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A Comparative Study of Three Methods of Hiv Determination in Barau Dikko Specialist Hospital Kaduna, Kaduna State, Nigeria

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Abstract: *The need for accurate diagnosis of HIV infection has become a major global issue of interest over the years. This study sets out to determine the sensitivity and specificity of HIV test kits used in Barau Dikko Specialist Hospital Kaduna, Kaduna State, Nigeria. The kits assessed were Determine, Stat-Pak and Uni-Gold HIV1/2 test kits. A total of 200 gold standard positive and 200 gold standard negative sera by ELISA method were used for this study. Of the 200 HIV positive (gold standard) sera tested against each of the kits, 196 were truly positive and 4 were falsely negative using Determine HIV ½ giving sensitivity of 98%, 198 were truly positive and 2 were falsely negative with Stat-Pak, giving a sensitivity of 99% and 197 were truly positive and 3 were falsely negative with Uni-Gold giving a sensitivity of 98.9%. Of the 200 negative sera (gold negative), 195 were truly negative and 5 were falsely positive for Determine giving a specificity of 97.5%. 197 were truly negative and 3 were falsely positive for Stat-Pak giving a specificity of 98.5% while 196 were truly negative and 4 were falsely positive for Uni-Gold giving a specificity of 98%. In all, Stat-Pak scored highest, followed by Uni-Gold and lastly Determine, but the differences were statistically insignificant (p>0.05). The use of these kits for screening blood donors should be discouraged and ELISA method introduced for all blood transfusion purposes as none of the kits exhibited 100% sensitivity and specificity. Stat-Pak should be used as a tier-breaker for screening tests in view of its higher sensitivity and specificity. Assessment of HIV test kits should be an ongoing exercise in all facilities and all test kits newly purchased should be assessed before use.*
Keywords: *Determine, HIV, Stat-Pak, Sensitivity, Specificity, Uni-Gold,*

I. Introduction

Human Immunodeficiency Virus (HIV) the causative agent of Acquired Immune Deficiency Syndrome (AIDS) is classified[1, 2] as belonging to the family *retroviridae* and the genus lentivirus.The disease (AIDS) was first recognized in the United States of America among homosexuals [3, 4], and in the same year, it was recognized in France [5]. AIDS was first diagnosed in Nigeria in 1983 in a 13 year old girl and in Kenya it was discovered in 1984 [6].

Ever since, the infection has assumed a global dimension with the highest prevalence running into millions in Sub-Sahara Africa and Asia [4]. The Human Immunodeficiency Virus is a single stranded RNA, diploid genome that is spherical, measuring about 80-100nm in diameter. The proteins are envelope glycoproteins that undergo antigenic variations using reverse transcriptase and protease for the production of infectious viruses [2].

The HIV infection is acquired mainly by sexual intercourse, exchange of contaminated blood, use of contaminated cutting instruments and could be from mother to child either before, during or after birth. Proper screening of HIV infection among patients, blood donors and in monitoring of infection has a major impact in HIV prevention [7].

This study was designed to identify the most suitable HIV rapid test kit which will be used for accurate diagnosis of HIV infection in Barau Dikko Specialist Hospital Kaduna, Nigeria.

II. Materials And Methods

2.1.Area of Study

The study was conducted in Barau Dikko Specialist Hospital, Kaduna, located in the Kaduna North Local Government Area of the State. The global location of the State is between longitude 30^{o} east of the Greenwich meridian and between latitude 11:30 north of the equator. Kaduna State occupies part of the central position of the Northern part of Nigeria with Kaduna as its capital. Kaduna comprises Kaduna North Local Government with a population of 357,694 and Kaduna South Local Government with a population of 760,084 [8].

2.2. Sample Collection

Samples were collected from patients at the point of care during normal working hours 8am-4pm at the GOPD laboratory of the hospital into plain CB vacutainer systems, manufactured by Franklin Lakes, New Jersey USA a total of 400 samples were collected. The samples were then separated by centrifugation at 3000 rpm for 15minutes using an electric bench top centrifuge. The sera were separated into plain tubes and stored in a deep freezer at -20^{o}C pending analysis.

2.3.Sample Analysis

The samples were analysed by ELISA [9] to obtain a total of 400 gold positive and negative samples. The 200 gold positive and 200 gold negative samples were analysed using the various Rapid test kits (Determine, Stat- Pak, Uni-Gold) methods as recommended by the manufacturers. All invalid or inconclusive results were not included in this study.

III. Results And Discussion

3.1. Results

A total of 200 gold standard positive and 200 gold standard negative sera by the ELISA method were used for the study. The three kits (Determine, Stat-Pak and Uni-Gold) were tested against each of the gold standard serum using the methods provided by the manufacturers of these kits. Out of the 200 HIV positive (gold standard) sera tested, 196 were positive and 4 were negative using Determine HIV ½ giving sensitivity of 98%, 198 were positive 2 were negative with Stat-Pak (Table 1) giving a sensitivity of 99%, 197 were positive and 3 were negative giving a sensitivity of 98.5% with Uni-Gold (Table 1), of the 200 negative sera (gold negative), 195 were negative and 5 were positive with Determine giving a specificity of 97.5%, 197 were negative and 3 positive with Stat-Pak giving specificity of 98.5%. 196 were negative and 4 were positive with Uni-Gold (Table 2) giving a specificity of 98%.

Table 1 shows the results obtained from running the gold positive samples against the three test kits. Out of the 200 gold standard positive samples, 196 were positive (truly positive) and 4 were negative (false negative) with Determine HIV ½ test kit. 198 were positive (truly positive) and 2 were negative (false negative) with Stat-Pak. Uni-Gold produced 197 positive (truly positive) and 3 negative (false negative) samples.

Table 1: Results Obtained From The Various Test Kits Against The Gold Standard Positive Samples.

Test kit	True positive samples	False negative samples	X^2	P^{-value}
ELISA	200	0		
Determine	196	4		
Stat-Pak	198	2	0.68	>0.05
Uni-Gold	197	3		

X2=0.68
P=>0.05

Table 2 shows the results obtained when the gold standard negative samples were tested against the three rapid test kits. Of the 200 gold negative samples tested, determine gave 195 negative (true negative) and 5 positive (false positive) while Stat-Pak had 197 negative (true negative) and 3 positive (false positive) while Uni-Gold gave 196 negative (true negative) and 4 positive (false positive).

Table 2: Results Obtained From The Various Test Kits Against The Gold Standard Negative Samples

Test kit	True positive samples	False negative samples	X^2	P^{-value}
ELISA	200	0		
Determine	195	5		
Stat-Pak	197	3	0.51	>0.05
Uni-Gold	196	4		

X2=0.51
P=>0.05

In our analysis, Stat-Pak gave a PPV of 98.5% Uni-Gold 98% while determine gave 97.5% (Table 3). On the other hand Stat-Pak gave a negative predictive value (NPV) of 98.9% followed by Uni-Gold with 98.4% and Determine 97.8% (Table 3)

Table 3: sensitivty, specificity, positive predictive value (ppv) and negative predictive value (npv) obtained from calculations:

Test kit	True positive	False positive	True negative	False negative	Sensitivity	Specificity	PPV	NPV
ELISA	200	0	200	0	100%	100%	100%	100%
Determine	196	4	195	5	98%	97.5%	97.5%	97.8%
Stat-Pak	198	2	197	3	99%	98.5%	98.5%	98.9%
Uni-Gold	197	3	196	4	98.5%	98%	98%	98.4%

3.2. Analysis of the Results:

When the three test kits Determine, Stat-Pak and Uni-Gold are compared against each other Stat-Pak and Uni-Gold had the highest sensitivity of 99% followed by Determine with 98%. Stat-Pak had the highest specificity of 98.5% followed by Uni-Gold with 98% and lastly Determine 97.5%. Stat-Pak was the highest with NPV of 98.9% followed by Uni-Gold with 98.4% and Determine with 97.8% as shown in Table 4

Table 4: Comparison Of Performance Of Kits

	Elisa	Determine	Stat-Pak	Uni-Gold
Sensitivity	100%	98%	99%	99%
Specificity	100%	97.5%	98.5%	98%
PPV	100%	97.5%	98.5%	98%
NPV	100%	97.8%	98.9%	98.4%

When the values of the three Rapid Test kits tested against the gold positive samples were subjected to statistical analysis, the results showed that there was no significant difference among the three Rapid Test kits ($p>0.05$), and when the values of kits tested against the gold standard negative samples were subjected to the same statistical analysis, the result shows that there was no significant difference among the three Rapid Test kits ($p>0.05$).

III. Discussion

The finding of this work has shown that the Rapid Test kits tested, Stat-Pak, Uni-Gold and Determine were highly sensitive and highly specific in that order thus could be used for the screening of blood, sera and plasma. However, none of the kits was found to be 100% sensitive or 100% specific by this work. When the results were subjected to statistical analysis, the X^2 and $\alpha=0.01$. With the p-value of $0.71>\alpha$ 0.01, there is no significant difference among the three rapid test kits. For the Gold negative samples, $X^2=0.51$, p-value 0.7748 where $\alpha=0.01$. When the p-value $0.7748>\alpha=0.01$, then there is no significant difference among the three kits.

These finding is in disagreement with a report by the Federal Ministry of Health [10], on the assessment of Uni-Gold, Stat-Pak and Determine, where it was stated that these kits have 100% sensitivity and specificity. These differences, however, may be due to the difference in location where the tests were performed, temperature of the location and possible cross reacting antigens that may interfere with the test kits. But their recommendation that the kits are suitable for screening of blood, sera and plasma in Nigeria, is in agreement with this recommendation of this work.

In their assessment in the University of Jos [11], it was reported that Determine was a reliable kit for HIV screening in developing countries like Nigeria because it is highly sensitive and specific, this also agrees with our work.

However, Determine was not recommended for use as a confirmatory kit due to its lower specificity which agrees with the finding of this work having a specificity of 97.5%, which is lower than Uni-Gold 98% and Stat-Pak 98.5%. Rather it recommended that Determine should be used as a tie-breaker in the event that the Stat-Pak is not available.

A serial algorithm using Determine and Stat-Pak and Uni-gold as a tie breaker was recommended as the work recognized Uni-Gold as performing well internationally [10], which also agrees with the findings of this work. The reliability of Determine rapid test kit was also confirmed by an evaluation carried out bythe University of Jos Nigeria in 2009 [11], where Determine, SD Bioline, Diaspot and DIALAB ELISA kits were evaluated and came out with a conclusion that all the kits including Determine are reliable for HIV testing in Nigeria and other developing countries.

In their work, [12]they found out that Determine rapid test kit was as sensitive as some other laboratory rapid test kit with a sensitivity of 100%. This disagrees with this work, the difference of which could be due to the batch of the test kit.The result of the study at Felege Hiwo Referral Hospital, Northwest Ethiopia[13]on Determine as a rapid test kit for blood donors, showed a poor sensitivity (60.5%) as a screening test kit for blood donors. However, no reason was given in their work for this poor performance which and does not agree with this work. They however suggested further evaluation at multiple Centres for their evaluation as a routine rapid test kit for blood donors. They recommended that it could be used in combination with another test kit in view

of its higher specificity (98.9%). This recommendation also agrees with the work of [14, 15] that test kits should be evaluated in each country before adoption for use.

In a separate assessment in Botswana of Determine and Uni-Gold rapid test kits, it was confirmed that Uni-Gold has a sensitivity of 87%, Determine 100% sensitivity thus can be used to identify un-infected HIV exposed infants which agrees with this work on their high specificity and sensitivity. In the report [16], it was discovered that some assays using African sera do not have similar test performance on European and American sera. They therefore recommended that test kits should be evaluated in the country in which they will be used before adopting them for wide scale use, a recommendation that agrees with that of our work.

In another evaluation carried in Dara Salaam, Tanzania [17], 390 gold positive and 1043 gold negative giving a total of 1433 samples were tested against Determine rapid test kit, SD Bioline, First response, Stat-Pak and Uni-Gold test kits. The result showed that all the kits including Determine, Stat-Pak and Uni-Gold have 100% sensitivity while Stat-Pak had highest specificity of 99.8%, Uni-Gold second with 98% and Determine third with 97.5% which agree with the findings of this work that Determine, Uni-Gold and Stat-Pak are highly sensitive and specific. In another assessment [18]in San Francisco USA, 155samples were tested against Ora Quick, Stat-Pak, Uni-Gold and Multispot with emphasis on Uni-Gold and Stat-Pak, they concluded that Uni-Gold was more sensitive than Stat-Pak and that it detected IgG and IgM thus can detect recent infection which accounted for the higher sensitivity more so that it uses higher volume of blood 60µl as against 5µl by Stat-Pak which according to their findings can increase sensitivity.

The assessment of Bioline, Determine and Uni-Gold rapid test kits was performed in Kenya [19], over fear that the Bioline rapid test kit was performing poorly following global alert by WHO over their accuracy. This fear was proved accurate by the outcome of the assessment when over one million Bioline rapid test kits were recalled and replaced with Uni-Gold as a tie breaker and Determine as a screening kit. This current findings, also agrees that kits be evaluated before being accepted for use as recommended by this work[16].

The algorithm in use in the Hospital is serial, using Determine as the first kit followed by Stat-Pak and Uni-Gold as a tie breaker. The claims by the manufacturers of the three rapid test kits assessed by this work, that the kits were 100% sensitive and 100% specific from the results in table 1-4 were found to be doubtful by this work and most evaluations cited in this work. The claim might be to attract patronage.

The consequence of these differences in diagnosis, will lead to increased incidence and prevalence of the HIV/AIDS infection in Nigeria, which will eventually increase the already existing burden on Agriculture,Education, Health and the business community, bearing in mind that the total spending for HIV/AIDS in Nigeria in the years 2007 and 2008 was $299,246,295.00 (N34,413,323,925.00) and $393,963,881.00 (N45,420,846,315.00) respectively with 85.4% and 92.3% of the fund coming from external sources.

IV. Conclusion And Recommendation

4.1. Conclusion

i. ELISA remains the gold standard in the screening of HIV infection and it use should be encouraged and provided in facilities especially for blood transfusion.
ii. The three kits tested have shown s high degree of sensitivity and specificity as shown in the evaluations carried out by other researchers including the WHO
iii. The claim by the manufacturers that their kits were 100% sensitive and 100% specific remains doubtful and maybe basically a marketing strategy

4.2. Recommendation

i. ELISA should be the gold standard in HIV screening in this environment
ii. The algorithm to be used should be Stat-Pak as a tie breaker.
iii. The use of these rapid test kits (Determine, Stat-Pak and Uni-Gold) for the screening of blood for transfusion should be discouraged by all facilities in view of the fact that none of these kit used for this work recorded a 100% sensitivity and specificity
iv. The ELISA method should be adopted for all transfusion purposes
v. None of the three rapid test kit should be used for screening of blood donors
vi. All rapid test kits should be evaluated before use
vii. More kits should be evaluated and those that perfume well should be included among the three kits in use in the hospital for fear of running out of any or two of those currently in use.

4.3. Contribution to Knowledge

We have determined the sensitivity and specificity of the three rapid test kits being used in BDSH Kaduna, Kaduna State the information of which is now available. The sensitivity of Determine has often come first but this work proves otherwise. The ELISA remains the Gold standard for this assessment.

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References

[1]. Jawetz, Melnick and Adelbergs, Medical Microbiology, 24th international edition(McGraw Hill publisher, 2004) 267- 272
[2]. MChessbrough,District lab practice in tropical countries. (Cambridge University Press, 2006) 248-266
[3]. RCGallo, SZSalahuddin, MPopovic, GMShearer, MKaplan, BFHaynes, TJPalker, RRedfield, JOleske, BSafai, et al, Frequent detection and isolation of cytopathic retroviruses (HTLV-III) from patients with AIDS and at risk for AIDS. Science 224, 1984, 500–503
[4]. PRMurray, EJBaron, MA Pfaller, CFTenovar and RHYolken, Manual of Clinical Microbiology 6th Edition(ASM Press Washington DC, W.H. 2005) 1049-1055
[5]. A Fauci,H. Lane, Immunological abnormalities in AIDS Annual Review. Immunology3,1985, 477-500
[6]. Jeanne-Marie Amat-Roze, L'infection à VIH/sida en Afrique subsaharienne, propos géographiques, Hérodote, 111,2003,121-125.
[7]. AAOsuji,Handbook of Aids Prevention1st Edition (Dalash Integrated Services Ltd Gwagwalada Abuja, 2008) 7-18
[8]. National Population Census 2006. http://www.population.gov.ng/index.php/publications/138-national-and-state-population-and-housing-tables-2006-census-priority-tables-vol-1
[9]. HEABum, ATH Figus, and GNVyas, Laboratory Diagnosis of hepatitis B virus infection by nucleic acid hybridization analysis and immunohistological detection of gene products. Developmental Biological Standard 59,1985, 125-139
[10]. Federal Ministry of Health 2007, Laboratory Based HIV Rapid Test Validation in Nigeria, Phase I, 1-10
[11]. EBBanwat, JYPeter, DZEgah,Evaluation of commercial test kits used in Nigeria. Nigerian Journal of Clinical Practice, 12(1), 2009, 11-14
[12]. BLouie, MW Pandori, E Wong, JDKlausner, and S Liska, Use of an acute sero-conversion panel to evaluate a third-generation enzyme-linked immunoassay for detection of human immunodeficiency virus-specific antibodies relative to multiple other ssays. Journal of Clinical Microbiology44,2006, 1856-1858
[13]. A Dessie, BAbera, FWalle, DWolday, WTamene, Evaluation of Determine HIV-1/2 rapid diagnostic test by 4th generation ELISA using blood donors' serum at Felege Hiwot Referral Hospital, northwest Ethiopia. Ethiopian Medical Journal, 46(1),2008, 1-5.
[14]. S Anderson, Z da Sliva, H Norrgen, F Dias, GBiberfeld, Field Evaluation of alternative testing strategies for diagnosis and differentiation of HIV-1 and HIV-2 infection in anHIV-1 and HIV-2 prevalent area. AIDS, 11,1997, 1815-1822
[15]. HC Steller, TCGranade, CANune, R Meza, STerrel, L Amador, JR George, Field Evaluation of Rapid HIV Serologic tests for Screening and confirming HIV-I infection in Honduras. AIDS 11, 1997, 369-375
[16]. WKUrassa, U Bredberg-Raden, E Mbena, Palson, E Minja, RA Lema, KPallangyo, FSMhalu, G Biberfeld, Alternative Confirmatory Strategies in HIV-I antibody testing. Journal of Aquired Immune Deficiency Syndrome5,1997, 170-176
[17]. EFLyamuya, SAboud, WKUrassa, JSufi, JMbwana, FNdugulile, Evaluation of simple rapid HIV assays and development of national rapid HIV test algorithms in Dar es Salaam, Tanzania. BMC Infectious Diseases 9, 2009, 19
[18]. B Louie, MWPandori, E Wong, JDKlausner, and SLiska,Assessment of rapid tests for detection of human immunodeficiency virus-specific antibodies in recently infected individuals. Journal of Clinical Microbiology, 46, 2008, 1494-1497
[19]. R Otini, 2011, HIV testing kits recalled over accuracy fearshttp://www.businessdailyafrica.com/Corporate-News/HIV-testing-kits-recalled-over-accuracy-fears/-/539550/1296788/-/gekdruz/-/index.html