

## SCROTAL SWELLING- EVALUATION BY HIGH FREQUENCY USG AND COLOUR DOPPLER STUDIES

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### ABSTRACT

#### BACKGROUND

The aim of the study is to-

1. Study ultrasonographic and colour Doppler patterns of different causes of scrotal swelling (masses).
2. Asses the role of high frequency real time USG in differentiating testicular and extra testicular masses.

#### MATERIALS AND METHODS

A hospital-based cross-sectional study of 100 cases of scrotal pathology were studied over a period of 1 year from 1<sup>st</sup> August, 2008, to 31<sup>st</sup> July, 2009, in the Department of Radiodiagnosis, Assam Medical College Hospital at Dibrugarh. All the patients were subjected to grey scale high resolutions USG of scrotum and then scrotal colour Doppler study. Sonographic imaging was performed with Phillips HD-11 real time scanner by using 2.5-5 MHz curvilinear probe and 10 MHz linear transducer.

#### RESULTS

Out of 100 cases of scrotal swelling- 97% were benign, 3% were malignant. Among the benign lesions, 82% cases were extra testicular, 7% intratesticular, 8% are both intra and extra testicular in origin. 100% of all malignant lesions were intratesticular. Of the benign lesion- 40% hydrocele, 26% inflammatory lesions, 5% hernia, 6% varicocele, 4% traumatic, 5% cases epididymal cyst, 2% cases torsion.

#### CONCLUSION

High resolution, high frequency US and colour Doppler study of scrotum had the advantages of being noninvasiveness, lack of ionising radiation, wide availability, cost effectiveness and repeatability. It is accurate in differentiating testicular ischaemia and torsion, solid and cystic, benign and malignant mass. It is highly sensitive in demonstrating varicocele.

#### KEYWORDS

Scrotal Swelling, High Resolution USG, Color Doppler.

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#### BACKGROUND

Scrotal swelling, a physical evaluation by itself maybe inadequate due to tenderness, swelling or gross distortion of scrotal contents. Clinical signs and symptoms are usually nonspecific, variable and misleading. After the clinical examination, the cause of patient's symptom can still be enigma in some patient with a large hydrocele where testis cannot be palpated and condition of testis cannot be known. Hydrocele can be easily diagnosed clinically by transillumination test, but cause of hydrocele whether it is idiopathic, infective origin or due to malignancy cannot be confirmed.

The purpose of this study is to evaluate the role of high frequency ultrasound and Doppler studies in scrotal diseases without exposing highly sensitive germinal cells to ionising radiation and to achieve correct diagnosis and thereby ensuring proper management of the scrotal diseases for the maximum benefit of the patients.

1. To study ultrasonographic pattern of different cause of scrotal pathology.
2. To study colour Doppler findings in various scrotal pathologies.
3. To assess the role of high frequency real time ultrasonography in distinguishing between testicular and extra testicular scrotal masses.
4. To correlate ultrasonographic findings in various patients with histopathological examination when necessary and if available, findings at operation or follow-up studies.

#### MATERIALS AND METHODS

In this series, 100 cases of scrotal swellings were studied using high-frequency real time gray scale ultrasonography and Doppler study within the period 1<sup>st</sup> August 2008 to 31<sup>st</sup> July 2009. These patients were referred to our department

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for scrotal ultrasonography and Doppler study from Surgery Department of Assam Medical College, Dibrugarh.

The color Doppler sonography was routinely performed in all these patients. Subsequently, these cases were followed up and correlated with histopathology report, fine needle aspiration cytology results, surgical findings, response to treatment, whenever available or indicated. Follow up scans were done in selected cases when clinically indicated.

Sonographic imaging was performed with a Phillips HD-11 real-time scanner.

**Ultrasonographic Examination of the Scrotum**

Scanning technique- Scanning was routinely performed in supine position after elevating scrotum using a towel draped over thigh and the penis is placed on the patient’s abdomen and covered with a towel. Both hemiscrotum was examined in transverse, longitudinal and oblique planes. Immobilisation was achieved by holding the testis with the left hand and scanning with the right hand. Testis was first held in neutral position and then in internal and external rotation. Scanning was also done with patient position in upright and during performing Valsalva manoeuvre. Additional scans of spermatic cord in region of scrotal neck and inguinal canal region were obtained in special circumstances- Undescended testis, encysted hydrocele of cord and varicocele.

During ultrasound scan on a routine basis following parameters were evaluated.

1. Testicular dimension and size.
2. Testicular contour normal/diffuse enlargement/focal enlargement.
3. Testicular echogenicity/normal focal abnormality- hypoechoic/hyperechoic/heterogenous diffuse abnormality - hypoechoic/hyperechoic/heterogenous.
4. Epididymis, (a) Enlargement - Diffuse/focal/head/body/tail, (b) Echogenicity focal abnormality-Hypoechoic/hyperechoic/heterogenous diffuse abnormality - Hypoechoic/hyperechoic.
5. Scrotal wall thickness.
6. Presence or absence of any collection in scrotal sac.
7. Presence or absence of any dilated veins.
8. Doppler assessment of testes, epididymis and vascular structures.
9. Presence of any anomalies in scrotum.

**Technical Factors**

Technical factors are important to produce adequate images. Major considerations include-

**Power**

It is best to keep the power at the minimum level required to penetrate through the scrotal wall.

**Gain**

The variable gain needed is provided by time-gain compensator.

**Transducer**

The study was conducted using 3-12 MHz linear array transducer for evaluation of scrotum and 2-5 MHz convex array transducer for evaluation of abdomen.

**RESULTS AND OBSERVATIONS**

100 patients with scrotal pain and swelling were selected for this prospective study after considering the inclusion and exclusion criteria. The duration of the study was from August 2008 to July 2009.

Clinical history and physical examination were done in all the patients. The objective of the study was to distinguish extra testicular lesions from intratesticular lesion, nature of the lesions and whether the lesions were benign or malignant.

Highest number of cases presented were in the age group of 31 to 40 years (29 cases - 29%), followed by 21 to 30 years (27 cases - 27%). The age groups of 21 to 40 years constitute 56%.

Commonest clinical presentation was combination of symptoms like pain and scrotal swelling, as in 34 cases (34%), combination of pain, swelling and fever in four cases (4%).

Most common pathology noted in this study was hydrocele, seen in 40 patients (40% of cases). It was noted unilaterally in 30 patients and bilaterally in 10 patients.

- There were 82 extra testicular and 10 testicular lesions.
- In eight cases, abnormality was noted in both intra- and extra testicular regions (ac. epididymo-orchitis, Tb epididymo-orchitis and nature).
- Largest number of lesions is noted in the 31-40 age groups, predominantly extra testicular abnormalities.
- Testicular lesions are more common in the 21-30 age groups. Age groups from 21-50 accounted for 70% of overall cases and also among testicular pathology.
- Inflammatory lesions constitute the most common testicular pathology (9 cases) followed by malignancy (3 cases) and torsion.

Hydrocele was the most common extra testicular lesions (40 cases) followed by inflammatory lesions.

Sl. No.	Age Group (Years)	No. of cases	%
1.	0-10	4	4%
2.	11-20	15	15%
3.	21-30	27	27%
4.	31-40	29	29%
5.	41-50	14	14%
6.	51-Above	11	11%
	<b>Total</b>	<b>100</b>	<b>100%</b>

**Table 1. Distribution of Cases According to Various Age Groups**

Sl. No.	Pathology	No. of Cases	% of Cases
1.	Acute epididymitis	13	50%
2.	Acute epididymo-orchitis	5	19.2%
3.	Acute orchitis	2	7.7%
4.	Chronic epididymitis	2	7.7%
5.	Chronic epididymo-orchitis (tb)	2	7.7%
6.	Scrotal filariasis	2	7.7%
	<b>Total</b>	<b>26</b>	<b>100%</b>

**Table 2. Inflammatory Scrotal Pathology Distribution**

Sl. No.	Echo Pattern	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Chronic Epididymo-Orchitis
1.	Hyperechoic	1				
2.	Hypoechoic	9	2	4		
3.	Isoechoic					
4.	Heterogeneous	3		1	2	3
5.	Complex Cystic					
6.	Purely Cystic					
7.	Epididymal Calcification					1
8.	Testicular Calcification					

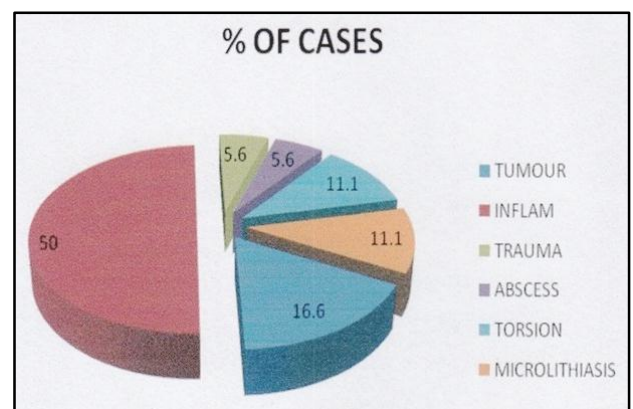
**Table 3. High-Resolution US Appearance of Inflammatory Scrotal Pathology**

Sl. No.	Color Doppler Appearance	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Chronic Epididymo-Orchitis
1.	Focal increase in vascularity	7	2	1		
2.	Diffuse increase in vascularity	6		4	2	1
3.	Focal decrease in vascularity					
4.	Diffuse decrease in vascularity					
5.	Normal vascularity					1

**Table 4. Color Doppler Appearance of Inflammatory Scrotal Pathology**

Sl. No.	Pathology	Number of Cases	% of Cases
1.	Tumour	3	16.6
2.	Inflammatory disease	9	50
3.	Trauma	1	5.6
4.	Abscess	1	5.6
5.	Torsion	2	11.1
6.	Microlithiasis	2	11.1
	<b>Total</b>	<b>18</b>	<b>100</b>

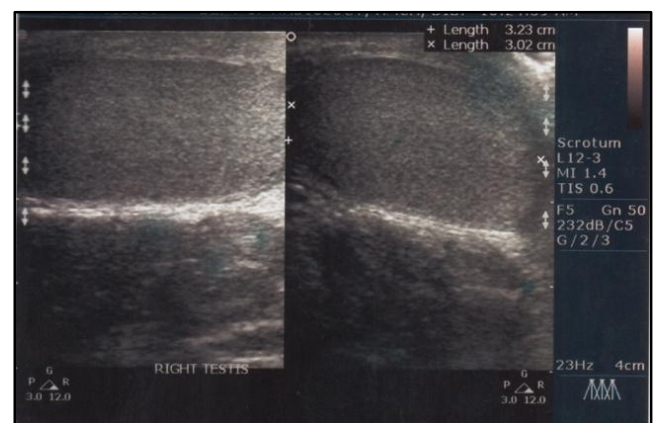
**Table 5. Distribution of Lesions Involving the Testis**



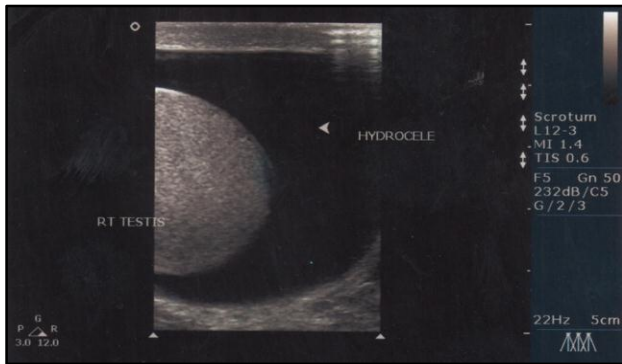
**Graph 1. Distribution of Lesions Involving Testis**

Sl. No.	Pathology	Number of Cases	% of Cases
1.	Hydrocele	40	48.8%
2.	Epididymal cyst	5	6.1%
3.	Inflammatory	17	20.7%
4.	Varicocele	6	7.3%
5.	Hernia	5	6.1%
6.	Trauma	3	3.7%
7.	Undescended testis	4	4.9%
8.	Scrotal pearl	2	2.4%
	<b>Total</b>	<b>82</b>	<b>100%</b>

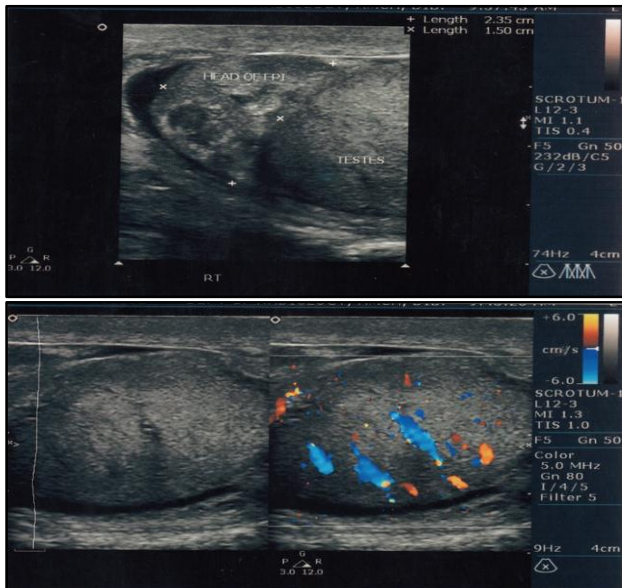
**Table 6. Non-Neoplastic Extra Testicular Pathologies of Scrotum**



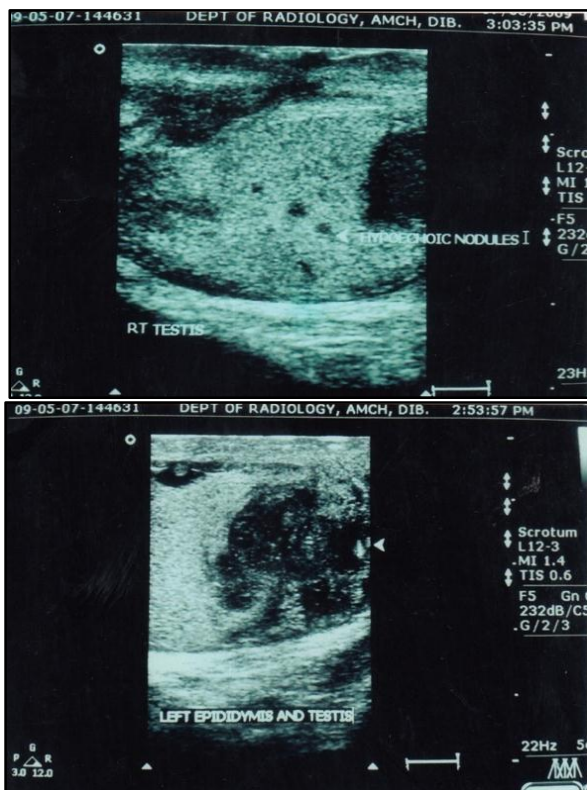
**Figure 1. Normal Testis**



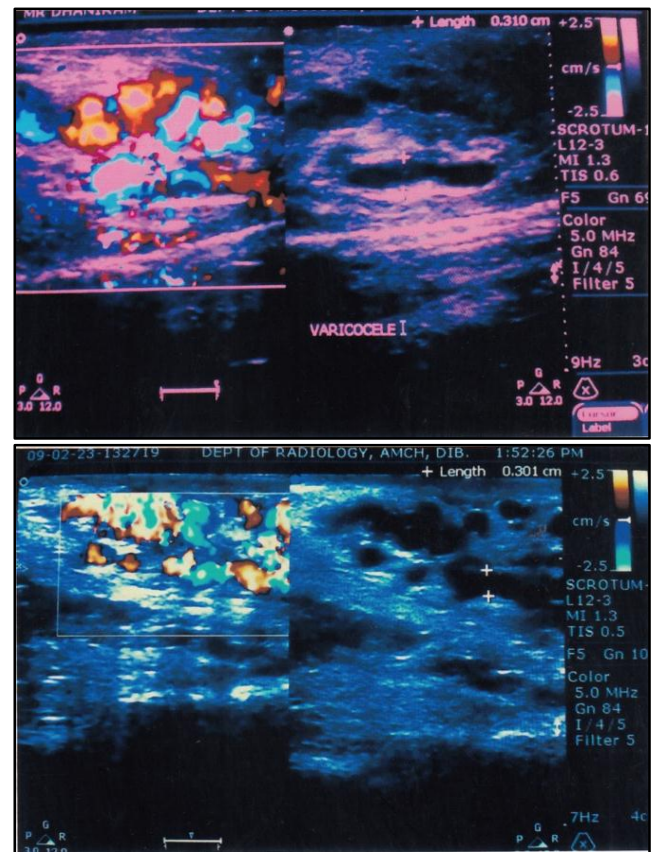
**Figure 2. Hydrocele**



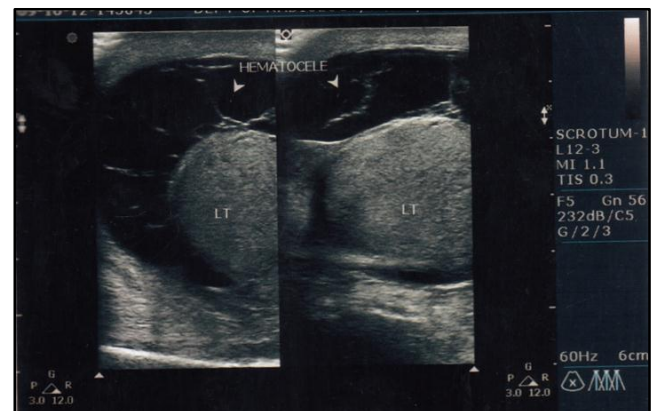
**Figure 3. Acute Epididymo-Orchitis**



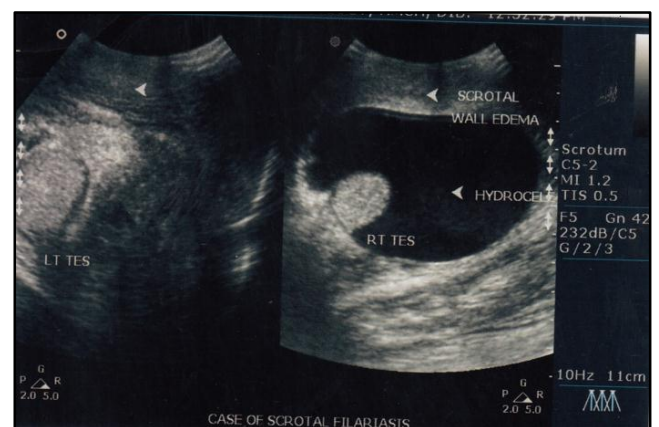
**Figure 4. Granulomatous Orchitis**



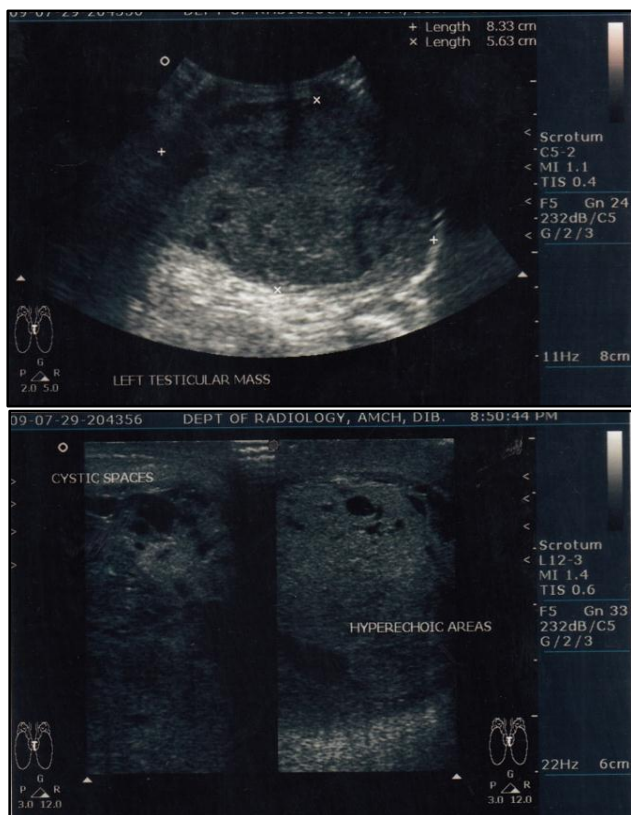
**Figure 5. Varicocele**



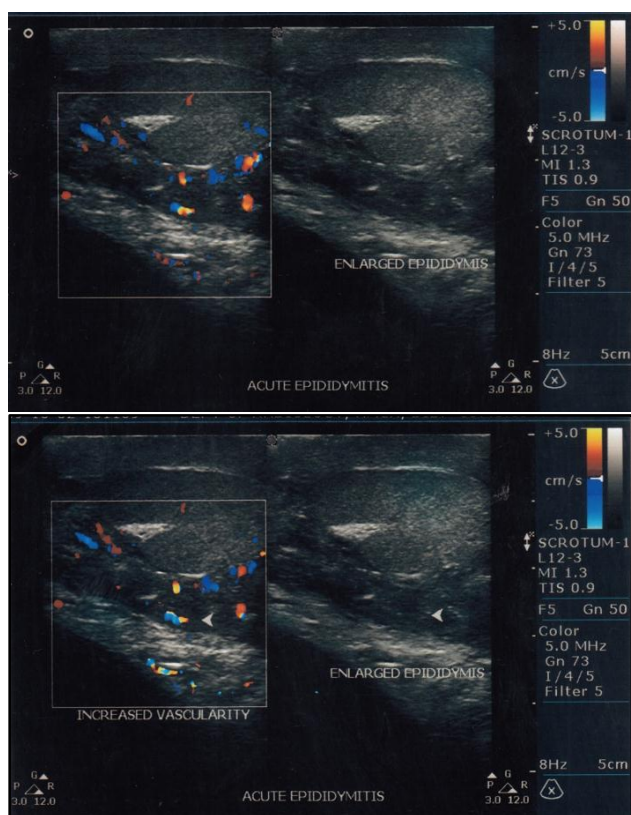
**Figure 6. Haematocele**



**Figure 7. Filariasis**



**Figure 8. Testicular Tumour**



**Figure 9. Acute Epididymitis**

**DISCUSSION**

The superficial location of the scrotal contents makes them ideally suited for sonographic examination. The development of right frequency, real-time scanners has enhanced the diagnostic accuracy of scrotal sonographic examinations. Scrotal ultrasound has reached a level of

maturity that allows the technique to be the first and only imaging examination necessary to evaluate the scrotal contents.

In this study, we have examined 100 patients with high frequency ultrasound scan and colour Doppler study was done in relevant cases for detection of scrotal and testicular pathology.

Miskin and Bain<sup>1</sup> and Murray Miskin, Martin Buckspan and Jerald Bain<sup>2</sup> first published report about using diagnostic ultrasound as a modality of investigating scrotal pathologies, advances in instrumentation and transducer design have progressed to the point where high frequency US is the modality of choice in investigating scrotal and testicular pathology. While CT and MRI have dominated imaging of other regions of the body, they have certain limitations in evaluation of scrotal diseases. Computed tomography delivers radiation to gonads, while MRI imaging is costly and not readily available.

**Inflammatory Diseases of Scrotum and its Contents**

In our study, out of 100 cases, 26 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 13 cases (50%). Next, most frequent inflammatory pathology detected was acute epididymo-orchitis noted in 5 cases (19.2%). Other detected inflammatory pathology include, scrotal filariasis 2 cases, acute orchitis 2 cases (7.7%), chronic epididymitis 2 cases (7.7%) and chronic epididymo-orchitis 2%.

Horstman Middleton and Nelson et al<sup>3</sup> in their study of 45 patients found acute epididymitis present in 25 cases (56%), acute epididymo-orchitis in 19 cases (42%), acute orchitis in 1 cases (2%) 17. No case of chronic epididymo-orchitis was reported.

Lerner et al<sup>4</sup> in their limited series of 5 cases of acute inflammatory diseases of scrotum found acute epididymitis in 3 patients (60%), acute epididymo-orchitis in 2 patients (40%).

Farriol et al<sup>5</sup> in their study of 25 cases of acute inflammatory disease of scrotum using high-resolution grey scale and power Doppler sonographic study found epididymitis in 11 cases (44%), epididymo-orchitis in 10 cases (40%), orchitis in 2 cases (8%), funiculitis in 2 cases (8%).

**High Frequency US and Color Doppler Appearance of Inflammatory Scrotal Pathology**

Of cases of acute epididymitis, we observed diffuse hypoechogenicity with diffuse increase in vascularity and size of epididymis, these findings are similar to the findings of Horstman et al<sup>3</sup> in their study of 45 cases (51 hemiscrotum), Farriol et al<sup>5</sup> in their study of 11 cases.

Acute epididymo-orchitis- We observed diffuse hypoechogenicity with diffuse increase in vascularity in 4 cases, one case showed heterogenous echotexture, one case showed focal increase in vascularity and size of epididymis was increased in all the cases. These findings are similar to the finding of Horstman et al<sup>3</sup> in their study of 45

cases (51 hemiscrotum), Farriol et al<sup>5</sup> in their study of 11 cases.

Chronic epididymo-orchitis in 2 cases (7.7%). Both were diagnosed as granulomatous orchitis- tubercular. Of these, one case had bilateral involvement. On high-frequency US sonography, we observed diffuse increase in size of epididymis with normal testicular size. There was heterogenous echotexture of epididymis with calcifications and multiple hypoechoic nodules in testis. On colour Doppler sonography, there was evidence of diffuse increase in vascularity in 1 case, normal vascularity in 1 case.

High-frequency US sonography and colour Doppler sonography findings are in similarity with study Kim S H et al.<sup>6</sup>

### Hydrocele

Hydrocele is the commonest pathology noted 40 cases (48.8%). Out of 40 cases, hydrocele was noted unilaterally in cases, bilateral in 10 cases. These findings are in similarity to previous studies of Arger et al and Willscher et al.<sup>7</sup>

Few cases showed low level internal echoes probably due to elevated proteins or cholesterol crystals as mentioned by Gooding GAW et al<sup>8</sup> (1994).

### Testicular Tumours

Of 100 cases of scrotal swelling, 3 cases were neoplastic lesions (3%) and all were diagnosed a malignant by USG. Histopathology was done in all the cases and came out to be malignant tumours.

Cystic changes and calcifications were more commonly found in tumours containing teratomatous elements. All cases showed increased vascularity on color Doppler study. One of the cases had metastatic adenopathy in retroperitoneum. These findings are in similarity to previous studies by Grantham et al<sup>9</sup> and Schwerek et al.<sup>10</sup>

### Varicocele

Varicocele was noted in 6 cases (7.3%) out of 82 cases. All had unilateral pathology on the left side. A varicocele was considered to be present by high-frequency grey scale US, if 2 or greater. A varicocele was considered to be present by colour Doppler US, if retrograde flow was identified within the pampiniform plexus spontaneously and/or during Valsalva manoeuvre (Randall et al).<sup>11</sup> Varicocele was detected in patients presenting with symptoms like scrotal swelling, pain and infertility. History of infertility was noted in 2 cases.

Rifkin MD, Foy PM, Goldberg BB (1984) et al<sup>12</sup> stated that idiopathic varicocele occur on left side in 98% cases and are usually detected in men between 15-22 yrs. of age.

### Epididymal Cyst

In our study, we noted 5 cases of epididymal cysts. Out of 5 cases of epididymal cysts, 4 were unilateral and one was bilateral. Most of the epididymal cysts are uniloculated situated in the head of epididymis, thin-walled anechoic. In present study, we detected no cases of spermatocele. Leung

et al 57, in their study of 40 subjects detected 29 cases of epididymal cysts and spermatoceles.

### Trauma

In the present study, out of 100 subjects examined, 4 cases (4%) of scrotal and testicular trauma were detected. Haematocele was noted in 2 cases, testicular haematoma with haematocele in 1 case and scrotal wall haematoma in 1 case.

Alexander S Cass et al<sup>13</sup> in their series of 86 patients with scrotal trauma noted unilateral involvement in 81 cases (94%) and bilateral in 5 case (6%).

George Schuster et al<sup>14</sup> had stated that right-sided traumas are more common. In a series of 72 patients, right-sided testicular injury noted in 40 patients (56%) and left-sided injury was noted in 32 patients (44%).

### Torsion

We had encountered 2 cases of testicular torsion. Both the patients are between 11-20 yrs. of age. Testis was swollen and hypoechoic in both the cases. Colour Doppler studies showed no flow within the involved testis.

Benson et al<sup>15</sup> (1989) stated that the sonographic appearance of torsion depends upon the time elapsed since the onset. In the first few hours, testis become enlarged with homogeneously decreased echogenicity. After 24 hrs., testis becomes heterogeneous as necrosis and haemorrhage sets in hydrocele also develops.

### Undescended Testis

We had 4 cases of undescended testis in our study. All were unilateral in presentation. Age of presentation varied from 0-10 years. Out of this, high frequency US could identify only 2 cases (50%) of incompletely descended testes, which were in the inguinal region. They were also clinically palpable. These testes were small compared to contralateral testes. These were showing normal colour flow on Doppler suggesting viability.

The present study shows that high frequency US is less sensitive in detecting clinically palpable cases and not a reliable diagnostic modality in detecting abdominal ectopic testes. Similar findings were noted in a previous study by Robert Weiss et al<sup>16</sup> in which they studies 20 cases of palpable undescended testes, could identify 14 cases only (70%) by high frequency US and out of 21 cases of non-palpable testes only one cases was identified by high frequency US.

### Testicular Abscess

We got one case of testicular abscess. It presented as an anechoic lesion with internal echoes and peripheral vascularity. Findings were similar to the previous studies.

Miskin et al<sup>1</sup> (1977) reported cases of testicular abscess that appears as diffuse enlargement with internal echoes and interspersed by areas of lucency.

### Hernia

In this study, we found 5 cases of hernia (5%). Three cases demonstrated only omentum (omentocele) and two cases showed bowel loops showing visible peristalsis.

Showker TH (1976) et al<sup>17</sup> reported that hernia is characterised by presence of air within scrotum.

Subramanyam BR et al<sup>18</sup> (1982) stated that hernia could be diagnosed by recognition of valvulae conniventes or haustrations and detection of peristalsis on real-time sonography.

### Scrotal Calcification

Scrotal Pearl- In this series, we got 2 cases of scrotal pearl. They appeared as freely mobile, echogenic masses with posterior acoustic shadowing between the layers of tunica vaginalis. Our findings are same as that presented in the previous literatures.

Kickham first described scrotal calculus (fibrinoid loose body or scrotal pearl) in 1935 as a "calcified hydrocele mimicking a tumour."

### Testicular Microlithiasis

In this series, we got 2 cases of testicular microlithiasis (2%). They appeared like bright echogenic foci without acoustic shadowing. Findings were consistent with those previously described in the literature.

Backus et al<sup>19</sup> described that the sonographic appearance of testicular microlithiasis is characteristic. Numerous tiny hyperechoic foci measuring less than 2 mm in diameter are present diffuse throughout both testes (tend to be uniform in size in each patient). Acoustic shadowing is not seen probably due to the small size of the calcifications.

### Accuracy in Differentiating Extra Testicular Pathology from Intratesticular Pathology

In our study, we found 100% accuracy in differentiating whether the lesion is intra or extra testicular. This correlated with Rifkin MD et al (1987) who also found that ultrasound technique is capable of differentiating intratesticular from extra testicular disease with an accuracy of 100%.

Benson CB et al<sup>15</sup> (1989) found 98-100% accuracy in differentiating intratesticular from extra testicular pathology.

The accuracy in our study is higher that of Willcher MK et al who found only 88% of the diagnostic accuracy.

The sensitivity in detection of malignant tumour in our study was 100% and specificity 98.2%.

Benson CB et al<sup>15</sup> (1989) in their study group found 100% sensitivity in detection of malignant testicular tumour. Accuracy rate of tumour detection in our study was 100%, which is higher than the findings of Karman et al (1988) who found accuracy of 88%.

The sensitivity and specificity of high-frequency ultrasonography is high compared with clinical examination in differentiating a scrotal mass. Present study shows a low sensitivity of physical examination (65%) and low specificity (50%), whereas high frequency ultrasonography is highly sensitive and specific (almost 100%) in differentiating a

scrotal mass as either intratesticular or extra testicular compared to physical examination.

### CONCLUSION

High frequency USG and colour Doppler are simple, noninvasive, cost effective, radiation free procedure mostly informative in scrotal pathology.

In acute scrotal inflammatory diseases when it is difficult to diagnose clinically, high frequency USG 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 USG with colour Doppler studies with great accuracy and sensitivity.

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