

# To Determine the Role of Color Doppler Ultrasonography (CDUS) as a Routine Investigational Method for Diagnosis of Scrotal Pathologies

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## ABSTRACT

**Introduction:** Colour Doppler ultrasonography (CDUS) is an important tool for diagnosis of scrotal diseases because of its ability to depict anatomy and perfusion in real time. Diagnosis of scrotal diseases has always been a challenge for the clinician due to non-specific signs and symptoms. The causes of scrotal swelling are broadly classified as neoplastic and non-neoplastic. This distinction between these is important because the plan for the management differ in each cause. Ultrasonography plays a major role in distinguishing neoplastic and non-neoplastic scrotal pathologies. To determine the role of color Doppler ultrasonography as a routine investigational method for diagnosis of scrotal pathologies.

**Materials and Methods:** This prospective observational study (case series) was carried out over a period of 12 months on 50 patients in the age range of 0 to 80 years, presenting with scrotal swellings and pain. After adequate history and examination, B mode and CDUS was performed. The CDUS findings were compared with final outcome, based on course and outcome of the disease, fine needle aspiration cytology results and operative findings.

**Results:** In our study the final diagnoses were acute epididymitis or epididymo-orchitis (7), hydrocele (6), varicocele (7), testicular malignancy (5), orchitis (1), testicular torsion (1), hematocele (3), spermatocele (2) and others.

**Conclusion:** Color Doppler ultrasonography is an excellent method for evaluating patients with scrotal pathologies. It aids in diagnosing testicular tumors and reduces the number of unnecessary explorations. It is especially important in conditions like testicular torsion where immediate diagnosis is required.

**Keywords:** Color Doppler Ultrasonography (CDUS), Routine Investigational Method, Diagnosis of Scrotal Pathologies

masses are almost always benign while intratesticular solid masses may be malignant. Ultrasonography plays a major role in distinguishing intratesticular from extratesticular abnormalities.

## MATERIAL AND METHODS

This prospective observational study (case series) was conducted in The Post Graduate Department of Radiodiagnosis and Imaging Acharya Shri Chander College of Medical Sciences and Hospital Sidhra over a span of 12 months from 1<sup>st</sup> November 2021 to 31<sup>st</sup> October 2022. The study was approved by the ethical committee of the hospital and a written informed consent was taken from each patient.

**Sample size:** - 50 patients presenting with symptoms of scrotal swelling, pain and fever referred from the surgery department.

### Inclusion criteria

1. Patients referred for scrotal colour Doppler ultrasonography with scrotal pain, swelling or any other complaint of any duration.
2. Patients referred for scrotal colour Doppler ultrasonography for detection of an occult lesion (as in suspected cases of metastatic testicular malignancy) in whom an occult lesion was detected on scrotal sonography.

**Exclusion criteria:** - Patients who presented with Inguinoscrotal hernia and undescended testis.

**Method of collection of data:** - After adequate history taking and physical examination, CDUS was performed. The patients were scanned with the linear array colour Doppler multi frequency (7 to 10 MHz) transducer using Voluson

## INTRODUCTION

Color Doppler ultrasonography (CDUS) is an important tool for diagnosis of scrotal diseases because of its ability to depict anatomy and perfusion in real time. Diagnosis of scrotal diseases has always been a challenge for the clinician due to non-specific signs and symptoms. The causes of scrotal swelling can be classified as acute and non-acute. Acute causes include torsion, trauma, abscess, and orchitis. Nonacute causes include hydrocele, scrotal hernia, lymphocele, and others. Scrotal lesions can also be classified as testicular and extratesticular. The common testicular lesions are torsion, trauma, neoplasms, and inflammatory conditions. Extratesticular lesions include lesions of the spermatic cord, the epididymis, and the scrotal wall. This distinction is important because extratesticular

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**How to cite this article:** Ahatsham ul Haq, Sumit Sharma, Akshit Kumar, Rajesh Sharma, Amitoj Singh Sodhi. To determine the role of color doppler ultrasonography (CDUS) as a routine investigational method for diagnosis of scrotal pathologies. International Journal of Contemporary Medical Research 2023;10(2):B1-B5.

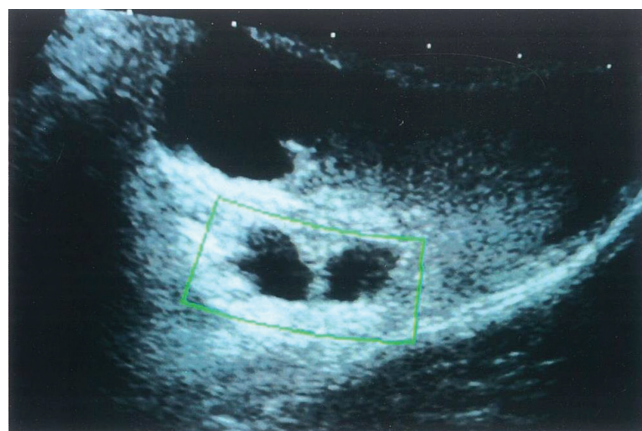


S8 (GE) ultrasound scanner and Siemens Acuson X300 and sagittal and transverse images were obtained. Additional views were also obtained in coronal and oblique planes, with the patient being upright and performing Valsava maneuver. Diagnostic accuracy of CDUS was determined by comparing it with the final diagnosis, which was based on clinical outcome (i.e positive response to medical treatment), operative findings, fine needle aspiration cytology (FNAC), and histopathological examination results.

**RESULTS**

The majority of the patients with acute scrotal condition were in their 2nd, 3<sup>rd</sup> and 4<sup>th</sup> decades of life whereas those presenting with testicular masses were in their 7th and 8th decades. With the help of CDUS, out of 10 cases of clinically suspected acute scrotal inflammatory pathology, 9(90%) were found to have acute inflammatory pathology on sonography whereas 1(10%) case was found to have testicular torsion that was confirmed at surgery. Out of 3 cases of clinically suspected testicular torsion, 2(66.66%) cases were found to have acute scrotal inflammation on color Doppler sonography

whereas 1(33.33%) case was found to have testicular tumor. All 9 clinically suspected cases of chronic inflammatory disease were confirmed on sonography. Out of 5 clinically suspected cases of testicular masses, 4(80%) were found to have testicular mass and 1(20%) case was found to have



**IMAGE 13: SPERMATOCELES**

Clinical impression	High frequency and colour doppler findings								Testicular cyst (n=1)
	Acute inflam mation (n=11)	Torsion Testis (n=1)	Chronic inflam mation (n=9)	Varico cele (n=7)	Hydro cele (n=6)	Epidid ymal cyst/Sp ermato cele (n=7)	Testi cular mass (n=5)	Testi cular trauma with hemat ocele (n=3)	
Acute inflammation (n=10)	9	1	-	-	-	-	-	-	-
Torsion Testis (n=3)	2	0	-	-	-	-	1	-	-
Chronic inflammation (n=9)	-	-	9	-	-	-	-	-	-
Varicocele (n=5)	-	-	-	5	-	-	-	-	-
Hydrocele (n=6)	-	-	-	-	6	-	-	-	-
Epididymal cyst/Spermato cele (n=7)	-	-	-	-	-	6	-	-	1
Testicular mass (n=5)	-	-	-	-	-	1	4	-	-
Testicular injury (n=3)	-	-	-	-	-	-	-	3	-
Normal (n=2)	-	-	-	2	-	-	-	-	-

**Table-1:** Comparison between sonographic findings and clinical picture

Scrotal pathology	Sonographic diagnosis	Surgical/histopathological diagnosis
Acute epididymo-orchitis with testicular abscess (n=2)	Testicular abscess (complicating acute epididymo orchitis) (n=2)	Testicular abscess
Acute epididymo-orchitis (n=1)	Acute epididymo-orchitis (n=1)	Acute epididymo-orchitis, no evidence of torsion testis
Torsion Testis (n=1)	Torsion Testis with absent intratesticular flow (n=1)	Torsion Testis with hemorrhagic parenchyma (unsalvageable)
Chronic Epididymo orchitis (n=5)	Chronic Epididymo orchitis (n=5)	Granulomatous pathology (Tubercular)
Varicocele (n=5)	Varicocele (n=5)	Varicocele
Testicular tumor (n=5)	Testicular tumor (n=5)	Testicular Germ cell tumors
Epididymal cyst (n=2)	Epididymal cyst (n=2)	Globus major cyst
Hydrocele (n=3)	Hydrocele (n=3)	Hydrocele
Testicular trauma (n=3)	Testicular hematoma, Hematocele with preserved colour flow to bulk of parenchyma (n=3)	Hematocele with testicular hematoma (with viable testicular parenchyma)

**Table-2:** Comparison between sonographic findings and surgical/ histopathological findings

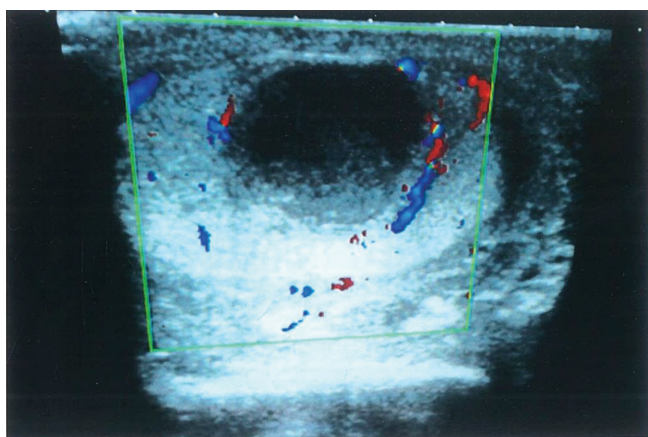


IMAGE 14: TESTICULAR ABSCESS

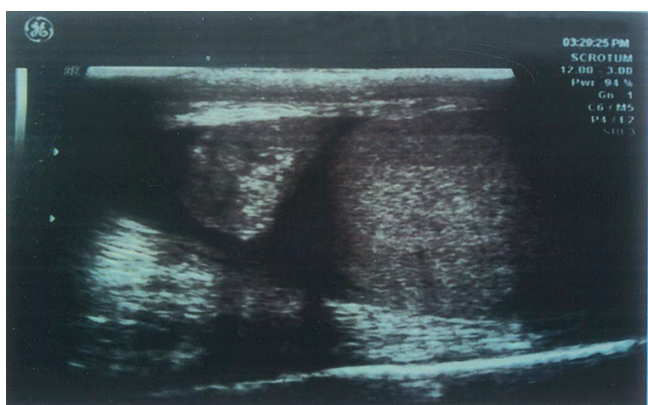


IMAGE 21: EPIDIDYMITIS WITH HETEROGENOUS EPIDIDYMAL ECHOTEXTURE

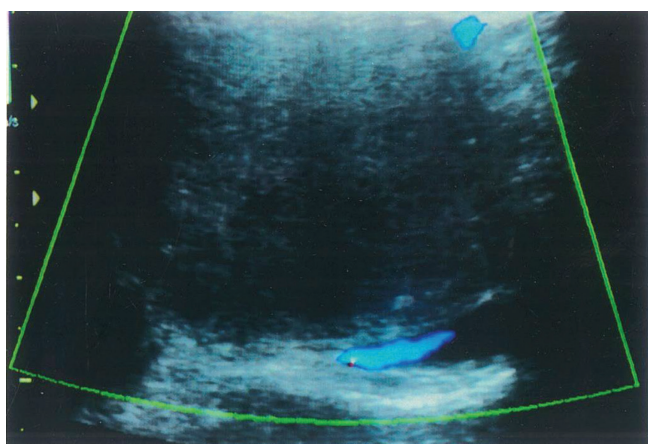


IMAGE 22: TORSION TESTIS WITH ABSENT INTRATESTICULAR FLOW

epididymal cyst on sonography. Out of 7 clinically suspected cases of epididymal cysts/ spermatoceles, 6(85.72%) cases were confirmed on sonography and 1(14.28%) case was shown to have testicular cyst on sonography. All clinically suspected cases of 7 varicoceles and 6 hydroceles were confirmed on sonography. However, 2(28.54%) cases of occult varicoceles, normal on clinical examination, were discovered at colour Doppler sonography. Thus, high frequency and colour Doppler findings were

correlated with surgical and histopathological findings in 27 cases. In all 27 cases, high frequency scrotal sonography with colour Doppler correctly detected scrotal pathology which was confirmed on surgery, histopathology or percutaneous aspiration.

## DISCUSSION

The superficial location of the scrotal contents makes them ideally suited for sonographic examination. The development of high frequency, real time scanners has enhanced the diagnostic accuracy of scrotal sonographic examinations. Further, colour Doppler imaging has added new dimensions in assessment of scrotal pathology that allows the technique to be the first and only imaging examination necessary to evaluate the scrotal contents.

The present study was undertaken in the Department of Radiodiagnosis, Acharya Shri Chander College of Medical Sciences and Hospital Sidhra, Jammu, on fifty patients with clinically suspected scrotal pathology who were referred to our department for high frequency and colour Doppler sonography.

Non-inflammatory pathologies were noted in the largest number of cases-27 (54%). Inflammatory pathologies were the next most commonly detected pathology, accounting for 20 cases (40%).

In our study, out of 6 cases, hydrocele was noted unilaterally in 5(83.33%) cases and bilaterally in 1(16.66%) case. All cases of hydroceles appeared as collection of fluid between two layers of tunica. In encysted hydrocele of cord, the collection of clear fluid along spermatic cord appeared as anechoic lesion adjacent to spermatic cord that moved with gentle traction on cord. 2(33.33%) cases of long-standing hydrocele showed thick internal septations and dense internal echoes were seen in one (16.66%) case. These findings are similar to previous studies of Arger *et al.*, (1981) and Willscher *et al.*, (1983).

Epididymo-orchitis and epididymitis predominantly affect sexually active males of less than 40 years of age, the older patient with urological disease and pre-pubertal boys having an associated urogenital anomaly. High Frequency and colour Doppler ultrasonography allows accurate assessment of inflammatory involvement of the scrotal contents. (Dogra *et al.*, 2003)

In the present study, chronic epididymo-orchitis and acute epididymo-orchitis were the commonest inflammatory conditions detected, each accounting for 7(35%) cases and together accounting for 70% cases of all inflammatory pathology detected in the study. 2(10%) cases of acute epididymo orchitis were complicated by testicular abscess formation. Other cases of inflammatory scrotal pathology were acute epididymitis: 2 (10%), acute orchitis: 1 (5%), chronic epididymitis: 2(10%), and scrotal wall inflammation: 1 (5%).

Varicoceles occur due to abnormal tortuous dilatation of the veins of the pampiniform plexus. They may either be primary or occur secondary to obstruction of gonadal veins by tumors, thrombosis of left renal vein and nodal masses.

Patients with varicoceles often present with decreased sperm counts, reduced sperm motility and abnormal sperm morphology. The association of varicoceles with infertility has been debated for long, it is postulated that presence of varicocele interferes with sperm production by reducing the temperature difference between the abdomen and the scrotum. (Meacham *et al.*, 1994)

On high frequency and colour Doppler sonography, varicoceles appear as dilated, tubular/serpiginous anechoic channels in the neck of scrotum, posterior to the testis with internal flow on colour Doppler imaging. Demonstration of flow reversal, either spontaneous or induced by Valsalva manoeuvre, is often possible. (Woodward *et al.*, 2003)

In the present study, all cases were of primary varicocele with no evidence of a contributing renal cause detected on simultaneously performed abdominal sonography. Out of 7 cases, unilateral varicocele was noted in 5 cases (71.4%) and all 5 were on the left side. Bilateral varicocele was noted in 2 cases (28.6%). Out of 7 cases, only 3 (42.85%) cases, which were clinically diagnosed as having unilateral left sided varicoceles, were confirmed by colour Doppler sonography as having unilateral left sided varicoceles only. 2(28.5%) cases which were diagnosed as having unilateral left varicoceles by physical examination, had bilateral varicoceles on colour Doppler sonography. 2(28.5%) cases were referred as not having varicocele by physical examination, which turned out to be having unilateral left varicocele. This shows that colour Doppler sonography has a much higher sensitivity for detecting varicoceles as compared to clinical examination. These findings were compared to previous similar studies by Meacham *et al.*, (1994) and Mc Clure *et al.*, (1986). The findings show similarity to previous studies.

Most of the neoplastic scrotal pathologies are testicular in origin, with very few arising from the epididymis. The commonest testicular tumours are of Germ cell origin, comprising seminoma, embryonal cell carcinoma, teratoma and choriocarcinoma. The role of sonography is to identify focal intratesticular mass lesion, to differentiate tumour from focal orchitis and infarction and to discover occult testicular tumours. Hypervascularity is usually observed in tumours larger than 1.5 cm in size. The most common sonographic appearance is of a hypervascular focal hypoechoic mass lesions, some tumors show heterogenous echotexture, calcification and varying colour Doppler signals. (Horstman *et al.*, 1992)

In the present study, 5 cases of testicular tumors were detected. Out of these, 4(80%) cases presented with painless testicular enlargement. One case (20%) was incidentally detected at sonography, presenting with a history of trivial trauma to the scrotum followed by moderate degree of scrotal pain, clinically diagnosed as testicular torsion. Colour Doppler was found to be 100% accurate in detection of testicular tumors. 3(60%) cases showed homogeneously hypoechoic echotexture whereas 2(40%) cases showed inhomogeneous echotexture with areas of breakdown showing decreased focal vascularity, histopathologic correlation showed necrosis in these areas of breakdown Histopathology revealed germ cell

tumors in all cases, 3(60%) cases were of seminoma, and one (20%) case each of embryonal cell carcinoma and yolk sac tumor were seen. Calcification was seen in one case of seminoma.

The sonographic findings of testicular tumors are compared with those of Krieger *et al.*, (1990), Horstman *et al.*, (1992) and Gallardo *et al.*, (1996) and are similar to those seen in these series.

Ultrasonography is the first-line imaging modality to help guide therapy for scrotal trauma. Trauma often may result in hematoma, hydrocele, hematocele, testicular fracture, or testicular rupture. The timely diagnosis of rupture, based on a sonographic finding of discontinuity of the echogenic tunica albuginea, is critical because emergent surgery results in salvage of the testis in 80%-90% of rupture cases. Colour flow imaging is highly useful techniques not only for assessing testicular viability and perfusion but also for evaluating associated vascular injuries such as pseudoaneurysms. A thorough familiarity with the US findings of scrotal trauma helps facilitate appropriate management. (Deurdulian *et al.*, 2007)

## CONCLUSION

In conclusion, high frequency and colour Doppler ultrasonography is a valuable technique for the evaluation of many abnormalities of the scrotum. Testicular and extra-testicular masses can usually be differentiated when clinical findings are inconclusive. Acute inflammatory pathology and testicular torsion can be accurately distinguished and unnecessary scrotal exploration avoided. Non-inflammatory pathologies can clearly be demonstrated with regards to location and presence of characteristic sonographic features. Testicular tumors can be accurately identified with the use of high frequency and colour Doppler ultrasonography. Colour Doppler ultrasonography is a reliable technique for evaluation of scrotal trauma and guiding surgical management. Thus, knowledge of the normal and pathological high frequency and colour Doppler appearance of the scrotum, as well as application of proper sonographic technique, is essential for accurate diagnosis of disorders of the scrotum and its contents.

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**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 28-12-2022; **Accepted:** 30-01-2023; **Published:** 28-02-2023