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Kidney Function Impairment in HIV Subjects On Art

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ABSTRACT: The number of people living with HIV/AIDS is on the rise, so are the problems like renal dysfunction which needs to be addressed. The study was aimed at providing data regarding prevalence and the association of certain modifiable and non-modifiable factors with renal function.This was a cross sectional study on 390 HIV positive subjects. Renal function was assessed by means of eGFR, calculated using Cockcroft-Gault equation, and proteinuria, estimated by spot urine albumin creatinine ratio (UACR). Renal dysfunction was identified by either eGFR<60 ml/min or UACR>30 mg/gm. The data was analyzed based on demographic characteristics, type of ART, height, weight, blood pressure and fasting lipid profile between renal dysfunction group and normal renal function group.
Different types of ART regimen,height, weight, systolic and diastolic blood pressure did not show any effect on renal function in this study.High triglyceride levels and high LDL levels are associated with decreased renal function.
KEYWORDS:HIV Seropositivity; Renal Insufficiency; Proteinuria; CD4 Cell Count ; Lipid profile;

I. INTRODUCTION

Human Immunodeficiency Virus (HIV) was identified in 1983 as a causative agent for Acquired Immunodeficiency Syndrome (AIDS) [1]. This virus progressively damages cells of the body's immune system thus predisposing the infected individual to opportunistic infections, cancers, and different organ pathology.

In 1984 Rao[2] et al reported a renal lesion in patients infected with HIV that was characterized with severe proteinuria, biochemical features of nephrotic syndrome, and renal function impairment that rapidly progresses to end stage renal disease. Various types and severities of renal disorders have been encountered at all stages of HIV infections, ranging from mild and transient renal impairment to end stage renal disease requiring renal replacement therapy[3]. The CD4 cell count is used as a surrogate marker of immune status in HIV infected patients. However infection with HIV leads to destruction and depletion of CD4 cells and this predisposes the individual to various disease conditions. CD4 cell count has been used to monitor, follow up and determine the severity of HIV infection4.

The renal function impairment (RFI) has been encountered at various stages of HIV infection, from the stage of seroconversion to advanced AIDS. The prevalence, severity, morbidity and mortality of renal function impairment in these patients have been associated with the degree of immunosuppression[5,6]. Various studies have reported that CD4 cell count of less than 200/ul is a poor prognostic index in HIV infected patients with renal disease[7,8]. Early detection and intervention delays progression and in many situations reverses impairment of renal function in HIV infected patients. The CD4 cell count of HIV infected patients is assessed on presentation in most health facilities. However renal function assessment is sparse inmost of the centres in attending to HIV patients. It is necessary to objectively assess the relationship between renal function and degree of immunosuppression in these patients.Renal function is usually assessed by means of serum creatinine measurement and then estimated glomerular filtration rate calculation by Cockroft-Gault formula or Modification of diet in renal disease equation (MDRD) [9]. Proteinuria and persistent microalbuminuria is also used for assessing renal function. Urine albumin creatinine ratio which is a surrogate marker for microalbuminuria can detect early renal dysfunction patients.Other determinants which contribute to renal dysfunction may include comorbidities such as hypertension, diabetes, hyperlipidemia, age, sex and ethnicity[10-12]. It might also be affected by many opportunistic infections, duration of HAART, type of drug regimen as shown in many previous studies[13,14].Most of the studies regarding renal impairment in HIV patients have been done outside India and data regarding prevalence and pattern of renal involvement and its correlation with various variables in this part of India is not available. So the aim of this study is to provide valuable data regarding renal dysfunction in HIV infected individuals.

OBJECTIVES

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1.To determine the prevalence of renal impairment in HIV seropositive subjects attending ART clinic.
2.To determine the association between renal impairment and variables such as height, weight, systolic and diastolic blood pressure, type of ART regimen, and lipid profile.

II. REVIEW OF LITERATURE

HISTORICAL ASPECTS

The first indication of a new syndrome began in the summer of 1981 reported from New-York and California of a sudden increase in the incidence of two very rare diseases. Kaposi's sarcoma and pneumocystis carinii pneumonia's in young adults who were homosexuals or addicted to heroin or other IV narcotic[15-17].

In May 1983, doctors from Dr. Luc Montagnier's team at the Pasteur Institute in France reported that they had isolated a new retrovirus from lymphoid ganglions that they believed was the cause of AIDS. The virus was later named lymphadenopathy-associated virus 1,[18].

In May 1984 a team led by Robert Gallo of the United States confirmed the discovery of the virus, but they renamed it human T lymphotropic virus type III (HTLV-III).[19,20]

In January 1985, a number of more-detailed reports were published concerning LAV and HTLV-III, and by March it was clear that the viruses were the same, were from the same source, and were the etiological agent of AIDS[21].
In India the first case of AIDS was reported in 1985 in Madras[22].

In May 1986, the International Committee on Taxonomy of Viruses ruled that both names should be dropped and a new name, HIV (Human Immunodeficiency Virus), be used[23].

The association between HIV and renal disease was first reported in 1984 by investigators in New York City and Miami, who reported a series of HIV-1– seropositive patients who developed a renal syndrome characterized by progressive renal failure and proteinuria[2]. The most common kidney biopsy finding was focal segmental glomerulosclerosis (FSGS)[25,26]. During the next several years, the existence of a specific HIVassociated nephropathy (HIVAN) was debated, in part, because of its similarity to heroin nephropathy and the frequent occurrence of intravenous drug use in this population[27]. Finding HIVAN in patients in whom a history of IVDU could be ruled out definitively helped to establish HIVAN as a distinct clinical entity[28,29].

III. METHODOLOGY

Source of data

The material for the study will be collected from subjects, who are HIV seropositive and who fulfill the inclusion and exclusion criteria, attending ART clinic,

Method of collection of data

a) **Study design:** Single centered cross sectional study in a tertiary care hospital
b) **Sample size:** 390 (As reviewed with statistician)
c) **Sampling Method:** Simple Random Sampling
d) **Duration of study:** January 2021 to August 2023
e) **Method of collection of specimens and processing:** Blood and urine sample will be collected at a single sitting with universal precautions into separate sterile containers. Blood sample will be used for testing CD4 count, haemoglobin, total count using automated counters, and used to test serum creatinine by Jaffe method. Urine sample will be tested for urine albumin creatine ratio by immunoturbidometric method.

f) **Inclusion criteria**
1. HIV seropositive subjects attending ART clinic.
2. Age more than or equal to 18 years.
3. Subjects either on Antiretroviral therapy or not on any drug therapy.

g) **Exclusion criteria**
1. Subjects with preexisting urinary tract infection.
2. Pregnancy
3. Subjects not willing to take part in the study.
4. Patients on steroid intake or antituberculous treatment.

h) **Investigations**
1) Haemoglobin
2) Urine albumin- creatinine ratio (Urine ACR).
3) Blood urea and serum creatinine
4) CD4 cell count
5) Lipid profile
6) RBS (Random Blood Sugar)
7) LFT (Liver Function Test)
8) White blood cell count

Data will be collected using a pretested proforma meeting the objectives of the study. Detailed history, physical examination and necessary investigation will be undertaken. The purpose of the study will be explained to the patient and informed consent obtained.

After collecting data subjects will be assessed for renal function impairment based on two criteria given below and classified into two groups, one with renal dysfunction and one with normal renal function. If a study subject satisfies any one of these two criteria, he/she will be

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considered to have renal function impairment or renal dysfunction.

Criteria are **1.)** Estimated GFR <60 ml/min as calculated using Cockcroft Gault formula and **2.)**Microalbuminuria or Macroalbuminuria based on urine albumin creatine ratio (UACR) >30 mg/gm. The prevalence of renal dysfunction will be found out using this definition and the rest of the data will be used for further analysis and interpretation.

Data Analysis and Interpretation

Data was entered into Microsoft excel and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 18.0; SPSS Inc, Chicago). Descriptive statistics such as mean and standard deviation (SD) for continuous variables, and frequency and percentage for categorical variables were determined. The level of significance was set at 0.05. Correlation analysis will be done wherever appropriate.

IV. RESULTS

In this study conducted in ART clinic, 390 subjects fulfilling inclusion and exclusion criteria were included. Out of them 83 subjects (21.28%) were found to have renal dysfunction according to the criteria used. Out of the 21.28% subjects with renal function impairment, 10 % had only low eGFR, 8.2% had only microalbuminuria and 3.08% had both decreased eGFR and microalbuminuria.

Table 1: Renal function distribution

Normalrenalfunction		307
Renaldysfunction	eGFR<60	39
	UACR>30	32
	Both	12

Figure 1: Renal function distribution

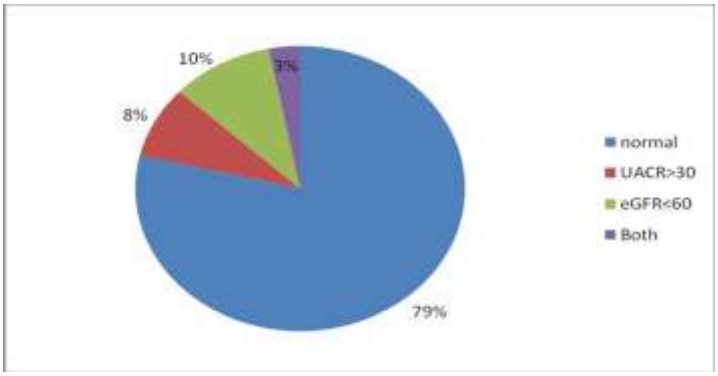

Table 2: ART Regimen distribution

ART Regimen	**NotonART** **%ofpatients (No.)**	**Stavudine(S)** **%ofpatients (No.)**	**Tenofovir(T)** **%ofpatients (No.)**	**Zidovudine(Z)** **%ofpatients (No.)**
Normal function	81.82%(72)	82.35%(14)	83.53%(71)	75.00%(150)
Renal dysfunction	18.18%(16)	17.65%(3)	16.47%(14)	25.00%(50)

P-value between Not onARTandS	**P-value between Not onARTandT**	**P-value between Not onARTandZ**	**P-value betweenS and T**	**P-value betweenS and Z**	**P-value between TandZ**
0.96012	0.7253	0.2048	0.90448	0.4983	0.1144

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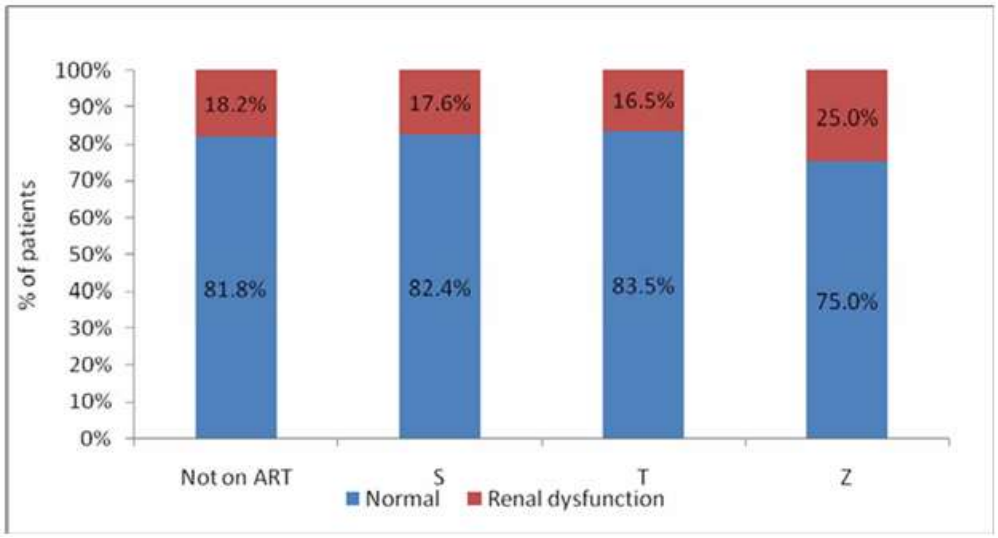
Figure 2: ART Regimen distribution

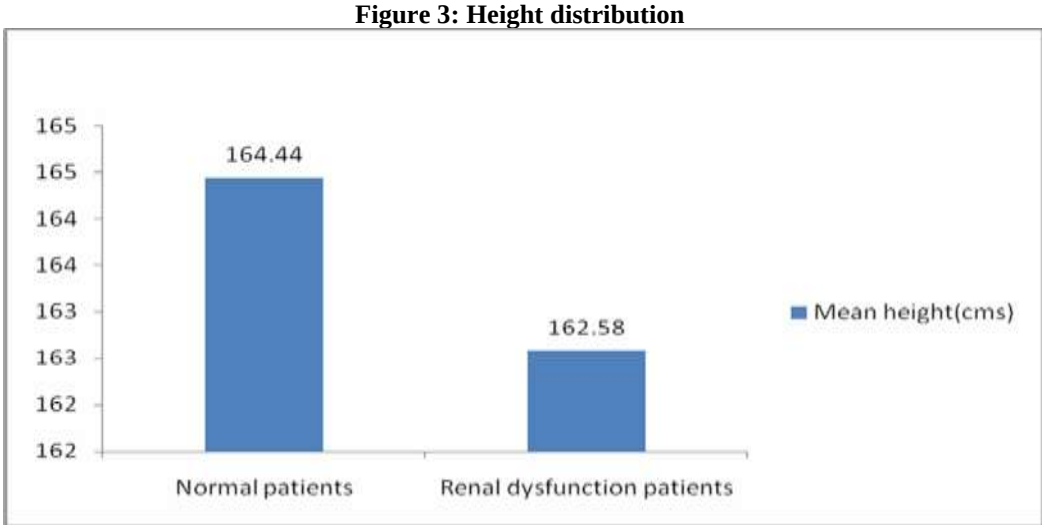


The proportions of patients with renal dysfunction across the entire regimen whether subjects were not on ART or on ART were statistically same with p-value greater than 0.05 at 5% significance level. Since the p-value is greater than 0.05 for any two proportion comparison across all the regimens, the proportions do not differ and are statistically same.

Table 3: Height distribution

Heightdistribution	**Numberof patients**	**Mean height(cms)**	**Minimum height(cms)**	**Maximum height(cms)**	**Standard deviation**	**P-value**
Normalpatients	307	164.44	150	182	6.75	0.032
Renaldysfunctionpatients	83	162.58	152	180	7.02	

Figure 3: Height distribution



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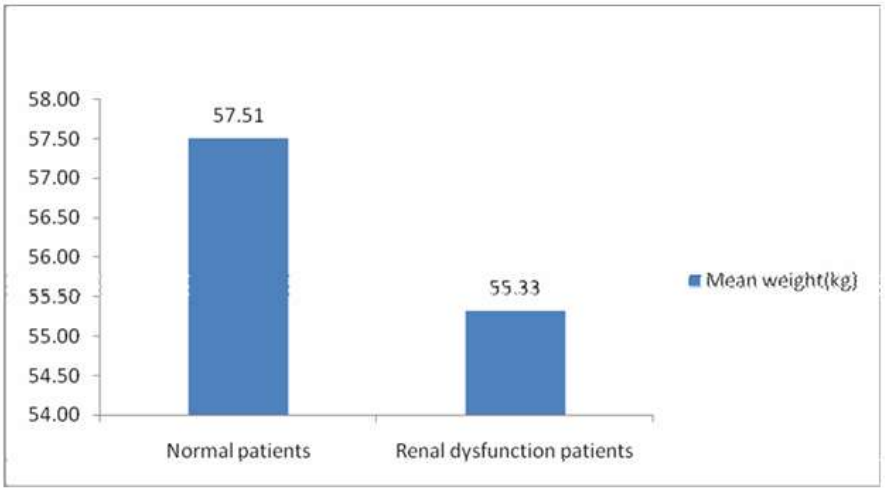
Mean height among normal patients and renal dysfunction patients is statistically different with p-value 0.032 which is significant at 5% significance level.

Table 4: Weight distribution

Weightdistribution	Mean weight(kg)	Minimum weight(kg)	Maximum weight(kg)	Standard deviation	P-value
Normalpatients	57.51	40	71	6.02	0.004
Renaldysfunctionpatients	55.33	43	68	6.04	

Figure 4: Weight distribution

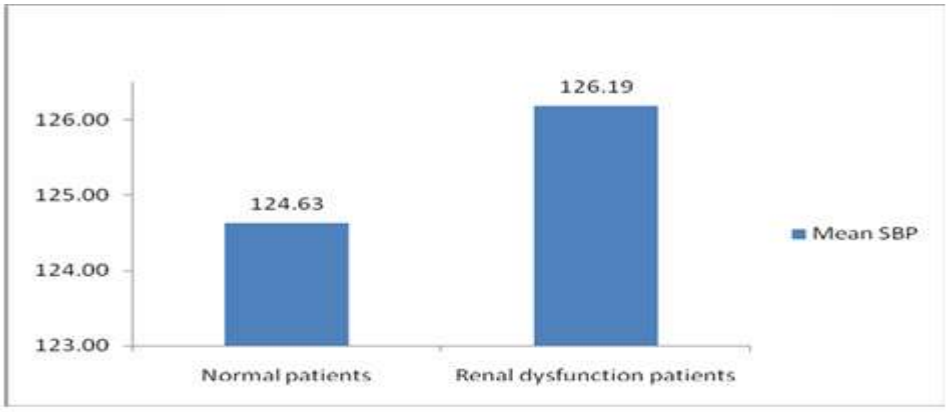


The mean weight is statically different among normal patients and renal dysfunction patients.

Table 5: Systolic BP distribution

SBPdistribution	Mean SBP	Minimum SBP	Maximum SBP	Standard deviation	P-value
Normalpatients	124.63	108	154	8.62	0.232
Renaldysfunctionpatients	126.19	12	150	15.71	

Figure 5: Systolic BP distribution



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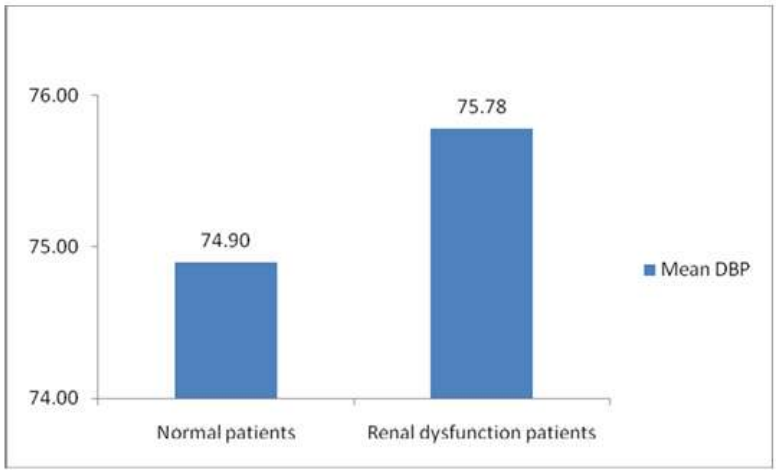
Mean SBP is statistically same among normal patients and also patients with renal dysfunction with p-value 0.232. The p-value is statistically insignificant at 5% significance level. It indicates that the mean SBP is statistically same across both the groups.

Table 6: Diastolic BP distribution

DBPdistribution	Mean DBP	Minimum DBP	Maximum DBP	Standard deviation	P-value
Normalpatients	74.90	62	90	5.57	
Renaldysfunctionpatients	75.78	68	90	5.75	0.204

Figure 6: Diastolic BP distribution

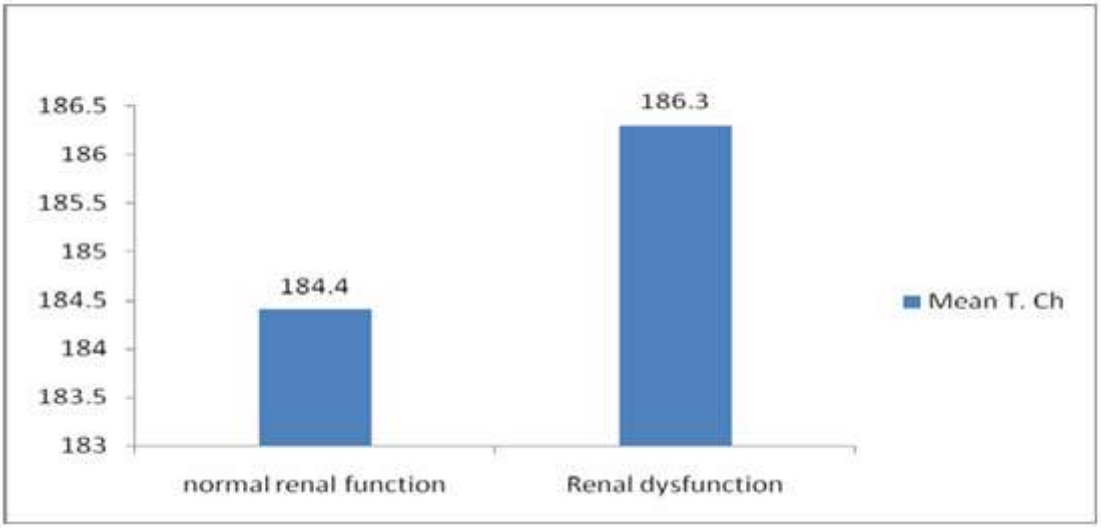


Mean DBP is statistically same among normal patients and also patients with renal dysfunction with p-value 0.204. The p-value is statistically insignificant at 5% significance level. It indicates that the mean DBP is statistically same across both the groups.

Table 7: Serum Cholesterol distribution

SerumCholesterol	Mean T.Ch	Minimum T.Ch	Maximum T.Ch	Standard deviation	P-value
Normalpatients	184.39	106	355	33.05	
Renaldysfunctionpatients	186.27	96	341	42.62	0.667

Figure 7: Serum Cholesterol distribution



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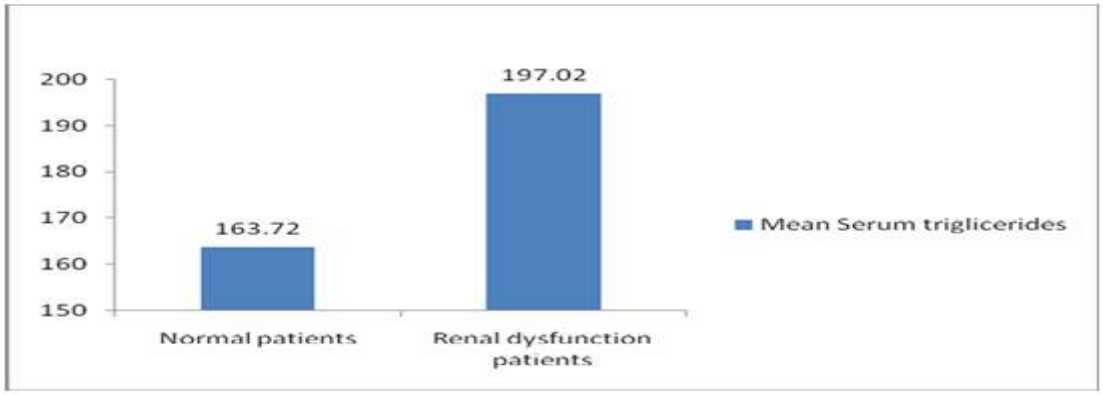
P-value 0.667 suggests that mean Serum total cholesterol is statistically same at 5% significance level.

Table 8: Serum triglycerides distribution

Serumtriglycerides	MeanSerum triglycerides	Minimum Serum triglyceride	Maximum Serum triglyceride	Standard deviation	P-value
Normalpatients	163.72	13	488	64.67	0.0
Renaldysfunctionpatients	197.02	84	580	88.84	

Figure 8: Serum triglycerides distribution

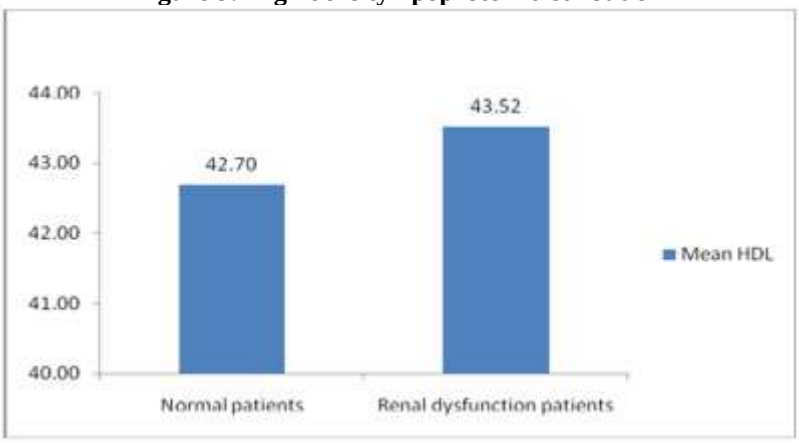


Mean Serum triglycerides is statistically different at 5% significance level with p-value 0.0. It indicates the mean of Serum triglycerides is different and it is significantly higher among the patients with renal dysfunction.

Table 9: High density lipoprotein distribution

HDLdistribution	Number of patients	Mean HDL	Minimum HDL	Maximum HDL	Standard deviation	P-value
Normalpatients	307	42.70	3	70	7.44	0.396
Renaldysfunctionpatients	83	43.52	27	88	9.07	

Figure 9: High density lipoprotein distribution



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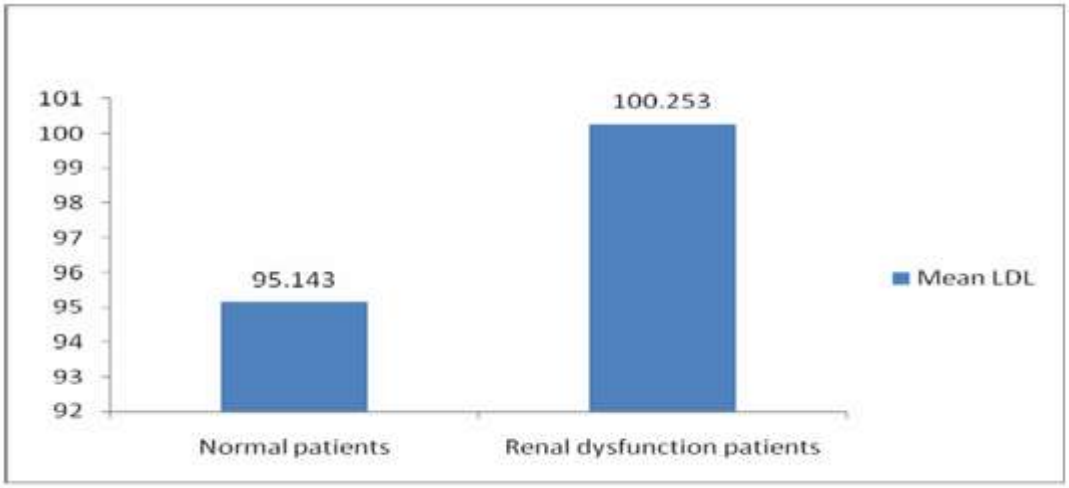
Mean HDL is statistically same among normal patients and also patients with renal dysfunction with p-value 0.396. The p-value is statistically insignificant at 5% significance level. It indicates that the mean HDL is statistically same across both the groups.

Table 10: Low density lipoprotein distribution

LDLdistribution	Mean LDL	Min. LDL	Max. LDL	Standard deviation	P-value
Normalpatients	95.143	25	153	14.77	0.005
Renaldysfunctionpatients	100.253	66	151	14.20	

Figure 10: Low density lipoprotein distribution



Mean LDL is statistically different among both the groups with p-value 0.05 at 5% significance level. It indicates that mean LDL is statistically higher among the patients with renal dysfunction.

V. DISCUSSION

In this study conducted in ART clinic, 390 subjects fulfilling inclusion and exclusion criteria were included. Out of them 83 subjects (21.28%) were found to have renal dysfunction according to the criteria used. Renal function impairment was identified based on two criteria, first one was estimated GFR<60 ml/min calculated using Cockcroft Gault formula and second one was microalbuminuria based on urine albumin-creatinine ratio>30 mg/gm. Patient was considered to have renal dysfunction if any one of the criteria was fulfilled.

ART REGIMEN

In this study subjects were divided into 4 groups based on their ART regimen namely Stavudine regimen, Tenofovir regimen, Zidovudine regimen and subjects who were not initiated on ART. The proportions of patients with renal dysfunction across the different regimens were statistically same with p-value greater than 0.05 at 5% significance level. So no statistically significant difference was seen between various regimens and renal dysfunction.

This was consistent with studies conducted by Keith Rawlings[81] et al (2009) in USA and H.M.F. Kamga[82] et al (2011) in Cameroon which showed no difference with different ART regimens. But study conducted by Menezes[10] et al (2009) showed tenofovir use as a risk factor for renal impairment.

HEIGHT

In this study mean height was 164.4 (S.D =6.75) cms in normal renal function subjects and 162.6 (S.D =7.02) cms in renal dysfunction subjects. P-value was 0.032 which is significant at 5% significance level. So less height was statistically associated with renal dysfunction i.e. decrease in eGFR.

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WEIGHT

In this study mean weight was 57.5 (S.D =6.02) kgs in normal renal function subjects and 55.3 (S.D =6.04) kgs in renal dysfunction subjects. P-value was 0.004 which is significant at 5% significance level. Decline in renal function was significantly associated with less weight. This result is consistent with the study by Menezes[10] et al in Brazil where higher weight was significantly associated with normal kidney function (RR= 0.89, p = 0.005). In the study by Struik[83] et al also lower weight was associated with lower eGFR.

BLOOD PRESSURE

In the present study mean systolic blood pressure (SBP) among normal renal function subjects and renal dysfunction subjects were 124.6(S.D=8.6) and 126.2(S.D=15.7) mms of Hg respectively. It was found to be statistically insignificant, p-value=0.232. Mean diastolic blood pressure (DBP) was 74.9(S.D=5.6) and 75.8(S.D=5.8) among normal function group and renal dysfunction group respectively. It was also found to be insignificant, p-value being 0.204. These findings were consistent with studies by Struik[83] et al in Malawi, Okafor5 et al in Nigeria and Han[36] et al in South Africa which showed no statistically significant difference in blood pressure between the two groups.

LIPID PROFILE

In this study mean total cholesterol was 184.9 (SD=33.05) mg/dl and 186.2 (SD=42.62) mg/dl among normal and renal dysfunction group respectively. The difference was statistically insignificant, p-value = 0.667. Mean triglyceride values were 163.7 (S.D =64.7) mg/dl and 197.0 (S.D =88.8) mg/dl respectively and p value was 0.00. So higher triglyceride value was associated with renal dysfunction. The difference in mean HDL value of 42.7 (S.D =7.4) mg/dl among normal renal function group and 43.5 (S.D =9.0) among renal dysfunction group was found to be statistically insignificant, p-value = 0.396. LDL means were 95.1(S.D =14.8) mg/dl and 100.3 (S.D =14.2) mg/dl among normal and renal dysfunction group and was found to be statistically significant, p-value = 0.005.

In the study by Overton[11] et al conducted among 845 subjects in USA it was found that higher total cholesterol and higher triglyceride level was associated with decline in renal function whereas HDL and LDL level did not show any significant association.

VI. CONCLUSIONS

1.A total of 390 HIV infected subjects were included in the study.
2.The prevalence of renal dysfunction in the study was 21.28% (N= 83). So around one fifth of HIV infected patients will have renal function impairment.
3.Around half of the renal dysfunction subjects (50.16%) were in the age group 38-47 years.
4. Though the study population was predominantly males, 60.24% of the renal dysfunction group was females.
5. HIV positive patients whether pre-ART or on different ART regimens did not have any implication on renal function.
6. There is increased chance of renal function impairment with increased duration of anti-retroviral therapy.
7. Lesser height and weight is associated with more chance of renal dysfunction.
8. Body mass index did not show any significant effect on renal function.
9. Systolic and diastolic blood pressure did not show any association with renal dysfunction in this study.
10. Lower CD4 count which indicates more immunosuppression is associated with decreased renal function and more so with decline in estimated GFR rather than proteinuria.
11. Abnormal lipid profile in the form of high triglycerides and high LDL contributes to renal function impairment.

SUMMARY

HIV infected population and AIDS is a global health concern and more so in a populated country like India. With increasing awareness and advent of ART, the number of people living with HIV/AIDS is on the rise, so are the problems like renal dysfunction which needs to be addressed. The study was aimed at providing data regarding prevalence and the association of certain modifiable and non-modifiable factors with renal function.

The study was conducted in ART clinic. A total of 390 subjects were studied and prevalence of renal dysfunction was found to be 21.28%. Around 3/5th of renal dysfunction population were females. Lower height, lower weight, increased duration of ART therapy were associated with decreased renal function. Different types of ART regimen, body mass index, systolic and diastolic blood pressure did not show any effect on renal function in this study. Decrease in CD4 count was shown to have positive correlation with decrease in estimated GFR. High triglyceride levels and high

LDL levels are associated with decreased renal function.

LIMITATIONS OF THE STUDY

1. No attempt was made to differentiate between causes of renal dysfunction in terms of acute/chronic or reversible /irreversible in the group studied.
2. This study did a onetime assessment of renal function which would have overestimated or underestimated the prevalence of renal dysfunction. Multiple assessments would have been better.

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