

Evaluation of Scrotal Diseases with High Frequency Ultrasonography and Colour Doppler Sonography

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Abstract

Introduction: Ultrasonography (USG) has been established as an essential imaging modality in diagnosing scrotal pathology. This study aimed at assessing the utility of evaluating scrotal diseases with high frequency ultrasonography and color Doppler sonography.

Methodology: This study was carried out in the Department of Radiology, Dr. R.P.G.M.C. Kangra at Tanda, Himachal Pradesh from July 2016 till June 2017. This study was carried on all consecutive patients referred for scrotal gray scale ultrasonography and/or colour Doppler ultrasonography with scrotal pain or swelling of any duration. The patients underwent gray-scale and colour Doppler ultrasonography of the scrotum in the same sitting with a linear array colour Doppler multi-frequency (7 to 10 MHz) transducer using GE LOGIQ P5 ultrasound scanner. The findings were recorded on a predesigned proforma. Testicular size, blood flow, echogenicity and lesions were noted. Data was tabulated as frequency distribution tables.

Results: During the study period 63 patients were included in the study. Acute epididymo-orchitis was the commonest inflammatory pathology noted in 15 cases, followed by scrotal wall inflammation & funiculitis in four cases each. Other cases of inflammatory scrotal pathology were acute epididymitis, acute orchitis, acute on chronic epididymo-orchitis, Fournier's gangrene and chronic epididymitis. High frequency and color Doppler sonography was accurate in each of these cases in determining the extratesticular or intratesticular origin of these conditions and in further characterisation of these conditions as per their number, vascularity and other sonographic characteristics.

Conclusions: High frequency gray scale sonography and Color Doppler ultrasonography in combination is a reliable technique for evaluation of scrotal pathologies and helpful in guiding further management.

Keywords: scrotal, pathology, diagnosis, ultrasound, Doppler, management

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I. Introduction

Ultrasonography (USG) has been established as an essential imaging modality in diagnosing scrotal pathology. It not only provides fine anatomical details of the testicle and surrounding structures, but also assesses vascular perfusion in real time. Clinical examination reveals only nonspecific signs and symptoms, and may be inadequate due to tenderness, swelling or gross distortion of scrotal contents. (1) Presently, gray scale ultrasonography, Doppler studies, magnetic resonance imaging, radioisotope studies and testicular angiography are some of the imaging modalities available for use in diagnosing scrotal pathology. USG is able to identify and characterize intratesticular or extratesticular lesions. Moreover, it is able to distinguish between benign or malignant lesions and identify conditions that require urgent surgical intervention. (2) Additionally, USG is a safe, relatively inexpensive, readily available imaging without the risk of ionizing radiation. This study aimed at assessing the utility of evaluating scrotal diseases with high frequency ultrasonography and color Doppler sonography.

II. Methodology

2.1 Study Design and Setting

This study was carried out in the Department of Radiology, Dr. R.P.G.M.C. Kangra at Tanda, Himachal Pradesh from July 2016 till June 2017, after approval from institutional ethics committee. This study was carried on all consecutive patients referred for scrotal gray scale ultrasonography and/or colour Doppler ultrasonography with scrotal pain or swelling of any duration.

2.2 Sample population

All consecutive patients referred for scrotal gray scale ultrasonography and/or colour Doppler ultrasonography with scrotal pain or swelling of any duration. We excluded patients having inguino-scrotal hernia, having undescended testis and those with history of previous surgery for scrotal pathology. All patients were included after taking their informed written consent.

2.3 Study procedure

The patients underwent gray-scale and colour Doppler ultrasonography of the scrotum in the same sitting with a linear array colour Doppler multi-frequency (7 to 10 MHz) transducer using General Electric LOGIQ P5 ultrasound scanner. The scans were performed in at least two planes along the longitudinal and transverse axis. Additional views in coronal and oblique planes and with the patient being upright and performing the Valsalva manoeuvre were acquired in case varicocele was suspected. Colour Doppler imaging was performed in all cases to investigate extratesticular vascularisation and testicular perfusion, with parameters optimized to display low flow velocities (low wall filter [100 kHz], low pulse repetition frequency [1–2 Hz], and 70%–90% colour gain output settings). Power Doppler imaging was performed in cases of suspected testicular torsion or tumors to supplement conventional colour Doppler imaging. In cases of acute scrotum, the unaffected side was scanned first to set the gray-scale and colour Doppler gain settings to allow comparison with the affected side.

2.4 Data Collection and Data Analysis

We obtained detailed clinical history and examination of the patients prior to the procedure. The findings were recorded on a predesigned proforma. A note was made of bilateral testicular and epididymal size and echogenicity. Any discrepancy on either side compared with the contralateral side was recorded. Any increase or diminution in testicular or epididymal vascularity was recorded. Absent testicular flow on colour Doppler imaging was noted as direct evidence of ischemia. The presence of any focal testicular or extratesticular lesion was noted and Doppler interrogation for assessment of lesional vascularity was performed. The presence of fluid within the scrotal sac was recorded. Scrotal skin thickness was also measured and any increase in the same was noted. The upper value of standard normal limits for measured physical parameters as described below were taken for data analysis. Data was tabulated as frequency distribution tables. No financial charges were accrued to the study patients.

III. Results

During the study period 63 patients were included in the study. The age of patients in our study ranged from 2-80 years (mean age 36.46 years). The most common age group was 21 to 39 years (Table 1). Out of 63 patients examined with ultrasonography, patients presented with a variety of symptoms as shown in the table & charts (Table 1). The commonest clinical presentation was pain with scrotal swelling, followed by pain with swelling & fever. Other presenting complaints were pain, swelling, trauma, heaviness, heaviness with swelling, heaviness with pain, heaviness with firmness, small testicle and infertility. Table 2 describes the frequency of various pathological conditions. Acute epididymo-orchitis was the commonest inflammatory pathology noted in 15 cases, followed by scrotal wall inflammation & funiculitis in four cases each. Other cases of inflammatory scrotal pathology were acute epididymitis, acute orchitis, acute on chronic epididymo-orchitis, Fournier's gangrene and chronic epididymitis. Out of 15 cases of acute epididymo-orchitis, all cases showed heterogeneous epididymal and testicular echogenicity, along with complication in form of extratesticular collection in three cases, testicular abscess formation in two cases and epididymal abscess formation in one case (Table 3). Out of three cases of acute orchitis, two cases showed heterogeneous echotexture, one case showed hypochoic echotexture along with complication in form of extratesticular collection by one case. Out of three cases of acute epididymitis, two cases showed hypochoic echotexture and one case showed heterogeneous echotexture. Two cases of acute on chronic epididymo-orchitis showed heterogeneous echotexture and four cases of funiculitis showed heterogeneous echotexture. On color Doppler, 9 cases of acute epididymo-orchitis showed diffuse increase in vascularity, three showed focal increase in vascularity, two cases also showed focal decrease in vascularity and one case showed diffuse decrease in vascularity. Three cases of acute epididymitis, three cases of acute orchitis and two cases of acute on chronic epididymo-orchitis showed diffuse increase in vascularity. Among benign non-inflammatory scrotal conditions, hydrocoel was the commonest pathology, followed by epididymal cyst. One case each of extratesticular extra-epididymal neoplastic swelling and testicular tumor was seen in this study. Extratesticular extra-epididymal neoplastic swelling presented as painless scrotal enlargement whereas testicular tumor presented with painless firmness of testicle. Color Doppler revealed a hypochoic lesion in one of the testis with increased color flow, suggestive of mass lesion (Table 4). Spermatic cord invasion not shown by the testicular tumor. Whereas extratesticular, extra-epididymal neoplastic swelling shows involvement of spermatic cord, which was homogeneously hypochoic on echotexture with increased

blood flow. This case was further evaluated using magnetic resonance imaging and diagnosed as extra testicular adenomatoid tumour. Four cases of scrotal trauma were seen, two cases have shown to have testicular hematoma. All hematomas were hypoechoic and well circumscribed. Color Doppler imaging showed focally reduced vascularity in two cases with normal vascularity in the remainder of testicular parenchyma; two cases showed normal testicular vascularity. Hematocele appeared as septated fluid collection in two cases, and as fluid collection with no internal echoes in two cases. One case of scrotal wall hematoma is also noted.

IV. Discussion

Gray-scale USG in combination with color Doppler imaging is a widely accepted technique for assessing scrotal lesions. The superficial location of the scrotal contents makes them ideal for sonographic examination. The development of high frequency, real time scanners have greatly enhanced the diagnostic accuracy of scrotal sonographic examinations. Moreover, USG helps us in differentiating between lesions that require urgent surgery and those that can be managed conservatively. Epididymo-orchitis is a common cause of acute scrotum in children and is mainly infectious in origin. It has been shown that the epididymal head is the most affected region, and reactive hydrocele and wall thickening are frequently accompanying features.(3) Increased size and, varying echogenicity are usually observed. Additionally, the inflammation produces increased blood flow within the epididymis, testis, or both. Rarely, orchitis without involvement of the epididymis is seen clinically and is most commonly seen after an infection of paramyxovirus. One of the most pathognomonic ultrasonography finding is markedly increased flow on color Doppler with heterogeneous appearance of the testicle due to diffuse edematous changes.(4) In cases of only focal involvement of the testicle, other conditions like infarction, tumor or metastatic disease should be ruled out. Testicular cancer accounts for approximately 2% of all malignant neoplasms diagnosed in men. Recently, the incidence rate has been observed to increase considerably.(5) The imaging modality of choice for such lesions is ultrasound with the color Doppler assessment. The sensitivity in the differentiation between intra- and extratesticular lesions has been reported. 98–100%.(6) Previous studies show that most tumors are hypoechoic compared with the surrounding tissue. The echogenicity of tumors can be heterogeneous with hyperechoic areas as they can contain calcifications or be solid-cystic. USG is characterized by a high sensitivity in diagnosing scrotal trauma as well. In the early phases of torsion, testicular echogenicity appears normal. With progression, enlargement of the affected testis may be seen and an increase in echogenicity may be noticed and a definitive diagnosis of complete testicular torsion is made when blood flow is visualized on the normal side but is absent on the affected side. Moreover, USG Doppler examination can differentiate testicular torsion from other similar conditions. However, the reported sensitivity is approximately 85–90%.(7) Scintigraphy and MR imaging may provide additional information in which decreased or reversed diastolic flow may be evident on the affected side.(8) Though visualization of intratesticular flow in young patients has been reported as a major limitation of color Doppler imaging (9); it is less problematic with the recently developed more sensitive equipment.

V. Conclusion

High frequency and Doppler ultrasonography is a valuable technique for the evaluation of many abnormalities of the scrotum. Non inflammatory conditions can clearly be demonstrated with regards to location and presence of characteristic sonographic features. Acute inflammatory pathology and testicular torsion can be accurately distinguished and unnecessary scrotal exploration can be avoided. Future studies are required to support our findings.

Table 1. Baseline characteristics of the patients included in the study

Age distribution	N
0 to 19 years	7
21 to 39 years	36
40 to 59 years	11
60 to 79 years	8
80 years and above	1
Chief complaints	
Pain	4
Pain and redness	1
Pain and scrotal swelling	21
Pain, swelling and fever	1
Swelling	11
Heaviness	2
Heaviness and swelling	2
Heaviness and firmness	1
Small testicle	1
Infertility	1
Hematospermia	1

Table 2. Types of pathology in the patients included in the study

Pathology	N
Acute epididymitis	3
Acute epididymoorchitis	15
Acute on chronic epididymoorchitis	2
Acute orchitis	3
Chronic epididymitis	1
Scrotal wall inflammation	4
Funiculitis	4
Fournier's gangrene	2
Benign non-inflammatory conditions	19
Trauma	4
Neoplastic conditions	2
Torsion	2
Normal	2

Table 3. High-resolution US appearance of inflammatory scrotal pathology

Echo Pattern	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Acute on Chronic Epididymo-Orchitis	Funiculitis
Hyper echoic	0	0	0	0	0	0
Hypo echoic	2	1	0	1	0	0
Iso echoic	0	0	0	0	0	0
Heterogenous	1	2	15	0	2	4
Extra Testicular Collection	0	1	3	0	0	0
Testicular Abscess Formation	0	0	2	0	0	0
Epididymal abscess	0	0	1	0	0	0

Table 4. Color Doppler appearance of inflammatory scrotal pathology

Color Doppler Appearance	Acute Epididymitis	Acute Orchitis	Acute Epididymo-Orchitis	Chronic Epididymitis	Acute on Chronic Epididymo-Orchitis
Focal Increase in Vascularity	0	0	3	0	0
Diffuse Increase in Vascularity	3	3	9	0	2
Focal Decrease in Vascularity	0	0	2	0	0
Diffuse Decrease in Vascularity	0	0	1	1	0
Normal Vascularity	0	0	0	0	0

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