Comparative Study on the Electrolyte Levels of HIV/AIDS Patients on High Active Antiretroviral Therapy (HAART) in Owerri Metropolis, South Eastern Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

This study investigated and compared the electrolyte levels of HIV/AIDS patients on high active antiretroviral therapy (HAART). Thirty patients (13 males and 17 females) were recruited for this study. Patients included in this study were HIV positive and on high active anti-retroviral treatment for at least three months. They were not on any mind altering medications and were mentally sound and are within the age range of 10 years to 59 years. Remarkable differences were observed in the concentrations of the electrolytes (Cl^-, Na^+, K^+, HCO_3^-) when compared with their

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normal ranges. Decreased levels (mmol/L) of serum Cl^- (3.90±0.54) and Na (31.70±0.10) were observed. Between the male and female patients, K^+ level (mmo/L) (3.70±0.54 and 4.0±0.54 respectively) was observed to be within the normal value of 3.5 – 5.0 mmo/L. Na^+ concentration (mmol/L) was observed to be decreased in both male and females with the values of 130.80 ±6.40 and 131.4±6.50 respectively. The Cl^- concentration (mmol/L) was observed to be increased in females (98.40±7.60) and decreased in males (97.20±8.90) when compared with the normal range (98.00-105.00 mmol/L). The male patients showed an observed significant increase in the concentration (mmol/L) of their HCO_3^- (38.20±15.70) than the females (25.10±2.60) when compared with the normal value of 24.00-30.00 mmol/L. The concentration (mmol/L) of Na^+ of all the ages (10-59years) was observed to be decreased when compared with the normal range (135.00- 150.00 mmol/L) while K^+ for all the ages was observed to fall within the normal range. Only the age range of 30 -39years had an increased level of Cl^- (145.90±48.10) while the other age ranges were decreased. The concentration (mmol/L) of HCO_3^- of all the age ranges were observed to be within the normal range except for the age range of 20-29years which was observed to show a decreased concentration (mmol/L) of 22.30±4.00 when compared with the normal range of 24.00-30.00 mmol/L. Findings from this study has led to the recommendation that strict monitoring of the serum electrolytes in HIV/AIDS patients on HAART is important as early detection and treatment of these abnormalities will enhance the quality of life of patients.

Keywords: Electrolytes; HAART; HIV; AIDS; blood.

1. INTRODUCTION

The human immunodeficiency virus (HIV), the virus that causes the acquired immune deficiency syndrome (AIDS) was identified in 1983. As at the end of 2003, about 70 million people had been infected and more than 42 million still living with the virus while 15,000 people worldwide are infected each day [1-3]. Sub-Saharan Africa is worst hit as more than 70% of the over 42 million persons infected worldwide live here and AIDS is now the leading cause of death in the region. Nigeria the most populous country in Africa has over 4 million persons living with HIV/AIDS and a national sero prevalence of 5.8% as at the end of 2001 [4-6].

Several factors have been identified as fueling the epidemic in Africa. Such factors include ignorance of the disease, lack of access to prevention, low socio-economic status of women, inadequate treatment and care services and stigma and discrimination [5,7-10]. Despite all the progress in HIV and AIDS science since 1981, the epidemic unfortunately continues to progress in the developing world, where over 95% of people infected with HIV live [11]. Though researchers have been making steady progress in the past 11 years, the pace according to Peter Piot the Executive Director of UNAIDS, is not fast enough for all the people who could benefit from it [9,12]. The antiretroviral drugs used in treatment are very expensive and unavailable and cannot reach millions of infected people who need them. As a result, for the uninfected, prevention is still better, but for the infected accurate and timely diagnosis and treatment are needed to prolong life span and improve quality of life as well as reduce the frequency and duration of hospital admission [13].

In countries where resources are plentiful, monitoring of HIV infection includes routine chemical assessment and measurement of $CD4^+$ T lymphocyte counts and plasma HIV load. These indicators are used to determine disease stage and progression, assist in decisions regarding when to start or change ART and assess treatment response. On the other hand, for resource-limited settings, Kent et al. [14] asserted that biological and social reasons such as HIV clades, differences in prevalence of co-infections and socio-economic differences make it inappropriate to apply the guidelines developed in wealthy industrialized countries in Sub-Saharan Africa and other poor nations.

From the foregoing, it is imperative that researches are required for the development of simple and rapid diagnostic tests upon which to build the guidelines for treatment that at the moment are exceedingly limited with standard monitoring tests largely inaccessible to many [3].

The present study seeks to measure and compare with respect age and sex the electrolyte levels of HIV/AIDS patients on HAART with a view to generating preliminary data that could be used in identifying the infection early and in monitoring the progression of the disease.

2. MATERIALS AND METHODS

2.1 HIV/AIDS Patients

Thirty HIV/AIDS patients (13 males and 17 females) aged 10-59 years drawn from patients attending Medical Out-patient Department of Federal Medical Center, Owerri were recruited for participation in the study. Patients included those whose HIV/AIDS status have been confirmed (Western blot), whether symptomatic or asymptomatic and were receiving HAART. Excluded from the study were patients that were not sure of their HIV/AIDS status or that were diabetic, hypertensive or have any other conditions that may interfere with the result. The purpose of the study was explained to the patients after which informed consent were obtained.

The Ethical Committee Federal Medical center Owerri approved the study protocol. The approval was on the agreement that patient anonymity must be maintained, good laboratory practice/quality control ensured, and that every finding would be treated with utmost confidentiality and for the purpose of this research only in compliance with the Helsinki declaration.

Socio-demographic data like age and sex, as well as duration of illness/infection and treatment details were obtained from case notes of the patients.

2.2 Sample Preparation

Blood samples were taken by venepuncture from the HIV/AIDS patients. Serum was prepared by centrifugation using MSE minor centrifuge model at 1,500 rpm for 5 min. The serum samples were stored at –20°C until needed for analysis.

2.3 Determination of Plasma Electrolytes

Chloride concentration was determined using the mercuric nitrate method while bicarbonate was assayed by back titration. Potassium and sodium were analyzed with the flame photometer [15].

3. RESULTS AND DISCUSSION

From Tables 1 and 2, Remarkable differences were observed in the concentrations of the electrolytes (Cl^-, Na^+, K^+, HCO_3^-) when compared with their normal ranges. Decreased levels (mmol/L) of serum Cl^- (3.90 ± 0.54) and Na (31.70 ± 0.10) were observed. Between the male and female patients, K^+ level (mmo/L) (3.70 ± 0.54 and 4.0 ± 0.54 respectively) was observed to be within the normal value of 3.5 – 5.0mmo/L. Na^+ concentration (mmol/L) was observed to be decreased in both male and females with the values of 130.80 ±6.40 and 131.4±6.50 respectively. The Cl^- concentration (mmol/L) was observed to be increased in females (98.40 ± 7.60) and decreased in males (97.20 ± 8.90) when compared with the normal range (98.00-105.00mmol/L). The male patients showed an observed significant increase in the concentration (mmol/L) of their HCO_3^- (38.20 ± 15.70) than the females (25.10 ± 2.60) when compared with the normal value of 24.00-30.00 mmol/L. The concentration (mmol/L) of Na^+ of all the ages (10-59years) was observed to be decreased when compared with the normal range (135.00- 150.00mmol/L) while K^+ for all the ages was observed to fall within the normal range. Only the age range of 30 -39years had an increased level of Cl^- (145.90 ± 48.10) while the other age ranges were decreased. The concentration (mmol/L) of HCO_3^- of all the age ranges were observed to be within the normal range except for the age range of 20-29years which was observed to show a decreased concentration (mmol/L) of 22.30 ± 4.00 when compared with the normal range of 24.00-30.00 mmol/L.

The significantly decreased mean concentration (mmol/L) of Cl^- in HIV/AIDS patients on HAART was observed to be in the same pattern as the level of Na^+ mean concentration which is an indication that Na^+ is in most cases associated with chloride. This suggests that a significant number of these patients under study are hyponatremic or hypochlorimic. Consequently, the mean serum concentration of $HCO3^-$ and K^+ of the patients were observed to be close to the upper limit of the reference range (24-30 mmol/L and 3.5-5.0 mmol/L) suggesting that significant number of them were hyperkalemic and alkalotic. However, none of these patients showed any sign of alkalosis and hyperkalemia suggesting that the observed increased levels of $HCO3^-$ and K^+ were characteristics of the study population and may be partly attributed to increased intake. Both increased and decreased mean serum concentration of K^+ has been shown to have profound effect on neurotransmission as well as cardiac functions [16].

Table 1. Comparison of serum electrolytes levels of male and female HIV/AIDS patients on HAART

Sex	Number of patients	Na^+ (mmol/L)	K^+ (mmol/L)	Cl^- (mmol/L)	HCO_3^- (mmol/L)
Male	13	130.80±6.40	3.70±0.54	97.20±8.90	38.20±15.70
Female	17	131.40±6.50	4.00±0.54	98.40±7.60	25.10±2.60
Normal Range	--	135.00-150.00	3.50-5.00	98.00-105.00	24.00-30.00

Each value is a mean of the number of patients expressed as mean ± S.D

Table 2. Comparison of serum electrolytes levels of HIV/AIDS patients on HAART based on their ages

Age range	Number of patients	Na^+ (mmol/L)	K^+ (mmol/L)	Cl^- (mmol/L)	HCO_3^- (mmol/L)
10-19	1	3.80±0.00	3.80±0.00	97.40±0.00	25.00±0.00
20-29	6	133.00±4.80	3.80±0.80	83.70±17.50	22.30±4.00
30-39	16	131.00±5.30	3.90±0.48	145.90±48.10	24.10±3.90
40-49	6	109.00±22.20	4.60±0.70	94.90±7.60	24.10±3.9
50-59	1	129.00±0.00	3.50±0.00	93.40±0.00	25.30±0.00
Normal Range		135.00-150.00	3.50-5.00	98.00-105.00	24.00-30.00

Each value is a mean of the number of patients expressed as mean ± S.D

Comparing the electrolyte levels of male and female HIV/AIDS patients on HAART, significant differences were observed. From Table 1, only the mean K^+ concentration (mmol/L) between the males and females (3.70±0.54 and 4.00±0.54 respectively) was observed to be within the normal range of 3.50-5.00 while the Na^+ concentration (mmol/L) was observed to be decreased in both the male female patients (130.80±6.4 and 131.40±6.5 respectively). The mean Cl^- concentration (mmol/L) was observed to be within the normal range in females (98.40±7.60) and decreased in males (97.20±8.90) when compared with the normal range of 98.00-105.00 mmol/L.

The mean concentration of bicarbonate in male HIV/AIDS patients on HAART was observed to be significantly increased (38.20±15.70 mmol/L) when compared with the normal value of 24.00-30mmol/L while that of the female patients falls within the normal range.

There was observed significant difference when the serum electrolyte levels of the different ages (10-19yrs, 20-29yrs, 30-39yrs, 40-49yrs, 50-59yrs) of HIV/AIDS patients on HAART were compared. From Table 2, it was observed that the mean Na^+ concentration (mmol/L) of all the ages of the patients were decreased when compared with the normal value range of 135-150 mmol/L while the mean K+ concentration of all the ages of the patients were observed to be within the normal value range. For mean Cl^- concentration, only the ages of 30-39yrs was

observed to be increased while all the other ages were decreased when compared with the normal range. All the mean concentration (mmol/L) of HCO3− for all the ages of the patients were observed to be within the normal range except for the ages of 20-29yrs which has a decreased mean concentration of 22.30±4.00 when compared with the normal range of 24.30 mmol/L.

These results are in line with the work of Ugwuja and Eze 2007 [17] who researched on the comparative study on the electrolytes, total protein, calcium and phosphate among diabetic and HIV/AIDS patients in Abakaliki, South Eastern Nigeria.

Our results compare well with the baseline levels of electrolytes of HIV/AIDS patients on HAART reported in other studies and the one mentioned above.

4. CONCLUSION

This study has shown variations between the electrolyte levels of males and females and also between the ages.

One of the limitations of this study include the fact that there may be unmeasured cofactors that could have influenced our results.

There are many factors that can cause an increase or decrease in the electrolyte level of HIV/AIDS patients on HAART. These factors

include increased diuresis, vomiting, diarrhea, poor metabolism of drugs, relative loss of body water etc.

CONSENT

The purpose of the study was explained to the patients after which informed consent was obtained.

ETHICAL APPROVAL

The Ethical Committee Federal Medical center Owerri approved the study protocol. The approval was on the agreement that patient anonymity must be maintained, good laboratory practice/quality control ensured, and that every finding would be treated with the utmost confidentiality and for this research only in compliance with the Helsinki declaration.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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