

## Role of ultrasound and color Doppler in the evaluation of acute scrotal pain

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### Abstract

**Background:** Traditionally acute scrotal pain is evaluated by gray scale ultrasound, which dissipated only the morphological changes of the lesion. But pattern of vascularity either normal, increased or absent of affected structure help to definitive diagnosis of the lesion and help to proceed the type of management either medical therapy or surgical treatment.

**Objectives:** To determine the relative importance of color Doppler in the evaluation of acute scrotal pain by ultrasound.

**Methods:** From June 2013 to June 2017 a total 150 patients with acute scrotal pain were selected. A thorough history taking and physical examination were done. Then patient were scanned with gray scale ultrasound followed by color Doppler study. Color Doppler diagnosis is compared with gray scale diagnosis.

**Results:** In gray scale ultrasonography among the 150 cases, 54% were diagnosed as epididymitis, 16.66% were epididymo-orchitis and 16% patient diagnosed as normal. But in combined gray scale and colour Doppler study 58% were diagnosed as epididymitis, 22% were epididymo-orchitis and 6% of patient diagnosed as normal. In gray scale 10% patient were diagnosed as normal but become epididymitis and epididymo-orchitis in colour Doppler. Four percent were diagnosed as epididymitis in gray scale but became epididymo-orchitis in colour Doppler. Four percent patient was diagnosed as epididymitis orchitis but became testicular torsion in Doppler study. Total 14.66% of gray scale diagnosis became another diagnosis in the Doppler study.

**Conclusion:** Combined gray scale and color Doppler study is superior than gray scale ultrasound in differentiating various cause of acute scrotal pain.

**Key word:** Gray scale ultrasound, Colour Doppler, Epididymitis, Testicular torsion.

### Introduction

Acute scrotal pain is the common clinical presentation of various disease processes of testis, epididymis, spermatic cord and scrotal wall itself. Common causes are epididymitis, epididymo-orchitis, torsion of the testis, torsion of the testicular appendage, strangulated hernia and trauma.

Epididymitis is an inflammation of the epididymis, usually resulting from bacterial infection. The incidence is 30% to 35% in patients with acute scrotal pain and 75% of acute intra scrotal inflammatory process.<sup>1,2</sup> Direct extension of epididymal inflammation to the testicle called epididymo-orchitis, occurs in up to 20% of patients with acute epididymitis. Isolated orchitis

may also occur. Testicular abscess are usually a complication of epididymo-orchitis. Testicular torsion results when testis twists within the scrotum. The incidence of testicular torsion is 1 in 160 patients, present with acute scrotal pain that is difficult to differentiate from epididymo-orchitis. The onset of symptom is usually spontaneous but may follow trauma.<sup>3</sup> Other causes of acute scrotal pain include idiopathic scrotal edema, Henoch Schonlein purpura, hydrocele, inguinal hernia are rare.<sup>4</sup>

Prompt diagnosis is required to differentiate surgically correctable lesions from abnormalities that can be adequately treated by medical therapy alone. Clinical symptoms and physical examination are often not enough for definite

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diagnosis.<sup>3</sup> Physical examination and laboratory test can not differentiate up to 50% of cases. Immediate surgical exploration has been advised in boys and young men with acute scrotal pain, unless a definitive diagnosis of epididymitis or orchitis can be made. This aggressive approach has resulted in an increased testicular salvage rate from torsion but also an increase in unnecessary surgical procedures. Abul et al in 2005 showed the accuracy of USG was only 72.7% in testicular torsion, but is good in epididymitis.<sup>5</sup> In another study combined gray scale and colour Doppler ultrasound showing 100% specificity for testicular torsion and 86% for epididymo orchitis.<sup>6</sup> Testicular radionuclide scintigraphy, MRI, real time sonography, and doppler sonography have been used to increase the accuracy of distinguishing between infection and torsion.<sup>7</sup> High resolution ultrasonography combined with color Doppler study is the imaging modality of choice for distinguishing between infection and torsion. Color Doppler ultrasound demonstrates testicular perfusion which aids in reaching a specific diagnosis.<sup>3</sup>

The gray scale findings of acute and subacute torsion are nonspecific and may be seen in testicular infarction caused by epididymitis, epididymo-orchitis and traumatic testicular rupture or infarction.<sup>8</sup> Colour Doppler sonography shows about the blood flow in the affected testis.<sup>9</sup> Examination of the acute scrotum should not be undertaken unless Doppler capability is available because the evaluation of blood flow is such an important part of diagnosis, of testicular torsion, epididymitis, epididymo orchitis, orchitis, trauma and hemorrhage into a mass. Misdiagnosing testicular torsion can lead to organ loss, cosmetic deformity, and compromised fertility.<sup>10</sup> The objective of this study was to determine the relative importance of color Doppler over gray scale ultrasound in the evaluation of acute scrotal pain by ultrasound.

## Materials and methods

This cross sectional prospective study was carried out in 150 patients who present in the Radiology and Imaging department of Khulna Medical College Hospital, Gazi medical college hospital Khulna and Vital research diagnostic centre with history of acute scrotal pain. History taking and physical examination were done first, then high resolution gray scale ultrasound and color Doppler study were done in all the cases by using 7.5 MHz liner array probe. First scan by gray scale ultrasound to see any parenchymal pathology

then set color flow to see the changes of perfusion or vascularity. The following outcome variables were studied-age, side of scrotum, structure of the scrotal content, echogenicity of the lesion and finally color flow characteristics of the lesion. Data were collected in a pre-designed structured data collection sheets. All the relevant collected data were compiled on a master chart. The result of gray-scale, and Doppler diagnosis was compared with each other and finally discrepancy between them was shown. Percentage was calculated to find out proportion of the finding. The results were presented in tables and figures. Sonological definition and Doppler findings of important cause of acute scrotal pain are mentioned below.

**Epididymitis:** Swelling of epididymis, heterogeneous echotexture and increased vascularity on Doppler study.

**Epididymo-orchitis:** Mild to moderate swelling of epididymis, heterogeneous echotexture. Swelling, hypoechoic testis or normal size testis in gray scale ultrasound but increased vascularity of testis and epididymis on Doppler study.

**Orchitis:** Swollen hypoechoic testis or normal testis but increased vascularity.

**Testicular abscess:** Hypoechoic area within the testis having no vascularity in the central part but increased peripheral vascularity.

**Testicular torsion:** Swollen hypoechoic testis, usually transversely oriented. No vascularity present. Torsion of spermatic cord also seen in the gray scale ultrasound.

**Testicular tumor:** Mass within the testis having normal or increased vascularity.

## Results

From June 13 to June 17 total 150 consecutive cases with acute scrotal pain were scanned by gray scale ultrasound and color Doppler. 38% of the patients were in 3rd decade, followed by 30% in 4th decade. The mean age of the patient was 28± 3.2 (mean+ SE) years. The lowest & highest ages were 3 & 59 years respectively (Table-I).

**Table I**

Distribution of the patient by their age group

Age Group (in years)	Number of patients	Percentage of Patients	Mean age + standard error
0-10	03	02	
11-20	15	10	
21-30	57	38	
31-40	45	30	28+3.2 Yr.
41-50	24	16	
51-60	06	04	
Total	150	100	

Logically all the patient presented with acute scrotal pain with or without other clinical feature. Among them 44% patients presented only with pain, 30% patients presented with pain and fever, 14% patient presented with pain and swelling and 12% patient presented with pain, swelling and fever.

In gray scale USG out of 150 cases 54% cases were epididymitis, 16.66% were epididymo orchitis, 2% were testicular abscess, 4% were trauma, 2% orchitis, 1.33% torsion, 2% tumor, 2% hernia and 16% were normal (Table-II).

**Table II**

Comparative chart of two diagnostic method

Name of patient	Gray scale diagnosis		Combined gray scale & Color doppler diag	
	No of patient	%	No of patient	%
Normal	24	16	9	6
Epididymitis	81	54	87	58
Epididymo-orchitis	25	16.66	33	22
Orchitis	3	2	3	2
Testicular abscess	3	2	3	2
Testicular torsion	2	1.33	3	2
Scrotal trauma	6	4	6	4
Testicular tumour	3	2	3	2
Hernia	3	2	3	2
Total	150	100	150	100

In combined gray scale & color Doppler diagnosis out of 150 cases, 58% cases were diagnosed as epididymitis, 22% were epididymo-orchitis, 2% were testicular abscess, 4% were trauma, 2% orchitis, 2% torsion, 2% tumour, 2% hernia and 6% were diagnosed as normal (Table-II).

Pattern of blood flow differentiated inflammatory from non inflammatory cause and testicular torsion. Out of 150 patients, 126 (84%) patient showed increased blood flow, 3 (2%) showed absent blood flow, and rest 21 (14%) of the patients showed normal blood flow (Table-III)

**Table III**

Color flow pattern of the patient

Blood flow pattern	Number of patient	Percentage of patient
Normal flow	21	14
Increased flow	126	84
Absent flow	3	2
Total	150	100%

In most of the inflammatory condition such as epididymitis, epididymo-orchitis and orchitis gray scale ultrasound showed enlargement and hypoechogenicity or heterogeneously hypoechogenicity of the involved epididymis and testis and color Doppler ultrasound showed increased blood flow within the lesion of affected testis and epididymis (Fig 1 & Fig 2).

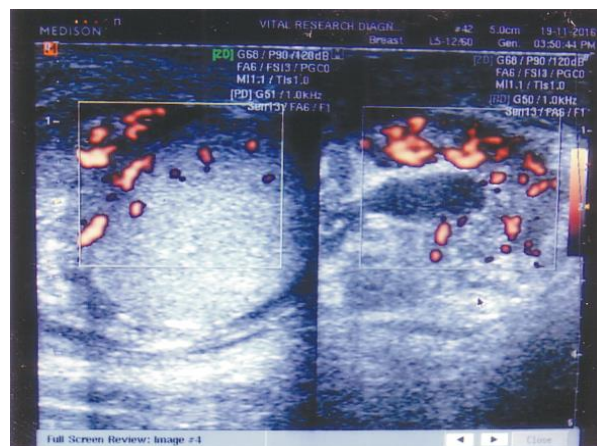


Fig.1. Epididymitis: Swelling, heterogeneous echotexture and increased vascularity of epididymis.

There is significance discrepancy between gray scale and combined gray scale & color Doppler diagnosis. 15 (10%) patients diagnosed as normal in gray scale ultrasound but diagnosed as epididymitis (12), epididymo-orchitis (3). Six (4%) patients in gray scale USG diagnosed as epididymitis but in color Doppler USG diagnosed as epididymo-orchitis. Another 1 (.66%) patient in gray scale USG diagnosed as epididymo orchitis but in doppler study diagnosed as testicular torsion. Total 14.66% of gray scale diagnosis become another diagnosis in the doppler study (Table-IV). This was a significant difference between the two modality. But due to unavailability of final result from surgery, FNAC,

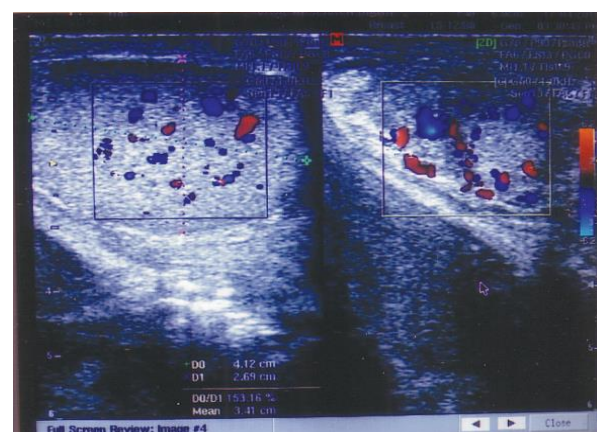


Fig. 2. Epididymo-orchitis: Increased vascularity of testis and epididymis.

biopsy and result of medical management significance tests were not done.

**Table IV**

Difference between gray scale and combined gray scale & color doppler diagnosis

Gray scale diagnosis	%	Gray scale & Color doppler diagnosis
Normal-15	10	Epididymitis-12 Epidi. orchitis-3
Epididymitis-6	4	Epidi. orchitis-6
Epididymo orchitis-1	0.66	Testi. torsion -1
Total-	21	14.66

**Discussion**

Many disease processes, including inflammation, testicular torsion, testicular trauma, and testicular cancer, may have similar clinical presentation as acute scrotum. Differentiation of these disease processes is important for proper management. High resolution gray scale ultrasound helps to better characterize the scrotal lesions. Color Doppler ultrasound demonstrates perfusion of the lesions which aids in reaching a specific diagnosis.<sup>3</sup>

Clinical symptoms and physical examination are often not enough for definite diagnosis.<sup>3</sup> On the other hand miss diagnosed testicular torsion may lead to organ loss and cosmetic deformity and compromised fertility.<sup>10</sup> A consecutive 150 cases were selected who came to Radiology & Imaging department with acute scrotal pain.

The age of the patient in this series ranged from 8 years to 59 years. The mean age was 28 ± 3.2 years. The peak incidence was between 21 to 30 years and most of the patients belong to 3rd and 4th decades.

Logically all the patient presented with acute scrotal pain, other clinical feature were fever, swelling and dysuria. In combined gray scale and color Doppler diagnosis 58% were epididymitis, 22% epididymo orchitis, 2% orchitis, 2% testicular abscess, 4% scrotal trauma, 2% testicular torsion, 2% testicular tumour, 2% inguinal hernia and 6% normal. Here total inflammatory condition were 84% and most common cause of acute scrotal pain was epididymitis (58%) then epididymo orchitis (22%). A study by Alam, et al showed 88% was acute condition of the entire inflammatory lesion. Among them 57% epididymitis, 35% epididymo-orchitis and 8% orchitis.<sup>11</sup> Another study showed incidence of testicular torsion is

about 1 per 160 but we have got 3 case out of 150 cases.

In most of the inflammatory condition such as epididymitis, epididymo-orchitis and orchitis gray scale ultrasound showed enlargement and hypoechogenicity or heterogeneously hypoechogenicity of the involved epididymis and testis and color Doppler ultrasound showed increased blood flow within the lesion of affected testis and epididymis.

There was a significant discrepancy between gray scale sonography and combined gray scale and colour Doppler study. Twenty one (14.66%) patient in gray scale diagnosis become another diagnosis in the combined gray scale and Doppler study. Out of them, 15 (10%) patients diagnosed as normal in gray scale ultrasound but diagnosed as epididymitis and epididymo-orchitis. Six (4%) patients in gray scale USG diagnosed as epididymitis but in color doppler USG diagnosed as epididymo orchitis. Another 1(.66%) patient diagnosed as epididymo-orchitis but diagnosed as testicular torsion in doppler study. Borhan uddin et al in 2006 showed 12.5% of epididymitis and 40% of epididymo orchitis had normal findings in gray scale imaging and hyperemia seen with colour Doppler sonography was only the evidence of inflammation.<sup>12</sup>

The main purpose of imaging in patients with acute scrotum is to distinguish inflammation from testicular torsion or other surgically correctable lesion from abnormalities that can be adequately treated by medical therapy alone.

Testicular torsion is a surgical emergency. After 6 hour of torsion the testis undergoes irreparable damage.<sup>13</sup> Color Doppler ultrasound can help in differentiation of torsion from epididymitis or epididymo-orchitis.<sup>14</sup> In gray scale USG of testicular torsion testis appears enlarged, hypoechoic and in epididymis it is also enlarged. Twisted spermatic cord was also seen easily due to hydrocele. On colour flow imaging it was seen completely devoid of vascularity.

Alka et al in her study showed with combined method, specificity was 100% for testicular torsion, whereas, for epididymo-orchitis it was 85.7%.<sup>6</sup> Limitation of this study was failure to do the significance test due to unavailability of data of final result from surgery, FNAC, biopsy and medical management.

Before the invention of color flow imaging, scintigraphy was the only modality to detect

testicular blood flow. Both scintigraphy and color flow imaging have almost similar sensitivity and accuracy. But color flow imaging has extra advantages over scintigraphy in that it provides morphologic status of the testis along with its vascularity and it is less time consuming with no radiation hazard.<sup>15</sup>

## Conclusion

Gray scale ultrasound dissipated only the morphological changes of the lesion. Colour Doppler shows the pattern of vascularity and helps to definitive diagnosis. So it can be concluded that combination of gray-scale and color Doppler imaging is superior than gray scale imaging.

## Reference

- Lewis A, Bukowski TP, Jarvis PD, Wacksman J, Sheldon CA. Evaluation of acute scrotum in the emergency department. *Pediatric surg.* 1995; 30: 277-282.
- Brian Gorman and Barbara A, Carroll. The scrotum, *Diagnostic Ultrasound* 2001; 1, 874-883.
- M Muttarak, B L ojanapiwat. The painful scrotum: An ultrasonographical approach to diagnosis. *Singapore med J* 2005; 46: 352-353.
- Michael C. Koester, Md, ATC. Initial evaluation and management of acute scrotal pain. *Journal of Athletic Training* 2000; 35: 76-79.
- Abul F, AL Sayer H, Arun N. Dept of surg, Faculty of Med. Kuwait university. The acute scrotum: A review of 40 cases. 2005; 14: 177-81.
- Alka M. Agrawal, Prern Siddharth Tripathi, Amit Shankhwar, and C. Naveen. Role of ultrasound with colour Doppler in acute scrotum Management. 2014; 3: 409-412.
- Watanable Y, Dohke M, Ohkubok: Scrotal Disorder: Evaluation of enhancement patterns at dynamic contrast enhanced subtraction MR imaging. *Radiology* 2000; 217: 219-227.
- Gorman B. The scrotum. In the Rumack CM, Editor *Diagnostic 4h ed. Vol I Elsevier. Mosby USA; 2011; pp.864-9.*
- Liang T, Metcalfe P, Sevcik W, Noga M, Retrospective review of diagnosis and treatment in children presenting to the pediatric department with acute scrotum. *AJR. AmJ Roentgenol* 2013; 200: 444 9.
- Blaivas M, brannam. L. *Emerg med clin North Am.* Testicular ultrasound. 2004 Aug; 22:723-48.
- Md Taharul Alam. Student Dept of Radiology & Imaging BSMMU. Dhaka. Bangladesh. Ultrasonographic evaluation of scrotal swelling. 2002; p 56.
- Md Borhanuddin. Dept. of Radiology & Imaging DMC. Dhaka. Bangladesh. Value of duplex colour doppler sonography in the evaluation of scrotal pathology. 2006; p 102.
- Yusuf GT, Sidhu PS. A review of ultrasound imaging in scrotal emergencies. *J Ultrasound.* 2013;16:171-8.
- Howlett DC. Maechbank ND, Sallome FD, *Ultrasound of testis. Clin Radiol* 2000; 55: 595-606.
- Sidhu PS. Clinical & imaging feature of testicular torsion: Role of ultrasound. *Clinical Radiology* 1999; 59: 343-352.