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ORIGINAL RESEARCH

Prevalence and Predisposing Factors of Atrial Fibrillation in a Multi-Ethnic Society: The Impact of Racial Differences in Bahrain

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Abstract

Background: The prevalence and epidemiological data of atrial fibrillation (AF) among multi-ethnic populations is less well studied worldwide.

Aim: Evaluation of the prevalence and predisposing factors of AF in patients who were admitted to acute medical emergencies (ER) in Bahrain over the period of one year.

Methods: Two hundred and fifty three patients with onset of AF were studied. The mean difference of biochemical data and clinical characteristics between Middle Eastern (ME) and sub continental (SC) patients was evaluated. The odds ratio of different predisposing factors for the development of clinical events in AF patients was assessed using multiple logistic regression analysis.

Results: Out of 7,450 patients that were admitted to ER over one year, 253 had AF based on twelve leads Electrocardiogram (ECG), with prevalence of 3.4%. In the whole study, the mean age was 59.45 ± 18.27 years, with 164 (65%) male. There were 150 ME patients (59%), and 107 (41%) SC, 55 (22%) were Indian (IND) and 48 (19%) were South Asian (SA). In the whole study clinical presentation was of 48% for palpitation, pulmonary edema was of 14%, angina pectoris on rest of 12%, 10% had embolic phenomena, 6% had dizziness, and 7% were asymptomatic. The odds ratio of different variables for occurrence of clinical events in the study was positive of 2.2 for history of hypertension, 1.8 for sickle cell disease, 1.2 for high body mass index (BMI) >30, 1.1 for mitral valve disease. The ME patients, compared with SC, were older, had significantly higher body mass index, higher history of rheumatic valve disease, sickle cell disease with high level of uric acid and lower hemoglobin. The history of hypertension, DM and smoking was higher among the SC patients. The rate of thyroid disease was equal in both groups.

Conclusion: The prevalence of atrial fibrillation was 3.4% with male predominance of 65%. Patients of sub continental origin were younger with a significantly high history of hypertension and ischemic heart disease. The patients of Middle Eastern origin had significantly high rate of rheumatic heart disease, and sickle cell disease. The history of hypertension was the most important independent clinical predictor of adverse events in patients presented with AF.

Keywords: atrial fibrillation, ethnicity, epidemiology, Bahrain

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Introduction

Atrial fibrillation (AF) is the most common arrhythmia that is often wrongly regarded as an acceptable alternative to sinus rhythm.[1] The risk of AF increases with age and with the underlying heart disease.[2–4]

There was a trend over the past decade for increasing the prevalence of AF in the Western world.[5] The annual incidence of AF was reported at 0.003% in men and 0.001% in women in the age group of 55–64 years, that was increased to 0.038 in men and 0.031 in women in the 85–94 age group.[6]

The prevalence of AF ranged from 0.1 percent among adults less than 55 years of age to 9 percent in those ≥80 years of age. The prevalence is higher in men than women (1.1% versus 0.8%) among subjects over 50 years and was more frequent in Whites than Blacks (2.2 versus 1.5 percent).[7]

The risk factors for AF include male sex, advancing age, ischemic heart disease, thyroid disease, hypertension, valvular heart disease, heart failure and diabetes.[8]

AF has a significant impact on patients' quality of life with an increased risk for mortality 1.5 to 1.9 fold compared with those without AF, mostly due to an increased heart rate, shortened diastolic filling time, dysfunction of the left atrium and left ventricle, and embolic phenomena.[9,10] The consequence of AF may be of serious sequel with development of acute pulmonary edema and stroke.[11]

In one study, ischemic stroke due to AF was more common in Whites (29%) than in either black (11%) or Hispanic (10%) patient groups.[12]

At present, information on epidemiology, risk factors, and complications of AF are largely confined to studies in Western (Caucasian) populations and the epidemiological data on AF in non-White populations are very limited.

Aim of the Study

In view of the lack of information on AF in non-Caucasian populations, the aim of the present study is, firstly, to evaluate the prevalence and predisposing factors of AF and secondly, to assess the predictive risk of different predisposing factors in the development of clinical events.

Material and Methods

The clinical data of all patients who were admitted acutely to Emergency Room (ER) were extracted from patient's files in Salmaniya Medical Complex (SMC) over the period of 12 months starting on 1.1.2010. The SMC is the main government hospital serving a catchment area of 800,000 populations.

Patients' clinical data were extracted and screened for each patient with the diagnosis of atrial fibrillation (AF).

A constitutional ethical committee approval was obtained prior to the data extraction.

Inclusion Criteria

Subjects were included if age was above 20 years and they had AF on admission with diagnostic code of AF. Atrial fibrillation was defined as absence of P wave on 12 leads electrocardiogram (ECG), with irregular ventricular rhythm and lasting for >30 seconds.[13]

Atrial fibrillation was classified as 1- first diagnosed or new onset AF, if presenting for the first time, 2- paroxysmal AF if it is recurrent but lasts less than 7 days or AF previously documented on 24 h Holter monitoring (10 or more beats), 3- persistent AF is when it lasts > 7 days but the rhythm control therapy is pursued and 4- permanent if it last >12 months and rate control therapy is pursued.[14]

Clinical, demographic data, past medical history prior to admission and previous documentation of AF were extracted from the patient files. The clinical events of these patients during their hospital stay were also recorded.

Atrial fibrillation (AF) was detected in 253 patients out of 7,450 of acute medical admissions over the period of 12 months. There were 150 (59%) new onsets AF, 33 (13%) had recurrent AF and 70 (28%) had permanent AF.

Exclusion Criteria

Patients were excluded if they had permanent pacemaker implant.

Clinical History and Examination

The patient's age, gender, history of rheumatic fever in childhood, history of hypertension, diabetes mellitus, smoking, and alcohol intake were all recorded.

The ethnicity of patients was recorded and accordingly patients were subdivided into three subgroups: Middle Eastern (ME, n = 150) and sub continental (SC, n = 103) which further subdivided into, Indians (IND, n = 55) and South Asian (SA, n = 48).

Furthermore, patients were divided according to their age into three categories, 1- age between 20–45 years, 2- age between >45–65 years, 3- age between >65 years. The number of patients in each category were 1 = 60, 2 = 86, and 3 = 107.

The clinical presentation on admission such as fast palpitation, angina pectoris pain, and dyspnea on rest, dizziness, and focal neurological deficit were recorded.

On on admission height and weight, pulse rate and blood pressure in mmHg were recorded for each patient. The presence of goiter, cardiac murmur suggestive of aortic or mitral or pulmonary valve disease was recorded. The signs of pulmonary edema such as basal crackles and gallop were recorded. The presence or absence of motor or sensory central deficit or cranial nerves palsy and peripheral arterial occlusion due to emboli were also recorded.

Twelve leads ECG findings of ST segment elevation or depression or T wave changes, voltage criteria for left ventricle hypertrophy using Sokolow criteria,[15] presence of Q wave or any other abnormalities were recorded.

Echocardiographic findings for valve disease and Left Ventricular Ejection Fraction (LVEF %) were obtained for all patients and defined as, normal left ventricle function of (LVEF 55%), mild dysfunction of (LVEF 45%–55%), moderate (LVEF 30%–44%), severe (LVEF < 30%).[16]

The serum level of hemoglobin, thyroid stimulating hormone (TSH), uric acid, random glucose, and potassium were recorded.

Statistical Analysis

All data were entered and analyzed using the Statistical Package of Social Sciences (SPSS) version 17.0. Data are presented as mean ± SD. Unpaired *student-test* was used to analyze the differences between the variables in the three groups based on ethnical background.

ANOVA with post-hoc analysis was used to test the differences between the three study groups.

Student's *t-test* was applied for continuous variables and *Chi-square* analysis for frequency non-continuous data.

The odds ratio of different clinical and biochemical variables for history of hypertension, history of SCD, RHD, BMI and serum level of uric acid, hemoglobin for the prediction of clinical events were assessed using multiple stepwise regression analysis.

All reported *P*-values are two tailed and *P*-value was regarded as significant at level of <0.05.

Results

There were a total of 7,450 adult patients who were admitted as an acute medical emergency. Out of these 253 patients had AF as a clinical diagnosis with mean age 59.45 ± 18.27 year, with 164 (65%) male.

There were 164 (65%) males in the whole study, with 78 out of 150 (52%) in ME group and 83 out of 107 (77%) in SC group. The prevalence of AF in the whole study in the year 2010 was 3.4%.

As shown in Figure 1, there were 60 patients in category 1 with age between 20–45 years, 86 patients in category 2 (age 45–65 years), and 107 patients in category 3 (age > 65 years).

Table 1 shows the clinical characteristic of patients presented with AF. Patients were grouped based on the ethnical origin.

The ME patients compared with SC were older, with higher body mass index, higher rheumatic valve disease and sickle cell disease. Male gender predominance was of 65% in the whole study and the male gender predominance was higher in the

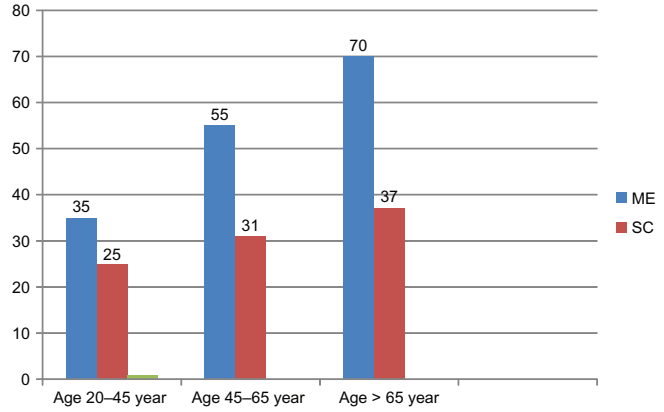

Figure 1. Distribution of Middle Eastern (ME) and Sub continental (SC) patients who presented with atrial fibrillation (AF) according to age category: 1-20-45 year, (n = 60), category II-45-65 year, (n = 86), category III-age > 65 year, (n = 107).

Table 1. Demographic and clinical characteristics of different ethnic subgroups of patients admitted with atrial fibrillation, n = 253.

	Total N = 253	Middle Eastern (ME) N = 150	Sub continental (SC) N = 107	Indian (IND) N = 55	South Asian (SA) N = 48
Age	59.45 ± 18.27	65.78 ± 20.33	56.51 ± 11.76	57.55 ± 12.54	56.67 ± 11.63
Male	161 (64%)	78	83	45	38
BMI	26.13 ± 5.8	30.12 ± 5.89	26.76 ± 5.66	27.65 ± 4.73*	25.13 ± 6.32+
History of BP	96 (38%)	36 (14%)	60 (23%)	35 (13%)*	25 (10%)+
History of DM	88 (35%)	55 (22%)	32 (13%)	20 (8%)	12 (5%)
History of RHD	50 (20%)	40 (16%)	10 (4%)	5 (2%)*	5 (2%)+
History of IHD	53 (21%)	32 (13%)	22 (9%)	12 (5%)*	8 (3%)+
History of SCD	55 (22%)	45 (18%)	10 (4%)	5 (2%)*	5 (2%)+
History of Th D	30 (12%)	20 (8%)	10 (4%)	7 (3%)	5 (2%)
History of smoking	98 (39%)	35 (14%)	63 (25%)	37 (15%)*	25 (10%)+
History of kidney disease	53 (21%)	40 (16%)	12 (5%)	7 (3%)*	5 (2%)+

Notes: Values presented as mean ± SD. ANOVA post hoc analysis between the three subgroups, **P* value significant of <0.05 between ME and IND group; +*P* value is significant <0.05 between ME and SA group.
Abbreviations: SCD, sickle cell disease; DM, diabetes mellitus; BMI, body mass index; Th D, thyroid disease; RHD, rheumatic heart disease; IHD, ischemic heart disease.

SC patients compared with ME. The male to female ratio was 1.08 in ME group, ratio of 4.5 for IND group and 3.8 among SA. The patients in SC group had higher history of hypertension, DM and ischemic heart disease. Thyroid disease was not different in the three subgroups.

Table 2 shows the clinical findings of blood pressure, heart rate, the associated co-morbid clinical events, serum level of hemoglobin, uric acid, TSH, random glucose and potassium.

The systolic and diastolic blood pressure and the fibrillation rate on admission were significantly higher among IND and SA patients compared ME patients.

The clinical onset of pulmonary edema and embolic phenomena (stroke or arterial) were significantly higher in both SA and IND patients compared with ME. Furthermore ME patients had significantly lower hemoglobin and potassium level with higher serum level of uric acid. Glucose and TSH level were of no difference among the three subgroups.

Figure 2 shows the main presenting complaints of patients on admission; 121 (48%) patients had palpitation, 35 (14%) patients had dyspnea due to

Table 2. The biochemical and clinical findings in patients presented with AF in each subgroup based on ethnicity.

	Middle Eastern (ME) N = 150	Sub continental (SC) N = 103	Indian (IND) N = 55	South Asian (SA) N = 48
SBP mmHg	162.51 ± 21.5	189.87 ± 27.9	195.45 ± 26.3*	183.87 ± 24.9+
DBP mmHg	81.47 ± 12.08	97.33 ± 11.8	100.78 ± 10.9*	95.13 ± 11.9+
HR/min	170.06 ± 16.8	179.08 ± 13.9	189.98 ± 14.8*	169.35 ± 12.9+
Embolic phenomena	15	10	5	2
Pulmonary edema	15	20	12*	8+
Haemoglobin gm/dl	10.47 ± 1.96	13.5 ± 1.4	13.14 ± 1.32*	14.87 ± 1.56+
Uric acid m.mol/l	446.58 ± 75.55	395.35 ± 57.23	400.65 ± 60.23*	390.12 ± 55.23+
TSH mU/l	2.1 ± 1.4	2.2 ± 1.7	2.2 ± 1.5	2.2 ± 1.7
Potassium m.mol/L	4.329 ± 0.65	5.2 ± 0.41	5.1 ± 0.45*	5.3 ± 0.54+
Glucose m.mol/L	8.45 ± 3.13	7.6 ± 3.12	7.12 ± 2.10	8.45 ± 4.4

Notes: ANOVA post hoc analysis between the three subgroups: *significant of <0.05 between ME and IND group, +significant between ME and SA group.
Abbreviations: SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; TSH, thyroid stimulating hormone.

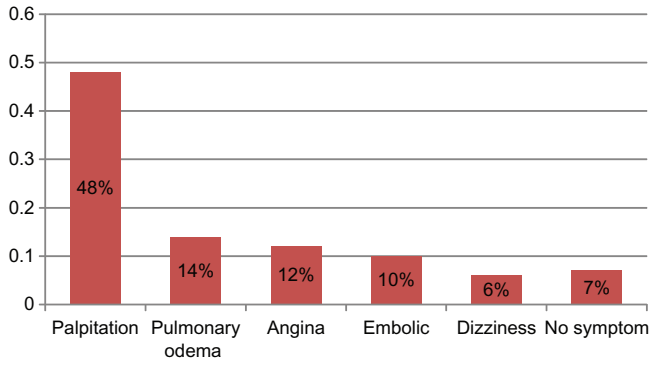

Figure 2. The parentage (%) of different clinical presentations in patients admitted with AF, (n = 253).

pulmonary odema, 15 out of 35 were in the ME group and 20 patients were in SC group. Twenty five patients (10%) had embolic phenomena due to neurological deficit or atrial embolic events with 15 out of the 25 were in the ME group and 10 patients in SC group. Thirty patients (12%) had ischemic cardiac pain and 15 (6%) patients had dizziness. Those who presented with no symptoms were 18 (7%) patients. Two patients died one with hypertensive encephalopathy and the second went into cardiogenic shock secondary to myocardial infarction.

Investigation Results on Admission

On twelve leads ECG the presence of acute ischemia was noted in 30 (12%) patients, 8 (3%) patients were ME, and 20 (8%) were SC. Those with ST Segment Elevation Myocardial Infarction (STEMI) were 18 and non ST elevation myocardial infarction (NSTEMI) were 6 and 6 patients had unstable angina.

Twelve lead ECG with voltage criteria of Sokolow-Lyon for left ventricular hypertrophy was reached in 78 (21%) patients, 42 were ME and 36 were in SC.

In the whole study, the of presence of valvular heart disease was confirmed in 45 (17%) patients, 10 had mild mitral stenosis (area of >1.8 m^2), 8 had moderate stenosis and 6 had severe stenosis with an area of <1.2 m^2, 6 had mild to moderate mitral regurgitation and 9 had mitral valve prolapsed, 6 had mild to moderate aortic valve stenosis with mean gradient of <35 mmHg, 3 had hypertrophic cardiomyopathy and 3 had atrial septal defect two of them were repaired in the past.

LV dysfunction on echo was observed in 34 (13%) patients in the study, mild left ventricular dysfunction was observed in 12 (4%) patients, 10 (3%) had moderate left ventricular dysfunction, and 12 (4%) had severe left ventricular dysfunction. Five patients presented with pulmonary odema had MVD and 6 had severe LV dysfunction, 21 patients had uncontrolled hypertension indicating the presence of hypertension crisis as possible cause of pulmonary odema and AF in these patients.

Table 3 shows the predictive risk of different variables for the development of clinical events in the study. The positive predictors for clinical events in the AF population were the history of hypertension, sickle cell anemia, mitral valve disease, high body mass index of >30, low level of HB of <10 gm/dl, low level potassium of <4.2 m.mol/L and high level of uric acid of >440 mmol/L. The history of DM and serum level of glucose was of no significant predictive value.

Discussion

This study showed the predisposing factors and clinical presentation of AF in patients with different racial background. The prevalence of AF was 3.4%, which was higher than that reported in a similarly conducted previous study.[17]

The Middle Eastern patients were significantly older compared with sub continental patients. This can be explained by the fact that the majority of SC patients are among the work force in Bahrain which expected to be of younger age.

The older the age of patients, the higher the rate of developing AF. This was evidenced in patient categories

Table 3. The odds ratio of different biochemical and clinical variables for the occurrence of clinical events in patients AF (n = 253).

	Odds ratio	(95%: Confidence interval)	*P* value
History of hypertension	2.2	1.2–3.4	0.01
History of SCD	1.8	0.8–3.2	0.04
BMI > 30	1.2	0.9–1.5	0.02
History of MVD	1.1	0.8–1.3	0.04
History of DM	1.2	0.7–1.2	0.25
Level of hemoglobin	1.8	0.6–2.9	0.01
Potassium	0.9	0.72–1.23	0.04
Glucose	0.7	0.5–0.9	0.45
Uric acid	0.9	0.6–1.3	0.02

based on age where the rate of AF was highest, 107 in category 3 compared with 60 in category 1. This is in agreement with previous reports where the risk of AF was shown to increase with advancing age.[18,19]

The percentage of the male gender of 65% in the study was higher than female. This is in agreement with a previous report where AF was more common in males rather than females.[20]

The male gender was significantly higher among the IND and SA patients who were living alone and having their families in the country of origin which may explain the fivefold increment of male to female ratio.

The ME patients had a higher BMI of >30 kg/m^2 and in previous reports, obese individuals (BMI >30 kg/m^2) were significantly more likely to develop atrial fibrillation than those with a normal BMI (<25 kg/m^2).[21,22]

In general practice-based survey, only one third of AF patients present to hospital, and thus hospital-based surveys may provide a misrepresentation of the true epidemiology of AF as many cases will be asymptomatic or managed in an outpatient setting.[23] Taking these facts into consideration, we may have to compare our study findings with those done previously with great caution.

The proportion of ME presenting with AF in the whole study after adjustment for the age was 1.2 higher than SC patients suggesting a trend for development of AF among ME compared with others.

In a previous report where 81 Chinese patients presented with paroxysmal AF, hypertension and ischemic heart disease were the commonest associated conditions of 43%.[24]

The history of rheumatic heart disease was higher among ME patients (20%) compared with SC patients. In one observational study of Ethiopian outpatients with AF, mean age was 41 years, rheumatic heart disease was the main associated etiological factor seen in 66% of the population.[25] In another report 108 patients with mitral stenosis 34 (31%) had AF which is higher than our study.[26]

Uric acid level was significantly higher in ME population. In one study uric acid was suggested as an independent risk marker of AF indicating the causal relationship of inflammation and oxidative stress in the genesis of AF.[27] Patients with sickle cell disease with low HB were markedly higher in ME patients who may be complicated by thrombosis, vaso-occlusive crises and pulmonary hypertension. In one report it was shown that stroke rate was three times higher in in adults with SCD compared to those without.[28]

The ME patients who had history of DM in the study was 50 (33%) which is similar to previous report regarding the prevalence of DM in Bahraini population of (36.5%) but without AF, however the IND and SA patients have higher rate of DM than ME population.[29]

The commonest presenting clinical feature in our population was palpitation of 48% which is in agreement with one previous study.[18] Pulmonary odema was the clinical presentation in 14% of the study population which was lower than a previous report in AF population.[19] Embolic phenomena (neurological and arterial) was the presenting complaint in 10% of patients that was high compared with a previous report from Hong Kong.[30]

The development of AF as a result of acute myocardial infarction was noticed in 22 (11%) in this study and 6 (3%) had unstable angina. The rate of development of AF on top of acute MI was lower than a previous report where 29% of patients developed AF within 48 hours after the onset of acute MI.[31]

Pulmonary edema was observed in 14% of patients with AF, the majority of them had hypertensive crisis on admission that is possibly due to the positive feedback as a causal mechanism due to elevated sympathetic tone constricting the systemic veins, thereby transferring blood from peripheral veins to the pulmonary.[32]

The reduced LVEF % on echo of <50% was observed in only 11% of the study population, that is lower than a previous report where 25% of AF had reduced LVEF.[33]

Irrespective of the underlying risk factors associated with AF, it seems that pulmonary odema may result from the sudden rise of hypertension, the lack of synchrony between atrium and ventricular contraction with shortened the time of diastolic filling.[34]

The proper utilization of investigations in patients presenting with AF is highlighted by this study as all patients in the study had ECG and echocardiogram as inpatient.

Study Limitations

This study is limited by its short duration and therefore the small size of study population. We did not

intend to undertake an audit or epidemiological study, and our design was corresponding to a previous survey of admissions with AF. Small numbers from ethnic groups make it difficult to make precise statements about inter-ethnic group comparisons, although some trends may be noted.

The fact that this is a hospital based study means that the data are difficult to extrapolate to the general ME population because of selection bias, particularly in view of the fact that many in this population may first try traditional medicines before presenting to hospital. Also as AF is often asymptomatic, or may be managed in the outpatient setting, patients would not necessarily present to hospital and therefore may underestimate the population prevalence.

Conclusion

The prevalence of atrial fibrillation was 3.4% with male predominance of 65%. Patients of sub continental origin were younger with a significant high history of hypertension and ischemic heart disease. The patients of Middle Eastern origin had a significant high rate of rheumatic heart disease, and sickle cell disease. The history of hypertension was the most important independent clinical predictor of adverse events in patients presented with AF.

Disclosures

Author(s) have provided signed confirmations to the publisher of their compliance with all applicable legal and ethical obligations in respect to declaration of conflicts of interest, funding, authorship and contributorship, and compliance with ethical requirements in respect to treatment of human and animal test subjects. If this article contains identifiable human subject(s) author(s) were required to supply signed patient consent prior to publication. Author(s) have confirmed that the published article is unique and not under consideration nor published by any other publication and that they have consent to reproduce any copyrighted material. The peer reviewers declared no conflicts of interest.

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