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Original Research Article

Role of Colour Doppler Ultrasonography in Diagnosing Acute Scrotum: A Retrospective Study

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Abstract

Aim: To determine the use of colour Doppler ultrasonography in diagnosing acute scrotum.

Material and Methods: This study was conducted in the department Radiology, Katihar Medical college and Hospital, Katihar, Bihar, India for one year. All patients of age group of ≤25 yearswith acute scrotum were admitted and subjected to detailed history and physical examination with emphasis on pulse, temperature, general and local examination findings. Baseline investigations involving hemogram, urine routine examination, urine culture with sensitivity and KFT were carried out in all patients. All patients were subjected to immediate Doppler ultrasonography scrotum. Scrotal Doppler ultrasonography was performed with the patient lying in a supine position and the scrotum supported by a towel placed between the thighs. (Optimalresults were obtained with 7 to 14 MHz high-frequency linear-array transducers).

Results: 50 patients of acute scrotum presented to surgical department who were ≤25 years, over a period of two years comprising 0.11% among 45260 total patients attended the surgery department. Patients presented with clinical features of pain in scrotum, swelling of hemiscrotum, nausea vomiting, fever, urinary symptoms, abdominal pain and tender scrotum with erythema. Most common presentation was scrotal pain and scrotal swelling. True positive-20, False positive-2, True negative-25, False negative-3. True positive-20, False positive-0, True negative-29, False negative-1. True positive-2, False positive-0, True negative-47, False negative-1. Three patients with equivocal Doppler findings, but strong clinical suspicion of testicular torsion was explored, and testis was found to be torsed in all the three patients.

Conclusion: Acute scrotum in children and young adults is a surgical emergency. Proper diagnosis and timely intervention can save testis and avoid unnecessary scrotal exploration. Color Doppler is an excellent modality of investigations which helps in correct diagnosis and timely intervention.

Keywords: Doppler ultrasonography, Torsion testis, Epididymal-orchitis

Introduction

Acute scrotum is a clinical emergency characterized by sudden onset of scrotal pain, swelling, and erythema. It can be caused by a variety of conditions, including testicular torsion, epididymitis, orchitis, torsion of the appendix testis, and trauma. Prompt diagnosis and management are crucial to prevent testicular loss, especially in cases of testicular torsion, where the time window for successful detorsion and salvage of the testis is narrow. Color Doppler ultrasonography (CDUS) has become an invaluable tool in the diagnostic evaluation of acute scrotum due to its non-invasive nature, real-time imaging capability, and high sensitivity and specificity in differentiating the underlying causes. [1] Color Doppler ultrasonography provides detailed information on both the anatomical structure and the blood flow within the scrotum. In cases of testicular torsion, CDUS typically reveals absent or significantly reduced blood flow to the affected testis, which is a critical finding that necessitates immediate surgical intervention. The sensitivity and specificity of CDUS for diagnosing testicular torsion are reported to be as high as 97% and 99%, respectively. [2] In contrast, increased blood flow on CDUS is indicative of inflammatory conditions such as epididymitis and orchitis. These conditions often present with hyperaemia, which appears as increased colour flow signal in the epididymis or

testis on Doppler imaging. This helps distinguish inflammatory causes from torsion, guiding appropriate medical management rather than surgical intervention. [3] Another important application of CDUS is in the evaluation of trauma to the scrotum. CDUS can identify testicular rupture, intratesticular hematomas, and testicular contusions by assessing both the parenchymal architecture and the blood flow. This information is essential for deciding between conservative management and surgical exploration. [4] CDUS is also effective in diagnosing torsion of the appendix testis, a less common cause of acute scrotum. This condition presents with a characteristic "blue dot sign" on physical examination and may show a normal or slightly increased blood flow on Doppler imaging, along with a hypoechoic mass adjacent to the testis. [5] Overall, the use of colour Doppler ultrasonography in the evaluation of acute scrotum enhances diagnostic accuracy, facilitates timely and appropriate management, and reduces the likelihood of unnecessary surgical interventions. Its role in distinguishing between surgical and non-surgical causes of acute scrotum makes it an indispensable tool in emergency and urological practice. [6]

Material and Methods

This study was conducted in the department Radiology, Katihar Medical college and Hospital, Katihar, Bihar, India for one year. All patients of age group of ≤25 yearswith acute scrotum were admitted and subjected to detailed history and physical examination with emphasis on pulse, temperature, general and local examination findings. Baseline investigations involving hemogram, urine routine examination, urine culture with sensitivity and KFT were carried out in all patients. All patients were subjected to immediate Doppler ultrasonography scrotum. Scrotal Doppler ultrasonography was performed with the patient lying in a supine position and the scrotum supported by a towel placed between the thighs. (Optimalresults were obtained with 7 to 14 MHz high-frequency linear-array transducers). The testes were studied in two planes (along the longitudinal and transverse axes). The size and echogenicity of each testicle and the epididymiswas compared with that on the opposite side. In patients being evaluated for an acute scrotum, the asymptomatic side was scanned initially to set the gray scale and color Doppler gains to allow comparison with the affected side. Color Doppler and pulsed Doppler were optimized to display low-flow velocities, and blood flow in the testis and surrounding scrotal structures was documented, including the Spectral Doppler recording of the intratesticular arterial flow in both testes. The patients were categorized into two groups. Group A comprised the patients who were on the basis of history, physical examination, laboratory investigations and Doppler ultrasonography (suggestive of testicular torsion) needed immediate surgical exploration. Group B comprised the patients who on the basis of history, physical examination, laboratory investigations and Doppler ultrasonography (suggestive of epididymal-orchitis, etc.) were managed conservatively. In group A, on surgical exploration the findings were recorded and corroborated to Doppler USG findings. The patients in group B were managed with antibiotics onthe basis of culture and sensitivity tests of urine, anti- inflammatory drugs, rest, elevation of scrotum (scrotal support), proteolytic enzymes and follow up at weekly intervals for 1st two weeks and thereafter monthly for at least 3 months for any testicular atrophy. Records of patients not responding to conservative treatment or any complication during the conservative treatment and the intervention done were made. The data is tabulated and was subjected to appropriate Statistical tests.

Results

50 patients of acute scrotum presented to surgical department who were ≤25 years, over a period of two years comprising 0.11% among 45260 total patients attended the surgery department. The age distribution of patients was as shown in Table 1.

Table 1: Age distribution of acute scrotum

Age (years)	Number ofpatients	Percentage
0-5	3	6
6-10	7	14
11-15	17	34
16-20	16	32
21-25	7	14

Patients presented with clinical features of pain in scrotum, swelling of hemi scrotum, nausea vomiting, fever, urinary symptoms, abdominal pain and tender scrotum with erythema. Most common presentation was scrotal pain and scrotal swelling as shown in Table 2.

Table 2: Clinical presentation in acute scrotum(n=50).

	Number ofpatients	Percentage
Symptoms		
Scrotal pain	49	98
Scrotal swelling	44	88
Nausea/vomiting	17	34
Fever	12	24
Urinary symptoms	6	12
Abdominal pain	1	2
Signs		
Scrotal erythema(Redness)	39	78
Scrotal tenderness	47	94
Absent cremasteric reflex	24	48
Lab. investigations		
Leukocytosis	24	48
Polymorphonuclear leukocytosis	23	46
Pyuria	6	12

All the fifty patients were subjected to Doppler ultrasound, the results of which are as under

Table 3: Sonographic diagnosis and operativefindings

		Final
	Sonological	diagnosis
Diagnosis	diagnosis	(Operative
	(DUS)	findings /
		Follow up)
Torsion of testis	22*	23
Epididymal-orchitis	20**	21
Torsion of testicular appendages	2***	3
Idiopathic scrotal edema	1	1
Incarcerated Inguinal hernia	1	1
Scrotal trauma (Hematocele)	1	1
****Equivocal	3	

*True positive-20, False positive-2, True negative-25, False negative-3. **True positive-20, False positive-0, True negative-29, False negative-1. ***True positive-2, False positive-0, True negative-47, False negative-1. ****Three patients with equivocal Doppler findings, but strong clinical suspicion of testicular torsion were explored, and testis was found to be torsed in all the three patients.

Table 4: Sensitivity and specificity of Dopplerultrasonography for testicular torsion

Doppler ultrasonography result	Final diagnosis(Torsion testis)	Final diagnosis (No torsion testis)
Positive	20 (true positive)	2 (false positive)
Negative	3 (false negative)	25 (true negative)
Sensitivity	92.6%	
Specificity	86.95%	
Total	23	27

Table 5: Sensitivity and specificity of Dopplerultrasonography for Epididymal-orchitis.

Doppler ultrasonography result	Final diagnosis(Epididymo-orchitis)	Final diagnosis(No epididymo-orchitis)
Positive	20 (true positive)	0 (false positive)
Negative	1 (false negative)	29 (true negative)
Sensitivity	= 95.23%	
Specificity	100%.	
Total	21	29

Discussion

The youngest patient in this study was an infant of 10 months age and the oldest was 24 years. Predominant agegroup in this study was 10-15 years comprising of 19 patients (38%). Department scrotal pain was the most frequent presenting symptom of acute scrotum (98%) followed by Swelling of the semi scrotum on the involved side presentin 88% of the patients. Tenderness of the involved semiscrotum and testis was the most frequent clinical sign of acute scrotum (94%). Scrotal erythema was present in 39 patients (78%). These observations are in close agreement with the findings of Cavusoglu YH, et al. and Liu CC. [7,8] Doppler ultrasound showed torsion of testis in 22 patients. On scrotal exploration, torsion of spermatic cord was confirmed in 20 patients, one patient had torsion of appendix of testis and the other had Epididymal-orchitis. Three patients with equivocal Doppler findings, but strong clinical suspicion of testicular torsion was explored, and testis was found tobe torsed in all the three patients. In all these three cases spermatic cord was found to have a partial twist (180^0). Thus the sensitivity and specificity of Dopplerultrasonography for testicular torsion was 86.9% and 92.6% respectively. This is in close agreement with the observations of Liu CC et al., [8] who reviewed 87 patients in the age group of <25 years of age with presentation of acute scrotum. The sensitivity and specificity of Doppler ultrasound in their study was found to be 87.9% and 93.3% respectively. Hod et al. [9] reported 86% sensitivity and 95% specificity of DUS for testicular torsion.

Preoperative Doppler ultrasonography showed Epididymal-orchitis in 20 patients, torsion of testicularappendage in 2 patients, Idiopathic scrotal edema in one, Incarcerated inguinal hernia in one, and a large hematocele in one patient. All twenty patients of epididymal-orchitis, two patients of torsion of testicular appendage, and one patient of idiopathic scrotal edema were managed conservatively. At three weeks follow up, all the patients were free of symptoms. One patient of scrotal trauma with Doppler showing a large hematocele, and the other one with obstructed inguinal hernia were explored and Dopplerfindings were confirmed. The sensitivity and specificity of Doppler ultrasonography for epididymal-orchitis was 95% and 100% respectively. Thus 23 patients were managed conservatively and were saved from unnecessary surgical exploration. We believe that Doppler sonography is very helpful in evaluating acute scrotum both in children and young adults. The method is very rapid, non-invasive and has a diagnostic accuracy at least equal to that of nuclear scanning. It can semi quantitatively characterize blood flow and can distinguish intratesticular blood flow from scrotal wall flow. It can also access other pathologic conditions involving the scrotum. Most importantly, it could be used at bedside to immediately help evaluate the cause of acute scrotum when patients are brought to the emergency department as has been opinion of most of the authors. Although the results of color Doppler ultra-sonography in differentiating TT from other causes of acute scrotum were quite satisfactory, but there were three cases of incomplete testicular torsion which were missed on CDUS. Similar cases of missed testicular torsion have also been reported by some authors. The possible causes of missed diagnosis of TT by CDUS include technical factors in the performance of the study (i.e. operator dependence), experience of the radiologist in reading scrotal ultrasonography, the possibility that torsion is intermittent, and difficulties with detection in younger children. This has been the opinion of most authors.

Conclusion

Acute scrotum in children and young adults is a surgical emergency. Proper diagnosis and timely intervention can save testis and avoid unnecessary scrotal exploration. Colour Doppler is an excellent modality of investigations which helps in correct diagnosis and timely intervention.

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