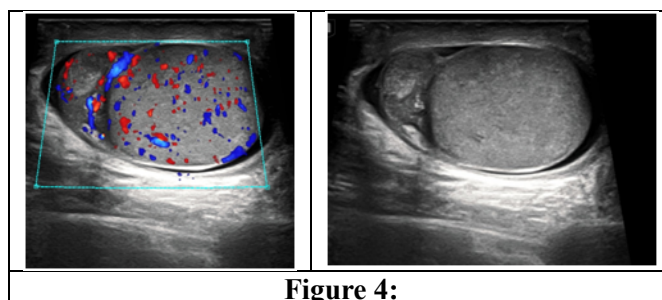
Figure 2: Inflammatory Pathology

In our study, 80 cases were detected with non-inflammatory scrotal pathology out of 100 cases on ultrasound and color doppler study. Among all non-inflammatory pathology hydrocele is most common pathology noted (cases 25, 27%), followed by

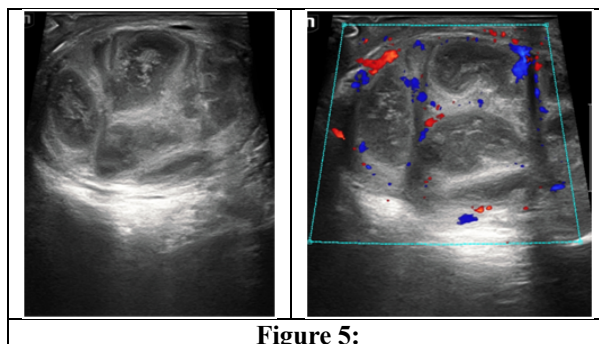
scrotal hernia in (case 15, 18.75%), epididymal cyst in (cases 10, 12.5%), varicocele in (cases 9, 11.25%) etc. the incidence of non-neoplastic condition is more common then neoplastic conditions.

Table 3: Non-Inflammatory Pathology

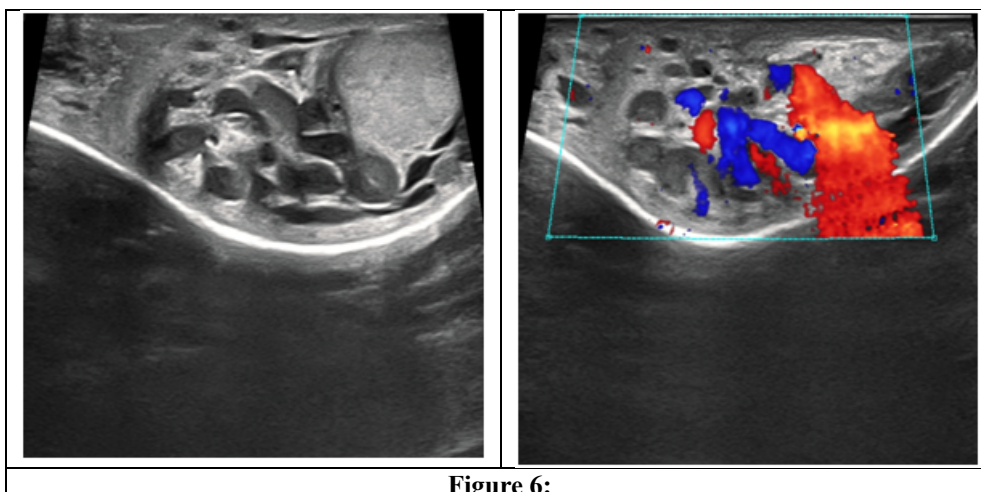
Pathology	No. of Cases	Percentage
Hydrocele	22	27.5 %
Scrotal hernia	15	18.75 %
Undescended testis	5	6.25 %
Epididymal cyst	10	12.5 %
Varicocele	9	11.25 %
Neoplasia	3	3.75 %
Testicular Contusion	2	2.5 %
Scrotal filariasis	1	1.25 %
Testicular microlith	1	1.25 %
Testicular cyst	5	6.25 %
Torsion	2	2.5 %
Spermatocele	5	6.25 %
Total	80	100 %

**Figure 3: Non Inflammatory Pathology****CASES 1:****Figure 4:**

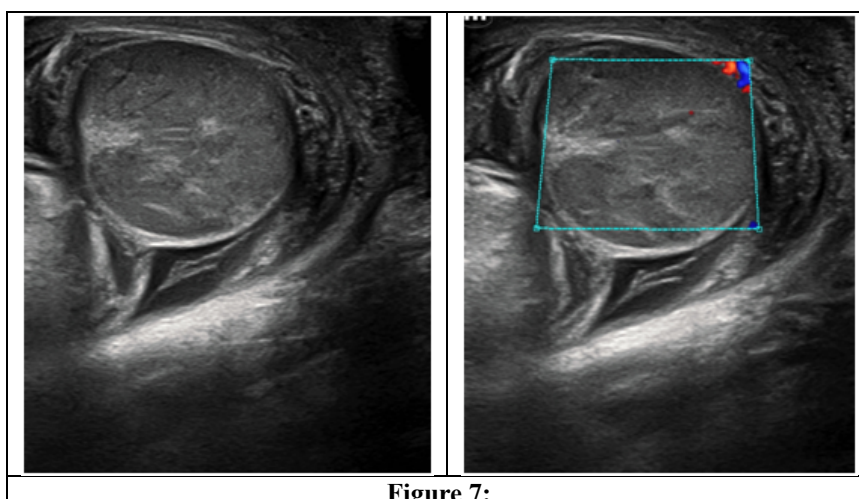
Testis and epididymis appears bulky, show alter echo-pattern and show increase in vascularity, s/o Acute epididymo-orchitis

CASE 2:**Figure 5:**

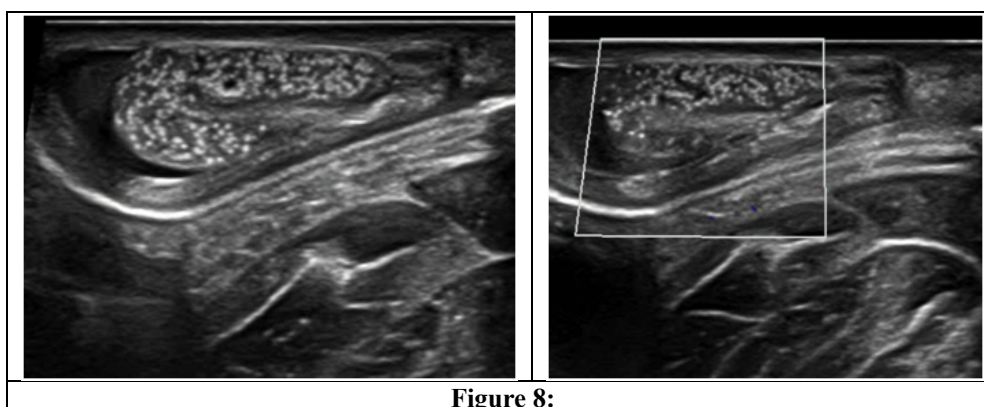
Mixechogenic collection seen in testis with increase vascularity, s/o testicular abscess.

CASE 3:**Figure 6:**

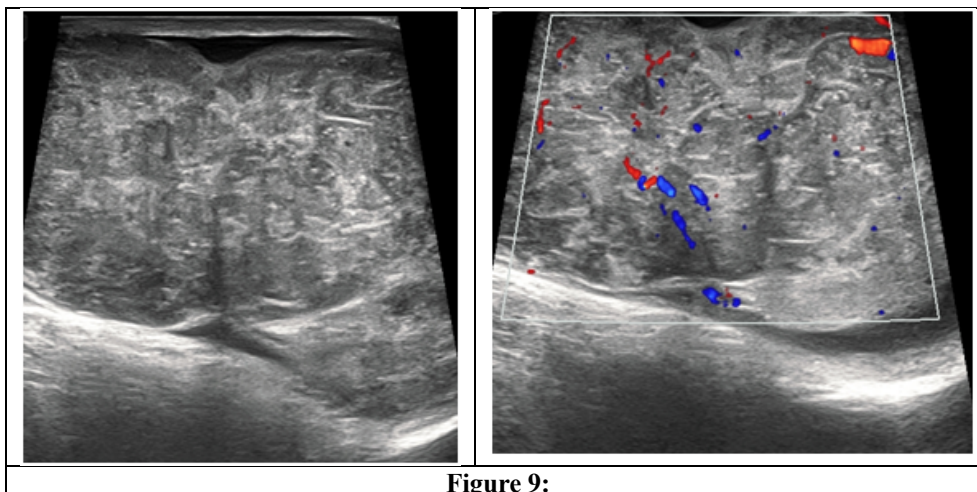
Dilated pampiniform plexus, s/o Varicocele.

CASE 4:**Figure 7:**

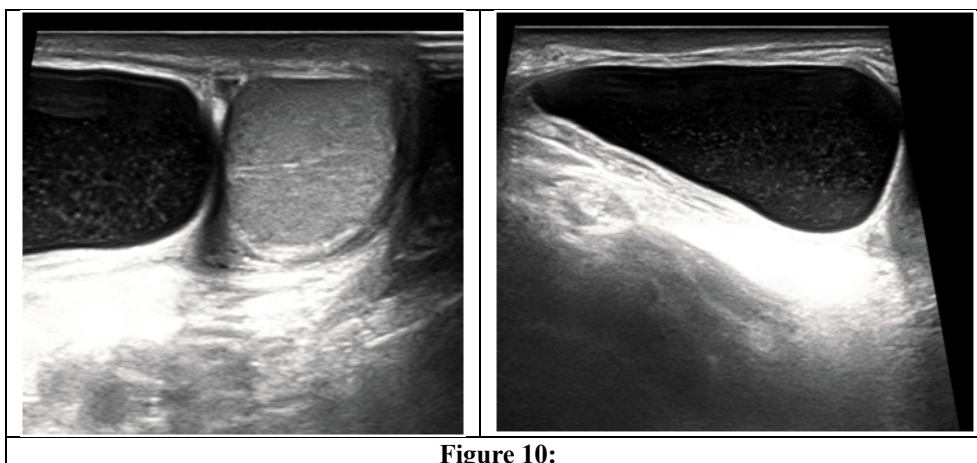
Areas of hyperechogenicity in testicular parenchyma, s/o testicular contusion.

CASE 5:**Figure 8:**

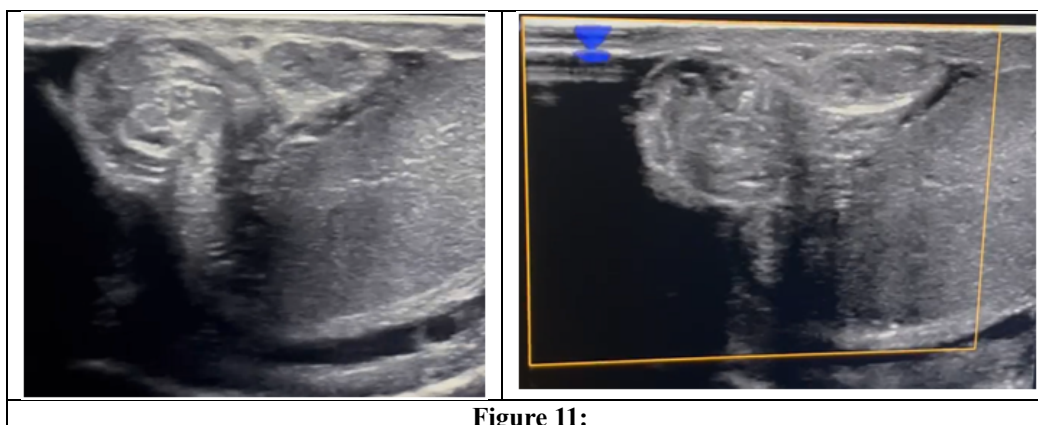
Multiple small, non-shadowing echogenic foci are seen throughout testicular parenchyma, s/o Testicular microlithiasis.

CASE 6:**Figure 9:**

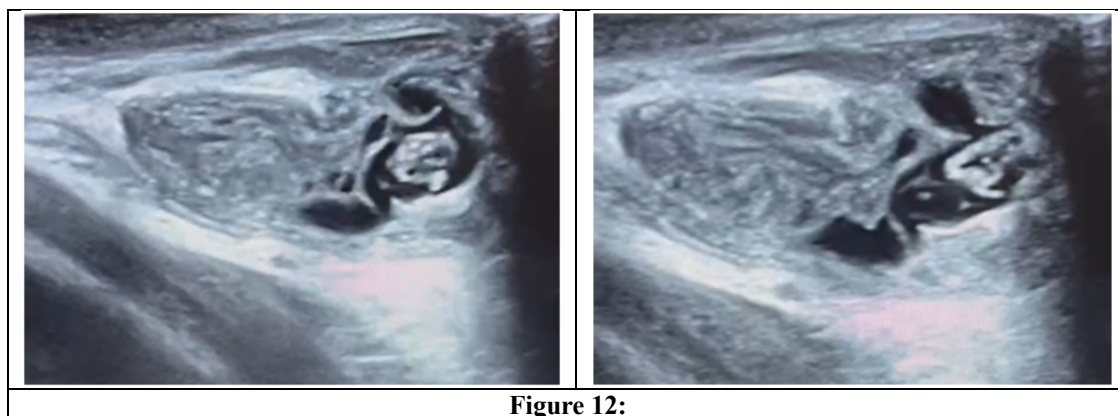
Large size ill-define heteroechoic lesion with internal vascularity seen in right testis, s/o mass lesion.

CASE 7:**Figure 10:**

Well define anechoic cystic lesion with few internal echos in right scrotal sac, p/o spermatocele.

CASE 8:**Figure 11:**

Spermatic cord twisting at site of external inguinal orifice called 'whirl pool sign' with enlarged testis and absent color flow in testis, s/o Torsion.

CASE 9:**Figure 12:**

There is evidence of echogenic, rapidly moving, linear structure within the left scrotal sac, s/o scrotal filariasis.

Discussion

The superficial anatomical position of the scrotal contents makes them highly suitable for ultrasonographic evaluation. The advent of high-frequency real-time ultrasonography combined with color Doppler imaging has significantly enhanced the diagnostic accuracy in assessing scrotal pathologies. At present, scrotal ultrasonography is widely accepted as the primary, and often the only, imaging modality necessary for evaluating scrotal abnormalities.

In the present study, patient ages ranged from all age groups, with the majority belonging to the 31–40-year age group (25%), followed by the 21–30-year group (22%). Hydrocele was identified as the most prevalent condition, accounting for 22 out of 100 cases.

This was followed by inguinal hernia (15 cases), epididymal cyst (10 cases), acute epididymo-orchitis (10 cases), varicocele (9 cases each), undescended testis and spermatocele (5 cases) and scrotal neoplasms (3 cases), testicular torsion and testicular contusion (2 cases) and scrotal filariasis and testicular microlithiasis (1 case). These findings are consistent with the study by Gajbhiye et al., who similarly reported hydrocele as the most frequent scrotal abnormality [7].

The diagnostic role of color Doppler sonography in testicular torsion has been well established in prior studies. Vishnu et al. demonstrated a sensitivity of 100% and specificity of 95% [8], while Gajbhiye et al. similarly reported 100% sensitivity [7]. Middleton and Melson also confirmed both 100% sensitivity and specificity [9], whereas Burks et al. reported slightly lower sensitivity (86%) with maintained specificity (100%) [10]. In our study, a single case of testicular torsion was documented, showing absent intratesticular blood flow and twisted vascular pedicle on Doppler imaging, corroborating previous findings.

Inflammatory scrotal diseases were observed in 20 out of 100 patients, with acute epididymo-orchitis being the most frequent (10 cases). Power Doppler imaging proved to be a valuable adjunct in this context, facilitating the detection of absent perfusion in torsion and enhancing visualization of hyperaemic changes in inflammatory conditions. These observations align with the reports of Farriol et al. and Luker et al. [11,12]. Normally, color and power Doppler imaging demonstrate vascular flow in the adult epididymis, and the diagnosis of epididymitis primarily relies on asymmetry of flow relative to the contralateral side, consistent with the findings of Keener et al. [13]. Our results were further supported by studies conducted by Petros et al. and Arger et al. [14,15]. Additionally, Brown et al. emphasized the role of spectral Doppler analysis in suspected inflammatory cases, proposing quantitative diagnostic thresholds, including a peak systolic velocity (PSV) of ≥ 15 cm/s or a PSV ratio exceeding 1.7 for the epididymis or 1.9 for the testis, both of which are in agreement with the present study [16].

Summary and Conclusion

This study was undertaken to evaluate scrotal Pathologies by High-resolution grey scale sonography evaluation of scrotal pathology. A total of 100 patients from all age group with signs of symptoms related to scrotal disease were evaluated. All the patients were properly followed up sonographically as per indication. Idiopathic hydrocele was most common scrotal pathology it featured as anechoic fluid in tunica vaginalis and it was correctly diagnosed on a grey scale. In patients of acute inflammation, Doppler sonography showed increased blood flow in affected epididymis and testis and thus showed 100% accuracy. The commonest pattern was enlarged testis or epididymis with altered echotexture. PSV > 15cms /sec and RI less than 0.5 were complementary to diagnosis. In the cases of

suspected Torsion of testis /acute inflammation, it is difficult to differentiate two by grey scale imaging. However, CDFI in symptomatic testis showed the absence of vascular signals in cases of Torsion of Testis. Among the cases of chronic inflammation tubercular epididymo orchitis was most common. Epididymis was more commonly involved as compared to the testis. The tail of epididymis suffered more than a body and showed heterogeneous echotexture. In cases of Varicocele, Grayscale was 80% sensitive. It failed to diagnose subclinical varicocele in infertile males in which venous diameter of pampiniform plexus was 2-3mm. However color Doppler and pulse Doppler accurately diagnosed in all cases (100% sensitivity). The undescended testis was noted in five cases and in four cases testis was located in inguinal canal and in one case it located in iliac fossa region and condition was unilateral. The testis was hypoechoic and small in size of the few cases of a scrotal hernia. In our study, most of the observations and results matched earlier studies. However, there were few results which did not match with earlier studies. This may be due to the smaller sample size of our study. To summarize an excellent correlation was seen in the diagnosis of scrotal lesions between sonography (Grayscale, CDFI and PD) and histopathology /surgery /treatment response. Sonography, both Grayscale and Color Doppler were found to be 93.33% sensitive in the diagnosis of Scrotal Pathology. The present study concludes that High-Resolution USG along with Color Doppler imaging and Power Doppler should be used as the first imaging modality in the evaluation of Scrotal Pathology

References

1. A 10-year review of ultrasonographic findings of scrotal diseases in Ibadan, South Western, Nigeria. Adekanmi AJ, Obajimi GO, Okafor EA, Adeniji-Sofoluwe A. Afr J Med Health Sci. 2018;17:60.
2. Ultrasound evaluation of scrotal pathology. Mirochnik B, Bhargava P, Dighe MK, Kanth N. Radiol Clin North Am. 2012;50:317-332.
3. Emergency ultrasound of acute scrotal pain. Wright S, Hoffmann B. Eur J Emerg Med. 2015;22:2-9.
4. Emergency evaluation of patients presenting with acute scrotum using bedside ultrasonography. Blaivas M, Sierzanski P, Lambert M. Acad Emerg Med. 2001;8:90-93.
5. Scrotal emergencies: an imaging perspective. Ong CY, Low HM, Chinchure D. Med J Malaysia. 2018;73:445-451.
6. Scrotal doppler ultrasound evaluation in Zaria, Nigeria. Ibrahim MZ, Tabari AM, Igashi JB, Lawal S, Ahmed M. Niger J Basic Clin Sci. 2016;13:89-93.
7. Role of ultrasonography & colour Doppler in scrotal pathologies. Gajbhiye DI, Shah SA, Gajbhiye MI. J Med Sci Clin Res. 2020;10:8-5.
8. Role of high-resolution sonography and doppler in evaluation of acute scrotal disease. Vishnu AR, Mini MV, Raini KP, Sinni KV. Int J Toxicol Pharmacol Res. 2022;12:88-97.
9. Testicular ischemia: color Doppler sonographic findings in five patients. Middleton WD, Melson GL. AJR Am J Roentgenol. 1989;152:1237-1239.
10. Suspected testicular torsion and ischemia: evaluation with color Doppler sonography. Burks DD, Markey BJ, Burkhard TK, Balsara ZN, Haluszka MM, Canning DA. Radiology. 1990;175:815-821.
11. Gray-scale and power Doppler sonographic appearances of acute inflammatory diseases of the scrotum. Farriol VG, Comella XP, Agromayor EG, Crèixams XS, De La Torre IBM. J Clin Ultrasound. 2000;28:67-72.
12. Scrotal US in pediatric patients: comparison of power and standard color Doppler US. Luker GD, Siegel MJ. Radiology. 1996;198:381-385.
13. Normal adult epididymis: evaluation with color Doppler US. Keener TS, Winter TC, Nghiem HV, Schmiedl UP. Radiology. 1997;202:712-714.
14. Correlation of testicular color Doppler ultrasonography, physical examination and venography in the detection of left varicoceles in men with infertility. Petros JA, Andriole GL, Middleton WD, Picus DA. J Urol. 1991;145:785-788.
15. Prospective analysis of the value of scrotal ultrasound. Arger PH, Mulhern CB Jr, Coleman BG, et al. Radiology. 1981;141:763-766.
16. Quantitative Doppler assessment of acute scrotal inflammation. Brown JM, Hammers LW, Barton JW, Holland CK, Scoutt LM, Pellerito JS, Taylor KJ. Radiology. 1995;197:427-431.