

Role of ultrasound and colour doppler in assessment of adult scrotal pathologies

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Abstract

In this paper, we conclude, 1. Evaluation of scrotal pathologies by gray scale ultrasonography and colour doppler. 2. To classify the scrotal swelling. 3. To evaluate the clinically suspected cases of scrotal lesions by colour Doppler ultrasound. 4. To find out the sensitivity of colour Doppler ultrasound in detecting scrotal lesions.

Key Words: Scrotal pathology.

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INTRODUCTION

The scrotum is a superficial structure separated by a midline septum, with each half of the scrotum containing testis, the epididymis and the lower part of the spermatic cord. The scrotal wall is composed of the following structures, listed from the superficial to the deep layers: skin, superficial fascia, dartos muscle, external spermatic fascia, cremasteric fascia, and internal spermatic fascia.¹ 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 skip significant pathology and physical signs elicited may be improperly interpreted.¹ Sonography played a vital role in the evaluation of testes

obscured from palpation by large hydrocele and accurately separated intra testicular from extra testicular masses, even when the location is equivocal on physical examination.¹ The most safety imaging modality for diagnoses scrotal abnormalities is ultrasound (u/s). Testicular u/s is a useful noninvasive tool in both adult and pediatric patient. It avails as a good screening and diagnostic method and helps transcribe further confirmation or exclude the clinical diagnosis.^{2,3} In the present study we combined USG with color Doppler interrogation which add important information for the guidance of treatment. From the view point that US is more convenient and easier to be performed in the emergency clinical settings than MRI, a contrast-enhanced ultrasound study would be the ideal tool in the assessment of testicular perfusion in patients with acute scrotal symptoms. The acute scrotum is a medical emergency defined as scrotal pain, swelling, and redness of acute onset.^{4,5} Causes of scrotal pain include inflammation (epididymitis, epididymo-orchitis, abscess), testicular torsion, testicular trauma, and testicular cancer.^{6,7}

MATERIALS AND METHODS

Type of study: The study was hospital based prospective observational study conducted at Government Medical College and Hospital, Aurangabad, Maharashtra, India.

Source of Data: The patients referred to our department of Radiodiagnosis for scrotal ultrasonography and Doppler study by department of Surgery.

Duration of study: The study was conducted for 2 years from May 2015 to May 2017.

Sample size: A total of 106 patients referred to our department of Radiodiagnosis for scrotal ultrasonography and Doppler study recruited into the study.

Method of collecting Data

- Prior to subjecting the patients for ultrasound examination, patient details, detailed clinical history was obtained along with thorough physical examination.
- 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.
- Follow up scans was done in cases wherever

applicable.

- Abdominal ultrasound scan was done in conjunction with scrotal scans in cases of undescended testis to look for ectopic testis, in tubercular Epididymoorchitis cases to look for abdominal tuberculosis, in cases of varicoceles to look for any cause of testicular vein obstruction.

Equipment: High-resolution real time gray scale ultrasonography and Doppler study of scrotum was carried out using 7.5 to 10 MHz linear transducer, abdominal ultrasonography in required cases was done using linear (5412/5-16MHz) transducer of ALOKA prosound alpha 7 ultrasound machine.

Statistical Methods: The data obtained was coded and entered into Microsoft Excel Worksheet. Data collected in the study was analyzed using statistical package for the social sciences (SPSS) software.

OBSERVATIONS AND RESULTS

Table 1: Distribution of cases according to various age groups

Sl no	Age group (years)	No of cases	Percentage
1	0 – 10	09	9.00
2	11 – 20	15	15.00
3	21 – 30	21	21.00
4	31 – 40	29	29.00
5	41 – 50	14	14.00
6	51 – 60	07	7.00
7	61 – 70	03	3.00
8	71-80	02	2.00
	Total	200	100

Table-1: shows the age distributions of cases, which varied from 2 Years to 73 Years. Highest number of cases presented were in the age group of 31 to 40 years (58 cases – 29%), followed by 21 to 30 years (42 cases – 21%). The age groups of 21 to 40 years constitute 50%.

Table 2: Clinical presentation

Sr. NO.	Symptoms	No Of Cases	Percentage
1.	Pain and Scrotal Swelling	34	34.00
2.	Pain, Swelling and Fever	04	4.00
	Scrotal Swelling	23	23.00
3.	Unilateral Swelling	17	17.00
	Bilateral Swelling	06	6.00
	Pain in scrotum	10	10.00
4.	Acute onset	4	4.00
	Chronic onset	6	6.00
5.	Infertility	07	7.00
6.	Absent testis on palpation	07	7.00
7.	Trauma	08	8.00
8.	Dysuria	3	3.00
9.	Pain abdomen	3	3.00
10.	Erythematous skin rashes and discharging wound on scrotal skin	1	1.00

Most of the cases Clinically presented with combination of multiple symptoms. Combination: Commonest clinical presentation was combination of Symptoms like, pain and scrotal swelling, as in 34 cases (34%), Combination of pain, swelling and fever in 4 cases (4%)

Table 3: Scrotal and testicular diseases: types of pathology detected

Sr. No.	Type of pathology	No Of Cases	Percentage
1.	Hydrocele	40	40.00
2.	Inflammatory	24	24.00
3.	Varicocele	13	13.00
4.	Undescended testis	08	08.00
5.	Epididymal cyst	06	06.00
6.	Hernia	10	10.00
7.	Scrotal tumours	02	02.00
8.	Torsion testis	04	04.00
9.	Spermatocele	03	03.00
10.	Others	14	14.00
11.	Normal	08	08.00

Table 4: showing side involvement:

Sr. No.	Side	No of cases	Percentage
1.	bilateral	26	28.2
2.	right	32	34.7
3.	left	34	36.9

Out of 92 cases, 26 cases had pathology bilaterally, unilaterally in 66 cases. Out of 66 cases of unilateral side involvement, 32 cases of involvement were on right side, 34 cases involvement was on left side. Totally, pathology was noted in 124 hemiscrotum out of 100 patients studied.

Table 5: Inflammatory scrotal pathology distribution

Sr. No.	Pathology	No Of Cases	Percentage
1	Acute Epididymitis	2	8.30
2	Acute Epididymo Orchitis	8	33.30
3	Acute Orchitis	3	12.50
4	Chronic Epididymitis	2	8.30
5	Chronic Epididymo Orchitis	3	12.50
6	Scrotal Wall Inflammation	2	8.30
7	Scrotal Filariasis	1	4.16
8	Funiculitis	1	4.16
9	Tubercular Epididymo Orchitis	1	4.16
10	Fournier's Gangrene	1	4.16
	Total	24	100 %

In our study, out of 100 cases, 24 cases were detected have inflammatory scrotal pathology on high frequency US and Doppler study. Acute Epididymoorchitis was the commonest inflammatory pathology detected, noted in 8 cases (33.3 %). Next most frequent inflammatory pathology detected was chronic epididymoorchitis, noted in 7cases (14.5%).

Table 6: Grey scale appearance of inlammatory scrotal pathologieS

Sr no	Echo pattern	Acute epididymitis	Acute Orchitis	Acute Epididymo-orchitis	Chronic epididymitis	Chronic Epididymo-orchitis
1	Hyperechoic	1		1	1	
2	Hypo echoic	1	2	4		
3	Iso echoic		1	2		
4	Heterogeneous			1	1	2
5	Complex cystic					1
6	Purely cystic					
7	Epididymal calcification				2	
8	Testicular calcification					2

Table 7: Color doppler appearance of inflammatory scrotal pathology

Color- Doppler appearance	Acute epididymitis	Acute Orchitis	Acute Epididymo-orchitis	Chronic epididymitis	Chronic Epididymo-orchitis
Focal increase in Vascularity	1	1	3		
Diffuse increase in Vascularity	1	1	5	1	1
Focal decrease in Vascularity				1	1
Diffuse decrease in Vascularity					
Normal vascularity					1

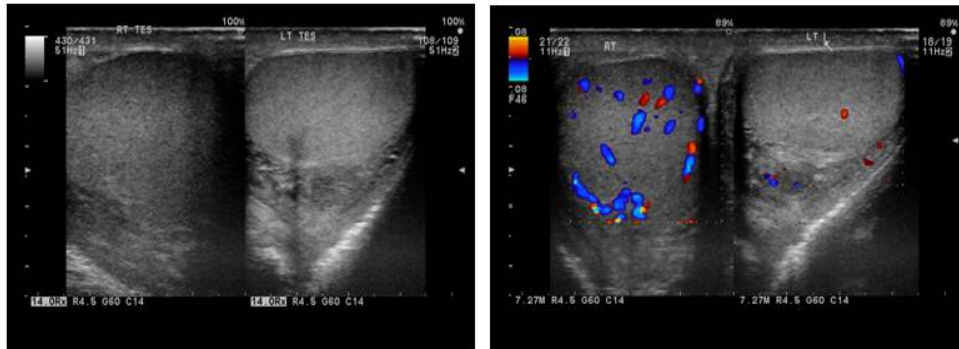


Figure 1(a and b): Gray scale and colour sonogram shows heterogeneous right testis with markedly increased vascularity on doppler study. findings consistent with right sided orchitis.

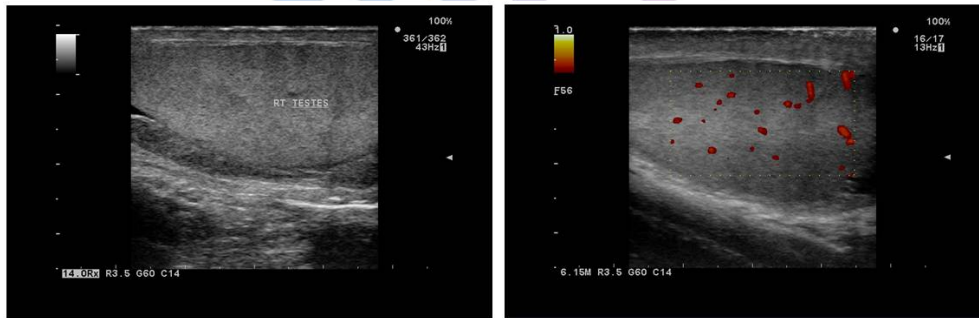


Figure 2 (a and b): Gray scale and colour sonogram shows heterogeneous right testis with increased flow on doppler study.. findings consistent with orchitis

EPIDIDYMITIS: (a) and (b)

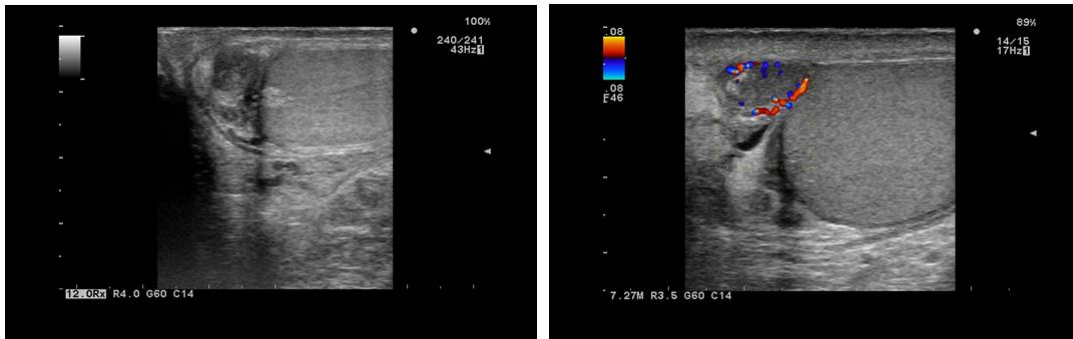


Figure 3 (a and b): Gray scale and colour sonogram shows epididymis appears bulky and heterogeneous with increased flow on doppler study. findings consistent with epididymitis.

EPIDIDYMO-ORCHITIS: (a) and (b)

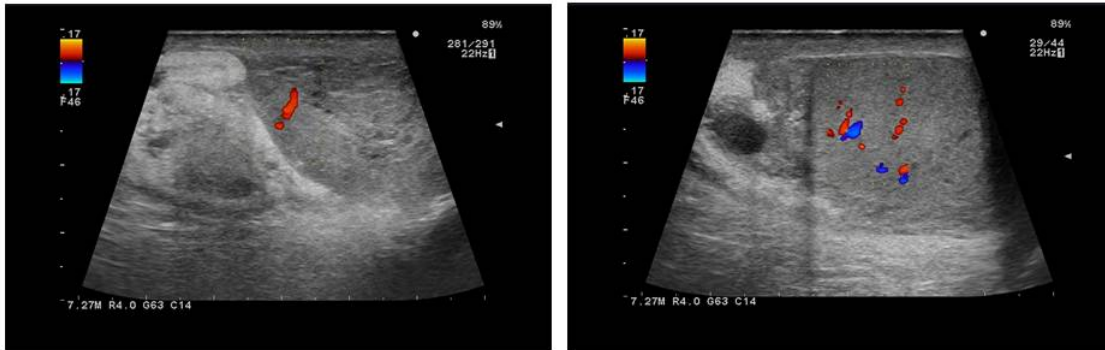


Figure 4 (a and b): Gray scale and colour sonogram shows testis and epididymitis appears bulky and heterogeneous with increased flow on doppler study..findings consistent with epididymo-orchitis.

FUNICULITIS: (a) and (b)

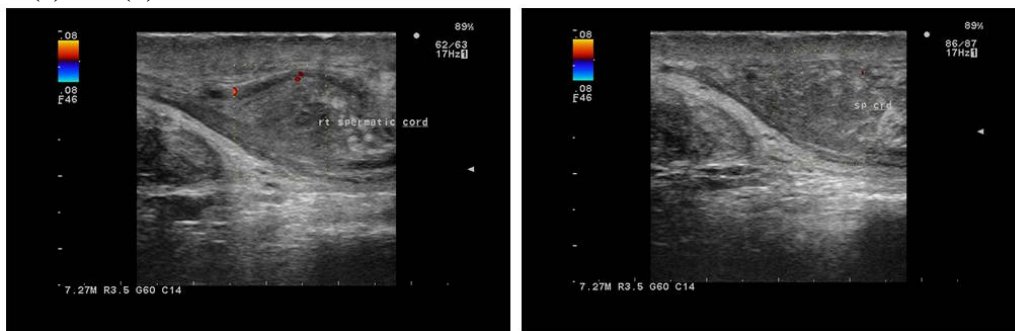


Figure 5: (a and b): Gray scale and colour sonogram shows spermatic cord appears bulky and heterogeneous with surrounding fat stranding. findings consistent with funiculitis.

SCROTAL WALL LESION:

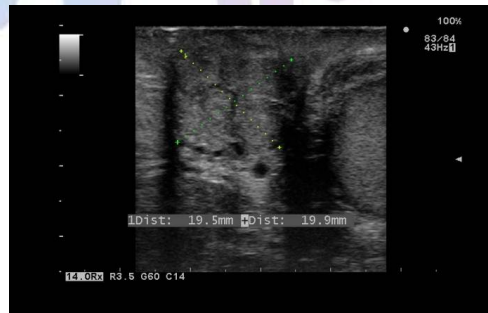


Figure 6: Gray scale sonogram shows hypoechoic lesion in the scrotal wall showing no vascularity on Doppler study. findings consistent with scrotal wall lesion likely abscess

DISCUSSION

Table 8: Inflammatory diseases of scrotum and its contents: comparison with other series

Inflammatory disease	Horstman <i>et al</i>	Lerner <i>et al</i>	Farriol <i>et al</i>	Present study
Acute epididymitis	25 (56%)	3 (60%)	11 (44%)	2 (8.3%)
Acute Epididymo- orchitis	19 (42%)	2 (40%)	10 (40%)	8 (33.3%)
Acute orchitis	1 (2%)		2 (8%)	3 (12.5%)
Complication of acute inflammation	5 (11%)			2 (8.3%)
Cellulitis of scrotal wall				2 (8.3%)
Fournier's gangrene				1 (4.16%)
Funiculitis			2 (8%)	1 (4.16%)
Chronic Epididymo- orchitis				3 (14.5%)

Table 9: Comparison with other series: (acute epididymitis)

	Horstman <i>et al</i> ,	Farriol <i>et al</i>	Present study
Focal enlargement in size	9 (18 %)	2 (18 %)	
Diffuse enlargement in size	36 (70 %)	9 (82 %)	2 (100 %)
Normal size	6 (12 %)		
Focal Hypo echoic		2 (18 %)	
Diffuse Hypo echoic	36 (70 %)	9 (82 %)	2 (100 %)
Isoechoic	15 (29 %)		
Focal increase in Vascularity	10 (20 %)	1 (9 %)	
Diffuse increase in Vascularity	35 (69 %)	8 (73 %)	2 (100 %)
Peri-lesional increase in Vascularity		2 (18 %)	
Normal vascularity	6 (12 %)		

Table 10: Comparison with other series: (acute epididymo-orchitis)

	Horstman <i>et al</i>	Farriol <i>et al</i>	Present study
Focal enlargement in size	2 (10 %)	2 (25%)	1 (12.5%)
Diffuse enlargement in size	10 (50 %)		3 (37.5 %)
Normal size	8 (40 %)	6 (75%)	4 (50.0%)
Focal Hypoechoic	2 (10 %)		2 (25.0 %)
Diffuse Hypoechoic	10 (50 %)		4 (50.0 %)
Isoechoic	8 (40 %)	6	2 (25.0%)
Focal increase in Vascularity	2 (10 %)	2 (25 %)	3 (37.5%)
Diffuse increase in Vascularity	13 (65 %)	6 (75 %)	6 (75 %)
Complex hypoechoic Lesion (abscess/pyocele)	5 (25%)	2 (25 %)	1 (12.5%)
Peri-lesional increase in Vascularity	5 (25%)	2 (25 %)	1 (12.5%)
Reactive Hydrocele		5 (62.5%)	5 (62.5%)

Table 11: Comparison with other series: (acute orchitis)

	Horstman <i>et al</i>	Farriol <i>et al</i>	Present study
Focal enlargement in size	2 (10 %)		1 (33.3%)
Diffuse enlargement in size	10 (50 %)		2 (66.6%)
Normal size	8 (40 %)	2 (100 %)	1 (33.3%)
Focal Hypo echoic	2 (10 %)		1 (33.3%)
Diffuse Hypo echoic	10 (50 %)		2 (66.6%)
Isoechoic	8 (40 %)	2 (100 %)	1 (33.3 %)
Focal decrease in Vascularity	1 (5 %)		1 (33.3%)
Diffuse increase in Vascularity	18 (90 %)	2 (100 %)	3 (100%)
Complex hypoechoic Lesion (abscess/pyocele)	1 (5 %)		1 (33.3%)
Peri-lesional increase in Vascularity	1 (5 %)		2 (33.3%)
Reactive Hydrocele	1 (5%)		3 (100%)

Epididymoorchitis: In our study, out of 100 cases, 28 cases were detected have inflammatory scrotal pathology on high frequency US and Doppler study. Types of inflammatory pathology detected with sidedness are depicted, acute epididymoorchitis was the commonest inflammatory pathology detected, noted in 8 cases (33.3%). Next most frequent inflammatory pathology detected was Chronic epididymoorchitis, noted in 3 cases (12.5%). Horstman, Middleton, and Nelson, 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 case (2 %) ⁸ No case of chronic Epididymoorchitis was reported. Lerner *et al*, ⁹ in their limited series of 5 cases of acute inflammatory diseases of scrotum, found acute epididymitis in 3 patients (60%),

acute Epididymoorchitis in 2 patients (40%) Farriol *et al*, ¹⁰ in their study of 25 cases of acute inflammatory diseases 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%). Comparison with other series is depicted in Table -10. In our study of 24 cases of inflammatory scrotal pathology, the High-resolution US appearance findings are depicted in Table 6 ; color Doppler findings are depicted in Table 7. The most common finding is hypoechogenicity of the testis and epididymis in acute epididymoorchitis (seen in 06 out of 24 cases) and heterogenous echo pattern in chronic epididymoorchitis (3 out of 24 cases). It is comparable to other studies. Of two cases of acute

epididymitis, we observed diffuse hypoechogenicity with diffuse increase in vascularity, and diffuse increase in the size of epididymis. These findings are similar to the findings of Horstman *et al*, in their study of 45 cases (51 hemiscrotum), Farrioret *al*¹⁰, in their study of 11 cases. Comparison with other series: (acute epididymo-orchitis, 8 cases showed diffuse hypoechogenicity, 4 cases showed focal hypoechogenicity, 8 cases were normal echotexture, 5 cases showed diffuse increase in vascularity, 3 cases showed focal increases in vascularity, and size of epididymis was increased in 5 cases. These findings are similar to the findings of Horstman *et al*¹³, in their study of 45 cases (51 hemiscrotum), Farriol *et al*¹⁰, in their study of 11 cases. 20 These findings are similar to the findings of Horstman *et al*¹³, in their study of 45 cases (51 hemiscrotum), Farriol *et al*¹⁰, in their study of 11 cases shown in table 10. Of 3 cases of acute orchitis, one case showed focal involvement, one case showed diffuse involvement. On high frequency US sonography, focal involvement appeared as focal area of hypoechogenicity, two cases of diffuse involvement, one case showed diffuse enlargement with diffuse hypoechogenicity and one case showed diffuse involvement with normal size of the testis. On color Doppler sonography, all the cases showed increased vascularity in the areas of hypoechogenicity. These findings are similar to the findings of Horstman *et al*¹³, in their study of 45 cases (51 hemiscrotum), Farriol *et al*¹⁰, in their study of 11 cases. Comparison with other series: (Acute orchitis) is depicted in Table-11. In our study of 24 cases of scrotal inflammatory pathologies, we observed 3 cases of complications of acute scrotal pathology, out of which 1 case was scrotal wall Cellulitis, 1 case of Fournier's gangrene and 1 case of funiculitis. In Cellulitis of scrotal wall, High-frequency US sonography showed loss of normal uniform hypoechoic appearance of scrotal wall, thickening of scrotal wall, presence of normal testis, epididymis and tunical sac. These findings are similar to those of Luker and Siegel.¹¹ Of 24 cases of inflammatory scrotal pathology, we noted chronic Epididymo-orchitis in 5 cases. Of these, 2 cases were bilateral involvement, 3 cases were unilateral involvement. On High-frequency US sonography, we observed diffuse increase in size of epididymis with normal testicular size in 2 cases, normal size of epididymis and testis in 1 case. There was heterogenous echotexture in 3 cases, hypoechogenicity in 1 case, hyper echogenicity in 1 case. There was evidence of epididymal calcification seen in 2 cases, testicular micro calcification in 2 cases. On color Doppler sonography, there was evidence of diffuse increase in vascularity in 4 cases, normal vascularity in 1 case, focal

increase in vascularity in 1 case. High-frequency US sonography and color Doppler sonography findings are in similarity with study KIM S H *et al*.¹² In our study, acute epididymo-orchitis is more in common which is comparable to other studies followed by chronic epididymo-orchitis. The sensitivity and specificity of High-frequency ultrasonography compared to physical examination in evaluation of inflammatory pathology as a cause of acute/chronic pain and differentiating the cause of swelling is either intratesticular or extra testicular are calculated using the following formulae,

- Sensitivity = $a / (a + c)$ (True positive) / { a (True positive) + c (False negative) }
- Specificity = $d / (b + d)$ (True negative) / { b (False positive) + d (True negative) }

Which shows a low sensitivity of physical examination (15%), and low specificity (50%), where as high frequency ultrasonography is highly sensitive and specific (almost 100%), in identifying inflammatory pathology as the cause of acute/chronic pain and knowing the cause of swelling is either intratesticular or extra testicular compared to physical examination.

Table 12:

Epididymo Orchitis	Positive	Negative
USG	48(41.5)(1.02)	0(6.5)(6.5)
CLINICAL	38(41.5)(1.02)	10(6.5)(6.5)

The Chi square statistic is 15.0361 and the P value is 0.000105. This result is significant at $p < 0.05$.

SUMMARY AND CONCLUSION

- The commonest indications for scrotal ultrasonography in clinical practice were inflammatory scrotal disorders and non-inflammatory scrotal swellings, which together constituted more than 50% of all pathologies.
- Commonest clinical presentation was scrotal swelling with / or without pain.
- Largest number of patients with scrotal pathologies presented in this study belongs to the age group of 21 to 40 years, which constituted 50% all cases.
- The bulk of scrotal and testicular pathologies were unilateral with regard to side of involvement. The greatest degree of bilateral pathology was seen in infertility related lesions.
- Among acute scrotal inflammatory diseases, acute Epididymo-orchitis was the leading cause, which was confirmed in earlier studies.
- High-resolution ultrasonography enables in clear demonstration of morphological alterations

associated with acute scrotal inflammatory diseases, but has the limitations, because it does not enable assessment of perfusion of scrotum and its contents. When color Doppler sonography is supplemented with High frequency grey scale US, the sensitivity of diagnosing acute scrotal pathology will be increased. In addition, Color Doppler sonography accurately differentiates between testicular ischemia and torsion from acute inflammatory diseases in acute painful scrotal conditions.

- Chronic inflammatory diseases were more common in Asian countries compared to western studies. The most notable sonographic findings of tuberculous epididymitis were enlarged epididymis, marked heterogeneity of echo texture of involved epididymis, hypoechoic nodular lesions within testis, obliteration of interface between testis and epididymis, and occasionally micro calcification. On color Doppler sonography, focal linear or spotty Doppler signals may be seen at periphery of epididymis.
- High-frequency ultrasonography is a simple, painless, rapid and easily reproducible method of evaluation of intrascrotal masses and comparison to the usually normal contralateral side offers rapid identification of abnormal architecture.

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