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Original article

Scrotal abnormalities and infertility in west African men: A comparison of fertile and sub-fertile men using scrotal ultrasonography

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Abstract

Objective: To determine and compare the spectrum of scrotal abnormalities in fertile and sub-fertile west African men using scrotal US.

Subjects and methods: The study examined 249 subjects over a period of 13 months. The subjects comprised 149 patients with diagnosis of male infertility, as well as 100 healthy individuals for comparison. The relevant clinical history of each patient was extracted from their case notes. All the subjects had their testes examined using a high frequency (7.5 MHz) linear transducer of an ultrasound scanner. Images in B-mode ultrasound scan and color Doppler were acquired in the supine and upright position. The results were expressed as percentages and tests of significance were done using the chi-square and Fisher's *t*-test. A P-value < 0.05 was considered statistically significant.

Results: The prevalence of abnormal scrotal findings in the sub-fertile and fertile men was 65.1% and 23% respectively ($P < 0.01$). Varicocele was the commonest and was found in 55% and 12% of the fertile and sub-fertile men respectively ($P < 0.01$). Hydrocele and epididymal abnormalities were the next common with higher prevalence in the sub-fertile men ($P > 0.05$), while testicular tumor was confirmed in one sub-fertile patient. With the exclusion of varicocele, there was no statistically significant difference in the prevalence of the other abnormalities between the sub-fertile and fertile groups.

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Conclusion: Male sub-fertility was associated with a higher prevalence of scrotal abnormalities. Apart from the diagnoses of the possible causes of the sub-fertility, routine scrotal US was able to diagnose other abnormalities of clinical relevance in the sub-fertile male. Scrotal US is a valuable tool in the evaluation of the sub-fertile west African man and should be considered in the routine evaluation of the sub-fertile west African man.

Introduction

The male factor plays a role in approximately 50% of infertility cases [1,2]. This is commonly due to abnormalities in testicular function.

The role of ultrasonography in the evaluation of male infertility has expanded with advancements in this technology with scrotal ultrasonography (scrotal US) serving multiple purposes in the sub-fertile man. Apart from diagnosing the cause of the sub-fertility like varicoceles, it can also readily diagnose many other scrotal abnormalities not directly related to sub-fertility but which may be associated with morbidity like in the screening for testicular tumor due its reported higher incidence in patients with sub-fertility. Indeed scrotal abnormalities have been found on ultrasonography (USS) in 38–72% of infertile men [3–5].

While racial and geographical differences in testicular diseases do exist and the association of testicular abnormalities with infertility on scrotal US are well established, to the best of our knowledge there is no published data on the possible association of abnormal scrotal US findings with male infertility in sub-Saharan Africa. This is a prospective study that evaluated the spectrum of scrotal abnormalities in sub-fertile black West African men using scrotal US.

The objective of this study was to determine the spectrum of scrotal abnormalities in fertile and sub-fertile west African men using scrotal US.

Subjects and methods

The study was conducted at our medical institutions located in South West Nigeria, also comprising the commercial capital and the most cosmopolitan state in West Africa.

The study was done over a period of 13 months (December 2009–December 2010) in which 149 patients diagnosed with male infertility were studied. Main inclusion criteria for the subjects were a history of infertility of at least 2 years duration and at least two consecutive semen fluid analysis (SFA) showing a sperm density less than 20 million/ml of semen.

One hundred subjects with apparently normal fertility were recruited from among the hospital patients with unrelated problems for comparison. The main inclusion criteria for the fertile subjects were the absence of any history of fertility challenge and history of impregnation of sexual partner (confirmed either by appropriate pregnancy tests or with pregnancy carried to term) within the last 2 years.

Approval for the study was granted by the hospital research and ethics board and informed consent taken from all patients.

Assessment of the scrotal contents

Aloka Prosound SDD-3500 Plus, Japan 2005 scan machine with high resolution (7.5 MHz) was used. Images with B mode USS and colored Doppler were acquired in both the supine and erect positions.

The criteria for the diagnosis of varicocele were: (1) The largest plexus pampiniformis vein measured more than 2 mm in diameter in supine position or >3 mm in the standing position. (2) More than 1 mm increase in size of the largest vein during Valsalva on gray-scale examination. (3) More than 2-s retrograde flow during Valsalva maneuver on color Doppler US. A combination of 1 and 2 above or 1 and 3 above was regarded as diagnostic of varicocele [6]. The criterion for a thickened epididymis was a mean diameter of more than 12 mm in cross-section at the level of the caput [7] while an epididymal cyst was diagnosed by the presence of cysts (on the epididymis) that were hypoechoic and circumscribed with good through transmission and posterior wall enhancement [7,8]. A suspicion of testicular tumor was defined as the presence of focal hypoechoic lesion within the normally homogenous testis [7,8]. The presence of multiple, diffuse, non-shadowing hyperechoic foci was diagnosed as microlithiasis [7,8]. The presence of echo-free (or faintly echoic) collection of fluid in the tunica vaginalis (or surrounding the testis) was diagnosed as hydrocele [7,8].

All the scans were performed by two radiologists (OBO and AOY).

Semen collection and assessment

The semen was collected after a 3–4 days abstinence by masturbation, processed and analyzed using the 1999 WHO criteria [9].

Data analysis

- The results were expressed as percentages and tests of significance were done using the chi-square and Fisher's exact *t*-test. The paired *t*-test was used for the comparisons of the mean age. For the association between each abnormality and fertility status the Fisher's exact test was used while the chi-square was used for the overall associations. The chi-square was used for the association between the frequency of abnormality per patient and fertility status.

A *P*-value of less than 0.05 was considered statistically significant.

Table 1 Number of abnormalities per patient.

No of abnormalities	Sub-fertile (%)			Fertile (%)
	Oligo	Azoo.	Total	
0	50	2	52	76
1	78	3	81	20
2	10	1	11	3
3	3	1	4	1
4	1	0	1	0
Total	142	7	149	100

Abbreviations: oligo = oligospermia, azoo = azoospermia.

Results

The age range of the sub-fertile men was 16–65 years with a mean of 36.5 ± 7.3 years while it was 15–69 years (mean – 38.1 ± 5.8) for the fertile men. There was no statistically significant difference between the two age groups. One hundred and twelve (75.2%) of the sub-fertile patients gave a positive history of having impregnated present or past partners in the past.

The relationships between the frequency of abnormal findings per patient and fertility are summarized in Table 1 ($P > 0.05$). Eighty-one (54.3%) and 20 (20%) of the sub-fertile and fertile patients respectively had only one abnormality while 16 (10.7%) and 4 (4%) of the sub-fertile and fertile patients respectively had multiple abnormalities. There was no statistically significant relationship between the multiplicity of scrotal abnormality and fertility.

The distribution and types of abnormalities are summarized in Table 2.

A total of 119 intra- and extra-testicular scrotal abnormalities were detected in 97 (65.1%) of the sub-fertile patients compared with 24 (24%) of the fertile group ($P < 0.001$). If varicoceles were excluded, there was no statistical significant difference between the prevalence of abnormalities between the two groups. The commonest abnormalities were varicoceles occurring in 55% and 12% of sub-fertile and fertile patients respectively and hydrocele with 10.1% and 6% respectively. The commonest combinations of abnormalities were epididymal thickening and hydrocele which occurred in five and one sub-fertile and fertile patients respectively. Varicoceles also accounted for 68.9% and 41.4% of all abnormalities in the sub-fertile and fertile patients respectively.

Table 2 Distribution of normal and abnormal findings in sub-fertile and fertile men.

Finding	Sub-fertile ($n = 149$)	Fertile ($n = 100$)	*P*-value
Normal	52 (34.9%)	76 (76%)	
Abnormal	97 (65.1%)	24 (24%)	<0.01
Varicocele	82 (55.0%)	12 (12%)	< 0.01
Hydrocele	15 (10.1%)	6(6%)	0.318
Epididymal thickening.	7 (4.7%)	3 (3%)	0.404
Testicular Cyst	1 (0.7%)	0 (0%)	0.419
Epididymal cysts	8 (5.3%)	6 (6%)	0.992
Microlithiasis	4 (2.7%)	2 (2%)	0.730
Suspected tumor	2 (1.3%)	0 (0%)	0.245
Total no of abnormalities	119	29	<0.01

Table 3 Prevalence and side distribution of varicocele.

Side	Fertile (%) ($n = 12$)	Sub-fertile (%) ($n = 82$)
Right side alone	0	3(3.7%)
Left sided alone	8 (66.7%)	40(48.8%)
Bilateral	4 (33.3%)	39 (47.6%)
Total	12 (100%)	82 (100%)

The side distributions of the varicoceles in the two groups are summarized in Table 3. The left side was involved in 96.4% of all cases of varicoceles in the sub-fertile men and in 100% of all cases in the fertile group, while it was bilateral in 47.6% and 33% of cases in the sub-fertile and fertile group respectively. There was no statistically significant difference in the side distribution of varicoceles between the two groups ($P = 0.459$).

Testicular tumor was suspected in two patients. Surgical intervention and histology confirmed a tumor in one patient and tuberculous orchitis in the other patient.

Discussion

Over the last few years there have been discussions over the evidence of reduced sperm quality in the male population [10]. In addition to this, more recent reports appear to suggest an increase in the incidence of ultrasonologically detected scrotal abnormalities in sub-fertile men [2,5].

The prevalence of scrotal abnormalities in this study was 65.1% and 24% in the sub-fertile and fertile groups, respectively. This appears to be consistent with other studies that have reported a prevalence of 38–72% and 29% for sub-fertile and fertile men, respectively [3–5]. However, comparison of different studies on scrotal abnormalities is not straightforward as it appears that the definition of abnormality is still not uniform as parameters like testicular size, testicular lie and homogenicity, epididymal thickening, spermatocele, epididymal cysts have been included by some and excluded by others [3–5].

Varicocele was the most common sonographic abnormality in this study occurring in 55% and 12% of the fertile and sub-fertile patients, respectively. Reports in literature have also described varicocele as the most common identifiable abnormality detected in infertile men on scrotal US. While varicocele has traditionally been reported to have an overall prevalence of 29– 40% in all infertile men [3,5,6,11–13], more recently some authors have reported prevalence of 35–41% in men with primary infertility and 70–81% in men with secondary infertility [11,14]. Even though 75.2% of the sub-fertile subjects in this study gave a history of having impregnated previous partners in the past, differentiation of primary and secondary infertility in our environment is usually not a straightforward matter as the usual story is that of the man claiming to have given his previous partner(s) money to terminate unwanted pregnancy(ies) without any effort to confirm the (female) partner's claims. In this study attempts were not made to differentiate between primary and secondary infertility and this may be a possible explanation for our overall high prevalence of varicoceles. Similarly, author variations in the criteria for the USS diagnosis of varicoceles do exist and may also account for the wide disparity in reports [5,6]. The 12%

prevalence of varicoceles in the normal population is consistent with most reports in the literature [2,11].

Most studies have reported varicoceles to be more common on the left in both sub-fertile men and normal population [12–15]. Our findings were consistent with these. However, there was no statistical significant difference in the side distribution of varicoceles between the fertile and sub-fertile patients. About 47.6% of all varicoceles in infertile patients were bilateral. The reported prevalence of scrotal US diagnosed bilateral varicoceles in sub-fertile men, however varies widely, accounting for 11–40% of cases of varicoceles with the incidence said to be higher in the older men [12]. Reasons for the relatively high bilateral prevalence in sub-fertile men in this study are unclear. Is there a relationship with race or geographical location? Fiogbe et al. in Cotonou [15], also in West Africa, in a random screening of 2724 adolescents using scrotal US reported a bilateral prevalence of 87.6%. However, Gat et al. [13] using a combination of multiple diagnostic tools, including scrotal US and venography also found a bilateral prevalence of 80.7% in infertile men and suggested that varicocele may actually be a bilateral disease. Most studies have reported the rarity of isolated right sided varicoceles and similarly in our study it accounted for only 3.7% and 0% of varicoceles in the sub-fertile and fertile men, respectively. Controversies also exist on the relevance of scrotal US detected sub-clinical varicocele, however, Jarow et al. [16] and Kondoh [17] et al. reported improvement in semen parameters after treatment of sub-clinical varicocele.

The second most common scrotal abnormality found in both groups in this study was hydrocele being more common in the sub-fertile patients. Until recently, the effect of idiopathic hydrocele on the testis was poorly understood as it was thought to be completely harmless to testicular health, however Mihmanli et al. [18] were able to demonstrate that idiopathic hydrocele may cause testicular enlargement and increased vascular resistance in the intratesticular arteries, thereby adversely affecting testicular function. The incidence of hydrocele in the sub-fertile men our study is consistent with reports by others [3,5]. The relationship between hydrocele and sub-fertility in this study may however by casual rather than causal as five (33%) of patients with hydrocele also had epididymal thickening a possible sequel to chronic epididymo-orchitis – an established cause of infertility.

Other abnormalities like epididymal cysts and microlithiasis have also been reported to be associated with infertility. Epididymal cysts are thought to cause obstruction while microlithiasis is thought to impair testicular function via an immunological mechanism [3,7]. This was, however, not consistent with our findings as there was no statistically significant difference between prevalence of these abnormalities in the sub-fertile and fertile subjects.

Studies have reported a higher incidence of histologically confirmed testicular tumors in sub-fertile subjects with rates between 0.3 and 0.6% compared with the general incidence of 0.005% – 0.0009 for primary testicular tumor [2,5,7]. Our prevalence of 1/149 (0.67%) in sub-fertile patients appears to be in agreement with this. In this study, two sub-fertile patients had a scrotal US diagnosis of testicular tumor. Histopathological evaluation confirmed a seminoma in one and tuberculos orchitis in the other. While a hypoechogenic area within the tunica albuginea is highly suspicious of testicular tumor, differentiation from a tuberculos orchitis can occasionally be very difficult. Early detection of testicular tumors is without doubt beneficial to any male, but carries greater significance in men interested in further procreation so that sperm cryopreservation can be performed before disease progression or disease treatment which may further impair fertility.

In conclusion, Scrotal US is a valuable tool in the evaluation of sub-fertile men. Sub-fertile men had a significantly higher prevalence of scrotal abnormalities, with varicoceles mainly responsible for this. There is, however, a need for a standardization of the criteria for the US diagnosis of testicular abnormalities.

Conflict of interest

None.

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