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EXPERIENCE IN SCROTAL DOPPLER ULTRASOUND IN A NIGERIAN TERTIARY HOSPITAL
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ABSTRACT

Background: **Scrotal diseases can be diagnosed with clinical examination or radiological imaging. The use of ultrasound with Doppler application has several advantages in the evaluation of this sensitive and private organ.**
Objectives: **To document the pattern of Doppler ultrasound findings in patients presenting with scrotal symptoms.**
Design: **A retrospective descriptive study.**
Setting: **The Vascular Imaging Unit, Radiology department, University of Benin Teaching Hospital, Benin, Edo, Nigeria.**
Subjects: **The Doppler scan results and stored images of 95 patients who had complaints related to the scrotum were retrieved and analyzed. Only cases that were agreed upon by the researchers were included in this study. All the Doppler scans were performed by either one or all researchers.**
Results: **The mean age of the study population was 37.96±1.43 years while scrotal swelling 31 (26.4%) was the commonest indication. Others were scrotal pain 30 (25.4%), varicocoele 20 (16.9%), infertility 13 (11.0%), etc. Scrotal Doppler ultrasound findings were hydrocoele 43 (35.5%), epididymo-orchitis 30 (24.6%), varicocoele 20 (16.4%), Orchitis 7 (5.7%), epididymal cyst 7 (5.7%). Hydrocoele was the commonest findings in those that presented infertility.**
Conclusion: **In conclusion, Doppler ultrasonography of the scrotum can be performed for scrotal diseases which often present with non-specific symptoms. Hence with it, diagnosis can be made between the different scrotal disease entities which will improve the treatment of such patients.**

Keywords: Doppler, ultrasound, scrotum.

INTRODUCTION

In diseases of the scrotum patients often present with nonspecific symptoms and non-specific signs are also elicited.[1] Such signs and symptoms include scrotal pain and tenderness, swelling or a palpable scrotal mass and sometimes infertility. In some instances like acute scrotum, such clinical symptoms and signs combined with physical examination are often not enough for definite diagnosis due to pain and swelling that limit an accurate palpation of the scrotal contents.[2] An imaging modality which can distinctively depict intratesticular or extratesticular lesions and also able to distinguish between benign or malignant lesions as well as identify scrotal surgical emergencies is highly desirable in scrotal examination. Ultrasonography is well documented to have met these requirements. In addition, ultrasonography is non-invasive, relatively cheap, and readily available and it is radiation free[1]. The high-frequency linear probe used in scrotal scan as well as the superficial nature of the testes enables detailed sonologic assessment of the scrotum and its contents.[3]

Scrotal ultrasound started with static B-mode imaging in 1974 by Miskin and Bain.[4, 5] However, the first documented colour Doppler study of the testes available in the literature was by Middleton *et al*[6]. Grey scale ultrasonography can identify scrotal pathologies such as hydrocoele, testicular masses, inguino-scrotal hernia, and epididymal cyst but limited in vascular pathologies such as varicocoele, testicular torsion, testicular infarct and strangulated hernia as well as in distinction between acute epididymo-orchitis and testicular torsion. Colour Doppler scan play very important role in these later indications. Magnetic resonance imaging can also be used in the assessment of the testes because of its excellent soft tissue resolution but it is expensive and not readily available. Computed tomography scan and radionuclide imaging are relatively contraindicated due to their high radiation dose. Hence ultrasonography still stands out among the imaging modalities.

Although, expertise in scrotal Doppler scan is relatively new in my center and in most centers in Nigeria, but some documented Doppler studies have been done here and elsewhere on other parts of the body but none has been done for the scrotum. The university of Benin Teaching hospital is a multidisciplinary tertiary health institution with a very viable urological unit hence some referral are sent to the radiology department for scrotal Doppler sonogram. However, expertise on scrotal Doppler scan has grown to a remarkable level and several departmental protocols and guidelines have been created especially aided by clinic-pathologic-sonologic correlations. Our aim is to document our scrotal Doppler sonographic findings with the intention that it will spur other centers to perform such scans and do research in it. It will also show the pattern and frequency of presentations.

METHODOLOGY

This was a retrospective descriptive study done at the Radiology department of the University of Benin Teaching Hospital between January 2015 and January 2017. Approval for the study was obtained from the hospital ethical committee. All scans were done using Sonoace X6 ultrasound machine (Medison, Korea, 2010) and were performed by one or more of the authors. These scans were done using departmental protocol which

entails full exposure of the scrotum, penis, groin, lower abdomen and perineum. Coupling gel was applied over the areas of interest and the scrotums were scanned in various planes as necessary. Both grey-scale and Doppler application were applied with the Doppler setting optimized for proper scrotal examination. The findings were then documented. The radiological request forms, ultrasound reports and images (stored in the ultrasound machine's hard drive) of patients who had scrotal Doppler scan were retrieved from the departmental record and reviewed by the authors. The ultrasonic diagnoses used in this study were those agreed upon by all the authors after selective review of each case.

There was no patient identifier in the data collected. The images and reports were password protected. The patients' age, presenting complaints and ultrasound findings as recorded in their reports were retrieved and analysed using IBM-SPSS (version 20). Statistical analyses of the frequencies and spread of central tendencies (on patients' ages) were performed. Associations between variables were assessed using Chi-square with P-value set at 95% confidence interval.

RESULTS

The request forms and ultrasound reports of a total of 95 patients who had scrotal Doppler scans were retrieved for this study out of which 14 had normal ultrasound report. The remaining 81 patients had one or more pathology seen on ultrasonography. The age range of the study population was 4 to 74 years with those aged 35 years (8.4%) having the highest population. The mean age of the study population was 37.96±1.43years with age group 31-40 years (30.5%) having the highest number of patients as shown in figure 1. This was followed by age group 41-50 (21.2%). The lowest frequency was shown by those at the extremes of age with age group 71-80 years (2.1%) being lowest, followed by 0-10 years (3.2%).

In table 1 the indications for the scrotal Doppler scan were enumerated and amounted to about 118. This is because some patients had more than one indication. Scrotal swelling (26.3%) was the commonest indication on the request card from the referring clinicians; this was followed by scrotal pain (25.4%) and varicocoele (16.9%). The least indication on the request card for scrotal Doppler scan was undescended testis (0.8%) and small testis (0.8%).

Table 2 showed the Doppler ultrasound findings and about 122 ultrasound findings are listed. Hydrocoele was the highest accounting for 43 (35.3%), this was followed by epididymo-orchitis 30 (24.6%), and varicocoele 20 (16.4%). Epididymal cyst and Orchitis accounted for 7 each (5.7%). Other ultrasound findings are shown in table 3 below. Bilateral occurrence was commonest for hydrocoele (27), followed by epididymo-orchitis (21), varicocoele (13) and epididymal cyst (6) as shown on table 3. Further analysis showed that hydrocoele, varicocoele, epididymo-orchitis and Orchitis were more on the left than right.

Table 4 shows ultrasound findings in patients that had infertility as indication for scrotal Doppler scan. Three patients had normal ultrasound findings while the remaining ten had multiple findings with hydrocoele being the highest (6). This was followed by varicocoele (4). Others were epididymal cyst (1), orchitis (1) and spermatic cord cyst (1).

Epididymo-orchitis, 17 (37.8%), was the commonest ultrasound finding in patients that presented with scrotal pain. This was

followed by hydrocoele in 12 (26.7%), varicocoele in4 (8.9%) and Orchitis in 3 (6.7%) patients. Three patients showed normal ultrasound findings (6.7%). Other findings are shown in table 5 below. Hydrocoele was the commonest Doppler ultrasound finding in patients that presented with scrotal swelling, 22 (53.7%). This was followed by epididymo-orchitis in 16 (39.0%) patients. Other findings are shown in table 6.

Furthermore, patients in the age group 41-50 years had the highest number of Doppler ultrasound findings of the scrotum as shown in table 7. Moreover, hydrocoele was found to be commonest in this age group. This was followed by those in age group 31-40 years. Epididymo-orchitis and orchitis were more in age group 21-30 years while varicocoele was more in age group 31-40 years.

Figure 1
Age distribution of respondents

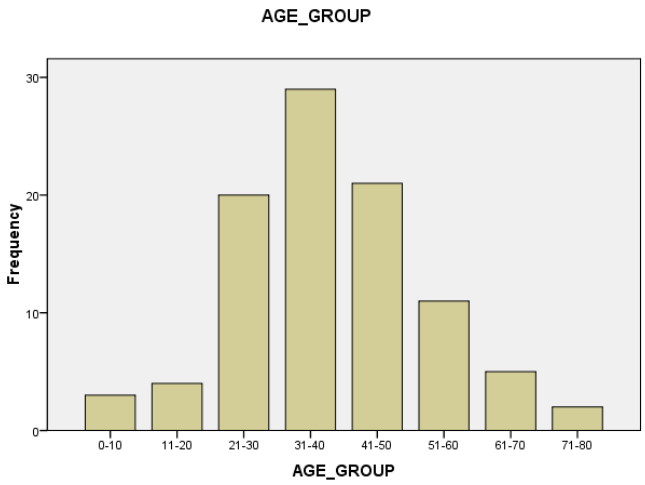

Table 1
Common indications for scrotal Doppler scan

Indications	Frequency	Percentage
Infertility	13	11.0
Epididymal cyst	2	1.7
Orchitis	8	6.8
Hydrocoele	2	1.7
Undescended testis	1	0.8
Inguinoscrotal hernia	4	3.4
Erectile dysfunction	4	3.4
Varicocoele	20	16.9
Scrotal pain	30	25.4
Testicular torsion	2	1.7
Scrotal swelling	31	26.3
Small testis	1	0.8
Total	118	100.0

Table 2
Common scrotal Doppler scan findings

Ultrasound findings	Frequency	Percentage
Epididymal cyst	7	5.7
Tunica vaginalis cyst	3	2.5
Varicocoele	20	16.4
Seminoma	1	0.8
Fournier's gangrene	1	0.8
Inguinoscrotal hernia	4	3.3
Undescended testis	2	1.6
Spermatic cord cyst	1	0.8
Testicular torsion	1	0.8
Testicular contusion	1	0.8
Scrotal haematoma	1	0.8
Hydrocoele	43	35.3
Orchitis	7	5.7
Epididymo-orchitis	30	24.6
Total	122	100.0

Table 3
Common ultrasound findings and their location

Ultrasound findings	Right	Left	Bilateral`
Varicocoele	1	6	13
Epididymo-orchitis	3	6	21
Hydrocoele	5	11	27
Epididymal cyst	1	nil	6
Inguinoscrotal hernia	nil	3	1
Orchitis	2	3	2

Table 4
Ultrasound findings in patients with infertility

Ultrasound findings	Frequency	Percentage
Epididymal cyst	1	6.3
Varicocoele	4	25.0
Spermatic cord cyst	1	6.23
Hydrocoele	6	37.5
Orchitis	1	6.3
Normal	3	18.8

Table 5
Ultrasound findings in patients with scrotal pain

Findings	Frequency	Percentage
Epididymo-orchitis	17	37.78
Hydrocoele	12	26.67
Varicocoele	4	8.89
Orchitis	3	6.67
Normal	3	6.67
Epididymal cyst	1	2.22
Seminoma	1	2.22
Fournier's gangrene	1	2.22
Inguinoscrotal hernia	1	2.22
Undescended testis	1	2.22
Testicular torsion	1	2.22
Total	45	100

Table 6
Ultrasound findings in patients with scrotal swelling

Findings	Frequency	Percentage
Hydrocoele	22	53.66
Epididymo-orchitis	16	39.02
Varicocoele	4	9.76
Inguinoscrotal hernia	3	7.31
Tunica vaginalis cyst	3	7.31
Fournier's gangrene	1	2.43
Orchitis	1	2.43
Normal	1	2.43
Total	41	100

Table 7
Distribution of Doppler ultrasound findings with age group

Ultrasound findings	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	Total
Hydrocoele	1	2	4	10	14	6	5	1	43
Epididymo-orchitis	1	0	8	5	7	5	4	0	30
Varicocoele	0	1	3	9	5	2	0	0	20
Orchitis	0	0	3	2	1	1	0	0	7
Epididymal cyst	0	0	1	1	2	1	0	0	7
Inguino-scrotal hernia	0	0	1	0	2	0	1	0	4
Tunica vaginalis cyst	0	1	0	1	0	0	0	1	3
Undescended testis	1	1	0	0	0	0	0	0	2
Spermatic cord cyst	0	0	0	0	1	0	0	0	1
Testicular torsion	0	0	1	0	0	0	0	0	1
Testicular contusion	0	0	1	0	0	0	0	0	1
Scrotal haematoma	0	0	1	0	0	0	0	0	1
Seminoma	0	0	0	0	1	0	0	0	1
Fournier's gangrene	0	0	0	0	0	0	1	0	1
Total	4	5	23	28	33	15	11	2	122

DISCUSSION

The mean age of our study population was 37.96 years and this is close to that of similar studies done in North-East and South-West Nigeria[5, 7]. At about this age men are still youthful and sexually active and procreating, hence any pathology that challenges this activity will make him present for medical attention. Scrotal Doppler scan is done based on some indications which range from infective, vascular, and traumatic to congenital problems. Our study showed scrotal swelling as the commonest indication for scrotal ultrasound; this is at variance with that of Ibrahim *et al*[5] where primary infertility was the commonest indication. This observation may be due to the difference in geographical spread of scrotal diseases in the same country. Furthermore presentation may be affected by individual belief and health seeking behavior as some individuals may trivialize some symptoms related to scrotal ailment. Shyness to expose ones genitalia to physical examination may also lead to reduction in clinic visitations.

Gray-scale ultrasonography differentiates testicular lesions from extra-testicular ones. Color Doppler helps to assess flow and perfusion. More so color Doppler is particularly helpful in acute painful conditions, where it can differentiate testicular ischemia from infective conditions and thus prevents unnecessary surgical explorations[8]. Our study showed hydrocoele as the commonest ultrasound findings. This is contrary to the study of Ibrahim *et al*[5]and Tijani *et al*[7] were varicocoele was the commonest and hydrocoele was second commonest ultrasound findings. Hydrocoele is abnormal free-fluid collection between the visceral and parietal layers of the tunica vaginalis; usually a cause of physical, psychological, social and economic distress such that some men think they cannot be cured from it.[9] It is mostly seen in men older than 40 years of age.[9, 10] We also found out that hydrocoele had the highest frequency in the age group 41-50 years which agrees with the literature above.[9] Furthermore, it is said to be bilateral in 7-10% of cases.[9] This is at variance with our study which showed bilateral occurrence in 62.8%.

The second most common finding was epididymo-orchitis which is often due to retrograde infection from the bladder or the prostate gland. It was described as the fifth most common urological diagnosis in a study done in the US.[11] The testis and epididymis will appear enlarged and hypoechoic on gray-scale and show marked vascularity with low resistance waveform on spectral Doppler.[8] It is said to occur between the ages of 18 and 50 years.[11] This is similar to our observation in which the highest frequency of those with epididymo-orchitis was in age group 21-30 years followed by age group 41-50 years.

Varicocoele was the third commonest finding on scrotal Doppler scan in our study. It refers to abnormal dilatation of veins of the pampiniform plexus greater than 3mm in diameter with or without venous reflux and it is seen in 20% of fertile men and 30-40% of infertile men.[12, 13] Tijani *et al*[7] and Ibrahim *et al*[5] reported varicocoele as the commonest ultrasound finding in both fertile and sub-fertile men but the proportion being more in sub-fertile men. Varicocoele was also seen to be more on the left than right which is in tandem with other studies in the literature.[7, 8, 12, 13] This left preponderance is because the left testicular vein is 8-10cm longer than its right counterpart and it drains at right angle into the left renal vein thus acting as a hydrostatic

column especially in the upright position with consequent dilatation of the veins.[13] Another proponent supporting the left preponderance of varicocoele is that catecholamine secreted from the left adrenal gland enters the left testicular vein through the left renal vein and causes contraction of the testicular vein.[13, 14] Varicocoele is said to be rarely reported in children below 10 years of age.[15] This is in support of our study as there was no reported case of patients with varicocoele below 10 years of age.

In our study, patients that had infertility as their indication for scrotal Doppler scan had hydrocoele as the commonest finding which was followed by varicocoele. Most other studies showed varicocoele as the commonest finding in infertility.[7, 8, 16]. The association of hydrocoele with infertility in this study may be a chance occurrence as it was only 6 cases of hydrocoele out of the 43 cases documented that had association with infertility. However, some studies have opined that hydrocoele perhaps causes testicular enlargement and increases vascular resistance in the intra-testicular arteries, thereby adversely affecting testicular function hence the association with infertility.[7, 9] One case of epididymal cyst and orchitis was associated with infertility in our study which is in agreement with previous study.[7]

Epididymo-orchitis was the commonest ultrasound finding in patients that presented with scrotal pain while hydrocoele was the commonest ultrasound finding in those that presented with scrotal swelling. Ibrahim *et al*[5] documented similar findings in a study done in Zaria, northeast Nigeria. This is expected as epididymo-orchitis is an inflammatory process that is expected to cause pain. The pain can be excruciating and similar to that from testicular torsion which happens to be a surgical emergency. It therefore becomes pertinent that patients presenting with scrotal pain should be properly diagnosed as having either epididymo-orchitis or testicular torsion, although other scrotal pathologies may also cause pain. In addition, the treatment for epididymo-orchitis is different from that of testicular torsion because antibiotic therapy is required for epididymo-orchitis while orchidopexy is performed for uncomplicated testicular torsion.

In conclusion Doppler ultrasonography of the scrotum is an indispensible tool in differentiating between infective and vascular scrotal diseases. Hence with it, this distinction can be made appropriately and best treatment options offered to patients.

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