

# A prospective assessment of the utility of high-resolution ultrasound and color doppler in evaluating the scrotal pathologies

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## Abstract

**Aim:** To classify (etiologically) and to evaluate various scrotal pathologies using ultrasonography and describe the role of high-resolution ultrasound and colour doppler in their diagnosis and differentiation.

**Methods:** A prospective study was conducted in the RVM Institute of Medical Sciences & Research Centre, Laxmakkapally, Telangana, India for the period of 1 year. The 100 patients with clinical features of scrotal diseases were include in this study. All the patients included in the study underwent scrotal ultrasonography using 7.0-12.0 MHZ high frequency linear array transducer coupled with Colour Doppler in Esaote My Lab 40 and Phillips affinti 70G equipments.

**Results:** The patients most commonly involved were those belonging to the age group of 30 to 40 years (38%). The least number of patients belonged to the age group of 0-10 years (4%). On USG, the total number of lesions detected were 120. The most common cause of scrotal pathologies was hydrocele (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%), testicular torsion (n=5, 4.17%), testicular abscess (n=5, 4.17%), inguino-scrotal hernia (n=4, 3.33%), testicular microlithiasis (n=3, 2.5%), testicular tumour (n=3, 2.5%) and tubercular epididymo-orchitis (n=3, 2.5%). The number of scrotal lesions seen on the left side were 45(37.5%), on the right side were 35 (29.17%) and in bilateral locations were 20(16.67%). Associated symptoms included swelling, pain, fever and infertility. Almost all the scrotal pathologies were associated with scrotal swelling (n=97, 97%) except in 3 cases. Epididymal cysts were seen in 20 patients, Acute epididymo-orchitis (n=16) was most commonly seen on the left side. Hydrocele (n=31) was the most common scrotal pathology detected in this study. Varicocele 7 patients was most commonly seen on the left side. Testicular torsion was detected in 5 (n = 5) patients. 3 (n=3, 60%) patients had right testicular torsion.

**Conclusion:** High frequency ultrasonography with Color Doppler study serves as an excellent diagnostic imaging modality in the evaluation of scrotal diseases. It is the investigation of choice since it is highly sensitive, easy to perform, widely available, repeatable and involves no risk of ionizing radiation. Periodic follow-up USG scans are recommended for patients with inflammatory scrotal lesions to monitor response to treatment and to reveal the development of complications.

**Keywords:** Torsion, epididymo-orchitis, varicocele, hydrocele, epididymitis, pyocele, testicular microlithiasis, epididymal cyst, testicular tumour

## Introduction

Scrotum illness can present itself in a variety of ways, including discomfort, swelling, or both, as well as a tumour. To distinguish surgically correctable lesions from lesions that can be treated medically, prompt diagnosis is essential. Since the ancient times scrotal pathologies have been cause of apprehension and anxiety on part of both the patient and clinician. Any solid lesion of the testis evokes the suspicion of malignancy in the clinicians mind as all testicular masses should be considered potentially malignant until proven otherwise<sup>[1]</sup>.

In the clinical examination of the scrotal swelling, physical evaluation by itself may be inadequate due to tenderness, swelling or gross distortion of scrotal contents. It is often difficult to decide whether a palpable scrotal mass is arising from the testes itself or from the extra testicular elements. In addition, the normal examination may over look significant pathology and physical signs elicited may be improperly interpreted<sup>[2]</sup>.

Imaging provides information that is unavailable from clinical examination, such as those of scrotal masses or inflammation<sup>[3]</sup>. Ultrasonography performed with a high-frequency transducer and the use of pulsed and color Doppler modes are the imaging modality of choice for evaluating acute and non-acute scrotal disease. Many of the disease processes, including testicular torsion, epididymo-orchitis and intratesticular tumor, produce the common symptom of pain at presentation, and differentiation of these conditions and disorders is important for determining the appropriate treatment. US with a high-frequency transducer helps to better characterize intrascrotal lesions and in many instances the findings suggest more specific diagnoses<sup>[4]</sup>. MRI gives the detailed anatomic imaging and provides a certain degree of tissue specificity. However, MRI is not easily available and its high cost resulting in its limitation for routine examination. Ultrasonography combining gray scale and color techniques, is irreplaceable in the diagnostic work-up of scrotal masses, while MRI can serve as a problem-solving diagnostic modality<sup>[5]</sup>.

Ultrasonography is simple to perform, rapid, noninvasive, relatively inexpensive, easily reproducible, widely available and does not provide radiation to gonads<sup>[6]</sup>. So we have conducted this study to classify (etiologically) and to evaluate various scrotal pathologies using ultrasonography and describe the role of high resolution ultrasound and colour Doppler in their diagnosis and differentiation.

## Material and Methods

A prospective study was conducted in the RVM Institute of Medical Sciences & Research Centre, Laxmakkapally, Telangana, India for the period of 1 year, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient or the relatives if the patient was not in good condition. The technique, risks, benefits, results and associated complications of the procedure were discussed with all patients.

The 100 patients with clinical features of scrotal diseases were included in this study.

## Inclusion criteria

Patients of all age groups with clinical manifestations of non-traumatic scrotal diseases.

## Exclusion criteria

### Post-operative cases

All the patients included in the study underwent scrotal ultrasonography using 7.0-12.0 MHZ high frequency linear array transducer coupled with Colour Doppler in Esaote My Lab 40 and Phillips affinti 70G equipments. Baseline demographic data were recorded, which included the patient's age, symptoms and clinical diagnosis. The ultrasound findings were analyzed with regard to the location and type of the abnormality which included- hydrocele, varicocele, testicular abscess, extra-testicular abscess, epididymal cyst, epididymitis, orchitis, testicular

torsion, tumours, scrotal wall thickening, inguino-scrotal hernia and calcifications if any. Subsequently, these cases were followed up and confirmed with either surgical findings, histopathology reports, response to treatment or follow up scans wherever applicable.

## Results

**Table 1:** Age of patients

Age	N=100	%
Below 10	4	4
10-20	11	11
20-30	34	34
30-40	38	38
Above 40	13	13

The study included a total of 100 patients. The patients most commonly involved were those belonging to the age group of 30 to 40 years (38%). The least number of patients belonged to the age group of 0-10 years (4%).

**Table 2:** USG diagnosis of various causes of scrotal pathologies

	N=120	%
Hydrocele	31	25.83
Epididymal cyst	20	16.67
Epididymo-orchitis	16	13.33
Epididymitis	9	7.5
Funiculitis	8	6.67
Varicocele	7	5.83
Pyocele	6	5
Testicular torsion	5	4.17
Testicular abscess	5	4.17
Inguino-scrotal hernia	4	3.33
Testicular microlithiasis	3	2.5
Testicular tumour	3	2.5
Tubercular epididymo-orchitis	3	2.5

On USG, the total number of lesions detected were 120. The most common cause of scrotal pathologies was hydrocele (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%), testicular torsion (n=5, 4.17%), testicular abscess (n = 5, 4.17%), inguino-scrotal hernia (n = 4, 3.33%), testicular microlithiasis (n= 3, 2.5%), testicular tumour (n=3, 2.5%) and tubercular epididymo-orchitis (n=3, 2.5%) (table 2). The number of scrotal lesions seen on the left side were 45(37.5%), on the right side were 35 (29.17%) and in bilateral locations were 20(16.67%). Associated symptoms included swelling, pain, fever and infertility. Almost all the scrotal pathologies were associated with scrotal swelling (n=97, 97%) except in 3 cases.

**Table 3:** Number of scrotal lesions on the basis of side

	N=120	%
Left side	45	37.5
Right side	35	29.17
Bilateral locations	20	16.67

Epididymal cysts were seen in 20 patients, 8 patients had right epididymal cysts (40%), 9 patients had left epididymal cysts (45%) and 3 patients had bilateral epididymal cyst (15%). Only 8 patients had complaints of pain and the size of the cysts in these patients was more than 3 cm. The largest epididymal cyst measured 5.5 cm in maximum dimension causing distortion of the adjacent testis. Acute epididymitis (n=9) was more common on the right side. All the patients had enlarged epididymis with hypoechoic echotexture with diffusely increased vascularity. Acute epididymo-orchitis (n=16) was most commonly seen on the left side. Majority of the patients had enlarged testis and epididymis with decreased echotexture and increased vascularity. Epididymis was enlarged in 13 cases (81.25%), normal in size in 3 cases (18.75%). The epididymis showed decreased echopattern in 13 cases (81.25%) and increased echopattern in 3 cases (18.75%). Diffuse increase in vascularity of epididymis was noted in 14 cases (81.72%). Testis was enlarged in 9 cases (56.25%), normal in size in 5 cases (31.25%) and decreased in size in 2 cases (12.5%). Testis was hypoechoic in 14 cases (81.25%) and showed normal echotexture in 2 cases (18.75%). Vascularity of testis was increased in 11 cases (68.75%), decreased in 4 cases (25%) and normal in 1 cases (6.25%). Hydrocele (n=31) was the most common scrotal pathology detected in this study. Among the study population, 13 patients (41.94%) had right sided hydrocele, 9 patients (29.03%) had left sided hydrocele and 9 patients (29.03%) had bilateral hydrocele. Among them, 2 patient was detected to have encysted hydrocele of the right spermatic cord. Hydrocele, as an isolated finding was seen in only 13 subjects. Varicocele 7 patients was most commonly seen on the left side. 4 patients had large varicocele and 3 patients had moderate varicocele. There were 3 patients with complaints of infertility and all 4 had left sided large varicoceles. These patients had dilated tortuous pampiniform plexus with reflux on Valsalva manoeuvre. Patients with large varicocele had a mean pampiniform plexus vein diameter of 6.2 mm on the affected side during standing posture. On Valsalva, the diameter increased by 1.6 mm. Those patients with moderate varicocele had a mean diameter of 4.4 mm in standing position and increased by 1.4 mm on Valsalva manoeuvre.

Pyocele was seen in 6 patients. Majority of the patients (n = 5, 83.33%) had mildly enlarged ipsilateral testis and epididymis. Chronic epididymo-orchitis was seen in 3 patients. 2(66.67%) subjects had right sided involvement. Heterogeneous echopattern with hyperechoic areas, enlarged epididymis and testis with increased vascularity were seen in all cases. Scrotal wall thickening was seen in all the patients. All 3 patients had history of systemic tuberculosis. 1 patient had associated testicular abscess, pyocele with internal septations and echogenic debris. All three subjects were subjected to USG following initiation of ATT. All of them showed good interval response to treatment. Testicular torsion was detected in 5 (n = 5) patients. 3 (n=3, 60%) patients had right testicular torsion. In all the cases, the testis was hypoechoic, showing reversed orientation with the absence of colour flow. Testicular abscess was seen in four (n=5) subjects. Right testis was involved in 3 subjects. All the patients had enlargement of the testis, epididymis with increased vascularity. Hypoechoic areas with internal echoes were noted within the testis. There was an extension of the abscess into the tunica vaginalis in one case. Minimal fluid collection was seen in tunica vaginalis in two cases, likely due to inflammatory reaction. Follow-up USG revealed good response to antibiotics in all patients. Scrotal tumours were seen in 3 patients, all involving the right testis.

## Discussion

The most commonly involved age group of 30 to 40 years (38%). The least number of patients belonged to the age group of 0-10 years (4%). A similar age group distribution of scrotal disorders was also reported by Thinyu *et al.* <sup>[7]</sup> in their study of 110 cases. Common symptoms were swelling, pain, fever and infertility among which swelling was the most common symptom. There was a total of 120 lesions detected. On USG, the most common cause scrotal pathology was hydrocele (n=31, 25.83%). Arjhansari K, Vises N *et al.* <sup>[8]</sup> had performed a retrospective study in 72 cases of extra testicular lesions and 48 cases of intratesticular lesions to find out the causes of intra-scrotal disease in which it was reported that hydrocele was the most common pathology. In our study of 100 patients, 97 patients (97%) had complaints of scrotal swelling, the most common cause being hydrocele. The second most common symptom was pain which was seen in 60 patients (60%). Our study showed similar results when compared to the observations made in other studies where the incidence of scrotal pain in patients with scrotal pathologies ranged from 62 to 76% <sup>[9, 10]</sup>.

Acute epididymitis (n=9) was more common on the right side. All the patients had enlarged epididymis with hypoechoic echotexture with diffusely increased vascularity. Other features such as reactive hydrocele and scrotal wall thickening further augment the diagnosis of epididymitis. A similar study done by Smith *et al.* <sup>[11]</sup> reported increased incidence with respect to the enlarged epididymis (71.5%), however hyper-vascular epididymis was reported in 72.9% of the cases and associated scrotal wall thickening in 11.3% cases. There were 16 patients with acute epididymo-orchitis. Accurate diagnosis of acute epididymo-orchitis was done in all cases. The patients were followed up following administration of systemic antibiotic and there was resolution of ultrasound features in all cases. USG features contributing to the diagnosis were bulky testis and epididymis showing hypoechoic echopattern and increased vascularity in a majority of the cases. Chronic tubercular epididymo-orchitis was diagnosed in 2 patients. Heterogeneous echopattern with hyperechoic areas, enlarged epididymis and testis with increased vascularity were seen in all cases. Compared to similar cross-sectional studies done by Horstman *et al.* <sup>[12]</sup> and Farriol *et al.* <sup>[13]</sup> in which acute epididymo-orchitis constituted about 40% of the scrotal pathologies, our study demonstrated acute epididymo-orchitis in only 2.5% of the study population. Reduced monetary input, limited accessibility to ultrasound and medical facilities compared to the western population and the lack of awareness could be the possible factors for the reduced detection of subjects with epididymo-orchitis inspite of poor socioeconomic status, reduced hygiene in rural areas and increased prevalence of sexually transmitted infections. Testicular abscess was seen in 5 subjects. Right testis was involved in 3 subjects. All the patients had enlargement of the testis, epididymis with increased vascularity. Hypoechoic areas with internal echoes were noted within the testis. Our results are similar to the studies performed by Luker and Siegel <sup>[14]</sup>. Hydrocele was the most common lesion detected in our study accounting to about 32.5% of the total lesions which is comparable to the findings from many other studies, where the incidence of hydrocele has been reported to be about 25.83%. Hydrocele (n=31) was the most common scrotal pathology detected in this study. Hydrocele (n=31) was the most common scrotal pathology detected in this study. Among the study population, 13 patients (41.94%) had right sided hydrocele, 9 patients (29.03%) had left sided hydrocele and 9 patients (29.03%) had bilateral hydrocele. Among them, 2 patient was detected to have encysted hydrocele of the right spermatic cord. Hydrocele, as an isolated finding was seen in only 13 subjects. Varicocele 7 patients was most commonly seen on the left side. 4 patients had large varicocele and 3 patients had moderate varicocele. There were 3 patients with complaints of infertility and all 4 had left sided large varicoceles. USG features were dilated tortuous pampiniform plexus with reflux of blood on Valsalva manoeuvre. Similar studies reported incidence of varicocele at 9.1%, 10.9% and 13.1% by Tinthyu M *et*

*al.*<sup>[7]</sup>, D'Andrea *et al.*<sup>[15]</sup> and Rizvi *et al.*<sup>[6]</sup> respectively. All the three studies reported that 20 to 30 years as the most common age-group for varicoceles which is similar to our study. Testicular torsion was detected in 5 (n = 5) patients. 3 (n=3, 60%) patients had right testicular torsion. In all the cases, the testis was hypoechoic, showing reversed orientation with the absence of colour flow. Vijayraghavan S *et al.*<sup>[16]</sup> conducted a prospective study of 211 patients with acute scrotum and had concluded that the sonographic realtime whirlpool sign is the most specific and sensitive sign of torsion, both complete and incomplete. Scrotal tumours were seen in 3 patients, all involving the right testis. On histopathological examination, they turned out to be seminoma, mixed germ cell tumour and teratoma. The ultrasound findings in our study are similar to those performed by Grantham *et al.*<sup>[17]</sup> Micallef M and Torreggiani WC *et al.*<sup>[18]</sup> in their study on scrotal swellings concluded that ultrasound examination distinguishes extra-testicular (almost always benign) from intratesticular (potentially malignant) causes of scrotal swelling. Infection, trauma, and torsion mimic the ultrasound appearance of a tumour as do rare benign entities. 3 cases of bilateral testicular microlithiasis were detected as incidental findings. There were no associated testicular masses detected. They were found as incidental lesions. In the pediatric population, Goede *et al.*<sup>[19]</sup> noted that the prevalence of testicular microlithiasis was 2.4% in asymptomatic male patients belonging to the 0-19 years age group, with an increase in prevalence noted with increasing patient age. Cast *et al.*<sup>[20]</sup> calculated a 21.6-fold relative risk of a concurrent tumour in patients with testicular microlithiasis. Isolated TM has been reported to be associated with germ cell tumours. However further longitudinal studies are required to firmly establish the relationship between testicular microlithiasis and germ cell tumours. Limitations of the study Follow up of few cases pertaining to inflammatory causes of scrotal pathology were not possible.

### Conclusion

High frequency ultrasonography with color Doppler study serves as an excellent diagnostic imaging modality in the evaluation of scrotal swellings. It is the investigation of choice as it is highly sensitive, easy to perform, widely available, repeatable and involves no risk of ionizing radiation, especially to radiosensitive parts like testis. It helps to arrive at an accurate diagnosis in a majority of patients with scrotal swellings, thus guiding further management. When USG findings are inconclusive MRI may be useful. Periodic follow-up USG studies are recommended for all patients with inflammatory scrotal lesions for monitoring response to treatment or to reveal development of complications.

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