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# Evaluation of Serum Electrolytes, Urea and Creatinine Levels in HIV – Positive Patients in Makurdi North Central Nigeria

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**ABSTRACT**
*A total of 150 subjects were used for this study. Out of these numbers 50 were HIV-infected patients on Antiretroviral therapy (ART) and 50 were not on ART. The remaining 50 were screened HIV negative individuals drawn from the donation unit to serve as control. The subjects were made up of both sexes, ages ranging from 16 – 54 years. Blood samples were collected and analyzed for electrolytes such as $Na^+$, $K^+$, Cl, $HCO_3^-$, and serum urea and creatinine. Biochemical parameters were analyzed for mean $\bar{X}$ ±Standard Deviation, and student's t-test for paired observation. All biochemical data were expressed as mean ± SD with the level of significance set at $P < 0.05$ confidence interval. There was a significant difference $P < 0.05$ in plasma creatinine and urea levels in patients with infected and treated (IAT) and infected and not treated (INT) when compared with controlled subjects. The $\bar{X}$ plasma creatinine level was also higher in INT than those of IAT with an insignificant difference. There was no significant difference in serum, $Na^+$, $K^+$, $Cl^-$, $HCO_3^-$ of IAT and INT when compared with control. Therefore this work recommends a periodic renal evaluation of HIV-infected patients to see the effect of the virus and probably drug on the serum electrolytes as this would help in the change of line of drug if effect or impairment is noticed early.*
**Keywords;** *HIV infected and treated, HIV infected untreated, serum electrolytes, Patients.*

## INTRODUCTION

The natural history of HIV infection has changed dramatically in the era of highly active antiretroviral Therapy (HAART) in the areas of the world that are able to afford those therapies. Since the initial report by[1]. Multiple studies have confirmed the existence of a specific human immunodeficiency virus-associated nephropathy (HIVAN). Rates of HIV-related opportunistic infections and diseases decreased dramatically from 1995 to 1999, coincident with the introduction of multidrug antiretroviral therapy. The effects of HAART on HIVAN and HIV-related end stage renal disease prevalence is less clear although studies suggested that HAART may decrease the risk of developing chronic renal

disease [1,2]. According to the National Institutes of Health, National Institute of Diabetes and Digestive and kidney Diseases, 2001 in the United State, 6,179 patients with HIV infections have received renal replacement therapy before May 2000.Apart from patients with overt HIVAN, in which attention is drawn of kidney function, HIV-infected patients may develop a variety of underreported biochemical abnormalities that may be classified in coincidental renal disorders, specific HIV abnormalities and anti-retroviral treatment induced side effect Patients with HIV infection are at increased risk of drug induced renal toxicity, most commonly associated with trimethoprim sulfamethoxazole (TMP-SMZ), pentamidine, or acyclovir treatment [3]. Acute renal failure (ARF) has also been occasionally associated with receipt of idinavir, ritonair, adefovir, and Cidofovir. Tenofovir (Vireal; Glead) is a new nucleotide reverse-transcriptase inhibitor used with other antiretroviral agents for the treatment of HIV-infection[3]. In a research to determine the pattern of renal disease and risk factors for renal disease in HIV-infected Nigerians, 400 consecutive HIV and AIDS patients were examined. It was observed that there was a high prevalence of renal disease (proteinuria and/or elevated serum Creatinine) in 152 out of 385 of the patients [4]. Evidence derived from numerous studies supports a primary role for HIV in the development of direct damage of different organs eventually being responsible for the appearance of dementia, cardiomyopathy, nephropathy and hematologic abnormalities. As a result of the introduction of effective antiretroviral combination therapies a dramatic decrease of AIDS-associated opportunistic infections and malignancies was observed; however, the role of HAART on HIV organ damage is less well appreciated (HIV and Direct Damage of Organs, 2003), Twenty-seven years after the first published description of AIDS, HIV-associated nephropathy (HIVAN) remains an important cause of kidney disease in HIV-infected patients [5]. The pathogenesis of HIVAN involves direct HIV infection of the kidney, with both viral and host genetic factors playing an important role. Thus, the widespread use of antiretroviral therapy has influence the epidemiology of HIV related kidney disease and the diseases of the kidney are among the most dangerous cause of death and disability in many countries throughout the world for example, more than 20 million adults in the united states were estimated to have chronic kidney diseases [6].Waste products of metabolism such as urea and creatinine accumulate almost in proportion to the number of nephrons that have been destroyed. The reason is that substances such as creatinine and urea depend largely on glomerular filtration for their excretion and they are not absorbed as avidly as the electrolytes, Creatinine for example is not absorbed at all, [6,7] Therefore, the aim of this study is to evaluate changes in renal parameters such as electrolytes [sodium (Na), Potassium ($K^+$), Chloride ($Cl^-$) and bicarbonates ($HCO_3^-$], serum urea and serum creatinine in individuals infected with HIV compared with the HIV-negative control subjects. Also to evaluate the effect of antiretroviral therapy on the renal function/system of HIV-infected subjects.

## MATERIALS AND METHODS

### STUDY SUBJECTS

A total of 150 subjects were used for this research. These were made up of 50 screened HIV-negative individuals drawn from the donation unit to serve as control, 50 new HIV-infected patients, and 50 on antiretroviral therapy randomly drawn from APIN-plus/HARVARD PEPFAR Unit of Federal Medical Centre Makurdi, Benue State. The subjects were made up of both sexes, ages ranging from 11 – 60 years. All the subjects used were free from any known opportunistic infections associated with HIV/AIDS.

### SAMPLE COLLECTION

All the blood samples were collected between 8.00am and 10.00am with minimum stasis. The samples were obtained by venepuncture from the

antecubital vein after sterilization with methylated spirit and delivered into dry plain bottles after the needle have been removed and the bottles well labeled to avoid mix up. The blood was allowed to clot and retracted, then centrifuged at 1000rpm for 5 minutes and serum separated into corresponding pre-labeled clean dry small bottles. The samples were stored at frozen temperature until analysis.

**ESTIMATION OF SERUM SODIUM AND POTASSIUM IONS USING FLAME PHOTOMETRIC METHOD**

Sodium and potassium ions were measured by standard flame photometric method.

**ESTIMATION OF BICARBONATES ION**

Bicarbonate was estimated by back titration method using modified Vanslyke method[8].

**ESTIMATION OF CHLORIDE ION**

Chloride was measured by using the modified mercuric nitrate $Hg(NO_3^-)$ titrimetric method of Schales and schales, [9].

**ESTIMATION OF SERUM UREA**

Urea was measured by Diacetylmonoxime method, (DAM method) using thiosemicarbozide [10,11].

**ESTIMATION OF SERUM CREATININE**

The serum creatinine was estimated using the Rehbery-Follin [12] modification of Jaffes Method [13]

**RESULTS AND DISCUSSION**

TABLE 1. shows the Mean ± SD of sodium ($Na^+$) Potassium (K), chloride ($Cl^-$), Bicarbonate (HCO3), urea and creatinine of HIV-infected patients on antiretroviral therapy (ART), HIV-infected patients Not on therapy and control N = 50. This research demonstrates that the renal failure associated with HAART is rare as described in researches because almost all the values for the parameters assessed are within the normal biochemical ranges for (Na =134-145mMol/L; $k^+$ =3.5-4.5mMol/L; $Cl^-$ =97-107mMol/L; $HCO_3^-$= 21-31mMol/L;Urea= 2.5-6.5 and Creatinine= 72-106mMol/L).However, subtle but significant changes in urea and creatinine were observed, associated with HIV-infected patients (both IAT and INT), whereas no significant changes in serum $Na^+$, $Cl^-$ and $HCO_3^-$ were observed. In this study it was found that there was significant difference in the level of plasma urea in patients with IAT and INT compared with control subjects. The result also showed a significant difference in plasma urea in IAT and INT compared with control subjects (3.3±17 and 4.80±1.45vs 4.00±1.15mMol/L, $P<0.05$). the result also showed a significant difference in plasma urea in IAT and INT . There was significant changes in the serum creatinine levels of IAT and INT of 64±15.50 and 73.78±39.92mMol/L respectively.

**TABLE 1.** Results of the Mean ± SD of sodium ($Na^+$) Potassium (K), chloride ($Cl^-$), Bicarbonate (HCO3), urea and creatinine of HIV-infected patients on antiretroviral therapy (ART), HIV-infected patients Not on therapy and control N = 50.

| Parameters (mMol/L) | HIV-Infected and on ART± SD | HIV-Infected and not on ART± SD | Control ± SD |
|---|---|---|---|
| **$Na^+$** | 130.90 ± 18.17 | 134.24 ± 6.42 | 132.90 ± 6.807 |
| **$K^+$** | 4.28 ± 0.55 | 4.32 ± 0.76 | 4.02 ± 0.52 |
| **$Cl^-$** | 102.00 ± 4.0 | 102.98 ± 4.12 | 103.32 ± 4.03 |
| **$HCO_3^-$** | 25.24 ± 2.75 | 25.58 ± 3.12 | 24.60 ± 2.91 |
| **Urea** | 3.31 ± 1.17 | 4.80 ± 1.45 | 4.00 ± 1.15 |
| **Creatinine** | 64.06 ± 15.50 | 73.78 ± 39.2 | 99.22±7.88 |

These can be explained by the following reasons: Administration of early combine therapy with different nucleoside analogues or with newer agents, such as protease inhibitors may profoundly

suppress viral replication, translating into prolonged survival [14]. This result agrees with Hitner and Nagle [15], who suggested that adverse effect of antiretroviral drug occurs more frequently in those patients with a history of neuropathy as well as those patients with low CD4 counts. In contrast, direct access to the patients was not established to find out whether they ever had a history of renal impairment. [16] who screened 65 HIV-infected Iranian patients found no renal failure or electrolyte abnormality in all the patients. There was no statistically significant difference in plasma level of $Na^+$, $Cl^-HCO_3^-$ except $K^+$ of all the test patients (both IOT and INOT) when compared with the control subjects. This assertion agrees with the work of Afhami et al (2007) who found no abnormality among 65 HIV- infected patients, there was no deviation in $K^+$ levels. The significant difference observed in $K^+$ conformed with the work of Carlos et al that revealed that, HIV-infected individuals have a significant abnormality in systemic $K^+$ equilibrium was not supported by this research. This abnormality which may subsequently leads to the development of hyperkalemia according to [17] is not in agreement with this research. The assayed parameters were not sex and age bias as there was no significant difference when subjected to statistical analysis. I recommend a periodic renal evaluation for HIV-infected patients to see the effect of the virus and probably drug. As this would help in the change of line of drug if effect/or impairment is noticed early and this will increase longevity of life of the patients ensured.

## CONFLICT OF INTEREST

No conflict of interest was declared at all by the authors

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