

## Electrolyte Abnormalities and Renal Impairment in Asymptomatic HIV-infected Patients in Owerri, South Eastern Nigeria.

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**Abstract:** The study was designed to assess the possible incidence of electrolyte abnormalities and renal impairment in treatment-naïve HIV patients in an urban Community in Nigeria. A total of 115 (50 Males and 65 Female) HIV-infected patients who have not been placed on any anti-retroviral drugs and 20 age and sex-matched persons (control) participated in the study. Serum electrolyte together with urea and creatinine levels were used for the assessment. Results obtained revealed that serum urea concentrations were significantly increased ( $p < 0.05$ ) in both male and female patients ( $29.14 \pm 7.70$  mg/dl and  $26.67 \pm 8.34$  mg/dl respectively) compared to their corresponding levels in the controls ( $17.45 \pm 12.10$  mg/dl; for males and  $17.13 \pm 1.51$  mg/dl; for females). Although no significant difference was obtained in the serum creatinine levels of the patients relative to the control, correlation analysis revealed a positive association between creatinine and urea levels in both male ( $r = 0.63$ ) and female ( $r = 0.68$ ) HIV patients. Hyponatremia occurred in 47.5% of the patients, hyponatremia in 22.5% while 32.5% were hypokalemic. None of the patients had hyperkalemia. Chloride ion ( $\text{Cl}^-$ ) was positively associated with sodium ion ( $\text{Na}^+$ ) ( $r = 0.35$ ) and negatively associated with bicarbonate ion ( $r = -0.37$ ). The results of the study therefore indicate that renal function may be impaired in HIV positive patients who have not been placed on any anti-retroviral drug.

**Key words:** Electrolytes, Urea, Creatinine, Asymptomatic HIV

### INTRODUCTION

Human immunodeficiency viral infection affects all body parts. The virus breaks down the body's immune system, infects  $\text{CD}_4^+$  cells initially and progressively leads to AIDS. Sub-Saharan Africa has been known to be worst hit by the HIV/AIDS pandemic (Akinsete 2002, Onwuliri *et al* 2003). As at the end of 2001, Nigeria had over 4 million people living with HIV/AIDS and a national seroprevalence of 5.8% (Akinsete 2002, Onwuliri and Ikwuyatun 2003). The current estimate of infected individuals in Nigeria is put at approximately 3.1% of adults between ages 15-49 years (UNAIDS 2008). This means that as at the end of 2007, 2.6 million Nigerians were infected with HIV. Given the Nigerian population census, this revised national estimate reflects only an improved data rather than a substantial decrease in actual prevalence. A number of factors have been known to be contributory to the increased prevalence. These include: Secrecy usually associated with the infection, lack of access to prevention, low socio-economic status of women, inadequate treatment and care services and stigma and discrimination (Metzenrath 1998, Onwuliri and Mohammed 2001, UNAIDS 2002). AIDS patients are frequently exposed to medications that can adversely affect their renal function. Reports show that frequency and nature of renal and electrolyte abnormalities in HIV patients vary considerably from centre to centre (Lu and Ross, 2005, Onwuliri 2004, Ahuja *et al*, 1999; Sency *et al*, 1990).

The prevalence of impaired kidney function was estimated to range between 10% and 20% of the adult population in most countries world wide (WHO 2003, Beaglehole and Yach 2003). In Nigeria, prevalence of preventable renal disease is not known (Afolabi *et al* 2009). Available data appear to suggest a high prevalence within the country. Abioye – Kuteyi *et al* in 1999 reported a prevalence rate of 19.9% of undetected renal diseases in a rural populace in Western Nigeria. An incidence of 45.5% of impaired kidney function was also reported among hospitalized hypertensive patients in Maiduguri, Northern Nigeria (Nwankwo *et al* 2006). However in 2008 a 38% prevalence of renal disease was observed in Nigerian HIV / AIDS patients who were on antiretroviral drugs (Emem *et al.*, 2008). Despite this, there is still paucity of data on the renal disease status in Nigeria and particularly on the assessment of renal status of asymptomatic HIV patients Prior to administration of appropriately therapy (ART). in Imo State. The study therefore sets out to assess the renal

status of newly infected HIV patients who have not been placed on any antiretroviral therapy. Findings from this study, it is hoped, will help establish baseline kidney status prior to introduction of the highly active antiretroviral therapy (HAART) in Nigerian patients.

## MATERIALS AND METHODS

The study was carried out at Imo State General Hospital, Owerri, from June to September 2008. A total of 115 newly diagnosed HIV infected patients who have not been placed on any antiretroviral therapy and 20 age/sex matched HIV-seronegative volunteers were enrolled into the study. Inclusion criteria for the patients were: positive testing to HIV antibody assay using an ACON HIV 1/2 Rapid Human Immunodeficiency Virus Test Strip and further confirmation of same using immunocomb HIV 1/2 Biospot (Oregenis, Israel). Patients were also included if they were aged 17-60years, were not yet placed on any antiretroviral drug and if their informed consent was given through completing and signing of the informed consent form. Exclusion criteria were: family history of kidney disease; initiation of any antiretroviral drugs; presence of any confounding illness like tuberculosis, HCV or any opportunistic infection as well as  $CD_4^+$  cell count less than 200 cells/ $\mu$ l of blood.

### *Sample Collection:*

A 5ml portion of venous blood was collected from each subject by venupuncture and allowed to clot. This was later centrifuged in a Wisperfuge (Model 684) centrifuge at 2500g for 5minutes and then analyzed for the kidney function parameters. Serum urea was determined by urease enzymatic method, creatinine by Jaffe's reaction and bicarbonate by titration as described by Tietz (1987). Serum sodium, potassium and chloride levels were determined by ion selective electrode method using Humalyte machine (Human, Germany) (Tietz 1987).

### *Statistical Analysis:*

Results were analyzed using Statistical Package for Social Sciences (SPSS) version 10.0. The data were expressed using descriptive statistics and percentages. Values were given as mean  $\pm$  standard deviation. Student's t-tests were used to compare groups and Spearman's correlation coefficients used to establish associations. P-values less than or equal to 0.05 were taken as statistically significant.

## RESULTS AND DISCUSSION

The demographic and anthropometric data of the studied population is as shown in Table 1. The result of the measured biochemical parameters are presented in Table 2. Blood urea concentration was significantly increased in both male and female HIV patients relative to their control levels. There was no significant difference between creatinine levels of both the male and female patients compared to the control. Serum sodium was significantly increased in male HIV patients compared to the control, whereas in the female patients, the increase was not significant. Hyponatremia ( $>145\text{mEq/L}$ ) occurred in 47.5% of the patients and 22.5% were hyponatremic ( $<135\text{mEq/L}$ ). Serum potassium was significantly decreased in both male and female HIV patients than in the control group. Hypokalemia ( $<3.5\text{mEq/L}$ ) occurred in 32.5% of the patients and none of the patients was hyperkalemic. There was no significant difference in the bicarbonate ion concentration of all the patients compared to their controls whereas chloride ion decreased significantly in both the male and female HIV patients. Although chloride was decreased in these patients compared to their control, correlation analysis revealed a positive association between chloride and sodium ion concentrations ( $r=0.35$ ) and a negative association between chloride and bicarbonate ion concentrations ( $r= -0.37$ ) in the male HIV patients. No such association was found in the females. However, urea and creatinine concentrations were found to be positively associated in both male ( $r=0.63$ ) and female ( $r=0.68$ ) HIV patients.

**Table 1:** Demographic and anthropometric data of the studied population

Parameters	Test	Control
Sample size	115	20
Age Range (years)	17-60	17-60
Male	50	7
Female	65	13
BMI ( $\text{kg/m}^2$ )	$24.65 \pm 8.74$	$21.87 \pm 8.23$

**Table 2:** Biochemical Parameters of the Studied Population

Serum parameters	Male		Female	
	Test	Control	Test	Control
Urea (mg/dl)	29.14±7.70*	17.45±2.11	26.67±8.34*	17.13±3.51
Creatinine (mg/dl)	0.86±0.39	0.82±0.40	0.85±0.38	0.85± 0.17
Sodium ion (Na <sup>+</sup> )(mEq/L)	149.47± 11.06*	140.22 ± 2.48	145.74± 14.20	139.43±4.24
Chloride ion (Cl <sup>-</sup> )(mmol/L)	92.86±6.24*	103.48±2.83	95.03 ± 8.60*	102.31±4.85
Potassium ion(K <sup>+</sup> )(mEq/L)	3.49± 0.34*	4.13± 0.24	3.53±0.35*	4.05±0.26
Bicarbonate ion(HCO <sub>3</sub> <sup>-</sup> ) (mmol/L)	21.31± 2.62	22.29±1.80	22.00±3.63	22.75±2.78

\* Significantly different at p ≤ 0.05

**Discussion:**

The study exhibited quite some abnormalities in the kidney function of HIV patients. The high urea concentration with normal serum creatinine concentration obtained in our study differs from results from previous studies which found elevated serum creatinine concentration in 38% of HIV patients in Nigeria (Emem *et al.*, 2008). The difference in the result of creatinine concentration could be as a result of the differences in the stages of HIV infection in the patients studied. While Emem and co-workers studied patients who were already on drugs most of whom had established renal diseases requiring biopsy, our patients were newly infected HIV-seropositive subjects not yet placed on any antiretroviral therapy. Since the creatinine levels of these patients were normal, the elevated urea concentration may suggest pre-renal ureamia. It could be as a result of high protein intake or hyper catabolic states including muscle wasting in these patients. Dehydration may also be considered as the cause of high urea level in these patients. Certainly, the normal creatinine concentration rules out overt renal failure.

Our result of electrolyte abnormalities differs from that obtained by Onwuliri in 2004, who found no electrolyte abnormality in newly infected HIV patients in Jos, Central Nigeria. The difference could be as a result of the stage of infection of the patients or better still due to individual idiosyncrasies as results vary from centre to centre. The abnormal electrolyte levels though quite high in our study with 47.5% hyponatremia, 22.5% hyponatremia and 32.5% hypokalemia is in line with some previous findings. Peter (1991) observed a 28.4% hyponatremia, 17.3% hypokalemia and 4.9% hyperkalemia without renal failure in a group of Latino and African-America patients with HIV/AIDS. This may buttress the fact that HIV-associated renal dysfunction and nephropathy occurs predominantly in African-American patients and blacks in general (Berggren and Batuman 2005). Ahuja *et al.*, (1999) also found that HIV-associated nephropathy was confined to African-Americans while Mazbar *et al.*, (1999) assessing renal disease in illicit drug injectors observed that the black race is a risk factor for HIV-associated nephropathy. This race-related kidney dysfunction may also explain the observations of no electrolyte imbalance, proteinuria or renal failure in HIV-infected patients on ART in Iran (Athami *et al.*, 2007).

Hyponatremia which occurred in most of the patients may also be a pointer to an intracellular dehydration state. Hyponatremia usually occurs as a result of excess water loss, a net Na<sup>+</sup> gain in excess of water and decreased sodium excretion (Newman and Price 2001). It should be noted however, that hyperkalemia was conspicuously absent in our study. This differs from reports from Peter (1991) and Emem *et al.* (2003) who found hyperkalemia in 4.9% and 5.6% of their patients respectively.

Our study also showed that HIV patients in addition to their well known predisposition to hyponatremia can also have alterations in serum bicarbonate and chloride concentrations. Hypochloremia is frequently observed in cases of metabolic acidosis. Chloride ion concentration is supposed to follow those of Na<sup>+</sup> in the absence of acid-base disturbances, but our study observed a decrease in Cl<sup>-</sup> concentration in HIV patients. This is a pointer to a possible acid-base disturbance in these patients. Although fluctuations in serum chloride have little clinical consequences, they are signs of an underlying disturbance in fluid and acid-base homeostasis. Fluid-electrolyte and acid-base derangements frequently encountered in AIDS, have been found to be major factors for the development of acute renal failure (Rao, 1998). The changes in Cl<sup>-</sup> and HCO<sub>3</sub><sup>-</sup> concentrations albeit small are suggestive of a possible existence of an alteration in the equilibrium of body anions in these patients. Further studies are however required in this aspect of HIV investigations.

We therefore conclude that renal impairment manifested in form of electrolyte abnormalities and increased urea concentration could occur in HIV patients not yet placed on any antiretroviral drugs. This may mean that some of the patients not yet placed on ART (and whose CD<sub>4</sub><sup>+</sup> cell count may be high) may actually have abnormal electrolyte parameters and may worsen if not attended to. This study clearly supports the high renal abnormalities often seen amongst black populations outside Nigeria.

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