ORIGINAL ARTICLE

COMPARISON OF HIGH-RESOLUTION SONOGRAPHY AND COLOUR DOPPLER FLOW IMAGING IN PATIENTS PRESENTING WITH ACUTE SCROTUM

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ABSTRACT

Introduction: One of the most common urological emergency conditions is acute scrotum. Scrotal pain is commonly seen in early adults in the emergency departments with an association of different pathologies. The aim of this study was to determine the comparison of high-resolution sonography and colour Doppler flow imaging in patients presenting with acute scrotum.

Material & Methods: A descriptive study was conducted at the Department of Radiology, Lady Reading Hospital, Peshawar, Pakistan**.** This study enrolled a purposive sample of emergency department patients presenting with acute scrotal pain. The pattern of blood flow, peak systolic velocity, resistive index, pulsatility index, mean and standard deviation were calculated for the continuous variables. Descriptive analyses were performed to investigate the distribution of data.

Results: A total of 72 patients were enrolled in our study. The mean age of patients was recorded 36.33±11.66 years. The most common scrotal pathologies that associated with scrotal pain was hydrocele 31(38.8%), followed by varicocele 22(27.5%), testicular torsion 9(11.3%), cyst 8(10.0%), epididymo-orchitis 7(8.8%), pyocele 6(7.5%), orchitis 4(5.0%), increase scrotal wall thickness 3(3.8%), undescended testis 3(3.8%), inguinoscrotal hernia 1(1.3%), testicular atrophy 1(1.3%), rete testis 1(1.3%), hemangioma 1(1.3%), hematoma 1(1.3%), scrotal mass 1(1.3%), testicular microlithiasis 1(1.3%), and normal scrotal sonography 4(5.0%) of cases respectively.

Conclusion: High-resolution ultrasonography along with color and power Doppler should be used as 1st line imaging modality in patients presenting with acute scrotal pain.

Key Words: acute scrotum, colour Doppler, sonography, scrotal pain, urological emergency,

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INTRODUCTION

The acute scrotum is one of the most common urological emergency conditions and possibly, it might present a diagnostic challenge even to the most proficient clinicians. The main goal of the sonography of the patients who are suffering from acute scrotal pain is to distinguish surgical versus non-surgical diagnosis.[1] It may along with or without scrotal swelling,[2] while acute scrotal pain contains less than 1% of the overall emergency department.[3] Physical examination is also important but alone it is not enough to distinguish between several pathologies.[4] The acute scrotal pain may be discomforting for the patients and it needs timely diagnosis because some conditions are truly urological or surgical emergencies and needs immediate surgical treatment.[5] There are several aetiologies involved by the term acute scrotum; these are (hydrocele, epididymitis, orchitis, epididymo-orchitis, and varicocele) along with testicular torsion and inguinal hernia.[6] To treat patients in an emergency condition or high significance of surgery, and those requiring non-emergency medical treatment, an exact variance diagnosis is essential.[7]

Acute Scrotal pain could be caused by a myriad of clinical conditions but often they are overlooked in the emergency department and the patient is merely treated symptomatically. The routine sonographic examination and previous studies show that the acute scrotum is a challenging clinical problem. It was seen that the patient with acute scrotum pain plays a significant role in his management and a misdiagnosis could be disastrous for the patient. High-resolution sonography with the help of colour Doppler flow imaging plays important role in the diagnosis of different scrotal pathologies in patients presenting with acute scrotum. They are imaging modalities of choice for the assessment of acute and non-acute scrotal etiologies.[8] Our study aimed to enlist the most common sonographic findings in acute scrotal pain and determine the value of Doppler application, which will bring ease in the prediction of various causes of acute scrotum. Secondly, the blood flow perfusion and velocimetry measured with Doppler sonography in normal and pathological conditions would be incorporated as additional parameters in the

characterization of various sonographic findings of the acute scrotum.

MATERIAL AND METHODS

This descriptive study enrolled a purposive sample of emergency department patients presenting with acute scrotal pain from October 2020 to May 2021. The study was approved by the Ethical Review Committee of the University of Lahore and the informed written consent was obtained from all the participant patients. The study was conducted at the Department of Radiology, Lady Reading Hospital, Peshawar, Pakistan. Scrotal sonography scans were carried out for all the patients during this period to detect various scrotal pathologies. All those patients with clinical manifestation of the acute scrotum, aged between 18 to 60 years, having recurrent pain with a previous history of lower abdominal surgery were included. All paediatric and non-cooperative patients were excluded from the study population. The selected patients were assessed pre-operatively in the emergency department. Toshiba Nemio 20 (Xeiro), Mindray DC 70, with frequency range 2.5–5.0 MHz convex and 7-14 MHz linear transducers were used. The scrotal sonography was performed with the patients in the supine position and scrotum supported by a towel draped over the thighs. During the examination, the American Institute of Ultrasound in Medicine guidelines were followed. The scrotal study was conducted with real-time sonography, preferably linear transducer with frequency range 7.0 to 14.0 MHz. Both tests were evaluated in long and short-axis views. The short axis view was obtained in the superior, mid, and inferior portions while the long axis view was obtained centrally, medically, and laterally of both testes. The comparisons of both testes were conducted with grey-scale and colour Doppler. Additional technique such as Valsalva manoeuvre was also performed.

The following parameters were studied in each case:

• Sonographic data regarding grades of vascularity of the lesion were obtained with colour Doppler

• Scrotal skin-thickening and swelling were conducted by grayscale

• The Fluid collection, if any: its Eco morphology and its relation to testes were conducted.

• Position, size, and echo pattern of the epididymis were carried out.

• Inguino-scrotal region for evidence of any varicocele or a hernia was observed.

The grades of varicoceles were evaluated with both high resolution and colour Doppler sonography as follows.

Grade 0: No sonographic evidence of varicocele

Grade I: Varicoceles were palpable only during the Valsalva manoeuvre

Grade II: Varicoceles were readily palpable without the need for the Valsalva manoeuvre

Grade III: Varicoceles were visible on inspection

Data was analysed with Statistical Software for Social Sciences (SPSS version 24.0). Descriptive analyses were performed to investigate the distribution of data. The pattern of blood flow, peak systolic velocity, resistive index, pulsatility index, mean and standard deviation were calculated for the continuous variables. Frequencies and percentages were also calculated for categorical variables and the collected data was stored in Microsoft excel. For all the analyses, $P<0.05$ was considered significant.

RESULTS

A total of 72 patients enrolled in our study, Of which the most common scrotal pathologies that associated with scrotal pain is hydrocele 31(38.8%), followed by varicocele 22(27.5%), testicular torsion 9(11.3%), cyst 8(10.0%), epididymo-orchitis 7(8.8%), pyocele 6(7.5%), orchitis 4(5.0%), increase scrotal wall thickness 3(3.8%), undescended testis 3(3.8%), inguinoscrotal hernia 1(1.3%), testicular atrophy 1(1.3%), rete testis 1(1.3%), hemangioma 1(1.3%), hematoma 1(1.3%), scrotal mass 1(1.3%), testicular microlithiasis 1(1.3%), and normal scrotal sonography 4(5.0%) of cases respectively (Table 1). During the sonographic examination of the right scrotum, high-resolution sonography and colour Doppler flow imaging were performed in patients; of which high-resolution sonography had detected 31(38.8%) pathologies in patients and colour Doppler flow imaging detected 41(61.2%) pathologies. When it was performed in the left scrotum, high-resolution sonography had detected 11(13.8%) pathologies and colour Doppler flow imaging detected 61(86.2%) of pathologies. When the combination of both high-resolution and colour Doppler sonography was performed, they detected 30(37.5%) pathologies (Table 2). A total of 72 patients, of which 68 patients had no varicocele in the right scrotal sac. High-resolution sonography detected 4 patients that had varicocele, of which 2 patients had grade II and 2 patients had grade III varicocele. Colour Doppler was also performed in the right scrotal sac, which detects grade I varicocele in 4 patients. During the examination of the left scrotum, a high-resolution was performed in 72 patients, in which 66 patients had no varicocele, 3 patients had grade I, and 3 patients had grade II varicocele. Colour Doppler was also performed in the left scrotal sac, which detected grade I varicocele in 13 patients (Table 3). According to table number 4, colour Doppler flow imaging of the right intratesticular artery was performed. During the examination, the intratesticular artery was detected in 60 patients. The mean peak systolic velocity of the right intratesticular artery was 12.32±5.29cm/sec, the resistive index was 0.54±0.13, and the pulsatility index was 1.40±0.66. The minimum right intratesticular artery peak systolic velocity was 5.12cm/sec, the resistive index was 0.22, and the pulsatility index was 0.51. The maximum right intratesticular artery peak systolic velocity was 26.40cm/sec, the resistive index was 0.77, and the pulsatility index was 4.11. Twenty-three patients had no scrotal pathology but the intratesticular artery flow was detected, the mean peak systolic velocity of the right intratesticular artery was 12.50±5.56cm/sec, the resistive index was 0.54±0.12, and the pulsatility index was 1.45±0.78. The minimum intratesticular artery peak systolic velocity was 5.12cm/sec, the resistive index was 0.25, and the pulsatility index was 0.51. The maximum intratesticular artery peak systolic velocity was 24.90cm/sec, the resistive index was 0.77, and the pulsatility index was 4.11. The patients that had scrotal pathology and the intratesticular artery was detected are 37, of which the mean peak systolic velocity of the right

intratesticular artery was 12.21±5.20cm/sec, the resistive index was 0.54±0.13, and the pulsatility index was 1.37±0.58. The minimum intratesticular artery peak systolic velocity was 7.10cm/sec, the resistive index was 0.22, and the pulsatility index was 0.46. The maximum intratesticular artery peak systolic velocity was 26.40cm/sec, the resistive index was 0.73, and the pulsatility index was 2.43. According to table number 5, colour Doppler flow imaging of the left intratesticular artery was performed. During the examination, the intratesticular artery was detected in 60 patients. The mean peak systolic velocity of the left intratesticular artery was 12.32±5.29cm/sec, the resistive index was 0.54±0.13, and the pulsatility index was 1.40±0.66. The minimum intratesticular artery peak systolic velocity was 5.12cm/sec, the resistive index was 0.22, and the pulsatility index was 0.46. The maximum intratesticular artery peak systolic velocity was 26.40cm/sec, the resistive index was 0.77, and the pulsatility index was 4.11. Ten patients had no scrotal pathology but the intratesticular artery flow was detected, the mean peak systolic velocity of the left intratesticular artery was 10.69±2.31cm/sec, the resistive index was 0.57±0.07, and the pulsatility index was 1.44±0.54. The minimum left intratesticular artery peak systolic velocity was 2.31cm/sec, the resistive index was 0.48, and the pulsatility index was 0.78. The maximum left intratesticular artery peak systolic velocity was 14.90cm/sec, the resistive index was 0.73, and the pulsatility index was 2.43. The patients who had scrotal pathology and the intratesticular artery were detected are 50, of which the mean peak systolic velocity of the right intratesticular artery was 12.65±5.67cm/sec, the resistive index was 0.54±0.13, and the pulsatility index was 1.39±0.68. The minimum intratesticular artery peak systolic velocity was 5.12cm/sec, the resistive index was 0.22, and the pulsatility index was 0.46. The maximum intratesticular artery peak systolic velocity was 26.40cm/sec, the resistive index was 0.77, and the pulsatility index was 4.11.

DISCUSSION

Acute scrotum emergencies signify a minor amount of admissions to the emergency department. However, the familiar nature and possibility for thoughtful results regularly cause excessive anxiety. Quick evaluation is essential to eliminate fertility-threatening situations and accelerate surgical treatment. Ultrasonography is an important method in acute scrotal evaluation as it tolerates fast, without radiation, high-resolution imaging, and significantly evaluation of vascularity with colour Doppler flow imaging. In the management of acute scrotum, the on-call physician will commonly be requested to exclude pathology requiring surgical treatment, in specific torsion of the spermatic cord. To deliver a precise assessment of the patient is required to have an understanding of scrotal anatomy, ultrasonography technique, and acknowledgment of disease.

In the present study, the mean age of patients was 36.33±11.66. The minimum age of the patient was 18 years and the maximum age of age was 60 years. High-resolution sonography determines the testicular perfusion which aids to reach the specific diagnosis and colour Doppler flow imaging could constantly define the morphological features and vascularity of scrotal lesions. Hence, high resolution along with the help of colour Doppler flow imaging is getting a correct diagnosis in acute scrotal pain. Testicular torsion requires quick diagnosis because there are usually 4-6 hours before major ischemic damage occurs. Therefore, it is essential to take a good medical history, proper clinical assessment, and sonography of the scrotum to determine the most apparent diagnosis. However, torsion is the surgical examination, and the remaining underwent unnecessary surgical examination. In our study the testicular torsion was found in 9(11.3%) patients, this was similar to the result of Ambroise et al they diagnosis testicular torsion in 14(9.20%) patients.[9] Tanaka et al also reported testicular torsion in 38(23.0%) cases.[10]

Blaivas, et al. described similar findings with a reported sensitivity of 95.0% and specificity of 94.0% with 95% of confidence intervals[4]. Selim et al also reported the sensitivity of 93.94% of high-resolution ultrasonography and sensitivity of 84.85% of colour Doppler flow imaging[11]. Pinar et al study also revealed the sensitivity of 88.3% and specificity of 52.7% of colour Doppler sonography[12]. The scrotal pathologies that are associated bilateral are 5 (6.5%) of cases, in the left scrotum, the number of cases is 31 (47.4%), in the right scrotum the cases are 14 (17.5%), in 4 (6.1%) of cases no pathology was found, and differential pathologies that occur in the right and left sides are 18 (22.5%) of cases. Onwuchekwa et al reported, hydrocele 27(36.49%) cases, was found in 9(12.16%) on the right side, 8(10.81%) on the left side, and bilateral it was found in 17(22.97%) of cases, followed by varicocele 16(21.62%).[13] These findings are also similar to the study conducted by Zubair et al they enrolled a total of 60 patients, of which the most common scrotal pathology that associated with scrotal pain were hydrocele that observed in 35 patients and the 2nd common pathology was varicocele occurs in 10 patients, of which 1(3.4%) had varicocele on the right scrotal sac while 5(25.0%) had varicocele on the left scrotal sac.[14] As compared to our study, in the right scrotal sac high resolution sonography detected varicocele in 4 patients, Of which 2 patients had grade II and 2 patients had grade III varicocele. Colour Doppler was also performed in the right scrotal sac, which detects grade I varicocele in 4 patients. During the examination of the left scrotum, a high resolution was performed in 72 patients, of whom 66 patients had no varicocele, 3 patients had grade I, and 3 patients had grade II varicocele. Colour Doppler was also performed in the left scrotal sac, which detects grade I varicocele in 13 patients.

Akcar, et al. enrolled a total of 58 patients, Of which 27(study group) and 31(control group).[15] In the study group (27 patients) the resistive index of the right intratesticular artery were 0.61±0.09 while the left intratesticular artery were 0.58±0.10 and in the control group (31 patients) the resistive index of the right intratesticular artery were 0.61±0.06 while the left intratesticular artery were 0.61±0.06. As compared to our study the resistive index of the right intratesticular artery was 0.54±0.13 (Table 4) and the left intratesticular artery resistive index was 0.54±0.13

(Table 5). Pinggera et al[16] measured the intratesticular artery flow on colour Doppler sonography, the mean of intratesticular artery resistive index of patients was 0.54, confirm the results of earlier studies; Table 6 compares intratesticular resistive index (RI) in different studies, including the present results as measured by colour Doppler flow imaging.

CONCLUSION

High-resolution sonography was highly sensitive in the diagnosis and localization of scrotal masses. It was also very accurate in the diagnosis of hydrocele, pyocele, epididymal cyst, and localizing undescended testes.

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Table 1: Sonographic findings that associated with scrotal pain

Pathologies	Yes	Percent	No	Percent
Hydrocele	31	38.8	41	61.2
Varicocele	22	27.5	50	72.5
Torsion	9	11.3	63	88.7
Cyst	8	10.0	64	90.0
Epididymo-orchitis	7	8.8	65	91.2
Pyocele	6	7.5	66	92.5
Orchitis	4	5.0	68	95.0
Scrotal wall thickness	3	3.8	69	96.2
Undescending testis	3	3.8	69	96.2
Inguino-scrotal Hernia	1	1.3	71	98.7
Testicular Atropy	1	1.3	71	98.7
Rete testis	1	1.3	71	98.7
Hemangioma	1	1.3	71	98.7
Hematoma	1	1.3	71	98.7
Scrotal mass	1	1.3	71	98.7
Testicular microlithiasis	1	1.3	71	98.7
Normal studies	4	5.0	68	95.0

Table 2: Classify the comparison of high-resolution sonography and colour Doppler flow imaging study

Side		No	Percent	Yes	Percent
Right Side High resolution	no	41	61.2	0	0
	yes	0	0	31	38.8
Left Side High resolution	no	61	86.2	0	0
	yes	0	0	11	13.8
Right Side Colour Doppler	no	31	38.8	0	0
	yes	0	0	41	61.2
Left Side Colour Doppler	no	11	13.8	0	0
	yes	0	0	61	86.2
Combination of Both	no	42	62.5	0	0
	yes	0	0	30	37.5

Table 3: high-resolution sonography and colour Doppler flow imaging in grades of Varicocele

Right High Resolution			Right Colour Doppler
	Grades	Frequency	Frequency
Vascularity	0	68	68
	1	0	4
	2	2	0
	3	2	0
Left High Resolution			Left Colour Doppler
Vascularity	0	66	59
	1	0	13
	2	3	0
	3	3	0

Table 4: Spectral Doppler findings of the Right Intratesticular artery

Right Side Doppler		PSV	RI	PI
No	Mean	12.5013	.5465	1.4578
	Std. Deviation	5.56295	.12953	.78072
	Minimum	5.12	.25	.51
	Maximum	24.90	.77	4.11
Yes	Mean	12.2192	.5459	1.3749
	Std. Deviation	5.20282	.13219	.58607
	Minimum	7.10	.22	.46
	Maximum	26.40	.73	2.43

Table 5: Spectral Doppler findings of the left intratesticular artery

Left Side Doppler		PSV	RI	PI
No	Mean	10.6910	.5760	1.4480
	N	10	10	10
	Std. Deviation	2.31726	.07863	.54812
	Minimum	7.10	.48	.78
	Maximum	14.90	.73	2.43
Yes	Mean	12.6546	.5402	1.3984
	N	50	50	50
	Std. Deviation	5.67124	.13791	.68731
	Minimum	5.12	.22	.46
	Maximum	26.40	.77	4.11
Total	Mean	12.3273	.5462	1.4067
	N	60	60	60
	Std. Deviation	5.29862	.13007	.66220
	Minimum	5.12	.22	.46
	Maximum	26.40	.77	4.11

Table 6: intratesticular resistive index (RI) in different studies

Study	Resistive index (RI)
Pinggera et al[16]	0.54
Biagiotti et al[17]	≥0.5
Pozor et al[18]	0.5
Akcar et al[15]	0.6
Present study	0.54