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LETTERS

RESEARCH LETTER

Ambulatory Rhythm Monitoring in People Living With HIV

A Cross-Sectional Analysis From a Comparative Cohort

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In sub-Saharan Africa, there is an increasingly recognized burden of cardiovascular disease, and yet there is limited to no access to electrophysiology services.[1] In 2020, the Pan-African Society of Cardiology established the Africa Heart Rhythm Association and emphasized the need to define the burden of arrhythmia in Africa.[2] Most published studies describing arrhythmia are cross-sectional analyses of electrocardiographs[3] and include no ambulatory rhythm monitoring data. Additionally, HIV infection is a known risk factor for arrhythmia[4] and, globally, more than two-thirds of people living with HIV (PLWH) reside in Africa.

The purposes of this study were: 1) to determine the prevalence of atrial fibrillation and flutter using 24-hour ambulatory rhythm monitoring in a comparative cohort of adults living with and without HIV in Northwestern Tanzania; and 2) to establish research capacity for ambulatory rhythm monitoring.

We conducted a cross-sectional analysis of ambulatory rhythm monitoring data from an ongoing prospective cohort (R01HL160332) of cardiovascular disease. PLWH and HIV-uninfected community controls were recruited from Bugando Medical Centre, a tertiary care center in Mwanza, Tanzania. A total of 478 PLWH and 487 consecutively enrolled community controls underwent 1 day of rhythm monitoring with a single-lead CamNtech Actiheart 5 electrocardiogram (ECG) and activity recorder between April 1, 2022, and May 1, 2023. The Actiheart 5 is a U.S. Food and Drug Administration-approved device that uses 2 standard ECG electrodes and records full waveform, single-lead ECG data. Recordings were analyzed using Cardiomatics, a cloud-based artificial intelligence software package. All 965 recordings were screened for atrial fibrillation and atrial flutter; the first 100 recordings (59 PLWH) underwent complete signal analysis.

Participants provided informed consent, and the study was approved by the institutional review boards at Weill Cornell Medicine and the Tanzanian National Institute of Medical Research. Health insurance and referral to a cardiologist were provided for any participants diagnosed with arrhythmia.

The median age of the cohort at the time of ambulatory rhythm monitoring was 44 years of age (range: 38 - 50 years), and 70% were female (n = 671). Almost all (95%) of the PLWH were on stable antiretroviral therapy (ART) with dolutegravir, tenofovir, and lamivudine and had suppressed viral loads and

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

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TABLE 1 Burden of Arrhythmia in Tanzanian Adults With and Without HIV[a]

	PLWH	Community Controls	P[b]
Screening for arrhythmias (N = 965)			
n	478	487	–
Atrial fibrillation	1 of 478	0 of 487	–
Atrial flutter	0 of 478	0 of 487	–
Complete signal analysis (N = 100)			
n	59	41	
Recording length, h	23.5 (21.9 - 25.2)	23.8 (21.8 - 25.8)	0.434
Percent quality signal	89.0 (81.7 - 92.6)	89.7 (84.6 - 91.5)	0.913
Clinical arrhythmias			
Atrial	0 of 59	0 of 41	–
Ventricular	0 of 59	0 of 41	–
Pauses >3 s	0 of 59	0 of 41	–
Atrial ectopy			
Supraventricular salvos[c]	7 of 59	1 of 41	0.136
1	3	0	–
2-5	3	1	–
5+	1	0	–
Percent of atrial ectopy			
<0.5%	58 of 59	39 of 41	0.510
0.5% - 1.0%	1 of 59	1 of 41	
1.5%	0 of 59	1 of 41	
≥5%	0 of 59	0 of 41	
Median no. of ectopic atrial beats (Q1, Q3)	7 (2 - 19); range: 0 - 518	11 (2 - 24); range: 0 - 1,426	–
Median % of ectopic beats (Q1, Q3)	0.00698 (0.00221 - 0.02336)	0.01040 (0.00342 - 0.02822)	0.308
Ventricular entropy			
Ventricular salvos[c]	0 of 59	2 of 41	0.166
1	0	2	–
2-5	0	0	–
5+	0	0	–
Percent of ventricular ectopy			
<0.5%	58 of 59	38 of 41	0.305
0.5% - 1.0%	0 of 59	1 of 41	
1% - 5%	1 of 59	1 of 41	
≥5%	0 of 59	1 of 41	
Median no. of ectopic ventricular beats (Q1, Q3)	1 (0 - 3); range: 0 - 2,638	1 (0 - 9); range: 0 - 6,950	–
Median % of ectopic ventricular beats (Q1, Q3)	0.00010 (0 - 0.00349)	0.00109 (0 - 0.00992)	0.395

[a]A low burden of arrhythmia in both PLWH and community control adults without any significant between-group differences was observed. [b]P values derived from Fisher exact test and Mann Whitney U tests. [c]Salvo is defined as 3 to 7 consecutive beats at a rate of >100 beats/min.

PLWH = people living with HIV.

high CD4 counts (median: 714 cells/mL [Q1-Q3: 536 - 942]). Age, sex, socioeconomic status, hypertension, tobacco, and alcohol use were generally similar between PLWH and community controls (Supplemental Table 1).[5] The results are displayed in **Table 1**. All 965 signals were successfully analyzed. The median percent of high-quality signal was 89% (82% - 92%). The overall burden of arrhythmia was low among the 965 adults who underwent screening; only 1 case of atrial fibrillation was identified. There were no other arrhythmias detected. The participant diagnosed with atrial fibrillation was 64 years of age, HIV-infected, and had a history of hypertension.

There were no arrhythmias in the subset of the first 100 participants enrolled who underwent complete signal analysis. There was no difference in the number of pauses or burden of supraventricular ectopy and ventricular ectopy between PLWH and community controls (**Table 1**).

Encouragingly, we found a low burden of clinical arrhythmia and no difference in the burden ectopic atrial and ventricular activity between PLWH and community controls over an admittedly limited duration of monitoring. Previously, in the United States, HIV has been associated with a higher risk of atrial fibrillation, particularly among those with advanced

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immunosuppression with low CD4 counts and high viral loads, yet limited data exists from sub-Saharan Africa.[4] Many HIV clinicians have been concerned that there might be a substantial burden of undiagnosed arrhythmia in PLWH in Africa. Our findings from a cohort of middle-aged adults living with HIV on stable ART are reassuring. Although this cohort does reflect the population commonly seen in HIV clinics in East Africa, we do acknowledge that it may not reflect higher-risk patients living with undiagnosed or uncontrolled HIV or those with other known risk factors for arrhythmia (eg, advanced age, active substance use, established cardiovascular disease, etc).

Ambulatory rhythm monitoring is key diagnostic tool and is practically unavailable in sub-Saharan Africa.[2] As modern ambulatory rhythm monitors and wearable devices become increasingly available, concentrated efforts should be made to provide equitable access to digital signal analyses. The typical price of analyzing a 24-hour recording ranges from $15 to $20 U.S. dollars, which is more than 5 to 10 times the daily wage of the average Tanzanian. This study was possible due to the generosity of Cardiomatics, which provided free signal analysis to support research in Africa.

To scale up electrophysiologic services and allocate resources for the management of arrhythmias in sub-Saharan Africa, high-quality studies are needed to determine the incidence of arrhythmia and identify high-risk populations. Collaborations between researchers, clinicians, and industry are needed to facilitate equitable access to ambulatory rhythm monitoring. Creative repurposing of devices that are commonly used in research studies may be necessary; in this study, the devices were borrowed from an ongoing study of sleep in PLWH.

In conclusion, our analysis provides reassurance to PLWH and HIV clinicians in sub-Saharan Africa that the prevalence of arrhythmia is likely low in young adults on stable ART. Our results also show that opportunities exist for leveraging new devices with digital signal analysis to produced needed epidemiologic data.

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APPENDIX For a supplemental table, please see the online version of this paper.