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Ultrasonography (Grey scale imaging and colour Doppler) in evaluation of acute scrotal pain

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***Abstract*---**Introduction: Ultrasonography with high frequency linear probe and Color Doppler is very important in evaluation of scrotal pathology in patients with acute scrotal pain. Computed tomography exposes testicles to the radiation and MRI is not so easily available. Therefore ultrasound with color Doppler is the best suited modality for the evaluation of scrotal pathologies in patients with acute scrotal pain as it is simple, noninvasive, reproducible, relatively inexpensive and widely available investigation that will not expose the testis to radiation. Aims and Objectives: To classify (etiologically) and to evaluate various scrotal pathologies in patients with acute scrotal pain using ultrasonography and describe the role of High resolution ultrasound transducer (7-11 MHz) and colour doppler in their diagnosis and differentiation. Materials and Methods: The study was done on 60 patients over period of One year (2021-2022) who were referred to the radiology department by the General Surgery and

department of urology for scrotal ultrasound and Doppler study at Dhiraj Hospital,S.B.K.S medical institute and research centre, Pipariya, Waghodia, Baroda. Results: Of the 60 patients studied, incidence of various pathologies were as follows -inflammatory pathology in 75%, torsion in 13.3%, trauma in 6.7%, and others in 5%. Imaging features of different pathologies causing acute scrotal pain are described. Conclusion: High frequency ultrasonography is extremely useful in evaluating normal testes and epididymis as well as allows clear demonstration of the morphological changes associated with acute scrotal pain. Color Doppler ultrasound is highly sensitive in diagnosing acute scrotal pathology and precisely differentiates testicular torsion from acute inflammatory conditions.

***Keywords*---**Ultrasonography, acute scrotal pain, epididymis-orchitis.

Introduction

Ultrasonography with Color Doppler is first investigation of choice to evaluate various causes of acute testicular pain(1). The development of sonogram with high frequency linear transducer and color Doppler is an important mile stone in evaluating acute scrotal pain. Risk of radiation is involve with CT Scan and Magnetic resonance imaging is not easily available in Indian setting[2]. Therefore USG with color Doppler is best for investigating patients with acute scrotal pain. It is noninvasive simple, easily accessible , relatively less expensive investigation that is not involve with radiation exposure to the testis [3]. So we have conducted this study to classify etiologically and to evaluate various causes of acute scrotal pain with the help of ultrasonography and describe the role of linear transducer and colour Doppler in their diagnosis and differentiation.

Materials and Methods

The study was done on 60 patients over period of One year (2021-2022) who were referred to the radiology department by the General Surgery and department of Urology for scrotal ultrasound and Doppler study at Dhiraj Hospital,S.B.K.S medical institute and research centre, Pipariya, Waghodia, Baroda. Permission from ethical board was obtained from hospital .it is a retrospective study , detailed history and local examination was done prior to scan and informal consent was taken. Grey scale imaging with Color Doppler are performed routiney Additional abdominal scan was done in patients with testicular malignancies to identify any associated lymphadenopathy , complicated and uncomplicated inguinal hernia extending to the scrotum . After the scan, and appropriate medical and surgical management these patients were followed up to see the improvement post treatment.

Equipment

Patients were scanned using GE Logiq P5 and P9 machine having curvilinear probes of frequency 2.5-5MHz and linear transducer of frequency 7-11MHz.

Scanning Technique:

Patient is lying comfortably in supine position on flat surface the scrotum was supported with a rolled towel or sheath placed between the legs and the penis was placed onto the abdomen and covered with a towel. Scanning was done in the transverse, longitudinal and oblique planes with a 7-11MHz linear array transducer. Additional positions/maneuvers like standing, valsalva maneouver were used whenever required (as in the evaluation of a varicocele). Colour and power Doppler ultrasound were used to detect perfusion and verify abnormal flow patterns. The spectral waveform of intratesticular arteries characteristically is of low resistance index (0.48 -0.75 ; average -0.62) and that of normal epididymis is 0.46 -0.68. (5)

Observations & Results

Table 1
Age Distribution

Age	No. of cases	Percentage
0-20	14	23
20-40	32	54
40-60	14	23

Nearly 54 percent of patients were young between 20 to 40 years of age. Around 23 percent were older than 40 years

Table 2
Causes of Acute scrotal Pain

Type	No. of Cases	Percentage
Inflammatory	45	75%
Testicular Torsion	8	13.3%
Testicular Trauma	4	6.7%
Others	3	5%

According to above table it is estimated that inflammatory causes are the main causes of acute scrotal pain in 20-40 years age group.

Table 3
Inflammatory causes

Condition	Incidence Cases
Acute epididymoorchitis	22
Acute epididymitis	10
Acute orchitis	7
Funiculitis	4
Cellulitis (scrotal wall)	2

Table 4
Noninflammatory Causes

Condition	Incidence cases
Torsion	8
Trauma	4
Others	3

Others include vericocele, obstructed inguinal hernia.

Table 5
Radiological finding in evaluating acute scrotal pain

Finding	Cases	Percentage
Altered echotexture of testis with raised vascularity	29	48.3%
Enlarged testis	20	33.3%
Altered echotexture of epididymis with raised vascularity	25	41.6%
Enlarged epididymis	21	35%
Hydrocele	30	50%
Absent of blood flow in testis (focal or diffuse)	12	20%
Absent of blood flow in epididymis	4	7%
Thickened scrotal wall with/without raise vascularity	2	3.3%
Pampiniform plexus vein diameter measure more than 2mm	2	3.3%

Acute epididymitis with Acute epididymoorchitis are two most common inflammatory lesion observed. In non inflammatory conditions torsion and testicular trauma were most common.

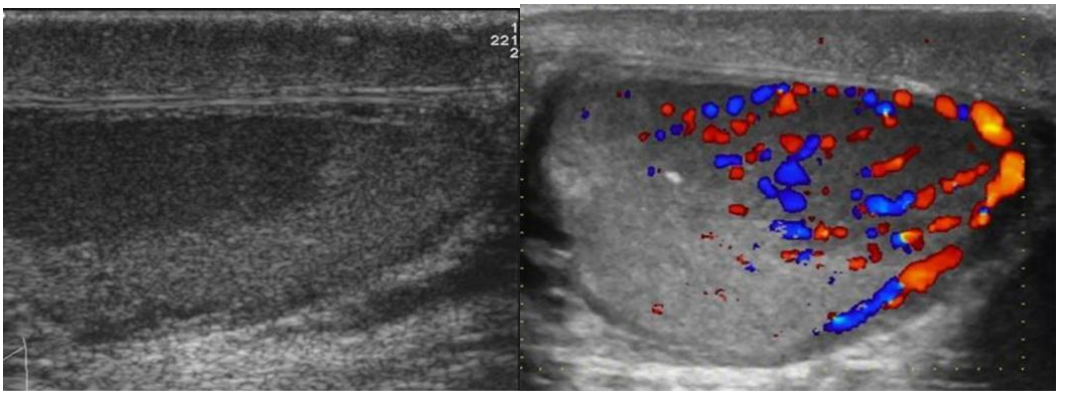
Discussion

Acute scrotal pain is a clinical scenario where patient present with chief complain of sudden onset of scrotal pain, increased local temperature redness and swelling most of the time unilateral condition, most common causes include acute epididymo-orchitis, testicular torsion and testicular trauma. While evaluating acute scrotal pain patients always start examination On the asymptomatic side to compare normal vs abnormal anatomy. Colour Doppler and power Doppler are added along grey scale real time imaging. Patients with absent or reduced flow are treated surgically, in case of inconclusive Doppler study MRI is always recommended.

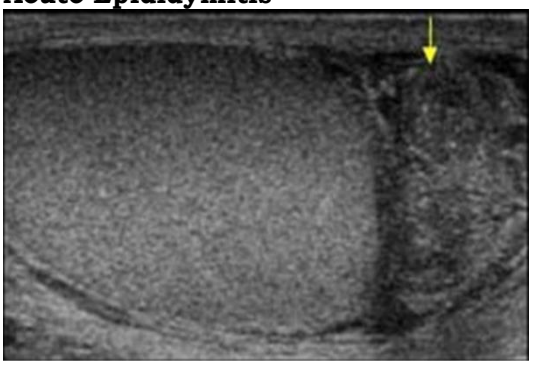
A total of 60 patient came with complain of acute scrotal pain and were examined after due consent from the patient. Out of 60 cases in the study, pathological process was detected in all the 60 cases and none of the case showed normal study. Of the 60 cases majority were in the age group of 20-40 years. Inflammatory pathologies are main cause of acute scrotal pain.

Acute Epididymitis, Orchitis And Epididymo-Orchitis- It is the most common cause of acute scrotal pain in adolescent boys and adults [2,3]. Common causative organisms are Chlamydia trachomatis, Neisseria gonorrhea, Escherichia coli, Pseudomonas, Proteusmirabilis and Mumps.

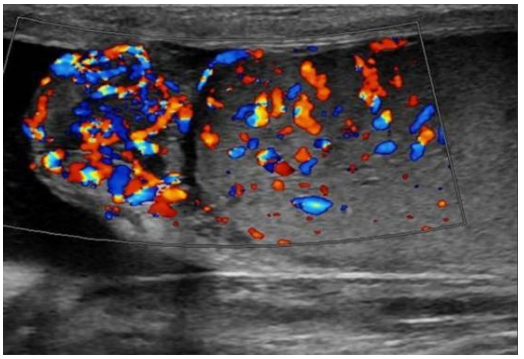
Acute Orchitis:



Acute Epididymitis



Acute Epididymo-Orchitis



Acute Funiculitis

Ultrasound features- Ultrasound features of acute epididymitis include reduced echogenicity of the testis and epididymis, increased size of the epididymis and the testis [normal-epididymal head : 7-14mm, body: 4mm], secondary hydrocele and scrotal wall thickening.

On Color Doppler, increased vascularity and high flow, low resistance pattern was noted with hyperemia. Resistive index is rarely less than 0.5 in normal individuals but is almost always less than 0.5 in epididymo-orchitis, with a peak systolic velocity threshold of 15cm/sec (diagnostic accuracy -90% for orchitis and 93% for epididymitis). Reversal of flow during diastole is suggestive of assosiated venous infarction
[5].

Acute Orchitis- Infection of the testis occurs most commonly due to the contiguous spread from the epididymis. Primary orchitis is rare and is most commonly caused by Mumps (Bilateral in 14-35% cases) [4].

Ultrasound Features- Ultrasound features of acute orchitis include a diffusely enlarged, hypoechoic testis with probe tenderness [3,4,6]. On Color Doppler, increased flow can be seen in the testis. Intratesticular venous flow is usually difficult to detect in normal testis. Increased and easily detected venous flow is highly suggestive of orchitis [4,6]. Hyperemia and heterogeneity isolated to testis is seen in orchitis, tumour and in transient torsion of testis.

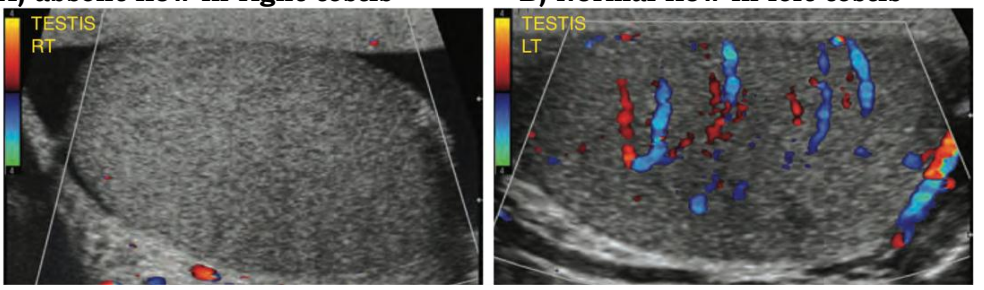
Complications- Complications include reactive hydrocele, scrotal wall abscess, funiculitis.

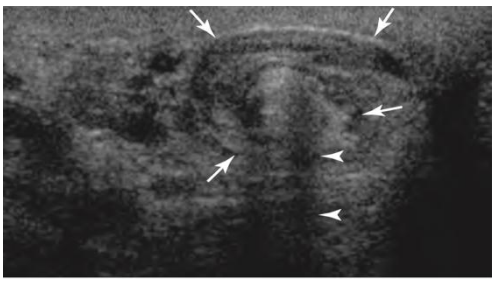
Inflammatory Diseases of Scrotal wall

Cellulitis of Scrotal Wall: Common in diabetic, obese and immune-compromised. Ultrasonographic findings include thickening of the scrotal wall and loss of uniform hyperechogenecity of the scrotal wall. Testis and epididymis may be normal.

Non Inflammatory causes of acute scrotum pain
Testicular torsion:
Testicular torsion or twisting of the spermatic cord, implies first venous and later arterial flow obstruction. The extent of testicular ischemia will depend on the degree of twisting (180°–720°) and the duration of the torsion. two types of testicular torsion are recognized: extravaginal and intravaginal.
Extra-vaginal torsion is seen mainly in newborns and Intra-vaginal torsion can occur at any age but is more common in adolescents. A predisposing factor is the "bell clapper" deformity, in which the tunica vaginalis joins high on spermatic cord.
In the early phases of torsion (1–3 hours), testicular echogenicity appears normal. With progressions, enlargement of the affected testis and increased or heterogeneous echogenicity are common findings. The orientation of the testis, epididymis,and cord may be inverted .
A definitive diagnosis of complete testicular torsion is made when blood flow is visualized on xthe normal side but is absent on the affected side. Incomplete torsion refers to cord twist-ing of less than 360°, in which some arterial flow persists in the affected testis. Meticulous comparison of the two testes by using transverse views is mandatory in these cases.
Normal echogenicity with mild testicular enlargement is a good sign of viability, whereas marked enlargement, heterogeneous echo-texture, and scrotal wall hypervascularity are signs of testicular infarction.

A) absent flow in right testis **B) Normal flow in left testis**





whirlpool appearance in twisted spermatic cord.

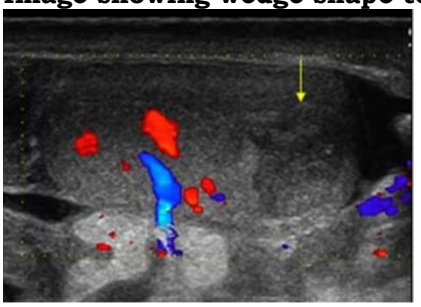
Testicular Trauma:

Testicular trauma is third commonest cause of acute scrotal pain
Testicular rupture and testicular ischemia are common severe complications needs to rule out.
Trauma can be blunt or penetrating or iatrogenic from surgery.

Ultrasound finding:

Hematocele is usually present assess for disruption of the tunica albuginea, which is normally a smooth echogenic line signs of disruption include loss of continuity, crinkling, or retraction A heterogenous testis suggests patchy testicular ischemia or infarct.
Ultrasound imaging features are similar to testicular torsion but the pathogenesis is different; post-traumatic infarct is due to increased intra-testicular pressure resulting in venous obstruction and venous infarction

Image showing wedge shape testicular infarct



Study	inflammatory causes	Non inflammatory causes
Andrea et al	72	45
Thinyu et al	52	32
Present study	45	15

In our study, inflammatory conditions constitute the majority of detected pathology, followed by testicular torsion. Possible reasons for this variation can be explained by Increased referral of inflammatory pathology to our tertiary center.

Conclusions and Summary

The advantages of High frequency Ultrasound and color Doppler include non-invasiveness, lack of ionizing radiation, simplicity, wide availability, cost effectiveness and repeatability. High frequency ultrasonography is invaluable in demonstrating normalcy of testes and epididymis in the presence of large hydroceles. High-frequency ultrasonography enables clear demonstration of the morphological alterations associated with acute scrotal inflammatory diseases. Color Doppler sonography is highly sensitive in diagnosing acute scrotal pathology and accurately differentiates testicular ischemia/torsion from acute inflammatory diseases. We conclude that High-frequency ultrasonography and

color Doppler sonography is an extremely valuable tool in evaluation of scrotal and testicular pathologies.

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Permission from IRB: Yes

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