CLINICAL RESEARCH

Atrial fibrillation in Africa: clinical characteristics, prognosis, and adherence to guidelines in Cameroon

Marie Ntep-Gweth, Marc Zimmermann*, Alexandre Meiltz, Samuel Kingue, Pierre Ndobo, Philipp Urban, and Antoine Bloch

Department of Cardiology, Hopital De La Tour, 1, Avenue J.-D. Maillard, Meyrin, Geneva 1217, Switzerland

Aims	The purpose of this prospective study was to characterize the clinical profile of patients with atrial fibrillation (AF) in the urban population of a sub-Saharan African country and to assess how successfully current guidelines are applied in that context.
Methods and results	This prospective study involved 10 cardiologists in Cameroon. Enrolment started on 1 June 2006 and ended on 30 June 2007. Consecutive patients were included if they were >18 years and AF was documented on an ECG during the index office visit. In this survey, 172 patients were enrolled (75 males and 97 females; mean age 65.8 ± 13 years). The prevalence of paroxysmal, persistent, and permanent AF was 22.7, 21.5, and 55.8%, respectively. Underlying cardiac disorders, present in 156/172 patients (90.7%), included hypertensive heart disease (47.7%), valvular heart disease (25.6%), dilated cardiomyopathy (15.7%), and coronary artery disease (6%). A rate-control strategy was chosen in 83.7% of patients (144 of 172) and drugs most commonly used were digoxin and amiodarone. The mean $CHADS_2$ score was 1.9 ± 1.1 and 158 of 172 patients (91.9%) had a $CHADS_2$ score ≥ 1. Among patients with an indication for oral anticoagulation (OAC), only 34.2% (54 of 158) actually received it. During a follow-up of 318 ± 124 days, 26 of 88 patients died (29.5%), essentially from a cardiovascular cause (15 of 26). Ten patients (16.1%) had a non-lethal embolic stroke and 23 (26.1%) had symptoms of severe congestive heart failure.
Conclusion	Clinical presentation of AF in Cameroon is much more severe than in developed countries. A rate-control strategy is predominant in Cameroon and OAC is prescribed in only 34.2% of eligible patients, despite a high $CHADS_2$ score at inclusion. Death and stroke rate at 1 year are very high in Cameroon possibly because of a lower use of OAC, and a higher prevalence of rheumatic mitral disease and of more severe co-morbidities.
Keywords	Atrial fibrillation • Africa • Adherence to guidelines • Cameroon

Introduction

In industrialized countries, atrial fibrillation (AF) is the most common sustained cardiac arrhythmia, strongly associated with an increased morbidity and mortality. Atrial fibrillation causes a five-fold rise in the risk of stroke and one of every six strokes occurs in a patient with AF. Atrial fibrillation is also associated with heart failure, with frequent physician's or emergency department visits and with hospitalization, and with significant economic consequences.[1] In the last decade, important acquisitions in the management of AF have emerged concerning treatment strategies, risk assessment or stroke prevention, and 'unified' guidelines (ACC/AHA/ESC) for AF management have been published.[2] Even in developed countries, suboptimal anticoagulation is frequently observed[3–7] and a high level of adherence to the guidelines has been shown only rarely.[8] Only very few data are available concerning AF or AF-related stroke in Africa[9–13] and little is known of the clinical characteristics, treatment, and prognosis of African patients with AF. Since the overall burden of cardiovascular disease is predicted to rise by ~150% in the developing

* Corresponding author. Tel: +41 22 782 9778; fax: +41 22 785 1863, Email: zimmermann.family@bluewin.ch

world within the next 20 years due to an 'epidemiologic transition' from infectious diseases and nutritional deficiencies to more chronic disorders, this subject is of crucial importance for the future. The purpose of this prospective study was: (i) to characterize the clinical profile of patients with AF in the urban population of a sub-Saharan African country and (ii) to assess how successfully current guidelines are applied in that context.

Methods

This prospective survey, entitled AFIB Cameroon (atrial fibrillation in Cameroon), is the counterpart of AFIB Geneva, a survey involving 23 cardiologists established in office practice in the canton of Geneva, Switzerland.[8] AFIB Cameroon involved 10 cardiologists from Douala and Yaoundé, Cameroon, on a voluntary basis (see Appendix).

Patients

Patients were prospectively included if they were 18 years or older and had documented AF on an ECG during the index office visit. Patients with atrial flutter were excluded. Enrolment started on 1 June 2006 and ended on 30 June 2007. The specifically designed report form was identical to the one used in AFIB Geneva and included patients characteristics, presence, and type of underlying heart disease, antiarrhythmic treatment, and anticoagulation status. Diagnosis of hypertensive heart disease required at least one of the following: (i) left ventricular hypertrophy during echocardiography (septum and posterior wall thickness >11 mm) and/or systolic or diastolic dysfunction; (ii) signs of left ventricular hypertrophy on the 12-lead resting ECG; (iii) persistent elevation of the blood pressure (>150/95 mmHg), despite antihypertensive drug therapy. Patients symptoms directly related to AF were also recorded.

Atrial fibrillation classification

Atrial fibrillation was subdivided into three clinical patterns at presentation: paroxysmal (>1 min but <7 days), persistent (>7 days but <3 months), and permanent (>3 months). The diagnosis of paroxysmal AF was based on the clinical history and symptoms of intermittent palpitations with at least one episode with documented AF on the 12-lead ECG. The term 'new-onset AF' was applied when AF was recorded for the first time and the estimated duration of the AF episode was reported. The term 'lone AF' was defined as an episode of AF in a patient younger than 65 years and without clinical or echocardiographic evidence of underlying cardiac disease. The choice of management strategy was indicated and the specific treatment proposed at the end of office visit was included in the report.

Stroke risk stratification

We used the recently validated CHADS$_2$ score[14] to stratify patients for stroke risk. Briefly, this index measures stroke risk by assigning one point each for congestive heart failure, hypertension, age 75 years or older, and diabetes mellitus, with two points added for a history of stroke or transient ischaemic attack. According to the guidelines,[2] a CHADS$_2$ score of ≥2 was considered as a marker of high risk and an indication for oral anticoagulation (OAC) therapy. A CHADS$_2$ score of 1 was considered as a marker of moderate risk and an indication for OAC or aspirin.

Diagnostic evaluation

Two-dimensional and Doppler transthoracic echocardiography was performed when available, with special attention given to left atrial size, left ventricular systolic and diastolic function, presence of valvular heart disease, and pulmonary arterial hypertension. Left ventricular function was defined as preserved when the left ventricular ejection fraction (LVEF) was >55%, slightly depressed when the LVEF was between 40 and 55%, moderately depressed when the LVEF was between 30 and 40%, and severely depressed when the LVEF was <30%.

Follow-up

Follow-up information was required 12 months after inclusion in all patients. A specifically designed follow-up form, identical to the one used in AFIB Geneva previously,[8] was prepared to evaluate the effect of antiarrhythmic treatment, the rate of sinus rhythm maintenance, and the rate and timing of AF recurrences and complications. Deaths were classified as cardiovascular, non-cardiovascular, or unknown.

Statistical analysis

Continuous variables are expressed as mean ± SD and categorical variables as percentages. Differences in continuous variables between two groups were evaluated using unpaired *t*-test and differences in categorical variables were evaluated using Fisher's exact test. A value of $P < 0.05$ was considered statistically significant.

Results

Patients characteristics

In this survey, 172 patients were enrolled by 10 cardiologists. Baseline clinical characteristics of the patients are summarized in *Table 1*. The male/female ratio was 0.44 (75 males and 97 females). Patient age ranged from 25 to 90 years with a mean age of 65.8 ± 13 years. Underlying heart disease was present in 156 patients (90.7%), the remaining patients belonging to the 'lone AF' group ($n = 16$). Hypertension was the most prevalent associated medical condition, diagnosed in 111 patients (64.5%), with hypertensive heart disease in 82 of 111 patients (73.9%). Rheumatic mitral valve disease was present in 44 of 172 patients (25.6%). A history of previous cerebrovascular accident was present in 30 of 172 patients (17.4%), and 34 of 172 patients in the study group (19.8%) had a history of hospitalization directly related to AF.

Atrial fibrillation was paroxysmal in 39 patients (22.7%), persistent in 37 patients (21.5%), and permanent in 96 patients (55.8%). For 58 of 172 patients (33.7%), AF at inclusion could be classified as 'new onset'. One hundred and fifty-eight patients (92%) reported AF-related symptoms, which were essentially dyspnoea (72.1%), palpitations (46.5%), malaise (20.9%), or congestive heart failure (49.4%). Syncope was a relatively frequent mode of presentation (8.7%).

Diagnostic evaluation

An echocardiographic examination was available in 141 of 172 patients (82%). The main findings were enlargement of the left atrium in 135 of 141 patients (95.7%) (mean, 50 ± 10 mm), a preserved left ventricular function in only in 44 of 141 patients (31.2%), the presence of diastolic dysfunction in 56 of 141 (39.7%), and signs of pulmonary hypertension in 64 of 141

Table 1 Clinical characteristics of the study population

	Total population (%), n = 172
Age (years)	65.8 ± 13
Male/female ratio	75/97
Type of AF	
Paroxysmal AF	39 (22.7)
Persistent AF	37 (21.5)
Permanent AF	96 (55.8)
New onset AF	58 (33.7)
Stroke risk factors	
Hypertension	111 (64.5)
Diabetes	18 (10.5)
Congestive heart failure	100 (58.1)
Prior stroke or TIA	30 (17.4)
Age > 75 years	47 (27.3)
Heart dis.[a]	156 (90.7)
Hypertensive heart dis.	82 (47.7)
CAD	11 (6.4)
Rheumatic mitral valve dis.	44 (25.6)
Hypertrophic CM	3 (1.7)
Dilated CM	27 (15.7)
SSS	3 (1.7)
Others	9 (5.2)
CHADS$_2$ score	1.93 ± 1.08
Echocardiographic data (141/172)	
LA diameter (mm)	50 ± 10
EF > 55%	44 (31.2)
EF = 40–55%	40 (28.4)
EF = 30–40%	32 (22.7)
EF < 30%	25 (17.7)
Diastolic dysfunction	56 (39.7)
Mitral regurgitation	43 (30.5)
Pulmonary hypertension	64 (45.4)

AF, atrial fibrillation; dis., disease; CAD, coronary artery disease; CM, cardiomyopathy; SSS, sick sinus syndrome; TIA, transient ischaemic attack; LA, left atrial; EF, ejection fraction of the left ventricle.
[a]Several diagnosis/symptoms possible in the same patient.

(45.4%) (Table I). Coronary angiography was not available in any patient.

Rhythm management

Rate control was the predominant strategy, chosen in 144 of 172 patients (83.7%), whereas the remaining 28 patients (16.3%) were treated using a rhythm-control approach. Antiarrhythmic drug therapy for the three forms of AF is summarized in Table 2. Direct-current cardioversion was performed electively in 4 of 172 patients (2.3%) with persistent or permanent AF. A permanent pacemaker was implanted in 1 of 172 patients (0.6%).

Stroke risk stratification and anticoagulation therapy

Oral anticoagulation was prescribed in only 57 of 172 patients (33.1%) in this cohort with a mean CHADS$_2$ score of 1.93 ±

1.08 (Table 2). Anticoagulation was prescribed in 20 of 47 patients (42.6%) with a CHADS$_2$ score of 1 and in 34 of 111 patients (30.6%) with a CHADS$_2$ score of ≥2. Therefore, only 54 of 158 patients (34.2%) who should have been treated with anticoagulant prophylaxis actually received it. Conversely, in the group of patients with a CHADS$_2$ score of 0, 3 of 14 (21.4%) of these low-risk patients were prescribed anticoagulant prophylaxis. Antithrombotic prophylaxis according to each CHADS$_2$ score is summarized in Table 3. Aspirin was prescribed in 105 of 172 (61%) patients and only 13 of 172 (7.6%) were left without any antithrombotic prophylaxis.

Follow-up

Follow-up data could be obtained in 88 of 172 patients (51.2%) and the mean follow-up was 318 ± 124 days. At the time of the last follow-up, rate control was applied in 76 of 88 (86.4%) and rhythm control in 12 of 88 (13.6%). At the time of follow-up, 17 of 88 patients (19.3%) were in sinus rhythm. Beta-blockers were used by 9 of 88 (10.2%), amiodarone by 21 of 88 (23.9%), calcium channel antagonists by 4 of 88 (4.5%) and digitalis by 54 of 88 (61.4%). Only one patient was treated with a class I anti-arrhythmic drug (0.6%). At the follow-up visit, 17 of 88 patients (19.3%) were still treated by OAC and 62 of 88 (70.5%) were on aspirin.

During follow-up 26 of 88 patients died (29.5%). The mean age of the patients who died was 69.9 ± 14.3 years (range 28–90) and their mean CHADS$_2$ score was 2.1. Death was cardiovascular in origin in 15 of 26 patients (57.7%), of unknown origin in 8 of 26 (30.8%) or non-cardiovascular in 3 of 26 (11.5%). Among the patients who died, only 3 of 26 (11.5%) were treated with OAC. Among the 62 survivors, there were 10 non-lethal embolic strokes (16.1%) and 1 transient ischaemic attack (1.6%). In this subset of patients, the mean CHADS$_2$ score was 2.4 and only 2 of 11 (18.2%) were treated with OAC. One significant bleeding complication (1.6%) was reported in a 74-year-old patient treated with OAC. Twenty-three episodes of congestive heart failure (26.1%) and 13 hospitalizations for uncontrolled AF (14.8%) were observed during follow-up. During follow-up, OAC was introduced in 5 patients, discontinued in 4, and unchanged in 12 of 88 patients.

Discussion

To the best of our knowledge, the present study is the first pro-spective survey assessing clinical characteristics, treatment, and prognosis of patients with AF in Africa.

In this survey, the vast majority of AF patients presented with structural heart disease (90.7%), with hypertensive heart disease and rheumatic heart disease as the main aetiologies. In the 'Heart of Soweto Study',[9] AF accounted for 7% of the primary diagnosis for cardiovascular diseases and AF was diagnosed in 8% of patients with heart failure (48 of 704), in 4% of patients with hypertension (12 of 310) and in 13% of patients with valve disease (32 of 268). Compared with the data obtained previously in Geneva, Switzerland,[8] using an identical method of data collection and analysis, AF patients in Cameroon are younger (65.8 ± 13 vs. 69.8 ± 12, P = 0.003), more often are females (97 of 172 vs.

Table 2 Drug therapy of AF in Cameroon

	Total (%), n = 172	Rate control (%), n = 144/172	Rhythm control (%), n = 28/172
Antiarrhythmics			
Class I	1 (0.6)	0 (0)	1 (3.6)
Beta-blocker (+sotalol) alone	18 (10.5)	15 (12.5)	3 (10.7)
Amiodarone alone	39 (22.7)	22 (13.9)	17 (60.7)
CCB alone	12 (7.0)	12 (8.3)	0 (0)
Digitalis alone	94 (54.7)	91 (63.2)	3 (10.7)
Digitalis + amiodarone	9 (5.2)	6 (4.2)	3 (10.7)
Digitalis + CCB	2 (1.2)	2 (1.4)	0 (0)
Digitalis + beta-blocker	2 (1.2)	2 (1.4)	0 (0)
Digitalis + amiodarone + CCB	1 (0.6)	0 (0)	1 (3.6)
Antithrombotic			
Oral anticoagulation alone	53 (30.8)	41 (28.5)	12 (42.9)
Aspirin alone	101 (58.7)	91 (63.2)	10 (35.7)
Clopidogrel	1 (0.6)	1 (0.7)	0 (0)
Oral anticoagulation + aspirin	4 (2.3)	2 (1.4)	2 (7.1)
No treatment	13 (7.6)	9 (6.3)	4 (14.3)

CCB, calcium channel blocker.

Table 3 Antithrombotic treatment according the $CHADS_2$ score

$CHADS_2$ score	0	1	2	3	4	5	6
Number of patients	14	47	62	35	13	1	—
Anticoagulation (%)	3 (21.4)	19 (40.4)	18 (29)	9 (25.7)	4 (30.8)	0 (0)	—
Aspirin (%)	10 (71.4)	22 (46.9)	40 (64.6)	21 (60.0)	7 (53.8)	1 (20)	—
Aspirin + OAC (%)	0 (0)	1 (2.1)	1 (1.6)	1 (2.85)	1 (7.7)	0 (0)	—
Clopidogrel (%)	0 (0)	0 (0)	0 (0)	1 (2.85)	0 (0)	0 (0)	—
No prophylaxis (%)	1 (7.2)	5 (10.6)	3 (4.8)	3 (8.6)	1 (7.7)	0 (0)	—

232 of 622, $P < 0.0001$), have more often signs of congestive heart failure (49.4 vs. 10.8%, $P < 0.0001$), more syncope (8.7 vs. 1.8%, $P < 0.0001$), and more often a history of previous stroke (17.4 vs. 11.7%, $P = 0.04$). The more severe clinical profile of patients with AF seen by cardiologists in Cameroon is confirmed by the higher $CHADS_2$ score observed in this study compared with the $CHADS_2$ score observed in Geneva (1.9 ± 1.1 vs. 1.4 ± 1.2, $P < 0.0001$), by a much higher prevalence of rheumatic mitral valve disease and by echocardiographic data (*Table 1*).

A rate-control strategy was proposed by the cardiologist in 83.7% of the patients presenting with AF, even though a third of the study population was considered as 'new onset' AF. A rate-control strategy was applied essentially for economical reasons and because rate control appears more realistic for patients with a low income. Class I antiarrhythmic drugs were almost never used, and amiodarone was the preferred antiarrhythmic medication, prescribed in 28.5% of the cases. Rate-control medications were almost always prescribed and digitalis was the preferred first-line therapy in 62.8% of the cases. Compared with what is observed in Europe, prescription of beta-blockers (11.6 vs. 52.1%, $P < 0.0001$) and calcium channel antagonists (8.1 vs. 15.8%, $P = 0.008$) was very low.[8,15,16]

To define stroke risk categories, we used the $CHADS_2$ score validated by Gage *et al.*[14] in 2001 essentially because this scoring system is simple, easy to use, and efficient. According to the $CHADS_2$ score, patients with at least one stroke risk factor have an annual stroke risk of 2.8 and should be prescribed OAC. Oral anticoagulation was prescribed in only 33.1% of the study population and adherence to current guidelines was poor in AF patients with $CHADS_2$ scores of ≥2 (*Table 3*). In fact, only 34.2% (54 of 158) of the patients who should have been given anticoagulant prophylaxis actually received it. The rate of OAC prescription was lower to what has been observed in Europe: in the Euro Heart Survey,[15] published after release of the ACC/AHA/ESC guidelines, OAC was prescribed to 67% of the eligible patients, and in Geneva,[8] OAC was prescribed in 88% of AF patients with a moderate or a high stroke risk. Reasons for the low prescription rate of OAC in Cameroon are obvious: economic factors, rural

environment, difficulties in evaluating adequate anticoagulation using the INR, and relative contraindications (e.g. uncontrolled hypertension). Similar observations have been made in Zimbabwe: only 38% of AF urban patients and only 19% of rural AF patients received OAC, despite a high-risk clinical profile.[10]

In the present study, overall mortality at 1 year was very high (29.5%) and much higher than the mortality rate observed in Europe (3.7–4.0%).[8,16] Stroke rate was also much higher (12.5%) compared with the ALPHA study (1.8%)[16] or to the study performed in Geneva (2.6%)[8] and higher even than what was observed for untreated groups in randomized trials of antithrombotic therapy (4.9–8.0% according to age).[17] Possible explanations for such a bad prognosis are the low rate of OAC in high-risk AF patients,[18] the high prevalence of rheumatic mitral valve disease, and/or the severity of co-morbidities in the African cohort. Possible ways to improve AF treatment, AF prognosis, and adherence to guidelines in Cameroon (and in Africa in general) include improvement in socio-economic level, teaching, improvement in personnel training, better coordination between existing structures, development of primary prevention programmes, better information to the general population, better access to cardiologists, cheap medications, and easy access to coagulation checks through existent infrastructures.

Limitations

This study was designed to assess the clinical characteristics, treatment, and prognosis of patients with AF and not to assess the incidence of AF in an African population. Data were collected on a voluntary basis and enrolment was not uniform among participants. The number of patients included is limited and follow-up was available only in 50% of the cases. It must be remembered, however, that a study of this type is extremely difficult to conduct in developing countries and that it is almost impossible to obtain follow-up data for patients coming from rural zones and seeking medical advice only when severely ill. However, baseline characteristics showed no statistical difference between patients with follow-up information and patients without follow-up (age 67 ± 12 vs. 65 ± 14, n.s.; permanent AF in 48 of 88 vs. 48 of 84, n.s.; congestive heart failure in 49/88 vs. 51/84, n.s.; rheumatic heart disease in 21 of 88 vs. 23 of 84, n.s.; CHADS$_2$ score 1.93 vs. 1.94, n.s.). Even if all patients without follow-up data were survivors, mortality rate would still be 15.1% (26 of 172), which is four times higher than the mortality rate observed in Europe. The cause of death is difficult to verify because no autopsy was available and because the cause of death was determined only on clinical ground. A selection bias is certainly present because only very sick patients are referred to a cardiologist in Cameroon. The health-care system in Cameroon is supervised by the Minister of Public Health. There are health units with 3 General hospitals, including 1 university teaching hospital, 3 Central hospitals, and 10 provincial hospitals. In addition to these are mission hospitals and private clinics. Medical equipment for cardiac care is available only in a few hospitals and essentially in the two main towns, Yaoundé and Douala. A cath lab has been installed in Yaoundé several years ago but is not functional. There is no universal medical insurance and patients have to pay themselves for medical care and treatments. According to the low economic power of the population, the amount of money which can be attributed to health care is minimal. Moreover, AF and cardiac problems, although a major issue as shown in the present report, are not considered a high priority compared with tropical infectious diseases, AIDS, and reproductive health problems in Cameroon.

The value of the CHADS$_2$ score used in this study may be subject to debate, especially in evaluating the risk associated with controlled hypertension and in defining the upper age-limit. Moreover, the CHADS$_2$ score has been validated only in industrialized countries and does not include rheumatic mitral valve disease, a common problem in sub-Saharan Africa.

Conclusion

Clinical presentation of AF in Cameroon is much more severe than in developed countries (more congestive heart failure, more syncope, higher incidence of stroke, higher prevalence of rheumatic mitral valve disease, larger left atrium, more LV dysfunction, etc.). A rate-control strategy is the rule in Cameroon and drugs most commonly used are digoxin and amiodarone. Oral anticoagulation is prescribed in only one-third of AF patients and only 34.2% of eligible patients receive it, despite a higher CHADS$_2$ score at inclusion. Death and stroke rate at 1 year are very high in Cameroon possibly because of a lower use of OAC and because of more severe co-morbidities. Better adherence to the current guidelines appears difficult in an African environment and new antithrombotic medications (cheap and without the need of anticoagulation monitoring) are urgently needed in this context.

Conflict of interest: none declared.

Appendix

Participating physicians: Dr Bonny, Pr. Kingue, Dr Menanga A, Dr Menanga M, Dr Ndjebet, Dr Ndonbo, Dr Ntep Gweth, Dr Ouankou, Dr Tchuem, and Dr Yiagnigni.

References

1. Lip GYH, Tse HF. Management of atrial fibrillation. *Lancet* 2007;**307**:604–18.
2. ACC/AHA/ESC 2006 guidelines for the management of patients with atrial-fibrillation—executive summary. *Eur Heart J* 2006;**27**:1979–2030.
3. Bradley BC, Perdue KS, Tisdel KA, Gilligan DM. Frequency of anticoagulation for atrial fibrillation and reasons for its non-use at a Veterans Affairs Medical Center. *Am J Cardiol* 2000;**85**:568–72.
4. Inoue H, Nozawa T, Okamura K, Iwasa A, Lee DJ, Shimizu A *et al.* Attitudes of Japanese cardiologists toward anticoagulation for nonvalvular atrial fibrillation and reasons for it's underuse. *Circ J* 2004;**68**:417–21.
5. Friberg L, Hammar N, Ringh M, Petterson H, Rosenqvist M. Stroke prophylaxis in atrial fibrillation: who gets it and who does not? *Eur Heart J* 2006;**27**:1954–64.
6. Monte S, Macchia A, Pellegrini F, Romero M, Lepore V, D'Ettore A *et al.* Antithrombotic treatment is strongly underused despite reducing overall mortality among high-risk elderly patients hospitalized with atrial fibrillation. *Eur Heart J* 2006;**27**:2217–23.
7. Nieuwlaat R, Capucci A, Lip GYH, Olsson SB, Prins MH, Nieman FH *et al.*, on behalf of the Euro Heart Survey Investigators. Antithrombotic treatment in real-life atrial fibrillation patients: a report from the Euro Heart Survey on Atrial Fibrillation. *Eur Heart J* 2006;**27**:3018–26.

8. Meiltz A, Zimmermann M, Urban P, Bloch A. Atrial fibrillation management by practice cardiologists: a prospective survey on the adherence to guidelines in the real world. *Europace* 2008;**10**:674–80.

9. Sliwa K, Wilkinson D, Hansen C, Ntyintyane L, Tibazarwa K, Becker A *et al.* Spectrum of heart disease and risk factors in a black urban population in South Africa (the Heart of Soweto Study): a cohort study. *Lancet* 2008;**371**:915–22.

10. Bhagat K, Tisocki K. Prescribing patterns for the use of antithrombotics in the management of atrial fibrillation in Zimbabwe. *Cent Afr J Med* 1999;**45**:287–90.

11. Rosman KD. The epidemiology of stroke in an urban black population. *Stroke* 1986;**17**:667–9.

12. Nwosu CM, Nwabueze AC, Ikeh VO. Stroke at the prime of life: a study of Nigerian Africans between the ages of 16 and 45 years. *East Afr Med J* 1992;**69**:384–90.

13. Zenebe G, Alemayehu M, Asmera J. Characteristics and outcomes of stroke at Tikur Anbessa Teaching Hospital, Ethiopia. *Ethiop Med J* 2005;**43**:251–9.

14. Gage B, Waterman AD, Shannon W, Boechler M, Rich MW, Radford MJ. Validation of clinical classification schemes for predicting stroke: results from the National Registry of Atrial Fibrillation. *JAMA* 2001;**285**:2864–70.

15. Nieuwlaat R, Capucci A, Camm AJ, Olsson SB, Andresen D, Davies DW *et al.*, on behalf of the Euro Heart Survey Investigators. Atrial fibrillation management: a prospective survey in ESC member countries. The Euro Heart Survey on Atrial Fibrillation. *Eur Heart J* 2005;**26**:2422–34.

16. Levy S, Maarek M, Coumel P, Guize L, Lekieffre J, Medvedowsky J-L *et al.*, on behalf of the College of French Cardiologists. Characterization of different subsets of atrial fibrillation in general practice in France. The ALPHA study. *Circulation* 1999;**99**:3028–35.

17. Atrial Fibrillation Investigators. Risk factors for stroke and efficacy of antithrombotic therapy in atrial fibrillation. Analysis of pooled data from five randomized controlled trials. *Arch Intern Med* 1994;**154**:1449–57.

18. Jones M, McEwan P, Morgan CL, Peters JR, Goddfellow J, Currie CJ. Evaluation of the pattern of treatment, level of anticoagulation control, and outcome of treatment with warfarin in patients with non-valvular atrial fibrillation: a record linkage study in a large British population. *Heart* 2005;**91**:472–7.