J Interdiscipl Histopathol 2013; 1(5): 252-260 *ISSN: 2146-8362*

Original Research

Renal Function Impairment and Associated Risk Factors among Human Immunodeficiency Virus Positive Individuals at Felege Hiwot Referral Hospital, Northwest Ethiopia

Getachew Kahsu[1], Wubet Birhan[2], Zelalem Addis[3], Mulat Dagnew[3], Baye Abera[4]

[1]Amhara Regional State Public Health Research Laboratory, Bahir Dar, Ethiopia
[2]Department of Immunology and Molecular Biology, School of Biomedical and Laboratory Sciences, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia
[3]Department of Microbiology, School of Biomedical and Laboratory Sciences, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia
[4]Department of Microbiology, College of Medicine and Health Sciences, Bahir Dar University, Bahir Dar, Ethiopia

Received: March 26, 2013

Accepted: May 08, 2013

Published Online: May 13, 2013

DOI: 10.5455/jihp.20130508063833

Corresponding Author:
Zelalem Addis,
Department of Microbiology, School of Biomedical and Laboratory Sciences, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia
addiszelalem151@gmail.com

Keywords: Human Immunodeficiency Virus, Highly Active Antiretroviral Therapy, Renal Impairment, Bahir Dar, Ethiopia

Abstract

Objective: The aim of this study was to determine the prevalence of renal impairment and associated risk factors among human immunodeficiency virus (HIV) positive patients.

Methods: A comparative cross-sectional study was conducted among HIV positive patients at Bahir Dar Felege Hiwot referral Hospital. Demographic and other data were collected using structured questionnaires. Body mass index, urine protein, CD4 count, hemoglobin, electrolyte, lipid profile, serum urea and creatinine were measured. Data was entered into EPI info version 3.5.1 and analyzed using SPSS version 16. Descriptive statistics was calculated and logistic regression models were used to investigate factors associated with renal impairment.

Results: A total 307 HIV positive patients, 153 highly active antiretroviral therapy (HAART) naïve, who didn't take highly active antiretroviral therapy, and 154 on HAART were enrolled in the study. The mean (±SD) age of the participants was 34.69 (± 8.86) years and about 61% were females. The prevalence of renal impairment in HAART naïve and on HAART individuals was 30.1% and 12.9% respectively. Proteinuria was found in 17.9 % of the participant. Low CD4 count (Adjusted odds ratio= 24.11; (95% CI 11.06, 52.56) and being HAART naïve (Adjusted odds ratio = 6.58; 95% CI 2.99, 14.47) showed significant association with the prevalence of renal impairment.

Conclusion: This study showed a high prevalence of renal impairment in HIV positive individuals with higher rates among HAART naïve individuals. It also indicated that renal function in HIV positive individuals, which are HAART naïve, particularly, persons with low CD4 counts. Further cohort studies with larger sample size are also important to establish the prevalence rate of renal impairment.

INTRODUCTION

In 2011, an estimated 34 million people were living with human immunodeficiency virus /acquired immunodeficiency syndrome worldwide (HIV/AIDS); of them 22.9 million were living in Sub-Saharan Africa. About 1.2 million people were estimated to be living with HIV in Ethiopia [1]. The introduction of highly active antiretroviral therapy (HAART) has led to a marked reduction in AIDS related morbidity and mortality [2]. Since its introduction patients have started to live longer, however co-morbid problems have been emerged [3]. Kidney disease is a common complication of HIV infection even in the era of HAART, with kidney function being abnormal in up to 30% the patients [4, 5].

The first reports of AIDS-related renal failure, published in the mid-1980s, described cases of what is now recognized as HIV associated nephropathy [6]. A variety of renal syndromes, either acute or chronic, may occur during the course of HIV infection [7]. HIV associated nephropathy, a third leading cause of end stage renal disease, is one of the chronic kidney diseases directly caused by HIV [8-10, 11]. Decreased glomerular filtration rate (GFR), elevated serum creatinine level and high level of protein in urine sample are common among HIV positive individuals [4, 12].

Older age, low nadir of CD4+ cell count and cumulative exposure to ART agents are associated with chronic kidney disease [13, 14, 15]. The risk of kidney disease associated with the widely used agents like nucleoside reverse transcriptase inhibitors (tenofovir) and the protease inhibitors (indinavir) which have known nephrotoxic potential [4, 16].

Recognition of common risk factors for kidney disease in HIV infected patients is important to guide efforts aimed at prevention and early diagnosis. Despite this fact, data regarding renal impairment in HIV disease among Ethiopians is scarce. Therefore the aim of this study was to assess the prevalence of renal impairment and its risk factors among HIV infected individuals in Felege Hiwot Referral Hospital, Bahir Dar town.

MATERIALS AND METHODS

Study Design and Study Area

A comparative cross sectional study was conducted at Felege Hiwot Referral Hospital in Bahir Dar town, Ethiopia, from January 01 to May 30, 2012. Felege Hiwot referral hospital is a regional referral hospital that serves approximately 5,000,000 people with 17 departments and has 307 beds including one standardized ART clinic room which gave service for a total over 25, 986 HIV positive individuals of whom 15, 952 and 10, 034 were HAART naïve, who did not take highly active antiretroviral therapy, and on HAART respectively.

Sample Size and Sampling techniques

Sample size was determined by considering 50% prevalence of renal impairment among HIV positive individuals, 5% margin of error and a power of 80%. By inserting these assumptions in to EpiInfo software the calculated sample size was 296, 148 for each group. By adding 5% compensation for non-respondents a total of 312 individuals, 156 for each group, were included in the study.

Then, participants were selected based on systematic random sampling technique after randomly selecting the first participant. All participants included were >18 years of age and HAART treated group were those with good ART adherence (adherence rate ≥ 95%). A good adherence is defined by missing < 2 dose of 30 doses or < 3 dose of 60 doses; and it was adopted from Ethiopian Federal Ministry of Health, HIV Care/ART follow-up form. Severely ill patients (unable to speak, admitted patients), amputees, pregnant women and individual with known kidney disease were excluded.

Data Collection

Sociodemographic factors and related data

Data about sociodemographic variables together with body mass index, underlying disease conditions (hypertension, diabetes mellitus, and tuberculosis) was collected using structured interview based questionnaire.

Blood sample collection and laboratory investigation

Eight milliliter of venous blood, 4ml with EDTA anticoagulant and 4ml in plane (without anticoagulant) test tubes, was collected from each patients. A portion of the EDTA anticoagulated blood was used for automated analysis of CD4/CD3 cells/mm^3 using BD FACS count machine (Becton Dickinson, San Jose, CA, USA) and a portion of it was analyzed for the determination of hemoglobin concentration using Cell Dyn 1800 (ABBOTT, USA). Serum extracted from the blood sample collected without anticoagulant was analyzed for creatinine, blood urea nitrogen, glucose, triglyceride and cholesterol using an Auto lab chemistry analyzer (AUTOLAB chemistry analyzer, Roma). Electrolyte (sodium and potassium) analysis was also performed from the serum sample using humalyte plus 3 chemistry analyzer (Humalyte plus 3/5, Germany).

Urine sample analysis

Ten milliliter of morning urine sample was collected in clean, dry, leak-proof and wide-mouthed urine cup for determination of proteinuria and hematuria using urine dipstick Multistix (Bayer, Germany).

Data Processing and Analysis

The collected data were checked for completeness, entered EPI info version 3.5.1 and transferred and analyzed using SPSS version 16 software. Results were summarized using descriptive statistics. To see the association between dependent variable with each independent variable we used bivariate and multivariate logistic regression (Tables 4 and 5). P-value < 0.05 considered as statistically significant at 95% confidence interval (CI).

Renal impairment was classified according to the National Kidney Foundation clinical practice guideline

based on the GFR determined by Cockcroft-Gault method. Accordingly, estimated GFR values ≥ 90ml/min/1.73m^2, 60-89 ml/min/1.73 m^2, 30-59 ml/min/1.73 m^2, 15-29 ml/min/1.73 m^2 and < 15 ml/min/1.73 m^2 were interpreted as normal, mild, moderate, sever and kidney failure. Chronic kidney disease was defined as GFR < 60 ml/min/1.73 m^2 [17].

Ethical consideration

The study was approved by ethical review committee of School of Biomedical and laboratory science, University of Gondar. All individuals participated in the study after they gave informed consent and abnormal results were communicated with their physician for appropriate management.

RESULT

General characteristics of the study subjects

A total 307 HIV infected individuals, 187 (60.9) females and 120 (39.1%) males participated in the study. The mean (±SD) age of the study participants was 34.69 (± 8.86) years; HAART naïve individuals were slightly younger than individuals on HAART. Eighty point five percent, 62% and 33.9% of the participants were urban residents, married and illiterate respectively. Majority (70.7%) of the participants had a normal body mass index (BMI) (Table 1). About 28% of HAART naïve and 75.3 % of individuals on HAART were found in world health organization clinical stage III. About 38.3% of individuals on HAART were receiving first line regimens with a combination of tenofovir (TDF) and efavirenz (EFV). History of underlying disease like hypertension, diabetic mellitus and tuberculosis were found similar in both groups of the study subjects. The mean (±SD) CD4 count was 377.07 (± 229.4) cells/mm^3 and 307 (± 178.2) cells/mm^3 for HAART naïve and HAART individuals, respectively. Forty (26.1%) of the HAART naïve individuals and 50 (32.4 %) of individuals on HAART had CD4 count < 199 cells/mm^3. The mean (±SD) hemoglobin concentration of the study participants was 14.22 (± 1.9mg/dl) and 14.15 (± 1.6 mg/dl) on HAART naïve and HAART respectively (Table 2).

Table 1. Demographic characteristics of the study participant at Felege Hiwot referral hospital Bahir Dar, Northwest, Ethiopia from January to April 2012 (N=307)

Variable	HAART naïve No (%)	On HAART No (%)	Total No (%)
Sex			
Female	102 (66.7)	85 (55.2)	187 (60.9)
Male	51 (33.3)	69 (44.8)	120 (39.1)
Age			
18-29	52 (34)	34 (22)	86 (28)
30-41	74 (48.3)	86 (55.8)	160 (52.1)
42-53	24 (15.7)	29 (18.8)	53 (17.3)
54-65	3 (2)	3 (1.9)	6 (2)
>66	0 (0)	2 (1.3)	2 (0.7)
Residence			
Urban	115 (75.2)	132 (85.7)	247 (80.5)
Rural	38 (24.8)	22 (14.3)	60 (19.5)
Educational level			
Illiterate	59 (38.6)	45 (29.2)	104 (33.9)
Primary completed	53 (34.6)	53 (34.4)	106 (34.5)
Secondary	24 (15.7)	42 (27.3)	66 (21.5)
Higher completed	17 (11.1)	14 (9.1)	31 (10.1)
Marital status			
Single	34 (22.2)	20 (13)	54 (17.6)
Married	90 (58.8)	100 (64.9)	190 (61.9)
Divorced	19 (12.4)	23 (14.9)	42 (13.9)
Widowed	10 (6.5)	11 (7.1)	21 (6.6)
Religion			
Orthodox	136 (88.9)	136 (88.3)	272 (88.6)
Muslim	7 (4.6)	15 (9.7)	22 (7.2)
Protestant	10 (6.5)	3 (1.9)	13 (4.2)
BMI (kg/m^2)			
<18.5	37 (24.2)	30 (19.5)	67 (21.8)
≥18.5-24.9	105 (68.6)	112 (72.7)	217 (70.7)
≥25	11 (7.2)	12 (7.8)	21(7.5)

Table 2. Laboratory results and clinical information of the study participant at Felege Hiwot referral hospital Bahir Dar, Northwest, Ethiopia from January to April 2012 (N=307)

Study variables			HAART naïve Mean (SD)	On HAART Mean (SD)	Total Mean (SD)
CD_4 (cells/mm^3)*			377.07 (229.4)	307.23 (178.2)	342.15 (203.8)
Hemoglobin (mg/dl)			14.22 (1.9)	14.15 (1.6)	14.18 (1.75)
Glucose (mg/dl)			93.88 (18.1)	100.15 (24.9)	97.03 (21.5)
Cholesterol (mg/dl)			134.71 (41.3)	162.44 (36.5)	154.9 (38.9)
Triglycerides (mg/dl)			147.31 (46.9)	144.94 (47.6)	139.84 (47.3)
CD_4 (cells/mm^3)*	≥200		113 (73.9)	104 (67.6)	217 (70.7)
	<199		40 (26.1)	50 (32.4)	90 (29.3)
History of other disease	Hypertension	Yes	5 (3.3)	5 (3.2)	10 (3.3)
		No	148 (96.7)	149 (96.8)	297 (96.7)
	Tuberculosis	Yes	5 (3.3)	4 (2.6)	9 (2.9)
		No	148 (96.7)	150 (97.4)	298 (97.1)
	Diabetes mellitus	Yes	2 (1.3)	2 (1.3)	4 (1.3)
		No	151 (98.7)	152 (98.7)	303 (98.7)
HIV related information	First line regimen		---	148 (96.1)	148 (96.2)
	Second line regimen		---	6 (3.9)	6 (1.8)
	TDF and EFV		---	59 (38.3)	59 (38.3)
	Without TDF and EFV		---	95 (61.7)	95 (61.7)
WHO HIV stages	Stage I		67 (43.8)	16 (10.4)	83 (27)
	Stage II		42 (27.5)	20 (13.0)	62 (20.2)
	Stage III		43 (28.0)	116 (75.3)	159 (51.8)
	Stage IV		1 (0.7)	2 (1.3)	3 (1)
Duration of since seropositive**			16.98 (1-78)	42.21(3-98)	29.6 (1-88)

*World health organization classification
**Month and range

Renal Function Tests and Prevalence of Renal Function Impairment

The mean (±SD) creatinine level was 1.03 (± 0.27) mg/dl for HAART naïve individuals and 0.94 (± 0.24 mg/dl) for those who were on HAART. HAART naïve participants had a mean (±SD) blood urea nitrogen value of 22.33 (± 8.8) mg/dl and it was 20.5 (± 7.1) mg/dl among individuals on HAART. The overall mean (±SD) creatinine clearance was 78.74 (+ 24.55) ml/min/1.73 m^2. Creatinine clearance estimated by Cockcroft-Gault method indicated that 30.1% of HAART naïve individuals had estimated GFR below 60 ml/min/1.73 m^2 and the proportion among individuals on HAART was 12.9%. The average serum creatinine concentration and BUN were higher and mean creatinine clearance was lower in HAART naïve individuals compared with those individuals who were on HAART. Proteinuria above 1+ was found in 18.9% and 16.9% of HAART naïve and HAART individuals respectively. None of the study participants showed electrolyte imbalance (Table 3).

Therefore the prevalence of renal impairment was 30.1% (46/153) and 12.9% (20/154) among HAART naïve and on HAART individuals, respectively (Figure 1). The overall prevalence of renal impairment was 21.5%.

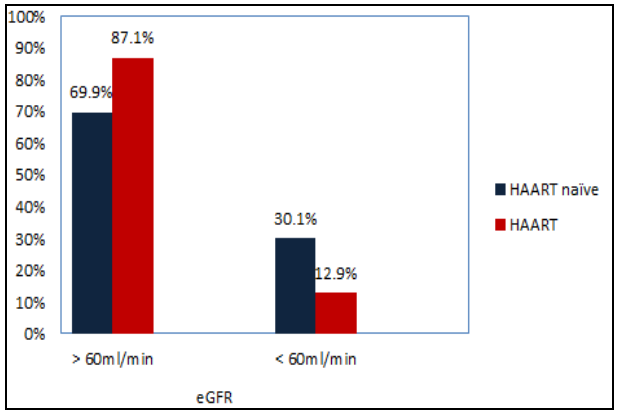

Figure 1. The prevalence of renal impairment among HAART naïve and HAART individuals.

Factors Associated with Renal Function Impairment

Both bivariate and multivariate logistic regression analysis showed that low BMI (AOR=7.02, 95% CI 1.80-27.34), low CD4 count (AOR=16.89, 95% CI 5.85-48.78) and advanced world health organization clinical stage (AOR=3.81, 95% CI 1.15-12.59) had statistically significant association with renal impairment among HAART naïve group. In individuals on HAART only low CD4 was found to be the

independent risk factor in both bivariate and multivariate logistic regression analysis (AOR= 28.68, 95% CI 6.13-130.37) (Table 4). It was also found that higher age, lower CD4 count, advanced in world health organization clinical stage and being HAART naïve were associated with moderate to severe renal impairment (as indicated by creatinine clearance) in binary logistic regression analyses. However, only low CD4 (AOR=24.11, 95% CI 11.06-52.56) and being HAART naive (AOR=6.58, 95% CI 2.99-14.47) remained independent risk factors for moderate to severe renal impairment in the multivariate logistic regression analysis (Table 5).

Table 3. Renal function test among HIV infected individuals at Felege Hiwot referral hospital Bahir Dar, Northwest, Ethiopia from January to April 2012 (N=307)

Renal Function tests	HAART naïve Mean (SD)	On HAART Mean (SD)	Total Mean (SD)
Serum Creatinine (mg/dl)*	1.03 (0.27)	0.94 (0.24)	0.983 (0.26)
Serum BUN (mg/dl)	22.33 (8.8)	20.5 (7.1)	21.4 (7.95)
Serum sodium (mmol/l)	140.9(2.7)	140.9 (2.9)	140.87 (2.8)
Serum potassium (mmol/l)	4.2 (0.48)	4.3 (0.55)	4.26 (0.52)
CrCl (Cockcroft-Gault, ml/min)	74.98 (25.2)	82.46 (23.9)	78.74 (24.55)
Proteinuria (> 1+)***	29 (18.9)	26 (16.9)	55 (17.9)
Hematuria (>1+)	18 (11.8)	17 (10.9)	35 (11.4)
Chronic kidney disease (CG) (ml/min/1.73 m^2)**			
Normal	34 (22.2)	49 (31.8)	83 (27.0)
Mild	73 (47.7)	85 (55.2)	158 (51.5)
Moderate	44 (28.8)	19 (12.3)	63 (20.5)
Severe	2 (1.3)	1 (0.6)	3 (1)

SD=standard deviation
*Based on single measurement
**Kidney disease staging based on creatinine clearance according to national kidney foundation guideline
***30 mg/dl on urine dip stick.

Table 4. Bivariate and Multivariate logistic regression of selected variables in relation to renal impairment among ART naïve and ART at Felege Hiwot referral Hospital, Bahir Dar, from March 1 to April 30, 2012 (N=307)

Variables	HAART naïve		On HAART	
	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)
Residence				
Urban	1.07 (0.48-2.240)		3.53 (0.45-27.8)	
Rural	1*			
Sex				
Female	1.63 (0.76-3.50)		1.25 (0.48-3.26)	
Male	1*			
Age				
18-29	1*			
30-41	1.19 (0.53-2.66)		2.12 (0.44-10.2)	
42-53	2.54 (0.92-7.03)		4.17 (0.77-22.6)	
54-65	1.50 (0.13-17.93)		8.00 (0.49-130)	
BMI				
BMI<18	13.37 (4.57-39.13)**	7.02 (1.80-27.34)**	1.04 (0.21-5.02)	
BMI=18-25	1*		1*	
CD4				
<199	22.50 (8.97-56.46)**	16.89 (5.85-48.78)**	28.68 (6.13-130.37)**	28.68 (6.13-130.37)**
≥200	1*		1*	
Hypertension				
Yes	0.01(0.00-1.50)		4.85 (0.76-31.04)	
No	1*			
WHO HIV stages				
Stage I	1*			
Stage II	3.44 (1.46-8.09)**	3.81 (1.15-12.59)**	2.65 (0.25-28.2)	
Stage III	2.01 (0.83-4.83)	2.83 (0.87-9.18)	2.40 (0.29-19.4)	
Proteinuria				
Negative	1*			
Positive (>1+)	1.06 (0.44-2.54)		1.79 (0.59-5.47)	

COR=Crude odds ratio, AOR=Adjusted odds ratio
*Reference category
**Statistically significant, Backward-Wald stepwise multiple logistic regression was used to assess the independent effect of explanatory variables.

Table 5. Factors associated with moderate to severe renal impairment among adult HIV positive patients at Felege Hiwot referral hospital, Northwest, Ethiopia 2012. (N=307)

Variables	eGFR (ml/min/1.73 m^2)		Multivariate analysis	
	>60 N (%)	<60 N (%)	*p value*	*AOR (95% CI)*
Sex				
Female	141 (58.5)	46 (69.7)	0.101	
Male*	100 (41.5)	20 (30.3)		
Age				
18-29*	71 (29.5)	15 (22.8)		
30-41	129 (53.5)	31 (46.9)	0.771	
42-53	36 (14.9)	17 (25.8)	0.049	
54-65	4 (1.7)	2 (3)	0.345	
>66	1 (0.4)	1 (1.5)	0.281	
CD4				
<199	41 (17)	49 (74.2)	0.000	24.11 (11.06-52.56)**
>200*	200 (83)	17 (25.8)		
Hypertension				
Yes	8 (3.3)	2 (3)	0.947	
No*	232 (96.7)	64 (97)		
Diabetes mellitus				
Yes	3 (1.2)	1 (1.5)	0.837	
No*	239	65		
WHO HIV stages				
Stage I*	69 (28.6)	14 (21.2)		
Stage II	40 (16.6)	22 (33.3)	0.012	
Stage III	129 (53.5)	30 (45.5)	0.702	
HAART naïve	107 (44.4)	46 (69.7)	0.000	6.58 (2.99-14.47)**
HAART*	134 (55.6)	20 (30.3)		1*

eGFR= estimated Glomerular Filtration Rate, AOR=Adjusted odd ratio, CI=Confidence interval, WHO=World health organization, CrCl= creatinine clearance by Cockcroft Gault method
*Reference category **Statistically significant, Backward-Wald stepwise multiple logistic regression was used to assess the independent effect of explanatory variable

DISCUSSION

Renal impairment is a common sequel of HIV infection or its treatment. Renal impairment, based on single creatinine clearance measurements, was very common among HIV infected adults with clinically non advanced HIV disease in most part of Africa [13].

The prevalence of renal impairment among HAART naïve individuals (30.1%) observed in this study is higher than studies from different African countries including Zambia, Kenya, Mali and Uganda which reported a prevalence of 8%, 11.5%, 21% and 7% respectively [18-21]. This difference may due to the difference in inclusion criteria of the studies, since those studies did not include hypertensive and diabetic individuals. But the prevalence among individuals on HAART (12.9%) is lower than studies from Uganda (20%), Nigeria (53.3% and 23.8%), Cote d'Ivoire (26%), Burundi (45.7%) and Tanzania (25%) [22-27]. This wide variation could be in part due to differences in study design, populations studied, stage of HIV infection and definitions of chronic kidney disease used. From other areas elsewhere in the world both higher and lower prevalence of renal dysfunction among individuals on HAART was reported [28, 29]. The involvement of individuals with undetectable viral load, use of modified diet of renal disease formula to estimate GFR and the number of study subjects may contribute to the differences observed. The overall prevalence of renal impairment in our study based on glomerular filtration rate using Cockcroft-Gault method was 21.5%. This result was in agreement to that reported in Nigeria retrospective cross-sectional study, 23.8% [24] but higher than reports from California [30] and Uganda [31].

Proteinuria was present in 17.9% of the total study participants, 18.9% among HAART naïve and 16.8% among those on HAART. As compared to ours a study from Nigeria reported higher results while South African studies indicated lower results [22, 32, 33]. On the other hand a similar result was observed in Brazil [34].

This study demonstrated low BMI (AOR=7.02; 95% CI 1.80, 27.34), low CD4 count (AOR=16.89; 95% CI 5.85, 48.78) and advanced in world health organization clinical stage (AOR=3.81; 95% CI 1.15, 12.59) as risk factor for renal impairment among HAART naïve group using both bivariate and multivariate logistic regression. Among individuals on HAART only low CD4 was found to be the independent risk factor both in the bivariate and multivariate logistic regression

analysis (AOR= 28.68; 95% CI 6.13-130.37). These results were also comparable with a report from Nigeria [32] and Kenya [19].

Our study showed the association between moderate to severe renal impairment with higher age, low CD4 count, advanced world health organization clinical stage and being HAART naïve in the bivariate analysis. However, only low CD4 (AOR=24.11; 95% CI 11.06-52.56) and being HAART naive (AOR=6.58; (95% CI 2.99, 14.47) remained independent risk factors for moderate to severe renal impairment in the multiple logistic regression analysis (Table 5). Regarding low CD4 count, our findings are concordant with other studies conducted in western California, Nigeria, South Africa, Tanzania, United State, London and Israel [26, 29, 32, 35- 38].

We found no electrolyte abnormality among 307 HIV infected patients. Similar finding was found in the study conducted by Afhami et al on 65 HIV patients in Tehran [39]

In our study, both creatinine and proteinuria were measured at a single point in time; therefore, we may have included short term, reversible causes of renal impairment. Use of the Cockcroft-Gault formula to assess renal function in HIV individuals could be not accurate enough to allow a firm conclusion of kidney function and can lead to misclassification of some patients.

In conclusion, we have found a high prevalence of renal impairment among HAART naïve than those on HAART in Felege Hiwot Referral Hospital Bahir Dar among HIV positive adults. The overall prevalence of renal impairment found in our series was also high. What is clear from this study is that renal dysfunction is common in patients with HIV. Results from this study indicated the importance of the investigating renal function among HIV infected patients, especially in those with low CD4 count and those who didn't take HAART. Regular screening for kidney disease needs to be widely implemented as standard of care. Prospective follow-up studies should be conducted to identify the factors associated to renal impairment in HIV-infected individuals. Finally we recommended prevention of renal disease among HIV infected individuals is a community as well as an individual concern, health care workers, health care managers and planners have to be given focus.

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest.

ACKNOWLEDGMENTS

We acknowledge all the staff members of Felege Hiwot Referral Hospital and Bahir Dar Regional Heath Research Laboratory Centre for their great cooperation during laboratory works. We would like to thank Amhara Regional Health Bureau for funding the study. We would also thank all participants in this study for their willingness to participate in the study.

REFERENCES

1. UNAIDS: AIDS epidemic update. Geneva, UNAIDS, 2011. http://www.unaids.org/en/dataanalysis/epidemiol
2. Palella FJ Jr, Delaney KM, Moorman AC, Loveless MO, Fuhrer J, Satten GA, Aschman DJ, Holmberg SD. Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. N Engl J Med 1998; 338: 853–860.
3. Cohan GR. HIV-associated metabolic and morphologic abnormality syndrome: Welcome therapy may have unwelcome effects. Postgrad Med 2000; 107:141–146.
4. Gupta SK, Eustace JA, Winston JA, Boydstun II, Ahuja TS, Rodriguez RA, Tashima KT, Roland M, Franceschini N, Palella FJ, Lennox JL, Klotman PE, Nachman SA, Hall SD, Szczech LA. Guidelines for the management of chronic kidney disease in HIV-infected patients: Recommendations of the HIV Medicine Association of the Infectious Diseases Society of America. Clin Infect Dis 2005; 40:1559-1585.
5. Choi AI, Rodriguez RA, Bacchetti P, Bertenthal D, Volberding PA, O'Hare AM. Racial Differences in End-Stage Renal Disease Rates in HIV Infection versus Diabetes. J Am Soc Nephrol 2007; 18: 2968-2974.
6. Rao TK, Filippone EJ. Associated focal and segmental glomerulosclerosis in the acquired immunodeficiency syndrome. N Engl J Med 1984; 310: 669-673.
7. Weiner NJ, Goodman JW, Kimmel PL. The HIV-associated renal diseases: current insight into pathogenesis and treatment. Kidney Int 2003; 63:1618–1631.
8. Kopp JB, Smith MW, Nelson GW, Johnson RC, Freedman BI, Bowden DW, Oleksyk T, McKenzie LM, Kajiyama H, Ahuja TS, Berns JS, Briggs W, Cho ME, Dart RA, Kimmel PL, Korbet SM, Michel DM, Mokrzycki MH, Schelling JR, Simon E, Trachtman H, Vlahov D, Winkler CA. MYH9 is a major-effect risk gene for focal segmental glomerulosclerosis. Nat Genet 2008; 40: 1175-1184.
9. Kao WH, Klag MJ, Meoni LA, Reich D, Berthier-Schaad Y, Li M, Coresh J, Patterson N, Tandon A, Powe NR, Fink NE, Sadler JH, Weir MR, Abboud HE, Adler SG, Divers J, Iyengar SK, Freedman BI, Kimmel PL, Knowler WC, Kohn OF, Kramp K, Leehey DJ, Nicholas SB, Pahl MV, Schelling JR, Sedor JR, Thornley-Brown D, Winkler CA, Smith MW, Parekh RS; Family

Investigation of Nephropathy and Diabetes Research Group. MYH9 is associated with non-diabetic end-stage renal disease in African Americans. Nat Genet 2008; 40: 1185-1192.

10. Genovese G, Friedman DJ, Ross MD, Lecordier L, Uzureau P, Freedman BI, Bowden DW, Langefeld CD, Oleksyk TK, Uscinski Knob AL, Bernhardy AJ, Hicks PJ, Nelson GW, Vanhollebeke B, Winkler CA, Kopp JB, Pays E, Pollak MR. Association of trypanolytic ApoL1 variants with kidney disease in African Americans. Science 2010; 329: 841-845.
11. Herman ES, Klotman PE. HIV-associated nephropathy: epidemiology, pathogenesis, and treatment. Semin Nephrol 2003; 23: 200–208.
12. National Kidney and Urologic Diseases Information: Your urinary system and how it works. A service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health (NIH). NIH Publication No. 07–3195 August 2007. http://kidney.niddk.nih.gov/kudiseases/pubs/yoururinary/YourUrinary_508.pdf
13. Mocroft A, Kirk O, Gatell J, Reiss P, Gargalianos P, Zilmer K, Beniowski M, Viard JP, Staszewski S, Lundgren JD. Chronic renal failure among HIV-1-infected patients AIDS 2007; 21: 1119-1127.
14. Franceschini N, Napravnik S, Eron JJ Jr, Szczech LA, Finn WF. Incidence and etiology of acute renal failure among ambulatory HIV-infected patients.Kidney Int 2005; 67: 1526-1531.
15. Roe J, Campbell LJ, Ibrahim F, Hendry BM, Post FA. HIV care and the incidence of acute renal failure in London. Clin Infect Dis 2008; 47: 242-249.
16. Winston J, Deray G, Hawkins T, Szczech L, Wyatt C, Young B. Kidney Disease in Patients with HIV Infection and AIDS. Clin Infect Dis 2008; 47: 1449-1457.
17. National Kidney Foundation. K/DOQI Clinical Practice Guidelines for Chronic Kidney Disease: Evaluation, Classification and Stratification. Am J Kidney Dis 39:S1-S266, 2002.
18. Mulenga LB, Kruse G, Lakhi S, Cantrell RA, Reid SE, Zulu I, Stringer EM, Krishnasami Z, Mwinga A, Saag MS, Stringer JSA, Chi BH. Baseline renal insufficiency and risk of death among HIV-infected adults on antiretroviral therapy in Lusaka, Zambia. AIDS 2008; 22: 1821-1827
19. Wools-Kaloustian K, Gupta SK, Muloma E, Owino-Ong'or W, Sidle J, Aubrey RW, Shen J, Kipruto K, Zwickl BE, Goldman M. Renal disease in an antiretroviral-naı¨ve HIV-infected outpatient population in Western Kenya. Nephrol Dial Transplant 2007; 22: 2208-12.
20. Struik GM, den Exter RA, Munthali C, Chipeta D, van Oosterhout JJG, Nouwen JL, Allain TJ. The prevalence of renal impairment among adults with early HIV disease in Blantyre, Malawi. Int J STD AIDS 2011; 22: 457-462
21. Reid A, Stöhr W, Walker AS, Williams IG, Kityo C, Hughes P, Kambugu A, Gilks CF, Mugyenyi P, Munderi P, Hakim J, Gibb DM; Development of Antiretroviral Therapy Trial. Severe renal dysfunction and risk factors associated with renal impairment in HIV-infected adults in Africa initiating antiretroviral therapy. Clin Infect Dis 2008; 46: 1271–1281.
22. Fabian J, and Naicker S. HIV and kidney disease in sub-Saharan Africa. Nat Rev Nephrol 2009; 5: 591–598.
23. Okafor UH, Unuigbe EI, Ojogwu LI, Oviasu E, Wokoma FS. Renal disease in HIV infected patients at University of Benin Teaching Hospital in Nigeria. African Health Sciences 2011; 11: 28-33
24. Agbaji OO, Onu A, Agaba PE, Muazu MA, Falang KD, Idoko JA. Predictors of impaired renal function among HIV infected patients commencing highly active antiretroviral therapy in Jos, Nigeria. Niger Med J 2011; 52: 182-185.
25. Cailhol J, Nkurunziza B, Izzedine H, Nindagiye E, Munyana L, Baramperanye E, Nzorijana J, Sakubu D, Niyongabo T, Bouchaud O. Prevalence of chronic kidney disease among people living with HIV/AIDS in Burundi: a crosssectional study. BMC Nephrology 2011; 12: 40.
26. Msango L, Downs JA, Kalluvya SE, Kidenya BR, Kabangila R, Johnson WD Jr, Fitzgerald DW, Peck RN. Renal dysfunction among HIV-infected patients starting antiretroviral therapy. AIDS 2011; 25: 1421-1425
27. Peters PJ, Moore DM, Mermin J, Brooks JT, Downing R, Were W, Kigozi A, Buchacz K, Weidle PJ. Antiretroviral therapy improves renal function among HIV-infected Ugandans. Kidney Int 2008; 74: 925–929.
28. Menezes AM, Torelly JJr, Real L, Bay M, Poeta J, Sprinz E. Prevalence and risk factors associated to chronic kidney disease in HIV-infected patients on HAART and undetectable viral load in Brazil. PLoS One 2011; 6: e26042.
29. Cheung CY, Wong KM, Lee MP, Liu YL, Kwok H, Chung R, Chau KF, Li CK, Li CS. Prevalence of chronic kidney disease in Chinese HIV-infected patients. Nephrol Dial Transplant 2007; 22: 3186-3190.
30. Crum-Cianflone N, Ganesan A, Teneza-Mora N, Riddle M, Medina S, Barahona I, Brodine S. Prevalence and Factors Associated with Renal Dysfunction Among HIV-Infected Patients. AIDS Patient Care STDs 2010; 24: 354-359.
31. Lucas GM, Clarke W, Kagaayi J, Atta MG, Fine DM, Laeyendecker O, Serwadda D, Chen M, Wawer MJ, Gray RH. Decreased Kidney Function in a Community-based Cohort of HIVInfected and HIV-Negative Individuals in Rakai, Uganda. J Acquir Immune Defic Syndr 2010; 55: 491-494.
32. Emem CP, Arogundade F, Sanusi A, Adelusola K, Wokoma F, Akinsola A. Renal disease in HIV-seropositive patients in Nigeria: an assessment of prevalence, clinical features and risk factors. Nephrol Dial Transplant 2008; 23: 741-746.
33. Han TM, Naicker S, Ramdial PK, Assounga AG. A cross-

sectional study of HIV-seropositive patients with varying degrees of proteinuria in South Africa. Kidney Int 2006; 69: 2243-2250.

34. Pinto Neto LF, Braga AC, Rocha JA, Vieira NF, Miranda AE. [Risk factors related to renal disorders in HIV-1 infected patients]. Rev Soc Bras Med Trop. 2011; 44(1): 30-34.
35. Franey C, Knott D, Barnighausen T, Dedicoat M, Adam A, Lessells RJ, Newell ML, Cooke GS. Renal impairment in a rural African antiretroviral programme. BMC Infectious Diseases 2009; 9: 143.
36. Franceschini N, Napravnik S, Eron J, Szczech LA, Finn WF. Incidence and etiology of acute renal failure among ambulatory HIV-infected patients in United States. Kidney Int 2005; 67: 1526-1531.
37. Roe J, Campbell LJ, Ibrahim F, Hendry BM, Post FA. HIV care and the incidence of acute renal failure in London. Clin Infect Dis 2008; 47: 242-249.
38. Behar DM, Shlush LI, Maor C, Lorber M, Skorecki K. Absence of HIV-associated nephropathy in Ethiopians. Am J Kidney Dis 2006, 47: 88-94.
39. Afhami S, Rasoulinejad M, Razeghi E, Shahriari S, Esmailpour N. Renal Disorders in HIV-Infected Patients. Arch Iranian Med 2007; 10: 335-338.