Bioscience Research Communications
Vol. 15, No. 1, February 28, 2003
Printed in Nigeria

0795-8072/2003 $12.00 + 0.00

BRC 2002032/15107

Sexually transmitted diseases and male infertility in the Nigerian

Mabel A. Charles-Davies and B. O. Osotimehin

Endocrine Unit, Department of Chemical Pathology, University College Hospital, Ibadan, Nigeria.

(Received May 10, 2002).

ABSTRACT: Infection related infertility is common in Nigeria. The study was designed to evaluate the involvement of sexually transmitted diseases (STDs) in the pathogenesis of male infertility. One hundred and eighty-two male subjects aged 18-56 years were investigated-fertile (85), infertile (50), men with STDs (47). Semen was analysed according to WHO guidelines and appropriate statistical tests performed.

Over 65% of subjects with STDs had gonorrhea and non-specific urethritis(NSU). More than two-thirds of STDs subjects (76.4%) were dyspermic and oligospermia was most frequently observed in infertile subjects (30%). Sperm count, percentage motility and morphology were significantly lower in infertile than fertile controls ($P<0.001$) while percentage motility was significantly lower in men with STDs than fertile controls ($P = 0.005$).

Gonorrhea and NSU are still prevalent in the Nigerian society. STDs may cause infertility in the African male by reducing sperm motility and semen volume.

Keywords: Sexually transmitted diseases, male infertility, seminal analysis.

Introduction

Africa has a strong traditional heritage and marriage in her socio-cultural context is primarily for procreation (1). There is therefore, a great deal of pressure on married couples to perform this social obligation fairly early in matrimony. Failure to achieve this is a social stigma often associated with considerable emotional stress, marital instability, divorce, separation, higher risk of having more sexual partners or acquisition of other wives (2,3). Consequently, couples intending to get married ensure that their partners can procreate before marriage is conducted. This is evident in the incidence of 65.5% pre-marital conception in married couples in the Nigerian Igbo experience – in a society where chastity before marriage was 'highly priced' (4).

Correspondence to: Charles-Davies, M.A.; Immunoassay Laboratories, 31 Glover Street, Ebute-Metta, Lagos, Nigeria.

Infertility affects 10% of couples in Africa. It is a major medico-social problem accounting for 40% of out-patient gynaecological consultations in Nigeria (3,5). The evaluation of the infertile couple hence, remains a continuing challenge to the practising doctor in this part of the world (5).

In most societies, infertility is perceived as a female issue. The male role is often neglected as most cultures equate sexual potency with normal male fertility. Only recently has the potent male been considered a possible cause of infertility in a couple (2).

In the past, the contribution of the males to infertile marriages was assessed to be about 16.4%. It is now estimated from clinical reports that 40-45% of clinical infertility is male factor dependent (7). Bornman et al (8) observed as much as 70% male factor contribution in their study of 1726 infertile African men in South African Andrology clinic.

In developing countries, poverty and infections are common place (1). Sexually transmitted diseases (STDs) are said to be highly prevalent (9) and infection related infertility, common in Africa (10).

This study was undertaken to evaluate the involvement of sexually transmitted diseases (STDs) in the pathogenesis of male infertility. This is an approach towards a better understanding of the pathogenesis of male infertility, which will inform new strategies in infertility management and explain the increasing rise in male infertility.

Materials and Methods

Subjects

A total of 182 African male subjects aged between 18 and 56 years participated in the study. 85 were fertile males with satisfactory semen profile, 50 recruited from both Urologic and Gynaecologic Clinics of the University College Hospital, Ibadan, Nigeria (UCH) were infertile for at least one year while 47 had incontrovertible evidence of STDs. Out of the 50 infertile men, 13 were normospermic while 37 were dyspermic. All subjects gave informed consent. Both fertile and infertile had no STDs while the STDs group was investigated before treatment.

Sample Collection

Semen was obtained from the subjects by masturbation after abstinence from sexual relations for 3 days and analysis performed biophysically according to World Health Organisation guidelines (11). White blood cells and pus cells/high power field were scored as: 1 = 1-4 cells; 2 = 5-9 cells; 3 = 10 and above; 4 = Numerous. Urethral swab for microbiological analysis was collected from urethra of each male subjects by rotating swab approximately for 5 seconds after inserting 2 to 4cm into the urethra.

Diagnosis of STDs

All STDs diagnosis were made first on clinical grounds at the STDs clinic at the UCH and confirmed by laboratory tests except for lymphogranuloma venereum, genital wart, herpes, genital ulcers and tinea cruris which were diagnosed on clinical grounds only (12, 14).

Statistical Analysis

Statistical analysis was carried out by means of computer statistical soft ware-Epi-info 6.02. Student's t-test (unpaired) used for comparison of means while Chi-square test (X^2) was used to test statistical association between variables.

Results

Sexually Transmitted Diseases

Men in the STDs group had various sexually transmitted diseases namely, gonococcal urethritis, non-specific urethritis, herpes genitalis, genital ulcer, genital wart, candidal urethritis and tinea cruris (Table 1). Gonococcal and non-specific urethritis were the most common findings representing about thw-thirds of total diagnosis made.

Biophysical Analysis of Semen

Sperm count of men in the various groups – fertile, infertile and the STDs groups are shown on Table 2. All subjects in the fertile group were normospermic. In the infertile group, about a third (30%) of subjects were oligospermic, 26% were normospermic, 14% were hypospermic, 20% were azoospermic while the last 10% had varying other forms of dyspermia. 73.4% of oligospermic infertile men had problems with sperm motility and/or morphology (Table 3).

35.4% of STDs subjects were hypospermic and only 23.6% were normospermic. The remaining 41% had various other forms of dyspermia (Table 2).

Oligospermia was most frequently observed in infertile subjects in this study while hypospermia was observed most frequently among STDs subjects. More than two-thirds of STDs subjects (76.4%) were dyspermic (Table 2).

Seminal biophysical indices of men in fertile, infertile and STDs groups are tabulated on Table 4. Sperm count, percentage with normal morphology, seminal volume, white blood cells and pus cells were not significantly different between STDs subjects and their fertile controls ($P>0.05$). However, percentage with normal motility differed significantly between men with STDs and fertile controls – the later being higher than the former ($P = 0.005$) (Table 5). Concentration, % normal morphology and % motility were significantly lower in infertile than fertile men (Table 6). Similarly, dyspermic infertile men had lower semen concentration, % motility and % normal morphology than fertile men ($P>0.05$; Table 7). No significant differences ($P>0.05$) were observed in seminal volume, white blood cells and pus cells between infertile men and fertile controls (Table 4). Similar observations were made between normospermic and dyspermic infertile men ($P>0.05$).

Table 1: Aetiological classification of men with STDs

A	**CS (sub-group) (n = 17)**	**C group (n = 47)**
Gonococcal urethritis	6(35.3)	18(38.2)
Non-specific urethritis	7(41.2)	13(27.7)
Herpes genitals	2(11.8)	4(8.5)
Genital ulcer		4(8.5)
Genital wart	1(5.9)	5(10.6)
Candidal urethritis		1(2.1)
Tinea cruris	1(5.9)	2(4.3)

C = Total men in STDs group; CS = men in STDs group from whom semen was obtained for analysis; values are in proportions with percentages in parentheses; n = number of subjects.

Table 2: Classification of fertile, infertile and STDs subjects based on their seminal characteristics.

Sperm Count	**Groups**		
	Fertile (n = 85)	**Infertile (n = 50)**	**STDs (n = 17)**
Normospermis	85(100)	13(26)	4(23.6)
Azoospermia		10(20)	1(5.9)
Oligospermia		1(2)	1(5.9)
Asthenozoopermia		1(2)	
Incomplete liquefaction		2(4)	1(5.9)
Hypospermia		7(14)	6(35.4)
Hyperspermia		1(2)	1(5.9)
Abnormal appearance			1(5.9)
Aspermia			1(5.9)

Values are in proportion; n = number of subjects; percentages in parentheses.

Table 3: Sub-classification of oligospermic subjects in infertile men, based on their seminal characteristics.

Sperm Count	**B group (n = 15)**
Hypospermia (H)	3(20)
Asthenozoopermia (S)	1(6.7)
Asthenosteratozoospermia (ST)	4(26.7)
Teratozoopermia (T)	1(6.7)
H and T	1(6.7)
H and ST	4(26.7)
Hyperspermia	1(6.7)

B = infertile men; values are in proportions with percentages in parentheses; n = number of subjects.

Table 4: Statistical comparison of characteristics (using ANOVA) between fertile, infertile and STDs groups.

	Fertile (n = 85)	**Infertile (n = 50)**	**STD (n = 16)**	**F**	**P**
Volume (mls)	3.0(0.1)	2.6(0.3)	2.4(0.5)	1.848	0.160
Sperm count (10^6/ml)	67.9(2.1)	37.7(5.8)	76.5(13.4)	16.108	0.0001+
% Normal Morphology	78.3(1.11)	48.4(5.0)	75.3(5.6)	26.799	0.0001+
% Normal Motility	79.3(1.4)	41.5(4.7)	67.2(6.6)	48.340	0.0000+
WBC				4.609	0.1
0	39(45.9)*	26(52)*	5(31.3)*		
1	16(18.8)*	13(26)*	3(18.8)*		
2	29(34.1)*	11(22)*	6(37.5)*		
3	1(1.2)*	0(0)*	0(0)*		
4	0(0)*	0(0)*	2(12.5)*		
Pus Cell				0.602	0.74
0	40(47.1)*	21(42)*	7(43.8)*		
1	15(17.6)*	15(30)*	3(18.8)*		
2	28(32.9)*	9(18)*	2(12.5)*		
3	2(2.4)*	2(4)*	4(25.0)*		
4	0(0)*	1(2)*	0(0)*		

A = fertile group; B = infertile group; C = STDs group; values are in mean with standard error in parentheses; n = number of subjects; * = proportions in percentages parentheses; + = Significant; P = probability.

Table 5: Statistical comparison of seminal characteristics between fertile controls and STDs subjects using (Student's t-test).

	Fertile (n = 85)	**STDs (n = 16)**	**t**	**p**
Sperm Count (10^6/ml)	67.9(2.1)	76.5(13.4)	1.1637	0.246
% Normal Morphology	78.3(1.11)	75.3(5.6)	0.839	0.59
% Normal Motility	79.3(1.4)	67.2(6.6)	2.888	0.005+

Values in mean with standard error in parentheses; n = number of subjects; + = significant; p = probability.

Table 6: Statistical comparison of seminal characteristics between fertile and infertile groups (using Student's t-test).

	Groups			
	Fertile (n = 85)	**Infertile (n = 50)**	**t**	**p**
Sperm Count (10^6/ml)	67.9(2.1)	37.7(5.8)	5.775	0.000+
% Normal Morphology	78.3(1.11)	48.4(5.0)	7.173	0.000+
% Normal Motility	79.3(1.4)	41(4.7)	10.06	0.000+

Values in mean with standard error in parentheses; n = number of subjects; + = significant; p = probability.

Table 7: Statistical comparison of seminal characteristics between normospermic and dyspermic infertile males (using Student's t-test).

	Infertile males			
	Normospermic (n = 13)	**Dyspermic (n = 37)**	**t**	**P**
Sperm Count (10^6/ml)	66.7(5.32)	27.5(6.8)	3.176	0.002+
% Normal Morphology	81.2(3.0)	36.9(5.5)	4.554	0.001+
% Normal Motility	71.9(6.1)	30.8(4.8)	4.312	0.000+

Values in mean with standard error in parentheses; n = number of subjects; + = significant; p = probability.

Discussion

Sexually transmitted diseases are said to be epidemic throughout most of the world (13) and constitute a major health problem in Africa (9, 14). In this study, gonococcal and non-specific urethritis were the most common findings of the total diagnosis made (Table 1). Similar observations were made by other investigators in sub-Saharan Africa (14).

The significance of the role of a sub-clinical genital tract infection in infertility is controversial. In the majority of male infertility investigations, the patient is asymptomatic. However, STDs have been linked to infertility by clinical and epidemiological studies and studies of subjects with post infection are well documented (13, 15). In sub-Saharan Africa, the role of STDs in male infertility has been demonstrated (9,16). These workers postulate that STDs retrograde into the testicular accessory organs leading to post inflammatory obstruction possibly atrophy or may secrete toxins, which alter the spermatozoal characteristics and this can cause infertility (13,16). Cates et al (10) observed that 35% infertility is related to infection in Africa.

Semen analysis begins the evaluation of the infertile couple and has been used routinely in infertility clinics in the world to assess the fertility of the males (17). Sperm counts, the percentage of motile and normally formed sperm, and the quality of sperm motions are essential components of semen analysis (7).

Men with STDs in the present study had poor sperm count. Only 23.6% were normospermic. Hypospermic was the most frequent cause of dyspermia affecting 35.4% of men with STDs (table 2). The dyspermia observed in most subjects with STDs may possibly be as a result of genitalk tract infection. Fertility may then be affected through the impairment of semen quantity and quality. Alemnji and Thomas (16) and Ekwere (9) in related studies observed significant involvement of bacterial infection of the genital tract of infertile Nigerian subjects. Reduction in semen volume can impair fertility by reducing the total sperm production of the testes. Moreover, Overstreet and Katz (18) reported that alterations in semen volume per se (independent of sperm numbers) below 1ml appear to affect fertility.

Comparison between men with STDs and fertile subjects did not reveal any significant differences in semen volume, sperm count and sperm morphology ($P<0.05$). Soffer et al (19) demonstrated that infection was unrelated to accessory gland evaluation or semen quality. However, percentage motility was the only seminal index that differed significantly between men with STDs and fertile controls in this study (the later being higher than the former, $P = 0.005$). It is likely that the involvement of infection of the genital tract in infertility may be through the impairment of sperm function i.e. lowering the motility of sperm. Ladipo et al (20) observed that the sperm motility index is by far the most important parameter in determining semen quality and can be a strong compensating factor when sperm count is low (<20 million/ml).

Akande (21) observed that low concentration of sperm in semen could result in infertility while Obafunwa et al (22) observed varying degrees of hypospermatogenesis in 40% of testicular biopsies of infertile men. Similarly, in the present study, oligospermia was most frequently demonstrated in infertile males representing 30% of men studied in this group. 74.3% oligospermic infertile men in this study had oligoasthenozoospermia and/or oligoteratozoospermia. Similar findings were made by Charvaria et al (23). Idiopathic oligoasthenozoospermia was demonstrated as the highest cause of infertility in their study.

Sperm count per se is a relatively insensitive indicator of infertility. Men with low sperm counts (10×10^6/ml) may be fertile. Thus relatively low numbers of functional sperm cells ($<5 \times 10^6$/ml) are adequate for fertility. However, the chances of initiating pregnancy declines as the sperm count decreases from 20 to <5 million/ml (17,18).

Only motile sperm are able to penetrate through cervical mucus, migrate through the reproductive tract, penetrate the zona of the ova, and achieve fertilization. Morphology on the other hand is an important factor in semen analysis because it is a reflection of spermatogenic development (17). Semen volume is important in assessing the total sperm production by the testes (18). Sperm count, percentage morphology and percentage motility were significantly lower in infertile than fertile men ($P<0.000$, Table 6) in the present study. Similarly, within the infertile group, normospermic infertile men had significantly higher sperm count, percentage motility and percentage morphology than infertile subjects with dyspermia ($P<0.001$, Table 7). These findings accord those reported by Ladipo et al (20) thus suggesting that these three parameters are predictive of male infertility. Sperm morphology is regarded as a significant prognostic factor for fertilization and pregnancy outcome in assisted reproductive settings. It is said to be the most significant predictor of sperm-zona binding in hemi-zona assays. On the other hand, curvilinear velocity and hyperactivated motility were significant predictors of successful zona binding after separation of the motile sperm fraction (24). Ilesanmi et al (7) demonstrated a positive correlation between sperm density and percentage of motile sperm. Katz et al (25) indicated that sperm with abnormal morphology are more likely to be immotile, and if motile, to swim slower than normal sperm. Conversely, in the present study, comparisons in seminal volume between infertile and fertile controls did not show any significant difference ($P>0.05$), Table 6). Neither was there any significant difference between normospermic and dyspermic infertile men ($P>0.05$; Table 7). Similar observations were made by other investigators in the same geographical sub-region (20, 26).

Traditionally, the diagnosis of genital tract inflammation has been made through the evaluation of leukocytes in the seminal fluid (13). The prevalence of leukocytospermia among fertile patients is approximately 10% to 20%. Controversy exists in the significance of WBC in semen. WBC numbers were found higher in infertile patients than fertile men and have been observed in association with decreased sperm numbers and impaired motility (27). In this study, the incidence of men with leucocytospermia was high. 47.1%, 42% and 43% of men in fertile, infertile and STDs groups respectively have WBCs in their semen (Table 4). Comparison between fertile, infertile and STDs groups in WBCs did not show a significant difference ($P>0.05$). Further comparison between normospermic and dyspermic infertile men

similarly showed no significant difference (P>0.05). It appears that WBCs in semen is not an indication of current STDs or infertility. Moskowitz and Mellinger (13) reported that an increased number of seminal leukocytes is specific for neither infertility nor infection.

Tomilson et al (28) had similar observations and suggested that measurement of seminal leukocytes in routine semen analysis appears to be of little prognostic value with regard to male fertilizing potential. Wolff observed that approximately 80% of leukocytospermic semen samples are microbiologically negative. *Chlamydia trachomatis* was presumed to trigger a persistent inflammatory reaction leading to leukocytospermia (27).

In conclusion, gonorrhoea and NSU are still prevalent in the African society and were the major infections in men attending the STDs clinic in this study. STDs appear to affect fertility by impairing seminal volume and percentage motility. Seminal analysis may be a more objective method of assessing male infertility. Sperm count, percentage motility and percentage morphology appear to discriminate between pathologic and normal semen. Thus, the cause of infertility appear to be testicular through the impairment of spermatogenesis while the contribution of STDs to infertility may be post testicular through the impairment of sperm function. Leukocytospermia may not be related to infection or infertility since they did not show any significant differences in comparisons between infertile men, men with STDs and fertile controls (P>0.05).

References

1. Leke, R.J.; Oduma, J.A.; Bassol-Mavagoitia, S.; Baclia, A.M.; Grigor, K.M.(1993). regional and geographical variations in infertility: effects of environmental, cultural and socio-economic factors. Environmental Health Perspectives; 101 Suppl. 2: 73 – 80.
2. Ladipo, O.A.; Osoba, A.O. (1978). Ureplasma Urealyticum (T. mycoplasma) and male infertility in tropical countries. Afr. J. Med. Sci.; 7: 187 – 190.
3. Favot, I.; Ngalula, J.; Mgalia, Z.; Klokke, A.H.; Gumodoka, B.; Boerma, J.T. (1997). HIV infection and Sexual behaviour among women with infertility in Tanzania, a hospital-based study. Int. J. Epidemiol. 26: 414 – 419.
4. Meniru, G.I. (1996). Pre-marital conception in married couples: the Nigerian Igbo experience. West Afr. J. of Medicine; 15: 177 – 80.
5. Ilesanmi, A.O.; Adeleye, J.A.; Osotimehin, B.O. (1995). Comparison of single serum progesterone and endometrial biopsy for confirmation of ovulation in infertile Nigerian women, African Journal of Med. Med. Sci.; 24: 97 – 101.
6. Ojo, O (1968). Male factor in infertile marriages in Nigeria. W. Afr. Med. J.; 17: 210 – 211.
7. Ilesanmi, A.O.; Omonriah, W.; Bankole, A.; Ojengbede, O.A. (1996). The semen of infertile Nigerian men. A statistical analysis of 1662 cases. Afr. J. Med. Med. Sci.; 25: 195 – 202.
8. Bornman, M.S.; Schulenburg, G.W.; Boomker, D.; Chauke, T.R.; Reif, G. (1994). Observations in infertile African males at an Andrology clinic in South Africa. Archives of Androl.; 33; 101 – 104.
9. Ekwere, P.D. (1995). Immunological infertility among Nigerian men: incidence of circulating antisperm auto-antibodies and some clinical observations: a preliminary report. Br. J. Urol.; 76: 366 – 370.
10. Cates, W.; farley, T.M.; Rowe, P.J. (1985). Worldwide patterns of infertility. Is Africa different? The Lancet; 2: 596 – 598.
11. World Health Organisation Laboratory Manual for the Examination of Human Semen and Semen-cervical Mucus Interaction. 4th edition. Cambridge University Press, 1999.
12. Arya, O.P.; Osoba, A.O.; Benett, F.J. (1988). Tropical Venereology, 2nd Ed. Edinburgh, Churchill Livingstone Inc., 370.
13. Moskowitz, M.O.; Mellinger, B.C. (1992). Sexually Transmitted Diseases and their relation to Male Infertility. Urologic Clinic of North Amer.; 19: 35 – 45.
14. Ekweozor, C.C.; Olaleye, O.D.; Tomori, O.; Saliu, I.; Essien, E.M. (1994). HIV infection and additional dimension. Afr. J. Med. Sci.; 33: 363 – 367.
15. Gilbaugh, J.H.; Lipshultz, L.I.(1994). Non-surgical treatment of male infertility. An update. urol. Clin. North Am.; 21: 531 – 548.
16. Alemnji, G.A.; Thomas, K.D. (1997). Sociological Status of Nigerian males with Primary and Secondary Infertility. East Afr. Med. J.; 74(8): 519 – 522.
17. Bar-Chama, N.E.; lamb, D.J. (1994). Evaluation of sperm function – What is available in the modern Andology laboratory. urol. Clin. North Am.; 21: 433 – 446.
18. Overstreet, J.W; Katz, D.F. (1987). Semen Analysis. Urol. Clin. North Am.; 14: 441 – 449.

19. Soffer, Y.; Ron-El, R.; Golan, A.; Herman, A.; Capsi, E.; Samra Z.(1990). Male genital mycoplasma and Chlamydia trachomatis culture: its relationship with accessory gland function, sperm quality and autoimmunity. Fertil. Steril.; 53: 331 – 336.
20. Ladipo, O.A.; Olatunbosun, D.A.; Ojo, O.A. (1978). Biophysical and Biochemical analysis of semen in fertile and infertile Nigerian males. Int. J. Gynaecol. Obstet.; 16: 58 – 60.
21. Akande, E.O. (1986). Problems of infertility in sub-Saharan Africa. Dokita; 16: 23 – 27.
22. Obafunwa, J.O.; Elesha, S.O.; Odunjo, E.O. (1993). Morphological changes found in the testis of 177 Nigerian males investigated for infertility. Afr. J. Med. Sci.; 22: 35 – 40.
23. Chavarria, E.; Reves, A.; Carrera, A.; Aquilera, G.; Rosado, A.; Velchuis, I.D. (1995). Kinetic study of pulsatility of gonadotropin and testosterone secretion in normospermic fertile and infertile men with idiopathic oligo-asthenozoospermia. Ginecogia obstetricia de Mexico; 63: 74 – 89.
24. Franken, D.R. (1999). Sperm Functional Assays. WHO Semenology Workshop, Tygerberg Hospital, South Africa; 26 – 43.
25. Katz, D.F.; Diel, L.; Overstreet, J.W. (1982). Differences in the movements of morphologically normal and abnormal human seminal spermatozoa. Biol. Reprod.; 26: 566 – 570.
26. Adejuwon, C.A.; Ilesanmi, A.O.; Ode, E.O.; Akinlade, K.S. (1996). Biophysical and Biochemical Analysis of Semen in Infertile Nigerian Males. Afr. J. Med. Med. Sci.; 25: 217 – 219.
27. Wolff, H. (1995). The biologic significance of white blood cells in semen (Review). Fertil. Steril.; 63: 1143 – 1157.
28. Tomilson, M.J.;Barratt, C.L.; Cooke, I.D. (1993). Prospective study of leukocytes and leukocyte sub-populations in semen suggests they are not a cause of male infertility. Fertil. Steril.; 60: 1069 – 1075.