REPUBLIC OF CAMEROON
PEACE-WORK-FATHERLAND

MINISTRY OF HIGHER EDUCATION

THE UNIVERSITY OF YAOUNDE I

FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES

DEPARTMENT OF INTERNAL MEDICINE AND SPECIALTIES

REPUBLIQUE DU CAMEROUN
PAIX-TRAVAIL-PATRIE

MINISTERE DE L'ENSEIGNEMENT SUPERIEUR

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FACULTE DE MEDECINE ET DES SCIENCES BIOMEDICALES

DEPARTEMENT DE MEDECINE INTERNE ET SPECIALITES

Impact of co-morbidities on the prognosis and the quality of life of patients with chronic heart failure in Yaoundé

MD thesis presented and defended in partial fulfilment of the requirements for the award of *Medicinae Doctor* (MD) degree by:

Nkipang Hubert MOH TANGONGHO

16M022

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Academic Year: 2022-2023

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PRELIMINARIES

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DEDICATION

This thesis is dedicated to

My parents!

Mr Moh Tangongho Sylvester

And

Mrs Mohnee Ndongho Celine Lenchu

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PHYSICIAN'S OATH

Declaration of Geneva adopted by the Geneva Assembly of the World Medical Association in Geneva, Switzerland, September 1948 and amended by the 22nd World Medical Assembly, Sydney, Australia (August 1968)

On admission to the medical profession:

I will solemnly pledge myself to consecrate my life to the service of humanity

I will give my teachers the respect and gratitude which is their due

I will practice my profession with conscience and dignity

The health of my patients will be my first consideration

I will respect secrets confided in me, even after the patient has died

I will maintain by all the means in my power the honor and noble traditions of the medical profession

My colleagues will be my brothers

I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my patient

I will maintain the utmost respect for human life from the time of conception, even under threat I will not use my medical knowledge contrary to the laws of humanity

I make these promises solemnly, freely and upon my honour.

ABSTRACT

BACKGROUND: Heart failure is a major public health problem which affects approximately 2% of the world's population. These patients usually have co-morbidities which accelerate disease progression and worsen response to treatment. This leads to more frequent and longer hospitalizations which in the long run affect the mortality and quality of life of these patients. In order to mitigate and prevent this harmful effect, we aimed at assessing how co-morbidities affect heart failure patients in our milieu.

OBJECTIVE: Determine the impact of comorbidities on the prognosis and quality of life of patients with heart failure in our setting.

METHODS: We conducted a cross-sectional study of patients who presented in the hospital with chronic heart failure at Yaoundé Central Hospital, Yaoundé General Hospital, Yaoundé University Teaching Hospital, and Efoulan District Hospital. We included patients presenting with chronic heart failure above the age of 18, hospitalized or followed up in cardiology external consultation within the period of 3months from February to April. The variables studied were the sociodemographic, clinical, and paraclinical characteristics, prognosis and quality of life of patients with heart failure. The prognosis was evaluated with the Charlson Comorbidity Score while the quality of life was evaluated using the Minnesota living with heart failure questionnaire. To do that, we obtained ethical and administrative approval, and thereafter the patients' consent was sort. SPSS version 26 was used for data entry and analysis, and a p-value of 0.05 with a 95% confidence interval was considered statistically significant. Pearson and Mann-Whitney U tests were used to analyse associations.

RESULTS: We recruited a total of 86 patients. The mean age of the participants was 62 ± 14.2 years. The median duration of evolution of heart failure was 3,5[2-5] years. Sedentary behaviour was the main cardiovascular risk factor with the most found aetiologies for heart failure being hypertension (30.2%) and ischemia (22.1%). The mean LVEF was 39.13± 14.18% with more than half having HFrEF. 60.5% of our participants were in stage II of NYHA. The most predominant Charlson comorbidities were diabetes (16.3%) and CKD (10.5%). The mean 10-year survival rate was 51.30 ± 34.25% with 9.3% having a 0% survival rate. The mean score of quality of life was 30.06 ± 17.13 with more than half of the patients having a good quality

of life (53.5%). We observed that an increase in NYHA classification stage (coefficient beta (β)=15.9; 95% confidence interval (CI), 12.3–19.6), HF of valvular origin (β=7.9; CI, 1.5–14.3), and presence of chronic kidney disease (β=16.1; CI, 9.5–22.7), were directly associated with poorer quality of life. We also found out that the prognosis of patients with HF was directly associated with quality of life (β=2.0; CI, 0.6–3.4).

CONCLUSION: Most patients had a good prognosis and quality of life. CKD was the only comorbidity found to independently affect the quality of life of HF patients negatively. Likewise, an increase in NYHA stage, and HF of valvular origin were directly associated with poor quality of life. Additionally, we deduced that the poorer the quality of life, the poorer the prognosis.

Keywords: Chronic heart failure, comorbidities, prognosis, quality of life, Yaoundé

RESUME

CONTEXTE : L'insuffisance cardiaque est un majeur problème de santé publique qui touche environ 2 % de la population mondiale. Ces patients présentent généralement des comorbidités qui accélèrent la progression de la maladie et détériorent la réponse au traitement. Cela entraîne des hospitalisations plus fréquentes et longues que chez les patients sans comorbidités, ceux-ci, à long terme, affecte la mortalité et la qualité de vie de ces patients. Afin d'atténuer et de prévenir cet effet néfaste, nous avons cherché à évaluer comment les comorbidités affectent les patients souffrant d'insuffisance cardiaque dans notre milieu.

OBJECTIF : Déterminer l'impact des comorbidités sur le pronostic et la qualité de vie des patients atteints d'insuffisance cardiaque dans notre milieu.

METHODES : Nous avons réalisé une étude transversale des patients qui se sont présentés à l'hôpital avec une insuffisance cardiaque chronique à l'hôpital central de Yaoundé, à l'hôpital général de Yaoundé, au Centre Hospitalier et Universitaire de Yaoundé et à l'hôpital de district d'Efoulan. Nous avons inclus les patients présentant une insuffisance cardiaque chronique de plus de 18 ans, hospitalisés ou suivis en consultation externe de cardiologie au cours de la période de trois mois allant de février à avril. Les variables étudiées étaient les caractéristiques sociodémographiques, les caractéristiques cliniques et paracliniques, le pronostiques et la qualité de vie de ces patients. Pour le faire, nous avons obtenu l'approbation éthique et administrative, puis le consentement des patients. Le pronostic a été évalué à l'aide de l'indice de co-morbidité de Charlson tandis que la qualité de vie a été évaluée à l'aide du Minnesota living with heart failure questionnaire. La version 26 de SPSS a été utilisée pour la saisie et l'analyse des données, et une valeur p de 0,05 avec un intervalle de confiance de 95 % a été considérée comme statistiquement significative. Les tests de Pearson et de Mann-Whitney U ont été utilisés pour analyser les associations.

RÉSULTATS : Nous avons recruté un total de 86 patients. L'âge moyen des participants était de 62 ± 14,2 ans. La durée médiane d'évolution de l'insuffisance cardiaque était de 3,5[2-5]. La sédentarité était le principal facteur de risque cardiovasculaire, les étiologies les plus fréquemment retrouvées étaient la cardiopathie hypertensive (30,2%) et la cardiopathie ischémique (22,1%). La FEVG moyenne était de 39,13± 14,18% et plus de la moitié des

participants souffraient d'insuffisance cardiaque à fraction d'éjection réduite. 60,5 % de nos participants étaient au stade II de la NYHA. Les comorbidités de Charlson les plus prédominantes étaient le diabète (16,3 %) et la MRC (10,5 %). Le taux de survie moyen à 10 ans était de 51,30 ± 34,25 %, avec un taux de survie de 0 % pour 9,3 % des patients. Plus de la moitié des patients avaient une bonne qualité de vie (53,5 %) avec un score moyen de 30,06 ± 17,13. Nous avons observé qu'une augmentation du stade de la classification NYHA (coefficient bêta (β)=15,9 ; intervalle de confiance à 95 % (IC), 12,3-19,6), l'IC d'origine valvulaire (β=7,9 ; IC, 1,5-14,3), et la présence d'une maladie rénale chronique (β=16,1 ; IC, 9,5-22,7), étaient directement associés à une moins bonne qualité de vie. Nous avons également relevé que le pronostic des patients atteints d'IC était directement associé à la qualité de vie (β=2,0 ; IC, 0,6-3,4).

CONCLUSION : La majorité des patients avaient un bon pronostic et une bonne qualité de vie. La MRC est la seule comorbidité étudiée qui affecte de manière indépendante et négative la qualité de vie des patients atteints d'insuffisance cardiaque. En outre, nous avons déduit que plus la qualité de vie est médiocre, plus le pronostic est mauvais.

Mots-clés : Insuffisance cardiaque chronique, comorbidités, pronostic, qualité de vie, Yaoundé

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ABBREVIATIONS, INITIALS AND ACRONYMS

ACC:	American college of cardiology
ACE:	angiotensin-converting enzyme
ADH:	antidiuretic hormone
AF:	atrial fibrillation
AHA:	American heart association
AIDS:	acquired immune deficiency syndrome
ANOVA:	analysis of variance
ARB:	angiotensin II receptor blocker
ARN:	angiotensin receptor/neprilysin inhibitor
ASD:	atrial septal defect
AVB:	atrioventricular block
BB:	beta blockers
BNP:	brain natriuretic peptide
BP:	blood pressure
CHARM:	candesartan in heart failure assessment of reduction in mortality
CI:	cardiothoracic index
COPD:	chronic obstructive pulmonary disease
CHF:	congestive heart failure
CKD:	chronic kidney disease
DVT:	deep venous thrombosis
ECG:	electrocardiogram
EDV:	end diastolic volume
EF:	ejection fraction
ESC:	European society of cardiology
ESV:	end systolic volume
GFR:	glomerular filtration rate
HF:	heart failure
HFmrEF:	heart failure with mid-range ejection fraction
HFpEF:	heart failure with preserved ejection fraction
HFrEF:	heart failure with reduced ejection fraction
HJR:	hepato-jugular reflux
HRQoL:	health related quality of life

JVP:	jugular venous pressure
LBB:	left branch block
LQH:	left atrial hypertrophy
LV:	left ventricle
LVH:	left ventricular hypertrophy
MCS:	mechanical circulatory support
MR:	mitral regurgitation
MLWHF:	Minnesota living with heart failure
MRA:	mineralocorticoid receptor antagonist
NSAR:	non-steroidal anti-rheumatic drugs
NYHA:	New York heart association
PAH:	pulmonary arterial hypertension
PE:	pulmonary embolus
RBB:	right branch block
RVH:	right ventricular hypertrophy
SV:	stroke volume
T2DM:	type 2 diabetes mellitus
TAPSE:	tricuspid annular plane systolic excursion
TEE:	thrombo-embolic events
TNF:	tumour necrosis factor
TR:	tricuspid regurgitation
VAD:	ventricular assist devices
VES:	ventricular extrasystole
VSD:	ventricular septal defect

INTRODUCTION

Introduction

Heart failure (HF) is the inability of the heart to provide, under physiological conditions, sufficient blood for the body's needs. It is usually the end result of most cardiovascular diseases which is a real public health problem affecting about 26 million people worldwide with a prevalence of 1-2% of adults[1]. As studies only usually include recognized/diagnosed HF cases, the true prevalence is likely to be higher. The prevalence increases with age: from around 1% for those aged <55 years to >10% for those aged 70 years or over[2]. Studies in sub-Saharan Africa revealed that heart failure represented about 9.4-42.5% of medical admissions and 25.6-30.0% of all admissions into cardiology units.[3]. In Cameroon, a study done in 2017 which revealed a hospital prevalence of 40.8% with a mortality of 16.4%[4].

The recent advances in the management strategies of heart failure have led to an increase in life expectancy in those with heart failure but the mortality is still high, especially in sub-Saharan Africa.[3]. This has led to numerous research studies on the factors associated with mortality in patients with heart failure. Many factors were identified as factors influencing mortality. The time of diagnosis and treatment strategies play an important role in the prognosis of the patients[5]. Given the fact that most patients with heart failure are elderly who are usually prone to other diseases, many studies were done to find the role of co-morbidities in the prognosis of patients with HF[6]. Among Medicare beneficiaries with HF, about 50% have >5 non-cardiac comorbidities, a percentage that has increased dramatically over the last two decades[7]. These comorbidities are associated with higher overall quality of life and worse clinical outcomes. Also, numerous studies have shown the benefit of its management, both in the reduction of the frequency and severity of decompensations, the reduction in the frequency of hospitalizations, the reduction in the overall cost of management and the improving the quality of life of patients.

Many societies such as the American heart association, suggest the early diagnosis and management of comorbidities in patients with heart failure for a better overall outcome. It is in this sense that many studies were done to know which comorbidities affected the survival of patients with HF more, the quality of life, and the prognosis of patients with HF. As such, indices were developed including the Charlson co-morbidity score which was proven to have a significant predictive value for clinical outcomes[8]. In the same sense, the Minnesota Living with heart failure questionnaire was also developed to evaluate the quality of life of HF patients. Assessing the burden of co-morbidities on prognosis and quality of life of patients with heart failure was our aim in this study.

CHAPTER 1: PROBLEMATIC

1.1. JUSTIFICATION OF STUDY

Heart failure is a common cause of in-hospital death from cardiovascular disease in Africa. It represents the ultimate evolution of most cardiac pathologies. In recent years, a lot of progress has been made in the management of heart failure which could be the cause of the increase in prevalence especially in the ageing population. But the mortality and quality of life in this population have decreased significantly as this population is usually associated with other cardiovascular and non-cardiovascular comorbidities. These comorbidities tremendously affect the life expectancy and quality of life of patients with HF. It is in this light that we want to carry out this study to find the prevalence of these comorbidities of patients with HF in our milieu, evaluate the prognosis and determine which co-morbidities mostly affect the quality of life in patients with heart failure.

1.2. RESEARCH QUESTIONS

- How do co-morbidities affect quality of life and predict the survival of patients with heart failure?

1.3. OBJECTIVES

General objectives

- Assess the burden of co-morbidities on the prognosis and quality of life of patients with heart failure.

Specific Objectives

1) Describe the profile of patients with chronic heart failure.
2) Determine the outcome of patients with heart failure with co-morbidities.
3) Identify the factors affecting the quality of life of patients with heart failure.

1.4. CONCEPTUAL FRAMEWORK

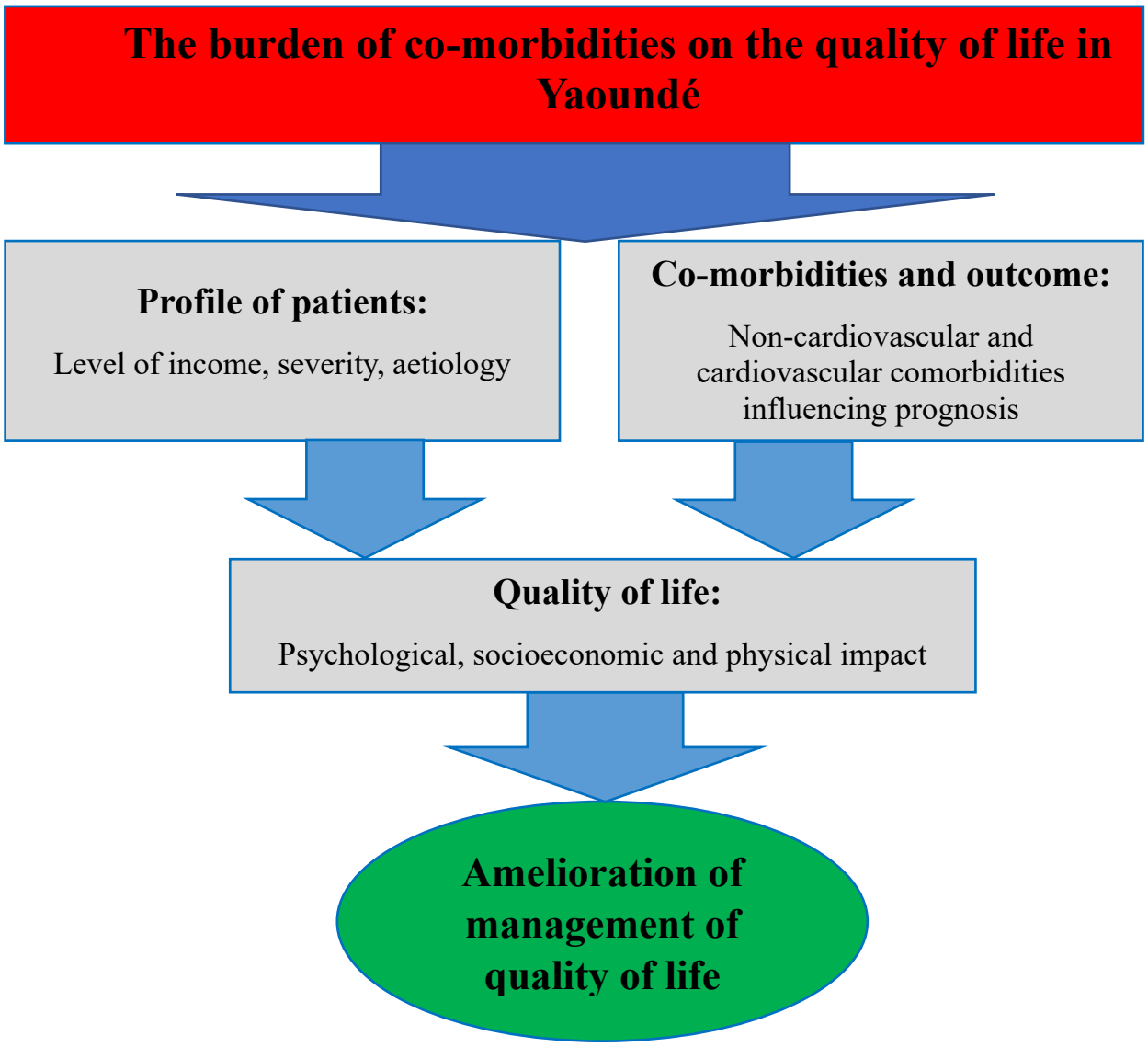

Figure 1: conceptual framework

1.5. DEFINITION OF TERMS

– **Heart failure**: this is a clinical syndrome associating specific or non-specific signs and symptoms, due to structural and/or functional abnormalities of the heart, resulting in high intracardiac pressures and/or insufficient flow during exercise and/or at rest. It is characterized by the presence of signs and symptoms grouped in the following table.

Table I: Signs and symptoms of heart failure

Symptoms	**Physical signs**
Typical	**More specific**
Dyspnoea	Elevated JVP
Orthopnoea	HJR
Paroxysmal nocturnal dyspnoea	Gallop rhythm
Exertional dyspnoea	Displacement of Apical heartbeat
Fatigue	
Pedal oedema	
Less Typical	**Less specific**
Nocturnal cough	Weight gain (>2kg/week)
Wheezing	Loss of weight (advanced HF)
Bloating	Cachexia
Loss of appetite	Heart murmurs
Confusion	Oedema in other extremities
Depression	Pulmonary crackles
Palpitation	Pleural effusion
Vertigo	Tachycardia
Syncope	Tachypnoea
Light-headedness	Cheyne-stokes respiration
	Hepatomegaly
	Ascites
	Arrhythmia
	Cold extremities
	Oliguria

- **Co-morbidity:** It is defined as the co-occurrence of more than one disorder in the same individual. The co-morbidities studied here are those of the Charlson comorbidity score which include Myocardial infarction, peripheral vascular disease, history of stroke, dementia, chronic obstructive pulmonary disease, connective tissue disease, peptic ulcer disease, liver disease, chronic kidney disease, hemiplegia, diabetes, solid tumour, lymphoma, leucemia and AIDS.

- **Prognosis:** According to Cambridge University, it is a doctor's judgment of the likely or expected development of a disease or a statement of what the likely future situation is. We evaluated the 10-year survival of patients using the Charlson comorbidity index.

Table II: charlson index and corresponding 10-year survival rate

Charlson index	10-year % survival (%)
0	**98**
1	**96**
2	**90**
3	**77**
4	**53**
5	**21**
6	**2**
>6	**0**

- **Quality of life**: It is a concept which aims to capture the well-being, whether of a population or individual, regarding both positive and negative elements within the entirety of their existence at a specific point in time. QoL differs from the public health measure health-related quality of life in that the latter is a measure that explores the connection between health and QoL. In this case, HF was the health condition. It was assessed here using the MINESSOTA LIVING WITH HEART FAILURE QUESTIONNAIRE, which has physical, socioeconomic, and emotional components to assess the impact of the disease on the daily lives of patients within a month.

Table III: MLWHF score and corresponding quality of life

MLWHF score	Quality of life
<24	Good
24-45	moderate
>45	poor

- **Chronic heart failure**: persistent heart failure syndrome over time (more than six months).

- **Stable chronic heart failure:** chronic heart failure syndrome, with the absence of clinical signs, or presence of clinical signs that can be managed on an outpatient basis, regardless of the value of the left ventricular ejection fraction.
- **Impact:** to have a strong effect or influence on a situation or person (Cambridge dictionary).

CHAPTER 2: LITERATURE REVIEW

2.1.KNOWLEDGE REVIEW ON HEART FAILURE

Definition

Heart failure is defined as the heart's inability to provide enough blood flow to meet the body's needs. At the physiological level, this results in abnormally high left ventricular filling pressures.

Intravascular pressure increases upstream of the heart, resulting in fluid accumulation in the lower limbs and the lungs. Any chronic or acute excess of the workload and any chronic or acute decrease in coronary perfusion can cause dysfunction of the left ventricle leading, in a few hours or several decades, to heart failure [1].

Heart failure is a syndrome (and not a disease) that can present in different forms and corresponds to the continuity of most cardiac pathologies. It is an extremely common condition in the elderly. The definition adopted by the European Society of Cardiology [1] is based on the presence of 3 criteria:

- presence of symptoms of heart failure (at rest or on exertion)
- associated with preferably echocardiographic evidence of systolic and/or diastolic (at rest) cardiac dysfunction.
- and in case of doubt, a favourable response to the usual treatment of heart failure, namely diuretics.

The first two criteria must be present to make the diagnosis.

Epidemiology

- An increasing prevalence

Heart failure is a major and growing public health problem. The global prevalence in the general population is estimated at 2%, in Europe it is between 1% and 2% with an incidence of 5/1000 in adults, while in Cameroon, a study conducted by Kuate *et al* found a hospital prevalence of 40.8%[2,4,12].

Note that this percentage increases rapidly with age. The average age of the population of heart failure is between 68-76 years, nevertheless, the spectrum of HF in Africa presents its particularities because it concerns a much younger population than that of developed countries[10]. Figure 2 below, [12] sures the world prevalence.

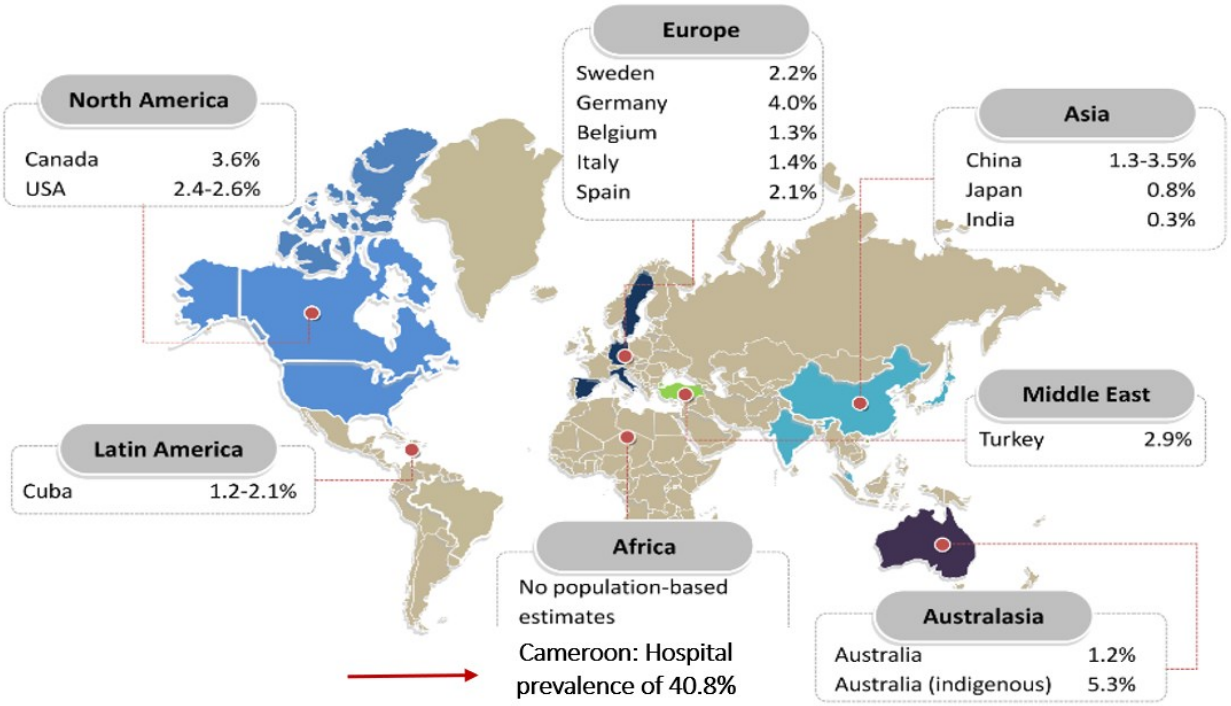

Figure 2: prevalence of heart failure in regions in the world

- High morbidity and mortality

HF is a pathology with a very poor prognosis. In stages III and IV, the prognosis for heart failure is bleak since one out of two patients dies within five years of diagnosis. In Morocco, there was an intra-hospital death rate of 6.1%, mainly patients over 55 years old[11]. In Cameroon, there was a prevalence of intra-hospital mortality of 18.45% in 2015 and 16.4% in 2018 with an average age of death of 67 years[4].

- Ageing population

This pathology is typically a disease that will affect the elderly. It has been observed that its incidence doubles every 10 years from the age of 45. It thus increases from 1% for those under 55 to more than 10% among those over 70[2].

- Economic Impact and Improvement of Care

This pathology consumes between 1 and 2% of all medical resources in developed countries. It is one of the main causes of hospitalization in adults in Cameroon. The impact mainly corresponds to the cost of hospitalizations estimated at 223,559 FCFA in sub-Saharan Africa (according to a Malian study), or about 7 times the minimum salary in Cameroon. It should continue to increase due to the gradual improvement in the survival of patients with severe heart disease, in particular

ischemic or hypertensive causes. The prevention of heart failure must therefore be a public health priority because this serious syndrome generally evolves into a severe form of disability[4,9,12].

RECALL

Anatomy

Dimensions, situation, and orientation:

The heart has the shape of a recumbent pyramid which would have fallen and rested on one of these faces[13]. Placed in the chest cavity, the apex of this pyramid projects forwards, downwards, and to the left, while the base is opposite the apex and projects backwards. The sides of the pyramid are:

- A lower diaphragmatic face on which the pyramid rests
- An anterior face (sternocostal) facing forward
- A right pulmonary side
- A left pulmonary side

The heart weighs between 250 and 350g, and lodges in the mediastinum (central cavity of the thorax). It extends obliquely from the second rib to the fifth intercostal space and measures 12 to 14 cm.

Layers of the heart:

The wall of the heart is made up of three tunics, all richly vascularized:

- The epicardium (external coat): is the visceral layer of the serous pericardium. It is often infiltrated by fat, especially in the elderly.
- The myocardium (muscle of the heart): forms the intermediate tunic. It is made up primarily of cardiac muscle cells and forms most of the mass of the heart.
- The endocardium: (internal tunic): is an endothelium (simple squamous epithelium) [13].

Cardiac cavities:

The heart contains four chambers: two atria in its upper part and two ventricles in its lower part. The partition that longitudinally divides the interior of the heart is called the interatrial septum where it separates the atria and the interventricular septum where it separates the ventricles. The right ventricle makes up most of the anterior surface of the heart. The left ventricle dominates the posteroinferior part of the heart and forms the cardiac apex.

Figure 3 shows the anterior view of the heart [14].

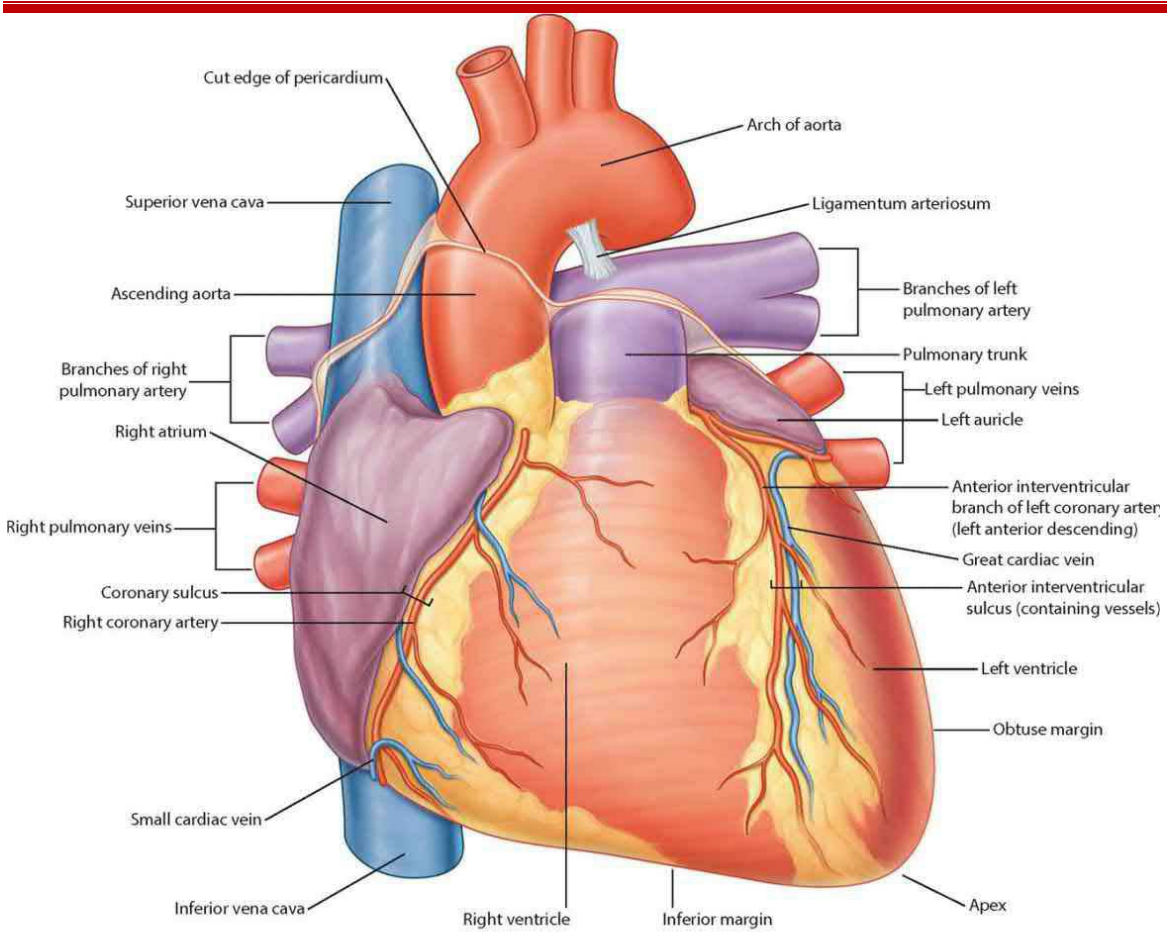

Figure 3: anterior view of the heart

Physiology

Mechanical phenomenon:

The heart is constantly animated by vigorous movements: the muscular tissue forming the wall of the atria and the ventricles contract to eject the blood, and then it relaxes so that these cavities fill up. The terms systole and diastole refer respectively to these successive phases of contraction and relaxation [15]. When they concern the atria and the ventricles, they correspond to the cardiac revolution. The different phases are:

- Ventricular filling
- Ventricular systole:
- Isovolumetric Relaxation:

Assuming that the heart beats 75 times per minute, the duration of the cardiac revolution is about 0.8 s, that is, 0.1 s for atrial systole, 0.3 s for ventricular systole, and 0.4 s for the period of complete

relaxation or phase of quiescence. Figure 5 shows ventricular function while figure 6 shows the volume-pressure diagram demonstrating changes in intraventricular volume and pressure during a cycle [15].

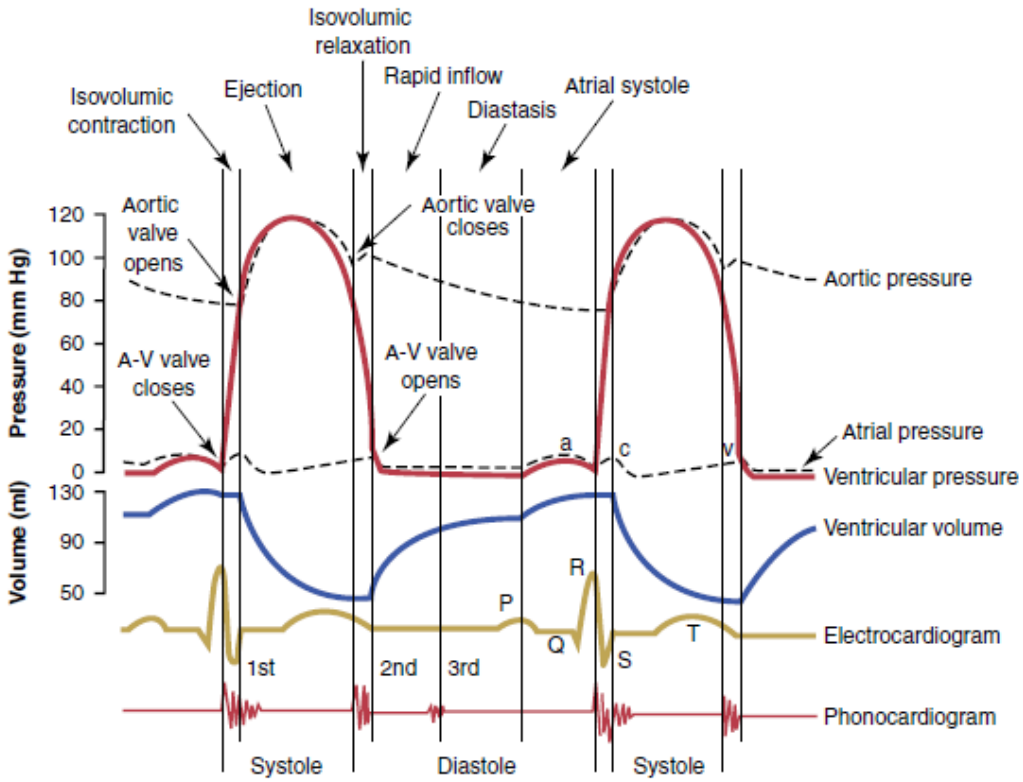

Figure 4: events of the cardiac cycle for left ventricular function

Electrical Phenomenon:

Normally, the ability to depolarize and contract the heart muscle is intrinsic, that is, it does not rely on the nervous system [15]. Indeed, even when detached from all its nerve connections, the heart continues to beat regularly, as can be seen during heart transplants. The fact remains that a healthy heart is largely supplied by neuro fibres of the autonomic nervous system which can modify the rhythm of the activity of the heart governed by intrinsic factors.

- Regulation of the basic rhythm: (conduction system of the heart)

The independent, but coordinated, activity of the heart is due to two factors: the presence of open junctions and the integrated control system of the heart. The conduction system of the heart is made up of non-contractile heart cells. Their function is to produce action potentials (impulses) and to propagate them in the heart so that the muscle cells depolarize and contract in a well-established order. Therefore, the heart beats as if it were only one cell.

- Course of excitation

These specialized cells are located in the following regions:

- The sinus node
- Atrioventricular node
- Atrioventricular bundle
- The right and left branches of the atrioventricular bundle
- The cardiac conduction myofibers of the ventricular walls.

The impulses travel through the heart in the order of this enumeration and follow the path indicated in yellow in the figure below[15].

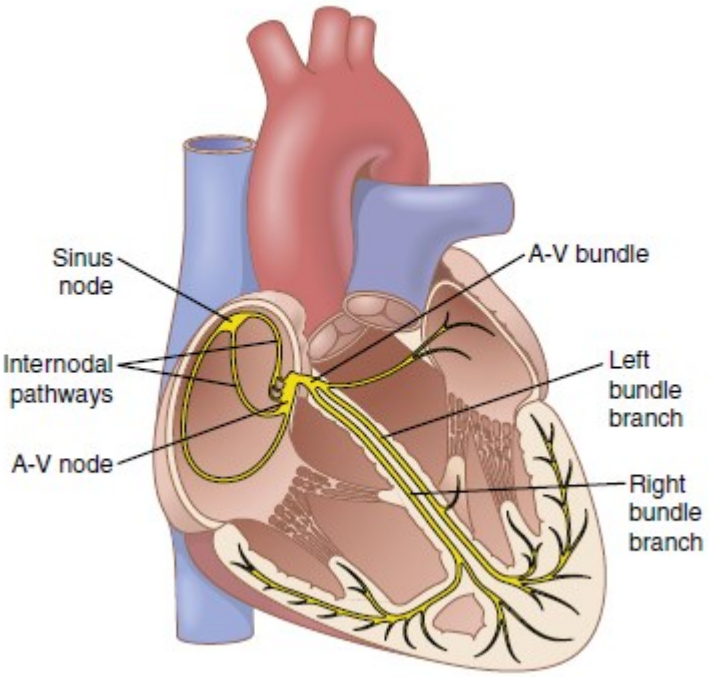

Figure 5: the electric system of the heart

It is the main quality of the normal VG to be able to adapt to the variations of the load conditions without increasing the filling pressures or lowering the volume ejected.

Pathophysiology

Heart failure is a clinical syndrome characterized by typical symptoms (e.g., dyspnoea, ankle swelling, fatigue) that may be accompanied by signs (e.g., elevated jugular venous pressure, pulmonary crackles, peripheral oedema) caused by a structural and/or functional cardiac abnormality, leading to a reduced cardiac output and/or elevated intracardiac pressures at rest or

during stress (definition according to the European Society of Cardiology, ESC 2016). Heart failure is present only when symptoms are apparent. The demonstration of an underlying cardiac dysfunction is essential for the diagnosis of heart failure [16–17]. This is usually a cardiac abnormality (e.g., myocardial infarction) causing systolic and/or diastolic ventricular dysfunction. Abnormalities of the valves (stenosis, regurgitation), pericardium, endocardium, heart rhythm/conduction or a combination of these alterations may also initiate heart failure. Identification of the pathophysiological mechanism leading to heart failure is crucial to choose adequate therapeutic options i.e., valve repair, treatment of rhythm disorders, and pharmacological treatment. The clinical severity of heart failure is graded according to the New York Heart Association (based on the clinical symptoms at various degrees of physical activity of the patient. The American College of Cardiology (ACC) and the American Heart Association (AHA) introduced a classification which combines clinical symptoms and the concomitant disease and risk factors to develop heart failure. The lifetime risk to develop heart failure is about one in five for a 40-year-old man in Europe or North America increases with age. Main risk factors are coronary heart disease, hypertension, diabetes mellitus, a family history of heart disease, obesity, chronic pulmonary diseases, inflammation or chronic infection, metabolic diseases, treatment with cardiotoxic agents (cocaine, anthracycline therapy in oncology e.g., doxorubicin, trastuzumab in the treatment of breast cancer) or alcohol abuse. Cardiotoxic agents may induce cardiotoxicity acutely, early onset chronically or late-onset chronically. Anthracycline-containing therapy leads to cardiotoxicity mostly within the first year and is associated with the given dose and the LVEF at the end of treatment. Early detection (echocardiographic strain imaging; cardiac biomarker troponin) and early treatment (ACE-I, ß Blocker, change in cancer treatment) of depressed cardiac function after anthracycline-induced cardiotoxicity is crucial for the recovery of the heart function. Heart failure is a progressive disease with an annual mortality rate of about 10%. The main causes of death are sudden cardiac death (>50%) or organ dysfunction due to hypoperfusion.

Classification:

Patients with heart failure may present with low or reduced ejection fraction (HFrEF: EF <40%; also, systolic heart failure), preserved ejection fraction (HFpEF: EF >50%; also, diastolic heart failure) or mid-range (HFmrEF: EF 40-49%) ejection fraction. Patients with HFpEF are more often older, female, and obese with a history of hypertension and/or atrial fibrillation. No evidence-based therapy to improve outcomes can be offered for patients with HFpEF.. Figure below shows aetiologies of heart failure [18].

Table IV: aetiologies of heart failure part 1

Systolic heart failure	Diastolic heart failure
Arterial hypertension	Arterial hypertension
Coronary artery disease	Diabetes mellitus
Valvular heart disease (Volume load)	Valvular heart disease (pressure load)
Arrhythmia	Hypertrophic cardiomyopathy
Inflammatory diseases	Restrictive cardiomyopathy
Idiopathic cardiomyopathy	Constrictive pericarditis (alcohol)
Toxic cardiomyopathy	Amyloidosis (storage disease)

Table V: aetiologies of heart failure part 2

Left-sided heart failure	Right-sided heart failure
Coronary artery disease	Coronary artery disease (right ventricle MI)
Hypertension	COPD
Myocarditis	Pulmonary hypertension
Heart valve disease	Pulmonary valve stenosis
Tachycardiomyopathy	Pulmonary embolism
	Tricuspidal regurgitation
	Pneumothorax
	Pericardial effusion

- **Genetic contribution to heart failure:**

Genetic contribution to the expression of heart failure is heterogeneous and complex[19]. Genomic variants and genetic predisposition influence the prevalence of risk factors (e.g., hyperlipidaemia, hyperglycaemia etc.) and causes of heart failure like coronary heart disease or dilated or hypertrophic cardiomyopathy (HCM). As genetic testing is more available and cheaper (next generation sequencing, NGS) it is also part of routine work up in special cases (e.g., HCM, familial heart failure syndrome). More than 100 genes have been identified to be connected with the occurrence of cardiomyopathies. Due to the specific morphological and functional phenotypes, cardiomyopathies can be clinically divided in five different groups, i.e., dilated cardiomyopathy (DCM), HCM, restrictive cardiomyopathy (RCM), arrhythmogenic right ventricular cardiomyopathy (ARVC), and non-classified cardiomyopathies as the left ventricular non-compaction cardiomyopathy. These forms may occur as familial (genetic) or non-familial

(nongenetic) entity. Genetic profiles may influence risk and prognosis as well as therapeutic options of heart failure e.g., defibrillator implantation in high-risk mutations for hypertrophy. Heart failure patients should also be asked for family history of the disease or the occurrence of sudden death. In the current ESC guidelines genetic testing is recommended when the prevalence of detectable mutations is sufficiently high and consistent to justify routine targeted genetic screening.

- Activation of compensatory mechanisms Neurohumoral activation

To overcome the impaired metabolic situation (central/ heart, peripheral) following reduced cardiac function or increased cardiac load several compensatory mechanisms will be activated i.e., activation of the neurohumoral system (renin-angiotensin-aldosterone-system (RAAS), sympathoadrenergic system) as well as adaptive mechanisms on the cellular and molecular level. In consequence, the muscle sympathetic nerve traffic is increased in HFrEF, HFmrEF and HFpEF. Catecholamines increase via ß-adrenoceptor activation of intracellular calcium and thus the contractility; however, in a long run catecholamines also increase myocardial oxygen demand, predispose life-threatening arrhythmias and activate signalling pathways of hypertrophy and cell death. In consequence, cardiac function further deteriorates and is associated with outcomes outcome (vicious circle). The permanent neurohumoral activators affect cell expression and cell function e.g., the stretch-induced force generation (Frank-Starling mechanism frequency-induced force generation (Bowditch, effect) and interstitial and structural cell-interaction (hypertrophy, fibrosis), and is a predictor of mortality in heart failure[20,21].

- Pressure-volume relationship

The left ventricular function is dependent on myocardial contractility, preload (diastolic filling volume and maximal stretch length), and afterload (resistance of the peripheral vasculature, aortic compliance). The Frank-Starling mechanism is the ability of the heart to change its contractile force and thus increase stroke volume due to elevated preload. On a cellular level, it is dependent on the length (sarcolemmal)-tension (-force) relationship. This relationship may change depending on the heart failure situation and may also reach a plateau when the heart is no further able to increase force following increased stretch. Part of the Frank-Starling mechanism is also the crosstalk of right and left ventricular function. Through shared myocardium (the interventricular septum and the common pericardium) the left ventricular contraction influences pressure development in the right ventricle; loading of the right ventricle (volume or pressure) is affecting the stretch of myocytes involved in left ventricular function. The force generation of the left ventricle is thereby influenced by preload of the right heart. In addition, the pressure and volume changes during a heart circle are described by the pressure-volume diagram. The ventricular filling pressure increases when venous

return fills the chamber (preload). The stroke volume will be dependent on preload, afterload, and inotropy and is described as pressure-volume loop.

- Structural changes

Chronic or acute injury (e.g., myocardial infarction) as well as overload (a volume, pressure) of the heart will initiate structural and subsequent functional changes. In consequence physiological (mostly reversible) or pathological (e.g., fibrosis) adaptations and involves cardites (hypertrophy, apoptosis, necrosis), fibroblasts (proliferation), endothelium and interstitium (extracellular matrix). These adaptive or maladaptive processes are the same, independent of the underlying pathological mechanism and involve the entire heart. Additionally, activation of the neurohumoral systems (angiotensin II, endothelin I, vasopressin), hemodynamic changes, or systemic inflammation (proinflammatory mediators IL 1, IL 8, TNFα) may act as modifiers. Structural changes involve ventricular hypertrophy (ventricular mass), chamber dilatation, disorganization of cardiomyocytes, and consequently the wall tension increases accompanied by a reduction of the subendocardial perfusion. These processes may further deteriorate cardiac function (vicious circle) (Figure 8).

- Baroreceptor stimulation

Following impaired contractility, the sympathoadrenergic system, the RAA (renin-angiotensin-aldosterone)-system and the release of vasoactive peptides (natriuretic peptides) are stimulated (Figure 8). Measures for increased tone are in the carotid sinus, aortic arch and in the left ventricle. These systems intend to increase preload via increasing circulatory fluid (antidiuretic hormone arginine), enhance afterload (sympathetic vasoconstriction of kidney, vasculature, skeletal muscle via α1-receptors) and increases thereby perfusion redistribution. Also, these systems initiate a positive inotropic (ß1–mediated intracellular cAMP and calcium-increases) and chronotropic (heart rate increase) effect as well as peripheral vasoconstriction (α1-receptors). [20].

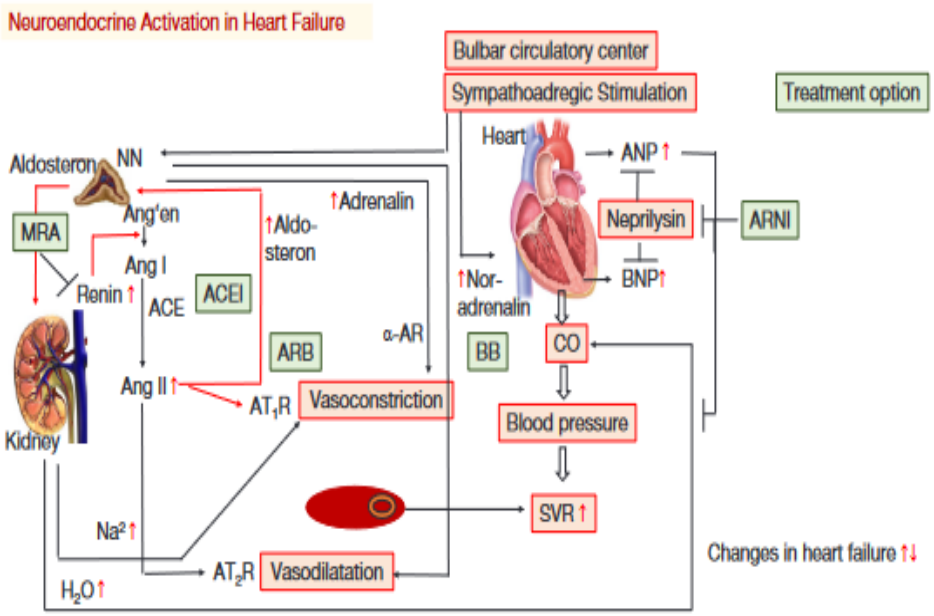

Figure 6: compensatory mechanisms of the body to HF

Clinical Presentation

Left heart failure.

- **Symptoms**
  - Dyspnoea = main symptom

The main symptom of the disease is dyspnoea. It generally begins with effort and then worsens during the evolution of the pathology to be present at rest; first in a lying position then it becomes permanent.

Dyspnoea should be graded according to the NYHA (New York Heart Association) classification:

- Class I: the patient is asymptomatic both at rest and during ordinary physical activity. Dyspnoea appears for unusual major efforts; no discomfort is felt in everyday life.

- Class II: the patient is moderately limited in physical activity, but asymptomatic at rest. Dyspnoea appears with usual heavy exertion, such as brisk or uphill walking or climbing stairs (> 2 floors).

- Class III: the patient is limited in his ordinary activity, but asymptomatic at rest. Dyspnoea appears for low intensity efforts of everyday life, such as walking on flat ground or climbing stairs (≤ 2 floors).

- Class IV: the patient is symptomatic at the slightest effort, and sometimes even at rest. Dyspnoea can be permanent at rest.

  - Decubitus dyspnoea or orthopnoea

This is dyspnoea occurring in the lying position, partially improved by the semi-sitting position due to the reduction in venous return.

It often follows an increasing phase of exertional dyspnoea but may be the first symptom in sedentary subjects,

Results in a feeling of difficulty breathing in decubitus, which forces the patient to sleep in a half-sitting or sitting position and can be assessed by the number of pillows used.

Orthopnoea is a sign of gravity of heart failure.

- Paroxysmal nocturnal dyspnoea:

It is a dyspnoeic attack occurring during the night, often accompanied by fits of coughing without expectoration, forcing the patient to get up.

- Cardiac asthma:

It is a predominantly expiratory bradypnea, wheezing, where cough and sputum are often absent. It is secondary to congestion of the bronchial wall.

- Cheyne-Stockes dyspnoea:

Cyclic in 5 phases with respiratory pause and drowsiness. It reflects hypo cerebral output.

- Cough:

Sometimes without any dyspnoea, on exertion or at night.

• Neuropsychic signs (anxiety, confusion), often present at the final stage of the disease, reflecting cerebral hypoperfusion.

• Alteration of general condition with asthenia, weight loss and anorexia.

- Physical signs
  - Cardiac signs:

Palpation: apex beat, spread and lowered in case of cardiomegaly

Auscultation:

- frequent, irregular tachycardia in case of arrhythmia

- left galloping noise: fundamental sign to look for carefully at the apex or at the endapex in left lateral decubitus; This is an added noise that can be proto diastolic (B3) or end diastolic (B4) or summation.

- frequent systolic murmur of mitral regurgitation, especially during attacks.

- snapping of B2 at the pulmonary focus, indicating the existence of pulmonary arterial hypertension. Blood pressure is normal for a long time, but often low, especially in severe forms due to the decrease in cardiac output. Differential blood pressure is pinched.

• Pulmonary signs:

Percussion can reveal liquid pleural effusions which are frequent, often bilateral and of variable abundance.

Pulmonary auscultation may show crackles or sub-crepitating rales localized to the bases or more extensive, sometimes wheezing.

• Other signs:

- Oliguria is generally late and is the prerogative of severe forms; it reflects the decline in renal blood flow and is often accompanied by impaired renal function.

The clinical diagnosis is more difficult in the elderly, especially because of comorbidities. On the one hand, dyspnoea may be common to different conditions, on the other hand, it may not appear due to the functional limitation caused by another pathology. Nevertheless, orthopnoea retains a good orientation value for the cardiac origin of dyspnoea even in the elderly [22–24].

Right heart failure

- Symptoms:

- exertional hepatalgia: heaviness-like pain, occurring on exertion, located in the epigastrium or in the right hypochondrium, giving way when the effort is stopped, sometimes accompanied by digestive disorders.
- Spontaneous hepatalgia.
- permanent hepatalgia in advanced forms.
- dyspnea is frequently encountered, related to associated left ventricular failure or a causal pulmonary pathology

- physical signs:
  - cardiac signs

On palpation: Harzer's sign, infundibulo-pulmonary systolic elevation.

On auscultation: tachycardia, xyphoid gallop sound, systolic murmur of tricuspid regurgitation, burst of the 2nd sound in the pulmonary focus in the event of pulmonary arterial hypertension.

  - peripheral signs

- Spontaneous turgidity of the jugular veins.
- Sensitive, even painful hepatomegaly, of firm consistency with a soft lower edge, giving rise to hepato-jugular reflux. The liver is expansive in systole in case of tricuspid insufficiency.
- Edema of the lower limbs white, soft, taking the pit, bilateral, predominant in the dependent parts, responsible for weight gain.

- At an advanced stage, anasarca with ascites, pleural effusion, edema of the lower limbs [25].

Global heart failure

It is an association of both left and right HF.

Paraclinical exams

Any heart failure must have an initial assessment including at least an electrocardiogram, a chest X-ray, a biological assessment and a heart ultrasound. Other exams are discussed on a case-by-case basis.

- **Biological examinations:**

- The dosage of BNP (B-type natriuretic peptide) and NT-proBNP (precursor of BNP) has a dual interest both diagnostic and prognostic: heart failure is suspected for an NT-proBNP greater than or equal to 125pg /mL and a BNP level greater than or equal to 35pg/Ml[26].
- Liver function abnormalities (cytolysis, cholestasis) are observed in cases of cardiac liver with sometimes haemostasis disorders (spontaneously low TP) due to end-stage hepatocellular insufficiency.
- Cardiac decompensation may be accompanied by a moderate elevation of troponin.
- Anaemia, on Complete blood count, which is a factor favouring cardiac decompensation, must be sought as well as serum ferritin and transferrin saturation coefficient in search of iron deficiency
- The examination will also focus on looking for an abnormality in serum sodium and/or serum potassium, often due to the treatment, and associated renal failure favoured by the low renal flow and the treatment [2].

- **Morphologic exams:**

- **Frontal chest X-ray:**

The cardiac silhouette:

- Cardiomegaly with a cardio-thoracic index greater than 0.50.
- Elongated lower left arch with sub-diaphragmatic point.
- Convex left mid arc indicating left atrial dilation or PAH
- Right overhang with appearance in double contour testifying to a dilation of the left auricle.
- A normal cardiac silhouette does not exclude the diagnosis of heart failure.
- Straight overhang (dilation of the right auricle).
- Convex upper right arch (dilation of the superior vena cava)

The cardiac lung:

The radiological signs are graded according to the elevation of the pulmonary venocapillary pressures:

- Stage 1: dilation of the upper lobar pulmonary veins (redistribution of venous blood to the apices)
- Stage 2: interstitial oedema: Enlargement of the pulmonary hiles Filling of fissures Frequent pleural effusion Kerley lines
- Stage 3: alveolar oedema: fluffy opacities, poorly limited, bilateral, predominantly peri-hilar. After this stage with can have pleural effusions[27].

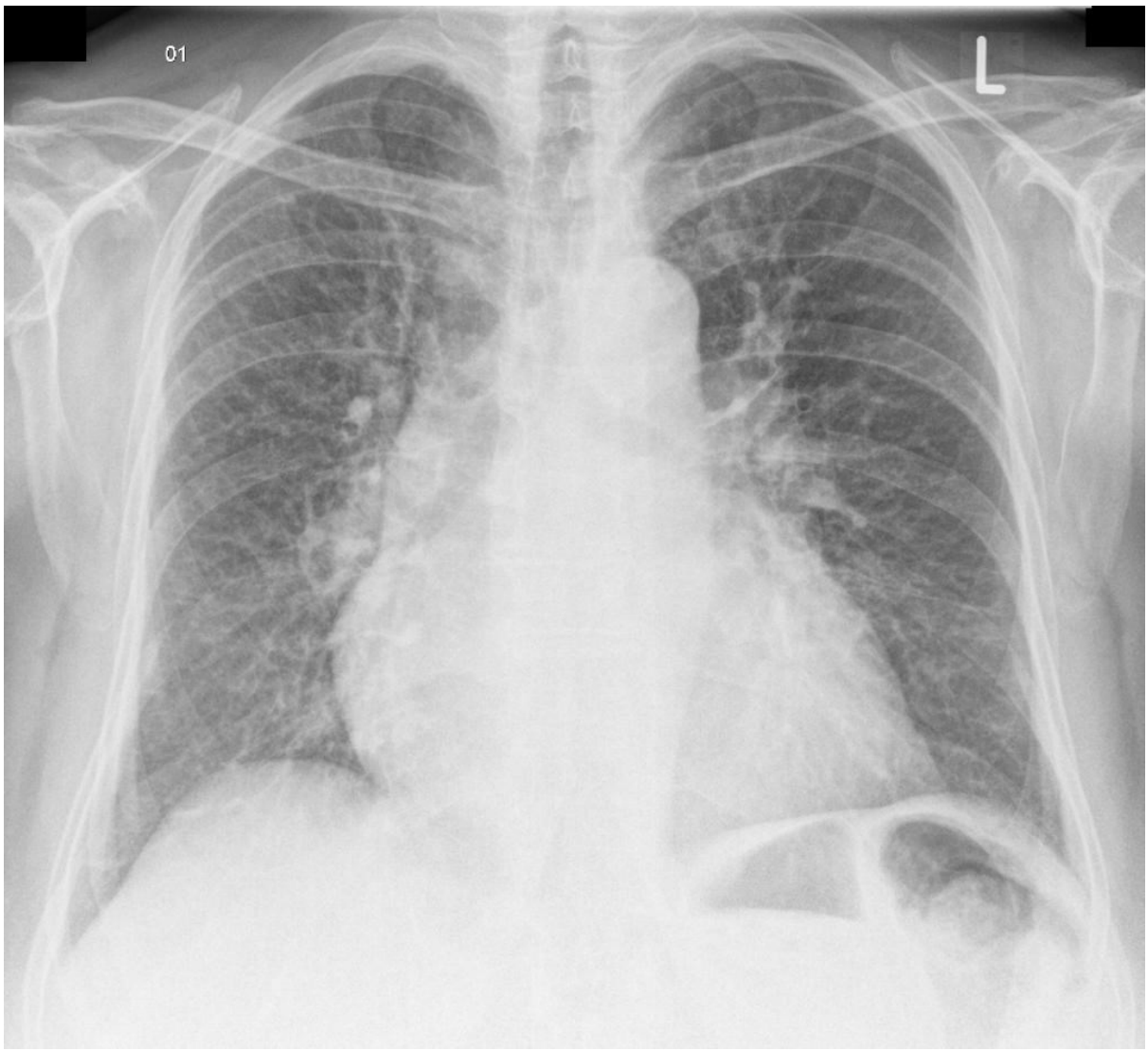

Figure 7: x-ray showing pleural effusion in HF (Case courtesy of Roberto Schubert rID: 18991)

- **The electrocardiogram (ECG):**

ECG changes are common in patients with heart failure:

- Signs of atrial or left ventricular overload.
- Intraventricular conduction disorders, in particular left bundle branch block.

- The ECG can sometimes guide towards an aetiology: Q wave in case of myocardial necrosis.
- ECG is essential to detect atrial fibrillation or flutter[28,29].

- **Heart Ultrasound:**

It is the key examination allowing the positive diagnosis, very often the etiological diagnosis, and the prognostic evaluation. This examination allows the positive diagnosis by detecting a systolic dysfunction (decreased left ventricular ejection fraction) and/or a diastolic dysfunction (raised left ventricular filling pressures). It measures the ejection fraction of the left ventricle and therefore distinguishes heart failure associated with systolic dysfunction of the left ventricle from heart failure with preserved systolic function (LVEF > or = 50% and elevations in blood pressure). left ventricular filling).

Measure:

- left ventricular diameters and volumes.
- cardiac output.

Study:

- valvular: structure in two-dimensional mode, regurgitant valvulopathies in color Doppler mode, regurgitant and stenosing valvulopathies in pulsed and/or continuous Doppler mode.
- right cavities, estimation of pulmonary pressures; pericardium[30]**.**

- **Right and left cardiac catheterization and left coronary catheterization**
  - **Right heart catheterization:**

Invasive examination, venipuncture. It allows the measurement:

- central venous, right ventricular, and pulmonary pressures (systolic, diastolic and mean pulmonary arterial pressure).
- pulmonary capillary pressure.
- cardiac output and pulmonary arteriolar resistance. Right heart catheterization is not systematic and is performed less and less. It is indicated in a few situations such as the diagnosis of pre-capillary pulmonary hypertension, suspicion of constrictive pericarditis, and very rarely during valvulopathy in case of diagnostic doubt if ultrasound is not contributory.

  - **Left coronary catheterization.**

There are two entities in left coronary catheterization which are;

- **left ventricular angiography (or ventriculography)**

Invasive examination, involving arterial puncture.

It permits:

- the study of the systemic and left ventricular pressures (catheterization).

- measure the ejection fraction of the LV and study the segmental systolic function of the LV (ventriculography).

- **Coronary angiography**

It permits the study of the coronary network. It is carried out only in case of suspicion of ischemic heart disease[31].

- **Cardiac magnetic resonance imaging (MRI):**

- Allows in case of non-contributory echocardiography (low echogenic patients):

- Measurements of left ventricular volumes, LVEF, and LV mass.

- The study of segmental systolic function, perfusion, and late enhancement.

- To help in the etiological diagnosis: congenital heart disease, tumours, myocarditis, arrhythmogenic dysplasia of the right ventricle, sequelae of infarction, etc.

- **Stress test:**

In clinical practice, exercise testing has limited diagnostic value. However, normal exercise capacity in an untreated patient makes the diagnosis of heart failure unlikely. The interest of the effort evaluation is in fact mainly prognostic.

The metabolic stress test is a stress test coupled with the measurement of gas exchange with in particular the measurement of the peak of oxygen consumption (peak of VO2). A low VO2 peak (recall < 10 mL/kg/min) is a poor prognosis, while a higher VO2 peak (recall > 18 mL/kg/min) identifies patients at lower risk of mortality.

The 6-minute walk test consists of measuring the distance covered by the patient for 6 minutes. A short distance travelled is associated with a poor prognosis[32].

Decompensation factors

Chronic heart failure assumes a longer and slower course over weeks, months, or even years, during which coping mechanisms have time to develop [33]. Patients may remain asymptomatic or minimally symptomatic for a long time. Patients may remain asymptomatic or minimally symptomatic for a long time. Then, heart failure often progresses by flare-ups during which signs of water and sodium retention or peripheral hypoperfusion appear, interspersed with phases of

relative stability. These episodes are often favoured by aggravating factors that it is essential to seek systematically:

• Anaemia

• Interruption of treatment or departure from the low-salt diet

• The occurrence of arrhythmias, first and foremost atrial fibrillation, which is also a common cause of an acute attack.

• Infections

• A flare of acute myocardial ischemia.

• Finally, certain associated pathological states (fever, anemia, pregnancy, onset of hyperthyroidism or renal insufficiency) can promote an acute attack by increasing cardiac work or blood volume[34,35].

➢ **Differential diagnosis**

- **Left heart failure**:

Mainly dyspnoea:

• Psychogenic dyspnoea

• Of pulmonary origin (COPD, asthma, pleurisy, pneumothorax, foreign body).

• Of neuromuscular origin (amyotrophic lateral sclerosis, myasthenia gravis,)

• Anaemia, dehydration, hyperthermia…

• Sinemateria dyspnoea: diagnosis of elimination

- **Right heart failure**:
  - Faced with painful hepatomegaly:

Other causes of painful hepatomegaly: primary or secondary tumoral liver, infectious liver (hepatitis, hepatic amoebiasis, hydatid cysts), cirrhosis

- In front of oedemas:

Oedema of the lower limbs of non-cardiac origin: renal, hepatic, chronic venous insufficiency, lymphatic involvement, neoplastic obstacle, malabsorption syndrome (hypoalbuminemia) [35].

➢ Treatment

Curative

The curative treatment of chronic heart failure has three goals:

- Relieve symptoms and improve quality of life.
- Slow down or stop the progression of the disease.

- Improve the prognosis.

- Patient education, self-care, and lifestyle advice

Adequate patient self-care is essential in the effective management of HF and allows patients to understand what is beneficial, and to agree to self-monitoring and management plans. HF patients who report more effective self-care have a better QOL, lower readmission rates, and reduced mortality. Misunderstandings, misconceptions, and lack of knowledge all contribute to insufficient self-care and therefore patient education is vital. Improving patients' knowledge of their condition is fundamental for the development of self-care skills. Education to improve self-care should be tailored to the individual patient and based on, where available, scientific evidence or expert opinion. There is little evidence that specific lifestyle advice improves QOL or prognosis; however, providing this information has become a key component of education for self-care.

- **Pharmacologic treatment[2]**

Different classes of drugs can be used depending on the type and severity of heart failure. These include;

- ACE inhibitors
- Angiotensin II Receptor Antagonists (ARB II)
- Beta blockers (BB)
- Diuretics
- Mineralocorticoid receptor antagonists
- Digitalis
- Antiarrhythmics
- Anticoagulants
- Positive inotropic treatments
- Sodium-glucose co-transporter 2 inhibitors
- Cyclic nucleotide-gated channel blocker
- Combination Hydralazine and Isosorbide dinitrate

- Non-pharmacologic treatment[2]

Cardiac resynchronization:

It is recommended for symptomatic patients with HF in sinus rhythm with QRS duration ≥150ms and left bundle branch block and with LVEF ≤35% despite OMT to improve symptoms and reduce morbidity and mortality.

- The implantable automatic defibrillator:

A defibrillator is recommended to reduce the risk of sudden death and all-cause mortality in patients who have recovered from a ventricular arrhythmia causing hemodynamic instability, and who are expected to survive for > 1 year with good functional status, unless the ventricular arrhythmia occurred <48 h after an MI.

• Surgical treatment:

Its purpose is to set up temporary circulatory support methods pending transplantation in advanced cases, or recovery in certain situations.

- Cell therapy
- partial left ventriculotomy (Batista operation)
- Cardiomyoplasty
- Heart transplant

- Indications
  - Heart failure with reduced ejection fraction: Management is as shown in figure below[2].

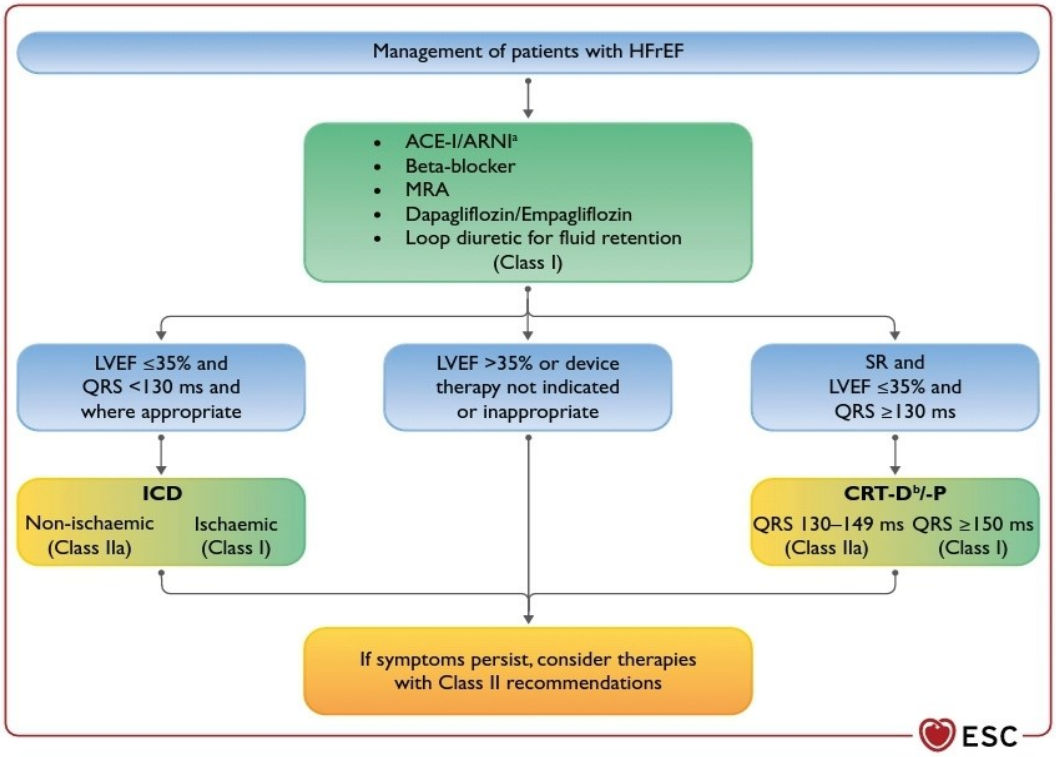

Figure 2 Therapeutic algorithm of Class I Therapy Indications for a patient with heart failure with reduced ejection fraction. ACE-I = angiotensin-converting enzyme inhibitor; ARNI = angiotensin receptor-neprilysin inhibitor; CRT-D = cardiac resynchronization therapy with defibrillator; CRT-P = cardiac resynchronization therapy pacemaker; ICD = implantable cardioverter-defibrillator; HFrEF = heart failure with reduced ejection fraction; MRA = mineralocorticoid receptor antagonist; QRS = Q, R, and S waves of an ECG; SR = sinus rhythm. [a]As a replacement for ACE-I. [b]Where appropriate. Class I = green. Class IIa = Yellow.

Figure 8: algorithm for management of patient with HFrEF

The class 1 drugs as recommended in HFrEF are as shown in table below[2].

Table VI: class 1 drugs recommended in HFrEF

Recommendations	Class[a]	Level[b]
An ACE-I is recommended for patients with HFrEF to reduce the risk of HF hospitalization and death.[110–113]	I	A
A beta-blocker is recommended for patients with stable HFrEF to reduce the risk of HF hospitalization and death.[114–120]	I	A
An MRA is recommended for patients with HFrEF to reduce the risk of HF hospitalization and death.[121,122]	I	A
Dapagliflozin or empagliflozin are recommended for patients with HFrEF to reduce the risk of HF hospitalization and death.[108,109]	I	A
Sacubitril/valsartan is recommended as a replacement for an ACE-I in patients with HFrEF to reduce the risk of HF hospitalization and death.[105]	I	B

ACE-I = angiotensin-converting enzyme inhibitor; HF = heart failure; HFrEF = heart failure with reduced ejection fraction; LVEF = left ventricular ejection fraction; MRA = mineralocorticoid receptor antagonist; NYHA = New York Heart Association.
[a]Class of recommendation.
[b]Level of evidence.

- **Heart failure with slightly reduced ejection fraction:**

  Drug usage in the management of HFmEF are as shown in table below[2].

Table VII: pharmacologic treatment indicated in HFmEF

Recommendations	Class[a]	Level[b]
Diuretics are recommended in patients with congestion and HFmrEF in order to alleviate symptoms and signs.[137]	I	C
An ACE-I may be considered for patients with HFmrEF to reduce the risk of HF hospitalization and death.[11]	IIb	C
An ARB may be considered for patients with HFmrEF to reduce the risk of HF hospitalization and death.[245]	IIb	C
A beta-blocker may be considered for patients with HFmrEF to reduce the risk of HF hospitalization and death.[12,119]	IIb	C
An MRA may be considered for patients with HFmrEF to reduce the risk of HF hospitalization and death.[246]	IIb	C
Sacubitril/valsartan may be considered for patients with HFmrEF to reduce the risk of HF hospitalization and death.[13,247]	IIb	C

- **Heart failure with preserved ejection fraction:**

Table VIII: recommendations in management of HFpEF

Recommendations	Class[a]	Level[b]
Screening for, and treatment of, aetiologies, and cardiovascular and non-cardiovascular comorbidities is recommended in patients with HFpEF (see relevant sections of this document).	I	C
Diuretics are recommended in congested patients with HFpEF in order to alleviate symptoms and signs.[137]	I	C

Table below shows recommendations in managing HFpEF[2].

- **Etiologic management**

In case of diagnosis of heart failure, it is imperative, at the same time as the symptomatic treatment, to consider, whenever possible, the etiological treatment of a possibly curable cause. This treatment can be:

- The treatment of hypertension.
- Myocardial revascularization (by angioplasty or coronary bypass) in the event of severe coronary artery disease with myocardial ischemia and/or proven viability on non-invasive tests (stress ECG, myocardial scintigraphy, echocardiography under dobutamine).
- Diagnosis and surgical treatment of left ventricular aneurysm post myocardial necrosis.
- Early surgical treatment of valve disease or prosthetic valve dysfunction.

2.1.10.2. **Prevention of heart failure**

- Primary prevention:

The management of risk factors for coronary heart disease is therefore essential: smoking cessation should be encouraged as much as possible as well as the practice of regular physical activity. Hypertension must be treated, but also dyslipidaemia and diabetes, with the implementation of appropriate lifestyle and dietary rules.

Prophylactic treatment of acute articular rheumatism.

- Secondary prevention:

Once heart failure is diagnosed, the first goal of treatment will be to correct or manage the cause(s) in order to prevent the progression of the disease. This is, as far as possible, the treatment of coronary artery disease, the surgery of valvulopathy, the treatment of dysthyroidism, the cessation of alcohol intoxication, for example. When the underlying cause cannot be corrected or when no cause is found, the management of heart failure is based on the application of a drug treatment that is now well codified, particularly in heart failure at impaired systolic function[36].

2.1.11. Prognosis and outcome

At the present time, optimization of guideline-directed chronic HF therapy remains the only definitive therapy for HFrEF patients to reduce early death and hospitalization. It is a matter of debate whether patients with longer duration of CHF are those who are better tolerating this condition or respond better to therapy and have prognosis or whether they are representing patients with long-standing clinical signs and symptoms with more advanced disease, higher non-cardiac co-morbidity load, and poorer outcomes. Data from the SHIFT trial have shown that the duration between the onset of HF signs and symptoms to treatment initiation has a substantial effect on clinical outcomes. Patients with worsening CHF and long-standing symptoms, requiring mechanical circulatory support, had worse outcomes compared with acute or sub-acute HF. In turn, better clinical outcomes were observed in HF patients receiving cardiac resynchronization therapy early after developing symptoms compared with those with longer symptoms duration. Heart failure is associated with a high burden of cardiac and non-cardiac co-morbidities, and HF patients with co-morbidities such as chronic kidney disease or diabetes are at higher risk.

The Charlson comorbidity index is a validated score to estimate mortality in patients with multiple comorbidities. It has been proven to have a significant predictive value for clinical outcome in HF and could be helpful in estimating outcome in HF patients[5,37].

2.2. QUALITY OF LIFE

The World Health Organization (WHO) established the definition of health as "the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" in 1948. Since then, QoL has been given more consideration in both clinical practice and scientific study. "Health-related quality of life" (HRQoL) restricts QoL to elements that are related to health. However, there is no widely accepted definition of HRQoL because it is a broad and multifaceted topic. Most definitions of HRQoL centre on two factors. First of all, it is a complex idea that might be considered a latent construct. It outlines the psychological, social, role-functioning, physical, and

biological components of health and functioning. Second, unlike QoL, HRQoL allows for both objective and subjective viewpoints within each domain (Testa and Simonson 1996). The objective evaluation, which emphasizes what the person can perform, is crucial in determining the level of health. The subjective evaluation of quality of life takes into account what it means to the individual; in essence, it entails the appraisal of the more objective measurement of health condition into the experience of QoL. People with the same objective health status can report quite variable subjective QoL, which is explained by differences in evaluation**[38]**.

2.2.1. HRQoF in Heart Failure:

By limiting the patient's independence and capacity for daily tasks, HF can significantly lower their quality of life (QoL). It can also negatively impact their mental health and emotional well-being. As such, different questionnaires were devised to evaluate the quality of life.

QUESTIONNAIRES for HRQoF in HF[39]:

Minnesota Living with Heart Failure Questionnaire:

The MLHFQ consists of 21 questions specific to heart failure and appraises HR-QoL over the period of the previous month. Questions are answered using a Likert scale of 0–5; 0 indicates that the question has no impact on the patient or is not applicable, and 5 indicates the greatest adverse effect. The questionnaires can be divided into three domains: overall QoL domain (score range 0–105), the physical domain consisting of eight questions (score range 0–40), and the emotional domain made up of five questions (score range 0–25). A higher score represents a poorer HR-QoL. The authors recommend the overall total score as the best measure as opposed to the other two domains, which were created following factor analysis. An overall score of less than 24 denotes a high quality of life, between 24 and 45, a moderate quality of life, and beyond 45, a low quality of life. Additionally, the combined scores for the physical and emotional components were determined and divided into three levels: good, middling, and bad. These classifications represented each dimension's level of functionality. A score of less than nine indicates good physical functioning, a number between nine and seventeen indicates intermediate physical functioning, and a score of more than seventeen indicates poor physical functioning. Scores below 6, between 6 and 11, and above 11 on the emotional component indicated good, moderate, and poor emotional levels, respectively.

Validity of tool[40]:

Following Mapi Linguistic Validation Guidance of a Clinical Outcome Assessment, the Arabic version of the English-language original instrument was created. Four faces were necessary for the

translated tool's validation. Forward translation occurs in phase one, and backward translation occurs in phase two. In order to evaluate the questionnaire and ensure that it would maintain its objectivity, the research tool underwent meticulous revision and forward and backward translation by Arabic and English experts.

In order to assess the accuracy of the translation from a nursing perspective, the tool was also presented to a panel of nine experts in the field of medical-surgical nursing; the item-content validity index was 0.95. Phase three involves testing the tool's viability, clarity, and application using a pilot trial on 25 patients (10% of those with heart failure). It took about 15 minutes to finish the questionnaire. The patients thought the instrument was understandable and identified no need for alterations or adjustments. The final step was proofreading to find any grammatical, spelling, or typing problems. Furthermore, the internal consistency (Cronbach's alpha = 0.983) was very high.

EuroQoL 5D-3L:

The EQ-5D-3L is a generic health questionnaire, which is composed of two parts. The first part, the health score, assesses the patient's ability to mobilise, self-care, and perform their usual activities and scores their pain/discomfort and anxiety/depression levels. The second part is the visual analogue score, which enables the patient to rate their current health state on a scale of 0–100, with 0 being the lowest and 100 being the best possible health state. It provides additional information as a quantitative measure of self-rated health from the patient's perspective. The health score and the visual analogue scores can be converted into a country-specific index. The maximum health index value equals 1 and indicates perfect health. For the health index value, it is possible to have a negative score, with a score below 0 indicating ‘a state worse than death’. The visual analogue index score is from 0 to 1 with no negative scores.

Kansas City Cardiomyopathy Questionnaire:

The KCCQ is a heart failure disease-specific questionnaire consisting of 23 questions. It is divided into several domains including physical and social limitations, symptoms, self-efficacy, and QoL, each transformed to score range between 0 and 100. The clinical summary score combines measures of symptoms and social factors, while the overall summary score brings together all the domains. A higher score is representative of a better health status.

2.3. CO-MORBIDITY

Comorbidity is the presence of more than one distinct condition in an individual. It is frequently used to describe the coexistence of one index ailment and other unrelated conditions. An index

condition or disease describes the main condition under study. Associated concepts like dual diagnosis and multimorbidity are frequently used in clinical and research contexts.

The term "dual diagnosis" is typically used to refer to conditions when a mental disease and a drug or alcohol use disorder coexist. Multimorbidity is the co-existence of several acute or chronic illnesses in a single individual. Clinicians may select multiple definitions or constructions to represent comorbidity depending on the context and application of the notion, such as in clinical care, epidemiology, or health services planning and economics. Comorbidity can reflect the burden or effect of the diseases on the individual in terms of severity. To quantify the severity of diagnoses and their effects on the use of healthcare resources, a number of formal scales and assessment measures are available, including the Charlson Comorbidity Index, the Comorbidity-Polypharmacy Score, and the Cumulative Illness Rating Scale, among others.

Comorbid illnesses may overlap and be present at the same time, or they may both occur within a specific time period but never be present at the same time (Valderas et al. 2009). This depends on the time period being analysed. The prognosis and course of treatment for an individual may be affected by the order in which comorbidities manifest (Valderas et al. 2009). For instance, although both are referred to as patients with cancer and depression, individuals with major depression who subsequently acquire a cancer diagnosis may be significantly different from those with cancer who obtain a new diagnosis of major depression. Comorbid disorders can have either a physical or psychological component. It frequently happens that a dysfunction in one area (such as a physical condition like a spinal cord injury) will cause or aggravate a disease in another area (such as a psychological condition like depression). It should be noted that many medical and psychological problems share symptoms and might be hard to identify from one another. Comorbidities are also two conditions that exist in the same domain, such as depression and anxiety or chronic obstructive pulmonary disease and ischemic heart disease. Some diseases have such high rates of comorbidity that they are grouped together and managed as a single condition. One such is the metabolic syndrome, often known as syndrome X, which comprises hypercholesterolemia, dyslipidaemia, type 2 diabetes, high blood pressure, and obesity. Obstructive sleep apnoea and these together are frequently referred to as syndrome Z. Numerous etiological patterns and complicated combinations of risk variables are frequently present in chronic medical and psychiatric diseases[41].

2.4. CO-MORBIDITIES AND IMPACT ON HEART FAILURE:

Heart failure (HF) is usually accompanied with multimorbidity, which is generally described as the co-existence of more than one chronic illness. Comorbid disorders have been asserted to be

significant predictors of HF outcomes and to significantly affect quality of life. Comorbidities are more common than not in today's aging population, which presents healthcare practitioners with the problem of managing HF and underlying illnesses at the same time. Multiple cardiovascular and non-cardiovascular comorbidities are common in CHF patients, which, to varying degrees, speed up the disease's progression and decrease its response to treatment. The ESC Heart Failure guidelines have long emphasized routine testing for coexisting comorbidities in all patients who are suspected of having HF[42] . Assessment and treatment of comorbid illnesses are given significant attention in the 2021 guidelines.

According to various studies, the non-cardiovascular comorbidities that are most common among CHF patients are iron deficiency (prevalence: 53–65%), anemia (prevalence: up to 37%), diabetes mellitus (prevalence: between 23% and 47%), renal failure (prevalence: up to 55%), depression (prevalence: up to 61%), and respiratory diseases (prevalence: up to 63%). The existence of these comorbidities and their link to longer hospital stays and greater hospitalization rates may significantly worsen individuals with CHF's functional ability and health-related quality of life (HRQoL)[43].

Co-morbidities and prognosis:

Many studies have shown that the presence of co-morbidities in an illness, leads to poor prognosis. As such different indices were developed to evaluate the prognosis of patients with co-morbidities in different settings. Amongst which we have the charlson comorbidity score.

Charlson Comorbidity score

This score was designed in 1986 by Charlson and al to evaluate the 10-year survival of patients with several comorbidities. It was to be used in longitudinal studies to predict mortality. This score was lateron reviewed by Charlson and al in 2022 as found found out that the different CCI versions were discovered to possess the clinimetric qualities of reliability, concurrent validity, sensitivity, incremental validity, and predictive validity after being widely used in a variety of medical situations[44]. The score contains 17 variables with some having higher values than other due to their impact on prognosis. These variables include age, myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular accident or transient ischemic attack, dementia, chronic obstructive pulmonary disease, connective tissue disease, peptic ulcer disease, liver disease, diabetes mellitus, hemiplegia, moderate to severe CKD, solid tumour, leukemia, lymphoma, and AIDS. The higher the score the poorer the prognosis.

Inclusion Criteria for each comorbidity[44]:

1- Myocardial infarction: Myocardial infarction includes patients with one or more definite or probable myocardial infarction. These patients should have been hospitalized for chest pain or an equivalent clinical event and have had electrocardiographic and/ or enzyme changes. Patients with electrocardiographic changes alone who have no clinical history are not designated as having had an infarction.

2- Congestive heart failure includes patients who have had exertional or paroxysmal nocturnal dyspnoea and who have responded symptomatically (or on physical examination) to digitalis, diuretics, or afterload reducing agents. It does not include patients who are on one of those medications but who have had no response and no evidence of improvement of physical signs with treatment.

3- Peripheral vascular includes patients with intermittent claudication or those who had a bypass for arterial insufficiency, those with gangrene or acute arterial insufficiency and those with a treated or untreated thoracic or abdominal aneurysm (6 am or more).

4- Cerebrovascular disease includes patients with a history of a cerebrovascular accident with minor or no residue, and patients who have had transient ischemic attacks, if the CVA resulted in hemiplegia, code only hemiplegia.

5- Hemiplegia: This includes patients with a hemiplegia or paraplegia, whether it occurred as a result of a cerebrovascular accident or other condition.

6- COPD includes patients with asthma, chronic bronchitis, emphysema, and other chronic lung disease who have ongoing symptoms such as dyspnoea or cough, with mild or moderate activity. This includes patients who are dyspnoeic with slight activity, with or without treatment and those who are dyspnoeic with moderate activity despite treatment, as well as patients who are dyspnoeic al rest, despite treatment, those who require constant oxygen, those with CO, retention and those with a baseline PO, below 50 torr.

7- Diabetes includes all patients with diabetes treated with insulin or oral hypoglycaemic, but not diet alone. Diabetes during pregnancy alone is not counted.

8- Moderate renal insufficiency includes patients with a serum creatinine >3 mg/dl. Severe renal disease includes patients on dialysis, those who had a transplant, and those with uraemia.

9- Mild liver disease consists of chronic hepatitis (B or C) or cirrhosis without portal hypertension. Moderate liver disease consists of cirrhosis with portal hypertension, but without bleeding. Severe liver disease consists of patients with ascites, chronic jaundice, portal hypertension or a history of variceal bleeding or those who have had liver transplant.

10- Peptic ulcer disease includes patients who have required treatment for ulcer disease, including those who have bled from ulcers.

11- Lymphoma includes patients with Hodgkins, lymphosarcoma, Waldenstrom's macroglobulinemia, myeloma, and other lymphomas. Leukaemia includes patients with acute and chronic myelogenous leukaemia, acute and chronic lymphocytic leukaemia, and polycythaemia vera. Solid tumour consists of patients with solid tumours without documented metastases, including breast, colon, lung, prostate, and a variety of other tumours.

12- Solid tumours: It includes Breast, Colon, Prostate, Lung, Melanoma, Others. Metastatic cancer includes patients with metastatic solid tumours, including breast, lung, colon, and other tumours.

13- Dementia includes patients with moderate to severe chronic cognitive deficit resulting in impaired function from any cause.

14- Rheumatologic disease includes patients with systemic lupus erythematous, polymyositis, mixed connective tissue disease, rheumatoid arthritis, polymyositis, polymyalgia rheumatica, vasculitis, sarcoidosis, Sjogrens syndrome or any other systemicvasculitis.

15- Acquired immune deficiency syndrome includes patients with definite or probable AIDS.

2.5. REVIEW OF PUBLICATIONS ON THE SUBJECT

2.5.1. In the world:

1) **The epidemiology of heart failure, based on data for 2.1 million inhabitants in Sweden (Ramin Zarrinkoub, Bjorn Wettermark,Per Wandell,Marit Mejhert, Robert Szulkin, Gunnar Ljunggren, and Thomas Kahan, 2013)**[45]**.**

Methods: This was a cross-sectional study on individual patient data from an administrative health data register in the Stockholm region, Sweden, comprising 2.1 million inhabitants. This contained all recorded diagnoses on all consultations in primary and secondary care (defined as specialist outpatient care), and on all hospitalizations. Prevalence, incidence, and

mortality were estimated for the entire Swedish population, adjusted for demographic composition in 2010.

Results: The study population consisted of 88 038 patients (51% women). The prevalence was 2.2% (both women and men), the incidence was 3.8/1000 person-years (both women and men), and mortality was 3.2/1000 person-years in women and 3.0/ 1000 person-years in men (P, 0.001); the 5-year survival rate was 48%. Mortality (age adjusted; hazard ratio and 95% confidence intervals) was higher in men, 1.29, 1.24—1.34; P, 0.001. Prevalence remained essentially unchanged from 2006 to 2010, while incidence decreased by 24% (P, 0.001) and mortality by 19% (both women and men; P , 0.001).

Conclusion: The estimated prevalence of CHF in Sweden is 2.2%, incidence 3.8/1000 person-years, and mortality 3.1/1000 person-years. There has been a decrease in incidence and mortality from 2006 to 2010 in both women and men, with no major change in prevalence over time.

2) **Contemporary Epidemiology, Management, and Outcomes of Patients Hospitalized for Heart Failure in China (YUHUI ZHANG, JIAN ZHANG, JAVED BUTLER, XIAOMIN YANG, PEIYI XIE, DONGSHUANG GUO, TIEMIN WEI, JING YU, ZHENLI WU, 2017)**[46]**.**

Methods: Data were collected prospectively on 13,687 patients with a primary discharge diagnosis of HF who were enrolled from 132 participating hospitals from January 2012 to September 2015. Data from the China-HF Registry was compared with previously published literature.

Results: The mean age was 65 ± 15 years, 59.1% were male, and 36.0% had preserved ejection fraction. Age, body mass index, and systolic blood pressure were lower than in high-income countries. Common comorbidities included hypertension (50.9%), coronary heart disease (49.6%), and atrial fibrillation (24.4%). The overall use of diuretics, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers (ACEI/ARB), and β-blockers at admission was 30.1%, 27.0%, and 25.6%, respectively, which was lower than in other registries. For patients discharged alive, ACEI/ARB, β-blocker, and mineralocorticoid receptor antagonist use in patients with reduced ejection fraction was 67.5%, 70.0%, and 74.1%, respectively; device use was much lower. The median length of hospital stay was 10 (range 7–15) days, and in-hospital mortality was 4.1 ± 0.3%. Predictors of mortality included low systolic blood pressure, acute myocardial infarction, infection, right bundle branch block, and elevated total bilirubin and blood urea nitrogen level.

Conclusion: The China-HF Registry study is the 1st and largest contemporary study that demonstrated the specific clinical characteristics, treatments, and outcomes of patients hospitalized with HF in China. The findings of this study provide important information for quality improvement, education, and awareness among clinicians and patients, and for implementation of clinical trials in China. Future publications will focus on longitudinal post-hospitalization outcomes, including mortality and readmission risk. The relative lower adherence to evidence-based care of patients hospitalized with HF requires additional ongoing programs to improve the care and outcomes of these patients. Further studies of the Chinese HF population are needed to improve HF quality and compliance with guidelines for clinicians and self-management by patients.

3) **Co-morbidities in patients with heart failure: an analysis of the European Heart Failure Pilot Survey in Netherlands (Vincent M. van Deursen, Renato Urso, Cecile Laroche, Kevin Damman, Ulf Dahlström, Luigi Tavazzi, Aldo P. Maggioni, and Adriaan A. Voors, 2014)**[47]**.**

   Methods: A total of 3226 European outpatients with chronic HF were included in this analysis of the European Society of Cardiology (ESC) Heart Failure Pilot Survey. The following co-morbidities were considered: diabetes, hyper- and hypothyroidism, stroke, COPD, sleep apnoea, chronic kidney disease (CKD), and anaemia. Prognostic implications of co-morbidities were evaluated using population attributable risks (PARs), and patients were divided into geographic regions. Clinical endpoints were all-cause mortality and HF hospitalization.

   Results: The majority of patients (74%) had a least one co-morbidity, the most prevalent being CKD (41%), anaemia (29%), and diabetes (29%). Co-morbidities were independently associated with higher age ($P < 0.001$), higher NYHA functional class ($P < 0.001$), ischaemic aetiology of HF ($P < 0.001$), higher heart rate ($P = 0.011$), history of hypertension ($P < 0.001$), and AF ($P < 0.001$). Only diabetes, CKD, and anaemia were independently associated with a higher risk of mortality and/or HF hospitalization. There were marked regional differences in prevalence and prognostic implications of co-morbidities. Prognostic implications of co-morbidities (PARs) were CKD = 41%, anaemia = 37%, diabetes = 14%, COPD = 10%, and <10% for all other co-morbidities.

   Conclusion: In this pilot survey, co-morbidities are prevalent in patients with chronic HF and are related to the severity of the disease. The presence of diabetes, CKD, and anaemia

was independently related to increased mortality and HF hospitalization, with the highest PAR for CKD and anaemia.

4) **Trends in prevalence of comorbidities in heart failure clinical trials in USA (Muhammad Shahzeb Khan, Ayman Samman Tahhan, Muthiah Vaduganathan, Stephen J. Greene, Alaaeddin Alrohaibani, Stefan D. Anker, OrlyVardeny, Gregg C. Fonarow, and Javed Butler, 2020)**[7]**.**

Methods: They searched MEDLINE for HF trials enrolling more than 400 patients published between 2001 and 2016.Trials were divided into HF with reduced ejection fraction (HFrEF), HF with preserved ejection fraction (HFpEF), or trials enrolling regardless of ejection fraction. The prevalence of baseline chronic comorbid conditions was categorized according to the algorithm proposed by the Chronic Conditions Data Warehouse, which is used to analyse Medicare data. To test for a trend in the prevalence of comorbid conditions, linear regression models were used to evaluate temporal trends in prevalence of comorbidities.

Results: Overall, 118 clinical trials enrolling a cumulative total of 215 508 patients were included. Across all comorbidities examined, data were reported in a mean of 35% of trials, without significant improvement during the study period. Reporting of comorbidities was more common in HFrEF trials (51%) compared with HFpEF trials (27%). Among trials reporting data, hypertension (63%), ischaemic heart disease (44%), hyperlipidaemia (48%), diabetes (33%), chronic kidney disease (25%) and atrial fibrillation (25%) were the major comorbidities. The prevalence of comorbidities including hypertension, atrial fibrillation and chronic kidney disease increased over time while the prevalence of smoking decreased in HFrEF trials.

Conclusion: Many HF trials do not report baseline comorbidities. A more rigorous, systematic, and standardized framework needs to be adopted for future clinical trials to ensure adequate comorbidity reporting and improve recruitment of multi-morbid HF patients.

5) **The age-adjusted Charlson comorbidity index: A significant predictor of clinical outcome in patients with heart failure, Israel (Mony Shuvy, Donna R. Zwas, Andre Keren, Israel Gotsman,2020)** [37]**.**

Methods: We retrieved electronically from the computerized database all members with a diagnosis of HF as coded by the database in Jerusalem in January 2017. Patients were followed for clinical events including cardiovascular hospitalizations and death until to January 2019. The type of HF (HF with reduced ejection fraction (HFrEF) and HF with preserved ejection fraction (HFpEF) was provided by the treating physician in 67% of the patients. Comparison of the clinical characteristics was performed using the Mann–Whitney U test for continuous variables. Kaplan–Meier curves, with the log-rank test, were used to compare survival according to AACI. Multivariate Cox proportional hazards regression analysis was used to evaluate independent variables that determined survival. Parameters included in the multivariate Cox regression analysis incorporated gender, NYHA class, hypertension, ischemic heart disease, atrial fibrillation, log transformed BMI, log-transformed serum urea levels, square root-transformed estimated glomerular filtration rate, serum sodium and haemoglobin. Significant drug therapy was included in separate models including renin-angiotensin system (RAS) blocker, beta blocker, mineralocorticoid receptor antagonists and aspirin. Restricted cubic spline multivariable cox regression analysis was performed to evaluate the relationship between ACCI as a continuous parameter and mortality. A p value of <0.05 was considered statistically significant.

Results: The study cohort included 6961 HF patients. The median age was 78 (67–85), 52% were male and 41% had HFrEF. The mean ACCI was 6.3 ± 2.2, median 6.0 (5.0–8.0). Patients with HFpEF had a higher ACCI compared to patients with HFrEF (7.0 (interquartile range 5.0–8.0) vs. 6.0 (5.0–7.0) respectively, $P < 0.001$). We divided the cohort into 5 quantiles based on the ACCI. A higher ACCI was associated with more advanced NYHA class, HFpEF, a lower BMI, higher urea and lower eGFR, sodium, haemoglobin and albumin. A higher ACCI was associated with less therapy with RAS blockers but with more furosemide therapy. The overall 2 year-mortality rate was 23%. Survival rate by Kaplan–Meier analysis demonstrated that the ACCI score was directly associated with reduced survival. Survival rates were reduced with increasing quintiles of the ACCI, Fig. 1A. The ACCI score was also directly associated with decreased event-free survival from death or cardiovascular-hospitalizations, Fig. 1B. Multivariable Cox regression analysis after adjustment for significant predictors and in separate models with drug therapy demonstrated that the ACCI score was a significant incremental predictor of mortality (Fig. 1C) and for the combined endpoint of death or cardiovascular-hospitalizations. Analysing the ACCI as a continuous parameter by adjusted cox regression analysis demonstrated a significant increase with each point increase in the ACCI score (HR

1.37, 95% CI 1.34–1.40, P < 0.0001). A sensitivity analysis evaluating ACCI score as a continuous parameter using restricted cubic splines was performed. Cox regression analysis demonstrated a direct relationship between the ACCI score and mortality. There was a continuous increase in the risk with increasing ACCI score, P < 0.0001 for the adjusted linear model.

Conclusions: the AACI has significant predictive value for clinical outcome in HF and could be useful in estimating outcome in HF patients

6) **QUALITY OF LIFE IN PATIENTS WITH HEART FAILURE in Croatia (SADAT KURTALIĆ, NERMINA KURTALIĆ, FAHIR BARAKOVIĆ, NEHRA MOSOROVIĆ, JASMINA BOŠNJIĆ,2013)**[48]**.**

Methods: This cross-sectional study analysed the quality of life in 120 subjects of both sexes and all age groups suffering from heart failure, according to the severity of clinical presentation. Subjects were divided into 4 equal groups according to NYHA classification of heart failure. Selection of subjects was made using the Framingham criteria for confirming already diagnosed heart failure. Control group included 30 patients not suffering from heart failure. Quality of life was assessed by use of the SF-36 and Minnesota questionnaire.

Results: In the study population of 150 subjects, there were 76 (51%) male and 74 (49%) female subjects divided into 4 NYHA groups of 30 subjects (20.0%) and control group of 30 subjects (20.0%). The analysis of within-group sex representation yielded no statistically significant difference ($\chi 2$=1.70, df=4; p=0.79). There was no statistically significant between-group age difference either (ANOVA, F=0.74; p=0.57). The values of SF-36 and Minnesota score expressed as median in the control and 4 NYHA groups were 98.6, 90.76, 70.14, 36.45 and 25.41 (Ht=116.84; p<0.0001) and 0.0, 0.47, 1.64, 2.99 and 3.42 (Ht=113.42; p<0.0001), respectively. The correlation coefficient r between heart failure NYHA classes expressed in the values of SF-36 and Minnesota score was r=-0950; p<0.0001 and r=0.931; p<0.0001, respectively. The correlation coefficient r between the number of major and minor Framingham criteria and the values of SF-36 and Minnesota score was r=-0.790, -0.660; p<0.0001 and r=0.774, 0.671; p<0.0001, respectively.

Conclusions: The findings suggested that the quality of life in patients with heart failure was impaired and associated with the severity of clinical presentation, and that Framingham

criteria could serve as significant predictors of the value of SF-36 and Minnesota scores and quality of life in patients with heart failure.

7) **Impact of non-cardiovascular comorbidities on the quality of life of patients with chronic heart failure: a scoping review in Spain ,2020(Josep Comín-Colet, Teresa Martín Lorenzo, Almudena González-Domínguez, Juan Oliva and Silvia Jiménez Merino)**[43]**.**

Method: A scoping review of the scientific literature published between 2009 and 2019 was carried out. Observational studies which assessed the HRQoL of patients with CHF using validated questionnaires and its association with non-cardiovascular comorbidities were included.

Results: The search identified 1904 studies, of which 21 fulfilled the inclusion criteria to be included for analysis. HRQoL was measured through specific, generic, or both types of questionnaires in 72.2%, 16.7%, and 11.1% of the studies, respectively. The most common comorbidities studied were diabetes mellitus (12 studies), mental and behavioural disorders (8 studies), anaemia and/or iron deficiency (7 studies), and respiratory diseases (6 studies). Across studies, 93 possible associations between non-cardiovascular comorbidities and HRQoL were tested, of which 21.5% regarded anaemia or iron deficiency, 20.4% mental and behavioural disorders, 20.4% diabetes mellitus, and 14.0% respiratory diseases. Despite the large heterogeneity across studies, all 21 showed that the presence of a non-cardiovascular comorbidity had a negative impact on the HRQoL of patients with CHF. A statistically significant impact on worse HRQoL was found in 84.2% of associations between mental and behavioural disorders and HRQoL (patients with depression had up to 200% worse HRQoL than patients without depression); 73.7% of associations between diabetes mellitus and HRQoL (patients with diabetes mellitus had up to 21.8% worse HRQoL than patients without diabetes mellitus); 75% of associations between anaemia and/or iron deficiency and HRQoL (patients with anaemia and/or iron deficiency had up to 25.6% worse HRQoL than between patients without anaemia and/or iron deficiency); and 61.5% of associations between respiratory diseases and HRQoL (patients with a respiratory disease had up to 21.3% worse HRQoL than patients without a respiratory disease).

Conclusion: The comprehensive management of patients with CHF should include the management of comorbidities which have been associated with a worse HRQoL, with special

emphasis on anaemia and iron deficiency, mental and behavioural disorders, diabetes mellitus, and respiratory diseases. An adequate control of these comorbidities may have a positive impact on the HRQoL of patients.

2.5.2. In Africa

1) **Epidemiology and management of heart failure in a Moroccan center (Jamal Kheyi, Abdelilah Benelmakki, Hicham Bouzelmat, Ali Chaib, 2016)**[11]**.**

Methods: We conducted a prospective observational study collected in the intensive care and rhythmology department of the Mohammed V military instruction hospital in Rabat, between December 2008 and December 2014, involving 424 patients. The parameters analysed were as follows: epidemiological data, clinical presentation of heart failure, electrocardiographic, radiological and echocardiographic abnormalities, nature of the underlying heart disease, therapeutic methods and evolution during hospitalization under conventional treatment.

Results: During the study period, 424 patients were admitted for heart failure. The average age of our patients was 60.91±12.77 years, mostly men (72%), with a sex ratio of 2.5. 90 patients had a history of cardiovascular event. The main cardiovascular risk factors encountered were arterial hypertension (46%), smoking (45%), diabetes (43%), dyslipidemia (26%) and overweight (22%). Clinically, 63% of patients were admitted for left heart failure, 29% for congestive heart failure and 8% for right heart failure. 54% of our patients were in stage III-IV heart failure, and 46% in NYHA stage I-II. The average heart rate was 98±21 bpm. 65% of our patients had a heart rate ≥80bpm. All our patients underwent an electrocardiogram. On chest radiography, cardiomegaly was present in 86% of cases, with signs of pulmonary overload in 82% of cases. 23% of our patients were in moderate to severe renal insufficiency, 21% in anaemia, 6% in hyponatremia and 4% in hypokalaemia. Transthoracic echocardiography found a dilated left ventricle (LV) in 58% of cases, with an average end-diastolic diameter of 60 ± 9.6 mm, an average end-systolic diameter of 45 ± 12.5 mm and an ejection fraction (EF) mean to VG at 36.33±13.5%. Figure 1. LV filling pressures were elevated in 60% of cases, and pulmonary arterial hypertension was present in 43% of cases.

Conclusions: Heart failure is a major public health problem, and it is growing. Ischemic heart disease is the main aetiology. The frequency and severity of this disease should encourage us to treat our patients as well as possible, using our resources to the maximum and explaining in detail to patients the merits of therapy, including dietetics. This should also encourage us to

develop support structures such as a day hospital or specialized consultations to improve the prognosis of this serious pathology.

2) **Health-Related Quality of Life Among Heart Failure Patients Attending an Outpatient Clinic in the University of Gondar Comprehensive Specialized Hospital Northwest, Ethiopia, 2020(Gebrekidan Ewnetu Tarekegn, Lemma Derseh Gezie , Tilahun Yemanu Birhan, Frew Ewnetu)**[49]**.**

   Method: A cross-sectional study was employed to select 469 heart failure patients who have follow-up at the University of Gondar Specialized Hospital consecutively from March 01 to 30, 2020. Data were entered to Epi Info 7 and exported to STATA version 15 for further statistical analysis. The quality-of-life domains were measured with World Health Organization Quality of Life BREF. Structural equation modelling was employed to estimate the relationships among exogenous, mediating, and endogenous variables simultaneously.

   Results: Chronic heart failure patients had a significantly lower mean score in physical health domain (31.70 mean score), environmental health domain (38.35 mean score), and in overall quality of life domain (41.61 mean score) moderate in social relation domain (46.22 mean score), and in psychological health domain (50.21 mean score) of health-related quality of life (p-value <0.0001). Age had a direct positive effect on health-related quality of life. Residency also had a direct negative effect on both physical and environmental health-related quality of life domain. Duration of heart failure had a direct negative effect on psychological health.

   Conclusion: The finding of this study indicated that poor health-related quality of life in the physical health domain, moderately poor in overall health-related quality of life, and moderate health-related quality of life in the psychological health domain among Chronic heart failure patients. Age, residence, marital status, income, and duration of HF were significantly associated factors for quality of life among HF patients.

3) **Predictive factors of quality of life among black Africans with heart failure, Ivory Coast, 2015(M.P.B. N'Cho-Mottoh, I. Coulibaly, K. Yayehd, B. Boka, D. Bamba-Kamagate, M. Sow-Toure)**[50]**.**

Methodology: This is a prospective and analytical study carried out in the department of hospitalization of the cardiology institute of Abidjan. From January to November 2014, patients hospitalized for heart decompensation were consecutively enrolled. The inclusion criteria were the

existence of chronic heart failure that has been developing for at least 6 months and that has been the subject of a medical prescription in patients of more than 18. Minnesota Living with heart failure questionnaire about was filled in for each patient.

Results: One hundred and twenty-one patients were recruited. The overall score for quality of life was on average 59.1 ± 21.2 with extremes of 12 and 96. In multiple linear regression, correlation coefficients of the total score for quality of life with age ($r = -0.2$; $p = 0.03$), the number of hospitalization ($r = 5.1$; $p < 0.01$) and the functional NYHA stage ($r = 11.2$; $p < 0.01$) were calculated.

Conclusion: Predictive factors of poor quality of life among black Africans with heart failure are young age, the number of hospitalization and functional NYHA stage. Therapeutic education sessions should be conducted to improve the functional symptoms of heart failure, reduce the rate of re-hospitalization and finally improve the quality of life.

CHAPTER 3: RESEARCH DESIGN AND METHOD

3.1. TYPE OF STUDY

The study was an analytical cross-sectional study.

3.2. SITE OF STUDY

To carry out this study, we recruited patients from:

- **Yaoundé Central Hospital:**

It is a 2nd category health facility created in 1933 is located in the centre region, in the department of Mfoundi in Yaoundé. It is in the downtown area behind the CENAME and not far from the Messa camp, it is an internationally renowned reference hospital, and is one of the second category hospitals in the national health pyramid. It offers specialized health care populations: we find the units and

following care services:

- Medicine and specialty unit

• Surgery and specialty unit

- Gynaecology and Obstetrics Unit

- Anaesthesia and resuscitation unit, reception, emergencies

- Medical-technical unit

The cardiology service is part of the medicine and specialty unit and is made of:

- Consultation rooms

- Cardiological exploration rooms: echocardiography, ECG

- Hospital wards

The medical team consists of:

- 05 cardiologists

- 01 major nurse and nurses

- **Yaoundé General Hospital:**

The General Hospital is a first category referral hospital in the city of Yaoundé. It provides very high-level health services and is also a center for medical research and training.

- Organization

There is an administrative and financial department as well as a medical department which coordinates the following services: Cardiology, Radiology and Medical Imaging, Gastroenterology, Oncology, Endocrinology, Infectiology, Neurology, Pediatrics, Gynecology, Radiotherapy, Surgery, Anesthesia and Resuscitation, Ophthalmology, Oto-Rhino-Laryngology, Physiotherapy and Emergencies.

- Cardiology Department

This department receives patients from other departments and other hospital structures. The medical team within it is made up of six cardiologists, the service major and nurses. It comprises of:

- A hospitalization unit located on the third floor.

- An outpatient unit located on the first floor. It is the place of carrying out assessment of cardiovascular pathologies. It has

• 03 consultation boxes

• 02 echocardiography rooms

• 01 stress test room, 01 treadmill and 01 bike

• 01 coronary angiography room

• 02 ECG, 10 Holter, O5 Ambulatory blood pressure monitoring

- **Yaoundé University Teaching Hospital:**

It is a first category hospital in the health pyramid. It is located in the centre region, department of Mfoundi, district of Yaoundé III. It is located in the Melen district. There are several departments there, such as the internal medicine department. The cardiology service is part of the medicine and specialty unit and is made of:

- Consultation rooms

- Cardiological exploration rooms: echocardiography, ECG

- Hospital wards

The medical team consists of:

- 05 cardiologists

- 01 major nurse and nurses

Efoulan District hospital:

It is a first category hospital in the health pyramid. It is located in the centre region, department of Mfoundi, district of Yaoundé III. It is located in the Efoulan district. There are several departments, such as the internal medicine department, which takes care of cardiovascular pathologies, among other things. The unit contains, a consultation box, an ultrasound machine, and an ECG machine managed by 2 cardiologist and nurses.

3.3. DURATION OF STUDY

The study was run for a six-month duration from January 1st, 2022, through June 30th, 2023. During this timeframe, the following was done: Writing of protocol, obtention of ethical clearance and authorization documents, data collection and analysis, proofreading, and publishing of results.

Recruiting of data began on the 1st of February 2023 and ended of the 30th of April 2023 that is a period of data collection of 3months.

3.4. POPULATION AND SAMPLE

STUDY POPULATION

Source Population: All Patients in cardiology unit in Yaoundé.

Target Population: All patients managed for chronic Heart Failure from the cardiology unit.

INCLUSION CRITERIA

- All patients followed up with chronic heart failure greater than 18 years of age
- All patients who agree to take part in the study.

EXCLUSION CRITERIA

- Patients who later on refuse to take part in the study.

3.5. SAMPLING METHOD

The sample size can be calculated using the following Daniel Cochrane's formula,

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where:

N= sample size

Z= level of confidence (95%)

P= prevalence of heart failure (2%)[1]

d= level of precision (5%)

Numerical application gives a value of n=81

3.6. STUDY RESOURCES

- Data collection and management tools

Pre-established data collection worksheets

Electronic blood pressure monitor

Pens

A stopwatch

A weight scale.

A stethoscope

A manual mercury thermometer

Care gloves

A hydro alcoholic gel

Surgical masks

Two white coats

A4 reams of paper

Writing material (pens, pencils, and eraser)

Computer

Microsoft Suite Package

USB flash drives

- Human Resource

Main Investigator

Supervisors

Statistician

3.7. PROCEDURE

- Administrative formalities

A research protocol was written and presented to the supervisors. Thereafter, a request was submitted for research authorization and ethical clearance from YCH and the Institutional Review Board of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I.

- Recruitment and data

All patients hospitalized and who came for consultation in the cardiology unit presenting with heart failure and who accepted to take part in the study shall be recruited. To do that we attended cardiology consultations in the different hospitals to find patients with HF. We also attended round in the units to find the hospitalized patients from there which we sought their concern for participation in our study. Those who accepted, signed a consent form before we started collecting data with the use of our readymade questionnaire.

- **Study variables**

For every record of an eligible participant in this study, information of interest was collected via a collection worksheet. This worksheet was designed by the chief investigator and internally corrected, validated, and adapted for this study by the supervisors. The following were searched for:

Sociodemographic data: age, sex, profession, matrimonial status, ethnicity, monthly income, insurance.

Cardiovascular risk factors: hypertension, diabetes, tobacco, dyslipidaemia, sedentary lifestyle, race.

Clinical parameters: Weight, height, Body mass index, NYHA classification, aetiology of heart failure, number of hospitalizations for heart failure in the last 12 months

Duration of heart failure

Paraclinical aspects: Ultrasound results in recent 12months.

Charlson comorbidity score: age, myocardial infarction, Congestive heart failure, peripheral vascular disease, Cerebrovascular accident or transient ischemic attack, dementia, Chronic obstructive pulmonary disease, connective tissue disease, peptic ulcer disease, liver disease, diabetes mellitus, hemiplegia, chronic kidney disease, solid tumour, leukaemia, lymphoma, AIDS.

Quality of life: Evaluated using the Minnesota living with heart failure questionnaire taking into account the physical, emotional and socioeconomic impact of the disease.

❖ **Procedure for data collection**

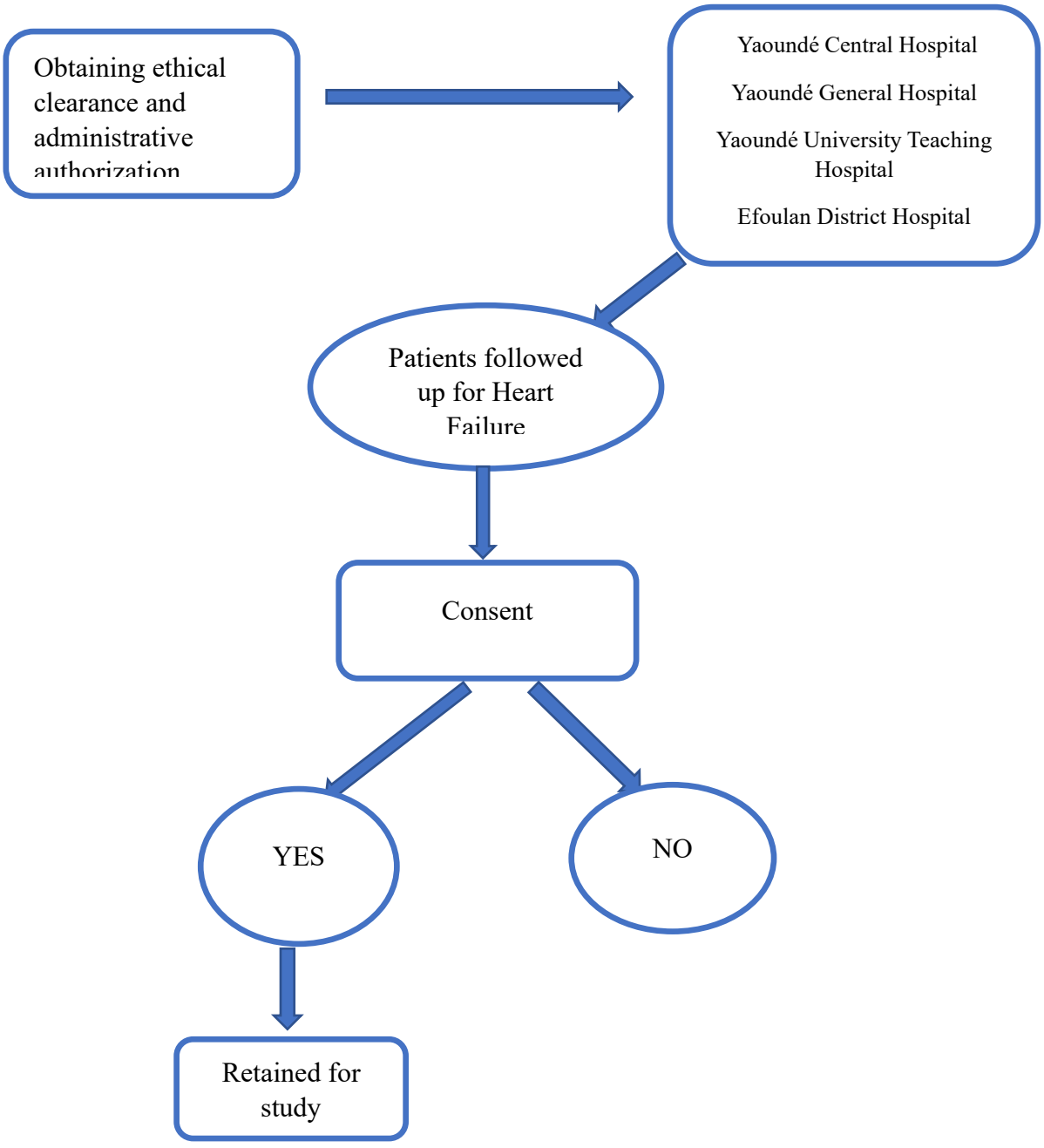

Figure 9: flow diagram for data collection

3.8. DATA ANALYSIS

For the analysis and data entry to be used will be Microsoft Word 2016 software, and IBM SPSS statistics version 26.

Continuous variables were presented either as mean ± standard deviation (SD) or as median and interquartile range (25th to 75th percentile), while categorical variables were presented using frequencies and percentages. The Kolmogorov–Smirnov test and graphs (histograms and normal Q-Q plots) were used to test the normality of the distribution of the continuous

variables. Continuous variables didn't follow normal distribution, and non-parametric methods were used. The statistical test were Mann Whitney U test and Pearson test with a probability threshold of 0.05. The parameters analysed with the Mann Whitney U test were quality of life and charlson comorbidity index (continuous variables) with categorical variable which were age, occupation, marital status, level of income, duration of disease, etiology of heart failure, NYHA classification, type of HF, cardiovascular risk factors, charlson comorbidities found which were Myocardial infarction, Peripheral vascular disease, Cerebrovascular accident, Dementia, Chronic obstructive pulmonary disease, Peptic ulcer disease, Liver disease, Hemiplegia, Chronic kidney disease, Solid tumour, and AIDS. Those analysed with the Pearson test were charlson comorbidity index, NYHA classification and LVEF. The significant variables were analysed with the ANOVA test.

3.9. ETHICAL CONSIDERATIONS

Before data collection for this study, Ethical clearance was obtained from the Institutional Review Board at the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I.

An authorization request was equally addressed to the Hospital Director and the Unit Head of Cardiology unit in the different Hospitals where we carried out the study. Data collection was performed with utmost discretion and anonymity for every individual.

CHAPTER 4 : RESULTS

4. RESULTS

4.1. Recruitment of study population

This study took place in the cardiology departments of 4 hospitals which were the Yaoundé Central Hospital, Yaoundé General Hospital, Yaoundé University Teaching Hospital and Efoulan District Hospital during the period from February 1 to April 30, 2023; i.e.,3 months. Figure 10 below describes the study population recruitment process.

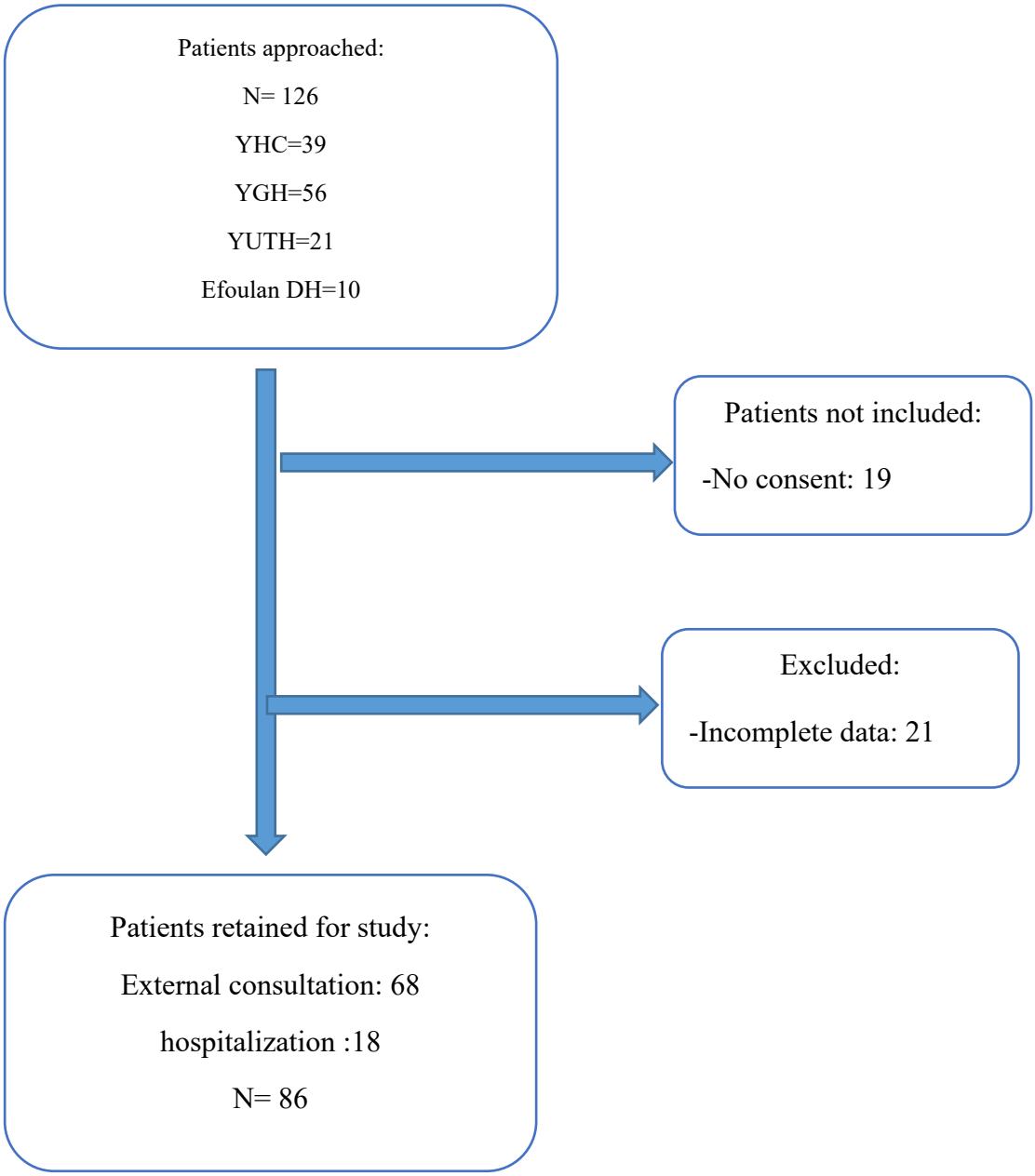

Figure 10: flux diagram of patient recruitment

4.2. Sociodemographic characteristics of the study population

4.2.1. Age, gender, marital status and region of origin

The mean age of participants was 62.6 ± 14.2 years, with ages ranging from 25 to 95 years. Most had an age above 65 years (51.2%), and were female (52.3%), with a sex ratio of 0.91. Concerning the marital status and region of origin, we found respectively mostly the married (55.8%) and those from the Centre (37.2%). (Table IX)

Table IX: repartition of the population according to age, gender, marital status and region of origin

Variables	Modalities	Effective (N=86)	Frequency (%)
Age groups (years)	[25-35[	6	7.0
	[35-45[	4	4.7
	[45-55[	11	12.8
	[55-65[	21	24.4
	≥ 65	**44**	**51.2**
Gender	Male	41	47.7
	Female	**45**	**52.3**
Marital status	Married	**48**	**55.8**
	Widow	23	26.7
	Single	12	14.0
	Divorced	3	3.5
Region of origin	Centre	**32**	**37.2**
	West	15	17.4
	South	14	16.3
	Littoral	10	11.6
	North	10	11.6
	North-west	2	2.3
	South-west	2	2.3
	East	1	1.2

4.2.2. Occupation, level of income and notion of insurance

The study revealed that the retired were the most frequent (48.8%). The median level of income was 90,000 (63,750-122,500) F CFA ranging from 40,000 FCFA to 650,000 FCFA. Most patients had a level of income between 50,000 FCFA and 100,000 FCFA (52.3%). As concerns the health insurance of patients, the frequency was 5.8% (table X).

Table X: repartition of the population according to their socioeconomic status

Variables	Modalities	Effective (N=86)	Frequency (%)
Occupation	Retired	**42**	**48.8**
	Employees in the private sector	16	18.6
	Actor in the informal sector	11	12.8
	Invalid	11	12.8
	Employees in the public sector	6	7.0
Level of income (F CFA)	< 41875	3	3.5
	41875-100000	**45**	**52.3**
	100000-150000	21	24.4
	150000-200000	8	9.3
	≥ 200000	9	10.5
Insurance	Yes	5	5.8
	No	**81**	**94.2**

4.3. General characteristics of heart failure

The median duration of the evolution of heart failure was 3.5 [2-5] years, with duration ranging from 4 months and 20 years. The main etiologies of heart failure were hypertensive (30.2%) and ischemic (22.1%). Management combined lifestyle and dietary measures (100.0%) and loop diuretics (94.2%). (Table XI).

Table XI: repartition of the population according to general characteristics of heart failure

Variables	Modalities	Effective (N=86)	Frequency (%)
Duration of heart failure (years)	≤ 1	13	15.1
	]1-5[	**42**	**48.8**
	]5-10[	26	30.2
	≥ 10	5	5.8
Etiology of heart failure	Hypertension	**26**	**30.2**
	Ischemic	19	22.1
	Idiopathic	9	10.5
	Valvulopathy	9	10.5
	Toxic	7	8.1
	Post-Rheumatic fever	3	3.5
	Peripartum cardiomyopathy	3	3.5
	Arythmia	2	2.3
	Others	8	9.3
Non pharmacologic management	Dietery and lifestyle changes	86	100.0
Pharmacologic management	Loop diuretics	**81**	**94.2**
	Beta blockers	58	67.4
	IEC	51	59.3
	Anti-platelet aggregators	46	53.5
	Mineralocorticoids receptor antagonists	31	36.0
	Statins	22	25.6
	Digitalis	19	22.1
	Ivabradine	2	2.3
Surgical management	Pacemaker	1	1.2
	Valvuloplasty/valve replacement	3	3.5

4.4. Specific characteristics of heart failure

The frequency of cardiac decompensation over the past 12 months was 30.2%. Concerning the ejection fraction of the left ventricle, it was altered in 55.2% of cases. The average ventricular ejection fraction was 39.13 ± 14.18% with extremes of 15 and 78%. The current stage of the disease according to the NYHA was II in the majority of cases (60.5%). (Table XII)

Table XIII: repartition of the population according to specific characteristics of heart failure

Variables	Modalities	Effectives (N=86)	Frequency (%)
Decompensation in the last 12 months	None	**60**	**69.8**
	1	24	27.9
	2	2	2.3
Type of Heart failure	HFrEF	**48**	**55.8**
	HFmrEF	**24**	27.9
	HFpEF	14	16.3
NYHA classification	Stage II	**52**	**60.5**
	Stage III	30	34.9
	Stage IV	4	4.7

4.5. Clinical characteristics of the study population

4.5.1. Cardiovascular risk factors

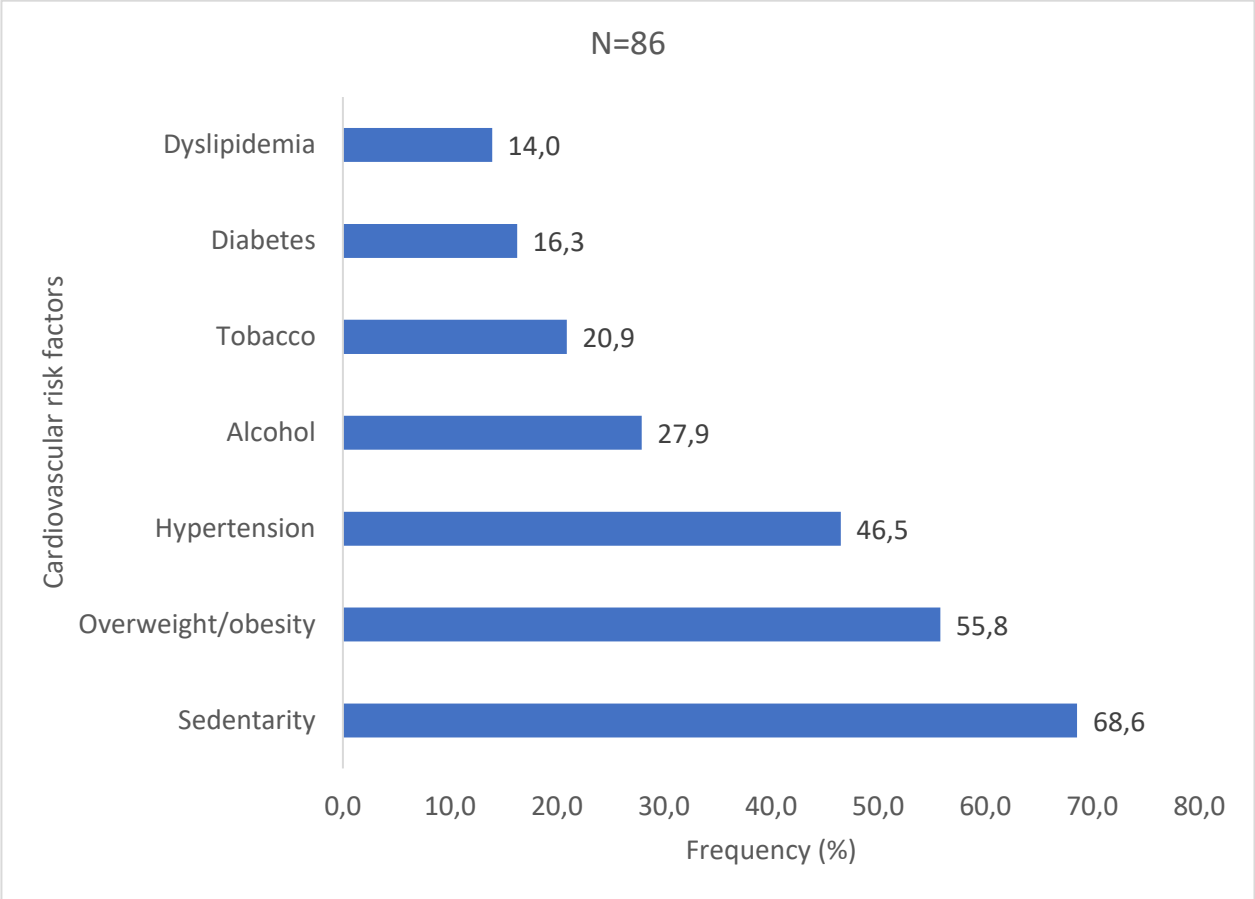

Figure 11: frequency of cardiovascular risk factors

Our study revealed that the principal cardiovascular risk factors were a sedentary lifestyle (68.6%), overweight/obesity (55.8%) and hypertension (46.5%). (figure 11).

4.5.2. Charlson comorbidities

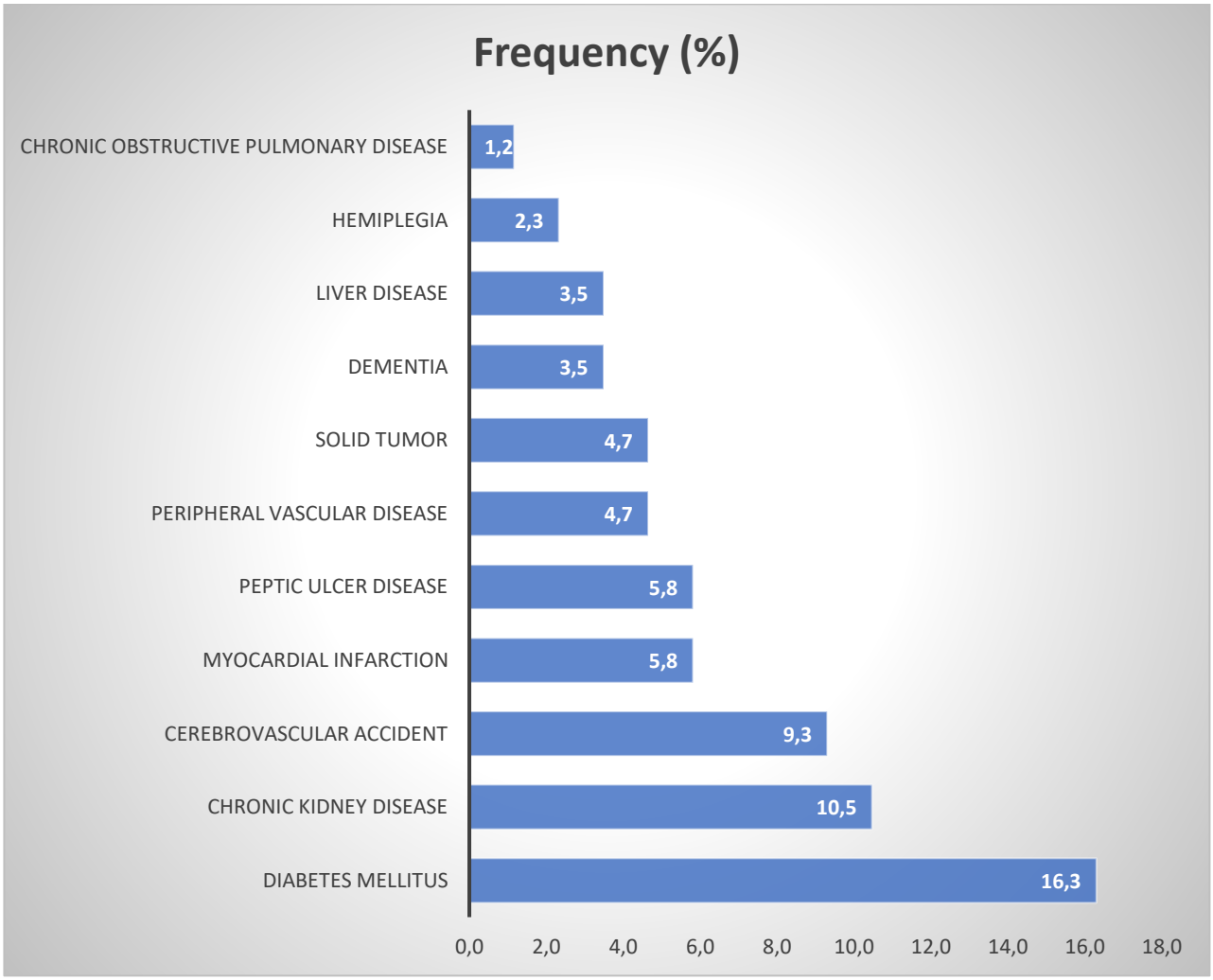

Figure 12: percentage of patient comorbidities from Charlson comorbidity score

52.3% of patients did not have any of the Charlson comorbidities. The majority of patients in our study had diabetes mellitus (16.3%) followed by chronic kidney disease (10.5%). (Figure 12).

4.6. Percentage survival: CHARLSON score

The mean percentage of survival according to the CHARLSON score was 51.30 ± 34.25%, with extremes of 0 and 96%; most of them having a survival percentage greater than or equal to 75% in the majority of cases (40.7%). (Table XIII). 9.3% had of 0% 10-year survival rate. (Table XIV).

Table XIII: frequency of each charlson comorbidity index and percentage survival

Variable	Modalities	10-years Percentage survival	Effective (N=86)	Frequency (%)
Charlson comorbidity index	1	96	11	12.8
	2	90	9	10.5
	3	77	15	17.4
	4	53	20	23.3
	5	21	15	17.4
	6	2	8	9.3
	>6	0	8	9.3

Table XIV: repartition of the population according to the percentage of survival

Variable	Modalities	Effective (N=86)	Frequency (%)
Percentage survival of Charlson score (%)	< 25	31	36.0
	[50-75[	20	23.3
	≥ 75	**35**	**40.7**

4.7. Quality of life in the study population

The mean quality of life score from Minnesota living with heart failure questionnaire was 30.06 ± 17.13 with scores ranging from 7 to 75. Table XVII below shows that the majority of heart failure patients had a good quality of life (53.5%), compared to 20.9% who had a poor quality of life.

Table XV: repartition of the population according to the quality of life

Variable	Modalities	Effective (N=86)	Frequency (%)
Classification of quality lifestyle	Good quality of life (< 24)	**46**	**53.5**
	Moderate quality of life (24-45)	22	25.6
	Poor quality of life (> 45)	18	20.9

4.8. Associated factors of poor quality of life

4.8.1. Univariate analysis

4.8.1.1. Correlation of the quality of life score with demographic, socio-economic and clinical characteristics of patients

As shown in Table XVI below, participants with age ≥ 65 had a significantly poorer quality of life (p=0.031) than those blow 65.

Table XVI: sociodemographic characteristics associated with poor quality of life

Variables	Number (%)	median (Interquartile)	p
Age groups (years)			
≥ 65	**44(51.2)**	**28[19.25-48.75]**	**0.031**
<65	42(48.8)	21.5[13.0-38.0]	
Gender			
Male	41(47.7)	23.00[13.5-43.00]	0.194
Female	45(52.3)	30.00[17.50-47.00]	
Marital status			
Married	48(55.8)	24.00[14.75-39.50]	0.411
Not married	38(44.2)	22.50[17.75-47.00]	
Level in incomes			
< 100 000	48(55.8)	24.00[18.00-48.75]	0.083
≥ 100 000	38(44.2)	23.00[13.00-38.00]	

The valvular aetiology of heart failure (p=0.035), and HFrEF (p= 0.029) had significantly poorer quality of life. (Table XVII)

Table XVII: characteristics of heart failure associated with poor quality of life

Variables	Number (%)	median (Interquartile)	p
Duration of disease			
< 1	8(9.3)	17.00[14.00-22.50]	0.066
[1-5[	47(54.7)	27.00[19.00-47.00]	0.134
[5-10[	26(30.2)	23.00[13.00-43.00]	0.349
≥ 10	2(2.3)	30.00[19.00-59.50]	0.351
Etiologies of HF			
Ischemic	19(22.1)	30.00[17.00-40.00]	0.658
Hypertension	26(30.2)	23.00[18.00-40.25]	0.933
Valvulopathy	**9(10.5)**	**47.00[22.50-57.50]**	**0.035**
Idiopathic	9(10.5)	19.00[13.50-40.00]	0.330
Others etiology	23(26.7)	21.00[13.00-46.00]	0.266
Type of Heart failure			
HFrEF	**48(55.8)**	**21.50[13.50-38.00]**	**0.029**
HFmrEF	24(27.9)	23.00[18.00-49.00]	0.056
HFpEF	14(44.216.3)	25.50[22.50-38.00]	0.535

Participants with overweight/obesity, history of stroke, peripheral vascular disease, chronic kidney disease, hemiplegia and solid tumours had a significantly poorer quality of life than those without (all $p < 0.05$). (Table XVIII)

Table XVIII: comorbidities associated with poor quality of life

Variables	Number (%)	median (±SD)	p
Cardiovascular risk factors			
Sedentary behaviour	59(68.6)	30.00[18.00-46.00]	0.053
Hypertension	40(46.5)	25.50[19.25-47.75]	0.225
Diabetes	14(16.3)	25.50[17.00-48.50]	0.888
Overweight/obesity	**48(55.8)**	**34.00[21.00-49.00]**	**0.000**
Dyslipidaemia	12(14.0)	28.50[21.00-45.50]	0.383
Tobacco	18(20.9)	21.00[10.00-44.25]	0.269
Alcohol	24(29.1)	23.00[13.25-46.75]	0.721
Charlson comorbidities			
Myocardial infarction	5(5.8)	43.00[17.50-53.00]	0.46
Peripheral vascular disease	**4(4.7)**	**50.00[44.75-59.75]**	**0.009**
Cerebrovascular accident	**8(9.3)**	**50.00[29.50-67.50]**	**0.004**
Dementia	3(3.5)	43.00[33.00-43.00]	0.415
Chronic obstructive pulmonary disease	1(1.2)	/	/
Peptic ulcer disease	5(5.8)	25.00[23.00-30.00]	0.796
Liver disease	3(3.5)	21.00[15.50-48.00]	0.947
Hemiplegia	**2(2.3)**	**72.00[69.00-75.00]**	**0.001**
Chronic kidney disease	**9(10.5)**	**49.00[44.00-59.00]**	**0.000**
Solid tumour	**4(4.7)**	**56.00[34.00-65.00]**	**0.049**
AIDS	1(1.2)	/	/

The table below (Table XIX) shows that there is a positive correlation between quality of life score and both NYHA classification (r=0.759, p=0.000) and Charlson comorbidity index (r=0.589, p=0.000). There was no significant correlation with Left ventricular ejection fraction.

Table XIX: correlation of MLWHF score with ordinal and continuous variables

Variable	Pearson correlation (r)	p-value
NYHA Classification	0.759	0.000
Charlson comorbidity index	0.589	0.000
Left ventricular ejection fraction	0.100	0.360

The independent risk factors for the poor quality of life were essentially Valvular aetiology(p=0.016) and chronic kidney disease(p=0.000) with the presence of each increasing the score by 17.748, 13.774, 17.553 and 2.133 respectively. Also, NYHA classification (p=0.000) and Charlson comorbidity index (0.006) were also found to be independent risk factors and an increase in value of 1 causing respectively an increase in score of 15.925 and 1.998. (Table XX)

T**able XX:** linear regression with significant bivariate variable with quality of life score

Variables	**Coefficient beta**	**Standard error**	**p-value**	**Confidence interval**	
				lower limit	upper limit
≥65years	-1.479	2.144	0.493	-5.752	2.794
Overweight/obesity	1.947	1.983	0.329	-2.004	5.899
HFrEH	-1.868	1.816	0.307	-5.486	1.750
Valvular etiology	**7.887**	**3.207**	**0.016**	**1.497**	**14.277**
Peripheral vascular disease	7.512	4.592	0.106	-1.639	16.663
cerebrovascular accident	-1.514	3.905	0.699	-9.295	6.268
Hemiplegia	11.625	6.928	0.098	-2.179	25.429
Chronic kidney disease	**16.112**	**3.301**	**0.000**	**9.534**	**22.690**
Solid tumour	8.970	4.711	0.061	-0.418	18.357
Charlson comorbidity index	**1.998**	**0.710**	**0.006**	**0.584**	**3.413**
NYHA_classification	**15.925**	**1.838**	**0.000**	**12.263**	**19.588**

CHAPTER 5 : DISCUSSION

DISCUSSION

We carried out a cross-sectional observational study to evaluate the impact of comorbidities on the prognosis and quality of life in patients with chronic heart failure in 4 hospitals in Yaounde. We recruited patients from external consultation and hospitalization who were already diagnosed and are being followed up for heart failure. We got our data within the period of 3 months, that is from the 1st of February to the 30th of April 2023.

LIMITATIONS TO OUR STUDY

Our study permits us to evaluate the prognosis of patients within 10 years and reach significant conclusions about comorbidities and other factors affecting the quality of life. However, this study has some limitations. Some patients recruited in hospitalization might have not been able to easily decern their quality of life before decompensation since hospitalisation is just a transitory period where the patient's quality of life at that moment would be poor with higher NYHA status. In addition, this was an observational study without comparison between patients with heart failure and patients with other chronic diseases or the general population. Furthermore, we didn't evaluate patient adherence to treatment both pharmacologic and non-pharmacologic, as it could affect the HRQoL of patients. The constraints of our study put its reliability in jeopardy and restrict how broadly the results can be applied. An in-depth investigation is required to determine the HRQoL among HF patients and the patient traits that may have an impact.

- Sociodemographic profile

We did a cross-sectional study of patients with chronic heart failure, and we had a sample size of 86. The mean age of the participants was 62 ± 14.2 years, with ages ranging from 25 to 95 years. There were more females with a sex ratio of 0.91. This is close to a study done by Nkoke *et al* in Buea, Cameroon which revealed a mean age of 59 ± 18.3 years with more women with a sex ratio of 0.80. This is in contrast with studies done in developed countries like the study done by Shuvy *et al* who had a mean age of 78 years (67–85) [51]. This could be because developed countries have an ageing population and people leave longer with the disease due to better health facilities.

Most patients were retired with a percentage of 48.8, didn't have health insurance (94.2%) and most had a level of income between 50000 and 100000 (52.3%). All these can contribute to a decrease in the quality of life of patients living with heart failure.

- Clinical characteristics of patients with Heart failure

The median duration of the evolution of heart failure was 3.5 [2-5] years, with duration ranging from 4 months and 20 years. Most patients had heart failure between 1 and 5 years (47.7%). This is similar to a study done by Yeoh *et al* which found most patients living with HF for over a year and less than 5 years (38.5%). [52]. The main aetiology of heart failure was hypertension (30.2%) followed by ischemia (22.1%) with mostly loop diuretics (94.2%) given as pharmacologic management This is in line with the study by Nkoke *et al* which revealed that hypertension (47.7%) was the main cause of heart failure with loop diuretics being the mainstay of treatment (97.9%). Only 4.7% of patients underwent surgery for heart disease with 33.3% of patients with valvulopathies. This is probably due to the cost of heart surgery which may be unaffordable by many, especially in a population without health insurance like ours.

Our study revealed a mean Left Ventricular Ejection Fraction of 39.13± 14.18% with values ranging from 15 to 78% with the highest proportion of patients with heart failure having reduced ejection fractions (55.8%). This is consistent with Nkoke *et al* who had an overall LVEF mean of 39.4%±19.3%.

Our study revealed that most of the patients were in stage 2 of the New York Heart Association classification (60%), with 69.8% not having decompensations in the last 12 months. This could be explained by the fact that we recruited symptomatic patients and most of our patients were recruited in external consultation with stable chronic heart failure.

- Cardiovascular risk factors

Our study showed that most patients had a sedentary lifestyle (68.6%) as the main cardiovascular risk factor followed by overweight/obesity before hypertension. A possible reason for a sedentary lifestyle being the highest cardiovascular risk factor is because of the misconception by patients from our interrogation who mistake physical inactivity for sedentary behaviour, as sedentary behaviour is spending more than seven hours per day sitting or lying down while inactivity is spending less than 2hours 30minutes per week on physical exercise at a moderate intensity. It could also be explained by the fact that most of our patients were retired and spent most of their time in sedentary positions watching tv, while others with sedentary jobs forced them to stay in those positions for long hours spending little energy (<1.5 metabolic equivalents). This could be the reason many of the patients were overweight and obese (46.5%) with a mean population BMI of 27.0 ±5.2.

- Comorbidities and HF classifications and characteristics

Our study showed that 52.3% of the study population did not have any of the Charlson comorbidities. The study showed that the most frequent comorbidity was diabetes (16.3%), followed by chronic kidney disease (14.0%). This is in line with the study by Van Deursen *et al* which found chronic kidney disease (41%) and diabetes (29%) as the most frequent comorbidities in patients living with heart failure[47]. The difference in prevalence of chronic kidney disease could be explained by a possible routine follow-up of patients' renal function in Western countries compared to here which is usually demanded on the diagnosis of heart failure and when presenting with symptoms.

- Charlson comorbidity score

On the evaluation of our study population, we had an average Charlson comorbidity score of 3.95±1.95. This gave an average 10-year survival rate of 51.30±34.25%, most of them having a survival percentage greater than or equal to 75% in the majority of cases (40.7%). 9.3% of patients had a survival rate of 0%. This implies that with a mean age of 62 years and an average 10-year survival of 51.30%, in the next 10 years, approximately half would not live to 72 years of age and 9.3% would not be alive in 10 years. This differs from the results gotten by Shuvy *et al* who had a mean charlson score of 6.3 ± 2.[51]. There were significant associations between the Charlson comorbidity index and level of income <100000FCFA, sedentary behaviour, hypertension and overweight/obesity. This can be explained by the fact that a low level of income means less access to health services which can make acute diseases become chronic. Also, sedentary behaviour, hypertension and overweight/obesity not only increase the risk of cardiovascular events but can also increase the risk of other diseases like renal failure and diabetes that can lead to a worse prognosis.

- Quality of life and risk factors

The average score of quality of life of patients living with heart failure using the Minnesota Living with heart failure questionnaire (which evaluates the physical, emotional and socioeconomic impact of heart failure on a patient's life) was 30.06 ± 17.13. We had most patients with a good quality of life (53.5%) compared to 20.9% who had a poor quality of life. These results contrast with those of N'Cho-Mottoh *et al* who had an average score of 59.1± 21.2. [50]

On bivariate and multivariate analysis, we found a positive association between the poor quality of life and various variables which included NYHA classification (Coefficient beta(β)=15.9; 95%

confidence interval (CI), 12.3–19.6, p= 0.000), Valvular aetiology of HF (β=7.9; CI, 1.5–14.3, p=0.016), Chronic kidney disease (β=16.1; CI, 9.5–22.7, p<0.000) and Charlson comorbidity index (β=2.0; CI, 0.6–3.4, p=0.006). This is similar to a study done by Fotos *et al* who found NYHA classification(p=0.002), and chronic kidney disease (p= 0.001) among the factors associated with HRQoF[53]. According to our analysis, a progression from one NYHA stage to the next worsens the quality of life by 15.93 units. It is credited to the fact that HF has a negative impact on a patient's functional capacity, and this impact intensifies as the disease progresses and symptoms grow more severe and frequent. Each stage is more severe than the other with NYHA stage I with no physical limitation, NYHA II with slight limitation to physical activity and symptoms, NYHA III with significant limitation to physical activity and more severe symptoms, and NYHA IV with symptoms at rest. This result also explains why our quality of life in our study population was relatively low as most of our patients were in stage II of the NYHA classification. This is also in accordance with the results gotten by N'Cho-Mottoh *et al* who found NYHA classification to be a predictive value of quality of life [50].

Likewise, HF caused by Valvulopathies worsened the score by 7.89 units. This could be explained by the fact that the majority of patients(66.6%) with HF of valvular aetiology didn't have their valves replaced surgically as studies reveal better quality of life after valve replacement[54]. It could be that the indication for surgical repair wasn't met, or the surgery was expensive. This could be due to the relatively low level of income of most patients in the population. Aortic stenosis which is the most common valvular disease mostly caused by the "wear and tear" in patients above 60 years of age, causes a lot of physical incapacitation as the heart struggles to pump blood through the stenosed valve to the rest of the body. This causes symptoms that hinder physical activity like angina and syncope with exercise. Concurrently, it also causes concentric left ventricular hypertrophy which can cause the other symptoms of heart failure. Hence without replacement of the valve, other complications keep arising such as microangiopathic anaemia as the red blood cells are damaged while crossing the valve. This anaemia could also explain the poor quality of life as it was proven to impair it [43]. Clinical measures, such as mortality, morbidity and left ventricular function maybe not fully capture the benefits of surgical repair which can be a serious problem in decision-making on surgery.

Amongst the Charlson comorbidities studied, we found the presence of chronic kidney disease to greatly affect the quality of life of patients with HF. Though HF and CKD can be caused by different afflictions, one of them can lead to the other in a syndrome known as cardiorenal syndrome (types

2 and 4). Chronic HF can cause CKD by the decreased blood flow to the kidney which causes ischemia and also activates the RAAS causing fluid retention which exacerbates HF. On the other hand, CKD causes fluid retention which stimulates the sympathetic system that causes ventricular changes to the heart due to increased preload and afterload. This loop worsens each disease that can affect the quality of life.

Our analysis also showed a positive association between poor prognosis (using the Charlson comorbidity index) and poor quality of life. Given that this score is gotten from comorbidities, it implies that the presence of the association comorbidities can affect the quality of life of patients.

Although bivariate analysis showed that patients with age ≥ 65 years, hemiplegia, history of stroke, solid tumour, peripheral vascular disease, overweight/obesity and HFrEF had poorer QoL, the multivariate statistical analysis did not confirm the result.

Interestingly, our study didn't find any link between the quality of life and factors like age group, sex, and all the other Charlson comorbidities ($p>0.05$). This is similar to a study done by Sadat *et al* who didn't find any association between quality of life and sex ($\chi2=1.70$, $df=4$; $p=0.79$) and age group (ANOVA, $F=0.74$; $p=0.57$)[48]. On the other hand, a meta-analysis done by Comin-Colet *et al* revealed that from 93 possible associations between non-cardiovascular comorbidities and HRQoL tested, 21.5% regarded anaemia or iron deficiency, 20.4% mental and behavioural disorders, 20.4% diabetes mellitus, and 14.0% respiratory diseases. It also showed that despite the large heterogeneity across studies, all 21studies showed that the presence of a non-cardiovascular comorbidity had a negative impact on the HRQoL of patients with CHF [43]. There is a need for comparative studies in our setting, to accurately assess the influence of these parameters. Our study also shows that there is a need for better and less costly management of heart failure caused by valvular disease to increase the quality of life of these patients and better management of patients with CKD and HF. Nevertheless, the evaluated prognosis of patients and quality of life were good for most of the population which is a good result as we thrive for our patients not only to have a long life but one with good quality.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

At the end of the study, we can state the following.

1- The mean age of persons with heart failure was 62.6 ± 14.2 years, with female predominance, with sedentary behaviour and overweight/obesity as the most prevalent cardiovascular risk factors. Hypertension was the most often identified cause of HF, loop diuretics and modifications in lifestyle were the main methods of treatment. The majority had HFrEF with NYHA stage II and no recent decompensations.
2- The two most common Charlson co-morbidities found were diabetes and CKD. Most patients had a 10-year survival rate greater than 75% while 9.3% had a 0% survival rate.
3- More than half of the patients had a good quality of life (53.5%). We observed that an increase in NYHA classification stage, HF of valvular origin, and presence of chronic kidney disease were directly associated with poorer quality of life in HF patients. We also found out that the prognosis of patients with HF (evaluated using the Charlson co-morbidity index) was directly associated with HRQoL. We can conclude that the poorer the quality of life, the poorer the prognosis.

RECOMMENDATIONS:

To Ministry of Public health

- Continue sensitisation on hypertension as it is still the main cause of HF in our milieu
- Continue to make available drugs used for treating heart failure and reagents necessary to diagnose co-morbidities.

To the scientific committee

- To conduct comparative and prospective studies on larger populations on the best way of managing patients with both CKD and HF.
- Compare the charlson comorbity score with other validated laboratory and ultrasound prognostic markers
- Conduct comparative studies to access the quality of life of patients with HF of valvular aetiology, find the benefits of surgical repair of valve and the risk factors around it.

To Clinicians and Teaching Hospitals

- Lay more emphasis on renal function assessment in patients with HF to be able to diagnose CKD early enough which can lead to better management.
- Suggesting the use of HRQoF amongst the indicators for surgery in patients with HF of valvular origin.
- Continue early detection of hypertension and management as it is the leading cause of HF in our milieu.
- Continue to educate and raise awareness on sedentary behaviour and weight loss as most patients were overweight which increased risk for other diseases.

To patients

To be complaint and to follow their treatment as indicated by the doctors.

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APPENDICES

APPENDIX 1: INFORMATION SHEET

Theme: Impact of Co-morbidities on the prognosis and the quality of life of patients with chronic heart failure in 3 hospitals in Yaoundé

Procedure:

We invite you to take part in our research project entitled: Impact of Co-morbidities on the prognosis and the quality of life of patients with heart failure in 4 Hospitals in Yaoundé".

After obtaining your agreement, we will collect data with the use of our questionnaire.

Principal investigator: Nkipang Hubert Moh Tangongho; Student in the 7th year of medical studies at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé 1.

Telephone number: 699413163/650627177

Email: mohhubert20@gmail.com

Director: Ass. Pr NGANOU-GNINDJI

Co-directors: Dr NDONGO AMOUGOU Sylvie Epse Zame, Dr. NDOBO Valerie, Dr OWONA Amalia

Location of the study: Yaoundé General Hospital; Central Hospital of Yaoundé; Yaoundé University Teaching Hospital and Efoulan district hospital

Duration of the study: It will extend from the drafting of the protocol in November 2022 to the date of the defense scheduled for June 2023.

GOAL OF THE STUDY:

To determine the impact of co-morbidities on the quality of life of patients with heart failure and predict the prognosis of the patients using the Charlson comorbidity score.

Advantage: - Participation in the study is free. - Any refusal to participate is legitimate.

- Even after accepting, you can withdraw from this study if you wish, and at any time without prejudice.

APPENDIX 2: INFORMED CONSENT FORM

Theme: "Impact of Co-morbidities on the prognosis and the quality of life of patients with heart failure in Yaoundé"

- Principal investigator: NKIPANG HUBERT MOH TANGONGHO student in the 7th year of medical studies.

- National Ethics Committee authorization number:

I, the undersigned, Mrs., Miss……

Freely and voluntarily accepts to participate in the community investigation on the theme Evaluation of the prognosis of patients with heart failure in Yaoundé.

It is understood that the investigator informed me and answered all my questions, the investigator told me that my participation is free and that my right to withdraw from this research can be done at any time, without doing no harm. I agree that the data recorded during this research may be subject to computer processing. I could exercise my right of rectification and opposition with this same investigator.

Done in Yaoundé on…. /……/2023

Investigator's signature Signature of participant

APPENDIX 3: REQUEST FOR ETHICAL CLEARANCE

NKIPANG HUBERT MOH TANGONGHO

7th-year general medicine student

Registration number: 16M022

Tel: 654566159

Email: mohhubert20@gmail.com

Yaoundé, the……

To

The President of the Institutional Ethics and Research Committee of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I

Subject: Request for an Ethical Clearance

Mister President,

I have the honor to come to your high benevolence to seek an ethical clearance.

Indeed, I am a student in the 7th year of general medicine at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I and I am doing a doctoral thesis in medicine entitled: "Impact of Co-morbidities on the prognosis and the quality of life of patients with heart failure in Yaoundé". The purpose of this work will be to describe the sociodemographic aspects of patients with heart failure, predict the prognosis and determine the quality of life of patients with respect to their co-morbidities.

Pending a favorable response to my request, please accept, Mr. President, the expression of my deep respect.

Attachments:

¬ A copy of the thesis protocol

¬ A photocopy of my university fee payment receipt for the 2022-2023 academic year

APPENDIX 4: RESEARCH AUTHORIZATION REQUEST

NKIPANG Hubert Moh Tangongho

7th-year general medicine student

FMSB/UYI

Registration number: 16M022

Tel: 654566159

Email: mohhubert20@gmail.com

Yaoundé, the….

To the Director of the Central Hospital of Yaoundé

Subject: Research authorization request

Mr. Director,

I have the honor to come to your high personality to request research authorization in your hospital structure.

Indeed, I am a student in the 7th year of general medicine at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I and I am working on a doctoral thesis in medicine entitled "Impact of Co-morbidities on the prognosis and the quality of life of patients with heart failure in Yaoundé". I would like to carry out my research work within your hospital for the period from January 2022 to April 2022, that is. a period of 4 months in the various internal medicine departments. The purpose of the work would be to describe the sociodemographic aspects of patients with heart failure, predict the prognosis and determine the quality of life of patients with respect to their co-morbidities., and I need your authorization to be able to lead it.

I enclose my request:

- A copy of the thesis protocol.

Pending a favorable response to my request, please accept, Mr. Director, the expression of my deep respect

APPENDIX 5: RESEARCH AUTHORIZATION REQUEST

NKIPANG Hubert Moh Tangongho

7th-year general medicine student

FMSB/UYI

Registration number: 16M022

Tel: 654566159

Email: mohhubert20@gmail.com

Yaoundé, the….

To the Director of the Yaounde General Hospital

Subject: Research authorization request

Mr. Director,

I have the honor to come to your high personality to request research authorization in your hospital structure.

Indeed, I am a student in the 7th year of general medicine at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I and I am working on a doctoral thesis in medicine entitled "Impact of Co-morbidities in the prediction of prognosis and the quality of life of patients with heart failure in Yaoundé". I would like to carry out my research work within your hospital for the period from January 2022 to April 2022, that is a period of 4 months in the various internal medicine departments. The purpose of this work will be to describe the sociodemographic aspects of patients with heart failure, predict the prognosis and determine the quality of life of patients with respect to their co-morbidities, and I need your authorization to be able to lead it.

I enclose my request:

- A copy of the thesis protocol

Pending a favorable response to my request, please accept, Mr. Director, the expression of my deep respect

APPENDIX 5: RESEARCH AUTHORIZATION REQUEST

NKIPANG Hubert Moh Tangongho

7th-year general medicine student

FMSB/UYI

Registration number: 16M022

Tel: 654566159

Email: mohhubert20@gmail.com

Yaoundé, the….

To the Director of Yaounde University Teaching Hospital

Subject: Research authorization request

Mr. Director,

I have the honor to come to your high personality to request research authorization in your hospital structure.

Indeed, I am a student in the 7th year of general medicine at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I and I am working on a doctoral thesis in medicine entitled "Impact of Co-morbidities on the prognosis and the quality of life of patients with heart failure in Yaoundé". I would like to carry out my research work within your hospital for the period from January 2022 to April 2022, that is a period of 4 months in the various internal medicine departments. The purpose of this work will be to describe the sociodemographic aspects of patients with heart failure, predict the prognosis and determine the quality of life of patients with respect to their co-morbidities, and I need your authorization to be able to lead it.

I enclose my request:

- A copy of the thesis protocol.

Pending a favorable response to my request, please accept, Mr. Director, the expression of my deep respect.

APPENDIX 6: RESEARCH AUTHORIZATION REQUEST

NKIPANG Hubert Moh Tangongho

7th-year general medicine student

FMSB/UYI

Registration number: 16M022

Tel: 654566159

Email: mohhubert20@gmail.com

Yaoundé, the….

To the Director of the Efoulan District Hospital

Subject: Research authorization request

Mr. Director,

I have the honor to come to your high personality to request research authorization in your hospital structure.

Indeed, I am a student in the 7th year of general medicine at the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I and I am working on a doctoral thesis in medicine entitled "Impact of Co-morbidities on the prognosis and the quality of life of patients with heart failure in Yaoundé". I would like to carry out my research work within your hospital for the period from January 2022 to April 2022, that is a period of 4 months in the various internal medicine departments. The purpose of this work will be to describe the sociodemographic aspects of patients with heart failure, predict the prognosis and determine the quality of life of patients with respect to their co-morbidities, and I need your authorization to be able to lead it.

I enclose my request:

- A copy of the thesis protocol

Pending a favorable response to my request, please accept, Mr. Director, the expression of my deep respect

APPENDIX 7: RESEARCH QUESTIONNAIRE

I- IDENTIFICATION

File number :
Date of entry :

II- SOCIODEMOGRAPHIC DATA

1-	**Age (years)** :	
2-	Sex : 1. Male ; 2. Female	
3-	**Profession** : 1. Employee in public sector ; 2. Employee in private sector ; 3. Actor in informal sector ; 4. Unemployed ; 5. Student 6. Invalid	
4-	**Statut matrimonial** : 1. Single ; 2. Married ; 3. Divorced ; 4. Widow	
5-	**Ethnicithy:** 1. Bantu 2. Semi-bantu 3. sudanese	
6-	**Level of income (FCFA):**	
7-	**Assurance**: 1. Yes 2. No	

III- PAST HISTORY

a) CARDIOVASCULAR RISK FACTORS

8-	**Hypertension** : 1) Yes ; 2) No	
9-	**Tobacco :** 1) Yes ; 2) No If yes, what amount	 |_____|
10-	**Alcohol :** 1) Yes ; 2) No **If yes, what amount**	 |_____|
11-	**Diabetes :** 1)Yes 2) No	
12-	**Dyslipidemia :** 1) Yes ; 2) No	
13-	**Sedentarity**: 1)Yes ; 2) No	
14-	**Race :** 1) Black 2) White 3) Yellow 4) Red	
15-	**Height :**	

16-	**Weight :**	

b) Others

17-	**Number of hospitalizations for heart failure decompensation in the last 12 months:**	
18-	**Infection:** 1) Yes 2) No	
19-	**Viral hepatitis:** 1) Yes 2) No	

IV- Classification

20-	**NYHA classification:** 1) stage I 2) stage II 3) stage III 4) stage IV	
21-	**Left Ventricular Ejection Fraction:**	
22-	**Type of HF:** 1) HFrEF(<40%) ;2) HFmrEF(40-50%) 3) HFpEF(>50)	
23-	**Etiology:** : 1) Ischemic 2) Hypertension 3) Valvulopathy 4) Congenital; 5) Pericarditis; 6) Post-RAA; 7) Anemia; 8) Arrhythmia; 9) Infectious; 10) Idiopathic; 11) Other: ……..	

V- Management

a) General

24-	Dietery and lifestyle changes 1) Yes 2)No	

b) Pharmacologic

25-	**Angiotensin converting enzyme inhibitor:** 1) Yes 2)No	
26-	**Angiotensin II receptor blocker:** 1) Yes 2)No	
27-	**Beta blockers:** 1) Yes 2)No	
28-	**Loop diuretics:** 1) Yes 2)No	
29-	**Digitalis:** 1) Yes 2)No	
30-	**Statins:** 1) Yes 2)No	
31-	**Mineralocorticords receptor antagonist:** 1) Yes 2)No	
32-	**Vasodilators:** 1) Yes 2)No	
33-	**Anti-platelet aggregators:** 1) Yes 2)No	
34-	**Antiarrhyhmics:** 1) Yes 2)No	
35-	**Angiotensin receptor/neprilysin inhibitor:** 1) Yes 2)No	
36-	**Sodium-glucose cotransporter-2(SGLT2) inhibitor:** 1) Yes 2)No	
37-	**Ivabradine:** 1) Yes 2)No	

c) Instrumental

38-	**Implantable cardioverter-defibrillator:** 1) Yes 2)No	
39-	**Cardiac resynchronization therapy:** 1) Yes 2)No	

40-	**Pacemaker:** 1) Yes 2)No	

d) Surgical

41-	**Coronary artery bypass graft:** 1) Yes 2)No	
42-	**Valvuloplasty:** 1) Yes 2)No	
43-	**Heart transplant:** 1) Yes 2)No	

VI- Charlson Comorbidity Score

1-	Age: 0) <50yrs ; 1) 50-59yrs ; 2) 60-69yrs ;3) 70-79yrs ;4) >80yrs	
2-	Myocardial infarction: 0) No ; 1) Yes	
3-	Congestive heart failure: 0) No ; 1) Yes	
4-	Peripheral vascular disease: 0) No ; 1) Yes	
5-	Cerebro-vascular accident or transient ischemic attack: 0) No ; 1) Yes	
6-	Dementia: 0) No ; 1) Yes	
7-	Chronic Obstructive Pulmonary Disease: 0) No ; 1) Yes	
8-	Connective tissue disease: 0) No ; 1) Yes	
9-	Peptic ulcer disease: 0) No ; 1) Yes	
10-	Liver disease: 0) No ; 1) mild 3) moderate to severe	
11-	Diabetes mellitus: 0) No ;1) Uncomplicated; 2) Yes	
12-	Hemiplegia 0) No ; 2) Yes	
13-	Moderate to severe Chronic kidney disease: 0) No ; 2) Yes	
14-	Solid tumor: 0) None ; 2) Localized 6) Metastatic	
15-	Leukemia: 0) No ; 2) Yes	
16-	Lymphoma: 0) No ; 2) Yes	
17-	AIDS: 0) No ; 6) Yes	
18-	INDEX TOTAL	

MINESSOTA QUALITY OF LIFE QUESTIONNAIRE

With the help of this questionnaire, we want to know to what extent your heart problems have prevented you from living as you would have liked during the last month. If you are sure that what the sentence describes does not apply to you or is not related to your heart failure, circle 0 (No) and continue to the next sentence. When, on the contrary, you consider that the sentence applies

to your case, circle the number which seems to you to correspond best to your condition. (From 1: a little to 5: a lot).

1-	By causing your ankles, legs, etc. to swell						
2-	By making your usual activities at home in the garden difficult?						
3-	By making relationships or activities with your friends or family difficult?						
4-	By forcing you to sit or lie down to rest during the day?						
5-	By causing you to feel tired, tired or lack energy?						
6-	By making it difficult to earn a living?						
7-	By making it difficult for you to walk or climb stairs?						
8-	By making you breathless?						
9-	By preventing you from sleeping well at night?						
10-	By forcing you to limit yourself on your favorite dishes?						
11-	By making it difficult for you to travel outside your home?						
12-	By making your sex life difficult?						
13-	By making your hobbies, the practice of sports or your favorite hobbies difficult?						
14-	By preventing you from concentrating or making it difficult for you to remember certain things?						
15-	By causing you adverse drug reactions?						
16-	By making you worry preoccupied?						
17-	By making you depressed?						
18-	By causing you additional expenses?						
19-	By making you feel less in control of what happens to you?						
20-	By forcing you to stay in the hospital?						
21-	By making you feel like a burden or a burden on your family or friends?						

Total score

1. Good quality of life (<24) 2. Moderate quality of life (24-45) 3. Poor quality of life (>45)	

UNIVERSITÉ DE YAOUNDÉ I
FACULTÉ DE MÉDECINE ET DES SCIENCES BIOMÉDICALES
COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE
Tel/ fax : 22 31-05-86 22 311224
Email: decanatfmsb@hotmail.com

THE UNIVERSITY OF YAOUNDE I
FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES
INSTITUTIONAL ETHICAL REVIEW BOARD

Ref. : N° 0453 /UY1/FMSB/VDRC/DAASR/CSD

CLAIRANCE ÉTHIQUE

Le COMITÉ INSTITUTIONNEL D'ÉTHIQUE DE LA RECHERCHE (CIER) de la FMSB a examiné

La demande de la clairance éthique soumise par :

M.Mme : NKIPANG Hubert MOH TANGONGHO Matricule: 16M022

Travaillant sous la direction de :

- **Pr Nganou-Gnindjio Chris Nadège**
- **Dr Ndongo Amougou Sylvie**
- **Dr Owono Ngandebe Amalia**
- **Dr Ndobo Juliette Valérie Danièle**

Concernant le projet de recherche intitulé : **Impact of co-morbidities in the prediction of prognosis and the quality of life of patients with heart failure in Yaounde**

Les principales observations sont les suivantes

Evaluation scientifique	
Evaluation de la convenance institutionnelle/valeur sociale	
Equilibre des risques et des bénéfices	
Respect du consentement libre et éclairé	
Respect de la vie privée et des renseignements personnels (confidentialité) :	
Respect de la justice dans le choix des sujets	
Respect des personnes vulnérables :	
Réduction des inconvénients/optimalisation des avantages	
Gestion des compensations financières des sujets	
Gestion des conflits d'intérêt impliquant le chercheur	

Pour toutes ces raisons, le **CIER** émet un avis **favorable** sous réserve des modifications recommandées dans la grille d'évaluation scientifique.

L'équipe de recherche est responsable du respect du protocole approuvé et ne devra pas y apporter d'amendement sans avis favorable du **CIER**. Elle devra collaborer avec le **CIER** lorsque nécessaire, pour le suivi de la mise en œuvre dudit protocole.

La clairance éthique peut être retirée en cas de non - respect de la réglementation ou des recommandations sus évoquées.

En foi de quoi la présente clairance éthique est délivrée pour servir et valoir ce que de droit

LE PRESIDENT DU COMITE ETHIQUE

PROFESSEUR

REPUBLIQUE DU CAMEROUN
Paix - Travail - Patrie

MINISTERE DE LA SANTE PUBLIQUE

HOPITAL GENERAL DE YAOUNDE

DIRECTION GENERALE

BP 5408 YAOUNDÉ - CAMEROUN
TÉL : (237) 22 21 31 81 FAX : (237) 22 21 20 15.

REPUBLIC OF CAMEROON
Peace - Work - Fatherland

MINISTRY OF PUBLIC HEALTH

YAOUNDE GENERAL HOSPITAL

GENERAL MANAGEMENT DEPARTMENT

N/Réf. : 195-23 /HGY/DG/DPM/APM-TR.

Yaoundé, le 23 FEV 2023

Le Directeur Général

A/TO

Monsieur NKIPANG Hubert MOH TANGONGHO
Etudiant en 7ème année de Médecine
Tél : (237) 654 566 159 Mle 16M022
Faculté de Médecine et des Sciences Biomédicales
UNIVERSITE DE YDE I

Objet/subject :
v/demande d'autorisation de collecte des données

Monsieur,

Nous accusons réception de votre correspondance du 14 février 2023 relative à une autorisation de recherches à l'Hôpital Général de Yaoundé.

Y faisant suite, nous marquons un avis favorable pour que vous effectuiez vos travaux de recherches au Service de CARDIOLOGIE dans le cadre de votre étude dont le thème s'intitule : « **Impact of Co-morbidities in the prediction of prognosis and the quality of life of patients with heart failure in three hospitals in Yaounde>>.**

Cette étude sera sous la supervision du Docteur OWONA Amalia, Cardiologue.

Pendant la durée de ses recherches, vous observerez le règlement intérieur de l'établissement. Toutefois, les publications se rapportant à ce travail devraient inclure les médecins de l'Hôpital Général de Yaoundé.

Recevez, Monsieur, nos salutations distinguées./-

Copies :
- DPM
- Chef service Cardiologie
- Archives/chrono.

Le Directeur Général,

HOPITAL GENERAL YAOUNDE H.G.Y Le Directeur Général Adjoint YAOUNDE GENERAL HOSPITAL

Prof. EYENGA Victor

REPUBLIQUE DU CAMEROUN
Paix –Travail – Patrie
MINISTERE DE LA SANTE PUBLIQUE
DELEGATION REGIONALE DU CENTRE
DISTRICT DE SANTE D'EFOULAN
HOPITAL DE DISTRICT D'EFOULAN

HD
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CENTER REGIONAL DELEGATION
EFOULAN HEALTH DISTRICT
EFOULAN DISTRICT HOSPITAL

N° 224 /AR/MSP/ DRSPC/DSYIII/HDE.

AUTORISATION DE RECHERCHE

Je soussigné ***Dr LOMBO LOMBO Landry, Directeur de l'Hôpital de District d'Efoulan certifie*** qu'une autorisation administrative de recherche portant sur le thème : « **Impact of Co-morbidities in the prediction of prognosis and the quality of life of patients with heart failure in hospital in Yaounde »,** est accordé à **NKIPANG Hubert MOH TANGONGHO,** étudiante en 7ème année de Médecine Générale, à la Faculté de Médecine et des Sciences Biomédicales, de l'Université de Yaoundé I.

L'éthique et la confidentialité sont à respecter ;

Au terme de ce travail, une copie sera déposée à la bibliothèque de l'Hôpital de District d'Efoulan.

Yaoundé, 23 FEV 2023

LE DIRECTEUR

REPUBLIQUE DU CAMEROUN Région du Centre Hôpital de District d'Efoulan La Directeur MINISTERE DE LA SANTE PUBLIQUE

Dr Lombo Landry Médecin Directeur HD EFOULAN

REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTERE DE LA SANTE PUBLIQUE

SECRETARIAT GENERAL

DIRECTION DE L'HOPITAL CENTRAL DE YAOUNDE

UNITE ADMINISTRATIVE ET FINANCIERE

N°2023/1204/AR/MINSANTE/SG/DHCY/UAF

REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF PUBLIC HEALTH

SECRETARIAT GENERAL

DIRECTORATE OF CENTRAL HOSPITAL

ADMINISTRATIVE AND FINANCIAL UNIT

Yaoundé, le 06 MARS 2023

AUTORISATION DE RECHERCHE

Je soussigné, **Professeur Pierre Joseph FOUDA**, Directeur de l'Hôpital Central de Yaoundé, accorde une autorisation de recherche de janvier 2022 à avril 2022, sous la direction du *Pr NGANOU GNINDJIO Christ Nadège* et la codirection des Drs OWONA Amalia et NDOBO Valérie à **Mr NKIPANG Hubert MOH TANGONGHO**, étudiant en Médecine Générale niveau 7 à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I, sur le thème : « **Impact of co-morbidities in the prediction of prognosis and the quality of life of patients with heart failure in 3 hospitals in Yaounde** ».

L'intéressé est tenu au strict respect du règlement intérieur de l'Hôpital Central de Yaoundé et s'engage à déposer un exemplaire de ladite thèse à la Direction dudit hôpital après correction.

En foi de quoi, la présente autorisation lui est délivrée pour servir et valoir ce que de droit. /-

REPUBLIQUE DU CAMEROUN * HOPITAL CENTRAL DE YAOUNDE * MINISTERE DE LA SANTE PUBLIQUE
Le Directeur

Le Directeur,

Pr Pierre Joseph FOUDA

REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie

MINISTERE DE LA SANTE PUBLIQUE

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Peace – Work – Fatherland

MINISTRY OF PUBLIC FEALTH

C U H C U
YAOUNDE

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YAOUNDE UNIVERSITY TEACHING HOSPITAL
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CELLULE D'APPUI PEDAGOGIQUE,
DE LA RECHERCHE ET DE LA COOPERATION
BUREAU DE LA CAPRC

N°123 /LA/CHUY/DG/CAPRC/CEAAP/CEARC

AUTORISATION DE RECHERCHE

Dans le cadre de la rédaction d'une thèse de fin d'étude, en vue de l'obtention de son doctorat en Médecine Générale, Monsieur NKIPANG Hubert MOH TANGONGHO est autorisé à mener une recherche au CHUYsur le thème:<<IMPACT OF CO-MORBIDITIES IN THE PREDICTION OF PROGNOSIS AND THE QUALITY OF LIFE OF PATIENTS WITH HEART FAILURE IN YAOUNDE>>.

Ces travaux se dérouleront dans le service médecine sous la supervision du chef de service.

Toutefois, il devra obligatoirement déposer un examplaire de sa thèse au CHUY (Bureau de la CAPRC).

En foi de quoi la présente autorisation lui est délivrée pour servir et valoir ce que de droit./-

Yaoundé, le 08 MARS 2023

LE DIRECTEUR GENERAL

Centre Hospitalier et Universitaire Yaoundé — Le Directeur Général

Pr. Arthur Essomba