Original Article

Point prevalence of metabolic syndrome in HIV positive patients

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Abstract

Introduction: Human immunodeficiency virus (HIV)-related morbidity and mortality have declined over time, but this increased longevity may lead to the development of other diseases, which may further manifest as the metabolic syndrome (MS). **Method:** To find out the point prevalence of MS in HIV positive patients, a cross-sectional prospective observational study was conducted on 200 patients who approached ART plus Centre of Government Medical College and Hospital Jammu, including 50 symptomatic patients HIV negative as controls. **Results:** The mean age group in MS was 37.85 ± 6.61. Males consisted of 55% (110) and females consisted of 45% (90). The overall prevalence of MS was 13.5%, with prevalence in males being 16.3% and in females 10%. Patients receiving first line highly active antiretroviral therapy (HAART) showed a 24% prevalence, while that of second line HAART showed a 14% prevalence. Central obesity (47.3%) was the most common component of MS followed by hyperglycemia (43.3%), hypertriglyceridemia (38.6%), and low high density cholesterol (HDL-C) level (38.6%). Out of 84 males with MS, 94% (79) males were having hypertriglyceridemia, 88% (74) were hypertensive, and 72% (60) were having FBS >=100. Out of 66 females with MS, 100% (66) females had central obesity and 88% (58) had hypertriglyceridemia and low HDL-C levels. **Conclusion:** The metabolic complications as a result of treatment with HAART leave HIV patients at a risk of developing cardiovascular disease and diabetes in spite of improvements in morbidity and mortality. Risk factors like central obesity, hypertension, hyperglycemia, and hypertriglyceridemia should be taken into consideration well before to prevent the add-on effect of developing MS.

Keywords: FBS (Fasting blood sugar), HAART (highly active antiretroviral therapy), HDL-C (high density cholesterol), human immunodeficiency virus

Introduction

The HIV pandemic has caused more than 36 million deaths worldwide since AIDS was first diagnosed.[1] But now, HIV-related morbidity and mortality have declined, and life quality has improved among patients having access to HAART.[2] This increased longevity may lead to the development of other diseases like obesity, type 2 diabetes mellitus (T2DM), and other cardio-metabolic diseases, which may manifest as the metabolic syndrome (MS).[3] The development of a new and more effective ART regimen has increased viral suppression and improved immunologic function recovery, leading to the extension of the lifespan of people living with HIV. Recent studies have reported this as one of the significant factors associated with weight gain, obesity, and long-term metabolic consequences in such patients.[4]

Several studies have shown that the prevalence of MS among such patients may be as high as 45.4%,[5-7] which would be then of immense implication to the primary care; therefore, this study was designed and aimed to estimate the point prevalence of MS in HIV positive patients.

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Material and Methods

In order to find out point prevalence of MS in HIV positive patients, a cross-sectional prospective observational study was conducted in the Postgraduate Department of Medicine, Government Medical College and Hospital Jammu for a period of 12 months. The study was targeted toward subjects who approached ART plus Centre GMC Jammu and comprised of a total of 200 patients, out of which, 150 were HIV positive, who were further subdivided into patients under first line (50), second line (50), and naïve HAART (50). Fifty symptomatic patients reporting at the ART Plus center but with HIV negative were selected as controls. This study sample inducted 110 (55%) male participants and 90 (45%) female participants. The study was undertaken after approval by the Institutional Ethical Committee, and all subjects selected for the study were evaluated after obtaining their informed consent.

Inclusion criteria

- Patients aged ≥18 years.
- Patients diagnosed with HIV infection.

Exclusion criteria

- Patients younger than 18 years of age.
- Patients with any complicated comorbid illness other than constituents of MS.

The presence of MS was diagnosed by using the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III)-2001. According to NCEP ATP III, MS is defined as having more than or equal to three of the following criteria:

- abdominal obesity (waist circumference >=90 cm for men and >=80 cm for women: South Asian population)
- fasting triglyceride levels >150 mg/dL or specific medication
- High-density lipoprotein (HDL) cholesterol level <40 mg/dL for men and <50 mg/dL for women, respectively, or specific medication.
- fasting plasma glucose levels >=100 mg/dL or on drug treatment
- hypertension (blood pressure >130 mm systolic or >85 mm Hg diastolic or previous diagnosis or specific medications).

Demographic profile of all the patients was taken. A detailed history of the illness and history of any coexisting disease was taken. Blood pressure was assessed using a mercury sphygmomanometer and waist circumference was measured for each patient. Investigations carried out included the following: HIV testing, Lipid profile–S. Triglyceride level; S. HDL–Cholesterol level, and fasting plasma glucose levels.

A descriptive statistical analysis based on frequency tables of categorical values was performed, using a Chi-square test, to test the significance of the association between qualitative variables, and the results were expressed as percentages. A student`s *t*-test for independent samples was used to compare means between groups, and the results were expressed as mean ± standard deviation. Comparisons among the groups were carried out using analysis of variance (ANOVA). This statistical analysis was carried out using SPSS version 16.0 software (SPSS, Chicago, IL, USA), and $P < 0.05$ was considered to be statistically significant.

Results

In the study, maximum patients were in the age group of 26–45 years [Table 1]. The mean age group in MS was 37.85 ± 6.61. Males consisted of 55% (110) and females consisted of 45% (90) of the study population [Table 1].

The overall prevalence of MS was 13.5%. There was a 16.3% and 10% prevalence of MS among male and female patients, respectively. Prevalence of MS among HAART patients was 18% and 16% among ART naïve patients. Among HAART patients, patients receiving first line showed a 24% prevalence of metabolic syndrome. Patients on second line ART showed a 14% prevalence of metabolic syndrome [Table 2].

Central obesity (47.3%) was the most common component of MS followed by hyperglycemia (43.3%), hypertriglyceridemia (38.6%), and low high density cholesterol (HDL-C) level (38.6%) [Tables 3 and 4].

Table 1: Distribution of patients as per age and gender

Age (years)	Number of patients (%)			
	1st Line HAART	2nd Line HAART	Naïve HAART	Control
≤25	6 (12.00)	3 (6.00)	8 (16.00)	3 (6.00)
26-35	22 (44.00)	12 (24.00)	18 (36.00)	15 (30.00)
36-45	14 (28.00)	22 (44.00)	15 (30.00)	17 (34.00)
46-55	7 (14.00)	9 (18.00)	8 (16.00)	9 (18.00)
>55	1 (2.00)	4 (8.00)	1 (2.00)	6 (12.00)
	50 (100.00)	50 (100.00)	50 (100.00)	50 (100.00)
Mean age (years) Mean±SD	35.82±8.48	40.24±9.62	35.44±9.54	41.56±9.92
Male	27 (54.00)	29 (58.00)	28 (56.00)	26 (52.00)
Female	23 (46.00)	21 (42.00)	22 (44.00)	24 (48.00)
	50 (100.00)	50 (100.00)	50 (100.00)	50 (100.00)

Patients with Metabolic Syndrome had a high CD-4 count, and BMI

Among 84 males with MS, 94% (79) males were having hypertriglyceridemia, 88% (74) were hypertensive, and 72% (60) were having FBS >=100. Among 66 females with MS, 100% (66) females had central obesity and 88% (58) had hypertriglyceridemia and low HDL-C levels.

Discussion

Developing countries have the greatest HIV/AIDS morbidity and mortality rates, with the highest rates found in young adults in Sub-Sahara Africa.[1] The global population of HIV has risen from 10 million in 1990 to 37 million in 2015,[8] while the mortality rates have fallen from 1.7 million in 2005 to 1.2 million in 2015.[9] This dramatic decrease in the morbidity and mortality of patients infected with HIV is attributed to the widespread use of HAART. However, HAART is increasingly associated with the emergence of adverse metabolic events. The first such criteria for the MS have been developed by the World Health Organization (WHO) in 1998.[10] The WHO definition consists of Insulin resistance or its surrogates (IGT or diabetes) as essential components and at least another two from hypertension, increased triglyceride level, decreased HDL-C level, obesity (increased BMI/waist to hip ratio), and microalbuminuria.[11]

With increased longevity in HIV-infected individuals, other diseases like T2DM and cardiometabolic diseases are likely to develop similar to those of the general population. HIV infection itself through chronic inflammation and immune dysfunction mechanisms is assumed to be an important determinant of dyslipidemia, atherosclerosis, and T2DM.[12] The importance of MS is that it is a powerful predictor of future cardiovascular disease and T2DM.[3]

Our study is also supported by studies conducted by Jerico C *et al.*,[5] who, in 2005, did a cross-sectional study on MS among HIV-infected patients comprising of 710 HIV-infected patients. In this study, 121 patients (86 men, 35 women) met MS criteria yielding an overall prevalence of 17%. Hypertriglyceridemia (95%) was the most frequent trait of the MS followed by low HDL-C (71.1%), high blood pressure (67.8%), abdominal obesity (47.1%), and high blood glucose levels (46.3%).

Mondy K *et al.*[7] in 2007 conducted a prospective, cross-sectional study "Metabolic syndrome in HIV-infected patients from an Urban, Midwestern US Outpatient population." Out of 601 patients, 69% were currently receiving HAART; 10% were HAART naïve. Out of 601 patients, only 471 had complete laboratory data and were thus evaluated for MS using NCEP ATP III criteria. Among this subgroup, 120 patients (26%) had MS, and 381 patients (81%) met >=1 of the criteria for risk of MS. HIV-infected patients with MS were more likely to be diabetic, older, and white and have a high CD4 cell count and body mass index, compared with patients without MS. The type or duration of antiretroviral therapy was not an independent risk factor for MS.

Bajaj S *et al.*[13] (2013) studied the prevalence of MS in human immunodeficiency virus (HIV) positive patients. In this study, 70 HIV positive patients were included those who are on HAART (47 patients) and who are not on HAART (23 patients). Cases were evaluated using NCEP ATP III criteria. Prevalence of MS was 20%. Main factor of MS present was low HDL (50%) followed by raised triglycerides (42.9%). They found no statistical difference between those who were on HAART and those not on HAART.

In the study conducted in 2017 by Dohou H *et al.*,[14] MS was found in 18.14% of patients according to the IDF criteria. Among the subjects, 33.02% were hypertensive, and 24.19% had abdominal obesity and dyslipidemia in 53.95% of cases. MS was found to be more associated with female sex and overweight.

The patients on HAART in our study sample showed 18% prevalence of MS which is supported by studies conducted

Table 2: Prevalence of metabolic syndrome among groups

Treatments	Prevalence		*P*
	Number	Percentage	
1st Line HAART	12	24.0	<0.0001
2nd Line HAART	7	14.0	
Naive HAART	8	16.0	
Control	0	0.00	

Table 3: Mean BMI and Fasting Blood Sugar (FBS) of patients

Treatments	Mean±SD		*P*
	BMI (kg/m^2)	FBS (mg/dl)	
1st Line HAART	22.30±2.75	102.74±13.83	<0.0001
2nd Line HAART	23.32±3.19	103.56±15.93	
Naive HAART	23.45±4.13	95.64±11.90	
Control	26.01±2.79	87.12±7.12	
P	<0.0001	<0.0001	

Table 4: Prevalence of various components of metabolic syndrome

Variables	Number of patients (%)			Overall
	1st Line HAART	2nd Line HAART	Naive HAART	
Waist circumference (>90 cm Men/>80 cm Women)	40 (80.00)	13 (26.00)	18 (36.00)	71 (47.3%)
Blood pressure≥130/≥ 85 (mmHg)	9 (18.00)	8 (16.00)	12 (24.00)	29 (19.3%)
Triglycerides>150 mg/dL	22 (44.00)	23 (46.00)	13 (26.00)	58 (38.6%)
HDL-C (<40 mg/dL Men/<50 mg/dL Women)	19 (38.00)	22 (44.00)	17 (34.00)	58 (38.6%)
FBS ≥100 (mg/dL)	26 (52.00)	26 (52.00)	13 (26.00)	65 (43.3%)

by Mbunkah HA *et al.*,[15] 2014; Jerico C *et al.*,[5] 2005; Livia D *et al.*,[16] 2017; Silva *et al.*,[17] 2009) which showed prevalence of MS among the patients on HAART as 15.6%, 16%, 28.8%, 13%, respectively.

In our study sample, central obesity (47.3%) was found as the most common component of MS followed by hyperglycemia (43.3%), hypertriglyceridemia (38.6%), low HDL-C level (38.6%), and hypertension (19.3%) which is comparable with the study done by Dimodi HT *et al.*[18] in which central obesity (40.5%) was the most common component, followed by hypertriglyceridemia (55.5%), low HDL-C (42.5%), and hyperglycemia (31.2%). In contrast to our study, Mbunkah HA *et al.*,[15] 2014 showed low HDL-C (43%) was the most common component followed by central obesity (35.5%) and hyperglycemia (26.5%). This variation can be explained by the cut-off values taken for abdominal obesity in this study (WC >102 cm in men and >88 cm in women).

Our study showed central obesity (36%) as the most common component among HAART naïve patients followed by low HDL-C levels (34%) followed by hypertriglyceridemia (26%) and hyperglycemia (26%), which correlates with the study done by Mbunkah HA *et al.*, in 2014,[15] which also showed central obesity (31.1%) as the most frequent component followed by hypertension (24%) and low HDL-C level (19%). Silva *et al.*[17] showed low HDL-C level (49%) and hypertriglyceridemia (41%) as the most frequent individual component. The difference in central obesity prevalence can be explained by our low cut-off values of considering central obesity in our subjects (Asians).

In our cohort study, it was found that the prevalence of MS in males was 16.3% and in females it was 10%. It was in variation to study (Mbunkah HA *et al.*, 2014)[15] in which higher prevalence was shown in females (18.6%) as compared to males (5%); this can be explained by the difference in sample size, males constituting 31.4% and female constituting 68.6% of their study population.

Certain studies undertaken recently have also shown that weight gain and obesity are increasing in patients living with HIV worldwide, and the prevalence of obesity is high in Korea (16.4% from 2006 to 2013). In particular, the newly introduced ARTs of Integrase strand transfer inhibitors (INSTIs) and Tenofovir (TAF) are well known to be related to weight gain during HAART. Patient characteristics, such as female sex, are among the risk factors.[4] In our study, factors like central obesity, hypertension, hyperglycemia, and hypertriglyceridemia should be taken into consideration well before in naïve patients to prevent the add-on effect of HAART in developing MS.

The prominent limitations of the present study were that the study was carried out on a small sample size and for a short duration and that the findings of a study conducted in one center cannot be generalized.

Conclusion

MS is more prevalent in HIV-infected patients on HAART than in ART-naïve patients and seronegative individuals. The metabolic complications as a result of treatment with HAART have left HIV patients at a risk of developing cardiovascular disease and diabetes in spite of improvements in morbidity and mortality. Also, risk factors like central obesity, hypertension, hyperglycemia, and hypertriglyceridemia should be taken into consideration well before in naïve patients to prevent the add-on effect of developing MS.

The benefit of HAART in HIV patients is far more than the complications of MS. However due to prolongation of life expectancy of HIV patients on HAART, the expected long-term usage of HAART will incr ease the prevalence of MS in these patients.

In conclusion, the patients need to be screened for risk factors of MS before starting HAART to prevent the adverse outcome attributable to HAART.

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Conflicts of interest

There are no conflicts of interest.

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