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Racial Differences in Atrial Fibrillation Epidemiology, Management, and Outcomes

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Abstract

Purpose of the review Atrial fibrillation (AF) is the most common sustained arrhythmia encountered in clinical practice and is associated with significant morbidity and healthcare cost. Most of the AF studies have predominantly included white population, with underrepresentation of minority population. In this review, we analyze the racial differences in epidemiology, disease awareness, risk factors, genetics, treatments, and outcomes of AF.
Recent findings African Americans have a higher prevalence of established AF risk factors but lower incidence and prevalence of AF than non-Hispanic whites. There is also a significant racial and ethnic differences in the prevalence of AF-related symptoms and the detection and awareness of AF. Non-white patients are afforded decreased use of rhythm control treatment strategies and anticoagulation both with warfarin and NOACs for stroke prevention. They are less likely to receive catheter ablation (CA) of AF, compared with non-Hispanic whites. AF in the minority racial and ethnic groups carries increased morbidity and mortality compared with white groups, especially in the black individuals with AF, who have been shown to have a lower QoL compared with their white or Hispanic counterparts. Minorities experience stroke more frequently than the whites which is usually more severe and disabling.
Summary There are significant racial differences in AF risk factors, manifestations, management, and outcomes. Recognition of these differences will aid in developing better preventive and treatment strategies for AF to decrease morbidity and mortality. In addition, this knowledge will enhance our understanding regarding the pathophysiology of AF including genetic predisposition.

Introduction

Atrial fibrillation (AF) is the most commonly treated arrhythmia in clinical practice, associated with significant morbidity and mortality attributable to stroke and heart failure [1••]. It affects 2.7 to 6.1 million people in the USA and the prevalence is expected to rise to 12.1 million by 2030 as the life expectancy continues to increase [2–4]. It is estimated that AF is seen in about 2% of people under 65 years of age and approximately 9% of people 65 years or older [5].

Epidemiological studies have traditionally under represented non-white racial and ethnic groups and this cohort has consistently reported a lower incidence and prevalence of AF in comparison with the whites [6]. An under-recruitment of ethnic minorities has also been noted in stroke prevention and catheter ablation trials which limits our understanding of the benefits of interventions that reduce morbidity and mortality in this population. In the last two decades, there have been several studies and meta-analysis investigating race-specific risk factors to understand racial differences in AF prevalence and AF-related outcomes [7]. This review summarizes the current understanding of AF and related outcomes in diverse racial and ethnic groups.

Racial differences in epidemiology of AF

Epidemiological studies suggest that AF is more prevalent in whites than in black population. Based on Medicare data from 2007, the prevalence rate of AF per 1000 beneficiaries was 90.8 in whites, 46.3 in blacks, and 47.5 in other/unknown race [8]. European BiomarCaRE Consortium concluded that the lifetime risk estimates for AF in individuals of European ancestry have is ≈ 1 in 3 [9•].

As women live longer and AF increases with age, AF is more prevalent in women and follows the racial trend [6]. In the Atherosclerosis Risk in Communities (ARIC) cohort, it was observed that the lifetime risk of AF was 36% in white males (95% CI, 32–38%), 30% in white females (95% CI, 26–32%), 21% in African American males (95% CI, 13–24%), and 22% in African American females (95% CI, 16–25%) [10]

In a recent study of 47,417 Medicare beneficiaries with implanted pacemaker/cardioverter-defibrillator/loop recorder, the incidence of atrial fibrillation/atrial flutter was 12.2 (95% CI, 11.5–13.1) per 100 black beneficiaries per year, compared with 17.6 (95% CI, 17.4–17.9) per 100 non-black beneficiaries per year. Black patients had a lower hazard of atrial fibrillation/atrial flutter than non-black patients (hazard ratio [HR], 0.75; 95% CI, 0.70–0.80) [11•].

Multi-Ethnic Study of Atherosclerosis study (MESA) investigators, estimated the age- and sex-adjusted incidence rate of hospitalized AF per 1000 person-years (95% CI) as 11.2 (9.8–12.8) in non-Hispanic whites, 6.1 (4.7–7.8) in Hispanics, 5.8 (4.8–7.0) in non-Hispanic blacks, and 3.9 (2.5–6.1) in Chinese [12]. In a large survey of 664,754 male veterans, the age-adjusted prevalence of AF was noted to be 3% in Hispanics, 3.4% in blacks, 3.6% in Asians, 5.2% in Pacific Islanders, 5.4% in Native Americans, and 5.7% in whites [13].

In essence, the available data from multi-ethnic communities have shown a consistently lower AF prevalence among minorities compared with whites.

Racial differences in AF risk factors

Age

The incidence of AF clearly increases with advancing age and the Framingham Heart Study group has shown age to be the greatest risk factor for AF, surpassing other risk factors, including male sex, obesity, diabetes mellitus, smoking, hypertension, HF, and coronary artery disease [14]. The MESA study reported age-specific incidence rate of AF in individuals aged 65 to 74 and 75 to 84 years of 3.4% and 8.6% for Chinese, 4.9% and 10.6% for non-Hispanic blacks, 7.3% and 9.4% for Hispanics, and 13.4% and 19.6% for non-Hispanic whites, respectively, over a mean follow-up period of 6.98 years [12].

Sex

The age-adjusted incidence of AF is higher in men compared with women. This has been seen in North American, European, and Asian populations [5, 15]. The Framingham Heart Study (FHS) observed lifetime risk of AF as one in four in Caucasian men and women above age 40 years. At 80 years of age, 21% of white men and 17% of white women are at risk of developing AF, compared with an 11% risk in African American men and women at that age [5].

Smoking

The Atherosclerosis Risk in Communities Study (ARIC) showed that the multivariable-adjusted incidence of AF was 1.58 times higher in patients who ever smoked (former and current) and 2-fold higher in those currently smoking when compared with non-smokers [10]. While studies show that smoking is an RF for AF across all races and ethnicities, in the Multi Ethnic Study of Atherosclerosis (MESA) cohort, smoking carried a significant risk of paroxysmal AF (population attributable fraction 27%) among non-Hispanic blacks in this cohort but not among the other race-ethnic groups [12].

Obesity

Population studies show that obesity and elevated BMI are independent risk factors for AF. Obesity is associated with a 51% increased risk of developing AF compared with non-obese counterparts [16]. In a study with 2717 participants, with every 1 standard deviation increase in BMI, abdominal circumference, and total fat mass, there was a 13 to 16% increased AF risk (hazard ratio [HR] 1.14, 95% CI 1.02–1.28; HR 1.16, 95% CI 1.04–1.28; and HR 1.13, 95% CI 1.002–1.27 respectively); however, no racial differences in the associations between the adiposity measures and AF were identified [17].

Sleep-disordered breathing

Sleep-disordered breathing has been shown to be associated with a 4-fold odds of AF in the Sleep Heart Health Study [18]. Obstructive sleep apnea (OSA) patients have a higher recurrence of AF after cardioversion and catheter ablation. Also, OSA patients treated with CPAP are less likely to progress to permanent AF compared with the untreated cohort [18]. Studies and meta-analysis have not yet validated the role of OSA as a race-dependent risk factor. The ORBIT-AF registry showed OSA was seen to be more prevalent in African Americans (25%) compared with whites (18.1%) and Hispanics (13.9%) [19].

Hypertension

The Framingham Heart Study showed that hypertension was associated with an odds ratio of 1.5 and 1.4 for AF in men and women respectively [20]. In the ORBIT-AF registry, the prevalence of hypertension was highest in blacks (90%) followed by Hispanics (86%) and whites (83%) [19]. In the MESA cohort, hypertension was identified as the most significant risk factor for AF with highest population attributable fraction in Chinese (46.3%), followed by Hispanics (43.9%), non-Hispanic blacks (33.1%), and non-Hispanic whites (22.2%) [12].

Diabetes

In the FHS, diabetes mellitus was shown to be associated with a 40% and 60% increased risk of AF in men and women respectively [21•]. The ORBIT-AF registry showed that the prevalence of diabetes was the highest in African Americans (41.9%), followed by Hispanics (39.4%) and Whites (28.3%) [15]. The population attributable fraction for diabetes was highest for Hispanics compared with non-Hispanic blacks and non-Hispanic whites in the MESA study, but the confidence interval crossed zero in all the groups [12].

Heart failure

The FHS showed that HF was associated with 4.5-fold risk of AF in men and 5.9-fold risk in women [22]. AF studies have shown greater prevalence of HF in blacks (44.2%) compared with the whites (32.7%) and Hispanic population (31.6%) [19].

Coronary artery disease

While coronary artery disease was associated with higher risk of development of atrial fibrillation in men (OR 1.4) in the Framingham Heart Study, in the ARIC study, it was associated with a hazard ratio of 2.2 in the entire population [23]. In the ORBIT-AF registry, CAD was more prevalent in whites (36.8%) than blacks (33%) and Hispanics (28.8%) with AF [19].

Racial paradox of AF risk

Several studies have shown that while the black population has a higher risk factor burden than the white population, they have a lower age- and sex-adjusted risk of AF than whites [11, 22, 24]. This disparity between the higher AF risk factors and the lower incidence and prevalence of AF in blacks has been termed "racial paradox." The Henry Ford Health System study of almost 246,059 patients demonstrated no racial disparity in prevalence of AF under 60 years of age, while cohort

over 60 years showed whites with twice the prevalence of AF (2.5% vs. 1.2%) compared with blacks, despite a higher prevalence of hypertension and diabetes among black patients [25]. In the Reasons for Geographic And Racial Differences in stroke study, 13,688 patients were followed for a median of 9.4 years, with an incidence of atrial fibrillation of 7.3% (997 patients). Black race was associated with a lower risk of AF (relative risk = 0.46, 95% CI = 0.39, 0.53) compared with the white race, even though blacks had a higher prevalence of AF risk factors like diabetes, hypertension, and obesity. In this study, the association of AF incidence with traditional risk factors was similar in blacks and white population [26]. Several potential explanations for this paradox have been proposed. Larger left atrial dimensions by echocardiography in whites may account for left atrial remodeling and higher incidence of AF [27]. It is possible that blacks may have under ascertainment of AF diagnosis due to decreased symptoms, intermittent (paroxysmal) AF as well as poor access to medical care. Finally, whites may be genetically predisposed to atrial fibrillation. This paradox further extends into the greater risk of stroke and other clinical manifestations of AF including HF in blacks despite the lower prevalence of AF [21•, 28•, 29•].

Race and genetics of AF

The Candidate Gene Association Resource Study showed that the risk of AF in blacks was independently influenced by the increasing percentage of European ancestry, as discussed above [30]. Marcus et al. suggested that a 10% increase in European ancestry was associated with a corresponding 13% rise in incident AF risk (HR 1.13; 95% CI 1.03–1.23; $P = 0.007$) in both blacks and whites [27]. This suggests that either African ancestry is protective against AF or European ancestry enhances AF risk [31]. Single-nucleotide polymorphism (SNP) analysis performed in 2 cohorts have shown that the rs10824026 SNP located on the 10q22 genetic locus is associated with a 11.4 to 31.7% increase in AF risk in whites, compared with blacks. The minor allele G of the SNP is believed to confer low AF risk and is more common in blacks than whites. An intronic SNP rs4845625 of the *IL6R* gene has been associated with increased AF in whites as well as in blacks [32]. Finally, the SNP rs4611994 on chromosome 4 near *PITX2* has also been noted to be associated with AF risk in both blacks in white individuals [32]. While the traditional AF risk factors are well studied, there is increasing evidence that race, ethnicity, genetics, and ancestry play a significant role in the predisposition to develop AF. Also, the recognition of a protective gene that is more prevalent in blacks may explain the "racial paradox" seen in this group, but needs further investigation.

Racial differences in outcomes in patients with AF

Stroke

In the national Reasons for Geographic and Racial Differences in Stroke (REGARDS) study with 27,744 participants, blacks were 1.5 times more likely to experience stroke compared with white participants, after controlling for age and gender [24]. They also had more severe and disabling strokes compared with whites [33].

In another study of 517,941 Medicare patients with newly diagnosed AF over a median follow-up of 20.3 months, compared with whites, blacks, and Hispanics, had a significantly higher hazard of stroke (hazard ratios[HR] of 1.66 and 1.21 respectively) [34]. After risk adjustments for comorbidities, the relative hazard of stroke was reduced (HR 1.46) in blacks as well as in Hispanics (HR 1.11).

A follow-up study of 460,417 Medicare patients with newly diagnosed AF showed that addition of the African American ethnicity to CHA_2DS_2-VASc score (CHA_2DS_2-VASc-R score) improved stroke prediction risk [35•]. When compared with CHA_2DS_2-VASc risk factors, only prior stroke, age ≥ 75 years, and female sex were found to have a stronger association with incident stroke than African American ethnicity [35]. The main limitation of these studies was exclusion of patients with CHA_2DS_2-VASc score of 0, as these studies only included patients > 65 years of age.

In another study of 267, 419 patients using Optum Clinformatics, a large administrative claims database of commercial and Medicare advantage health plan enrollees, over a mean follow-up of 22 months, the incidence of ischemic stroke or TIA was higher in blacks than Hispanics or whites (1.65, 1.40, and 1.22 cases per 100 person-years, respectively) and increased with increasing CHA_2DS_2-VASc, with no race/ethnicity-based differences (P for interaction = 0.17). The study showed that the predictive ability of CHA_2DS_2-VASc for ischemic stroke or TIA in AF is comparable among whites, blacks, and Hispanics and the addition of race/ethnicity to the CHA_2DS_2-VASc does not improve its predictive ability [36•].

Simpson et al. showed a higher risk of stroke recurrence in the presence of AF but a lower risk of death in Mexican Americans (MAs) compared with non-Hispanic whites when examining all ischemic strokes in the community [37].

Heart failure

HF is both a risk factor and an adverse clinical cardiovascular outcome in AF patients. In the ARIC cohort, 15,080 participants (mean age 54.2 ± 5.8 years; 55% women, 25.4% blacks) were followed up for 20.6 ± 6.2 years [38]. There were 2348 cases of incident AF—1914 in whites (incidence rate of 8.1 per 1000 patient-years) and 434 in blacks (incidence rate of 5.8 per 1000 patient-years). Among patients with AF, incidence of heart failure was 112.8 per 1000 patients-years in blacks versus 77.4 per 1000 patient-years in whites. The rate difference (rate of the manifestation in those with AF minus the rate in those without AF per 1000 person-years) for HF was 1.5- to 2.0-fold higher in black individuals than white [38]. Investigating the role of AF in severity of HF in various ethnic and racial minorities may help reduce morbidity and mortality in these subsets [39].

Cognitive decline

AF is associated with an adjusted increased risk of cognitive impairment and all variants of dementia in patients with and without a history of stroke [40, 41]. Studies have repeatedly shown that white AF patients have greater loss of cognition and this is probably again due the minority under-enrollment in various studies and trials [41, 42]. In a study with a bi-racial group of 12,515 participants (mean age, 56.9 [SD, 5.7] years in 1990–1992; 56% women and 24% black) from 1990 to 1992 through 2011 to 2013, Lin Chen et al. showed that middle-aged patients AF had greater cognitive decline over 20 years, compared with those who did not develop AF. AF was associated with 23% higher risk of dementia. The cognitive loss in this study was consistent across the two races [43•].

Quality of life

While the most common symptoms of AF are dyspnea and palpitations, individuals with AF report significantly worse QoL than those without AF. This is in most part due the HF, stroke, and cognitive loss that AF patients are at risk of. Considerable differences exist in risk factor burden, patient-reported symptoms, and clinical outcomes based on race and ethnicity that eventually define QoL [42]. Analysis of ORBIT-AF registry's participants showed that black individuals had a higher AF symptom burden and lower QoL compared with their white or Hispanic counterparts [19].

Mortality

A sub-study of Atrial Fibrillation Follow-Up Investigation of Rhythm Management (AFFIRM) trial compared the survival with rate and rhythm control in Caucasians, African Americans, and Hispanics [44]. While the overall survival rates were similar in all the 3 races, the event-free survival was high in in Caucasians followed by Hispanics and lowest in African Americans over a follow-up of 5 years.

In a study of 517,941 Medicare patients with newly diagnosed AF, compared with whites, blacks had a significantly higher hazard of death (hazard ratio (HR) 1.46) [21]. After risk adjustments for comorbidities, the higher hazard of deaths in blacks was eliminated (HR 0.95). In the Hispanic population, compared with whites, there was a higher risk of death (HR 1.11). However, after controlling for pre-existing comorbidities, relative hazard of death was lower (HR 0.82) compared with whites.

In the ARIC cohort, blacks had a higher mortality than whites. The rate difference for mortality (rate of mortality in patients with AF minus patients without AF per 1000 patient-years) in whites was 55.9 (95% CI, 48.1–63.7) compared with blacks who had a rate difference of 106.0 (95% CI, 86.0–125.9) [38].

Racial differences in AF management

Anticoagulation

AF is associated with 4- to 5-fold increased risk of stroke in the absence of anticoagulation [1]. Anticoagulation reduces risk of AF-related thromboembolism by over 60%. Several racial differences in anticoagulation have been identified. Blacks require higher dose of warfarin than whites while Hispanic and Asians require a lower dose. The time in therapeutic range (TTR) measures warfarin efficacy and is consistently lower in blacks compared with whites. In Asians and Hispanics, TTR

was similar to whites. This may account for higher stroke in blacks on warfarin compared with whites. In an AF Medicare cohort, the stroke rate per 100 years of warfarin therapy in blacks was 10.2 compared with 5.6 in whites [45]. A genomic study of African ancestry taking warfarin identified a novel SNP that influences warfarin dose independently of previously reported genotypes [46]. This may explain racial variability of TTR and stroke risk between blacks and whites. The identification of genotype variants may facilitate more stringent warfarin-dosing in blacks. Similar data on warfarin efficacy in other ethnic groups is lacking.

Racial differences also exist in anticoagulation practice. Whites are more likely to be therapeutically anticoagulated than blacks and other racial and ethnic minorities [47]. The REGARDS study showed that the probability of blacks being treated with warfarin were only one-fourth that of whites. Hispanics, Native Americans, and Asian/Pacific Islanders were also less likely to receive warfarin in an analysis of hospital discharge records across five US states when compared with the white cohort [48]. This racial difference in anticoagulation represents a profound demonstration of racial disparities and presents a great challenge to stroke prevention in AF. The initial trials with novel oral anticoagulants (NOACs) were conducted with fewer than 2% representation of the ethnic minorities. In a recent analysis of ORBIT-AF II cohort, Essien et al. conclude that after adjusting for clinical and socioeconomic factors, blacks were less likely than whites to receive NOACs for AF, with no difference between the white and Hispanic groups [49•]. The TREAT-AF study showed that TTR was lowest in blacks and highest in whites and the black race was associated with lower first year and long-term TTRs and the 1 year warfarin compliance was slightly lower in blacks compared with whites [50]. In this VA cohort retrospective study of 184,161 patients with a new diagnosis of AF/flutter from 2004 to 2012, the association of race and INR, was studied. A total of 116,021 patients in this cohort received warfarin, and it was noted that, while the rigor of INR monitoring was similar across racial groups, TTR was lowest in blacks and highest in whites: 64% of whites and 49% of blacks had long-term TTR > 55% ($P < 0.001$). One-year warfarin compliance was slightly lower in blacks compared with whites (58% vs. 60%, $P < 0.0001$). It was concluded that in AF patients anticoagulated with warfarin, differences in INR control are most evident among blacks. Hence, there should be concerted effort to assess other management options or warfarin alternatives to improve anticoagulation among vulnerable AF populations [50].

Rate control versus rhythm control

Data assessing rate versus rhythm control strategies in management of AF in ethnic and racial minorities has been limited till recently. The impact of such choices is paramount as shown in a subgroup analysis of the Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) trial. In this analysis, out of 4060 total patients, 3599 were Caucasian, 265 were African American, and 132 were Hispanic. For Caucasians at 5 years, the overall rate of survival for the rate control and rhythm control groups was 78.9% versus 76.4%, respectively ($P = 0.04$); for African Americans, 79.0% versus 69.4% ($P = 0.22$); and for Hispanics, 66.5% versus 83.9% ($P = 0.01$). While survival was not different between the three races, lower rates of event-free survival were recorded for Hispanics and for African Americans ($P = 0.0182$) [41].

In more recent ORBIT-AF trials with higher minority participation, overall 68% of patients were managed with a rate control strategy [19]. While 67% of the white patients were managed with rate control strategy, 72% of the blacks and 80% of Hispanics in this cohort were managed with a rate control strategy [19]. Whites underwent more cardioversions and were more frequently treated with antiarrhythmic drug regimens in this study [51, 52]. A subsequent analysis such as that of ORBIT-AF II registry by Golwala et al. also showed greater use of interventional therapies for rhythm control of AF in whites. Black and Hispanic individuals were less frequently managed with a rhythm control strategy, independent of an attempt to control rate [19].

Catheter ablation

There is a significant racial disparity in AF patients undergoing catheter ablation (CA), favoring Caucasian. Hoyt et al. and Naderi et al. reported gender and ethnic differences with the use of CA for AF in small, single-center studies [53, 54]. However, these studies did not include a substantial number of Hispanics. Tamariz et al. in a better represented cohort showed blacks and Hispanics had less CA than non-Hispanic whites for AF [55]. They analyzed 923,590 subjects with AF between 2006 and 2009. The adjusted OR of having catheter ablation for AF for blacks was 0.67 (95% confidence interval [CI] 0.60–0.75, $P < 0.01$), and for Hispanics it was 0.83 (95% CI 0.75–0.91, $P < 0.01$) when

compared with whites [54]. In particular, sizable differences were noted in the use of catheter ablation, with Hispanics and women being substantially less likely to undergo ablation compared with whites and male patients. Other interventions such as the MAZE also show a trend favoring the white AF patients but lack large cohort analysis. Further studies are also needed to compare racial differences in outcomes of AF ablation.

Racial trends of novel AF risk factors and biomarkers—future directions in race-based AF risk assessment

Thyroid disease, alcohol intake, obstructive sleep apnea, P wave indices (PWI), which is an electrocardiographic measure of atrial electrical function, and biomarkers represent the novel RFs predicting the risk of AF [56]. Clinical hyperthyroidism and the subclinical variant represented by low serum thyroid-stimulating hormone levels increase the risk of AF [57]. Alcohol intake especially binge drinking is noted to increase the risk of AF [58]. Obstructive sleep apnea leads to increased incidence of AF. The role or relative contributions of hyperthyroidism, alcohol, hyperthyroidism, and OSA in the pathogenesis of AF have not been validated in any racial minorities including blacks and Hispanics.

P wave duration has been studied as a marker of increased incidence of AF. In a study of approximately 15,000 participants, blacks had a higher proportion of abnormal PWI but significantly less incidence of AF, once again following the racial paradox. The associations of PWI and AF have had limited investigation in individuals not of African or European ancestry [59].

Biomarkers such as Brain Natriuretic Peptide (BNP), N-terminal proBNP, and C-reactive protein (CRP) have been shown to be independent predictors of risk of developing AF. Blacks have substantially higher levels of CRP [60]. An analysis of approximately 19,000 cohorts in the Reasons for Geographic And Racial Differences in Stroke (REGARDS) study concluded that blacks had higher levels of CRP compared with whites, by a 2:1 ratio; however, the AF incidence follows the white predominant incidence trends. While this study does validate the racial paradox in the predictive value of these biomarkers in blacks, further studies are needed to validate their usefulness in recognizing AF patients in different ethnic groups with high risk of morbidity and mortality [61–63].

Conclusion

Minority, non-white racial, and ethnic groups are under-represented in various larger AF studies but are known to have a higher prevalence of established risk factors associated with the development of AF but an overall lower incidence and prevalence of AF as compared with non-Hispanic whites. There is also a significant racial and ethnic disparity in the prevalence of AF-related symptoms and the detection and awareness of AF in these groups. Non-white patients are afforded decreased use of rhythm control treatment strategies and anticoagulation both with warfarin and NOACs for stroke prevention. AF in these minority racial and ethnic groups carries increased morbidity and mortality compared with white groups.

While racial and ethnic differences exist in the prevalence, quality of life, management, and outcomes of AF patients, the basis for these differences needs further definition. Racial and ethnic differences in AF warrant further analysis to understand the factors contributing to the differences in prevalence and management to ensure the delivery of high-quality care that prevents stroke, reduces deaths, and decreases expenses associated with caring for under-represented populations with AF.

Compliance with Ethical Standards

Conflict of Interest

Amit Nanda declares no potential conflicts of interest. Rajesh Kabra has licensed technologies from Icahn School of Medicine at Mount Sinai to Rx. Health Digital Therapeutics Prescribing Platform. Dr. Kabra is the section editor of the Arrhythmia section of *Current Treatment Options in Cardiovascular Medicine*.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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