Research Article

Fasting lipid profile, fasting blood sugar and anthropometric parameters in Human Immunodeficiency Virus infected patients not initiated on antiretrovirals

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Abstract

Aims: 1. To evaluate the fasting lipid profile and fasting blood sugar in HIV patients who are not initiated on antiretroviral drugs and compare with that of healthy controls. 2. To assess the anthropometric parameters of HIV patients who are not initiated on antiretroviral drugs and compare with that of healthy controls. **Methods:** HIV positive patients attending Internal Medicine and Infectious Diseases departments in a tertiary care hospital in South India satisfying the inclusion criteria were included in the study as cases. Healthy subjects in the age group 20-40 years were taken as controls. The study was conducted in forty cases and forty controls. **Results**: Analysis of anthropometric parameters showed a mean waist circumference of 81 cm in cases, compared to 76cm in controls with a difference of 5 cm ($P<0.01$). The mean waist-hip ratio for cases and controls were 0.86 and 0.83 respectively with a difference of 0.03. ($P<0.01$). The mean body mass index in cases and controls were 20.7 and 23 kg/m^2 with a difference of 2.3 kg/m^2 ($p<0.01$). The mean total cholesterol, triglycerides, LDL-C, HDL-C, VLDL-C, FBS were 179, 131.1, 107.2, 45.7, 26.2,88.9 mg/dL in control compared to 160.3, 222.6, 77.1, 38.9, 44.2, 92 mg/dL respectively in cases($P<0.001$). Analysis of fasting lipid profile showed a decreased in total, LDL and HDL cholesterol and increase in TG and VLDL-C in HIV positive cases compared to controls. Comparison of FBS between control and cases showed a difference in mean FBS of 3 mg/dL which was not statistically significant. **Conclusion:** Significant metabolic and morphological alterations occur in HIV infected, treatment-naïve patients. There is a substantial decrease in serum total cholesterol, HDL-C, LDL-C and an increase in TG and VLDL-C in HIV infected. There is increased incidence of impaired fasting blood glucose in advanced HIV. There is significant alteration in body morphology in HIV as noted by increased waist circumference and waist-hip ratio with possible fat redistribution causing central obesity and peripheral lipoatrophy.

Keywords: Human Immunodeficiency Virus, Fasting lipid profile, Anthropometry.

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INTRODUCTION

Metabolic derangements and body fat abnormalities are well known to occur in the course of human immunodeficiency virus (HIV) infection, both due to a direct effect of the infection and as a complication of treatment.[1] Various studies have addressed the occurrence of lipodystrophy as a consequence of highly active antiretroviral therapy (HAART) especially with the use of protease inhibitors characterized by hyperlipidemia, insulin resistance and fat redistribution with central obesity and peripheral wasting.[2,3,4,5] Abnormalities in lipid metabolism in HIV infected patients are described before the advent of HAART[6]. Increased serum triglycerides (TG) and decreased total cholesterol (TC) were associated with advanced HIV disease. Patients with AIDS have lower high density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C), decreased TG clearance and a predominance of small

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dense LDL (low density lipoprotein) particles compared with controls.[7] Most of the derangements are probably due to the elaboration of cytokines.[8,9] Early detection of lipid abnormalities in HIV infected will be helpful in initiating treatment strategies since dyslipidemia is a well known cardiovascular risk factor. This assumes special importance in the present context of increased life span of HIV patients after the advent of HAART so that mortality due to cardiovascular events can be decreased.

AIMS OF THE STUDY

1. To evaluate the fasting lipid profile and fasting blood sugar in HIV patients who are not initiated on antiretroviral drugs and compare with that of healthy controls.
2. To assess the anthropometric parameters of HIV patients who are not initiated on antiretroviral drugs and compare with that of healthy controls.

MATERIALS AND METHODS

HIV positive patients (including freshly diagnosed cases) attending Internal Medicine and Infectious Diseases departments in a tertiary care hospital in South India satisfying the inclusion criteria were selected at random and included in the study as cases. Healthy subjects in the age group 20-40 years attending medical outpatient, those admitted to medical wards for other causes like uncomplicated snake bite and post graduate students were taken as controls. Those subjects with sexual promiscuity, intravenous drug addiction and high risk behaviour were excluded. The case-control study was conducted in forty cases and forty controls.

Inclusion Criteria

Age group 20-40years and HIV positivity confirmed by Triple ELISA testing.

Exclusion Criteria

HIV positive patients initiated on antiretrovirals, patients with overt thyroid dysfunction, familial hyperlipidemia, nephrotic range proteinuria, diabetes, patients on antihyperlipidemic agents, beta blockers, thiazides, steroids. Age group between 20 to 40 years was selected because by 20-21 years a person attains adult anthropometric proportions and remains more or less static until around 40-45 years after which age related changes occur especially in the form of increased waist circumference and waist-hip ratio. This selection prevented age related changes as a confounding factor while assessing anthropometric parameters. Triple ELISA (rapid test) according to National AIDS Control Organisation (NACO) guidelines was used for diagnosis. Triple ELISA testing involves the use of three different methods of ELISA of which the first ELISA is highly sensitive and second and third highly specific.

Data

A proforma was filled up for each patient which included age, history of smoking and alcoholism, hypertension, vascular diseases like coronary artery disease, cerebrovascular accident, peripheral occlusive vascular disease. A detailed physical examination was done including anthropometric measurements. The height (meters) was measured barefoot and weight (kilogram) in normal indoor clothing. Waist circumference (WC) was measured as the narrowest measurement between the ribcage and iliac crest. Hip circumference was measured as the largest measurement of the hip over the buttocks. Waist-hip-ratio (WHR) was calculated. Blood was collected from patients and controls after an overnight (12 hours) fasting for lipid profile and blood sugar measurements.

Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 16. Quantitative or parametric data were expressed as mean as $\pm$ standard deviation (SD) while qualitative or non-parametric data were expressed in its frequency and percentage. Chi square ($\chi 2$) test was used as nonparametric test. $\chi 2$ test for categorical variables was used to compare data between patients and controls or between patients having or not having a specific factor. For all statistical evaluations, a two-tailed probability value < 0.05 was considered significant.

RESULTS

This study was conducted in forty HIV positive patients as cases and forty healthy subjects as controls. It was planned to include both males and females in the study. Most of the female patients came without bystander and were not willing for anthropometric assessment. Some did not turn up a second time in fasting state for blood collection. At the end of study only four female patients were evaluated completely and the data was insufficient for statistical significance. Hence the study was completed with forty male patients and forty male controls. Of the 40 patients, 7.5% were in the age group 25-29 years, 35% in 30-34 years, 57.5% in 35-40 yrs. The respective percentages for controls were 12.5, 37.5 and 50% respectively. There were no significant differences between cases and control with respect to age distribution and hence were age-matched. There was a higher prevalence of smoking and alcoholism in cases 65% and 57.5% compared to control – 12.5% and 15% respectively. The differences were highly significant ($P<0.001$) and may tally with the high risk behaviour among cases. Of the forty cases and forty controls none had hypertension or clinical evidence of coronary artery disease. Analysis of anthropometric parameters (Table 1) showed a mean waist circumference of 81 cm in cases,

compared to 76cm in control with a difference of 5 cm. This was statistically significant (P<0.01). Waist–hip-ratio was between 0.8 – 0.9 in 92.5% cases and 87.5% controls, less than 0.8 in 5% controls and none of the cases, more than 0.9 in 7.5 % each of cases and controls. The mean WHR for cases and controls were 0.86 and 0.83 respectively with a difference of 0.03. The differences were statistically significant (P<0.01). Analysis of body mass index (BMI) showed a BMI between 18.5 – 24.9 kg/m^2 in 90% cases and 77.5% controls, BMI less than 18.5 in 7.5% cases and none of the controls. BMI more than 25 kg/m^2 was present in 2.5% cases and 22.5% controls. The mean BMI in cases and controls were 20.7 and 23 kg/m^2 with a difference of 2.3 kg/m^2. The differences were significant (p<0.01). The mean total cholesterol, TG, LDL-C, HDL-C, VLDL-C, FBS were 179, 131.1, 107.2, 45.7, 26.2,88.9 mg/dL in control compared to 160.3, 222.6, 77.1, 38.9, 44.2, 92 mg/dL respectively in cases (Table 2, Figure 1). Analysis of fasting lipid profile showed a decrease in total, LDL and HDL cholesterol and increase in TG and VLDL-C in HIV positive cases compared to controls. All the differences were statistically highly significant. (P<0.001). Compared to controls, the cases as a whole showed a decrease in mean total cholesterol by 19 mg/dL, LDL-C by 30 mg/dL and HDL-C by 7 mg/dL. The increase in mean TG and VLDL were 92 mg/dL and 18 mg/dL respectively. It was also observed that 65% of cases had a TG level more than 200 mg/dL while none in the control had. HDL-C below 40mg/dL was observed in 50% of cases and in only 10% of controls. Also an LDL-C value less than 100 mg/dL was seen in 82.5% of cases compared to 30% of controls. Comparison of fasting blood sugar (FBS) between controls and cases as whole showed a difference in mean FBS of 3 mg/dL which was not statistically significant. Of the total cases 10% had an FBS more than 100mg/dL while 2.5% in controls had. In this study, there were no statistically significant changes between different age groups with regard to lipid profile, FBS, WC, WHR and BMI in both cases and control. Also no significant differences were observed in metabolic parameters among alcoholics and non alcoholics in both cases and control. The absence of significant difference between age groups is probably due to the narrow and specific age group (20-40 yrs) included in this study. This has helped by avoiding the interference of age as a confounding factor especially in assessing the anthropometry.

Table 1: Comparison of anthropometry between control and case

Parameter		Mean	± SD	p- value
Waist circumference (cm)	Control	76.200	5.761	< 0.01
	Cases	80.875	5.915	
Waist-hip-ratio	Control	0.832	0.034	< 0.001
	Cases	0.862	0.027	
Body mass index (BMI-kg/m^2)	Control	23.068	2.737	< 0.001
	Cases	20.714	1.839	

Table 2: Comparison of fasting lipid profile and fasting blood sugar between cases and control

Parameter	Group	Mean	± SD	p- value
Total cholesterol (mg/dL)	Control	179.050	18.208	< 0.001
	Cases	160.275	23.608	
Triglycerides (mg/dL)	Control	131.100	17.484	< 0.001
	Cases	222.600	65.440	
LDL (mg/dL)	Control	107.175	19.696	< 0.001
	Cases	77.125	28.004	
HDL (mg/dL)	Control	45.700	4.900	< 0.001
	Cases	38.925	5.877	
VLDL (mg/dL)	Control	26.225	3.497	< 0.001
	Cases	44.200	13.356	
FBS (mg/dL)	Control	88.925	5.456	> 0.05
	Cases	91.950	8.193	

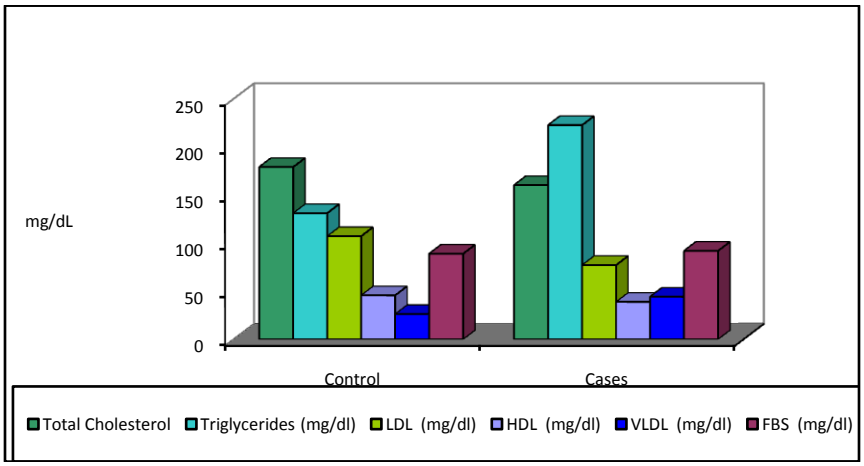

Figure 1: Mean lipid profile and FBS in control and cases

DISCUSSION

Studies have shown significant metabolic alterations in patients infected with HIV, independent of those caused as a consequence of HAART[10,11,12]. Metabolic abnormalities are predominantly in the form of alteration in lipid profile and occurrence of insulin resistance. Body fat abnormalities were also reported in advanced stage of HIV infection independent of HAART in the form of lipodystrophy - fat redistribution with central obesity and peripheral wasting and worsening metabolic abnormalities. Fat redistribution was assessed clinically by measuring waist–hip ratio which was found to be increased in advanced HIV. Since metabolic and body fat abnormalities are more common in patients on HAART than in treatment-naïve patients, most studies were done in patients on HAART. Only a few studies were done in treatment–naïve patients. Sharon. A. Riddler *et al*. in a study of 50 treatment–naïve HIV positive men found a mean decline in total cholesterol by 30 mg/dL, HDL-C by 12 mg/dL and LDL-C by 22 mg/dL from preseroconversion values. There was an increase in serum TG from preseroconversion values. In this study: 'Fasting lipid profile, fasting blood sugar and anthropometric parameters in Human Immunodeficiency Virus infected patients not initiated on antiretrovirals'- cases and controls were age and sex matched. Among cases, there was a high prevalence of smoking and alcoholism tallying with their high-risk behaviour. There were significant anthropometric and morphological abnormalities in the form of decrease in BMI with increase in WC and WHR. The morphological abnormalities are probably due to decrease in total body mass as reflected by decrease in BMI and fat redistribution with peripheral lipoatrophy and central lipohypertrophy as reflected by increase in WC and WHR. There were also significant metabolic abnormalities in HIV positive cases in the form of decreases in total cholesterol, LDL-C, HDL-C and increases in TG and VLDL-C. The changes in mean values between cases and controls were a decrease in mean total cholesterol, LDL-C, HDL-C by 19, 30 and 7 mg/dL respectively and an increase in mean TG and VLDL-C by 92 and 18 mg/dL respectively. There was an increase of mean FBS by 3 mg/dL in cases compared to control which was not significant. None had FBS more than 126 mg/dL. None of the cases or control had history or clinical evidence of coronary artery disease or cerebrovascular accident. The central obesity, increased TG, decreased HDL-C and the possible insulin resistance (which was not measured in this study) associated with lipodystrophy may increase the patients' cardiovascular risk. A significant reduction in LDL-C was also observed which is a favourable alteration. The final impact of these metabolic and morphological abnormalities on the cardiovascular risk and any therapeutic intervention in this direction need further studies. The lack of uniformly accepted definition for lipodystrophy and the lack of clinical tools in correctly assessing lipodystrophy are worth mentioning. Also it is suggested that a baseline anthropometric and metabolic assessment including fasting lipid profile and FBS be included as part of initial evaluation of freshly diagnosed HIV seroconverters before starting treatment, to detect any abnormalities and for future reference. Further large scale studies are needed to confirm the results of this study.

CONCLUSIONS

Significant metabolic and morphological alterations occur in HIV infected, treatment-naïve patients. There is a substantial decrease in serum total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol and an increase in triglycerides and very low density lipoprotein cholesterol in HIV infected. There is increased incidence of impaired fasting blood glucose in advanced HIV. There is significant alteration in body morphology in HIV as noted by increased waist circumference and waist-hip ratio with possible fat redistribution causing central obesity and peripheral lipoatrophy. The impact of these metabolic and morphological changes on cardiovascular risk and the role for therapeutic interventions need further studies. Baseline anthropometric and metabolic assessment including fasting lipid profile and fasting blood sugar should be done as part of initial evaluation in every freshly detected HIV positive case.

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