Resting Heart Rate and Associated Factors in Patients with Chronic Heart Failure in Cameroon: A Cross-sectional Study in Sub-saharan Africa

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Abstract: Introduction: Controlled heart rate has been associated with better prognosis in patients with chronic heart failure (CHF). Radial pulse palpation is a simple and useful method to evaluate heart rate control especially in limited resources setting such as sub-Saharan Africa. However, data on heart rate control in patients with heart failure are scarce in our context. Therefore, we sought to investigate heart rate control in patients followed for chronic heart failure in Cameroon. Methodology: We conducted a cross-sectional study from January to September 2017 in three specialized cardiology centers of Cameroon. We included patients with chronic heart failure, normal sinus rhythm without recent cardiac events. Resting heart rate was measured by pulse palpation after 05 minutes of rest, three (03) times over 60 seconds. An uncontrolled heart rate was defined as HR ≥70bpm. Results: Overall, 213 patients with a mean age of 63±15 years were included. About 64.8% of patients have a heart rate above recommended targets (≥70 bpm). There was no significant association between age, gender, NYHA stage, cardiovascular risk factors or current therapies and heart rate control. Conclusion: Uncontrolled heart rate is frequent in patients with chronic heart failure in our context with more than half presenting a resting heart rate above currently recommended values.

Keywords: Heart Rate, Stable Chronic Heart Failure, Cameroon

1. Introduction

Heart failure affects about 2% of the general population and is the major complication of hypertension in sub-Saharan Africa. [1] Despite advances in medical and device therapy, the prognosis remains poor for patients with chronic heart failure (HF), with a mortality rate of 75% at 7 years of follow-up. Heart rate not only predicts the outcome but may also be a therapeutic target in patients with chronic heart failure. [2] An uncontrolled heart rate is known to have a detrimental effect on the occurrence of heart failure and is a well-established risk factor in patients with chronic heart failure [3–5]. Guidelines for the management of stable CHF recommend heart rate values below 70 bpm to prevent myocardial ischemia and improve cardiac outcomes [6]. Indeed, it is now well established that patients with heart rate

≥70 bpm have a higher risk of vascular outcomes compared with patients with heart rate less than 70 bpm [7-9]. Moreover, there is evidence that clinical benefits are tightly associated with the magnitude of heart rate reduction.

Despite the proven benefits of heart rate reduction, several observational studies suggest that this target is not systematically achieved in clinical practice. Our study explored heart rate control in the major heart failure centers throughout the country, Cameroon. We aimed to identify the proportion of patients with stable chronic heart failure attending heart failure clinics with a resting heart rate of ≥70 bpm as well as to determine factors associated with poor heart rate control.

2. Methods

2.1. Ethical Statement

This study was approved by the Institutional and Research Ethical Committee of the faculty of medicine and biomedical sciences and we obtained administrative authorizations of the reference centers where the study was carried out. All participants provided written informed consent.

2.2. Study Design and Sampling

This was a cross-sectional study involving 213 patients from 03 major centers of heart failure management in Cameroon carried out from January 2017 to September 2017. These centers regularly follow patients with acute and chronic heart failure. We included all consenting adults in an out-patient setting with stable chronic heart failure and normal sinus rhythm. We excluded patients hospitalized for decompensated heart failure within the month prior to consultation and those presenting any conditions which could alter heart rate.

2.3. Variables and Measurements

Data were collected on demographic characteristics, risk factors and lifestyle, medical history, physical condition, and vital signs, records were made of heart failure therapies including the use and dosage of heart rate reducing agents. Resting heart rate was recorded by three separate radial pulse assessments and their mean was used for analysis. This was done in a quiet environment, with the patient in a sitting position, for 60 seconds.

2.4. Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 23.0. Data are presented using descriptive statistics with numbers and percentages (%) for categorical variables, and the mean ± standard deviation for continuous variables. The chi-square test was used to study the association between two qualitative variables, while for the quantitative independent variables the association with heart rate was investigated by comparing the mean with a Student test. Binary logistic regression was used in multivariate analysis to determine factors associated with poor heart rate control. The statistical significance threshold was set at $p < 0.05$.

3. Results

Among the 310 patients enrolled, 213 patients met the inclusion criteria and were included in the final analysis. 64.8% (n = 138) of participants had sub-optimal heart rate control, while 35.2% (n = 75) were well controlled with heart rate less than 70 beats per minute (bpm). The characteristics of our patients are summarized in Table 1.

Table 1. *Characteristics of the patient with stabilized chronic heart failure.*

Variable	Frequency (N = 213)	Percentage (%)
Male	82	38.5
Female	131	61.5
Age (years)		
≥ 55	160	75.1
< 55	53	24.9
Diabetes	50	23.5
Hypertension	145	68.1
Smoking	27	12.7
Obesity	63	29.6
CKD	18	8.5
COPD / Asthma	5	2.3
Causes of HF		
Ischemic	29	13.6
Non-ischemic	184	86.4
NYHA		
1	26	12.2
2	116	54.5
3	71	33.3
Beta blockers	149	70
Digoxine	25	11.7
Ivabradine	1	0.5
ACEi	152	71.4
ARB	34	16
Aldosterone antagonist	98	46
Diuretics	173	81.2

There were no differences among controlled and uncontrolled patients in the baseline characteristics namely age, sex, hypertension, diabetes, Left Ventricular Ejection Fraction, the etiology of systolic dysfunction, New York Heart Association (NYHA) functional class (Table 2).

Table 2. *Factors associated with suboptimal heart rate control.*

Variable	Heart rate ≥ 70 bpm (n = 138)	Heart rate < 70 bpm (n = 75)	*p* value
Male (%)	39	37	0.912
Female (%)	61	63	
Age (years)			
≥ 55	75	25	0.376
< 55	25	75	
Diabetes (%)	27	17	0.077
Hypertension (%)	71	63	0.783
Smoking (%)	12	13	0.832
Obesity (%)	33	24	0.336
CKD (%)	7	12	0.120
COPD / Asthma (%)	2	3	0.999
Causes of HF (%)			
Ischemic	14	13	0.930
Non-ischemic	86	87	

Variable	Heart rate ≥ 70 bpm (n = 138)	Heart rate < 70 bpm (n = 75)	p value
NYHA (%)			
≥ 3	31	33	0.745
< 3	69	67	
LVEF (%)			
≥ 35	51	59	0.313
< 35	49	41	
Betablockers (%)	67	75	0.269
Digoxin (%)	12	11	0.720
Ivabradine (%)	0	0	0
ACEi (%)	70	73	0.639
ARB (%)	19	11	0.090
Aldosterone antagonist (%)	47	43	0.471
Diuretics (%)	81	81	0.975
Systolic BP (mean)	135 (±23)	133 (±21)	0.429
Diastolic BP (mean)	86 (±17)	81 (±12)	0.011

In our study population, about 70% (149) of patients were taking beta-blockers with 93 controlled vs 56 with suboptimal control of heart rate. However, few patients were taking recommended or optimal dosage (06 vs 02 respectively). There was no significant association between beta-blocker dosage, concomitant therapies, and sub-optimal heart rate control.

4. Discussion

This study aimed to evaluate heart rate control in patients with stable chronic heart failure in three reference centers of heart failure management in Cameroon. We found that more than sixty-five percent of patients had suboptimal heart rate control.

In this study 64.8% of patients followed for stable chronic heart failure had poor heart rate control. These results are similar to those of Pastror-pérez, [10] but superior to those of Moran and Pourdjabbar, [11, 12] who found that 1/3 of the population with chronic HF had poor HR control. This difference can be related to the high proportion of patients not taking a beta-blocker (30%) in our study, unlike the other two, where this proportion was respectively 10.56% and 5.29%. As the benefits of reducing HR in CHF is proven, identifying such a large population of uncontrolled patients had a significant clinical consequence. Indeed, given that a 1bpm drop in HR produces a 3% reduction in cardiac events, [9] increased follow-up and appropriate management can reduce morbi-mortality in this subgroup of the heart failure population.

Unachievement of recommended target heart rates were unrelated to age, gender, cardiovascular risk factors, and medication. These results corroborate those of Moran in Ireland [11], but they are contradictory to those described by studies reported in the literature [9]. In these studies, patients with HR ≥ 70bpm were younger, had a lower ejection fraction, higher systolic blood pressure, and a more advanced NYHA stage than patients with FC <70bpm. This difference could be related to the fact that in our study population there were few young subjects, few severe alterations LVEF and stage 3 NYHA were poorly represented. There was no difference between patients receiving beta-blockers or not, but 67% of patients with HR ≥70 bpm were on beta-blocking

agents, this can be explained by insufficient titration of beta-blockers, but we found no significant association between beta-blocker dose and poor HR control, results similar to those found in several studies [9, 11-13] thus evoking, on one hand, the theory of variability of responses to beta-blockers. Indeed, some patients may be poor responders to beta-blockers regardless of the dose [13]. On the other hand, may suggest that the bradycardic effect of beta-blockers alone is not always sufficient for optimal heart rate control. In this context, the use of more than one drug like recommended to achieve HR goals may be beneficial for patients with stable chronic HF and high HR [6]. The low prescription of ivabradine (1.69% of patients) in our study can be explained by the cost of the drug or it could be a problem of indication. Indeed, according to the recommendations of the European Society of Cardiology, ivabradine is indicated in patients with stable chronic heart failure with a left ventricular ejection fraction<35% and an HR>70 bpm in sinus rhythm despite standard therapy including beta-blockers, optimal-dose SRAA inhibitors or in case of intolerance or contraindications to beta-blockers, [6] but in our study population few had all these characteristics.

Limitations: use of the radial pulse palpation which is not the gold standard to measure heart rate. Indeed, the ECG Holter is the reference method for this evaluation but Pastor-Perez et al highlighted a strong concordance between the palpatory method and the Holter ECG nevertheless this concordance remains suboptimal for some lower values of heart rate. Our study was performed in reference management centers and this could be underestimated patient with poor heart rate control in our context since most of the patients are followed by a specialist and could therefore present better condition than others patients followed in primary care centers where there is no specialist and guidelines are not always respected due to insufficient technical plateau or unavailability of some molecules. Given that, poor heart rate control in our context might be more frequent than the proportion found in this study.

5. Conclusion

This study showed that more than a half of heart failure patients had sub-optimal heart rate control and stress the need to pay greater attention to heart rate control in patients with stable chronic heart failure in order to meet recommended targets that could improve patients' outcome in terms of life expectancy, hospitalizations, and quality of life.

List of Abbreviations

HR: Heart Rate; CHF: Chronic Heart Failure; LVEF: Left Ventricular Ejection Fraction; NYHA: New York Health Association.

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Authors' Contributions

Study conception and design: Audrey Joyce Foka, Kingue Samuel, Jérôme Boombhi, Ba Hamadou.

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All the authors approved the final version of the manuscript.

Competing Interests

The authors declare that they have no competing interests.

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