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Research Article

Seroprevalence of *Treponema pallidum*, HIV- Co-Infection, Cognitive Effects and Risk–Variables for Infection in a Tertiary Psychiatric Hospital in Nawfia, Nigeria

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Abstract

Background:*Treponemapallidum* and Human Immunodeficiency Syndrome infections can initiate psychosis.

Method: A cross- sectional study on sero-prevalence of *Treponema pallidum*, HIV- co-infection, cognitive effects and infection risk – variables was conducted on 154 mentally ill patients, eighty males and seventy-four females, age-range, 18-75 years old in psychiatric hospital Nawfia. Ethical approval was obtained. Subjects were recruited with the (DSM-IV-TR) criteria for dementia. Psychiatric condition was re-evaluated with (MMSE) tool and data collected with psychiatric assessment screening tool. Venereal disease was screened with VDRL kit, syphilis with *T. pallidum* immunochromatographic kit, confirmed with TPHA ELISA passive haemagglutination method. HIV antibodies were screened using parallel testing, confirmed with CD4+ western-blot method and statistics analyzed with SPSS version 23.

Results: Results revealed that males tested positive to *Treponema pallidum*(66.7%) than females (33.3%) with 3(100.0%) positives in total and 31-50 years old had the highest prevalence (66.7%). More subjects had severe cognitive impairment (51.1%) with (66.7%) of them (HIV-1 +; TPHA +), and (33.3%) (HIV-1 - ; TPHA +), (P = 0.010) between both statuses. For mild cognitive status, (6.8%) were (HIV+; TPHA-), (P= 0.001).Comparing screening and confirmatory tests showedlowerpositives with VDRL (1.3%) than TPHA kit (1.9%) (P= 0.001). Positive status for HIV screening and confirmatory methods were the same (8.4 %). Association between risk-factors and syphilisstatuses showed significant associationwith being HIV positive, spousal status (P= 0.01) andnot visitingprostitutes (P = 0.03), highest prevalence observed in Anambra state origins, Igbos, school drop-outs, non-condom users, and not having untreated sexually transmitted disease (100.0%).

Conclusion:*T. pallidum* and co-HIV infection in Nawfia psychotic patients encouraged more of severe cognitiveimpairment requiring awareness and prompt treatment.

Keywords: Seroprevalence;*Treponema Pallidum*; HIV- Co-infection; Cognitive; Psychiatry; Nawfia

Introduction

In the last decade, an increase in Human Immunodeficiency Virus (HIV) infection, the latest global threat paved way for the increase in new emerging and re-emerging sexually transmitted diseases (STD`s) especially in Africa where health care policies are non-existent or not workable. Syphilis is a sexually transmitted disease caused by a spirochete *Treponema pallidum*. STD`s like syphilis remains an emerging threatening disease which can go unnoticed because of the asymptomatic nature of its tertiary stage. Several occupational groups, lifestyle factors, and age are at risk of being infected and can even be transferred congenitally which poses a threat to the unborn child. The disease is highly infectious and can be passed not only through sex but also through fomites and personal contacts.

In Africa, especially in Nigeria an overwhelming prevalence of mental disorders together with its stigma encourages the rate at which the mentally ill are disregarded with denial of thorough medical health care in these groups [1]. Neurosyphilis usually occur in people who have had chronic untreated syphilis, usually about 10-20 years after first infection and develop in about 25% - 40% of persons who are not treated [2]. The disease is usually overlooked as most cases symptoms in patients especially the aged is considered as "spiritual" or "frustration-induced". In Nigerian society as well as in Africa and most underdeveloped worlds, any history of mental disorder results in everlasting stigma for the family leading to family rejection. Sometimes these mentally ill people may accept the prejudice about their illnesses causing them to turn against themselves and lose confidence [3]. They may therefore not report any further symptom they notice at late stage of the disease or all symptoms at all stage is assumed to be from spiritual factors.

Shockingly, in this millennium, Okpalauwaekwe et al. [4] in a study conducted in Nigerian, noted that greater number of respondents believed supernatural causes like (witchcrafts, magic, sorcery and divine punishments) were responsible for causing mental illness, while others thought it was due to demonic possession. These in all show a strong negative view about the mentally ill in Nigeria and even among health care workers. As such, further medical investigations are neglected which can increase the chances of this "latent neurosyphilis" heralding into a stage that can aggravate or cause psychosis.

Risk factors such as increase in HIV, men who had sex with men (MSM), illegal drug abuses, hazards of prior STD`s , increase in travelling and commercial sex workers have been postulated to increase emergence of the supposedly almost eradicated syphilis infection. In a study by Anwuluorah [5], it was noted that Nigeria had the second largest number of people living with HIV/AIDS (PLWHA) in Africa, with a prevalence of 4.5% in Anambra state, which is a staggering number that increased risk for syphilis. Sero-prevalence of syphilis in mentally ill patients was significantly higher (5.4%) than among voluntary blood donor (VBDN) and all psychotic disorders as shown in a study by Issa et al. [6] in in-patients of UITH in Ilorin, Nigeria.

Actually, a paucity of literature exist in knowledge of sero-prevalence of syphilis in Anambra state and most of the existing literatures deals on psychosocial problems and in Nigeria, Issa et al. [6] worked on the sero-prevalence of syphilis among patients with mental illness in comparison with blood donors, in Ilorin. Despite the increase in bad environmental monitoring, poor sexually transmitted awareness, increase in insurgency with a subsequent increase in sexual abuse, poverty, poor hygiene and displacement in Nigeria, especially with regards to Anambra State, not much interest have been placed on the possible effects of sexually transmitted infections on mental status. There are few researches on the disease in relation to mental illness in Anambra state, south-east Nigeria, therefore in helping to combat the increase in syphilis-associated, HIV-co-syphilis infection psychosis and dementia, there is a need that the sero-prevalence of syphilis in these group is assessed and treatment as well as cancelling implemented in psychotic patients in Anambra state to reduce the risk of neurosyphilis, its consequent psychosis and possibly help people to understand that it is preventable to reduce stigmatization.

The study was done to screen and determine the sero-prevalence of *Trepanoma pallidum* infection, HIV co-infection, cognitive status, and risk variables in patients of neuropsychiatric hospital, Nawfia, Nigeria.

Materials and Method

Study area

The study was carried out in neuropsychiatric hospital Nawfia, Anambra state.

Study design

The study was a cross - sectional research on the sero-prevalence of *Treponema pallidum*, HIV- co-infection, cognitive effects, and risk – variables for infection in a tertiary psychiatric hospital in Nawfia, Nigeria.

Study population

The study population involves only willing in and outpatients clinically diagnosed with psychosis of different disorders was used. They include eighty (80) males and seventy-four (74) females of age - range of 18 to 75 years old. Patients with general paresis (GP) who fulfilled the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) criteria for clinical diagnosis of dementia as described by (American Psychiatric Association, 2000) were used.

Sample size

The sample size was calculated using Naing et al. [7] sample size calculation expressed mathematically as,

$$N = Z^2 PQ / D^2$$

N = minimum sample size required

Z = standard normal deviation for normal distribution taken as 95% confidence interval which corresponds to 1.96

P= prevalence of psychiatric patients in Nigeria which is 5.8 % [8]

Q = 1- P

D = degree of accuracy (0.05)

Therefore,

$N=1.96^2 \times 0.058 \times 0.942/0.05^2$

N=153.956

N is approximately 154 samples.

Ethical approval

The ethical approval for the research was obtained from the ethical approval board of Faculty of Health Science and Technology, College of Health Science, Nnamdi Azikiwe University, Awka, Nnewi campus.

A. Informed consent: Informed consent was signed by participant relatives or capable participants.

B. Inclusion criteria

a) Willing participants.

b) In- and- out patients clinically diagnosed of psychosis as of time of study.

c) Age ranges of 18 and above.

d) Clinically diagnosed psychiatric patients of various stages and disorders.

C. Exclusion criteria

a) Unwilling participants.

b) Patients outside of the hospital.

c) Patients below 18 years old.

d) Psychologically stable patients.

Sample collection

A five (5) millilitre syringes was used to collect whole blood from the cubital fossa. It was allowed to clot and taken to the laboratory immediately. Serum was extracted, labelled, stored at 4°C and analytes carried out after two hours of collection.

Sample processing/ Assay

Data collection

Psychiatric re-evaluation: A standard psychiatric assessment screening health questionnaire tools adapted from Amoran *et al.* [9] and a Mini Mental State Examination tool, (MMSE) Rovner and Folstein [10] were used to re-assess mental status of the subjects already confirmed psychotic by clinical symptom before admittance into the hospital. English language as well as vernacular was used to collect data questions, with the help of clinic nurses, relations or by capable participants. Maximum score was taken as 30 and normal score 27-30. Mild dementia 20-26; moderate dementia 11-19; and severe dementia <10.

VDRL non-treponemal test

One step strip serum serial double dilution quantitative method was used to assess for venereal disease status as described by Pangborn [11] using ANTI-TP Venereal Disease Research Laboratory (VDRL) screening kit (Thermo scientific, Oxoid).

Syphilis screening

Syphilis was screened with *T. pallidum* immunochromatographic strip kit method according to methods described by Rathlev [12].

T. pallidum treponemal confirmation test

The bacterial presence in serum was confirmed with commercially prepared TPHA ELISA kit (Linear Chemicals, Spain) according to passive haemagglutination assay method [13].The absorbance was measured with a plate reader (Agilent technologies, USA) calibrated and read at 450nm. The cut-off value was calculated, and interpretations done as instructed by the manufacturers.

HIV screening test

HIV 1 and 2 antibodies were screened in serum samples to assess presence or absence of antibody to the virus. Method used was the three panel parallel testing method recommended by CDC [14] using qualitative immune-chromatographic method as described by Ariah *et al.* [15] with Determine kit (Determine™ Alere kit, Alere Medical Co. Ltd, Chiba, Japan), Unigold and Stat pack immune-chromatographic kits methods.

HIV Confirmation

This was carried out using $CD4^+$ T - cell western-blot Cyflow cytometry method as described by Towbin et al. [16] with cyflow counter (Model CY-s-3022, Partec, Germany) and CD4 easy count kit, (Partec, Germany).

Statistical data analysis

Data was analysed using SPSS version 23, prevalence percentage and chi square was used, and level of significance set at 0.05 at 95% confidence interval.

Result

In relation to sex, males had more positive status 2(66.7%) than females 1(33.3%) out of a total of 3(100.0%) infected people without a significant difference between positive and negative status in all subjects (X^2 =0.27; 0. 612).The age range of 31-50 years old groups had the highest prevalence 2(66.7%) without a statistical significance P<0.05 (Table 1).

Table 1: Prevalence of Treponema pallidum status in relation to sex and age.

Variables	Class	Status Positive	Status Negative	Total	X^2	P-value
		F%	F%	F%		
Sex	Males	266.7	7851.7	8051.9	0.27	0.612
	Females	133.3	7348.3	7448.1		
	Total	3100.0	151100.0	154100.0		
Age(yrs.)	18-30	133.3	5133.8	5233.76	0.67	0.883
	31-50	266.7	7549.7	7750.00		
	51-70	00.0	2214.6	2214.28		
	>70	00.0	32.0	31.94		
	Total	3100.0	151100.0	154100.0		

Prevalence and association between *HIV*-1 and syphilis co-infection with different Mini Mental State Examination cognition statuses (MMSE) among the subject participants.

More men in the study had severe cognitive impairment 80 (51.1%) in the total population sampled 154 (100.0%).Out of a total of 74(48.1%) showing mild cognitive impairment (MCI), none 0(0.0%) was (HIV +; TPHA+), but 5(6.8%) were (HIV+; TPHA-) with a significant difference between HIV and syphilis co-infection status (X^2=11.12, P<0.001). Out of 80(51.1%) showing severe cognitive impairment (SCI), 2(66.7%) had (HIV +; TPHA +), and 1 (33.3%) were (HIV- ; TPHA +) with significant difference between HIV and syphilis co-infection status (X^2=13.42, P < 0.010).None had no cognitive status (0.0%) (Table 2).

Table 2: Prevalence and association between HIV and syphilis co-infection with different Mini Mental State Examination cognition statuses (MMSE) among the subject participants. Key:*=Significant at P <0.05. MMSE= mini mental state examination; NCI= no cognitive impairment;MCI= mild cognitive impairmentand SCI= severe cognitive impairment.

MMSE	INFECTION	STATUS	TESTTPHA				Total		X2	P-value
			positive		Negative		positive	Negative		
			F	%	F	%	F	%		
MCI	HIV	+	0	0	5	6.8	5	6.8	11.12	0.001
		_	0	0	69	63.2	69	93.2		
		Total	0	0	74	49.1	74	48.1		
SCI	HIV	+	2	66.7	6	7.8	8	10.0	13.42	0.01
		_	1	33.3	71	92.2	72	90.0		
		Total	3	100	77	50.9	80	51.9		
NCI	HIV/AIDS	+	0	0	0	0	0	0.0	K	K
		_	0	0	0	0	0	0.0		
		Total	0	0	0	0	0	0.0		
Total		TOTAL	3	100	151	100	154	100.0		

Comparative analysis of the screening and confirmatory test methods (VDRA/ ELISA- TPHA and HIV antibody strip test / CD4 count) used for the analysis of syphilis and HIV disease statuses among the study participants

Treponema pallidum (syphilis) screening with VDRL testing showed positive results were lower 2(1.3%) than that obtained with the confirmatory TPHA (ELISA) testing kit 3 (1.9%) with a significant difference observed between the values obtained in the two test kit methods (X^2=134.23; P= 0.001).HIV screening using parallel testing and the confirmation with CD4 cell count methods showed the same values of positive status 13(8.4 %) with a constant significant association (K) between the two methods (Table 3).

Table 3: Comparative analysis of the screening and confirmatory test methods (VDRL / ELISA- TPHA and HIV antibody strip test / CD4 count) used for the analysis of syphilis and HIV disease statuses among the study participants.Key:VDRL= Venereal Disease Research Laboratory test;ELISA= Enzyme linked Immunosorbent assay; *= significance at P< 0.05; K= constant.

Test	Status	Frequency (f)	Percentage (%)	X2	P-value
VDRL	Positive	2	1.3	134.23	0.001
	Negative	152	98.7		

TPHA (ELISA)	Positive	3	1.9		
	Negative	151	98.1		
HIV Screening	Positive	13	8.4		
(parallel testing)	Negative	141	91.6	K	K
HIV confirmation	Positive	13	8.4		
CD4 count	Negative	141	91.6		

Association between risk-factors variables and *Treponema pallidum* infection statuses among the study participants

In tables 4a and 4b, significant associations were observed between *T. pallidum* infection status and risk variables like; being HIV positive 2 (66.6%) (X^2= 13 .42; P= 0.01), spousal HIV state in all answers 1(33.3%) (X^2= 16.75; P= 0.01) and no visitation to prostitutes 2(66.7%) (X^2= 4.42; P= 0.03) and highest prevalence also observed, though without significant associations (P>0.05) with the listed; age (31-50) years old category , Males , married , self-employed, having 1-2 children , living in two rooms, not having been institutionalized , not sharing belongings with another, having a first sexual experience, having 1 sexual partner, no history of Gonorrhoea 2(66.7%); Anambra state origin, being an Igbo, drop-out from school, not using condom during sex, and no history of untreated sexually transmitted disease present 3(100.0%) (Table 4a and 4b).

Table 4a: Association between risk-factors variables and *Treponemapallidum* infection statuses among the study participants.

Variable	Class	Treponema pallidum infection (n %)		X2	P
		Positive	Negative		
Socio-demographic variables					
Age (years)	18-30	1(33.3)	51(33.8)	0.67	0.88
	31-50	2(66.7)	75(49.7)		
	51-70	0(0.0)	22(14.6)		
	≥70	0(0.0)	3(2.0)		
Sex	Male	2(66.7)	78(51.7)	0.27	0.61
	Female	1(33.3)	73(48.3)		
Marital status	Single	1(33.3)	81(53.6)	0.75	0.86
	Married	2(66.7)	64(42.2)		
	Divorced	0(0.0)	2(1.3)		
	Widowed	0(0.0)	4(2.6)		
Occupational Status	self-employed	2(66.7)	77(51.0)	1.87	0.6
	Gov. employed	0(0.0)	18(11.9)		
	Unemployed	0(0.0)	34(22.5)		
	Student	1(33.3)	22(14.6)		
Number of Children	None	1(33.3)	89(58.9)	6.2	0.18
	2-Jan	2(66.7)	22(14.6)		
	5-Mar	0(0.0)	24(15.9)		
	5 and above	0(0.0)	14(9.3)		
	Dead children	0(0.0)	2(1.3)		
State of origin	Anambra	3(100.0)	127(84.1)	0.57	0.99
	Imo	0(0.0)	10(6.6)		
	Enugu	0(0.0)	8(5.3)		
	Lagos	0(0.0)	2(1.3)		
	Ebonyi	0(0.0)	2(1.3)		
	Abia	0(0.0)	2(1.3)		
Ethnic group	Igbo	3(100)	148(98.0)	0.06	0.97
	Hausa	0(0.0)	1(0.7)		
	Yoruba	0(0.0)	2(1.3)		

Country of origin	Nigeria	3(100)	151(100	K	K
Educational attainment	Secondary	0(0.0)	2(1.3)	0.9	0.64
	Tertiary	0(0.0)	33(21.9)		
	Drop out	3(100)	116(76.8)		

Table 4b: Association between risk-factors variables and *Treponema pallidum* infection statuses among the study participants (cont). KEY:*= Significant at p<0.05,STD= sexually transmitted diseases.

Variable	Class	Treponema pallidum infection (n %)		X2	P
		Positive	Negative		
Number of RoomsLived in	one	1(33.3)	44(29.1)	0.66	0.88
	two	2(66.7)	80(53.0)		
	three	0(0.0)	18(11.9)		
	four and above	0(0.0)	9(6.0)		
Lifestyle variables					
HIV Infection	Positive	2(66.7)	11(7.3)	13.4	0.01*
	Negative	1(33.3)	140(92.7)		
Spousal HIV status	Yes	1(33.3)	2(1.3)	0.75	0.86
	No	1(33.3)	84(55.6)		
	Don't know	1(33.3)	29(19.2)		
Visits to Prostitutes	Yes	1(33.3)	7(4.6)	4.42	0.03*
	No	2(66.7)	144(95.4)		
Institutionalization	Prison	1(33.3)	8(5.3)	4.83	0.19
	TB center	0(0.0)	30(19.9)		
	Military training	0(0.0)	14(9.3		
	None	2(66.7)	14(9.3		
Sharing of Belongings	Yes	1(33.3)	16(10.6)	1.68	0.43
	No	2(66.7)	124(82.1)		
First sexual Experience	Yes	2(66.7)	71(47.0)	0.46	0.5
	No	1(33.3)	80(53.9)		
Number of sex Partners	None	1(33.3)	66(43.7)	0.51	0.77
	One	2(66.7)	73(48.3)		
	>One	0(0.0)	12(7.9)		
Condom usage During sex	Yes	0(0.0)	42(27.8)	1.15	0.24
	No	3(100.0)	109(72.2)		
History of Gonorrhea or any STD	Yes	1(33.3)	26(17.2)	0.53	0.47
	No	2(66.7)	125(82.8)		
Any untreated STD presently	Yes	0(0.0)	8(5.3)	0.17	0.68
	No	3(100.0)	143(94.7)		

Discussion

Syphilis is an infectious venereal disease caused by the spirochete *Treponema pallidum* sub-specie pallidum Bowen et al. [17] while psychosis is a general term used to describe a set of symptoms of mental illnesses that result in strange or bizarre thinking, perceptions (sight, sound), behaviours, and emotions [18]. Untreated syphilis at its tertiary stage can result to psychosis. In the present study, in relation to sex, males had more positive status 2(66.7%) than females 1(33.3%) This could be related to male resistance to condom use, reduced immunity in males more than in females, sexual habits and morality, and number and types of sexual partners exposed to. Panchanadeswaran et al. [19] also noted the higher prevalence in syphilis infection in men. Behavioral changes in men, increase in high-risk sexual behavior in men like men who have sex with men, lesser tendency to attend a screening test associated with men, earlier sexual debut in men and higher rate of partner changes than females could account to that [20]. It has also been noted that many STIs are transmitted more efficiently from

men to women since semen is pooled more in female vagina and greater trauma is created in tissues in females during intercourse than in males [20].

A low population were infected with syphilis 3(1.94%) out of a total of 154 (100.0%) sampled without a significant difference between positive and negative status in all subjects (P>0.05). Reason could be that the bacteria is a very delicate one and is sensitive to a wide range of antibiotics. Unrestricted over-the- counter sale and use of antibiotics in the streets and markets in Nigeria and self-medication could result in an extensive abuse of antibiotic use, especially Penicillin used in the treatment for syphilis, enhancing eradication. This is a strict sexually transmissible bacterium that needs contact to be established and survives for only a short time outside a human host. Thus, spread of the organism according to Stoltey and Cohen [21] depends on susceptibility in exposed partner, durable immunity, underlying disease factors as well as intimate contact between an infected person and a susceptible person. This could result in the low transmission of T. palladium, leading to the reduction in the number of seropositive individuals over time. Also, the part of the country where the research was conducted was in the eastern part of Nigeria and their lifestyle with regards to marriage (monogamy), sexual habit, religion, personal hygiene, could have affected the outcome of the disease compared to other parts of the country like the North. More so, as the subjects are patients, antibiotics taken over time for other ailments could have been susceptible and efficient in its eradication. A low prevalence of (1.9%) was also observed in a Nigerian sentinel report by FMoH [22] much less than a sero-prevalence rate of 11%, 20%, and 23.8% reported in Ghana, Sierra Leone, and Senegal respectively [23].

Age range of 31-50 years old groups had the highest prevalence 2(66.7%) in the present study. This could be because they are sexually active age groups. Age at first sexual exposure, sexual activeness, life style factors and sex habits, number of sexual partners and susceptibility to the infection could have contributed to this as well. Despite being found in all ages, Syphilis has been noted to be more prevalent in sexually active age group of 15- 49 years, in a Ghanaian study Banong-le et al. [24], and in a Nigeria study in paramilitary recruits, a higher prevalence of 6.7% was found among older people of age-range 35-39 years (6.7%) than younger groups of 25- 29 years old groups, (2.3%) according to Nwokedi et al. [25].

In table 2, more men in the study had severe cognitive impairment (SCI) 80 (51.1%) than mild cognitive impairment (MCI) 74(48.1%), because the hospital is an institutionalized center for confirmed psychotic cases from various tertiary hospitals in Anambra state who may be a problem for their family and so need a hospital to keep them for monitoring, hence is bound to have more cases. Out of those showing (SCI), more men were (HIV +; TPHA +) than those with (MCI), and (33.3%) were (HIV- ; TPHA +) with significant difference between Human Immunodeficiency Virus (HIV) and syphilis co-infection status (X^2=13.42, P < 0.010). Reasons could be that their state of health (psychosis) may have made them vulnerable to STDs through sexual abuse. Substance use occurs frequently among psychiatric patients which may impair decision making (especially during intoxication), hence contributing to HIV high-risk behaviour e.g., sensation seeking and impulsivity [26]. Again, cognitive challenges and negative symptoms may limit their ability to comprehend and retain information about HIV/AIDS causation and prevention. This may potentially influence behavior and attitude to being infected HIV. More so, psychopathologic and behavioral changes associated with mental disorders like increased libido, and impaired judgment may increase exposure to risky situations [27].This prevalence is higher when compared with that obtained by Edward et al. [28] (14.2%) where the sero-prevalence of HIV/AIDS among patients screened from 2008-2013 in Federal Neuropsychiatric Hospital Barnawa, Kaduna state, north -west Nigeria was assessed. In their study however, co-infection with syphilis was not done. Nnoruka and Ezeoke [29] reported a lower 2.1% prevalence rate of HIV-Syphilis co-infection in a hospital setting at Enugu, Anambra state, in Nigeria, though the patients in this study were not psychologically challenged.

Co-infection was observed in the research because of the shared risk factors related to sexual behaviour, duration and course of the infection, and pathological changes caused by both diseases. This could have enhanced cognitive changes in infected subjects. There is also evidence that HIV may lead to more rapid progression to neurosyphilis [30]. Also, syphilis is an important co-factor in facilitating HIV transmission [31]. Syphilis-induced genital tract inflammation and/or ulcerations may disrupt innate barriers to HIV. By altering normal immune responses, HIV may in turn affect the presentation, diagnosis and natural course of syphilis [32].

More so, syphilis may have been asymptomatic and since diagnostic testing for syphilis is complex and imperfect in detection of late stage of the infection or neuron- psychiatric changes, it may have progressed as *Treponema pallidum* invades the CNS without detection to stimulate ingress of HIV infected T cells, augmenting CNS infection which creates injury in tissues to result to cognition dysfunction [33]. Marra et al. [3] noted that psychiatric changes are associated with HIV in syphilis co-infected subjects. HIV infection is a high risk disease for syphilis infection, and patients with HIV-syphilis co-infection usually develop severe cognitive impairment depending on the duration of infection, level of viral activity, effects of inflammatory mediators which results to damages associated with HIV neurocognitive disturbances [34]. More so, mentally ill patients with syphilis are at increased risk of acquiring HIV, and syphilis is an important co-factor in facilitating HIV transmission [31].

In those with mild cognitive impairment (MCI) 74(48.1%) none was (HIV +; TPHA+), but in those with (HIV+; TPHA-) (6.8%), cognition impairment could have been as a result of viral activity, ART effect or is associated with the stage of the infection as of the time of study, changes in clinical course of the disease associated with the infection and poor drug metabolism and distribution. It is a well-known fact that HIV is associated with neurological changes that could be psycho somatic and as it is associated with immunosuppression, aging, diseases like syphilis can be easily contacted and if not diagnosed earlier, produce CNS changes and psychosis as CD4 count decreases as a result of viral load increase with disease progression. Positive test was lower (1.3%)for *Treponema pallidum* (syphilis) when screened with VDRL testing, than that obtained with the confirmatory TPHA (ELISA) testing (1.9%) with a significant difference observed between the values obtained in the two test kit methods (X2=134.23; P= 0.001).This could be because VDRLis a non-Treponema test with limitations of usually not being specific to *T. pallidum* antibodies and has low sensitivity in primary syphilis and late latent infection and can mask these stages producing false negative result. Humoral antibodies are detected with non-treponemal and treponemal serological kit tests 1 to 4 weeks after the appearance of primary chancre.

HIV screening using parallel testing and the confirmation with CD4 cell count methods showed the same values of positive status 13(8.4 %) in the two methods. This may be because the screened positive tests were really positive with the virus or enhanced by the sensitivity of the test kit used.

In tables 4a and 4b, significant associations observed between *T. pallidum* infection status and risk variables like; being HIV positive (66.6%) (X2= 13 .42; P= 0.01), spousal HIV state (33.3%) (X2= 16.75; P= 0.01) could be because both infection statuses are acquired from the same risk factors and transmission routes and genital syphilitic ulcers increases the risk acquisition of HIV virus as well as because syphilis has been proven to be recurrent in HIV patients. Novak et al. [35] worked on the risk factors and incidence of syphilis in HIV infected persons and recorded that out of 6888 HIV infected participants, 641 had one or more new syphilis diagnosis during a median follow up of 5.2 years. Ogilvaie et al. [36] noted that HIV infection is a risk factor for syphilis infection by biological susceptibility or sexual behaviour. Significant association was also found between *Treponema pallidum* infections and having no history of visitation to prostitutes (66.7%) (X^2= 4.42; P= 0.03). This fact could be because the infection can be acquired not only from the common route via sexual intercourse from prostitutes but also from contact with men who have sex with men (MSM), congenitally , through blood transfusion, organ donation, congenitally or when passing through an infected birth canal, infected tattoo instruments, circumcision or use of unsterilized puncture items. Endemic syphilis is acquired through non-sexual contact in communities with poor hygienic condition, Stoltey and Cohen [21] and rarely via occupational and other exposures [37]. This may have been the case in the affected men. Failure to use protective sexual devices and relapse in treatment or recurrent syphilis may account for the reason for spousal HIV state. Aydin et al. (2015) in a study on the sero-prevalence and risk factors of syphilis among HIV/AIDS patients in Istanbul, Turkey showed that *T. pallidum* exposure was observed by 21.3% in homosexuals and heterosexuals who have HIV positive spouses or who do not even know the status of their spouse. Visiting prostitutes was also significantly associated with syphilis status (X^2 = 4.42; P = 0.03) higher status obtained from those who did not do so (66.6%). This could be because it can also be transmitted from non-sexual routes.

High prevalence was observed non-significantly (P>0.05) in the listed risk variables; (31-50) years old category , being a male , married , self-employed, having 1-2 children , living in two rooms, not having been institutionalized , not sharing belongings with another, having a first sexual experience, having one sexual partner, having no history of gonorrhea 2(66.7%); being an Anambra state origin, being an Igbo, dropping out from school, not using condom during sex, and no history of untreated sexually transmitted disease present 3(100.0%).This could be due to risk factors common in the study group, sexual behaviors of the at-risk population, local epidemiology, individual immunity etc. Behavioral factors, socioeconomic and demographic factors, condom use, being single, having multiple sexual partners, being a female, partner's sexual behaviours, location and culture have been noted as risk factors associated with sexually transmitted diseases [38-40].

Conclusion

Conclusively, syphilis alone or co-infection with HIV is found in psychotic patients and produced more severe than mild cognitive disorders in males depending on several factors. It is therefore recommended to test for syphilis and HIV routinely in patients presenting with a neuropsychiatric disorder using screening and confirmatory tests as well as to assess their disorder levels from time to time. Psychotic patients should further be assessed for conditions or infections that can herald psychosis such as Alzheimer's disease, Toxoplasma. gondii infection, epilepsy, anemia etc. to rule out other underlying causes and reduce relapse in psychosis. Awareness on the possible risk factors which can predispose one to syphilis should be created in the group to reduce Treponema palladium infection among psychiatric patients that can aggravate psychotic states.

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