Management of atrial fibrillation in a rural zone of Cameroon: importance of echocardiographic indices

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Résumé

Objectif: La fibrillation auriculaire (FA) est l'arythmie la plus couramment rencontrée. Mais le profil épidémiologique et sa prise en charge dans les pays d'Afrique Sub-saharienne ne sont pas suffisamment étudiés. Les buts de cette étude étaient de présenter les caractéristiques de la FA ainsi que de relever l'importance des paramètres échocardiographiques en relation avec le traitement pharmacologique de la conversion de la FA en rythme sinusal.

Méthodologie: 185 patients avec FA d'une zone rurale Camerounaise ont été rétrospectivement étudiés. Des électrocardiogrammes (ECG) et échocardiogrammes doppler transthoraciques (EDT) étaient réalisés. Les paramètres échographiques d'intérêt étaient les suivants : dimension médiolatèrale de l'oreillette gauche (DDIa), les diamètres télésystolique (DSIv) et télédiastolique (DDIv) du ventricule gauche. Le traitement pharmacologique de la conversion de la FA consistait en l'administration de l'Aspirine 250 mg une fois/j, ou l' Acécoumarol 4 mg/j et l' Amiodarone 400 mg en dose journalière.

Résultats: La fréquence de la FA post valvulopathie rhumatismale (PVR) était de 53%. 24% des patients avaient une FA associée à une hypertension, 9% une FA idiopathique, et chez 14% la FA était associée à une cardiomyopathie dilatée (CMD). Chez les patients avec PVR , DDIa était 48,8± 1.5 mm tandisque DSIv and DDIv étaient respectivement de 40±1,2 et 61±1,3 mm. Chez les sujets avec FA idiopathique, le DDIa était de 36,2±1,2 mm tandisque le DSIv et le DDIv étaient respectivement de 38,2±1,1 et de 52,1±1,3 mm. La FA était convertie en rythme sinusal respectivement dans 60%, 15% et 90% des patients avec PVR, hypertension, et FA idiopathique.

Conclusions: Notre étude montre que la PVR est la principale cause de la FA en milieu rural Camerounais. Le traitement pharmacologique de la conversion de la FA en rythme sinusal semble un meilleur traitement alternatif de la FA particulièrement là où le traitement par électrochoc n'est pas réalisable. Ce traitement est efficace même lorsque le DDIa est inférieur à 52,4 mm.

Mots clés: Fibrillation auriculaire, Cardiopathie post rhumatismale, Cardiomyopathie dilatée, hypertension.

Summary

Objective: Atrial fibrillation (AF) is a highly prevalent sustained dysrhythmia. But, the pattern and management of AF are insufficiently studied in sub-Saharan Africa. The aims of this study were to investigate the pattern of AF and the relevance of echographic indices in relation to pharmacologic cardioversion of AF to a sinus rhythm.

Methods: In a retrospective study, 185 patients with AF living in a rural area of Cameroon were studied. Electrocardiograms and transthoracic Doppler-echocardiogramms (TTE) were recorded. We analysed the following indices: mediolateral dimension of the left atrium.
(DDIa), diameters of left ventricle telesystolic (DSIv) and telediastolic (DDIv). Pharmacologic cardioversion of AF consisted to administration of aspirin 250 mg once or acecoumarol 4 mg once and amiodarone 400 mg twice daily.

Results: Frequency of AF post –rheumatic valvulopathies (PRV) was 53%. 24% of patients had AF with hypertension, 9% an idiopathic AF, and 14% had AF with dilated cardiomyopathy (DCM). In PRV patients, DDIa was 48.8± 1.5 mm while DSIv and DDIv were 40±1.2 and 61±1.3 mm respectively. In idiopathic AF, DDIa was 36.2±1.2 mm while DSIv and DDIv were 38.2±1.1 and 52.1±1.3 mm, respectively. AF was converted to sinus rhytm in 60%, 15% and 90% of PRV, hypertension, and idiopathic AF patients, respectively.

Conclusions: Our study shows that PRV was the main cause of AF in rural Cameroonian patients. Pharmacologic cardioversion appears the best alternative treatment of AF mainly where electrical cardioversion is lacking. This treatment is achievable even when DDIa is lower than 52.4 mm.

Key words: Atrial fibrillation, rheumatic heart disease, dilated cardiomyopathy, hypertension

Introduction

Rheumatic heart disease (RHD) remains a major public health problem worldwide and in the developing countries in particular (1). Although the African population represents only a small (10%) fraction of the world's population, as many as half of the 2.4 million children affected by RHD globally live in that continent, indicating a very high RHD prevalence among children and young adults (2). Reports from a Cardiovascular Health Study and the Framingham Study showed that the incidence of AF per 1000 person-years in subjects under 64 years is 3.1 in men and 1.9 in women. This incidence rises sharply to about 19.2 per 1000 person-years in patients aged between 65 and 74 years, and is as high as 31.4 to 38.0 in octogenarians (3, 4). In Africa, AF is the major complication of post-rhumathismal valvulopathies (5). Hypertension is very prevalent in cardiovascular pathologies, and compared with other risk factors (heart failure, valvular heart disease, myocardial infarction); it is considered as the leading cause of AF in the general population (14%) (6). However, in the USA among the standard cardiovascular risk factors, hypertension, diabetes and obesity are considered as independent predictors of AF. The management of RHD remains very challenging more importantly because of associated secondary diseases (complica-tions) including AF, chronic congestive heart failure and recurrent thrombo-emboli. Among these complications, AF is the most common arrhythmia in the adult population with an incidence between 0.4 and 0.9%. AF is frequently associated with disabling symptoms and has been shown to induce an increased cardiovascular morbidity and mortality in both patients with and without any heart disease (7, 8). The main goals in the treatment of AF have included heart rate control, reduction of symptoms, and prevention of embolism. However, nowa-days there is another approach, which is the application of cardioversion with subsequent maintenance of sinus rhythm. Whether this strategy is better over the previous ones is under active investigation. Digoxin, non-dihydropyridine calcium channel antago-nists, beta-adrenoreceptor antagonists (beta-blockers), and amiodarone are the most commonly used pharmacologic agents in order to achieve heart rate control. Although pharmacologic cardioversion is successful in a selected population of patients, conversion of AF to sinus rhythm is best achieved by electrical cardioversion. In patients with drug-resistant AF for instance, atrioven-tricular nodal ablation (or modification) with implantation of a permanent pacemaker is the alternative therapy (9, 10).

In rural regions of Cameroon, defibrillators are scarce and consequently pharmacologic cardioversion is the sole option. The aims of this study were: to investigate the pattern of AF and the relevance of echocardiographic indices in relation to pharmacologic conversion of AF to a sinus rhythm in patients from a rural area of Cameroon.

Material and methods

Patients

The Ethics Committee of the Shisong cardiac centre approved the study and all the patients signed a consent form. Between July 2005 and 2007, 185 patients diagnosed with AF were selected for the study. The exclusion criteria included patients younger than 15 years with valvulopathies, or those with thyroid gland dysfunction.

Cardiological explorations

The electrocardiogram (ECG) was done on admission, as well as the transthoracic doppler-echocardiogramm (TTE). The TTE indices analysed included the medio-lateral dimension of the left atrium (DDla) in the four chambers view using the apical position, the left ventricle telesystolic diameter (DSlv) and the left ventricle telediastolic diameter (DDlv)

using the parasternal long axis position in M mode. The control ECG was done on day 6 of admission, and the TTE just before the patient was discharged.

Treatment

To convert AF to sinus rhythm, in addition to the conventional therapy for the underlying disease patients were put either on 250 mg aspirin (idiopathic AF) or a loading dose of acecoumarol 4 mg (twice daily) till the INR level was equal to 2. Then maintenance doses (1 to 3 mg daily) of acecoumarol (to maintain INR between 2 and 3) were administered along with a loading dose of amiodarone 400 mg (twice daily for 4-5 days). In order to maintain the sinus rhythm after conversion, patients were put on amiodarone 200 mg once a day.

Data analysis

Data are expressed as mean ± SD. The results were analysed for statistical difference by Student *t* test. The SPSS 11 statistical analysis software was used for analysis and $p < 0.05$ was considered significant.

Results

Electrocardiogram

Patient's age ranged between 16 and 65 years (mean: 45.2 ± 4.5 years) with 55% of them being men and 45% women. Nine percent (n = 17) of the patients had an idiopathic AF, 13.5% (n = 25) dilated cardiomyopathy (DCM), 53.1% (n = 98) secondary AF following post-rhumathismal valvulopathies (PRV) and 24.3% (n = 45) AF combined with hypertension (HTN) (Fig. 1).

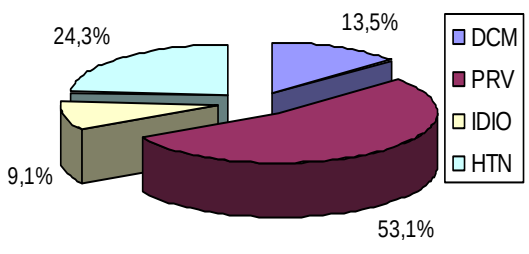

Figure 1. Distribution of patients per aetiology of atrial fibrillation
DCM: Dilated cardiomyopathy
PRV: post rheumatic valvulopathies
IDIO: idiopathic atrial fibrillation
HTN: atrial fibrillation due to hypertension

Comparison of AF prevalence in relation to underlining diseases and age showed that AF was significant in young PRV patients between 16 and 35 years old. It remains significant ($p<0.05$) in older PRV patients between 36 and 45 years old though much less than in the previous group. From the age of 46 onwards till 65 years, AF was prevalent in DCM and HTN patients (Table 1).

Table 1. Characteristics of patients in different categories

Diagnosis	Age (years)			
	16-25	26-35	36-45	46-65
DCM	0	0	5.4	40.8*
Idiopathic AF	0	0	16.2	10.1
Hypertension associated to AF	0	2.8	18.5	39.1
Valvulopathies	100	97.2*	59.9*	10

Values expressed as percentages
* $p< 0.05$
DCM: dilated cardiomyopathy, AF: atrial fibrillation

Transthoracic doppler-echocardiogramm

In patients with idiopathic AF, the ejection fraction (EF) and shortening fraction (SF) were approximately 55 ± 1.1 and 26.6 ± 1.1% respectively. DDla was 36.2 ± 1.2 mm, DDlv 52.1± 1.3 mm and DSlv 38.2 ± 1.1 mm. In DCM patients EF and SF were 35.2 ± 1.1 and 13.1 ± 1.1% respectively. DDla was 42.2 ± 1.1 mm, DDlv 62.3± 1.1 mm and DSlv 54.1 ± 1.2 mm. There was a significant ($p < 0.03$) difference in TTE indices between idiopathic and DCM patients. In PRV patients with mitral valve regurgitation, EF and SF were 40 ± 1.2 and 29 ± 0.9% respectively. DDla was 51 ± 1.4 mm, DDlv 63.1± 1.5 mm and DSlv 45 ± 1.3 mm. The velocity of regurgitant jet in the left atrium was between 3.5 and 4.5 m/s. In PRV patients with mitral valve stenosis, EF and the SF were 38 ± 1.2 and 31 ± 1.1% respectively. DDla was 48,8 ± 1,2 mm, DDlv 61 ± 1.3 mm and DSlv 40 ± 1.2 mm. DDla, DDlv, and EF in patients

with MVR were significantly ($p<0.04$) higher than in patients with MVS (Table 2).

Table 2. Echocardiographic indices of patients before conversion to sinus rhythm

	DDla (mm)	DDlv (mm)	DSlv (mm)	EF (%)	SF (%)
Hypertension	39.5 ±1.1 #	54.2±0.9#	39.8 ± 1#	65± 1.1#	28.3±0.9#
Idiopathic FA	36.2 ± 1.2	52.1± 1.3	38.2 ± 1.1	55± 1.1	26.6 ± 1.1
DCM	42,2 ± 1.1#	62.3± 1.1#	54.1 ± 1.2#	35.2 ± 1.1#	13.1 ± 1.1#
MVR	51 ± 1.4 *	63.1± 1.5*	45 ± 1.3	40 ± 1.2 %*	29 ± 0.9
MVS	48.8 ± 1.2	61 ± 1.3	40 ± 1.2	38± 1.2	34 ± 1.1*

*: $p<0.05$ between indices of MVR (mitral valve regurgitation) and MVS (mitral valve stenosis) patients
#: $p<0.05$ between indices of hypertensive, DCM patients and patients with idiopathic AF

Conversion to sinus rhythm

In some patients (n = 7) the left atrium was larger and the diameter could reach 80 mm. The conversion of AF to sinus rhythm was effective in 75 ($p<0.05$), 56 ($p<0.02$) and 15% ($p<0.05$) of patients with idiopathic AF, RVP and HTN-combined AF respectively. The conversion to sinus rhythm was unsuccessful in DCM patients and those with DDla above 55 mm. Non symptomatic bradycardia was the only complication observed in patients with a successful conversion to sinus rhythm. All the patients with successful conversion to sinus rhythm had better control TTE indices. Mean indices were: EF 50± 1.1%, SF 22.6 ± 0.9%, DDla 35.2 ± 1.1 mm, DDlv 50.5± 1.1 mm, and DSlv 36.2 ± 1.2 mm.

Discussion

AF is a pathology encountered in rural Cameroon. Our study shows that in patients between 16 and 45 years old, PRV was the main causative factor. This corroborates well with the study of Marijon E *et al* and Abdel-Moula AM *et al* (11, 12). The authors reported that RHD accounts for the major proportion of all cardiovascular diseases in children and young adults in African countries and lead to AF. Our patients had very thick and rigid calcified mitral valve leaflets and subvalvular apparatus. In very severe valvulopathy, the size of left atrium could exceed that of left ventricle. There are still some controversies about the relationship between some cardiovascular diseases and AF prevalence. The authors of the Cardiovascular Health Study, Furberg CD *et al* (13) reported that there is no association between valvular heart disease, echocardiographic enlargement of the left atrium, abnormal mitral or aortic valve function and AF incidence and prevalence. In that study, AF was mainly associated with age, valvular and hypertensive etiology, higher left atrium diameter and lower left end-systolic left ventricular diameter. The patients with AF resulting from post-rhumastismal valvulopathies and dilated cardiomyopathy had the echocardiographic indices worse than those with hypertension or an idiopathic AF (15). This finding can well explain the pharmacologic cardio-version results observed in our study. In Furberg *et al* study (13), AF as a result of dilated cardiomyopathy and hypertension are represented mostly in older patients from 46 years old and above Urrutia *et al* (14). The left atrial dimension was more pronounced in patients with DCM and PRV. It was not always possible to put patients on anticoagulants (2 to 3 weeks) prior to initiation of cardioversion as recommended in current literature because of patient limited financial resources, very poor compliance and illiteracy. The only option was to use the loading doses of amiodarone and the anticoagulant. Our data are comparable to those of the

Framingham Study where the echocardiographic predict-tors of AF include left atrial enlargement (39% increase in risk per 5-mm increment), left ventricular fractional shortening (34% per 5% decrement), and left ventricular wall thickness (28% per 4-mm increment) (16, 17). We would like to underline that there was a serious concern regarding possible intracavitary thrombus formation given the fast anticoagulation. Fortunately, on the TTE control no intracavitary thrombus was observed in patients with successful conversion. In the present study, the pharmacologic cardioversion to sinus rhythm was not effective in patients with DDIa above 55 mm. Similar results were shown by Vora *et al* (18). Patients with successful conversion were put on a conservative dose of amiodarone 200 mg (daily) continuously for one month. While those with an unsuccessful conversion had their heart rate controlled either with digoxin (DCM and PRV patients) or verapamil, beta blockers (HTN patients) in addition to anti-coagulation. Two patients later showed symptoms of thyroid gland-related dys-function, which was confirmed by laboratory analysis. Amiodarone was immediately discontinued and the patients referred to an endocrinologist. The traditional view of AF mechanisms is that the arrhythmia results from multiple re-entrant wavelets that move randomly throughout the atria. Re-entry is promoted by decreased atrial refractory periods, slowed conduction and an increased mass of cardiac tissue. Recently, it was shown that atrial tachyarrhythmia, including AF, alter atrial electrical properties thus promoting multiple-circuit re-entrant AF (19, 20). This "electrical remodelling" encompasses a variety of changes including alterations in sarcolemmal ion channel gene expression, cellular size and content, in addition to changes in connexions that couple cells electrically. The most important ionic changes involve, but not limited to reductions in L-type calcium current. The net effect of these modifications is to decrease the atrial refractory period and possibly interfere with atrial conduction in a spatially heterogeneous way (i.e., the magnitude of the changes varies in different locations, increasing electrical heterogeneity and promoting fibrillation), thereby providing a substrate for multicircuit re-entry and facilitating reinitiating of AF, should it end (21).

In conclusion, AF is a disturbance of the heart rhythm and is observed in a significant population of cardiac patients in rural areas of Cameroon. We showed that PRV was the main cause of AF in these patients, and that pharmacologic cardioversion of AF to sinus rhythm was best achieved in those patients who had an idiopathic AF and in all other cases with DDla below 52,5 mm. The length of anticoagulation for pharmacologic conversion should be revised. Echocar-diographic indices are therefore very important parameters in the assessment of heart cavities in patients with AF for pharmacologic cardioversion.

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