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ORIGINAL ARTICLE

Risk factors for Kaposi's sarcoma in human immunodeficiency virus patients after initiation of antiretroviral therapy: A nested case—control study in Kenya

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Abstract *Background/Purpose:* This study aimed to evaluate the association between highly active antiretroviral therapy (HAART) adherence and development of Kaposi's sarcoma (KS) in human immunodeficiency virus (HIV)/AIDS patients.
Methods: We conducted a retrospective nested case—control study of 165 participants (33 cases and 132 controls) receiving HAART care at Maseno Hospital, Kenya, from January 2005 to October 2013. Cases were HIV-positive adults with KS, who were matched with controls in a ratio of 1:4 based on age (±5 years of each case), sex, and KS diagnosis date. Perfect adherence to HAART was assessed on every clinic visit by patients' self-reporting and pill counts. Chi-square tests were performed to compare socioeconomic and clinical statuses between cases and controls. A conditional logistic regression was used to assess the effects of perfect adherence to HAART, the latest CD4 count, education level, distance to health-care facility, initial World Health Organization stage, and number of regular sexual partners on the development of KS.
Results: Only 63.6% participants reported perfect adherence, and the control group had a significantly higher percentage of perfect adherence (75.0%) than did cases (18.2%). After

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adjustment for potential imbalances in the baseline and clinical characteristics, patients with imperfect HAART adherence had 20-times greater risk of developing KS than patients with perfect HAART adherence [hazard ratios: 21.0, 95% confidence interval: 4.2—105.1]. Patients with low latest CD4 count ($\leq$350 cells/mm^3) had a seven-times greater risk of developing KS than did their counterparts (HRs: 7.1, 95% CI: 1.4—36.2).
Conclusion: Imperfect HAART adherence and low latest CD4 count are significantly associated with KS development.

Introduction

Kaposi's sarcoma (KS) is one of the defining features of AIDS since 1982.[1] It is known to cause deep-purple skin lesions that can be disfiguring and can also be fatal if the cancer spreads to the lungs and other organs.[2] Once traditionally considered a slow-growing malignancy, KS continues to be a global scourge since the advent of the human immunodeficiency virus (HIV) pandemic, and it is currently one of the most commonly diagnosed cancers among HIV-infected persons in Africa.[3—5] Since it became available in 1996, the use of highly active antiretroviral therapy (HAART) to treat HIV infections has led to decreases in KS mortality rates in resource-limited settings and to increases in the number of persons living with HIV infection.[1,6] However, the disease still develops in approximately 15% of AIDS patients.[7,8]

HAART is a lifelong therapy, and its success in reducing the viral load to undetectable levels by current blood testing techniques relies on continual adherence to medications.[9,10] According to the World Health Report 2003, the consequences of imperfect medication adherence are so huge that people across the world would benefit more from efforts aimed at improving medication adherence than from the development of new medical treatments.[11,12] According to a previous study, acceptable adherence rates of HAART are 90—95% to avoid rapid treatment failure, which ultimately leads to disease development.[13] Treatment efficacy relies, however, on sustained adherence, which constitutes a serious challenge to those receiving HAART.

The regimens are often complicated and can include varying dosing schedules, dietary restrictions, and adverse effects.[14,15] As more patients are initiated on lifelong HAART, one of the major future challenges, apart from securing sustainable funding, lies in retaining patients in care and sustaining adherence to HAART.[16] Although the close linkage of AIDS and KS and the importance of HAART adherence for AIDS control were pointed out by various studies, to our knowledge, no study has evaluated the relationship between HAART adherence and KS development.

In Africa, there have been comparatively few published studies or data on KS treatment and epidemiology. According to a recent report, about 80,000 cases of cancer are diagnosed each year. Of all the cancers registered, KS accounted for 6.9% of the total cases.[17] While Kenya is at the epicenter of the HIV/AIDS epidemic with approximately 1.6 million people currently living with the virus, this condition has emerged as a priority that needs to be studied. Therefore, we conducted this study in Kenya to evaluate the association between HAART medication adherence and the development of KS in HIV/AIDS patients.

Materials and Methods

We conducted a retrospective nested case—control study of KS patients receiving primary care at the Maseno Hospital Comprehensive Care Clinic, Kenya, from January 2005 to October 2013.

Data source

This study was conducted at the Maseno Comprehensive Care Clinic in Maseno Hospital, which is situated in the western part of Kenya. Maseno Hospital was established in 1906 with a capacity of 175 beds, and the comprehensive care clinic was set up in 2005 to cater to HIV/AIDS patients. The clinic has had 4330 patients enrolled in the program since its inception in 2005.

Medical records of patients are captured and stored in the International Quality Care Tool, a patient management electronic medical record database recommended by the World Health Organization (WHO).[17—19] The information used in this study was collected from this electronic database.

At enrollment, patients routinely have clinical, laboratory, and radiological evaluations including a physical examination, full blood count, alanine transaminase, serum creatinine, Venereal Disease Research Laboratory test, CD4 count, and a chest X-ray. The CD4 count is monitored every 6 months. The viral load is only performed when treatment failure is suspected, based on clinical and immunological parameters. HAART is typically initiated when the CD4 count is $\leq$ 350/mL in line with national and WHO guidelines or if the patient is in WHO Clinical Stage 3 or 4 regardless of the CD4 count.

Definition of cases and the matching process

Cases were defined as HIV-positive adults with KS receiving HAART care at the comprehensive care clinic. The morphology code of the International Classification of Disease (ICD)-10 for KS (M9140/3) was used to identify cases.

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