

## Role of high resolution ultrasound and colour doppler in diagnosis and differentiation of scrotal pathologies

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### Abstract

**Aims:** To assess the role of high resolution ultrasound and colour Doppler in diagnosis and differentiation of scrotal pathologies. **Material and Methods:** A prospective study was conducted in the Department of Radiology, Narayana Superspeciality Hospital, Howrah, West Bengal, India, from July 2017 to July 2018. The 80 patients with clinical features of scrotal diseases were included 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 LOGIQ P6 PRO equipment. **Results:** The study included a total of 80 patients. The patients most commonly involved were those belonging to the age group of 30 to 40 years (n = 30; 37.5%). The least number of patients belonged to the age group of 0-10 years (n = 3; 3.75%). On USG, the total numbers of lesions detected were 100. The most common cause of scrotal pathologies was hydrocele (n=25, 25%) followed by epididymal cyst (n= 17, 17%), epididymo-orchitis (n =14, 14%), epididymitis (n = 8; 8%), funiculitis (n=7, 7%), varicocele (n = 6, 6%), pyocele (n= 5, 5%), testicular torsion (n=4, 4%), testicular abscess (n = 4, 4%), inguino-scrotal hernia (n = 3, 3%), testicular microlithiasis (n= 2, 2%), testicular tumour (n=2, 2%) and tubercular epididymo-orchitis (n=2, 2%).

**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.

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### Introduction

The scrotum is a musculo-fascial sac containing the testes, epididymis and their appendages. The accessibility of these structures for clinical examination is easy in the absence of any pathology. Most of the diseases that affect the scrotum causing swelling and tenderness limit the clinician to differentiate intra-testicular from extra-testicular lesions and benign from malignant lesions. Acute painful conditions like acute testicular torsion and acute epididymo-orchitis also hamper the accurate

diagnosis of the underlying pathology because of overlapping clinical features, thereby requiring prompt diagnosis for providing the necessary treatment<sup>1</sup>. High-frequency ultrasound is an outstanding modality to evaluate the scrotal wall, epididymis, testes and their appendages as it provides high-quality anatomical detail. High-frequency ultrasound, coupled with colour flow Doppler imaging help in determining the viability and vascularity of the testes, thereby assisting in providing an accurate diagnosis in perplexing situations<sup>2</sup>. The advantages of ultrasonography in the evaluation of scrotal diseases are – non-invasive, easy reproducibility, rapid evaluation with real time examination capability, easy availability, economical and the lack of radiation. Computed tomography has the disadvantage of ionising radiation to the gonads,

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requirement for contrast media and is a relatively expensive modality. Magnetic Resonance Imaging (MRI) is also expensive and not readily available, even though it provides improved cross-sectional information. Therefore, USG is the undisputed first choice investigation for scrotal pathologies<sup>3</sup>.

Ultra sound with Color Doppler, Magnetic resonance imaging, testicular angiography and radioisotope studies are now first line of investigations used mainly to investigate various scrotal pathologies<sup>4</sup>. The development of sonogram with high frequency linear transducer and color Doppler is an important milestone in evaluating scrotal pathologies. Computed tomography exposes testicles to the radiation and MRI is not so easily available<sup>5</sup>. So ultrasound with color Doppler is best suited for evaluation of scrotal pathologies. It is simple, non-invasive, reproducible, widely available, relatively inexpensive investigation that does not expose the testis to radiation<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 Department of Department of Radiology, Narayana Superspeciality

Hospital, Howrah, West Bengal, India, from July 2017 to July 2018

#### Methodology

The 80 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 LOGIQ P6 PRO equipment. 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=80	%
Below 10	3	3.75
10-20	8	10
20-30	27	33.75
30-40	30	37.5
Above 40	12	15

The study included a total of 80 patients. The patients most commonly involved were those belonging to the age group of 30 to 40 years (n = 30; 37.5%). The least number of patients belonged to the age group of 0-10 years (n = 3; 3.75%).

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

Diagnosis	N=100	%
Hydrocele	26	26
Epididymal cyst	17	17
Epididymo-orchitis	14	14
Epididymitis	8	8
Funiculitis	7	7
Varicocele	6	6
Pyocele	5	5
Testicular torsion	4	4
Testicular abscess	4	4
Inguino-scrotal hernia	3	3
Testicular	2	2

microlithiasis		
Testicular tumour	2	2
Tubercular epididymo-orchitis	2	2

On USG, the total numbers of lesions detected were 100. The most common cause of scrotal pathologies was hydrocele (n=25, 25%) followed by epididymal cyst (n= 17, 17%), epididymo-orchitis (n =14, 14%), epididymitis (n = 8; 8%), funiculitis (n=7, 7%), varicocele (n = 6, 6%), pyocele (n= 5, 5%), testicular torsion (n=4, 4%), testicular abscess (n = 4, 4%), inguino-scrotal hernia (n = 3, 3%), testicular

microlithiasis (n= 2, 2%), testicular tumour (n=2, 2%) and tubercular epididymo-orchitis (n=2, 2%) (Table 2). The number of scrotal lesions seen on the left side was 44(44%), on the right side were 42 (42%) and in bilateral locations were 14(14%). Associated symptoms included swelling, pain, fever and infertility. Almost all the scrotal pathologies were associated with scrotal swelling (n=77, 96.25%) except in two cases.

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

Side involved	N=100	%
left side	44	44
right side	42	42
bilateral locations	14	14

Epididymal cysts were seen in 17 patients, 7 patients had right epididymal cysts (41.17%), 8 patients had left epididymal cysts (47.05%) and 2 patients had bilateral epididymal cyst (11.76%). Only 7 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=8) was more common on the right side. All the patients had enlarged epididymis with hypoechoic echotexture with diffusely increased vascularity. Acute epididymo-orchitis (n=14) 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 12 cases (85.72%), normal in size in 2 cases (14.28%). The epididymis showed decreased echopattern in 12 cases (85.72%) and increased echopattern in 2 cases (14.28%). Diffuse increase in vascularity of epididymis was noted in 12 cases (85.72%). Testis was enlarged in 8 cases (57.14%), normal in size in 4 cases (28.57%) and decreased in size in 2 cases (14.29%). Testis was hypoechoic in 12 cases (85.72%) and showed normal echotexture in 2 cases (14.29%). Vascularity of testis was increased in 10 cases (71.42%), decreased in 3 cases (21.42%) and normal in 1 case (7.14%). Hydrocele (n=26) was the most common scrotal pathology detected in this study. Among the study population, 10 patients (38.46%) had right sided hydrocele, 8 patients (30.77%) had left sided hydrocele and 8 patients (30.77%) had bilateral hydrocele. Among them, 2 patients were detected to have encysted hydrocele of the right spermatic cord. Hydrocele, as an

isolated finding was seen in only 12 subjects. Varicocele 6 patients were most commonly seen on the left side. 3 patients had large varicocele and 3 patients had moderate varicocele. There were 3 patients with complaints of infertility and all 3 had left sided large varicocele. 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 mm on the affected side during standing posture. On Valsalva, the diameter increased by 1.7 mm. Those patients with moderate varicocele had a mean diameter of 4.3 mm in standing position and increased by 1.3 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 2 patients. 1(50%) 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 2 patients had history of systemic tuberculosis. One 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 4 (n = 4) patients. 3 (n=3, 75%) 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=4) subjects. Right testis was involved in 2 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 2 patients, all involving the right testis. On histopathological examination, they turned out to be seminoma, mixed germ cell tumour and teratoma. 2 cases of bilateral testicular microlithiasis were detected as incidental findings. There were no associated testicular masses detected.

### Discussion

The most commonly involved age group was 30 to 40 years (n = 30, 37.5%) followed by 20 to 30 years (n = 27, 33.75%) and above 40 years (n = 12, 15%). 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 were a total of 100 lesions detected. On USG, the most common cause scrotal pathology was hydrocele (n=26, 26%). 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 80 patients, 77 patients (96.25%) had complaints of scrotal swelling, the most common cause being hydrocele. The second most common symptom was pain which was seen in 50 patients (62.5%). The most common cause of pain was infective/ inflammatory etiology (n = 40, 80%). 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=8) 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 14 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 four (n=4) subjects. Right testis was involved in 2 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 26%. Hydrocele was most commonly seen in the age group of 30 to 40 years. Hydrocele (n=26) was the most common scrotal pathology detected in this study. Among the study population, 10 patients (38.46%) had right sided hydrocele, 8 patients (30.77%) had left sided hydrocele and 8 patients (30.77%) had bilateral hydrocele. Among them, 2 patients were detected to have encysted hydrocele of the right spermatic cord. Hydrocele, as an isolated finding was seen in only 12 subjects. Varicocele 6 patients was most commonly seen on the left side. 3 patients had large varicocele and 3 patients had moderate varicocele. There were 3 patients with complaints of infertility and all 3 had left sided large varicoceles. 3 patients (50%) belonged to the 20 to 30 years age group. 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 varicocele which is similar to our study. Testicular torsion was detected in 4 (n = 4) patients. 3 (n=3, 75%) 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 real-time whirlpool sign is the most specific and sensitive sign of torsion, both complete and incomplete. Scrotal tumours were seen in 2 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>. Micaleff 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. 2 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 paediatric 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 testicular microlithiasis 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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