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Research paper

Atrial fibrillation prevalence and management patterns in a Middle Eastern community in the United States: A retrospective study

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ABSTRACT

Atrial fibrillation (AF) is the most common sustained cardiac dysrhythmia in the United States, and its prevalence is expected to increase along with associated morbidity and economic burden. Prior research has demonstrated differing prevalence patterns of AF between racial and ethnic groups, with lower rates identified in Black patients. However, to date there have been no studies on AF prevalence in people of Middle Eastern descent within the United States. This retrospective cross-sectional study aimed to characterize prevalence patterns of AF in Middle Eastern patients in Southeast Michigan relative to White and Black patients. The final cohort included 919,454 patients with a median (IQR) age of 53 (33) years (515,902 [56 %] female). The overall prevalence of AF was approximately 5 %. We observed a lower prevalence of AF in Middle Eastern (2.8 %) and Black patients (3.4 %) than in White patients (6.5 %). Middle Eastern patients with AF were younger with a lower prevalence of cardiovascular risk factors than White patients. Multivariable analysis showed that Middle Eastern (OR 0.75; 95 % CI 0.71–0.80; $P < 0.001$) and Black racial identity (OR 0.48; 95 % CI 9.47–0.49; $P < 0.001$) were associated with a lower odds of AF, even after adjustment for traditional risk factors.

1. Introduction

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia in the United States (US), with an estimated prevalence of 5.2 million in 2010, which is expected to increase to 12.1 million cases by 2030 [1]. AF is a significant public health concern and is associated with increased risks of stroke, heart failure, repeat hospitalization, and mortality [2–4]. AF places a significant economic burden on the US healthcare system with estimated AF-specific costs of $6 billion per year [2]. Also, the disease and cost burdens due to AF are expected to increase with the aging US population [5,6]. With a growing percentage of non-White individuals in the US population, understanding the epidemiology of AF among various ethnic populations will be essential for improving resource allocation for screening, management, and outcomes for AF.

Studies have shown a lower incidence and prevalence of AF in underrepresented racial and ethnic groups such as non-Hispanic Black, Asian, and Hispanic patients compared to White patients [5]. However, Middle Eastern (ME) populations in the US have been underrepresented in studies of AF [5], in large part because the current US census guidelines specify that people originating from the Middle East and North Africa are to be considered as White. The lack of a specific ethnic identifier in the US Census and national health surveys for individuals with an ME identity [7] and other factors drive this underrepresentation, despite the high prevalence of various risk factors in ME patients in the US [8]. This retrospective cross-sectional study aimed to determine the prevalence of AF and its associated risk factors in a community of ME patients within a single health care system in southeastern Michigan as compared to Black and White patients.

2. Methods

We retrospectively analyzed electronic health records of patients who were treated between January 2014 and December 2021 within the Henry Ford Health System in southeast Michigan. Patients were included if they were ≥18 years and had a healthcare provider visit, defined as any outpatient provider visit or an in-hospital admission,

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within the study period.

Patients' race designations were based on self-identification from the demographic section in the electronic health records and were categorized as Black, White, or ME. Patients were included in the ME category if they or their families were originally from Bahrain, Cyprus, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, or Yemen. Patients were excluded if race was not identified or if they did not belong to the aforementioned categories.

Clinical data elements, including demographics, comorbid conditions, laboratory data, and in-hospital outcomes, were collected from the electronic health care records using ICD-9 and ICD-10 code diagnoses. Patient zip codes were obtained from the electronic health record. Zip-code-derived median incomes were obtained through the latest 2018 American Community Surveys [9].

2.1. Statistical analysis

Data were analyzed using SPSS Statistics software. Categorical variables were described by frequency and percentages, and continuous variables were described by the median (IQR). Descriptive statistics were obtained for all included study variables (Table 1 and Supplementary Table 1). Race groups were compared using chi-square or Fisher's exact tests based on cell count for categorical variables and independent 2-group *t*-tests or Wilcoxon rank sum tests based on normality for continuous variables. Univariate logistic regression models were used to obtain crude odds ratios and their 95 % confidence intervals.

3. Results

3.1. Overall patient population

The electronic health care records were queried, and we identified a total of 919,454 patients whose self-identified racial category was White (n = 478,369, 52 %), Black (n = 382,522, 42 %), and ME (n = 58,563, 6 %). The median (IQR) age was 53 (33) years, and median (IQR) body mass index was 28 (12) kg/m^2. There were 519,902 (56 %) female and 403,484 (44 %) male patients. The overall prevalence of AF was 5 % (n = 45,636) among the whole cohort, 6.5 % (n = 31,070) among White patients, 2.8 % (n = 1625) among ME patients, and 3.4 % (n = 12,921) among Black patients (Fig. 1). Supplementary Table 1 outlines the patient demographics for the overall patient population.

ME patients were less likely to have AF relative to White patients. The overall ME patients were also younger and had a lower incidence of cardiovascular comorbidities and risk factors than White patients (Supplementary Table 1). Black patients also had a lower prevalence of AF than White patients. Black patients were younger and had a higher incidence of diabetes, dyslipidemia, cerebrovascular disease, hypertension, and chronic kidney disease than White patients (Supplementary Table 1).

3.2. Atrial fibrillation in the cohorts

ME patients with AF were younger than their White counterparts (median [IQR] 43 [30] vs. 57 [34] years) (Table 1). Within the racial cohorts, a larger percentage of ME patients with AF were <50 years old compared to White patients (59.5 % ME vs. 38 % White) (Fig. 1 and Table 1). ME patients had a lower incidence of chronic obstructive pulmonary diseases, chronic kidney disease, heart failure, cerebrovascular disease, peripheral artery disease, coronary artery disease, and hypertension than White patients. ME patients had a similar diabetes mellitus prevalence compared to White patients (Table 1).

Black patients with AF were younger than White patients with AF (median [IQR] 48 [32] vs. 57 [34] years). Similar to ME patients, a larger within-cohort percentage of Black patients with AF were <50

Table 1
Baseline demographics of patients with atrial fibrillation according to racial category.

		Race		
	All 45,636 (100 %)	White 31,070 (68 %)	Middle Eastern 1645 (4 %)	Black 12,921 (28 %)
Age, years, median (IQR)	78 (20)	79 (19)	78 (20)†	72 (21)*
≥65 years	37,322 (82 %)	26,902 (87 %)	1342 (82 %)†	9078 (70 %)†
Body mass index, kg/m^2, median (IQR)	28 (10)	28 (10)	29 (10)	30 (14)†
Sex				
Male	23,962 (53 %)	16,703 (54 %)	857 (52 %)	6402 (50 %)
Female	21,674 (48 %)	14,367 (46 %)	788 (48 %)	6519 (51 %)
Hypertension	41,553 (91 %)	27,992 (90 %)	1423 (87 %)†	12,138 (94 %)†
Diabetes mellitus	8465 (19 %)	4955 (16 %)	259 (16 %)	3251 (25 %)†
Dyslipidemia	35,048 (77 %)	24,595 (79 %)	1202 (73 %)†	9251 (72 %)†
Heart failure	24,275 (53 %)	16,012 (52 %)	817 (50 %)	7446 (58 %)†
Systolic dysfunction	20,398 (45 %)	13,241 (43 %)	670 (41 %)	6487 (50 %)†
Coronary artery disease	26,822 (59 %)	18,469 (60 %)	906 (55 %)†	7447 (58 %)†
Peripheral artery disease	10,861 (24 %)	7298 (24 %)	266 (16 %)†	3297 (26 %)†
Cerebrovascular disease	15,550 (34 %)	10,050 (32 %)	482 (29 %)*	5018 (39 %)†
Chronic kidney disease	18,522 (41 %)	11,519 (37 %)	556 (34 %)*	6447 (50 %)†
Chronic obstructive pulmonary disease	9394 (21 %)	6658 (21 %)	246 (15 %)†	2490 (19 %)†
Obstructive sleep apnea	10,749 (24 %)	7533 (24 %)	277 (17 %)†	2939 (23 %)†
Alcohol use	3823 (8.4 %)	2193 (7 %)	72 (4.4 %)†	1558 (12 %)
Smoking history	21,419 (47 %)	14,218 (46 %)	570 (35 %)†	6631 (51 %)†
CHADS-VASC2, median (IQR)	4.82 (2)	4.83 (2)	4.58 (2.1)†	4.83 (2.1)
0	646 (1.4 %)	397 (1.3 %)	55 (3.3 %)	194 (1.5 %)
1	1958 (4.3 %)	1233 (4 %)	94 (5.7 %)	631 (4.9 %)
≥2	43,032 (94 %)	29,440 (95 %)	1496 (91 %)	12,096 (94 %)
Rhythm control strategy	12,203 (27 %)	8590 (28 %)	479 (29 %)	3134 (24 %)†
Anti-arrhythmic	12,030 (26 %)	8435 (27 %)	475 (29 %)	3120 (24 %)†
Atrial fibrillation ablation	827 (1.8 %)	694 (2.2 %)	16 (1.0 %)†	117 (0.9 %)†
Anticoagulation therapy	29,245 (64 %)	20,338 (65 %)	1015 (62 %)*	7892 (61 %)†
Warfarin	14,307 (31 %)	9402 (30 %)	412 (25 %)†	4493 (35 %)†
NOACs	20,115 (44 %)	14,251 (46 %)	764 (46 %)	5100 (39 %)†
Left atrial appendage occlusion device	402 (1.0 %)	325 (1.0 %)	13 (0.8 %)	64 (0.5 %)†

IQR = interquartile range; NOACs = non-vitamin K antagonist oral anticoagulants.
Data are reported as number (%) unless otherwise indicated.
* Denotes P value <0.05.
† Denotes P value <0.01 as compared to the White patient cohort.

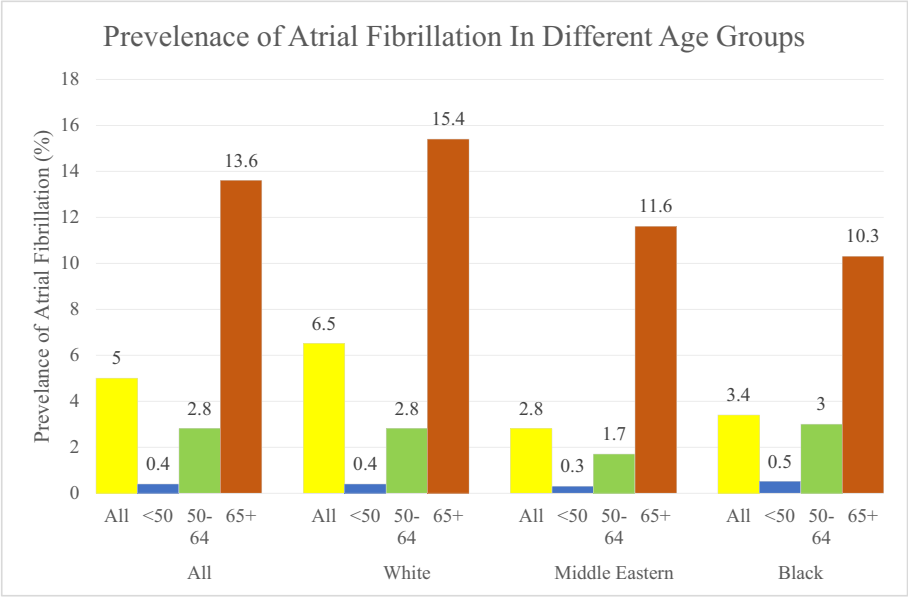

Fig. 1. Prevalence of atrial fibrillation among different age groups per racial category (see supplementary Table 1).

years old compared to White patients (51.9 % Black vs. 38 % White) (Fig. 1 and Table 1). Black patients had a lower prevalence of chronic obstructive pulmonary diseases, dyslipidemia, and coronary artery disease and a higher prevalence of cardiovascular comorbidities, including heart failure, chronic kidney disease, cerebrovascular disease, peripheral artery disease, and hypertension than White patients (Table 1).

3.3. Variables associated with atrial fibrillation

On univariate regression analysis, the racial categories ME (OR, 0.42; 95 % CI, 0.40–0.44; P < 0.001) and Black (OR, 0.50; 95 % CI, 0.49–0.51; P < 0.001) along with female sex (OR, 0.70; 95 % CI, 0.68–0.71; P 0.001) were associated with a lower odds ratio of AF. Cardiovascular risk factors including diabetes mellitus, dyslipidemia, heart failure, peripheral artery disease, cerebrovascular disease, and hypertension were associated with a higher prevalence of AF. On multivariable analysis, the ME (OR, 0.75; 95 % CI, 0.71–0.80; P < 0.001) and Black (OR, 0.48; 95 % CI, 0.47–0.49; P < 0.001) racial categories were associated with a lower odds of AF (Table 2).

3.4. Atrial fibrillation management

There was no statistical difference in rhythm control strategy (either anti-arrhythmic drug therapy or catheter ablation) between ME and White patients with AF. ME patients were, however, less likely to have AF ablation than White patients (1.0 % vs. 2.2 %). ME patients with AF were also less likely to be prescribed anticoagulation as compared to their White counterparts with a lower percentage of patients being on warfarin (25 % vs. 30 %) and no difference in direct oral anticoagulant prescriptions (Table 1).

Black patients with AF on the other hand were less likely to have been considered for a rhythm control strategy, including anti-arrhythmic drugs (24 % and 27 %) and AF ablation (0.9 % vs. 2.2 %) as compared to the White cohort. Black patients were also less likely to have been prescribed anticoagulation with a lower percentage being prescribed a direct oral anticoagulant and a higher percentage to have been prescribed warfarin (Table 1).

4. Discussion

In this cross-sectional study, we described the prevalence and management patterns of AF within the Middle Eastern community of southeast Michigan. The observed overall prevalence of AF was lower in ME patients than in White patients, and ME patients had a lower prevalence of AF even after controlling for AF risk factors. To our knowledge, this is the first study that has investigated AF specifically within a ME patient population within the US.

Several studies have shown a decreased prevalence of AF in different racial groups relative to White individuals after adjusting for age and sex

Table 2
Univariate and multivariable analysis for variables associated with atrial fibrillation.

Variable	Univariate analysis Odds ratio (95 % CI), P value	Multivariable analysis Odds ratio (95 % CI), P value
Age < 65 years	Reference	Reference
Age ≥ 65 years	12.03 (11.74–12.32), P < 0.001	3.24 (95 % CI 3.15–3.33), P < 0.001
Female	0.70 (0.68–0.71), P < 0.001	0.79 (95 % CI 0.77–0.81), P < 0.001
Hypertension	19.03 (18.42–19.65), P < 0.001	4.80 (95 % CI 4.63–4.98), P < 0.001
Diabetes mellitus	4.29 (4.18–4.40), P < 0.001	0.89 (95 % CI 0.86–0.92), P < 0.001
Coronary artery disease	14.77 (14.47–15.07), P < 0.001	2.04 (95 % CI 1.99–2.09), P < 0.001
Peripheral artery disease	7.94 (7.75–8.13), P < 0.001	1.16 (95 % CI 1.13–1.20), P < 0.001
Cerebrovascular disease	7.37 (7.22–7.53), P < 0.001	1.60 (95 % CI 1.56–1.65), P < 0.001
History of heart failure	22.25 (21.79–22.72), P < 0.001	4.63 (95 % CI 4.51–4.76), P < 0.001
Chronic kidney disease	10.58 (10.37–10.80), P < 0.001	1.60 (95 % CI 1.56–1.64), P < 0.001
Chronic obstructive pulmonary disease	6.97 (6.79–7.15), P < 0.001	1.23 (95 % CI 1.19–1.27), P < 0.001
Alcohol use	1.77 (1.71–1.84), P < 0.001	1.15 (95 % CI 1.10–1.20), P < 0.001
Smoking history	2.07 (2.03–2.11), P < 0.001	0.95 (95 % CI 0.93–0.97), P < 0.001
White	Reference	Reference
Middle Eastern	0.42 (0.40–0.44), P < 0.001	0.75 (95 % CI 0.71–0.80), P < 0.001
Black	0.50 (0.49–0.51), P < 0.001	0.48 95 % CI (0.47–0.49), P < 0.001

[10,11]. Epidemiologic and clinical studies of AF in the US ME population are sparse, and our study is the first to investigate the epidemiology of AF in ME people within the US. The prevalence of AF among our White patient cohort was around 5.7 %, which is consistent with other population-based studies [11,12]. Previous studies have shown lower incidence and prevalence of AF in Black individuals than in White patients, despite higher levels of AF risk factors such as hypertension, coronary artery disease, diabetes mellitus, and heart failure in the underrepresented groups [13,14]. These findings have been termed the AF paradox [13], and the findings in White and Black patients in our population were consistent with these previously described patterns. Conversely, the patients with ME identity living in the US in our study had a lower prevalence of AF but also had a lower prevalence of AF risk factors, including significantly lower hypertension, coronary artery disease and smoking compared to Black and White patients, which is inconsistent with the AF paradox. In addition, data from AF studies assessing Middle Eastern populations outside the US have demonstrated lower average age of AF onset of approximately one decade as compared with European populations despite the lower overall AF prevalence [15]. It is also interesting that Black patients have been shown to develop AF at a younger age, despite having a higher prevalence of AF risk factors, and older Black patients in particular have more AF risk factors [6]. Our study was limited in this regard because it was a retrospective study that did not capture the age of onset of AF. However, our study did show a younger age-distribution of AF in ME patients as compared to White patients (Fig. 2).

The age and risk factor paradox may potentially point toward a different mechanism of AF development in ME and Black patients, which could implicate an underlying genetic influence as opposed to simple attribution to the classic patterns of chronic inflammation associated with age and cardiovascular risk factors. Indeed, numerous studies have previously demonstrated the potential influence of genetics on the clinical risk of AF [16,17]. Genome-wide association studies (GWASs) have identified numerous genetic loci that could potentially confer such AF susceptibility [18–21]. While some GWASs have included primarily White subjects in their analysis [18], these populations are noted to be of European ancestry. Given the evidence we present for varying patterns of AF risk between ME and White patients, further genetic analysis specifically of Middle Eastern patients disaggregated from the generalized White population could provide valuable insights into the mechanisms behind the findings reported in this study.

Several other non-genetic mechanisms have also been suggested to explain the lower incidence observed in minority groups compared to White patients in the US. The Mediterranean Diet, which many individuals of ME identity may roughly follow, has already been shown to be associated with a lower rate of cardiovascular diseases [22] and the ongoing PREDIMAR study will shed further light on any protective effect of the Mediterranean diet on the incidence of AF [23]. Socioeconomic factors may also play a role. Notably, ME patients in our study had a lower median income as compared to White patients, which may lead to an under ascertainment of the disease prevalence due to poorer access to health care and screening. Further detailed investigation into these topics could provide valuable insights into the relative contributions of these other factors in conferring AF risk.

4.1. Limitations

This was a single-center retrospective study limited to Southeast Michigan and therefore confers several limitations to generalizability. However, the Detroit metro area is home to one of the largest populations of Middle Eastern people in the US [8] and therefore provides ample size for this type of analysis. Another potential limitation is incomplete AF and comorbidity ascertainment, as the diagnoses were based on ICD codes. Furthermore, our patient population may include a selection bias toward patients within a healthcare system and thus may overestimate the prevalence of diseases. As with other studies, the true prevalence of AF may be underestimated due to underdiagnosed asymptomatic AF. However, this would be expected to impact the prevalence among all ethnic groups studied equally and should not affect observed differences between groups as long as all ethnic groups utilize the healthcare system at comparable rates. Furthermore, the overall prevalence of AF in our study was similar to that reported in other published studies, suggesting that few patients were missed. Given the study's cross-sectional design, we cannot definitively establish the protective effect of ME ethnicity on AF risk. While we make associations between different management strategies between ME and Black patients compared to their White patient counterparts, any inferences would be limited by multiple factors that are not accounted for, including socioeconomic status, insurance, patient-physician preferences, and patient symptoms.

5. Conclusion

Based on our large single-center cross-sectional study, we found a significantly lower prevalence of AF in ME and Black patients than in White patients. Our findings suggest that the ME population in southeast Michigan may not conform to the AF paradox. However, ME identification was still found to be associated with a lower prevalence after controlling for other AF risk factors. Further epidemiologic and genetic studies are needed to more deeply characterize the underlying associations between different racial and ethnic categories and AF. Such information is vital for optimizing targeted screening and treatment of AF

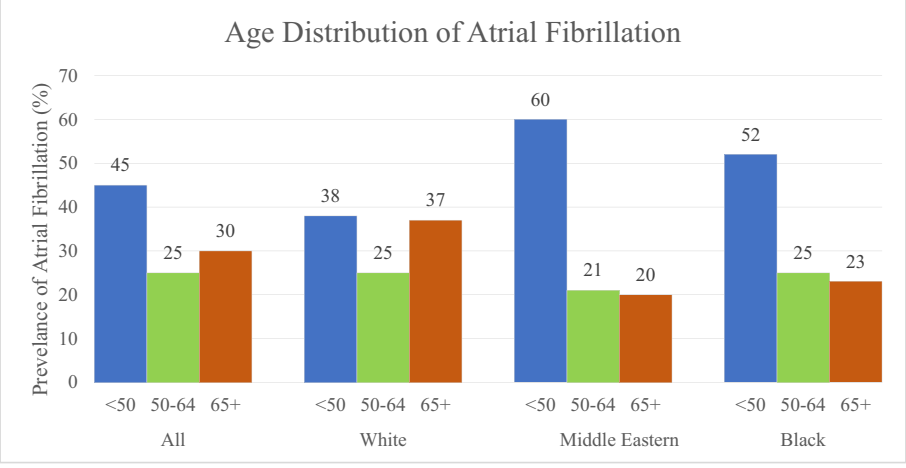

Fig. 2. Age distribution of atrial fibrillation among different races and age categories.

to improve population health outcomes. Furthermore, our study adds to the cumulative evidence that Middle Eastern patients should be considered as a separate race/ethnicity under US Census and national health surveys.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ahjo.2022.100221.

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None.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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