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Sonographic Assessment of The Effect of Varicocele on Testicular Volume in Men With Infertility

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Abstract

Background: Infertility is a major cause of marital discord in Nigeria. Many physicians who manage male infertility patients believe that varicoceles are a major cause and that its repair will improve fertility. 80% of testicular volume is comprised of the seminiferous tubules, consequently, a testicular volume of infertile men with varicocele indirectly assesses the effect of varicocele on spermatogenesis.
Objective: The study was conducted to compare the testicular volume of infertile men with varicocele with infertile men without varicocele with the ultimate aim of knowing the effects of varicocele on infertility.
Methodology: This was a comparative cross -sectional study. Using consecutive sampling, seventy new male patients with infertility with abnormal seminal fluid parameters with or without varicocele presenting to urology division, University of Abuja Teaching hospital were recruited. The testicular volume of all the subjects were measured by gray scale ultrasonography after clinically grading those with varicocele. Collected data was analyzed using SPSS version 25.0. P-value ≤ 0.05 was considered statistically significant, and results were presented in tables, charts and graphs.
Results: There was a significant decrease in testicular volume and sperm count of infertile men with varicocele compared to those without varicocele. The mean testicular volume of those with varicocele was 6.42±2.04ml compared with mean testicular volume of 12.45+/-1.53ml in those without varicocele (p <0.001). Also, the mean sperm count of men with varicocele was 3.00±3.54ml compared with the mean sperm count of 6.73+/-2.30ml in those without varicocele (p <0.001)
Conclusion: Infertile men with varicocele had significant decrease in ipsilateral and total testicular size compared to those without varicocele and it has further authenticated the usefulness of testicular ultrasound in the assessment of patients with infertility.

Keywords: Infertility, varicocele, seminal fluid parameters, testicular volume, scrotal ultrasound scan.

Introduction

Infertility is the inability of sexually active, non-contracepting couple to achieve pregnancy in one year[1,2,3,4] and male infertility refers to the inability of a man to achieve a pregnancy in a fertile female.[5]
About 10-15% of marriages are infertile and, in at least 30% of the infertile marriages, the cause is found in the male.[4] Infertility is a major cause of marital discord in Africa because of the high premium placed on child bearing. Unfortunately, the blame is on the woman most times.[6]
Many physicians who manage male infertility patients believe that varicoceles are a major cause of male infertility and that its repair will improve fertility.[7] A varicocele is a vascular abnormality of the spermatic cord that is defined as dilated veins of the pampiniform plexus.[8] It is graded into sub-clinical and clinical groups; grades 0 to 3 depending on whether it is detected by Doppler ultrasound,

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palpable or visible.

There are several accepted theories on likely causes of varicocele. Though the exact mechanism is not yet known, the negative impact of varicocele on testicular size had been shown decades ago in both adolescents and adult males depending on its clinical grade. They are clearly associated with decreased testicular volume and subsequent impairment of testicular function.[9-11] However only clinically palpable varicoceles have been clearly associated with infertility.[10]

Scrotal ultrasound has since become a primary imaging modality in the evaluation of testicular function, and this study is therefore aimed at using it to assess the testicular volume of infertile men with or without varicocele.

Material and Methods

This descriptive cross-sectional comparative study was done within six (6) months from January to July, 2022, at the Departments of Surgery and Radiology, University of Abuja Teaching Hospital, Abuja Nigeria. Seventy consecutively selected male patients (thirty five infertile men with varicocele (case group) and thirty five infertile men without varicocele (control)) aged 29 to 52 years, were recruited for this study to determine the relationship between varicocele and testicular volume. Patients with any confounding factors such as orchitis, cryptochidism, disorders of sexual differentiation and previous testicular torsion or previous history of surgical intervention for varicocele were excluded from the study

All patients diagnosed with male infertility with abnormal seminal fluid parameters, defined in this study as sperm concentration less than 15million sperm cells/ml, with or without clinical varicocele were recruited for this study from the Urology clinic and General Outpatient Department (GOPD) and their information entered into a proforma. A detailed physical examination was carried out to rule out co-founding factors such as orchitis, Cryptochidism, Previous testicular torsion, Disorders of sexual differentiation and to clinically diagnose and grade the varicocele.

The procedure was explained in detail to the patients at enrolment. After obtaining an informed consent, they were assessed with colour Doppler ultrasound scan machine (Logic F8 expert GE (General Electric, USA 2016) using high frequency linear transducer with frequency range of 5 to 12mHz. The study was performed with patients in supine position, and scrotum in normal anatomical position.

Following the application of ultrasound coupling gel to the scrotum, the scan of the testicles was done on gray scale mode for the determination of testicular volume. The scan was done in two planes (transverse and longitudinal planes) and testicular volume was automatically generated by the software of the ultrasound machine after measuring the length, height and width of the testicles. Ultrasononography (US) measurement of the testicular volume was done twice and the average taken. Total testicular volume (sum of right and left testes) determined and mean total testicular volume calculated.

The biodata, duration of infertility, history of previous pregnancy by their wives, presence of co-morbidity, social habits, physical examination and scrotal USS findings were entered into a structured proforma designed for the study, using Microsoft excel software.

Ethical Consideration

Approval for the study was obtained from the Health Research ethics committee of University of Abuja Teaching Hospital, Abuja (PROTOCOL NUMBER: UATH/HREC/PR/2020/007/013. Informed consent was obtained from all patients who met the criteria for this study, and anonymity was strictly adhered to in order to maintain high level of confidentiality.

Data Analysis

The collected data were analyzed using Statistical Package for Social Science (IBM SPSS) version 25. The results were reported as mean ± (SD). Chi-square and Student t test were used to determine the association between variables. All test of significance were two-tailed, and P-values < 0.05 were considered statistically significant.

Results

A total of 70 men with infertility were evaluated over a period of 6 months. The age range was 29-52 years with a mean age of 44.63±6.39 for those with varicocele and 46.03±6.47 for those without

varicocele. Most of the subjects were in the 41-50 year age group and the least were those in 51-60 year age group as shown in table 1. There was no statistically significant difference between the age distribution of the 2 groups (those with varicocele and those without varicocele). Greater number of our subjects (29%) were traders, and more than half (54%) of the subjects had secondary school. The occurrence of varicocele was not significantly associated with level of education of patients (P= 0.918) nor with their BMI (P= 0.73), (see table 2).

There was no significant association established between consumption of alcohol and varicocele (P= 1.198) but hypertension, diabetes and cigarette smoking had strong correlation with varicocele , p = 0.003, 0.024 and 0.003 respectively (table 3).

Most of the patients with varicocele in this study had grade 2 varicocele, followed by grade 3 and then grade 1. This is depicted in figure 1. The infertile patients with varicocele had significantly reduced testicular volume with a mean volume of 6.42ml (Figure 2) as against infertile men without varicocele whose mean testicular volume was 12.45 ml. Also, the seminal fluid analysis was adversely affected by varicocele. The observed difference between these groups of patients was significant (P< 0.001), as depicted in table 4.

Table 1: Socio-demographic characteristics of the patients

Variables	Varicocele n=35(%)	No Varicocele n=35(%)	χ^2	*p-value*
Age in years (mean±SD)	44.63±6.39	46.03±6.47	-0.508**	*0.645*
Age category (years)				
20 – 30	2 (2.9)	0 (0)	1.420	*0.847*
31 – 40	15 (21.4)	7 (10)		
41 – 50	17 (24.3)	19 (27.1)		
51 – 60	1 (1.4)	9 (12.9)		
Occupation				
Civil servant	11(31.4)	8(22.9)	1.481	*0.687*
Farmer	5(14.3)	7(20.0)		
Trader	11 (31.4)	9(25.7)		
Artisan	8(22.9)	11 (31.4)		
Level of Education				
None	2 (5.7)	1 (2.9)	0.505	*0.918*
Primary	7 (20.0)	7 (20.0)		
Secondary	18 (51.4)	20 (57.1)		
Tertiary	8 (22.9)	7 (20.0)		

X^2 = Chi square test
**t-test
**p-value: significant at <0.05*

Table 2: Relationship between Anthropometric characteristics of the patients and Varicocele

Variables	Varicocele n=35(%)	No Varicocele n=35(%)	t-test	*p-value*
Height in meters (mean±SD)	1.65±0.79	1.65±0.81	-0.534	*0.595*
Weight in Kg (mean±SD)	69.38±15.38	69.13±12.02	0.076	*0.940*
BMI (mean±SD)	25.51±5.15	25.15±3.46	0.343	*0.733*

Table 3: Association between Relevant Medical History of the Patients and Varicocele

Variable	Varicocele	No Varicocele	χ^2	p-value
Hypertension	6 (8.6)	18 (25.7)	9.130	0.003
Diabetes	1 (1.4)	7 (10)	5.081	0.024
Alcohol	1 (1.4)	5 (7.1)	2.917**	1.198
Smoking	2 (2.9)	12 (17.1)	8.929	0.003

χ^2 = Chi square test **Fisher's Exact Test
**p-value: significant at <0.05*

Table 4: Association between Testicular Volume and Seminal Fluid analysis and Varicocele

Variable	Varicocele (mean±SD)	No Varicocele (mean±SD)	t-test	*p-value*
Left testicle (ml)	6.41±2.29	12.47±1.75	-12.285	*<0.001**
Right testicle (ml)	6.42±2.43	12.25±1.55	-11.818	*<0.001**
Total volume (ml)	12.83±4.09	24.53±3.20	-13.265	*<0.001**
Mean volume (ml)	6.42±2.04	12.45±1.53	-13.943	*<0.001**
Seminal fluid volume (ml)	1.55±0.50	1.95±0.72	-2.663	*0.010**
Sperm count ($X10^6$)	3.00±0.54	6.73±2.30	-5.222	*<0.001**

**p-value: significant at <0.05*

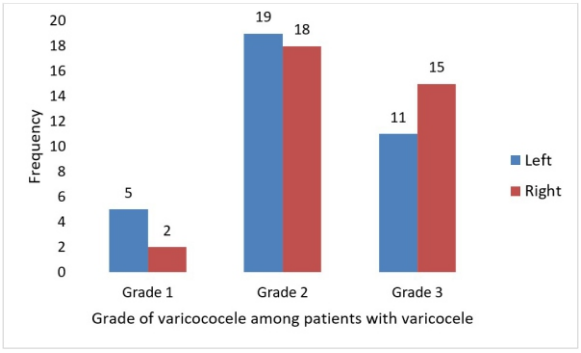

Figure 1: Grade of varicocele among the patients

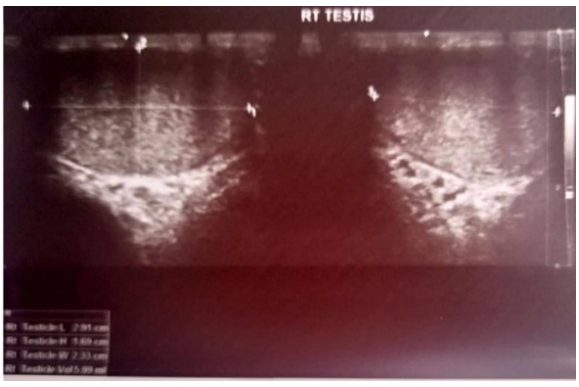

Figure 2: Gray scale ultrasound image of a patient with varicocele and testicular atrophy with testicular volume of 5.9cm^3

Discussion

The mean age of the subjects was 44.6 years in this study. This is higher than the mean age of 39 years observed by Manuel and colleagues in a study in Southeast Nigeria[12] and 36.8years by Tijani and colleagues in Lagos Nigeria.[13] Most studies had the mean age fall into reproductive age group and it is not out of place since they are the ones that present to fertility clinic. In this study, most of the patients were in the age range of 41-50 years but any age can be affected as pathogenesis of varicocele is not age dependent.

The testicular volume comprises of approximately 80% of seminiferous tubules and germ cells at various stages of development. Any reduction in testicular volume invariably affects spermatogenesis and consequently may result to infertility.[7] Estimated 30-50% of men with primary infertility have varicocele as it is associated with smaller ipsilateral testis.[11] In this study, the infertile men with varicocele had average testicular volume of 6.5ml which adversely affected spermatogenesis and therefore confirms the submission of other authors.[6,8] The assessment of testicular volume is therefore key in assessing men with infertility as testicular volume is an index of spermatogenesis.

There is fair representation of the various ethnic groups in the study thus eliminating the possibility of ethnic influences in the development of varicocele, reduction in testicular volume and then male infertility. The observation supports the cosmopolitan representation of the patients that were examined. In the same vein, there was also no significant association between varicocele and ethnicity which concurred with the study of Witt and Lipshultz.[14]

The majority of our patients (54%) attained secondary education and the observation is consistent with the study of Manuel and colleagues, where majority of their patients (68%) also had secondary education.[12] In this study, 27% of the patients were gainfully employed as Federal Civil Servants and it is not surprising as the study centre is in the federal capital territory. In a similar study by Manuel and colleagues[12] majority (72%) of the patients were employed as unskilled workers but the index study did not show any association between occupation, economic status or affluence with the incidence of varicocele/infertility.

Nine percent of volunteers admitted taking significant quantity of alcohol while 20% gave history of tobacco use. This is in contrast to the finding of 13% history of alcohol and not alluded to use of tobacco by Nwajiaku and colleagues in a study at Nnewi, South East Nigeria where they looked at the prevalence, clinical pattern and major causes of male infertility.[6] The difference in the findings may lie in the environments where the studies were carried out. Open display and consumption of alcohol in the northern part of Nigeria is quite uncommon due to religious views unlike the southern part of Nigeria where moderate alcohol consumption by adults is not frowned at. Smoking in northern part of Nigeria is common unlike in Southern part of the country and this might be the reason for the difference in both studies. In the index study also, there was significant association between smoking and varicocele and by extension infertility, and this is in-tandem with the submission of other authors.[12,15] However no significant relationship was established between alcohol consumption and varicocele. This is at variance with the findings of Okonofua and colleagues[16] that established a positive association between male infertility and heavy alcohol consumption. This observation could be accounted for by smaller sample size used in the index study which subsequently could be improved upon in future studies.

There was equal distribution of clinical varicocele on both sides of the study. This is in contrast to submission by Gat and colleagues where left sided varicocele predominate (71%)[17] and also at variance with findings of Dubin and colleagues where bilaterality of 30.7% of varicocele was documented.[10] The sample size and demographics of the study population may account for this dichotomy.

In the index study also, most of the patients had grade 2 varicocele. However Jonathan Jarrow's study on effects of varicocoele on male fertility suggested that varicocele size does not have prognostic value.[8] Kass and colleagues however submitted that the effect of varicocoele on testicular volume worsens with the grade.[18]

The mean testicular volume for infertile men with varicocele was 6.42ml. This is in contrast to the findings of a mean testicular volume of 10.2ml by

Mbaeri and colleagues[19] and 19.9ml by Tijani and colleagues in Lagos among normal individuals.[13] The result of this study is also different from those of other studies where a volume of 20ml was obtained from Caucasians and blacks.[20,21] Early presentation to the hospital may account for the discrepancy as the effect of varicocele on testicular volume is progressive. In our setting, infertility is always assumed to be due to female factors and men hardly present in good time as against what is obtainable in other climes.

The mean testicular volume of infertile men without varicocele was 12.45ml. This agrees with finding of average testicle volume of 12.5 - 19ml by earlier researchers.[22] This shows that testicular volume is greatly affected by varicocele. This corroborated the observation of many researchers, indicating that male factors contributed largely to infertility as reduced testicular volume occasioned by varicocele in the study has a direct relationship with spermatogenesis.

There was a significant decrease in testicular volume of infertile men with varicocele compared to those without varicocele in the index study. Previously, Lipshultz and Corrierre observed progressive testicular hypotrophy in patients with varicocele compared with healthy controls[23] while Jarrow observed that 50% of infertile patients with unilateral varicocele have ipsilateral testicular atrophy[8] and these observation are consistent with the outcome of our study.

Limitations of the study

Diagnosis of varicocele was made by physical examination (using Dubin grading system) which has limitations. Comparison with duplex Doppler ultrasound assessment should be adopted in future study to improve the efficiency of the clinical grading of varicocele.

Conclusion

The study showed that men with varicocele had significantly reduced testicular volume and reduced sperm count with consequential effects on their fertility status. This has further re-echoed the usefulness of testicular ultrasound in the assessment of men with infertility with the aim of detecting early atrophic changes and institution of prompt management to avert irreversible testicular damage.

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