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Original article

Assessment of testicular volume: A comparison of fertile and sub-fertile West African men

K.H. Tijani[a,*], **B.O. Oyende**[b], **G.O. Awosanya**[b], **R.W. Ojewola**[a], **A.O. Yusuf**[c]

[a] *Section of Urology, Department of Surgery, College of Medicine University of Lagos and Lagos University Teaching Hospital, Lagos State, Nigeria*
[b] *Department of Radiodiagnosis, Lagos University Teaching Hospital, Nigeria*
[c] *Head Department of Radiology, Ben Carson Snr. School of Medicine, Babcock University teaching Hospital, Ogun State, Nigeria*

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Abstract
Background: While the semen analysis appears to be the cornerstone in the evaluation of testicular function, the testicular volume has long been associated with testicular function. However, racial variations in testicular volume do exist. Neither the critical minimum testicular volume that guarantees adequate function, nor the optimal testicular volume that indicates peak testicular function are also known.
Objective: To evaluate the relationship between testicular volume and function using scrotal ultrasound scan in black West African men.
Patients and methods: The study examined 236 subjects over a period of one year. The subjects comprised of 136 patients with diagnosis of male infertility, as well as 100 healthy individuals as control. 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. The results were expressed as percentages and tests of significance were done using the chi-square and Student's *t*-test. A P-value < 0.05 was considered statistically significant.
Results: The mean testicular volume for the sub-fertile patients was 15.32 ml while it was 19.89 ml in the control group. There was a statistically significant difference between the testicular volumes in fertile and

* Corresponding author. Tel.: +234 8023049739.
E-mail addresses: habeeb_tijani@yahoo.com, khtijani@cmul.edu.ng (K.H. Tijani).

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infertile men at different age groups, while there was an inverse relationship between testicular volume and severity of oligospermia. This was, however, not directly linear as a mean testicular volume of 18–20 ml was associated with highest semen density. Volumes higher than 20 ml and lower than 18 ml were associated with reduced sperm density. There was also a sharp decline in sperm density when the mean testicular volume reduced from 14 ml to 13 ml. Severe oligospermia (<5 million/ml) was associated with mean testicular volume less than 12 ml.

Conclusion: Testicular volume on scrotal ultrasound correlates well with severity of oligospermia in men with sub-fertility. While the critical mean testicular volume necessary for adequate spermatogenesis has not been determined, it appears there is an optimal testicular volume of 18–20 ml at which spermatogenesis is at its peak in sub-fertile Nigerian men.

Introduction

Male infertility refers to the inability of a male to achieve a pregnancy in a fertile female [1]. Male infertility is commonly due to deficiencies in the semen quality.

The male factor plays a role in approximately 50% of infertility cases [1,2]. The testes are the central organs for male fertility. Traditional evaluation of testicular function has included clinical evaluation, semen fluid analysis (SFA), vasography, scrotal ultrasonography (scrotal US) and testicular biopsy [2]. However, unlike vasography and testicular biopsy, scrotal US is non-invasive with no risk to either the patient or physician. Scrotal US has since become the primary imaging modality in the evaluation of testicular function [2–5].

Scrotal US is used to evaluate testicular size and location in addition to detection of subclinical varicocele, which have been reported to be associated with testicular atrophy [6]. Assessment of testicular volume is also important as atypical dimensions have been reported to be present in as many as 64% of men with infertility [7].

Effective assessment of testicular size and atrophy in adolescents is done by comparing the differences in sizes between testicles on scrotal US [8]. Serial testicular volume assessment using scrotal US is also an effective means to assess improvement after varicocelectomy [8].

The testis has 2 main functions – an endocrine function to produce testosterone, responsible for the male secondary sexual characteristics including erection and the exocrine function to produce sperm cells. The Leydig cells are responsible for the former while the seminiferous tubules which constitute over 80% of testicular size are responsible for the later [3]. As a result an impotent man is more likely to have normal sized testes when compared with an infertile man.

While the semen analysis appears to be the cornerstone in the evaluation of testicular function, the testicular volume has long been associated with testicular function. However, racial variations in testicular volume do exist. The critical minimum testicular volume that guarantees adequate function is also yet to be clearly defined. This is a prospective study that evaluated the relationship between testicular volume and function using scrotal US in black West African men.

The objectives of this study were to determine and compare the mean testicular volume in fertile and sub-fertile Nigerian men and to assess the relationship between testicular volume and testicular function in sub-fertile Nigerian men.

Subjects and methods

The study was conducted at our centre, a tertiary medical institution located in an urban and cosmopolitan area in Nigeria.

The study was done over a period of one year (December 2009–November 2010) in which 136 patients diagnosed with male infertility were studied. Main inclusion criterion for the subjects was a history of infertility of at least 2 years duration and at least 2 consecutive SFA showing a sperm density less than 20 million/ml of semen [9].

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 within the last 2 years. Eleven of them also had an SFA available (which were normal) while in 89 it was based on history alone.

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

Assessment of testicular volume

Aloka Prosound SDD-3500 Plus, Japan 2005 scan machine with high resolution (7.5 MGHz) was used. Images with B mode USS were acquired in the longitudinal and transverse planes. The testicular length was measured on the longitudinal view while the antero-posterior (AP) and transverse diameters were measured on the transverse view. All the scans were performed by the radiologist (OBO).

Testicular volume was then calculated manually using the formula:

– length × AP diameter × transverse diameter × 0.71 [8].

Semen collection and assessment

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