Comparison of CD4 Cell Counts in Pregnant HIV-Seropositive and HIV-Seronegative Nigerian Women

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ABSTRACT

Objective: To evaluate the CD4 cell count of human immunodeficiency virus (HIV)-positive pregnant ethnic Nigerian women and compare it with that of HIV-negative pregnant ethnic Nigerian women and to determine the relationship between CD4 cell count and the packed red blood cell volume (PCV) of HIV-seropositive and HIV-seronegative pregnant women.

Materials/Methods: The study population included 130 ethnic Nigerian women between the ages of 17 and 40 years who came to the Antenatal and Prevention of Mother-to-Child Transmission (PMTCT) units of Jos University Teaching Hospital, in Jos, Nigeria. Relevant information such as age, occupation, tribal affiliation, gestational age, and prescribed drugs currently taken were obtained using a structured questionnaire. A selective technique was used to enroll pregnant women who tested positive for HIV infection and negative for malaria parasitemia, syphilis, and hepatitis B virus, along with healthy pregnant women with no history of these diseases. CD4 cell counts were determined using a Cyflow machine and packed red blood cell volume (PCV) obtained using a microhematocrit centrifuge. The Student *t*-distribution *t*-test was used to analyze data.

Results: The highest prevalence of HIV infection was found in the group aged 26 to 30 years; the lowest prevalence was found in the group aged 36 to 40 years. The mean (SD) CD4 cell counts of HIV-seropositive and seronegative women were 323.7 (170.7) and 578.3 (167.4), respectively ($P < .001$). Comparison of the CD4 cell count of HIV-positive and HIV-negative pregnant women with the PCV values from specimens from those women demonstrated a correlation coefficient r of 0.37 ($P < .001$) for the former group and an r of 0.37 ($P < .82$) for the latter. In HIV-seropositive and HIV-seronegative pregnant women with gestational age of less than 13 weeks, the mean (SD) CD4 cell counts were 610.X (170.3) ($P < .001$) and 302.0 (49.0) ($P < .001$) for the former and latter groups, respectively. The mean CD4 cell counts of the HIV-positive and HIV-negative pregnant women enrolled in our study with gestational age of 13 to 25 weeks and 26 to 38 weeks were 596 (146) ($P < .001$), 304 (170) ($P < .001$), 534 (189) ($P < .001$), and 254 (191) ($P < .003$), respectively.

Conclusions: This study suggests that pregnancy may partially deplete CD4 cells because a significant difference was observed in mean (SD) CD4 cell count in HIV-seropositive and HIV-seronegative pregnant women at various gestational ages. Chronological age did not affect the mean CD4 cell count if there was no accompanying disease condition. We also conclude that PCV in HIV-seropositive pregnant women was directly proportional to their CD4 cell counts.

Keywords: CD4 cells, HIV, pregnant women

Since the onset of the AIDS pandemic, women have consistently represented one the largest subgroups of patients with AIDS.[1] Human immunodeficiency virus (HIV) infection is a major public health problem in Nigeria and other parts of sub-Saharan Africa.[2,3] Nigeria ranks third among all countries for the total number of people living with HIV: about 1.7 to 4.2 million Nigerians are infected with the virus. CD4 lymphocyte count and HIV RNA viral load are independent predictors of the course of HIV progression.[4] The HIV epidemic has gained momentum in Nigeria during the past few years, with a prevalence of 8.5% among antenatal patients within the metropolitan area of Jos, Plateau state, Nigeria.[5]

Infection with HIV results in defective immune function, particularly involving cell-mediated immunity. Infected individuals may be asymptomatic or have progressive disease associated with recurrent opportunistic infections, certain types of cancer, severe weight loss, and central nervous system degeneration.[6] Because pregnancy is known to have a suppressive effect on cell-mediated immunity, the condition may

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Abbreviations

HIV, human immunodeficiency virus; PMTCT, Prevention of Mother-To-Child Transmission; PCV, packed cell volume

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accelerate the course of HIV disease. Hence, it is vital to screen pregnant women to monitor progression of the disease.[7]

Efforts to prevent HIV transmission to the fetus dominate current research on HIV infection in pregnancy. Estimates of vertical transmission have been revised downwards as more information has become available. The largest follow-up study of pregnancy and HIV infection has reported a vertical transmission rate of 14.4% in the Western world.[8] Of the neonates infected by maternal transmission, 26% developed AIDS and 17% died of HIV-related illness by the age of 12 months. The management of pregnancy in Nigeria is difficult because practical methods of prenatal diagnosis for affected or at-risk infants are seldom available.

Counting CD4 T-cells is an essential component of monitoring the course of HIV infection and evaluating the response to treatment. The absolute CD4 cell count measures the number of CD4 cells in each cubic millimeter of blood. In apparently healthy individuals, this number varies from 500 to 1200 cells per µl of blood.[9] The untimely induction of a form of programmed cellular demise (ie, apoptosis), which occurs mainly in HIV-infected individuals, is proposed as a mechanism for CD4+ T-cell loss in HIV infection.[10]

The aims of the present study were to evaluate the CD4 cell count of HIV-positive pregnant women and to compare this count with that of HIV-negative pregnant women.

Materials and Methods

This study was conducted at the Antenatal and Prevention of Mother-To-Child Transmission (PMTCT) units of the Jos University Teaching Hospital in Jos, Plateau State, Nigeria. Approval was sought from the AIDS Prevention Initiative in Nigeria Unit of the Jos University Teaching Hospital. Pregnant women with positive HIV test results from the wards, specialist clinics, and other health care facilities are usually referred for comprehensive services.

A total of 130 women between the ages of 17 and 40 years were enrolled in this study, all of whom were pregnant. Sixty-five of the women had HIV-seropositive status; 65 were HIV-seronegative.

After informed consent had been obtained from each participant, demographic data, including age, occupation, tribal affiliation, and gestational age were obtained using a structured questionnaire. We used a selective technique in which pregnant women who had tested positive for HIV infection and negative for malaria parasitemia (as assessed by Giemsa stain), syphilis, and hepatitis B virus (confirmed using the Rapid Reagin Card Test and the Bioelisa HBsAg diagnostic kit [Super Religare Laboratories Ltd, New Delhi, India]) were enrolled alongside apparently healthy pregnant women with no history of the diseases mentioned herein. Blood samples were assayed for CD4 T-cell count using the No-Lyse, No Wash flow cytometer (Partec GmbH, Munster, Germany). Packed cell volume (PCV) was estimated using the microhematocrit centrifuge and cell volume reader.

The HIV-positive status of all the pregnant women in our cohort was confirmed by Western blot testing (Immunetics Inc, Boston, MA) after presentation of positive screening results via STAT-PAK (Chembio Diagnostic Systems, Inc, Medford, NY). The CD4 T-cell counts were reported as cells per µl of blood and PCV was expressed as a percentage. The blood specimens were analyzed soon after collection.

Data were analyzed statistically using Epi Info software, version 3.3.2 (Centers for Disease Control and Prevention, Atlanta, GA). The Student's *t* test was used to compare the data sets.

Results

Of the 130 pregnant women enrolled in this study, 65 tested positive and 65 tested negative for HIV. The group of women aged 26 to 30 years had the highest prevalence of HIV (ie, 33.4%); the lowest prevalence was found among women aged 36 to 40 years (ie, 8.4%), as shown in **Table 1**. The mean (SD) percentage for the PCV of HIV-seropositive pregnant women was 30.1% (1.6%) with a median of 30%, a maximum of 33%, and a minimum of 26%. The corresponding PCV of HIV-seronegative pregnant women was 34.9% (2.3%) with a median of 35%, a maximum of 39%, and a minimum of 29%. The mean (SD) CD4 T-cell count of HIV-seropositive pregnant women was 323.7 (170.7) cells per µL with a median of 287 cells per µL; that of HIV-seronegative pregnant women was 578.3 (196.7) cells per µL, with a median of 534 cells per µL ($P < .001$).

Table 1. Age Distribution of HIV-Positive Women

Age Range (years)	HIV Positive, No. (%)
17-20	6 (9.2%)
21-25	20 (30.6%)
26-30	22 (33.4%)
31-35	12 (18.4%)
36-40	5 (8.4%)

Table 2. Pattern of CD4 and PCV of HIV-Positive and HIV-Negative Pregnant Women

HIV Status	Mean (SD) PCV, %	CD4 cells/μL	*r* Value	*P* Value
Positive	30 (1.6)	323.7 (171)	0.37	< .002
Negative	35 (2.3)	578.3 (196)	0.37	< .82

Table 3. Comparison of CD4 Cell Counts Based on Gestational Age

Gestational Age, wks	HIV Status	Mean (SD) CD4 Count, cell/μL	*P* Value
≤13	Negative	610 (170)	< .001
≤13	Positive	302 (49)	< .001
13-25	Negative	596 (146)	< .001
13-25	Positive	304 (170)	< .001
26-38	Negative	534 (189)	< .001
26-38	Positive	254 (191)	< .001

Comparing the CD4 count with gestational age, the mean (SD) CD4 count for HIV-seronegative pregnant women and HIV-seropositive pregnant women, both at less than 13 weeks' gestational age, was 610 (170) cells per μl and 301.9 (49) cells per μL, respectively ($P <$ .001). HIV-seropositive and HIV-seronegative women at 13 to 25 weeks' gestational age had mean (SD) CD4 cell counts of 303.6 (170.2) cells per μl and 596.9 (146) cells per μL, respectively ($P <$ .001) and those at 26 to 38 weeks' gestational age had mean (SD) CD4 cell counts of 533.5 (189) cells per μL and 254 (191.2) cells per μL ($P <$ .001), respectively (**Table 2**).

When the CD4 count of the pregnant women was compared with the PCV value, the HIV seropositive pregnant women had an *r* of 0.37 (P < .002). The HIV-seronegative pregnant women had an *r* of 0.37 ($P <$ .82), **Table 3**.

Discussion

Most Nigerian women become pregnant in the years when they are most sexually active, namely, between the ages of 25 and 30 years; this may explain why the highest number of enrollees were of this age group. Our study supports the work of Sagay et al[5] in 2003, who reported that the highest percentage of women with HIV infection in their cohort was found in the group between the ages of 21 and 28 years.

The PCV results of HIV-positive pregnant women compared with those of HIV-negative women were statistically significant. This study suggests that HIV infection lowers the PCV in pregnancy; this finding is in line with that of Lamcha et al whose results showed a decrease in PCV for HIV-positive patients.[11] However, the mean PCV for the HIV-positive women was higher for women taking hematinics compared with those not taking any form of hematinics. Of interest, the CD4 count was higher in both groups compared with that of individuals not taking any form of hematinics, suggesting that the drugs may influence these hematologic parameters.

The median CD4 count of the HIV-seronegative pregnant women (ie, 534 cells/μL) is similar to counts reported in Ethiopia and Botswana.[11] This result may indicate that a pregnant woman with HIV-negative status as measured by CD4 cell count may have lower immune status compared with her counterparts in the Western world, where counts are in the range of 600-1500 cells per μL.[11]

Comparing the CD4 counts in different gestational ages showed a progressive decline in the CD4 count of the HIV-negative women, from 610 cells per μl to 534 cells per μL ($P <$ .05), which was not significant. This finding may be associated with other factors, such as stress or decreased immunity. However, there was a statistical significant difference in the CD4 count of the different gestational ages of the HIV-positive and HIV-negative pregnant women at less than 13 weeks' gestation ($P <$ .001), 13 to 25 weeks' gestation ($P <$ .001), and 26 to 38 weeks' gestation ($P <$ .001). This finding confirms a lower CD4 cell count in HIV-seropositive pregnant women.

A correlation was observed when the PCV of the HIV-positive women was compared with the CD4 count, implying that the PCV of HIV-positive pregnant women

was directly proportional to their CD4 count; this finding was supported by results reported by Lemoha et al.[11] However, there was a zero correlation (ie, 0.034) when the CD4 counts of HIV-negative women were compared with their gestational ages, which shows that no relationship exists between gestational age and CD4 cell count.

The results of this study confirm that HIV in pregnancy affects the CD4 cell count in Nigerian women and that CD4 varies based on gestational age. Also, hematinics may play an important role in boosting the CD4-cell count and PCV of pregnant women. Other variables in pregnancy such as maternal weight should be monitored to confirm the relationship between maternal weight in pregnancy and CD4 cell counts in HIV-positive pregnant women. LM

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