ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 10, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

# DIAGNOSTIC ACCURACY OF ULTRASONOGRAPHY IN TESTICULAR SWELLING

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***Received: 20 May 2023, Revised and Accepted: 07 August 2023***

**ABSTRACT**

**Objective:** The aim of this study is to determine the accuracy of ultrasonography (USG) for the diagnosis of testicular swelling.

**Methods:** This prospective study has been accompanied for a duration of 6 months from November 2022 to April 2023 at the Department of General Surgery in collaboration with Department of Urology and Department of Radiodiagnosis, LN Medical College and JK Hospital, LNCT, Bhopal, and BhimaBhoi Medical College and Hospital, Balangir. All the study participants were subjected to scrotal USG to examine the scrotal swelling. The subjects who presented with a history of chronic testicular swelling and suspected to have testicular tumor were taken up for surgery. The demographic and clinical details collected on a case record form were entered into Microsoft Excel and subjected to statistical analysis using statistics is a statistical software suite v. 20.0.

**Results:** Most of the patients presenting with a chronic testicular swelling belonged to the third and fourth decade of life. A majority of these patients (46.2%) were detected with testicular tumors due to the chronicity of the condition. Teratocarcinoma was the highest in the third decade whereas Seminoma was most frequent in the fourth decade. Metastatic testicular swellings were detected only after the sixth decade. Majority of the patients with testicular tumors (83%) has loss of testicular sensations.

**Conclusion:** Scrotal USG is an easy, non-invasive, and a very accurate diagnostic tool. This simple test which can be affordable to the common mass and available in remote areas is thus encouraged in all cases with scrotal swelling to support the ultimate analysis.

**Keywords:** Diagnostic accuracy, Ultrasonography, Testicular swelling, Scrotal infection, Non-invasive methods.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i10.48388. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

## INTRODUCTION

Ultrasonography (USG) has been demonstrated to be an operational and scientifically satisfactory resource of assessing scrotal infection. Its ability to go beyond other non-invasive methods like physical examination is a principle benefit of this technique. In forecasting whether a particular lesion is benign and/or malignant in the non-appearance of palpable tumor, USG is harmless, quick, readily accessible, non-invasive and accurate as an analytical tool. In this part of the country where moderate to large-sized hydrocele are often encountered, coexisting testicular tumor is likely to be missed. Till lately, scientific endorsement frequently vital surgical investigation as the only diagnostic criteria as intrascrotal mass is extremely suspicious for principal testicular neoplasm. With the advent of real-time grey scale USG, pre-operative characterization of the scrotal mass can enable surgical elimination of the tumor. In addition, scrotal USG is also valuable in the revealing of tumor in a normal palpable testis [1].

Color Doppler ultrasonography (CDUS) is supportive in identifying the perfusion of the testis and in receiving structural evidence [2]. It is a precise beneficial device that sources light liability to the patient with an acute scrotum [3]. Although it quickly offers us the precise evidence in most cases, it may not be observed as the definitive adjunct. However, as compared to the grey scale, it is definitely more accurate in diagnosing the acute cases that need urgent surgical exploration.

## METHODS

This prospective study has been accompanied for a duration of 6 months from November 2022 to April 2023 at the Department of General Surgery in Collaboration with the Department of Urology and Department of Radiodiagnosis, LN Medical College and JK Hospital, LNCT, Bhopal, and Bhima Bhoi Medical College and Hospital, Balangir. The study participants were screened from among the surgical outpatients of both the institutions and those satisfying the addition and elimination criteria have been encompassed in the study. Patients of testicular swelling presenting with pyocele or gangrene of the testis were excluded from the study. The various demographic and clinical parameters were recorded systemically in a case proforma. Routine blood, urine, and stool investigations were done. Special investigations such as X-rays, intravenous pyelography, computed tomography scan of abdomen and pelvis and various tumor markers were conducted as necessary. The study complied to the principles of good clinical practices and Declaration of Helsinki. Ethical clearance was obtained from the Institutional Ethics Committee of LN Medical College and JK Hospital, Bhopal, and Bhima Bhoi Medical College, Balangir, before the start of the study. A printed informed agreement was acquired from entire study subjects and strict confidentiality has been maintained throughout the study process.

### Radiological evaluation

All the study participants were subjected to scrotal USG to examine the scrotal swelling. Proper shaving of the area below the umbilicus up to the mid-thigh region was done before subjecting the patient to scrotal USG. The patient was laid in the supine position with his thighs completely abducted for better exposure. A paper towel is placed underneath the scrotum to provide adequate support to it. A layer of acoustic coupling gel has been applied above the scrotum. The fine lubricated scrotum is alleviated with single hand to align the testicular fundamentals with the epididymis in a single scan. Serial sagittal and transverse USG sections of the scrotum were taken. All the ultrasonographic features were recorded. The acute cases were subjected to color Doppler sonography to rule out testicular torsion, hematoma, or any other etiology. Based

on the history, clinical presentations, and ultrasonographic findings, the cases were either managed conservatively or subjected to surgical explorations, along with long-term follow-up.

**Surgical technique**

The subjects who presented with a history of chronic testicular swelling and suspected to have testicular tumor were taken up for surgery. The surgical procedure was carried out in supine position under general anesthesia. Orchidopexy has been completed for all cases of testicular torsion with a feasible testis. For the cases with non-viable testis, orchidectomy and contralateral orchidopexy have been completed. Hematocele is exhausted and testicular contusions were repaired.

The side of the testis bearing or suspected to have the tumor was unprotected over an inguinal incision. A soft clamp was pragmatic at the uppermost fact of the cord. It is handled with care so as to avoid dissemination of the tumor. Chevassu's maneuver is performed. Tumors identified by the naked eye and by Chevassu's maneuver were exposed to orchidectomy. Biopsy from the testicular tissue was taken and sent for histopathological investigation. The incision was locked with intermittent absorbable sutures.

The cases suspected to be benign hydrocele were activated with eversion of the sac. Cases with spermatocele underwent spermatocelectomy through trans-scrotal approach. Varicocelectomy with eversion of sac was performed through inguinal method for cases of varicocele with hydrocele.

Postoperatively, the patients were given intravenous fluids, antibiotics, and analgesics. The sutures were removed on the 7$^{th}$ day. They were observed for any immediate or delayed post-operative complications.

**Statistical analysis**

The demographic and clinical details collected on a case record form were entered into Microsoft Excel and subjected to statistical analysis using Statistics which is a statistical software suite v. 20.0. The categorical data were expressed in terms of frequency and percentages. Suitable statistical tests were applied and any result was considered significant at $p<0.05$.

**RESULTS**

The study comprised of 52 patients (104 testes) of testicular swelling. Among them, 18 patients (18 testes) were acute cases and 34 patients (39 testes) were chronic cases with a clinical suspicion of testicular mass. Among the 34 chronic cases, five presented with bilateral swelling. USG of the scrotum was done for all the study subjects (52 patients; 104 testes). On USG examination, 57 testicles (18+39) were suspected to have an abnormality. The 18 acute presentations existed further exposed to color Doppler sonography. The remaining 47 testicles were established to be normal on scientific investigation and no indication of abnormality was originated in USG.

Majority of the patients with acute swellings were teenagers (Table 1). All the cases presented with unilateral involvement of the testis. Among the 14 cases who presented with pain over testis as well as scrotum, nine were diagnosed with acute epididymo-orchitis and five with torsion of testis. Fever was encountered in two patients, but there was no evidence of testicular abscess in USG. The time of presentation shows a vitalpart in determining the viability of the affected testis and thus deciding the method of management. Patients with torsion testis who presented beyond 24 h of the appearance of the symptoms were subjected to orchidectomy of the affected testis and contralateral orchidopexy due to torsion-induced non-viability of the testis.

Most of the patients presenting with a chronic testicular swelling belonged to the third and fourth decade of life (Table 2). A majority of these patients (46.2%) were detected with testicular tumors due to the chronicity of the condition. Teratocarcinoma was the highest in the third decade whereas Seminoma was most frequent in the fourth decade. Metastatic testicular swellings were detected only after the sixth decade. Majority of the patients with testicular tumors (83%) has loss of testicular sensations. Metastasis to para-aortic nodes and abdominal nodes was encountered in one case each. There was no involvement of the supraclavicular nodes in any of the study subjects. Most of the patients detected with a testicular tumor had the testicular swelling for 3–6 months. The longest duration of symptoms was 18 months. Testicular tumors were further mutual toward the left side. Among the

**Table 1: Demographic and clinical parameters of acute cases**

| | |
|---|---|
| Total number of patients | 18 |
| Total number of testes | 18 |
| Side of involvement | Number of patients (n [%]) |
| Unilateral | 18 (100) |
| Bilateral | 0 |
| Age distribution (in years) | |
| 0–10 | 1 (5.6) |
| 11–20 | 8 (44.4) |
| 21–30 | 5 (27.8) |
| 31–40 | 3 (16.7) |
| >40 | 1 (5.6) |
| Clinical presentation | |
| History of trauma | 6 (33.3) |
| Pain over testis and scrotum | 14 (77.8) |
| Pain over testis alone | 3 (16.7) |
| Pain over scrotum alone | 1 (5.6) |
| Fever | 2 (11.2) |
| Absent cremasteric reflex | 5 (27.8) |
| Time of presentation (in hours) | |
| 0–6 | 2 (11.2) |
| 6–24 | 11 (61.1) |
| >24 | 5 (27.8) |

**Table 2: Demographic and clinical parameters of chronic cases**

| | |
|---|---|
| Total number of patients | 34 |
| Total number of testis | 39 |
| Side of involvement | Number of patients (n [%]) |
| Unilateral | 29 (85.3) |
| Right | 14 |
| Left | 15 |
| Bilateral | 5 (14.7) |
| Age distribution (in years) | |
| 0–10 | 0 |
| 11–20 | 1 (2.9) |
| 21–30 | 13 (38.2) |
| 31–40 | 11 (32.6) |
| 41–50 | 4 (11.8) |
| 51–60 | 3 (8.9) |
| >60 | 2 (5.9) |
| Clinical presentation | |
| Loss of testicular sensation | 15 (44.1) |
| Mild tenderness | 3 (8.9) |
| Inflamed para-aortic nodes | 1 (2.9) |
| Hydrocele | 12 (35.3) |
| Epididymo-orchitis | 5 (14.7) |
| Varicocele | 1 (2.9) |
| Types of tumors detected (total=39) | Number of testes (n' [%]) |
| Seminoma | 6 (15.4) |
| Teratocarcinoma | 3 (7.7) |
| Embryonal cell carcinoma | 2 (5.1) |
| Yolk sac tumor | 1 (2.6) |
| Seminoma+embryonal cell carcinoma | 1 (2.6) |
| Teratocarcinoma+embryonal cell carcinoma | 2 (5.1) |
| Embryonal cell carcinoma+yolk sac tumor | 1 (2.6) |
| Metastasis | 2 (5.1) |
| Total | 18 (46.2) |
| USG finding of tumors (total=39) | |
| Cystic | 11 (28.2) |
| Solid | 18 (46.2) |
| Mixed | 10 (25.6) |

USG: Ultrasonography

five bilateral cases of testicular involvement, two were tubercular, one was inflammatory in origin, and two were affected due to metastasis secondary to prostate tumor. USG of all the malignant testicular tumors showed focal poorly reflective disorganized lesions when compared to normal healthy testicular tissue. The two cases of secondary metastasis from prostrate displayed hypoechoic mass above bilateral testis.

USG was done for all the acute and chronic cases. The cases suspected for torsion of testis on USG were surgically explored and two of them were ruled out as the same. Since spontaneous detorsion occurs in some cases, ultrasound cannot rule out testicular torsion for which exploratory surgery is definitive. Immediately after detorsion, widespread hyperemia may be observed on USG which simulates epididymo-orchitis. Inappropriate management of testicular torsion promotes testicular infection, atrophy, and necrosis. There was a discrepancy in the USG and final diagnosis of the prevalence of benign and malignant nature of the chronic testicular swellings. However, this discrepancy was not a statistically significant finding (p=0.94 for acute swellings and p=0.06 for chronic swellings).

True positives were designated for those testicular swellings where the exploratory surgical operation findings aligned with the USG findings. Due to chances of occurrence of spontaneous detorsion, the number of false positive acute cases could not be accurately determined. All the false positive swellings identified as tumor by USG turned out to be indolent inflammations. True negative cases were those that were appropriately identified by USG and did not call for exploratory surgery. The USG findings were calculated to have reliable sensitivity, specificity, and accuracy (Table 3 and Fig. 1).

$$\text{Accuracy} = \frac{\text{true positive} + \text{true negative}}{\text{all}} \times 100\%$$

$$\text{Sensitivity} = \frac{\text{true positive}}{\text{true positive} + \text{false positive}} \times 100\%$$

$$\text{Specificity} = \frac{\text{true negative}}{\text{true negative} + \text{false positive}} \times 100\%$$

$$\text{Positive predictive value} = \frac{\text{true positive}}{\text{true positive} + \text{false positive}} \times 100\%$$

$$\text{Negative predictive value} = \frac{\text{true negative}}{\text{true positive} + \text{false positive}} \times 100\%$$

**Fig. 1: Formulae of the different parameters used in the study**

## DISCUSSION

In an endeavor to compare sonographical findings with histopathological features, this prospective study with scrotal USG was executed over duration of 6 months at both the institutions concurrently.

In the present study, the age of presentation of cases with testicular swelling ranged from 11 to 60 years. The age occurrence of dissimilar categories of testicular tumors simulates with the results of previous studies. Four cases of seminoma presented between 21 and 40 years, with peak incidence among 31–40 years of age. These findings tally with established literature that reports the peak incidence of seminoma to be 35–45 years [4]. The age incidence of teratocarcinoma in our study was between 21 and 40 years which was line with the literature that states the peak incidence of the same to be 20–35 years [4].

All the cases of absent cremasteric reflex had torsion of testis. This correlates with a study by Arjhansiri *et al*. [5] Clinical enlargement of epididymis along with testis was established in 35% of patients. In our set-up, chronic Epididymo-orchitis due to Filariasis is a common entity and hence USG would discriminate amid a benign and underlying malignant lesion. Finding of a solitary intra-testicular mass deprived of epididymal lesion or skin thickening referred to malignant entity, though diffuse abnormal echogenicity of the testis with epididymal lesion and skin thickening referred to an infectious procedure [6]. In our study, hydrocele was found in 11% of cases. Secondary hydrocele is present in approximately 10% of cases of testicular tumors [4]. In the eastern part of our country where moderate to large-sized hydroceles are prevalent, it becomes tough to appreciate loss of testicular sensations on the part of the clinician. The crucial role of USG in pinpointing the diagnosis is valuable in these cases.

Palpable abdominal nodes were seen in one case. This was an advanced case of teratocarcinoma with metastasis to the retroperitoneal para-aortic lymph nodes. This finding is at par with the studies of Oliver *et al*. [7].

Usually, torsion of testis is an acute condition and presents early. The cases that presented within 24 h had the viability of their testes preserved and those with delayed presentations (>24 h) lost their viability as a result of which were removed. In the present study, the two cases that appeared after 6 months of the appearance of symptoms presented with distant metastasis. The length of delay in presentation correlates with the incidence of metastasis which is similar in results to the already reported research [8].

The study reveals left-side predominance (50%) of testicular tumors. This finding was contrary to a study by Shawker [9] where testicular

**Table 3: Ultrasonographic findings of testicular swellings**

| Acute swelling (total testis=18) | Number of testes (n' [%]) | | p-value |
|---|---|---|---|
| Clinical diagnosis | Ultrasound diagnosis | Final diagnosis | 0.94 |
| Testicular torsion | 5 (27.8) | 3 (16.7) | |
| Hematocele | 1 (5.6) | 1 (5.6) | |
| Contusion | 2 (11.2) | 2 (11.2) | |
| Epididymo-orchitis/orchitis | 10 (55.6) | 10 (55.6) | |
| Chronic swelling (total testes=39) | Number of testes (n' [%]) | | |
| Clinical diagnosis | Ultrasound diagnosis | Final diagnosis | 0.06 |
| Benign | 11 (28.2) | 19 (48.7) | |
| Malignant | 28 (71.8) | 20 (51.3) | |
| Results of ultrasonography | Acute cases | Chronic cases | |
| True positive | 8 | 20 | |
| False positive | 0 | 8 | |
| True negative | 10 | 11 | |
| False negative | 0 | 0 | |
| Accuracy | 100 | 79.5 | |
| Sensitivity | 100 | 100 | |
| Specificity | 100 | 58 | |
| Positive predictive value | 100 | 71.4 | |
| Negative predictive value | 100 | 100 | |

cancers were more common on the right side. No definite cause could be attributed to this variation. However, in a current research by Gunther *et al*. (502 specimens) over a period of 12 years and 2 months (1995–2007), the left side was found to be involved in 68% of cases. Intratesticular masses can be recognized with a great grade of precision by scrotal USG. The USG findings were accurate except two cases that resembled closely with seminoma in USG finding but had histological analysis of metastatic testis. Scrotal USG has been an underused modality in urologic diagnosis partially as of unusualness with the procedure. Equipment currently existing can add investigative precision to the physical investigation of the scrotum by constructing it probable to characterize intrascrotal structures as solid or cystic, and intratesticular or extratesticular. Intrascrotal masses can be recognized appropriately as intratesticular or extratesticular in more than 90% of cases and appearances connecting to the nature of the mass-cystic, solid or complex pattern can be evaluated precisely [10]. Way back, a large number of testicular tumors were misdiagnosed as epididymitis leading to delay in management [7]. In our understanding, initial presentation of scrotal ultrasound will definitely avoid this problematic. The incidence of various histopathological types in our study was at par with the incidences found in recent study [11].

In the diagnosis of acute testicular swellings, CDUS study findings were correlated with surgical findings and clinical diagnosis. The results were found to be very accurate. For acute testicular swellings, the accuracy, sensitivity, and specificity was 100% which corroborates with the study revealed that CDUS did not miss any case of testicular torsion [12]; also another study which the identification of the testicular torsion had 94% sensitivity, 96% specificity, and 95.5% accuracy has been documented [13]; diagnosis of hematocele had 87% sensitivity and 89% specificity was also documented by the recent study [5]. In the diagnosis of chronic testicular swellings, eight false positive cases were detected by USG. These misdiagnosed as tumor, turned out to be benign. Similar cases of false positive diagnosis have been reported by another research [14]. The overall accuracy, sensitivity, and specificity for chronic swellings closely corroborated with few documented studies [15].

## CONCLUSION

Scrotal USG is an easy, non-invasive, and a very accurate diagnostic tool. This simple test which can be affordable to the common mass and available in remote areas is thus encouraged in all cases with scrotal swelling to support the ultimate analysis. The advent and application of this method for scrotal masses have made the diagnosis and treatment of testicular swellings more apt.

## ACKNOWLEDGMENT

Nil.

## CONFLICTS OF INTEREST

Nil.

## FUNDING SOURCE

Nil.

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