Health Sciences & Disease
The Journal of Medicine and Biomedical Sciences

Original Article

Functional Status by EHRA Classification of Patients with Atrial Fibrillation in the Yaounde General Hospital: a Cross-Sectionnal Study

Évaluation du statut fonctionnel par la classification ERHA des patients en fibrillation atriale à l'Hôpital Général de Yaoundé: une étude transversale

Boombhi J[1,2], Mokube MN[1], Menanga A[1,2], Nganou C[1,3], Mfeukeu-Kuate L[1,3], Dzudie A[1], Hamadou B[1], Ebene M[1], Owona A[1], Kingue S[1,2]

1. Department of Internal Medicine and Specialties, Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Yaoundé, Cameroon.
2. Cardiology Unit, General Hospital of Yaoundé, Yaoundé, Cameroon
3. Cardiology Unit, Central Hospital of Yaoundé, Yaoundé, Cameroon

Correspondant Author :
Dr Jérôme Boombhi
Tel. (+237) 675814913
Email :
boombhijerome@yahoo.fr

Keywords: atrial fibrillation, functional status, rate control, diastolic dysfunction
Mots-clés : fibrillation atriale, état fonctionnel, contrôle de la fréquence, dysfonction diastolique

ABSTRACT

Introduction. Atrial fibrillation (AF) is the commonest heart rhythm disturbance. In Cameroon, its prevalence is about 7-8% in hospital based studies. AF is associated with symptoms which affect the functional status of patients. Functional class of AF patients rated by the (European Heart Rhythm Association) EHRA scale has not been studied in Cameroon. We aimed to determine the functional status of AF patients according to the EHRA classification in a hospital setting in Yaounde. **Methods.** It was a cross-sectional analytic study. We recruited 61 patients. Informed consent was obtained from all participants. Proportions were calculated to display the frequency of various EHRA classes and to stratify them into good and poor functional class groups. Univariate and multivariate analyses were performed to determine the factors associated with poor functional status. A result was considered statistically significant if the 95% confidence intervals did not include 1 or if the p-value was <0.05. **Results.** Our mean age was 71 years with 62% of our patients aged between 60-80 years. The most common risk factor of AF were hypertension (63%), and heart failure (41%). Majority (40%) had HFpEF. Beta-blockers were the most used rate control strategy (50%) and 72% patients had optimal heart rate. More than half our AF patients (54%) had poor functional class. Diastolic dysfunction was a significant predictor of poor functional status (OR=5; 95%CI: 1.04-25; P=0.03). **Conclusion.** Poor functional status was frequent in our population of AF patients despite most of them having good systolic function. Diastolic dysfunction has a negative impact on functional class of AF patients. Treating diastolic dysfunction may be an important long term strategy in improving functional status of AF patients.

RÉSUMÉ

Introduction. La fibrillation auriculaire (FA) est le trouble du rythme cardiaque le plus fréquent. Au Cameroun, sa prévalence est d'environ 7 à 8% en milieu hospitalier. La FA est associée à des symptômes qui affectent l'état fonctionnel des patients. L'évaluation du statut fonctionnel des patients selon la classification EHRA (European Heart Rhythm Association) n'a pas encore été étudiée au Cameroun. Notre objectif était d'évaluer l'état fonctionnel des patients atteints de FA selon la classification EHRA en milieu hospitalier à Yaoundé. **Méthodologie.** Il s'est agi d'une étude transversale analytique. Nous avons recruté 61 patients atteints de FA. Un consentement éclairé a été obtenu de tous les participants. Les proportions ont été calculées pour afficher la fréquence des diverses classes EHRA ; les classes fonctionnelles ont été stratifié en deux groupes : bon statut fonctionnel pour les classes I et II de ERHA et mauvais statut fonctionnel pour les classe III et IV de ERHA. Un résultat était considéré comme statistiquement significatif si les intervalles de confiance à 95% n'incluaient pas 1 et la valeur p était <0,05. **Résultats.** L'âge moyen était de 71 ans et 62% de nos patients étaient âgés de 60 à 80 ans. Les facteurs de risque de FA les plus courants étaient l'hypertension (63%) et l'insuffisance cardiaque (41%). La majorité (40%) avait une insuffisance cardiaque à fraction d'éjection préservée. La stratégie de contrôle de la fréquence était la plus utilisée et faisait appel majoritairement aux bétabloquants (50%) ; la fréquence cardiaque optimale chez 72% des patients. 54% de nos patients avaient un mauvais statut fonctionnel. La dysfonction diastolique était un prédicteur significatif d'un mauvais statut fonctionnel (OR = 5; IC à 95%: 1,04-25; P = 0,03).**Conclusion.** La majorité de notre population de patients atteints de FA présente un mauvais statut fonctionnel, bien que la plupart d'entre eux aient une bonne fonction systolique. La dysfonction diastolique a un impact négatif sur la classe fonctionnelle des patients atteints de FA.

INTRODUCTION

Atrial fibrillation (AF) is the commonest heart rhythm disturbance (1). The average prevalence of AF worldwide is about 1% (2). With overall increase in cardiovascular risk factors and life-expectancy, the prevalence of AF is expected to rise by 150% come 2050

(3–5). AF patients have higher morbidity and mortality. It increases stroke risk 3 to 5 times. It also accounts for 14% of early demise in congestive heart failure patients and its occurrence increases with worsening functional class of heart failure (6). AF remains a significant predictor of death, almost doubling risk of death even after controlling for the effect of cardiovascular factors associated with it.

By 2050, AF prevalence in Africa, is predicted to surpass any other region in the world (7). Already however, the AF prevalence in sub-Saharan Africa probably supersedes the world average. Studies have found a prevalence which ranges from 0.7% in Kenya to as high as 5.5% in Ivory Coast (7,8). In South Africa and Senegal, authors estimated a prevalence of 4.6% and 5.35% (7,9) respectively. In Cameroon, prevalence of AF has been estimated to be about 7-8% with an average age of 59 ($\pm$ 15)(10,11).

AF causes an increase in the DALYs (12), indicating that AF markedly affects functional status (FS). Some studies have assessed AF related FS using tools to evaluate quality of life (QoL) and exercise capacity in patients on rate control therapy (13–15). These instruments used were not AF specific.

These studies, though being more accurate due to their randomized controlled nature, were carried out on an older population as compared to Cameroon's younger AF population. More so, in most cases apart from the effect of rate control, they did not elucidate the effects of other factors on the functional class of AF patients.

To the best of our knowledge, there was no study which had assessed the functional class of AF patients using the modified EHRA (Modified European Heart Rhythm Association symptom) scale (16) and the factors that predict functional status. In view of this existing gap, we conducted a study to determine functional status of AF patients as measured by the modified EHRA scale patients and characteristics that modulate the former.

MATERIALS AND METHODS

We carried out a cross-sectional study at the General Hospital of Yaounde. Our study comprised 61 patients at the selected health facility who had been diagnosed with atrial fibrillation for over a year ago and consented voluntarily to participate. Selection was by convenient consecutive sampling.

Data Collection

Information was first collected by history taking. EHRA classes were assigned as stipulated by Kirchhof et al (17) and as shown in figure 1 according to the frequency of development of symptoms like palpitations, chest pain, breathing difficulties, fatigue and their impact on daily activities. The symptoms were rated with respect to their occurrence and impact on life as never, occasional, intermediate and frequent. Those with a maximum rate of never are were classed as 1, maximum rate of occasional 2, maximum rate of intermediate 3 and of frequent 4.

Modified EHRA score	Symptoms	Description
I	None	AF does not cause any symptoms
2a	Mild	Normal daily activity not affected by symptoms related to AF[a]
2b	Moderate	Normal daily activity not affected by symptoms related to AF, but patient troubled by symptoms[a]
3	Severe	Normal daily activity affected by symptoms related to AF
4	Disabling	Normal daily activity discontinued

Figure 1: Modified European Heart Rhythm Association rhythm scale(16)

Physical examination included anthropometric measurements, blood pressure recording and cardiac auscultation. Height and weight were taken using a meter and scale respectively. Blood pressure was measured using a sphygmomanometer. Heart rate was recorded by cardiac auscultation for at least a minute.

Electrocardiography was used to confirm AF, obtain the ventricular rate and to exclude conditions like acute coronary syndrome.

Echocardiography was performed to obtain left ventricular systolic function using time motion mode measurements and the biplane Simpson method. Left atrial anteroposterior diameter, surface are and volume were measured. Diastolic function was assessed by measuring the peak velocity of the mitral inflow, the septal e' with tissue Doppler imaging, the speed of the tricuspid regurgitation, and the isovolumetric relaxation time. A peak mitral inflow velocity of $\geq$ 1.9m/s, an E/e' septal ratio >11, velocity of tricuspid regurgitation >2.8 m/s, and isovolumetric relaxation time $\leq$ 65ms were criteria indicating diastolic dysfunction in these patients according to American society of echocardiography (18).

Statistical Analysis

Structured questionnaires were used to record obtained data. About 10% of questionnaires were double checked by co-investigators to mitigate errors. Data was keyed into the Stata database for cleaning and analyses (Stata 12, StataCorp, LP, Texas, USA).

The dependent variable was EHRA class and the independent variables were patient characteristics like age, presence of rate control medications (beta blockers, amiodarone, digoxin, etc), heart failure, sex and hypertension.

Summary statistics were computed to describe the population. Proportions were also calculated to group AF patients into various modified EHRA classes.

The modified EHRA class which was an ordinal variable was transformed into a binary variable based on whether patient's daily activities were affected by symptoms or not. Univariate analysis was done using logistic regression so as to determine the odds of having an unfavourable modified EHRA class according to the various patient characteristics collected. 95% Confidence intervals and p values were obtained. A result was considered statistically significant if confidence intervals

of odds ratios does not include 1 or if the p value is <0.05.

Additionally, multivariate models were built using multiple logistic regressions to further test the effect of characteristics that were significantly related with Qol in the univariate model. This was done by adding in a stepwise fashion confounders some of which were apriori confounders such as age and others that were determined by statistical methods. A variable was considered statistically as a confounder if it modified the result of the odds by at least 10%. For continuous variables, the likelihood ratio test was used to explore whether to fit them in the model in their continuous form or as categorical variables.

Furthermore, interaction tests were carried out to determine whether combination of different characteristics had a significant effect on modified EHRA class.

Ethical Considerations

Administrative and ethical approvals to conduct the study were obtained from the Director of the Yaounde General Hospital and Institutional Review Board (IRB) of the Faculty of Medicine and Biomedical Sciences, Cameroon respectively. All participants provided written informed consent. Apart from the inconvenience of taking time to answer the research questionnaire, participants were not exposed to any undue risk. Individual results were provided to participants for their appropriate management.

RESULTS

The characteristics of the 61 AF patients who participated in our study are summarized in Table 1.

Table 1: Distribution of participants according to sociodemographic characteristics (n=61)

Variables	N (%)
Age(years)	
<50	4 (7)
51-60	6 (10)
61-70	19 (31)
71-80	19 (31)
81-90	8 (13)
>91	5 (8)
Sex	
Female	34 (56)
Male	27 (44)

The mean age of our population was 71 years (SD=15). Most of our participants were in the 61-80 age bracket (62%) and the minority were less than 50 years. The sex ratio was 1.2:1 (females to males).

Table 2, shows the comorbidities and risk factors of AF present amongst our patients.

Table 2: Distribution of participants according to clinical characteristics (n=61)

Variables	N (%)
Hypertension	38 (63)
Heart Failure	25 (41)
Excessive alcohol consumption	9 (15)
Valvular Heart Disease	8 (13)
Ischemic Stroke	7 (11)
Hyperuricemia	5 (8)
Diabetes	4 (7)
Chronic Kidney Disease	4 (7)
Obesity	4 (7)
Current Smoking	3 (5)
Dyslipidemia	2 (3)
Thyroid Disease	2 (3)
Myocardial Infarction	1 (2)

The most represented clinical pathology in patients with atrial fibrillation was hypertension (63%), followed by heart failure (41%). About 11% of our participants had a history of ischemic stroke.

Amongst patients with heart failure in our study population, majority had an ejection fraction of at least 40% (Table 3).

Table 3: Distribution according to type of heart failure

Variables	N (%)
Heart Failure (n=25)	
Preserved ejection fraction (≥ 50%)	10 (40)
Mid-range ejection fraction (40-49%)	10 (40)
Reduced ejection fraction (<40%)	5 (20)

Regarding thyroid disease, hypothyroid and hyperthyroid disease were equally represented

The repartition of our study participants according to the rate control strategy is depicted by Table 4.

Table 4: Distribution with regards to rate control strategy

Variables	N (%)
Rate control strategy (n=22)	
Beta-blockers only	11 (50)
Digoxin only	9 (40)
Beta-blockers and Digoxin	1 (5)
Amiodarone	1 (5)
Optimal heart rate (n=61)	44 (72)

Optimal heart rate was effectively achieved in most of the participants (72%). Beta-blockers were the most prescribed (50%), drug for rate control. Combined therapy (beta-blockers plus digoxin) was sparingly used (5%).

Bisoprolol was the beta-blocker most used for rate control, followed by nebivolol and metoprolol. Other beta-blockers like carvedilol or atenolol were not used in our study population (Table 5).

Table 5: Beta-blockers used by our participants (n=11)

Variables	N (%)
Bisoprolol	7 (64)
Nebivolol	3 (27)
Metoprolol	1 (9)

Globally, the average heart rate was 99bpm (min=54bpm, max=159bpm) whereas the median blood pressure in our population was 126/80 mmHg (88/49mmHg – 200/125mmHg).
Concerning functional status, cumulatively, a greater proportion of our patients (54%) had an unfavorable EHRA classification (poor functional status) (figure 2).

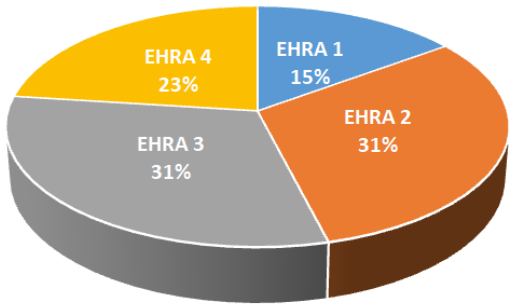

Figure 2: Distribution of respondents according to modified EHRA class

Table 6 shows the association between characteristics and functional status of patients with AF in the Yaounde General Hospital. In the final multivariate model, after adjusting for confounders, diastolic dysfunction remained significantly associated with functional status of AF patients as determined by the modified EHRA classification. AF patients with diastolic dysfunction were five times more likely to portray unfavorable EHRA class characteristics than those without diastolic dysfunction (OR=5; 95% CI: 1.04-25; P=0.03).

Table 6: Multivariate analyses showing the relationship between characteristics and EHRA class

Variables	N (%)	EHRA class	
		Odds Ratio 95%CI[$]	P
Sex			
Female	34 (56)	1	0.1
Male	27 (44)	3 (0.8-15)	
Optimal heart rate	44 (72)	0.21 (0.04-1.2)	0.08
LAVI[*]	67 (54-95)	1.01 (0.98-1.03)	0.6
SPAP[δ]	55 (19)	1.03 (0.99-1.1)	0.1
Diastolic Dysfunction	24 (39)	5 (1.04-25)	**0.03**
Age	71(15)	1.02 (0.96-1.08)	0.6

*LAVI-Left atrial volume index (Continuous variable expressed as median, and interquartile range)
δ SPAP- Systolic pulmonary artery pressure (continuous variable expressed as mean and standard deviation).
$ Odds ratios and p values adjusted using a multiple logistic regression model including the variables displayed in the table
* (Continuous variable expressed as median, and interquartile range)
δ (continuous variable expressed as mean and standard deviation).

DISCUSSION

Our mean age was 71 years (SD=15) with most of our patients aged 60-80 years. We noted a slight female preponderance. Most of our patients were hypertensive (63%), and had heart failure (41%). Amongst heart failure patients, the greater part (40%) had a preserved left ventricular ejection fraction. In our study, beta-blockers were the most used rate control strategy (50%) and almost three-quarters (72%) of our patients had an optimal heart rate. The average heart rate of our population was 99bpm (min=54bpm, max=159bpm) whereas the median blood pressure in our population was 126/80 mmHg (88/49mmHg–200/125mmHg).With respect to functional status, more than half of our AF patients (54%) had a poor EHRA classification. Diastolic dysfunction was a significant predictor of quality of life (OR=5; 95%CI: 1.04-25; P=0.03).
Regarding demographics, the mean age of our population was 71 years (SD=15) and the gender structure was in favour of females. Our mean age is similar to the 66 (SD=12) recorded by Boombhi *et al* (11) and Ntep *et al* (66 +/-13) in Yaounde, Cameroon (19). Kamdem *et al*(10) in Douala, Cameroon had a similar age profile to ours with most of their patients also in the 60-80 years group. Our findings were different from the 57 (SD=19) observed by Alassane *et al*(9) in Senegal. This shows that the age distribution of AF patients may not significantly vary across different regions within the same country but from nation to nation.
Our gender structure is similar to that in studies by Boombhi *et al*, Ntep *et al*, Kamdem *et al* and Alassane *et al*. On the otherhand, Chugh *et al*(12) in his study on the analysis of the 2010 global burden of disease data, found more AF amongst males than females. This disparity between sub-Saharan Africa and the rest of the world could be due to the difference in health-seeking behaviors of women and men in various parts of the world. Generally, in Cameroon, apart from the fact that the female population slightly surpasses that of males, women are also more likely to visit the hospital than men(20). Since most studies in sub-Saharan countries are hospital based, it is not surprising therefore that more AF patients recruited in our studies are found to be women.
With respect to risk factors, majority of our AF patients (63%) had hypertension. Studies by Kamdem *et al*, and Ntep *et al* corroborate this finding with hypertension noted in 77% and 65% of their patients respectively. In the same vein, Ntep *et al* observed that most of their heart failure patients had a preserved left ventricular ejection fraction. Conversely, Boombhi *et al*, observed that most of their patients (64%) had heart failure and Steg *et al* mainly had coronary artery disease patients.
Concerning rate control, beta-blockers were the most prescribed pharmacological agent (50%) in our study. This is identical to the prescription rate of beta-blockers observed by Steg *et al*. On the contrary, Boombhi *et al*, Ntep *et al*, Kamdem *et al* recorded that digoxin was more frequently used. The bulk of our patients (72%) had an optimal heart rate. This deviates from the 89% found by Steg *et al*.
As regards, functional status, 54% of our AF patients had a poor functional class due to AF related symptoms according to the modified EHRA classification. Steg *et al*, also noted a high burden of symptoms amongst AF patients and a consequently high proportion of poor functional class and quality of life. They reported that about 74% of their patients had an EHRA class >I. The

fact that our value is not consistent with theirs is clearly because, we considered EHRA classes above class II rather than above I as important. We observed that diastolic dysfunction was an independent predictor of AF related functional class in our study such that those with diastolic dysfunction were five times more likely to have an unfavourable EHRA class than those without. Contrarily, Steg *et al*, found that rate control was a significant predictor of quality of life in their study. This inconsistency could be explained by the fact that the tools used to assess functional class were not the same. However, it is important to note that rate control improves diastolic function as diastolic filling is improved at lower heart rates(21).

Many flaws can be identified in our study which are inherent to its design, the sampling technique and the instrument we used to measure our outcome. The design of our study does not permit us to make a conclusion on causal relationship, for example between diastolic function and functional class. There may also be selection bias. Our tool for measuring functional status, is quite subjective causing inter-observer variations and bias. It is not possible to predict how these biases affected our measure of the effect of certain predictors on functional class.

Hence we propose that further research should be done on the impact of diastolic dysfunction on functional class and quality of life in AF patients. A clinical trial should be envisaged whereby one group is randomized on diuretics plus standard therapy (therapy for underlying diseases) and the other only on standard therapy, with primary endpoints being diastolic function, functional class and quality of life.

CONCLUSION

To conclude, atrial fibrillation leads to symptoms which affect the functional status of patients. Hypertension was the most common underlying disease in AF patients followed by heart failure. Poor functional class was frequent in our population of AF patients despite most of them having optimal heart rate, blood pressure and preserved systolic function. Most significantly, diastolic dysfunction has a negative impact on the functional class of AF patients such that patients with diastolic dysfunction were more likely to have poorer functional status than those without. Treating diastolic dysfunction may be an important long term strategy in improving functional class in AF patients.

Acknowledgments

We thank all study participants. We also thank Pr Kingue Samuel, Pr Menanga Alain, Dr Boombhi Jerome for their assistance in the conception and realization of the study. Further, we thank Dr and Mrs Mokube, Dr Ngoah Marie-France for supporting the implementation of this project.

Author Contributions

Conceived and designed the study: MNM, BJ, MA, and KS. Did critical appraisal: NC, KL, DA, BA, EM, OA. Analyzed the data: MNM, BJ. Wrote the paper: MNM BJ, MA, KS.

REFERENCES

1. Fuster V, Rydén LE, Cannom DS, Crijns HJ, Curtis AB, Ellenbogen KA, et al. ACC/AHA/ESC 2006 Guidelines for the Management of Patients With Atrial Fibrillation. Circulation [Internet]. 2006 Aug 15 [cited 2019 Feb 2];114(7):e257-354. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16908781
2. Feinberg WM, Blackshear JL, Laupacis A, Kronmal R, Hart RG. Prevalence, Age Distribution, and Gender of Patients With Atrial Fibrillation. Arch Intern Med [Internet]. 1995 Mar 13 [cited 2019 Feb 2];155(5):469. Available from: http://archinte.jamanetwork.com/article.aspx?doi=10.1001/archinte.1995.00430050045005
3. Novaro GM, Asher CR, Bhatt DL, Moliterno DJ, Harrington RA, Lincoff AM, et al. Meta-Analysis Comparing Reported Frequency of Atrial Fibrillation After Acute Coronary Syndromes in Asians Versus Whites. Am J Cardiol [Internet]. 2008 Feb 15 [cited 2019 Feb 2];101(4):506–9. Available from: https://www.sciencedirect.com/science/article/pii/S0002914907020425
4. Go AS, Hylek EM, Phillips KA, Chang Y, Henault LE, Selby J V., et al. Prevalence of Diagnosed Atrial Fibrillation in Adults. JAMA [Internet]. 2001 May 9 [cited 2019 Feb 2];285(18):2370. Available from: http://jama.jamanetwork.com/article.aspx?doi=10.1001/jama.285.18.2370
5. Furberg CD, Psaty BM, Manolio TA, Gardin JM, Smith VE, Rautaharju PM. Prevalence of atrial fibrillation in elderly subjects (the Cardiovascular Health Study). Am J Cardiol [Internet]. 1994 Aug 1 [cited 2019 Feb 2];74(3):236–41. Available from: https://www.sciencedirect.com/science/article/pii/0002914994903638
6. Amin A, Houmsse A, Ishola A, Tyler J, Houmsse M. The current approach of atrial fibrillation management. Avicenna J Med [Internet]. 2016 [cited 2019 Feb 2];6(1):8–16. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26955600
7. B.S. S, L.M. N. Atrial fibrillation in sub-saharan Africa: Epidemiology, unmet needs, and treatment options. Int J Gen Med [Internet]. 2015;8:231–42. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L605741406%5Cnhttp://dx.doi.org/10.2147/IJGM.S84537%5Cnhttp://sfx.library.uu.nl/utrecht?sid=EMBASE&issn=11787074&id=doi:10.2147%2FIJGM.S84537&atitle=Atrial+fibrillation+in+sub-sahara
8. Coulibaly I, Anzouan-Kacou JB, Konin KC, Kouadio SC, Abouo-N'Dori R. [Atrial fibrillation: epidemiological data from the Cardiology Institute in Abidjan, Côte d'Ivoire]. Med Trop (Mars) [Internet]. 2010 Aug [cited 2019 Feb 2];70(4):371–4. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22368936
9. Alassane M, Souleymane P, Malick B, Bamba NM, Fatou M, Adama K, Valentin YN, Maboury D AK. La fibrillation atriale , fréquence, facteurs étiologiques , évolution et traitement dans un service de cardiologie de Dakar , Sénégal. Pan Afr Med J. 2010;6(16):1–11.
10. Kamdem F, Hamadou B, Kamdem M, Nganou CN, Dzudie A, Monkam Y, et al. Epidemiologic Aspects of Atrial Fibrillation in a Tertiary Hospital in a Sub-Saharan Africa Setting. OALib [Internet]. 2017;04(02):1–8. Available from: http://www.oalib.com/paper/pdf/5281913
11. Boombhi J, Menanga A, Mfeukeu-Kuaté L, Kungni E, Mounpou B, Kingué S. Caractéristiques Cliniques et Thérapeutiques de la Fibrillation Atriale en Milieu Hospitalier à Yaoundé , Cameroun. 2019;(2):23–6.

12. Chugh SS, Havmoeller R, Narayanan K, Kim Y, Jr JHM, Zheng Z. Worldwide Epidemiology of Atrial Fibrillation: A Global Burden of Disease 2010 Study. Circulation. 2014;129(8):837–47.
13. Khand AU, Rankin AC, Martin W, Taylor J, Gemmell I, Cleland JGF. Carvedilol alone or in combination with digoxin for the management of atrial fibrillation in patients with heart failure? J Am Coll Cardiol [Internet]. 2003 Dec 3 [cited 2019 Feb 2];42(11):1944–51. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14662257
14. Ware J, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Med Care [Internet]. 1996 Mar [cited 2019 Mar 24];34(3):220–33. Available from: http://www.ncbi.nlm.nih.gov/pubmed/8628042
15. Thrall G, Lane D, Carroll D, Lip GYH. Quality of Life in Patients with Atrial Fibrillation: A Systematic Review. Am J Med [Internet]. 2006 May [cited 2019 Jan 6];119(5):448.e1-448.e19. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16651058
16. Kirchhof P, Benussi S, Kotecha D, Ahlsson A, Atar D, Casadei B, et al. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. Europace. 2016;18(11):1609–78.
17. Kirchhof P, Ammentorp B, Darius H, De Caterina R, Le Heuzey J-Y, Schilling RJ, et al. Management of atrial fibrillation in seven European countries after the publication of the 2010 ESC Guidelines on atrial fibrillation: primary results of the PREvention oF thromboemolic events--European Registry in Atrial Fibrillation (PREFER in AF). Europace [Internet]. 2014 Jan [cited 2019 Jan 19];16(1):6–14. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24084680
18. Dufaitre G, Meuleman C, Logeart D. Evaluation échocardiographique des pressions de remplissage ventriculaire gauche. In: Cohen A, Guéret P, editors. Manuel d'échocardiographie clinique. Paris: Médecine Sciences Lavoisier; 2012.
19. Ntep-Gweth M, Zimmermann M, Meiltz A, Kingue S, Ndobo P, Urban P, et al. Atrial fibrillation in Africa: Clinical characteristics, prognosis, and adherence to guidelines in Cameroon. Europace. 2010;12(4):482–7.
20. National Institute of Statistics. 2Nd Survey on the Monitoring of Public Expenditures and the Level of Recipients' Satisfaction in the Education and Health Sectors in Cameroon (Pets2) [Internet]. 2010. Available from: www.statistics-cameroon.org/.../pets/2/Rapport_principal_Sante_anglais.pdf
21. Gutierrez C, Blanchard DG. Diastolic heart failure: Challenges of diagnosis and treatment. Am Fam Physician. 2004;69(11):2609–16.