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Comparative assessment of venereal disease research laboratory (VDRL) and point of care (POC) tests for diagnosing syphilis among pregnant women at a tertiary health facility in Lagos: A retrospective cohort study

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Abstract

Background: Syphilis is a systemic infection caused by the Spirochete *Treponema Pallidum*. The infection is of particular concern during pregnancy because of the high risk of vertical transmission causing adverse outcome including death. Traditional screening method is with Venereal Disease Research Laboratory (VDRL), which has a high false positive result and an increased waiting time.

Aim: To compare the syphilis detection rate between Point-of-Care testing and Venereal Disease Research Laboratory testing among pregnant women.

Methods: The retrospective cohort study was conducted at 68 Nigerian Army Reference Hospital Yaba (68NARHY), Lagos between July 2021 and June 2023. Data from antenatal clinic records were retrieved. All eligible pregnant women had both POC and VDRL testing. The primary outcome measures were false positive, false negative, true positive, true negative of the two tests. The sensitivity, and specificity and the diagnostic accuracy of both tests were calculated following which the ROC curve was drawn. Women with

incomplete record or who did not conduct both testing were excluded from the study. All data set were collected using a well-designed purpose driven proforma. The data set were stored and later analyzed using the IBM SPSS for Windows, version 26.0 Armonk, NY: IBM corp. Analysis was both descriptive and inferential. The p-value of < 0.05 was set as statistically significant levels.

Result: The mean age of the participants was 31.30 ± 5.3 . About 45.5% were of low parity while military personnel consisted of more than half of the study population.

The prevalence of syphilis was 1.8% and 4.3% using VDRL and POC test kits respectively. When compared, there was a significant difference ($P < 0.001$). It was also noted that a greater proportion of military personnel were reactive to the screening using either of those kits as against civilians.

Conclusion: In our study, POC has demonstrated its ability to detect more cases of syphilis than VDRL as a screening test. Therefore, POC may serve as a cost-effective replacement screening test for VDRL, to rapidly and accurately detect syphilis infection. This step is crucial for early diagnosis, prompt treatment, and the prevention of further transmission of syphilis.

Key words: POC, VDRL, Syphilis in pregnancy, Nigeria.

Introduction

Over the years, there have been difficulty in developing a standard laboratory method for isolating *Treponema pallidum*.⁹ Thus, diagnosis depends on direct isolation of the pathogen or using serological methods.¹⁻⁴

The use of serological testing methods has gained popularity in screening for syphilis infection in pregnancy owing to its simplicity, availability and affordability.⁵⁻⁹ Serology testing can be either treponemal antibody tests (TT) or non-treponemal antibody tests (NTT).¹⁰⁻¹³

Venereal Disease Research Laboratory (VDRL) belongs to the non-treponemal tests (NTT) class.¹³ NTTs measures individual's response to non-treponemal antigens and are reported in titres, while the TTs assays human serum/plasma antibodies to *Treponema pallidum*.^{10,13} In "addition, screening tests (RPR and VDRL), do not detect antibodies specific for syphilis and are based upon the reactivity of serum from infected patients to a cardiolipin-cholesterolecithin antigen (regain)".^{10,13} "The results should have a quantitative titer reported with them (1:2, 1:4, 1:8, etc.)".^{10,13}

Most POCs can detect antibodies to *Treponema*

pallidum antigen or anticardiolipin antibodies.^{10,13} These POC assay are highly sensitive and specific for syphilis diagnosis at all stages of infection and results are available in minutes.¹⁰ Of note is that POC testing follows ASSURED (Affordable, Sensitive, Specific, User-friendly, Rapid and Robust, Equipment-free and Delivered to end users) criteria as outlined by WHO's Special Program for Research and Training in Tropical Diseases.^{9,10,13-15} This is necessary in resource limited countries, where point-of-care (POC) tests can be utilized to reduce the effects of limited number laboratories and their personnel. The rapidity of POC test results, the possibility of treating the patient immediately, the ease of performance requiring no elaborate technical training in non-laboratory settings have made it acceptable in some facilities.¹⁰ Furthermore, POC results are expressed in a qualitative means (either detected or not detected) and it has been reported to be free from prozone phenomenon which is another advantage.^{10,16}

Regrettably, using either POC or VDRL may lead to over-treatment due to false positive results. However, treatment is less dangerous than not treating the infection, as non-treatment leads to development of

congenital syphilis and its attendant consequences. Additionally, anecdotal evidence suggest that POC may be faster, more convenient and detect more cases than VDRL, we embarked on this study to refute or accept this.

This study therefore aims to compare the proportion of the participants that are detected to be either positive or negative using VDRL or POC in the screening of syphilis among antenatal women that presented for antenatal booking at 68 Nigerian Army Reference Hospital Lagos.

Methods

Study design and setting

The retrospective cohort study was conducted at 68 Nigerian Army Reference Hospital Yaba (68NARHY), Lagos. The hospital offers specialized treatment to all categories of pregnant women, it also has a unit dedicated to care of HIV positive pregnant women and other Sexually Transmitted Infections.

Participants

The antenatal medical records of pregnant women that sought care over a two-year period, between July 2021 and June 2023 were retrieved. All eligible pregnant women had both POC and VDRL testing. Women with incomplete record or who did not conduct both testing were excluded from the study. Participants with systemic lupus erythematosus, rheumatoid arthritis or any autoimmune or collagen disease, Lyme disease, antiphospholipid syndrome, drug addiction, HIV/AIDS and liver disease were excluded from the study.

Variables

Outcome of interest was women who tested positive for POC or women who were reactive to VDRL.

Data Collection and Analysis

All data set were collected using a well-designed

purpose driven proforma. The patients' demographics such as age, parity, gestational age of the pregnancy were retrieved from patients case note. The information sought included VDRL and POC results. The data set were stored and later analyzed using the IBM Statistical Package for Social Sciences (SPSS Statistics) for Windows, version 26.0 Armonk, NY: IBM Corp. The data analysis was both descriptive and inferential. Associations between qualitative variables such as proportions were determined using Chi-square while continuous variables such as age etc were summarized as means and standard deviations. Positive cases detected by the two tests were compared using Chi square while level of association was determined using OR at 95% CI.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee (HREC) of 68 NARHY (68NARHY/EC/124). Ethical principles according to Helsinki's declaration were observed throughout the study duration.

Primary Outcome Measures

The primary outcome measures were the proportion of women that tested positive to either of the screening tests individually and a combination of both.

Specimen Collection

The participants were tested using POC kit after counselling in the clinic and the result recorded. "Veda Lab SYPHCheck Syphilis Home Test Kit used was produced by VEDA lab in FRANCE. It is a simple and confidential, 5-10 minute, finger-prick blood spot self-test that can be performed at home or clinic. It enables detection of syphilis infection. It is believed to be 97% accurate and results are available in as little as 10 minutes. It has a lateral flow test, one line means negative and two means positive".

At the same time 5ml of blood was collected from the median cubital vein of each participant using standard venipuncture technique in serum separator tube (SST). The specimens were labelled with an identifier, date and time of collection. This was transported to the central laboratory for the assigned senior laboratory scientist to conduct the test.

Results

During the study period, 807 women attended antenatal care, out of which 506 were tested for syphilis using POC and VDRL test kits concurrently.

The mean age of the participants was 31.30 ± 5.3 . About 45.5% were of low parity while 11.1% were of high parity. Civilians were 42.1% while military personnel consisted more than half of the study population Table 1.

The prevalence of syphilis was 1.8% and 4.3% using VDRL and POC test kits respectively. Comparing the two tests, it was found that POC detected more women with positive result in the screening in relation to VDRL ($p < 0.001$) Table 2, Figure 1. It was also noted that more of the military personnel were reactive to the screening using either of those kits ($P < 0.001$) Table 3.

Discussion

Vertical transmission of syphilis is one of the leading causes of neonatal deaths especially in low-income countries where there is presumably high prevalence of syphilis and low testing rates.¹⁷ It is even more worrisome that the confirmatory laboratory investigations require a lot of expertise, facilities and electricity most of which may not be available in low resource settings which invariably hampers efficient diagnosis and treatment.^{16,17}

Our study was undertaken to compare the detection of syphilis using point of care testing versus venereal disease research laboratory testing among pregnant women. The result showed that there was

Table 1. Socio-demographic characteristics of participants.

VARIABLE	FREQUENCY (N=506)	PERCENTAGE
AGE GROUP (YEARS)		
≤25	69	13.2
26-30	152	30.0
31-35	188	37.2
36-40	74	14.6
>40	23	4.5
Mean± SD	31.30±5.3	
PARITY		
0-1	230	45.5
2-4	220	43.5
≥5	56	11.1
OCCUPATION		
Civilian	213	42.1
Military	293	57.9

a significant difference between the two screening tests, with POC detecting more positive cases than VDRL tests. Thilakavathi in India found that POC is more effective in detecting syphilis when compared to VDRL.¹⁵ However, he used TPHA as a standard to compare both tests.

The prevalence of syphilis was 1.8% using VDRL. This is comparable to the finding of 1.98 by Opone et al in southern Nigeria.¹⁸ It is also comparable to 1.7%, 1.5%, and 0.4% reported in other parts of Nigeria.¹⁹⁻²¹ However, it is lower than 5.0% and 10.0%. reported by other authors in south-south and south-west Nigeria respectively.^{22,23}

More than half (57.9%) of the pregnant women that tested positive to the screening tests were military personnel. This is similar to the result of Gottwald and co-workers who reported that soldiers infected with sexually transmitted infections were very much higher than in civilian population.²⁴ Similarly, Okeke and colleagues in Enugu in their study also revealed a high prevalence of sexually

Table 2. Comparison of the performance of VDRL and POC Tests.

	POC		X ²	P-VALUE
	NON-REACTIVE	REACTIVE		
VDRL				
Non-reactive	482 (95.3)	15 (3.0)	118.800	<0.001*
Reactive	2 (0.4)	7 (1.4)		

X²- Fisher exact

Table 3. Cross tabulation of the association between syphilis and selected characteristics.

	POC		X ²	P-VALUE
	REACTIVE	NON-REACTIVE		
Age group (Years)				
≤25	3 (4.3)	66 (95.7)	5.981	0.201*
26-30	9 (5.9)	143 (94.1)		
31-35	8 (4.3)	180 (95.7)		
36-40	1 (1.4)	73 (98.6)		
>40	3 (13.0)	20 (87.0)		
Parity				
0	4 (4.0)	96 (96.0)	0.734	0.947
1	7 (5.4)	123 (94.6)		
2	7 (5.7)	116 (94.3)		
3	4 (4.1)	93 (95.9)		
≥4	2 (3.6)	54 (96.4)		
Occupation				
Civilian	3 (1.2)	240 (98.8)	12.738	<0.001*
Military	21 (8.0)	242 (92.0)		

Fisher Exact

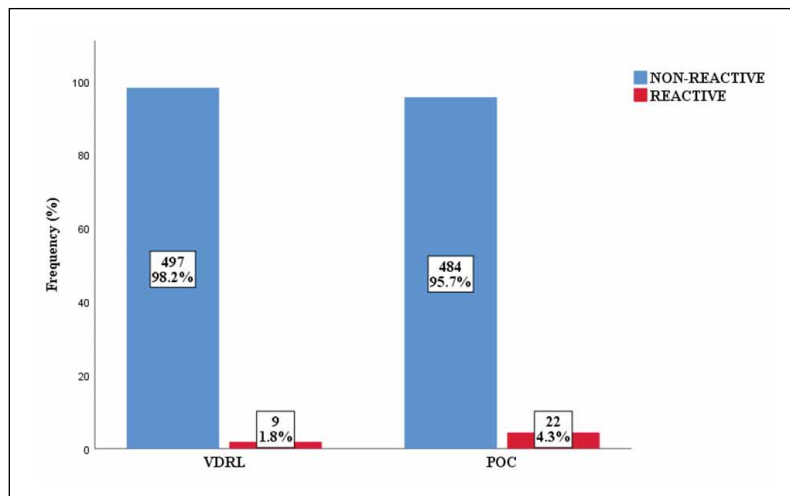


Figure 1. Prevalence of syphilis using VDRL and POC test kits.

transmitted infection in soldiers compared to civilian population.²⁵

The effectiveness of POC test lies in increase in the uptake of screening for syphilis, it also helps to screen hard-to-reach pregnant populations. It may also afford the opportunity for self-sampling.²⁵

However, a single centre study may not be applicable to the entire population. Moreso sustaining the continued supply of POC test kits and overburdening the already overworked clinic staff may also be a setback in the deployment of POC tests. Moreso, it would have been better to compare these results with a standard test kit such as to be definite if those screened were actually infected.

Conclusion

In our study, POC has demonstrated its ability to detect more cases of syphilis than VDRL as a screening test. Therefore, POC may serve as a cost-effective replacement screening test for VDRL, to rapidly and accurately detect syphilis infection. This step is crucial for early diagnosis, prompt treatment, and the prevention of further transmission of syphilis

Conflict of Interest

None

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