ROLE OF HIGH FREQUENCY ULTRASOUND AND COLOUR DOPPLER IN EVALUATION OF SCROTAL PATHOLOGIES

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ABSTRACT

BACKGROUND

High frequency ultrasonography with colour Doppler is highly accurate and sensitive modality for investigation of scrotal pathology. Hence, in appropriate clinical setting with adequate history and physical examination, it offers specific diagnosis.

MATERIALS AND METHODS

In this series, 100 cases of scrotal pathology were studied using high-frequency real time gray scale ultrasonography and Doppler study, during the period from September 2012 to March 2016, were included in this study.

RESULTS

In our study, out of 100 cases, 40 cases were detected to have inflammatory scrotal pathology on high frequency US and Doppler study. Chronic epididymo-orchitis was the commonest inflammatory pathology detected, noted in 18 cases (45%). Next most frequent inflammatory pathology detected was acute epididymo-orchitis noted in nine cases (22.5%).

CONCLUSION

The advantages of high frequency US and colour Doppler includes non-invasiveness, lack of ionising radiation, simplicity, wide availability, cost effectiveness and repeatability.

KEYWORDS

High Frequency Ultrasonography, Scrotal Swellings, Colour Doppler Sonography.

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BACKGROUND

Scrotum is a cutaneous bag containing right and left testis, the epididymis and the lower part of the spermatic cord. Externally, scrotum is divided into right and left parts by a ridge or median raphe, which is continued forwards on to the undersurface of the penis and backwards along midline of the perineum to the anus. The testis is separated from the examining fingers by little more than a few millimetre covering of loose skin and fibromuscular tissue, so is most accessible for clinical examination. Consequently, one should pre-suppose that clinical diagnosis of a scrotal swelling would be straight forward. On the contrary, certain testicular swellings are most difficult to diagnose with confidence based on physical examination alone. It is often difficult to decide whether a palpable scrotal mass is arising from the testes itself or from the extratesticular elements. In addition, the normal examination may overlook significant pathology and physical signs elicited may be improperly interpreted.

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. Clinical signs and symptoms are usually nonspecific, variable and misleading. Until mid-1970 clinical evaluation of scrotal contents was confined to palpation, trans-illumination, supplemented by investigative modalities like thermography and venography. The present day diagnostic armamentarium includes gray scale ultrasonography, Doppler studies, Magnetic Resonance Imaging, in addition to Radioisotope studies and Testicular angiography.

Since Miskin and Bain¹ and Murray Miskin, Martin Buckspan and Jerald Bain² 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.

Ultrasonography is exceptionally well suited to study of scrotum and its contents. Sonography is simple to perform, rapid, non-invasive, relatively inexpensive, easily reproducible, widely available and does not involve irradiation of gonads.

The study is done to assess the usefulness of high frequency gray scale US and colour Doppler study in evaluation of various scrotal pathologies.

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Aims and Objectives

Until the advent of ultrasonography and its application to scrotal imaging, diagnosis of scrotal pathologic conditions traditionally has been based upon the clinical history and physical examination. Definitive diagnosis is not always possible with clinical examination, especially in patients with a marked inflammatory reaction and it is often difficult to decide whether a palpable scrotal abnormality arises from testicle itself or from extratesticular elements in scrotum.

This study will be an effort in establishing the role of high frequency ultrasound as an investigating modality in accurately distinguishing between testicular and extratesticular pathology of scrotum.

High frequency gray scale ultrasonography enables only in identification of morphological alterations that are associated with scrotal disorders. This study will also be an effort in establishing the role of Colour Doppler Sonography in evaluation of scrotal pathology.

Objectives of the Study

To evaluate scrotal pathology with reference to,

- Assess the role of high frequency real time ultrasonography in accurately distinguishing between testicular and extratesticular scrotal masses.
- Assess the role of Colour Doppler sonography in evaluation of scrotal pathologies.

MATERIALS AND METHODS

In this series, 100 cases of scrotal pathology was studied using high-frequency real time gray scale ultrasonography and Doppler study, during the period from September 2012 to March 2016 were included in this study. These patients were referred to our Department for scrotal ultrasonography and Doppler study by Department of Urology and Department of Surgery of Srinivas Institute of Medical Sciences and Research Centre, Mukka, Mangalore.

RESULTS

Sl. No.	Echo Pattern	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Chronic Epididymo-Orchitis
1	Hyperechoic				2	
2	Hypoechoic	22	3	7		
3	Isoechoic			1		
4	Heterogeneous			1	1	13
5	Complex cystic					5
6	Purely cystic					
7	Epididymal calcification					2
8	Testicular calcification					2

Table 1. High-Resolution US appearance of Inflammatory Scrotal Pathology

Colour-Doppler Appearance	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Chronic Epididymo-Orchitis
Focal increase in Vascularity		2	2	2	
Diffuse increase in Vascularity	2	1	7	2	11
Focal decrease in Vascularity				1	3
Diffuse decrease in Vascularity					4
Normal Vascularity					

Table 2. Colour Doppler appearance of Inflammatory Scrotal Pathology

	Pathology	No. of Cases	% of Cases
1	Hydrocoele	24	52%
2	Epididymal Cyst	6	13%
3	Spermatocoele	3	7%
4	Varicocoele	13	28%
5	Testicular Cyst		
	Total	46	100%

Table 3. Non-Neoplastic Swellings of Scrotum: Types of Pathology Detected

Among non-neoplastic scrotal swellings, hydrocoele is the commonest pathology noted in 24 cases (54%). The incidence of non-neoplastic scrotal swellings is very much high compared to neoplastic swellings. Incidence of extratesticular swellings is more compared to intratesticular swellings. High frequency was 100% sensitive in differentiating intratesticular swellings from extratesticular swellings.

Sl. No.	Clinical Diagnosis		High-Frequency US Diagnosis	
1	Intratesticular	12	Intratesticular Extratesticular Both intra + extratesticular	2 6 4
2	Extratesticular	24	Extratesticular Intratesticular Both intra + extratesticular	18 -- 6
3	Both intratesticular + extratesticular	6	Intratesticular Extratesticular Both intra + extratesticular	-- 5 1
4	No diagnosis	4	Normal Intratesticular Extratesticular Both intra + extratesticular	2 -- 2 --
5	Unilateral	32	Bilateral Unilateral	18 16
6	Bilateral	10	Unilateral Bilateral	4 8

Table 4. Comparison between Sonological Diagnosis with Clinical Diagnosis

The sensitivity and specificity of high-frequency ultrasonography is compared with physical examination in differentiating a scrotal mass as either intratesticular or extratesticular. Present study shows a low sensitivity of physical examination (15%) and low specificity (50%), whereas high frequency ultrasonography is highly sensitive and specific (almost 100%) in differentiating a scrotal mass as either intratesticular or extratesticular compared to physical examination.

Undescended Testis

Hematocoele

Varicocoele

DISCUSSION

The superficial location of the scrotal contents makes them ideally suited for sonographic examination. The development of high frequency, real time scanners have 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.

Out of 23 cases of acute onset scrotal swellings, 7 cases (30%) had h/o trauma, 6 cases (26%) had h/o dysuria, 2 cases (8%) had h/o pain abdomen. Other associated symptoms include discharging wound on scrotal skin 5 cases, erythematous skin rashes in 1 case.

In our study, inflammatory conditions constitute the largest number of detected pathology followed by non-inflammatory swellings.

	No. of Cases	Inflammatory Pathology	Non-Inflammatory Pathology
Present Study	132	40 (30.5%)	29 (22%)

In our study, the bulk of the pathology detected by high-resolution US are from two groups: Inflammatory pathologies and non-inflammatory swellings (69 cases - 52%), which correlates with findings documented in previous studies 1, 16, 20. However, in our study, we noticed that proportion of Inflammatory pathology is higher, compared to previous studies. Factors contributing for this variation:

- Higher incidence of chronic inflammatory pathology, especially tubercular aetiology.
- Higher complication rate in our study.

In 1976, Thomas H. Shawker,³ reported details of 14 patients scanned with the Picker Echo View VI B-scanner and a 2.25 MHz transducer and concluded that ultrasound B-scanning of the scrotum is a feasible diagnostic study. In 1978 Sample et al,⁴ evaluated a large series of patients with scrotal masses using 5.0 MHz, 7 mm diameter transducer with short internal focus produced high quality images of scrotal contents. In 1979, Leopold et al⁵ studied 22 patients referred with a strong clinical suspicion of intra-scrotal pathology. In 1981, Peter H. Arger et al⁶ examined 69 consecutive patients with suspected testicular abnormalities prior to surgery. In 1983, John M. Bockrath et al⁷ described an ultrasound technique that accurately detected an occult testicular primary in a young man with a large retroperitoneal seminoma.

In 1983, Michael K. Wolverson et al,⁸ conducted real-time sonography of the scrotal veins in a group of patients who are clinically suspected cases of varicocele. In 1984, Monica L. Leung et al,⁹ evaluated 40 men who had no known scrotal or testicular symptoms using a real-time dedicated superficial parts scanner (Picker Micro view) 10 MHz transducer.

In 1985, Gregory D. Linkowski et al,¹⁰ described ultrasonic appearance of scrotal calculi. They used a sector real-time scanner with a 10 MHz transducer. In 1983, Michael K. Wolverson et al¹¹ did a comparative study of CT and high-resolution ultrasound in localisation of impalpable undescended testis. In 1990, John N. Krieger, Keith Wang and Lawrence Mack¹² conducted scrotal US study in a group of asymptomatic patients using both real-time, high-resolution gray-scale ultrasound and also Pulsed Doppler ultrasound.

These results indicate that colour Doppler sonography is having high sensitivity (100%) and positive predilection value (72%) compared to physical examination. These findings were compared to previous similar study by Randall B. Meacham et al¹³ and Petros J. A. et al.¹⁴ The findings show similarity to previous studies.

In our study of 46 cases of non-inflammatory scrotal swellings, we noted 6 cases of epididymal cysts, 3 cases of spermatoceles. Out of 6 cases of epididymal cysts, 5 were unilateral, 1 was bilateral and 2 cases showed multiple cysts. Most of the epididymal cysts are uniloculated situated in the head of epididymis, thin walled, anechoic. Associated ipsilateral hydrocoele was noted in 2 cases. In present study, we detected 3 cases of spermatoceles, which appeared on high frequency US scan as cystic structure with fluid level or fluid-debris level.

In this study, we came across 15 cases of congenital anomalies. Out of this 3 cases (20%) were found to be congenital hydrocoele, 4 cases (27%) were incompletely descended testis and 8 cases (53%) were undescended testis. The three cases of congenital hydrocoeles were presented in the age group of 2 - 4 years, all were unilateral. These cases were clinically referred as scrotal swelling with suspicion of congenital hernia or congenital hydrocoele.

Of 12 cases of congenital anomaly associated with descent of testes, 7 cases were referred with clinical suspicion of incompletely descended testes, which were clinically palpable. All were unilateral in presentation. Age of presentation varied from 2 years to 26 years with a median age of 3 years. The size of undescended testes found to be smaller in cases, which

presented clinically in later stages. Out of this, high frequency US could identify only 4 cases (57%) of incompletely descended testes, which were in the inguinal region. These testes were small compared to contralateral testes. These were showing normal colour flow on Doppler suggesting viability. Remaining 3 cases of clinically palpable testes were not identified. Among 5 cases of undescended testes, which were clinically not palpable, high frequency US could not identify any of the case of abdominal testis. Among uncooperative younger patients, it is more difficult to identify the undescended testis.

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.

CONCLUSION AND SUMMARY

High frequency ultrasonography is highly sensitive in picking up of small, clinically impalpable intratesticular lesions like cyst or small malignant foci. Haematocoele was the most commonly detected traumatic pathology detected in this study.

High frequency ultrasonography is highly sensitive in detecting intratesticular microlithiasis, which cannot be diagnosed clinically. Followup scans are required for such cases because of high incidence of testicular malignancy associated with intratesticular microcalcification.

High frequency ultrasonography with Doppler is highly sensitive in demonstrating the dilated, tortuous veins of pampiniform plexus and flow reversal on Valsalva manoeuvre. When compared to physical examination, it is highly sensitive in detecting sub-clinical cases of varicoceles.

Ultrasonography is exceptionally well suited to study of scrotum and its contents. The study is done to assess the usefulness of high frequency gray scale US and colour Doppler study in evaluation of various scrotal pathologies.

The advantages of High frequency US and colour Doppler includes non-invasiveness, lack of ionising radiation, simplicity, wide availability, cost effectiveness and repeatability.

High-frequency ultrasonography enables in clear demonstration of morphological alterations associated with acute scrotal inflammatory diseases and colour Doppler sonography is highly sensitive in diagnosing acute scrotal pathology. In addition, colour Doppler sonography accurately differentiates between testicular ischaemia and torsion from acute inflammatory diseases in acute painful scrotal conditions.

High frequency ultrasonography is highly sensitive in differentiating solid from cystic scrotal masses. High frequency ultrasonography is highly sensitive in detecting intratesticular microlithiasis.

High frequency ultrasonography is invaluable in demonstrating normalcy of testes and epididymis in presence of large hydrocoeles.

High frequency ultrasonography with Doppler is highly sensitive in demonstrating the varicoceles. When compared to physical examination, it is highly sensitive in detecting sub-clinical cases of varicoceles.

The advantages of high frequency US and colour Doppler includes non-invasiveness, lack of ionising radiation,

simplicity, wide availability, cost effectiveness and repeatability.

We conclude that high-frequency ultrasonography and colour Doppler sonography is an extremely valuable tool in evaluation of scrotal and testicular pathologies.

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