

Spectrum of High Frequency Ultrasound and Colour Doppler Findings in Scrotal Lesions

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Abstract

Introduction: In the past, scrotal assessment relied on palpation, transillumination, and other methods. Today, advanced techniques like high-frequency ultrasound and color Doppler offer detailed imaging, aiding in diagnosis. This study aims to explore sonographic features of scrotal lesions using these modalities, enhancing understanding and informing clinical management strategies.

Methods: This cross-sectional study, conducted at GSL Medical College, Rajahmundry, included patients with scrotal pain and swelling. High-resolution grey scale and Doppler imaging were used with specified ultrasound equipment. Patient information was gathered, and thorough physical examinations were conducted before ultrasound. Scanning covered various scrotal planes and included dynamic maneuvers.

Results: Out of the 100 study participants, primarily aged 31-40 years (28%). Scrotal swelling with pain (32%) was predominant, followed by swelling alone (28%) and scrotal pain (10%). Inflammatory conditions exhibited hypoechoic patterns on ultrasound. Increased vascularity was common, with chronic epididymo-orchitis prevailing (31.1%), followed by hydrocele (35%) and varicocele (27.5%). Spermatocele was least common (5%).

Conclusion: our findings underscore the utility of high-frequency ultrasound and color doppler in diagnosing scrotal pathologies. Early detection of conditions like epididymitis and orchitis aids in timely intervention, mitigating complications. Future research should explore larger cohorts and prospective designs for more robust conclusions.

Keywords: Scrotal Ultrasound, Pathology, Diagnosis, Complications, Retrospective.

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Introduction

In the past, scrotal evaluation relied on palpation, transillumination, venography, and thermography. [1] Today, despite advancements like high-frequency ultrasound and color doppler imaging, thorough physical examination may still be limited by pain, tenderness, swelling, or distortion of scrotal contents, complicating diagnosis.

Modern evaluation of scrotal abnormalities employs high-frequency ultrasound, color doppler, CT, MRI, testicular angiography, and radioisotope tests. Ultrasonography stands out for its cost-effectiveness and absence of ionizing radiation, facilitating repeated examinations. [3] It enables detailed imaging of testicular architecture, vascularity, and pathology. Color doppler adds vascular mapping, aiding in distinguishing benign from malignant

lesions based on blood flow patterns. [2] CT and MRI offer complementary information, especially in complex cases or staging. Testicular angiography provides precise vascular mapping, while radioisotope tests aid in functional assessment.

Color Doppler Sonography (CDS) is crucial for distinguishing intra-testicular and extra-testicular pathologies, guiding appropriate management, whether conservative for inflammation or urgent surgery for torsion. [4] In this backdrop, the study attempted to understand the sonographic characteristics of the spectrum of scrotal lesions among the subjects using high-frequency ultrasound and color doppler.

Methods

It was a cross-sectional study, conducted in the department of Radiodiagnosis, GSL Medical College, Rajahmundry. Study was conducted between January 2021 to June 2022. Study protocol was approved by the Institutional Ethics Committee. Informed written consent was taken from the study members.

The inclusion criteria encompassed all patients presenting with scrotal pain and complaints of swelling, regardless of the palpability of the testis. Patients with both clinically palpable and non-palpable testes were referred to the radiology department for scrotal ultrasonography and color doppler imaging were included. Patients unwilling to participate or provide consent, those presenting with acute scrotal pain and clinical features indicative of testicular torsion were not considered.

This study utilized high-resolution real-time grey scale and doppler imaging of the scrotum with a 7.5 to 10 MHz linear transducer and abdominal ultrasound with a 3.5 to 5.0 MHz convex curved array on a PHILIPS Affiniti 70G US transducer with color doppler. Patient information and clinical history were collected, and a thorough physical examination was conducted before initiating ultrasound examination. The scrotum was elevated using a towel wrapped over the thighs, with the penis positioned on the patient's abdomen and covered. The transverse, sagittal, and oblique planes of each hemiscrotum were investigated. Scanning was performed during the Valsalva maneuver and while the patient was standing, as appropriate.

Statistical Analysis: All statistical analyses were conducted using SPSS software trial version 20.0 and MS Excel-2010. The Chi-square test was employed to evaluate associations among categorical variables. A p-value of <0.05 was deemed statistically significant, indicating meaningful associations between variables.

Results

Total 100 members were included, maximum (28%) in 31 – 40 group. Scrotal swelling with pain (32%) was the common clinical presentation followed by swelling alone (28%), and scrotal pain (10%). In acute epididymitis and orchitis, all cases exhibited a hypoechoic pattern. Chronic cases showed heterogeneous or hyperechoic patterns. In color doppler examination, increased vascularity was the common finding. Acute epididymitis and orchitis exhibited diffuse increase in vascularity, while epididymo-orchitis predominantly showed diffuse increase. In the study, chronic epididymo-orchitis was the most prevalent inflammatory condition (31.1%), followed by acute epididymo-orchitis (22.2%). Hydrocele was the most prevalent non-neoplastic scrotal swelling (35%), followed by

varicocele (27.5%), with spermatocele being the least common (5%).

Discussion

Sonographic investigation stands as the optimal choice for evaluating scrotal contents due to their superficial position. [5] Advancements in high-frequency, real-time scanners have significantly enhanced diagnostic accuracy in scrotal ultrasonography. With these improvements, scrotal ultrasonography has reached a stage where it can serve as the primary imaging modality for assessing scrotal contents. In this study, 100 individuals underwent high-frequency ultrasound examinations, with color doppler USG studies conducted when necessary to assess scrotal and testicular pathology. This approach offers several advantages, including non-invasiveness, lack of ionizing radiation, and the ability to provide detailed imaging of testicular architecture, vascularity, and pathology. Moreover, the real-time nature of ultrasound enables dynamic assessment, allowing for the detection of conditions such as torsion or inflammation promptly. [6] Overall, the utilization of high-frequency ultrasound and color doppler imaging represents a comprehensive and effective approach to evaluating scrotal and testicular diseases. [7]

Maximum (28%) study members were in 31 – 40 group. Testicular microcalcifications are often incidental findings, occurring in approximately 5% of males aged 17 to 35. [5] While usually benign, they can occasionally indicate underlying pathology, such as testicular malignancy or inflammation. Monitoring and further investigation may be necessary to rule out associated conditions. [8]

Scrotal swelling with pain (32%) was the common clinical presentation followed by swelling alone (28%), and scrotal pain (10%). A hydrocele results from a significant accumulation of fluid between the layers of the tunica vaginalis, causing painless scrotal swelling. However, a small amount of serous fluid within these layers is a benign finding and should not be confused with a hydrocele. [9]

In acute epididymitis and orchitis, all cases exhibited a hypoechoic pattern. Chronic cases showed heterogeneous or hyperechoic patterns. In color doppler examination, increased vascularity was the common finding. Acute epididymitis and orchitis exhibited diffuse increase in vascularity, while epididymo-orchitis predominantly showed diffuse increase. On sonography, the majority of intratesticular lesions typically appear as hypoechoic structures. This hypoechoic appearance is commonly observed and serves as a characteristic feature aiding in the identification and characterization of intratesticular pathology. [10] Compared to other study series, this research observed a lower frequency of acute inflammatory

issues but a higher occurrence of complications in acute scrotal inflammatory diseases.

This disparity may be attributed to a longer interval (typically 4-5 days) between symptom onset and examination. It's hypothesized that in Western populations, where details are lacking, patients are often evaluated earlier in the disease course, resulting in fewer complications. [11,12] In three cases of acute epididymitis, we observed enlarged epididymis size, diffuse hypoechoic areas, and widespread increase in vascularity. Our findings align with those reported by Horstman et al. [13] and Farriol et al. [14]

Limitations of this study include its single-center design and relatively small sample size. Additionally, the retrospective nature may introduce bias. Despite these constraints, our findings underscore the utility of high-frequency ultrasound and color Doppler in diagnosing scrotal pathologies. Early detection of conditions like epididymitis and orchitis aids in timely intervention, mitigating complications. Future research should explore larger cohorts and prospective designs for more robust conclusions.

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