

Sonographic Spectrum of Inguinoscrotal Mass Lesions

Rachna Chaurasia¹, Vijay Kumar Gupta², Shaily Panwar³, Anurag Dhanik², Vineet Srivastava²

¹Associate Professor, Department of Radiodiagnosis, MLB Medical College, Jhansi, Uttar Pradesh, India, ²Post-graduate Student, Department of Radiodiagnosis, MLB Medical College, Jhansi, Uttar Pradesh, India, ³Lecturer, Department of Radiodiagnosis, MLB Medical College, Jhansi, Uttar Pradesh, India

Abstract

Background and Objectives: Scanning of inguinoscrotal region is needed when clinical examination does not identify any significant abnormality. For patients presenting with inguinoscrotal masses, it is critical to determine whether the mass is intra- or extra-testicular. High-resolution ultrasonography (US) combined with color Doppler US has become the imaging modality of choice for evaluating inguinoscrotal diseases. US is helpful in differentiating extra from intratesticular lesions and in inguinal lesions. US provides excellent anatomic detail; when color Doppler and power Doppler (PD) imaging are added testicular perfusion can be assessed.

Materials and Methods: Data for the study were collected from 60 patients attending/referred to Maharani Laxmi Bai Medical College and Hospital, Jhansi, Uttar Pradesh. The gray scale and color Doppler sonography routinely performed in all these patients. Subsequently, these cases were followed up and correlated with either surgical and laboratory findings, response to treatment or follow-up scans whichever applicable.

Results: This study was undertaken to evaluate the multifold data obtained by high-resolution gray-scale sonography, color Doppler flow imaging, and PD in the evaluation of scrotal pathology. A total of 60 patients from all age groups with signs and symptoms related to inguinoscrotal diseases have been included in this study. All the 60 patients were properly followed up sonographically/medically/surgically/pathologically as per indication, to arrive at the final diagnosis. The final diagnosis was extratesticular fluid collection in 16 cases, acute inflammation in 10 cases, varicoceles in 9 cases, epididymal cysts in 6 cases, and chronic inflammation in 4 cases, testicular tumor in 2 cases, and torsion of testis in 1 case. The rest of the lesions included malposition testis, inguinoscrotal hernia, testicular microlithiasis, and scrotal wall abscess and filariasis.

Conclusion: High-frequency US when supplemented with color Doppler sonography is sensitive in diagnosing acute scrotal pathology. It is also highly sensitive in differentiating solid from cystic inguinoscrotal masses, as well as intratesticular from extratesticular origin of scrotal masses. High-frequency US with Doppler is highly sensitive in demonstrating the varicoceles. We conclude that high-frequency US and color Doppler play an important role in the diagnosis and proper management planning of the inguinoscrotal disorders.

Key words: Color Doppler, Inguinoscrotal high frequency, Ultrasonography

INTRODUCTION

Scrotum is a cutaneous bag containing the right and left testis, epididymis, and lower part of the spermatic cord. Externally, scrotum is divided into right and left parts by a ridge or median raphe, which is continued forward onto

the under surface of the penis and backward along midline of the perineum to the anus.

High-resolution ultrasonography (US) combined with color Doppler US has gradually become the imaging modality of choice for evaluating inguinoscrotal diseases. The diagnosis of the inguinoscrotal pathologies primarily rests on clinical history and careful physical examination. However, in many patients, clinical symptoms are non-specific and often misleading. Clinical symptoms and physical examination are often not enough for definite diagnosis due to pain and swelling that limit an accurate palpation of the scrotal contents. Inguinoscrotal abnormalities can be associated

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Corresponding Author: Rachna Chaurasia, Department of Radiodiagnosis, MLB Medical College, Jhansi, Uttar Pradesh, India.
E-mail: dranshulrachna@rediffmail.com

with two main complaints, which is pain and mass. Causes of inguinoscrotal pain include inflammation (epididymitis, epididymo-orchitis, and abscess), testicular torsion, testicular trauma, testicular tumor, and obstructed inguinal hernias. This study has been undertaken to determine the role of US in the diagnosis of inguinoscrotal disorders in patients of all ages.

US provides excellent anatomic detail; when color Doppler and power Doppler (PD) imaging are added, testicular perfusion can be assessed. Sonography is simple to perform, rapid, non-invasive relatively inexpensive, easily reproducible, widely available, and does not involve irradiation of gonads.

Aims and Objectives

This study carried out with following aims and objectives:

- To assess the role of high-resolution sonography and color Doppler as primary imaging modality in the diagnosis of inguinoscrotal mass lesions
- To classify inguinoscrotal lesions into testicular and extratesticular
- To study the clinicoradiological spectrum of inguinoscrotal lesions
- To detect testicular ischemia with color flow and power mode Doppler.

MATERIALS AND METHODS

This study was undertaken to evaluate the multifold data obtained by high-resolution gray-scale sonography (usg Machines SA 8000SE [Medison] and SONOACE X 8 [Medison]), color Doppler flow imaging (CDFI), and PD in the evaluation of scrotal pathology. A total of 60 patients from all age groups with signs and symptoms related to inguinoscrotal diseases have been included in this study.

All the 60 patients were properly followed up sonographically/medically/surgically/pathologically as per indication, to arrive at the final diagnosis.

RESULTS

The present study was undertaken to evaluate the role of high-resolution sonography, color Doppler, and PD in the evaluation of inguinoscrotal pathology. A total of 60 patients from all age groups (Table 1) with signs and symptoms related to scrotal diseases (Table 2) have been included in this study. All the cases were properly followed up sonographically/medically/surgically/pathologically wherever indicated to arrive at the final diagnosis.

In sonographic findings, hydrocele was present in 13 (21.7%) cases (Table 3), followed by acute inflammation

in 10 (16.7%) cases, and varicoceles in 9 (15%). Other pathologies were chronic inflammation, torsion, and testicular tumors. Epididymal cyst, spermatocele, inguinoscrotal hernia, testicular trauma, hematocele, pyocele, testicular microlithiasis, scrotal wall abscess, and undescended testis were encountered occasionally (Tables 4 and 5).

DISCUSSION

Majority of the patients were between 21 and 40 years of age (56.7%) and the predominant group in this study was

Table 1: Age distribution of cases (n=60)

Age	Number of cases (%)
01-10	4 (6.7)
11-20	8 (13.4)
21-30	20 (33.3)
31-40	14 (23.3)
41-50	9 (15)
51-60	3 (5.0)
61-70	2 (3.3)

Table 2: Clinical symptoms (in decreasing order of prevalence)

Symptoms	Present in number of cases (%)
Scrotal swelling	34 (56.7)
Scrotal pain	24 (40)
Fever	16 (26.7)
Scrotal discomfort	11 (18.4)
Extrascrotal pain	3 (5.0)
Extrascrotal swelling	3 (5.0)
Absent testis scrotal sac	2 (3.3)
Trauma scrotum	1 (1.7)

Table 3: Spectrum of sonographic findings in all patients with inguinoscrotal pathology (n=60)

Diagnosis	Number of findings	Percentage of total sonographic findings (n=60)
Hydrocele	13	21.7
Acute inflammation	10	16.7
Varicocele	9	15
Chronic inflammation	4	6.7
Epididymal cyst	6	10
Torsion	1	1.6
Hernia	3	5
Hematocele	1	1.7
Pyocele	2	3.3
Testicular tumor	2	3.3
Spermatocele	1	1.7
Testicular microlithiasis	2	3.3
Undescended testis	2	3.3
Filariasis	2	3.3
Fournier's gangrene	1	1.7
Scrotal wall abscess	1	1.7

21-30 years comprising 20 patients (33.3%). This is possibly because of the repeated minor trauma to the testes due to the strenuous activity performed by the persons in this age group and also because, both the inflammatory and neoplastic diseases of the scrotum are more common in this age group. Testicular tumors are frequent in the age group of 15-35 years. Deland *et al.*¹ in their study of inflammatory conditions of testes found that mean age of presentation in their study was 22 years.

Unilateral scrotal swelling was the most common presentation (78.3%). Other symptoms included bilateral swelling and infertility. Few patients presented with a combination of symptoms, the most common one being pain and swelling.

Fluid collections were the most common abnormality detected on sonography. Hydrocele was seen in 13 (21.7%) cases and was the most frequent type of fluid collection. These were subsequently proved on aspiration and cytology. Thus, accuracy of 100% was achieved in diagnosing hydrocele on sonography. Most common type of hydrocele was the one with the fluid being confined to tunica vaginalis cavity (100%). Martin *et al.*,² 1996 also described similar sonographic features in hydrocele of the spermatic cord.

In the present study, 10 (16.6%) patients with acute inflammation of scrotal structures were noted. Out of these, most patients were in age group 21-40 years, that

is, sexually active young males. At final diagnosis, there were 2 cases of orchitis (20%), 4 cases of epididymitis (40%), and 1 case (10%) of funiculitis, and some of the patients had more than one of the above three pathologies in different combinations. Three of the patients had simultaneous involvement of testis and epididymis and cord, were diagnosed as case of epididymitis with funiculitis. Epididymis was the most common anatomical structure involved in acute inflammation (4 out of 10 cases [40%]). Gray-scale sonography demonstrated abnormality in all these cases (100% accuracy). In 3 cases, epididymis was enlarged in size. Diffuse involvement in 2 cases (50%). Enlargement of epididymis with altered echotexture was the most common pattern of involvement (Figure 1a and b). In 2000, Xavier *et al.*³ also described similar findings in cases of acute epididymitis.

Doppler sonography showed increased blood flow in the affected epididymis and testis (100% accuracy). There was hyperemia in the affected structure. Thus, Doppler sonography proved to be better than gray-scale sonography in the diagnosis of acute inflammatory conditions. Similar findings were suggested by Horstman *et al.*,⁴ 1991. CDFI revealed increased intratesticular blood flow in involved testis as compared to normal contralateral testis. Garriga *et al.*,⁵ 2000 suggested that PD is more helpful than color Doppler in evaluation of acute inflammatory conditions.

In this series, nine cases of varicoceles were included. All of these cases were correctly diagnosed. They comprised 15% of total number of cases. Varicoceles have been reported to be present in 10-15% of adult men by Meecham *et al.*,⁶ 1994.

On gray-scale sonography, varicoceles were seen as multiple, hypoechoic, serpiginous, and tubular structures larger than 2 mm in diameter, visible superior, and/or lateral of the testis (Figure 2). Color Doppler depicted blood flow within these tubular channels. These findings were in accordance with those of Dogra *et al.*,⁷ 2003.

Three cases of scrotal hernias were noted in the study. Omentum was seen herniating into the inguinoscrotal region in one case while bowel loops were seen in two cases.

Table 4: Extratesticular lesions (n=45)

Extratesticular pathology	Number of cases (%)
Hydrocele	13 (28.9)
Acute epididymitis	4 (8.9)
Varicocele	9 (20)
Chronic epididymitis	1 (2.2)
Epididymal cyst	6 (13.3)
Spermatocele	1 (2.2)
Inguinoscrotal hernia	3 (6.7)
Hematocele	1 (2.2)
Filaria	2 (4.5)
Funiculitis	1 (2.2)
Pyocele	2 (4.5)
Fournier's gangrene	1 (2.2)
Scrotal wall abscess	1 (2.2)

Table 5: Intratesticular lesions (n=15)

Intratesticular pathology	Number of cases (%)
Acute orchitis	5 (33.4)
Torsion	1 (6.7)
Testicular tumor	2 (13.3)
Chronic orchitis (o+epi o)	3 (20)
Undescended testis	2 (13.3)
Testicular microlithiasis	2 (13.3)

o+epi o: Orchitis + epididymo orchitis

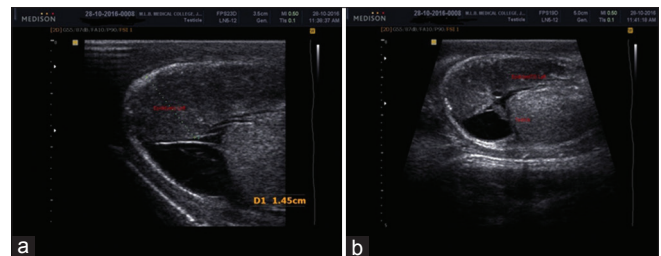


Figure 1: (a and b) Bulky and heterogeneous testes and epididymis (epididymo-orchitis)

Thus, an incidence of 5% (3/60) was noted. An incidence of 7.6% was noted by Subramanyam *et al.*,⁸ 1982 in their study.

One case of spermatocele and 6 cases of epididymal cysts were identified. Both these lesions were common in the head of epididymis. The contents were echogenic in spermatocele and anechoic in all cases of epididymal cysts (100%). Septations were noted in 2 cases of epididymal cyst (Figure 3). However, these conditions could not be reliably distinguished on the sonographic examination alone. Similar concern was shown by Krone and Carroll,⁹ 1985.

The incidence of undescended testes was 3.3% (2 out of 60) in our series. It is similar to that observed by Pinch *et al.*¹⁰ All the patients had unilateral undescended testis. The location of undescended testis was in inguinal region in all the patients (within the inguinal canal). Harrison *et al.* reported location of cryptorchid testes in inguinal canal in 72% and abdominal in 8% of cases. On sonography, the testes were comparative, smaller in size, and homogeneously hypoechoic in nature. Madrazo *et al.*¹¹ described similar sonographic features of undescended testes.

In our study, testicular microlithiasis was encountered in two cases with an incidence of 3.3% (2/60). They were observed as multiple, small (1-2 mm), diffusely scattered, hyperechoic foci within testicular parenchyma without acoustic shadowing. These are incidental finding. Doherty *et al.*¹² described similar findings with a reported incidence of 0.6%.

In the present study, testicular tumors were found in 2 cases (3.3%). The use of ultrasound in diagnosis of testicular tumors is well documented. In our study, tumors were found commonly from age group 0-10 years and 21-30 year's and in these age group most common tumor were found yolk sac tumor and seminoma respectively. Ultrasound is highly sensitive for detection of testicular tumors with a sensitivity of 100% in this study, however, the sample size was small. In the study carried out by Fowler *et al.*,¹³ sensitivity was 100% and specificity was 99%. He reported that seminomas were more homogeneous in echotexture than other tumors (Figure 4).

All the 60 patients were properly followed up sonographically/medically/surgically/pathologically as per indication, to arrive at the final diagnosis.

The final diagnosis was extratesticular fluid collection in 16 cases, acute inflammation in 10 cases, chronic inflammation in 4 cases, testicular tumor in 2 cases, torsion of testis in 1 case, epididymal cysts in 6 cases, and varicoceles in 9 cases. The rest of the lesions included malpositioned testis, inguinoscrotal hernia, testicular microlithiasis, and scrotal wall abscess.

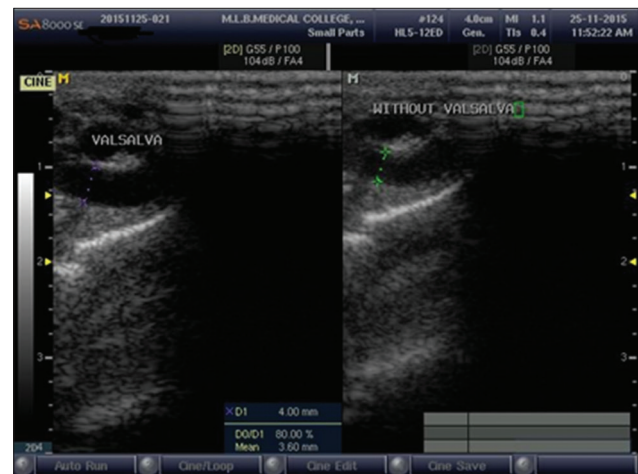


Figure 2: Dilated venous channels on left side showing increased flow post-Valsalva maneuver – left-sided varicocele

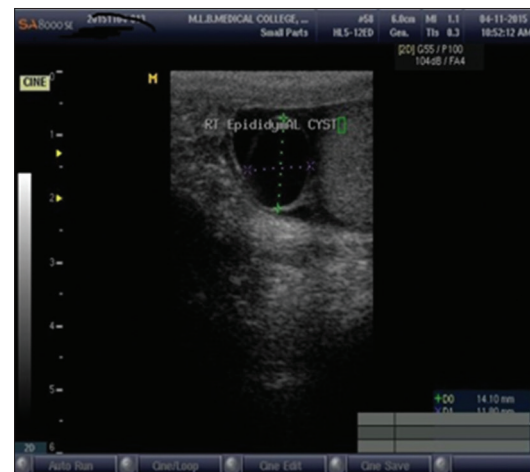


Figure 3: Anechoic cystic structure with septations at head of the epididymis (epididymal cyst)

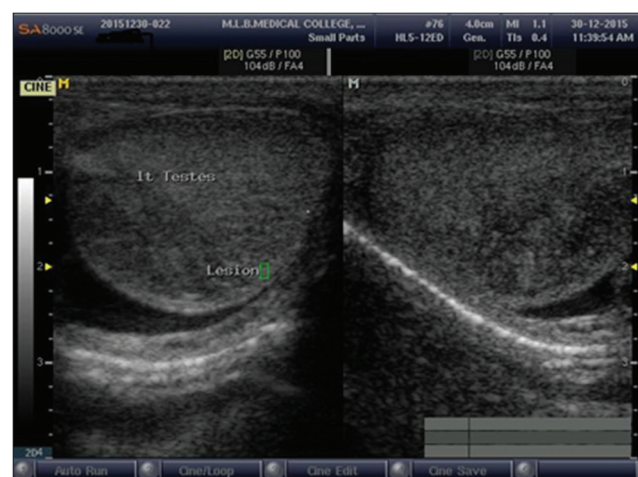


Figure 4: Irregular hypoechoic area in left testis (seminoma)

Extratesticular fluid collection was the most common scrotal pathology noted. Of this, idiopathic hydrocele was the most common abnormality observed. It featured mostly

as an anechoic collection in the tunica vaginalis cavity. All cases of hydrocele were correctly diagnosed on gray-scale sonography.

Extratesticular fluid collection following trauma and infection depicted septations. As a result, gray-scale sonography could not reliably distinguish between hematocele and extratesticular abscess (Figure 5).

In 10 patients with acute inflammation, at the final diagnosis, there were 5 cases of orchitis (50%), 8 cases of epididymitis (80%), and 1 cases (10%) of funiculitis, as some of the patients had more than one of the above three pathologies in different combinations. Doppler sonography showed increased blood flow in the affected epididymis and testes and thus showed 100% accuracy in diagnosis of acute inflammation. The most common pattern was enlarged epididymis with altered echotexture. PD proved to be more sensitive than color Doppler in detecting inflammatory pathology. Peak systolic velocity (PSV) more than 15 cm/s and resistive index (RI) <0.5 were complementary to the diagnosis of acute inflammation.

In 10 patients with acute inflammation, at the final diagnosis, there were 5 cases of orchitis (50%), 8 cases of epididymitis (80%), and 1 cases (10%) of funiculitis, as some of the patients had more than one of the above three pathologies in different combinations. Doppler sonography showed increased blood flow in the affected epididymis and testes and thus showed 100% accuracy in diagnosis of acute inflammation. The most common pattern was enlarged epididymis with altered echotexture. PD proved to be more sensitive than color Doppler in detecting inflammatory pathology. PSV more than 15 cm/s and RI <0.5 were complementary to the diagnosis of acute inflammation.



Figure 5: Extratesticular collection with internal septations (scrotal wall abscess)

Gray-scale ultrasound could not well-differentiate acute torsion from acute orchitis, as both the conditions showed hypoechoic testis. The most important role of CDFI and PD was noted to differentiate equivocal gray-scale sonographic features of testicular torsion and acute inflammations. With CDFI, symptomatic testes showed the absence of vascular signals in all cases of testicular torsion (100% sensitivity).

Four patients with chronic inflammation of scrotal structures were included in the study. Majority of the patients were in the age group of 21-40 years. At final diagnosis, testes were involved in 3 cases (75%) and epididymis in 3 cases (75%), of which 1 case of orchitis and 1 case of epididymitis were proved to be tuberculous in nature. Out of the 4 cases of chronic inflammation, gray scale and Doppler sonography could diagnose abnormality in two cases and failed to detect chronic inflammatory changes in epididymis in 1 case of non-tuberculous chronic epididymo-orchitis.

In majority of these cases (2 out of 3 cases) involved, epididymis was heterogeneous in echotexture (67%) followed by hypoechoic echotexture in one case (33%). Tuberculous epididymitis demonstrated heterogeneous echotexture of the involved epididymis along with interspersed hypoechoic nodules. Similar findings were depicted by Kim *et al.*,¹⁴ 1993. The echogenicity of enlarge epididymis was relatively homogenous in patients with non-tuberculous epididymitis. This finding was also noted by Chung *et al.*,¹⁵ 1997.

Testes were involved in 3 patients (75%). Sonographic features of testicular involvement comprised ill-defined areas of intratesticular hypoechoic in 1 case (33.3%) and heterogeneous echopattern of testis with irregular margin between epididymis and testes in two case (66.7%). Kim *et al.*¹⁴ and Chung *et al.*¹⁵ also described similar features in their studies.

Evidence of tuberculosis in the lung was associated in 2 cases (50%). Testicular and epididymal calcification were noted in 2 cases each.

Strikingly, similar observations were noted in patients with tuberculous and non-tuberculous epididymo-orchitis by Kim *et al.*¹⁴ in a study of 12 patients. They found diffuse enlargement of epididymis in 50% of cases and involvement of tail in 25%. Testes were involved in 50% of their patients with similar sonographic features.

Nine cases of varicoceles were seen (Figure 2). However, gray-scale sonography could diagnose only 8 cases (88.9%)

sensitivity). It failed to diagnose 1 case of subclinical varicoceles in infertile males, in which the venous diameter of pampiniform plexus was 2-3 mm. However, color and pulse Doppler accurately diagnosed all cases of varicoceles (100% sensitivity).

Undescended testis was noted in 2 cases. In all cases, condition was unilateral and testis was located in the inguinal canal. In both cases, undescended testis was comparatively smaller and hypoechoic.

In total, there were 7 cases of cysts in the head of epididymis, subsequently proved to be 6 cases of epididymal cyst, and 1 cases of spermatocele at the final diagnosis of the 3 cases of scrotal hernia, omentocoele was seen in 1 case, and enterocoele in 2 cases.

CONCLUSION

In our study, most of the observations and results matched the earlier studies. However, there were few results which did not match the literature. This may be due to small sample size.

To summarize, an excellent correlation was seen in the diagnosis of scrotal lesions between sonography (gray scale, CDFI, and PD) and histopathology/surgery/treatment response. Sonography (gray scale and Doppler together) was found to be 93.33% sensitive in the diagnosis of scrotal pathology.

The present study concludes that high-resolution sonography, along with CDFI and PD should be used as first-line imaging modality in the evaluation of inguinoscrotal pathologies. CDFI and PD and useful

information and complement gray-scale sonography are very much helpful in reaching a correct diagnosis.

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