ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

POSTGRADUATE PROGRAMME

PREVALENCE OF ARRHYTHMIAS AND ASSOCIATED FACTORS AMONG COVID-19 PATIENTS IN THE ICU AT CO-VID-19 TREATMENT CENTERS, ADDIS ABABA, ETHIOPIA, 2021

BY:GOBU LETEMU

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CO – ADVISOR: EMEBET BIRHANE (MSc, PHD STUDENT)

A RESEARCH THESIS TO BE SUBMITTED TO SCHOOL OF GRADUATE PROGRAM OF ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE, SCHOOL OF NURSING AND MIDWIFERY,NURSING DEPARTMENT; IN PARTIAL FULFILLMENT OF THE RE-QUIRMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN CARDIOVASCULAR NURSING.

FEBRUARY, 2022

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APPROVAL SHEET

I declare and affirm that this thesis is my original work by signing below. All of the ethical principles of scholar paper preparation, such as data collection, data analysis, and thesis completion, were followed by me. All scholar materials that are included in the thesis have been given recognition through citation. I hereby certify that all sources cited and referenced in this document have been properly cited and referenced. Every effort was made to avoid plagiarism in the preparation of this thesis.

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As members of the Board of Examination for the MSN thesis evaluation, we have read and evaluated the thesis prepared by Gobu Letemu entitled "Prevalence of arrhythmias and associated factors among COVID-19patients in the ICU at COVID-19 centers, Addis Ababa, Ethiopia, 2021." It is certified and accepted in its present form by the board of examination as satisfying the thesis requirement for the degree of masters in cardiovascular nursing.

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LIST OF ACRONYMS

AOR	Adjusted Odds Ratio
CAD	Coronary Artery Disease
CKD	Chronic Kidney Disease
COR	Crude Odds Ratio
COVID-19	Coronavirus Disease 2019
CRHD	Chronic Rheumatic Heart Disease
CVD	Cardiovascular Disease
ECG	Electrocardiography
HCQ	Hydroxychloroquine
HeRG	Human Ether-à-go-go-related Gene
ICU	Intensive Care Unit
IHD	Ischemic Heart Disease
NSVD	Non-Sustained Ventricular Tachycardia
SCD	Sudden Cardiac Death
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia

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ABSTRACT

Background: Arrhythmia is a condition in which the heart beats become abnormal rhythms, below 60 or above 100 beats per minute. Arrhythmias are common clinical events in the intensive care unit (ICU) setting, including COVID-19 patients. A global survey indicates that there is a higher incidence of arrhythmia in COVID-19 patients that accounts for 16.8% of their deaths, and reports 2 deaths out of 10 after developing arrhythmia.

Objective: The study's goal is to assess the prevalence of arrhythmias and associated factors in COVID-19 patients in the ICU at public COVID-19 treatment centers in Addis Ababa, Ethiopia.

Method: A descriptive cross-sectional study design based on a facility was used. A simple random sampling technique was used to select the records of 422 patients whose records fulfilled the inclusion criteria from February 15, 2021, until April 15, 2021, in Addis Ababa. A checklist was prepared to collect the data. The statistical software SPSS Version 26.0 was used to collect, enter, and analyze the data. The ethical clearance was obtained from Addis Ababa University College of Health Sciences, School of Nursing and Midwifery. The frequency, median, and standard interquartile range were calculated using descriptive statistics and inferential statistics such as bivariate and multivariable logistic regression analysis; statistical significance was determined using a P-value less than 0.05.The results were presented using tables and charts.

Result: The result showed that most of the study subjects were in the age range of 62–76 years old. The median age of the study population was 60 (interquartile range 50-70) years. Among the total 422 patient' records analyzed, 270 (64%) of them were males. The prevalence of cardiac arrhythmias was 231 (54.7%). Patients aged (16-31) [AOR = 0.24; 95%CI (0.084-0.678)], those aged (32-46) [AOR = 0.106-0.766]], those with a history of CKD [AOR = 0.155; 95%CI (0.035-0.690)], and those with high serum Cl- [AOR = 3.88; 95%CI (1.17-12.85)] were found to have a significant association.($p < 0.05$, 95% C. I).

Conclusion: The majority of COVID-19 patients admitted to the ICU had cardiac arrhythmias. Arrhythmia prevalence is associated with serum Cl imbalance.

Key words: Arrhythmia, COVID -19, Cardiac disorder

CHAPTER 1

1. INTRODUCTION

1.1 Background of the Study

Arrhythmia is defined as any deviation from the normal sequence of electrical impulses. Electrical impulses can occur too slowly, too quickly, or in an irregular pattern.Irregularities are defined as causing the heart to beat too fast (above 100 beats per minute), too slowly (below 60 beats per minute), or irregularly (1, 2).

Arrhythmias are classified into four types: extra beats, ventricular arrhythmias, supraventricular tachycardias, and bradyarrhythmias (3). Premature atrial contractions, premature ventricular contractions, and premature junctional contractions are examples of extra beats. Fibrillation, paroxysmal supraventricular tachycardia and atrial flutter are all examples of supraventricular tachycardia. Premature ventricular contraction, ventricular fibrillation, and ventricular tachycardia are examples of ventricular arrhythmias (3). Sinus node dysfunction and heart block are examples of Bradyarrhythmia (2).

Arrhythmias are commonly associated with risk factors or co-morbidities such as hypertension, heart failure, diabetes, stroke, rheumatic heart disease, Coronary Artery Disease (CAD) and dilated cardiomyopathy. Arrhythmias are risk factors for non-rheumatic valvular diseases, congenital heart disease, hyperthyroidism, obesity, smoking, obstructive sleep apnea, and increased alcohol consumption (4).

Arrhythmia, a condition in which the heart beats in an erratic or abnormal rhythm, affects approximately 300 million people worldwide. Atrial fibrillation is the most common arrhythmia, affecting approximately 30 million people globally (5). An epidemiological study of community-based atrial fibrillation in low- and middle-income countries showed a prevalence of 0.03–1.25% (6). According to the 2017 Global Burden of Disease Study, about 1.3 million people, or 0.13%, have atrial fibrillation or atrial flutter in Sub-Saharan Africa. This prevalence is lowest as compared to the high-income countries such as, Western Europe and North America, where their report revealed a prevalence rate of 1.5% (4). Furthermore, an annual incidence of 35 per 100,000 people and a prevalence of 2.25 per 1,000 people of paroxysmal supraventricular tachycardia are estimated (6). In addition, in Asia, the annual incidence rate of atrial fibrillation has been

reported in the range of 0.37–15.8% (6). However, in Ethiopia, there is no literature regarding arrhythmias.

Arrhythmias are common clinical events in the Intensive Care Unit (ICU) setting. The frequency and prognosis related to arrhythmias may vary according to the clinical setting where they are admitted. Thus, arrhythmias have been reported to occur in 15.7 and 19.7 percent of surgical and medical ICU patients, respectively (7).

Worldwide, more than 3.7 million people die every year due to sudden cardiac cases. Over 300,000 of these are from the USA. In the USA and Europe, the annual incidence of sudden cardiac death in the general population ranges from 50 to 100 per 100,000. In Asia, the incidence of Sudden Cardiac Death (SCD) in a year per 100,000 people has been reported as 37, 41, 38, and 43 in Japan, China, Thailand, and the Philippines, respectively. Ventricular Tachycardia (VT) and Ventricular Fibrillation (VF) are the most common pathophysiological cascades involved in fatal arrhythmias, recorded as the primary electrical events at the time of sudden cardiac death (8).

Certain conditions, such as a current heart attack, scarring of heart tissue from a prior heart attack, changes to the heart's structure, such as from cardiomyopathy, high blood pressure, blocked arteries in the heart (coronary artery disease), an overactive or underactive thyroid gland, sleep apnea, diabetes, and COVID-19 infection, can lead to or cause arrhythmia. Other factors that can cause an arrhythmia include smoking, excessive alcohol or caffeine consumption, drug abuse, stress or anxiety, and genetics (2).

According to an online survey of electrophysiology professionals conducted by the Cardiac Rhythm Society (HRS) on 1197 patients, atrial fibrillation was the most commonly reported tachyarrhythmia (21%), while severe sinus bradycardia (8%) and complete Adams-Stokes syndrome (8%) were the most common bradyarrhythmias in COVID-19 hospitalized patients (15).

1.2 Statement of the Problem

In December 2019, a replacement zoonotic beta coronavirus (SARS-CoV-2) has spread everywhere on the planet, causing acute respiratory distress and was initially reported from Wuhan, China as Coronavirus Disease (COVID-19) (9).

According to the Johns Hopkins COVID-19 resource center report, 7.4 million people have been infected worldwide within the seven-month duration (December 2019–June 2020) (10). Moreover, as of November 30, 2020, the World Health Organization (WHO) has also reported that a total of 62,363,527 confirmed cases and 1,456,687 deaths have occurred worldwide since the first declaration of the COVID-19 disease; and in Africa, 2,187,417 people have been infected, while 52,083 deaths have been reported (11).

Literature indicates Cardiac complications are common in COVID-19, in patients with or without previous cardiovascular problems, and contribute to increased morbidity and mortality. Among the cardiac complications are arrhythmias, heart failure, myocarditis, and acute coronary syndrome caused by coronary artery thrombosis or SARS-CoV-2-related plaque ruptures. Of these, arrhythmias are the major complications as SARS CoV-2 induces a potent inflammatory and cardiovascular reaction, possibly leading to a fatal outcome even in previously healthy people. Cardiac arrhythmias developed in 44% of patients admitted into medical ICU, while 17% occurred in patients who were admitted to surgical ICU, according to the case series of 138 patients in Wuhan hospital (12).

The underlying mechanisms of cardiac arrhythmia in patients with COVID-19 may be as a result of cardiac injury, excessive production of the immune system, medication adverse effects and drug interactions of concomitantly used drugs, electrolyte abnormalities, systemic hypotension, coronary plaque rupture, pulmonary embolism, and the uncovering of Brugada syndrome due to fever (12). Acute myocardial injury is thought to be the primary cause of increased cardiac arrhythmias in COVID-19 patients (13). According to a recent retrospective cohort study, 1159 out of 1284 patients with severe COVID-19 had a cardiac troponin I upon hospitalization. 170 people (14.7 percent) tested positive for cardiac injury. Mortality in patients with cardiac injury was higher than in patients without cardiac injury (71.2 percent vs. 6.6 percent) (14).

Both chloroquine and hydroxychloroquine, can cause prolongation of the QT interval and ventricular tachycardia, including Torsade de pointes. Azithromycin can also increase the QT interval and cause arrhythmias, especially if utilized in combination with hydroxychloroquine (15).

In a recent study of 700 patients with COVID-19, nine cardiac arrests, nine bradyarrhythmias, ten Non-Sustained Ventricular Tachycardias (NSVTs), and 25 incident Atrial Fibrillation (AF) episodes were reported (14) In one study, palpitations were reported in 7.3% of patients who were admitted to a hospital with COVID-19 in the Hubei province, China (16).

A global survey indicates a higher incidence (16.8%) of arrhythmia in COVID-19 patients, with 2 out of 10 dying after developing arrhythmia (17, 18). The incidence of different types of dysrhythmias in COVID-19 patients was as follows: 12.0%, 8.2%, 10.8%, 8.6%, and 3.3% for non-classified arrhythmia, atrial fibrillation, atrial flutter, atrial tachycardia, conduction disorders, premature contraction, and ventricular fibrillation /ventricular tachycardia, respectively. The most common type of arrhythmia in COVID-19 patients is atrial fibrillation (16). Mortality also accounts for 20.3% (18).

Another meta-analysis of the mortality rate among CVD patients with COVID-19 indicates as follows: Acute Cardiac Injury (52%), Hypertension (51%), Arrhythmia (37%), Coronary Heart Disease (23%), Heart Failure (27%), and Cardiovascular Diseases (23%). The most common cardiovascular complication was hypertension (43 percent), followed by arrhythmia (33 percent), acute cardiac injury (33 percent), coronary artery disease (20 percent), and heart failure (20 percent) (19).

In Africa, including Ethiopia, there is limited literature related to arrhythmia among COVID-19 patients. The purpose of this study is to determine the prevalence of arrhythmias and associated factors among COVID-19 patients in Addis Ababa, Ethiopia's ICU. Because arrhythmias are fatal, careful monitoring and management of COVID-19 patients is required. The findings of this study may aid in highlighting the need for frontline health workers and policymakers to reform health care services in order to reduce mortality rates.

CHAPTER 2

2. LITERATURE REVIEW

Cardiac arrhythmia is a generic term used for any of a heterogeneous group of conditions in which there is abnormal electrical activity in the heart. Some arrhythmias cause only irritating symptoms, such as the awareness that the heart is beating very fast, while others can lead to potentially fatal conditions, such as strokes or cardiac arrest (20). A heart rate that's too fast, above 100 beats per minute in adults, is called tachycardia, and a pulse that's too slow, below 60 beats per minute, is called bradycardia. Extra beats, supraventricular tachycardias, ventricular arrhythmias, and bradyarrhythmias are the four major types of arrhythmias (3). In addition to bradyarrhythmias, tachyarrhythmias such as fibrillation, atrial flutter, and supraventricular tachycardias, also known as ventricular arrhythmias, have been reported in COVID-19 patients. An ECG finding of ST-segment elevation preceded a case of multifocal ventricular tachycardia in a patient with COVID-19 (21).

Sinus tachycardia is the most common rhythm disturbance in patients with COVID-19 infection, due to a variety of factors such as fever, hemodynamic compromise, respiratory insufficiency/hypoxiamia, pain, fear/anxiety, and a variety of other physical and emotional symptoms (13).

Consistent with a recent survey of electrophysiology professionals, fibrillation (AF) was the most commonly encountered arrhythmia observed in patients with COVID-19 infection. Critically ill COVID-19 patients often have comorbidities that will increase the danger of malignant ventricular arrhythmias.

Different tests to diagnose cardiac arrhythmia may include: electrocardiogram (ECG or EKG), holter monitor, event recorder, echocardiogram, implantable loop recorder (13).

2.1. Introduction of COVID-19

Coronavirus Disease2019 (COVID-19), caused by the novel severe acute respiratory syndrome coronavirus 2 (SARSCoV2), first appeared in December 2019 in patients with pneumonia of unknown origin in Wuhan, China. Exponential increases in global cases and mortality have precipitously led to a global public health crisis, which the World Health Organization (WHO) has declared a global pandemic on March 21, 2020 (16).

The time period varies from 1 to 14 days, although cases with longer incubation periods of up to 24 days have been identified. SARS-CoV-2 infection may cause a good range of clinical presentations, from asymptomatic to severe. The most common clinical symptoms develop within about 10 days and include dry cough, fever, fatigue, dyspepsia, and anosmia; other less characteristic symptoms are headache, runny nose, pharyngitis, nasal congestion, poor appetite, and diarrhea (22).

Several studies have indicated that numerous risk factors are related to a worse outcome in patients with SARS-CoV-2 infection. Age, cancer, diabetic mallets, hypertension, obesity, and former heart conditions are related to an increased risk of severe forms and mortality. When serious and non-serious patients were compared, the chances ratios of hypertension, system respiratory disease and Cardiovascular Disease (CVD) were 2.36, 2.46 and 3.42, respectively (23).

The current treatment of COVID-19 is usually symptomatic and supportive treatment and intervention. Although currently no specific guidelines regarding the prevention and treatment of cardiovascular complications of COVID-19 have yet to be established (24).

2.2. Prevalence of Cardiac Arrhythmias in Patients with COVID-19

In a recent meta-analysis study conducted in Egypt by Omar Hamam et al., the incidence of cardiac arrhythmias in COVID-19 patients ranged from 17% to 30%. Atrioventricular/ventricular block (11.8%) was the most common type of arrhythmia, outnumbering sinus tachycardia (7.5%), sinus bradycardia (8%), atrial arrhythmias (7%), and ventricular arrhythmias (4%) (13).

According to the findings of a meta-analysis that included nine studies, the incidence of arrhythmia in COVID-19 patients was 19.7 percent (13). A meta-analysis of 17 prospective co-

hort studies conducted in the United States by Bishnu P. Dhakal et al., which included 5,815 patients with COVID-19, found that the pooled incidence of arrhythmia was 9.3 percent (5.7 percent for cardiac arrhythmia) (25). According to a recent study, only 26 percent of patients had normal ECGs. Another study found that 24 percent of COVID-19 patients had arrhythmias, and 33 percent of ICU patients had arrhythmias. In fatal COVID-19 cases, 60% had arrhythmia; additionally, cardiac arrhythmias were independently associated with an increased risk of in-hospital death (11.5 percent vs 5.6 percent among those without arrhythmia) in China (24).

In 355 Italian COVID-19 patients who died, a retrospective chart review identified a history of AF in 24.5% that reported by Akanksha N. Thakkar et.al. During hospitalization, malignant ventricular arrhythmias, defined as sustained Ventricular Tachycardia (VT) or Fibrillation (VF), occurred in 11 (5.9%) of the patients (26).

2.3. Risk Factors for Arrhythmias

2.3.1. Diseases

Some types of heart disease, such as high blood pressure, coronary heart disease, and diabetes mellitus, Cardiovascular disease is a risk factor for atrial fibrillation, which is a type of arrhythmia. By interfering with the heart's electrical system, scarring or abnormal tissue deposits can also cause bradycardia and tachycardia (27). Congenital conditions can predispose a person to arrhythmia from birth. For example, bradycardia can be caused by a congenital heart defect that affects the organ's built-in electrical system. Those who are born with extra electrical pathways are more likely to develop tachycardia (28).

2.3.2. Drugs

In fact, many drugs used to treat COVID-19 patients have the power to change cardiac potassium balance, with subsequent prolongation of the QT-interval and an increased risk for arrhythmias. In particular, Chloroquine (CQ) and Hydroxychloroquine (HCQ) are drugs used for these patients with known QT-prolonging effects (29) These drugs may increase the depolarization length duration and Purkinje fiber biological time, resulting in atrioventricular nodal and/or His system dysfunction (24). An important role in the development of arrhythmias could also be played by pharmacological treatment used for COVID-19 patients that increases the susceptibili-

ty to QT-related life-threatening ventricular arrhythmias, particularly torsades de pointes (30). In another study, about 10% of COVID-19 patients treated with these drugs developed QT prolongation, with ventricular arrhythmia in 2 of these patients out of a total of 28 treated with high-dose chloroquine (31).

2.3.3. Hypoxia

Arrhythmias in COVID-19 may occur as a result of hypoxia caused by direct viral tissue involvement of the lungs, myocarditis, or an abnormal host immune response, intravascular volume imbalances, myocardial ischemia, electrolyte derangements, pulmonary hypertension-induced myocardial strain, and drug side effects (21). Direct virus infection, hypoxia-induced apoptosis, and association with the cytokine storm could also be the mechanisms causing arrhythmias. Systemic inflammatory response syndrome is often a crucial risk factor for arrhythmia onset: In this study, IL-6 directly inhibits the Human Ether-à-go-go-related Gene (hERG) K+ channel and prolongs nerve impulse duration in ventricular myocytes; indirectly, the systemic inflammatory response hyper-activates the cardiac sympathetic system via central hypothalamus-mediated (inflammatory reflex) and peripheral (left stellate ganglia activation) pathways. However, myocardial damage alone is not sufficient, and other factors contribute to the increased arrhythmic risk in COVID-19: despite the high frequency of arrhythmias, only half of these patients showed acute cardiac injury (30).

2.3.4. Electrolytes Imbalance

According to the American Heart Association, potassium imbalances are the most common electrolyte-associated cardiac arrhythmias. Potassium is involved in both nerve conduction and the ability of the heart to send an electrical impulse. Low potassium levels are associated with relatively stable arrhythmias, whereas high potassium levels can rapidly lead to lethal arrhythmias. Arrhythmias are also caused by sodium, magnesium, and calcium imbalances in the heart. However, the American Health Association notes that arrhythmias caused by these electrolytes only occur then electrolyte levels are extremely low or high levels that are typically incompatible with human functioning, leading to death (1, 27). Different types of chemical agents can cause arrhythmias, sometimes with serious consequences. Minerals such

as potassium, magnesium, and calcium are essential for the normal function of the heart. However, when the levels of these minerals are too high or too low, they can cause arrhythmias (32).

In general there are different documented speculations to elucidate the association of with COVID-19. As an example, this might be correlated with metabolic disruption, hypoxia, pro-inflammatory process, or different stressors associated approaching the road with COVID-19. Moreover, a number of ion channels are often affected because of COVID-19 which can cause subsequent alterations in cardiac conduction or repolarization. Thus, it can increase the danger for arrhythmia to occur (33).

2.3.5. Emotional Disturbance

Sinus tachycardia is common in patients with COVID-19 and likely represents a physiological response to illness (12). Autonomic imbalance is notorious for its implication in arrhymio-genicity. It is also well-known that several conditions can activate the Sympathetic Nervous System (SNS), such as physical (e.g. pain, dyspnea) or emotional stress, and sleep disorders (14).

2.3.6. Mechanical Ventilator

The study conducted in New York City indicated that atrial arrhythmias were more prevalent in mechanically ventilated patients than non-mechanically ventilated COVID-19 patients (17.7% versus 1.9%, respectively) (12).

2.3.7. Socio-demographic Characters

A retrospective study in hospitalized 4526 COVID-19 patients across the world reported by Ellie J.Coromilas et.al that eight hundred twenty-seven patients developed cardiac arrhythmia, and of those who developed cardiac arrhythmia, 65% were men, and the mean age was 71 years (38).

2.4. Conceptual Framework

Cardiovascular comorbidities such as hypertension and coronary artery disease are related to arrhythmia in patients with coronavirus disease 2019. Hypoxia-induced apoptosis and association with the cytokine storm may be the mechanisms causing arrhythmias. Medications that have been proposed as treatments for COVID-19, such as hydroxychloroquine and azithromycin, have pro- arrhythmic effects. Aging is the number one risk factor for cardiac arrhythmias, with disruption of intracellular Ca2+ regulation as a key suspect. Both persistent and acute psychosocial stressors leading to anxiety are related to arrhythmic risk (34).

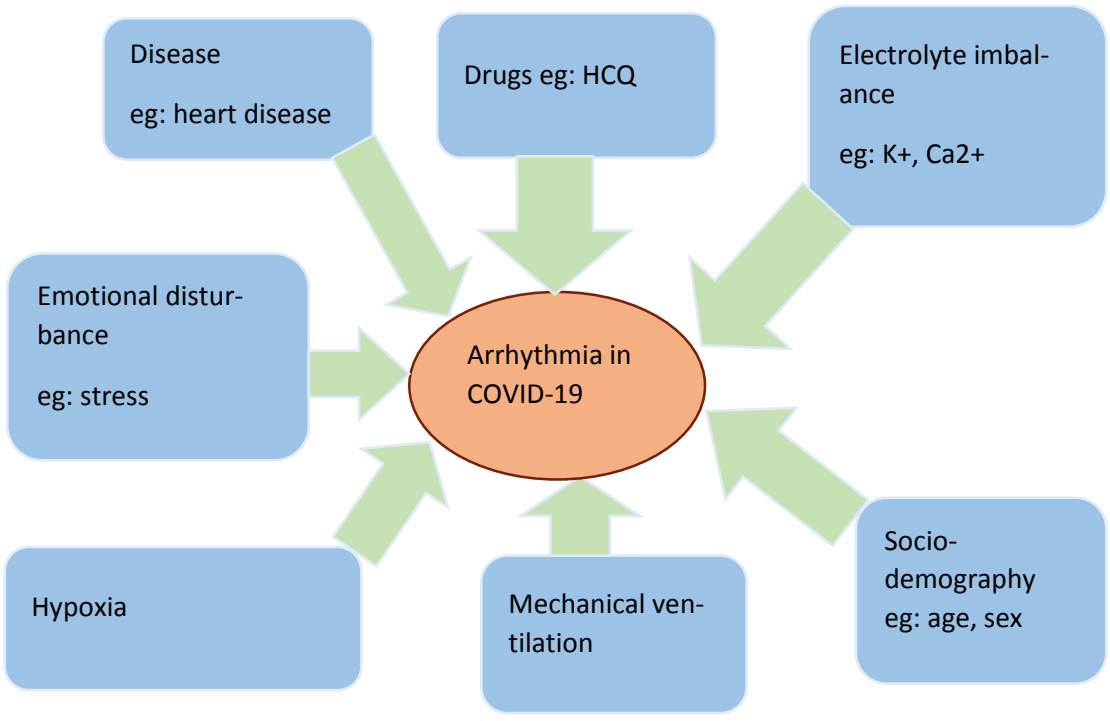

Figure 1: Conceptual framework arrhythmia and Arrhythmias' associated factors among COVID-19 patients. Adapted from Masataka Nishiga et al, 2020(34)

2.5. Justification of the Study

In developed countries, cardiac arrhythmias related to COVID-19 are well known and able to find specific risk factors and mechanisms associated with COVID-19, but in Africa, including Ethiopia, it is not studied yet. I am unaware of any study which has examined the prevalence and associated factors of arrhythmia in COVID-19 patients in Ethiopia. So in this study, we try to find out the kinds of arrhythmias that occur in COVID-19 patients and also identify the determinate factors that may cause cardiac arrhythmias in those patients.

2.6. Significance of the Study

First, the study focuses on assessing the prevalence of arrhythmias in COVID-19 patients and associated factors among those admitted into COVID-19 centers (ICU) in Addis Ababa, Ethiopia. The study result will provide highlight, regarding the prevalence of arrhythmias on COVID-19 patient, for health workers who work in the centers, and for other health professional to be aware about cardiac arrhythmia as a COVID-19 complications, and help for policy makers to design protocols to manage the critical condition of patients and at the mean time will help to decrease mortality. Second, this research will be used as a baseline for future researchers who are interested in similar studies in Ethiopia.

CHAPTER 3

3. OBJECTIVES

3.1. General Objective

To assess the prevalence of arrhythmias and associated factors among COVID-19 patients in the ICU at COVID-19 treatment centers in Addis Ababa, Ethiopia.

3.2. Specific Objectives

The following are the specific objectives of this paper work that will be achieved:

- To determine the prevalence of arrhythmias among COVID-19 patients in the ICU at COVID-19 treatment centers in Addis Ababa.
- To identify associated factors of arrhythmias among COVID-19 patients in the ICU at COVID-19 treatment centers in Addis Ababa.

CHAPTER 4

4. METHODS AND MATERIALS

4.1. Study Setting and Period

The study was conducted in Addis Ababa, the capital city of Ethiopia. Addis Ababa lies at an altitude of 2,300 meters above sea level and was established in 1889. The estimated city population was 6.6 million inhabitants in 2016 (35). As of July 2020, there are six federal and three centers under the city administration for the treatment of COVID-19. These are Bole millennium, St. Peter hospital, St. Paul hospital, Alert hospital, TikurAnbessa hospital, and Ekakotebe hospital under federal centers; and Tirunesh Beijing, Yekatit 12 hospital, and Zewditu memorial hospital under the city administration. Among the COVID-19 treatment centers in Addis Ababa: St. Peter specialized hospital, St. Paul's Hospital, Millennium Medical College, Zewditu Memorial Hospital, and Millennium Hall were selected through the lottery method. The study was conducted from February 15 to April 15, 2021.

4.2. Study Design

Retrospective cross-sectional study designs to employ in this study to assess the prevalence of arrhythmias and associated factors among COVID-19 patients in ICU at COVID-19 centers, Addis Ababa.

4.3. Population

4.3.1 Source of Population

The sources of population for this study were all patients' charts diagnosed as COVID-19 positive in COVID-19 centers in Addis Ababa.

4.3.2 Study Population

The study population for this study were all COVID-19 patients' medical record charts, of those who were admitted to ICU and who have healthcare document charts at selected COVID-19 centers.

Inclusion Criteria

All COVID-19 diagnosed patients' charts of those admitted into the ICU of the COVID-19 centers have confirmed positive COVID-19 test results, ECG results, and electrolytes.

Exclusion Criteria

COVID-19 patients' charts which lost personal information and chart ID numbers.

4.4. Sample Size Determination

The required sample size of eligible participants for the study is determined by using a single population proportion formula.

$n= (Z_{\alpha/2})^2 * p\ (1-p)/d^2$

Where: n = the desired sample size.

p = 50% is taken because we did not get an estimated proportion for other research in a similar situation.

d= 5% is the maximum margin of error the researcher is willing to tolerate.

Z= 1.96 is the standard normal deviation value corresponding to the 95% CI.

$n= (1.96)^2 * 0.5 * 0.5/0.05^2$

$= 3.8416 * 0.25/0.0025$

$= \underline{384}$

For incomplete data, 10% was added to the sample size:

Total sample size = n*10%+n

= 384*0.10+384

= 38.4 + 384

= 422 COVID-19 patient’s charts

4.5. Sampling Technique and Sampling Procedure

In this study, a simple random sampling technique would be used to select the charts of COVID-19 patients. The chart would be selected by using lottery methods from a list of four COVID-19 centers in Addis Ababa: St. Peter's specialized Hospital, St. Paul's Hospital, Millennium Medical College, Zewditu Memorial Hospital, and Millennium Hall. Then a final sample is selected from respected COVID-19 centers using a proportional size allocation formula.

$= (n_i * n_f)/N$

n_i= number of patient holding capacity in each select COVID-19 center

n_f = final sample of the study

N = total number of patient holding capacity in select covid-19 centers

Millennium hall = 1000*422/2000 ~ **211 COVID-19 patient' charts**

St. Peter's specialized hospital =200*422/2000 ~ **42 COVID-19 patient' charts**

St. Paul's Hospital Millennium Medical College = 700*422/2000 ~ **148 COVID-19 patient' charts**

Zewditu memorial Hospital = 100*422/2000 ~**21 COVID-19 patient' charts**

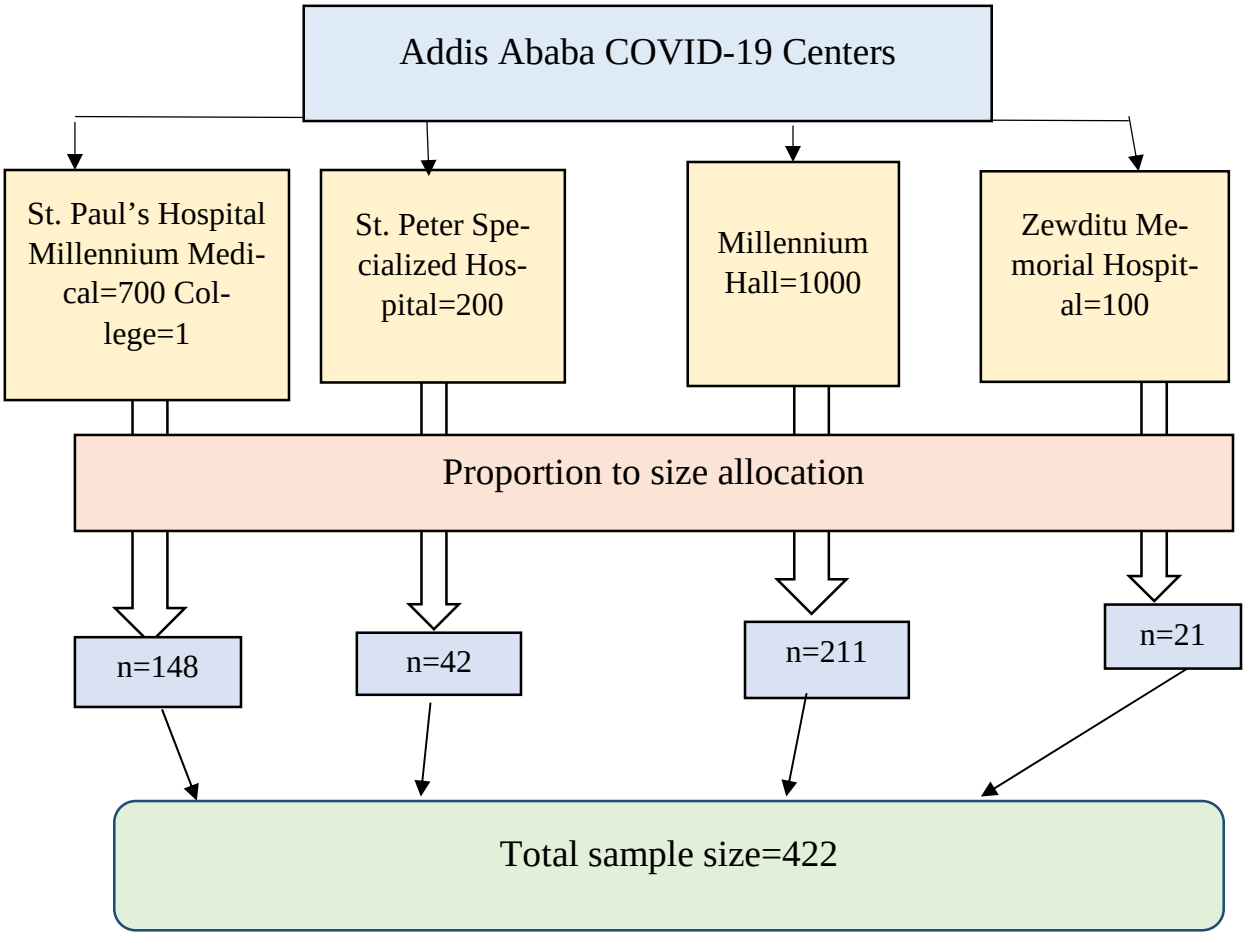

Figure 2: Schematic presentation of sampling procedure

4.6. Variables of the Study

The study used two variables, which are:

- **Dependent variable**: prevalence of Arrhythmias
- **Independent variables**: age, gender, drug, electrolytes, hypertension, diabetes mellitus and hypoxia.

4.7. Operational Definitions

COVID-19 is a viral infection that causes severe acute respiratory syndrome and was discovered in December 2019.

Arrhythmia refers to cardiac arrhythmia in COVID-19 patients characterized by irregular heartbeats either too fast (above 100 beats per minute), or too slow (below 60 beats per minute).

Tachycardia is defined as a heart rate above 100 beats per minute in a patient with COVID-19.

Bradycardia is defined as a heart rate below 60 beats per minute in a patient with COVID-19.

4.8. Data Collection Methods and Instrument

A check list is prepared to assess the prevalence of arrhythmias and associated factors among COVID-19 patients. The check list is adapted from Ulla Walfridsson's "Arrhythmia-Specific Check List in Tachycardia and Arrhythmia" (36). The check list contains 37 questions. Five personal information, seven health history, and five laboratory results. The rest of the questions are about arrhythmias and related questions. Data was collected by using a check list, which was filled in by data collectors.

Data collection procedure

To collect the data, four BSC nurses and one supervisor were trained for 3 days by the principal investigator about how to extract data from the chart, inclusion and exclusion criteria, ethical issues, and rights of participants. Those four BSc Nurses was assigned to the selected four hospitals independently to collect the data. The entire data collection period was supervised by one trained health professional and the principal investigator.

4.9. Data Quality Control

A pretest was conducted on 5% of the sample in one of the COVID-19 centers one week before the actual study, and the patient's records were excluded from the study. If a flaw was discovered, it was corrected as soon as possible.The principal investigator was actively involved in supervision of the data collection. The supervisor checked for completeness in daily basis. Data cleaning was done manually by removing the question with missing values.

4.10. Data Processing and Analysis

The collected data was check for completeness and inconsistencies' data was cleaned by epi info version 7 and code and analyze by using SPSS version 25 software. Descriptive and inferential statistics was computed: the descriptive statistics was calculated frequency, percentage, median and interquartile range. Association between dependent and independent variables was calculated using binary and multinomial logistic regression. And P value below 0.05 at 95% confidence interval was considered statically significant. And the result was present in tables, graph and or charts.

4.11. Ethical Consideration.

Ethical approval would be obtained from the Institution Review Board (IRB) of Addis Ababa University, college of health science, school of nursing and midwifery, and an official letter of cooperation from the school of nursing and midwifery to respected COVID-19 centers found in Addis Ababa. There were no potential risks that may have imposed any harm in any form on the study participants. Information obtained from individual charts would be kept confidentially.

4.12. Dissemination and Utilization of Result

The primary objective of this study is to partially fulfill the requirements for a master's degree in cardiovascular nursing; it will be presented and submitted to the department of nursing and midwifery, school of health sciences, Addis Ababa University. Also, copies of the results will be submitted to COVID-19 treatment centers to utilize the information for further development of strategic and educational plans for the prevention of the diseases by governmental bodies. Presentations at professional, local, national, and international meetings and publications in peer-reviewed national or international journals will be attended.

CHAPTER 5

5. RESULTS

5.1. Socio-demographic and Physiological Characteristics

A total of 422 patients diagnosed with COVID-19 who were admitted to the COVID treatment centers in Addis Ababa, patients' medical records were included in the study. All records fulfilled the inclusive criteria to respond to the check list, making the response rate 100%. Regarding sex distribution in the reviewed medical records, 270 (64%) were males while the rest were females. About 145 (34.4%) of the records were in the age group 62–76, while 134 (31.8%) were in the age group 47–61, and the median (IQR) age was 60 (50–70), while the minimum and maximum age of respondents were 16 and 100 years, respectively. The details of the socio-demographic characteristics of patients are summarized in Table 1. Physiologic status of the patient such as Oxygen saturation (FiO2) and body temperature (Hyperthermia and Hypothermia) were also assessed. Body temperature ranged from 34.0 oc- 38.3 oc; median body temperature of patients with IQR was 36.8 (36.4-37). The FiO2range for patients on mechanical ventilation was assessed. It ranged from 15–100% while the median and IQR of FiO2 was 92 (70–100).

Table 1: Socio-Demographic and physiological Characteristics of Respondents in Pub-lic CO-VID-19 treatment centers in A.A, Ethiopia, 2021 (N=422).

Characteristics		**Frequency**	**Percentage (%)**
Age	16-31	24	5.7
	32-46	70	16.6
	47-61	134	31.8
	62-76	145	34.4
	>76	49	11.6
Sex	Male	270	64.0
	Female	152	36.0

Variables	**Obs**	**Media**	**IQR**	**Min.**	**Max.**
Age	422	60	50-70	16	100
Percentage of patients FiO2	71	92	70-100	15	100
Body T^o of patients in ^oC	422	36.8	36.4-37	34.0	38.3

5.2 Prevalence of Cardiac Arrhythmias in Patients with COVID-19

Cardiac arrhythmia with COVID-19 patients characterized by ECG abnormality was used for the prevalence study. An ECG was done for all the admitted patients. The prevalence of cardiac arrhythmias was 231 (54.7%).

Prevalence of cardiac arrhythmias is depicted in Fig 3 and summarized in Table 2.

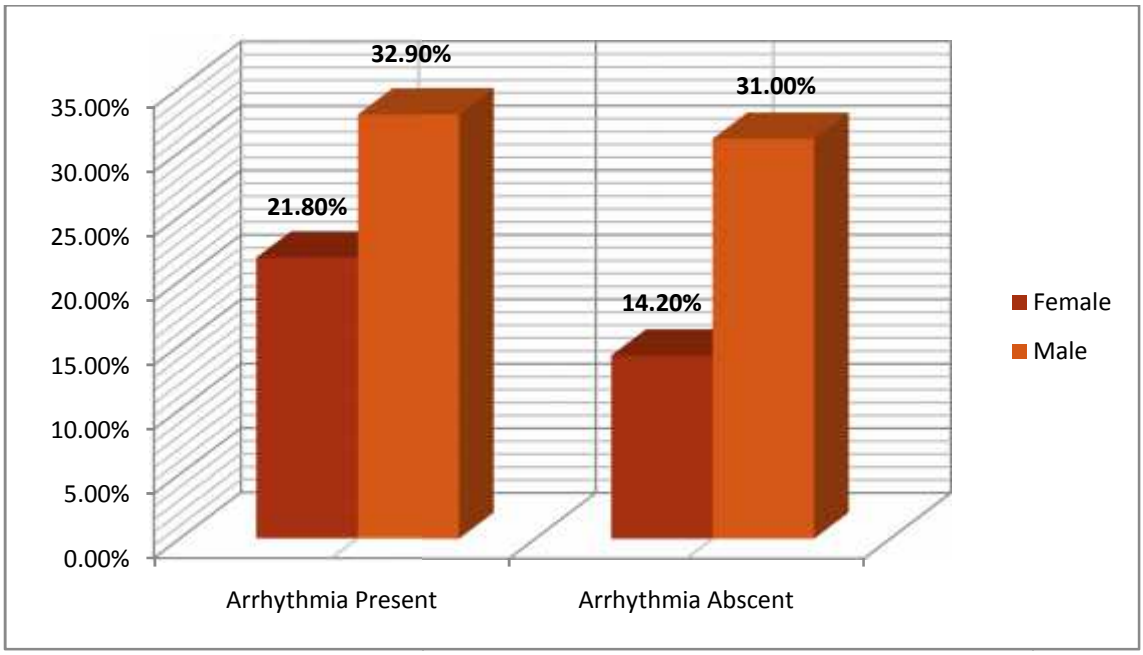

Figure 3: Prevalence of cardiac arrhythmias among COVID-19 Patients in selected Public CO-VID-19 treatment centers in A.A, Ethiopia, 2021 (N=422).

Of the total admitted patients, 116 (27.5%) suffered from atrial tachycardia. Considering the length of time (in hours) by which arrhythmia usually stays in an episode in patients, 68 (16.1%) of patients reported arrhythmia stays of 1–7 Hrs., closely followed by 57 (13.5%) of patients who reported arrhythmias to have stayed for 7–24 Hrs. While considering the longest duration by which arrhythmias last, 90 (21.3%) of the records revealed that arrhythmias stayed for more than 24 hours. Regarding the frequency or repetition by which arrhythmias occur in a single day, 116 (27.5%) reported that arrhythmias occur sporadically "on and off" throughout the day. From the total record, 27 (6.4%) experienced fainting spells with cardiac arrhythmias. Regarding treatment of arrhythmic patients, 65 (15.4%) were treated with anti-arrhythmic medication. Out of the total, 49 (11.6%) were treated with B-Blockers and Amiodarone, while the rest were treated with Amiodarone, Digoxin and Atropine.

Table 2: Frequency Distribution of characteristics of Cardiac arrhythmias among COVID-19 Patients in public COVID-19 treatment centers in A.A, Ethiopia, 2021 (N=422).

Characteristics		**Frequency**	**Percentage (%)**
Has electrocardiogram (ECG) examination?	Yes	422	100
	No	0	0
Any cardiac arrhythmia identified during ECG	Yes	231	54.7
	No	191	45.3
Cardiac Arrhythmias detected in ECG	Normal rhythm	191	45.3
	Atrial fibrillation	33	7.8
	Atrial flutter	12	2.8
	Bradycardia	12	2.8
	PVC	10	2.4
	ST- Depression	19	4.5
	ST-Elevation	19	4.5
	Atrial Tachycardia	116	27.5
	VTC	8	1.9
How long does arrhythmia normally last?	Less than1 hour	50	11.8
	1 hour – less than 7 hours	68	16.1
	7 hours – less than 24 hours	57	13.5
	More than 24 Hrs.	36	8.5
What is the longest time have experienced arrhythmia?	Less than 1 hour	14	3.3
	1 hour – less than 7 hours	61	14.5
	7 hours – less than 24 hours	46	10.9

	More than 24 Hrs.	90	21.3
How many times have experienced arrhythmia in the ICU?	None	211	50
	Less than 3 times	70	16.6
	I experience arrhythmia on and off every day	116	27.5
	I suffer from persistent arrhythmia	25	5.9
Have ever fainted in connection with arrhythmia?	Yes	27	6.4
	No	395	93.6

5.3. Medication that used to Manage Cardiac Arrhythmia in COVID-19 Patients

After a clinical diagnosis of cardiac arrhythmias, COVID-19 patients were promptly treated. From the total patient' records evaluated, 65 (15.4%) were started on anti-arrhythmic medications. The most commonly used medication was single-agent beta blockers in 49 (11.6%) of the patients. Among the total records, 73 (17.3%) of patients were on mechanical ventilation. Despite prompt management of patients, 86 (20.4%) of them were recorded to have sustained cardiac arrest during the course of their treatment, while Patient management courses are summarized in Table 3.

Table 3: Frequency Distribution of Cardiac arrhythmias among COVID-19 Patients in public COVID-19 treatment centers in A.A, Ethiopia, 2021 (N=422).

Characteristics		**Frequency**	**Percentage (%)**
Does cardiac arrest occur?	Yes	86	20.4
	No	336	79.6
Was there any antiarrhythmic medication administered?	Yes	65	15.4
	No	357	84.6
What was the major antiarrhythmic drug administered?	Beta blockers	49	11.6
	Digoxin	4	0.9
	Amiodarone	3	0.7
	Beta blockers and amiodarone	3	0.7
	Lidocaine	4	0.9
	Digoxin and metoprolol	2	0.5
Was the patient on mechanical ventilation?	Yes	73	17.3
	No	349	82.7

5.4. Patient' Outcome among COVID-19 Patients

79 (18.7%) patients were reported to have succumbed to their condition, while of those deaths reported 12.10% were males and the rest 6.60% were females. 329 (78%) were recorded to be discharged alive and compared with sex, 49.8% were males while 28.20% were female. 14 (3.3%) were transferred to a higher facility hospital for specialized care. Those also high present were co-occupied by males (2.10%) and the rest were female (1.20%).

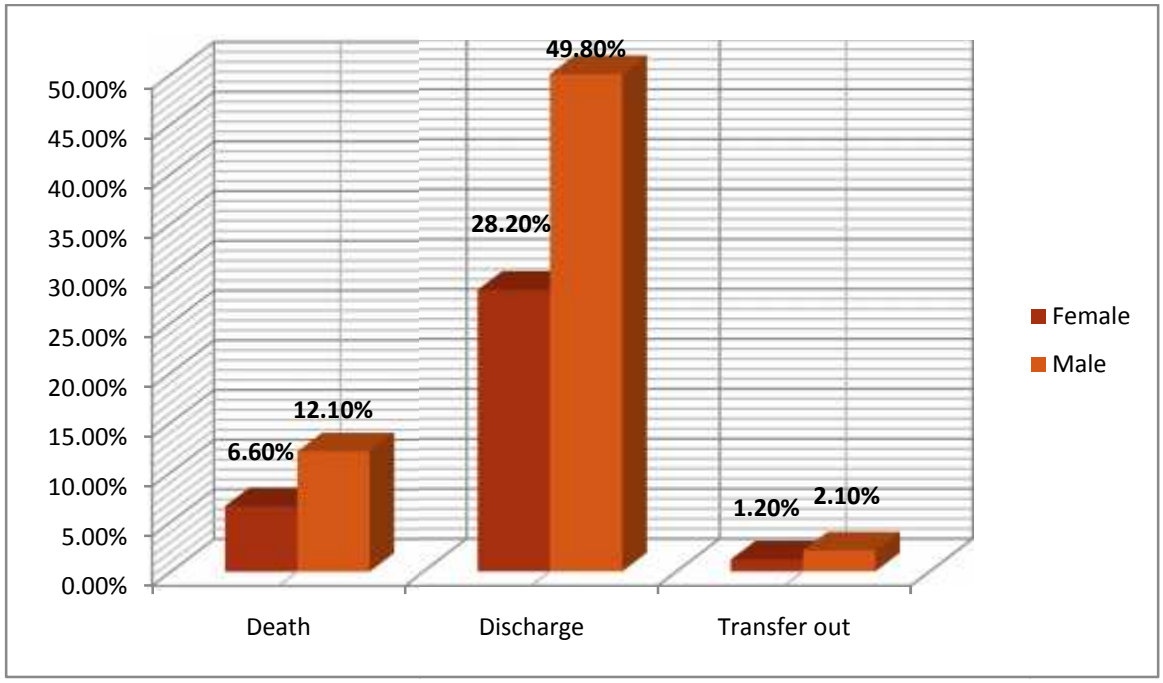

Figure 4: Graphic presentation of patient outcome among COVID-19 patients in selected public COVID-19 treatment centers in A.A., Ethiopia, 2021 (N = 422).

5.5. Frequency and Distribution of Co-morbidity with Cardiac Arrhythmias among COVID-19 Patient

Co-morbid conditions like diabetes mellitus, hypertension, heart disease, and chronic kidney disease appeared concomitantly with cardiac arrhythmia. Out of all 309 patient records, 309 revealed that they have co-morbidities. Out of which, 168 (39.8%) of them had one co morbidity, 94 (22.3%) of they had two co morbidities, 42 (10%) had three co morbidities and finally only 5 (1.2%) had four combined co morbidities. Thus, in comprehension, of the patients' records, 181 (42.9%) had diabetes; 199 (47.2%), hypertension (17.4%), CKD, and one fourth (24.9%) of the records had a history of heart disease (any form of cardiovascular disease apart from hypertension). On further review, 49 (11.6%) of patients had ischemic heart disease. Using Echocardiography to asses any structural anomaly; on101 (23.9%), admitted COVID-19 patients were examined; and 71 (16.8%) of then had abnormal structure. Among the findings, 22 (5.2%) were found to have IHD.

Serum electrolytes as well as serum troponin levels were also reviewed as risk factors for cardiac arrhythmias on top of exacerbation. Serum Na^{+} was high in 23 (5.5%) and low in 104 (24.6%) of participants. Serum K^{+} was high in 147 (34.8%) and low in 37 (8.8%) of participants. Serum Ca^{++} was high in 14 (3.3%) and low in 127 (30.1%) of participants. Serum Cl^{-} was high in 25 (5.9%) and low in 129 (30.6%) of participants. In addition, serum troponin was done for 180 patients, out of which 20 (4.7% of the total) had elevated serum levels.

Table 4: Frequency Distribution of Risk factors for Cardiac arrhythmias among COVID-19 Patients in public COVID-19 treatment centers in A.A, Ethiopia, 2021 (N=422).

Characteristics		**Frequency**	**Percentage (%)**
Have Diabetes Mellitus	Yes	181	42.9
	No	241	57.1
Have Hypertension	Yes	199	47.2
	No	223	52.8
Have history of heart disease	Yes	105	24.9
	No	317	75.1

Type of cardiac disease	ACS	6	1.4
	CHF	20	4.7
	CRHD	15	3.6
	IHD	49	11.6
	MI	7	1.7
Echocardiography results	Examination not done	321	76.1
	CHF	8	1.9
	Cardiac enlargement	6	1.4
	IHD	22	5.2
	MI	16	3.8
	Pericardial effusion	7	1.7
	MS	6	1.4
	Normal	30	7.1
Have History of CKD	Yes	17	4.0
	No	405	96.0
Serum Sodium	High	23	5.5
	Normal	295	69.9
	Low	104	24.6
Serum potassium	High	147	34.8
	Normal	238	56.4
	Low	37	8.8
Serum calcium	High	14	3.3
	Normal	281	66.6
	Low	127	30.1
Serum Chloride	High	25	5.9
	Normal	268	63.5
	Low	129	30.6
Serum troponin	High	20	4.7
	Normal	160	37.9
	Unknown	242	57.3

5.6 Association between Prevalence of Cardiac Arrhythmia and Independent Variables

I. Binary and Multinomial Logistic regression analysis of Cardiac Arrhythmia with different variables

A Binary and Multinomial Logistic regression analysis was computed to identify the factors that have an association with cardiac arrhythmia. Variables such as age, Presence of prior illness like; DM, HTN, and Heart disease and CKD; serum electrolyte, oxygen saturation, being on mechanical ventilation and body temperatures were assessed using binary logistic regression analysis. Therefore, variables such as age, heart diseases, CKD co-morbid, serum electrolytes (Na+, K+, Ca++, Cl-), oxygen saturation, mechanical ventilation, and body temperature have been selected as candidates with a p-value <0.2 with 95% CI. The variables that were taken into multivariate analysis; and then found to be significant were age, CKD co-morbidity, serum chloride level, and oxygen requirement.

Patients that were in the age range of 16–31 and the age group (32-46) were 24% less likely to develop arrhythmia than the age group above 76 years, [AOR = 0.24; 95%CI (0.084–0.678)]. Those in the age group (32-46) [AOR = 0.29; 95%CI (0.11-0.77)] were found to have a 29 % less significant association with arrhythmia compared with their older compatriots. Furthermore, gender of COVID-19 patients were found no significant association to develop cardiac arrhythmia.

In addition, the previous presence of chronic kidney disease was also less significantly associated with arrhythmia with [COR = 0.152; 95%CI (0.034-0.675)]. at p-value <0.05 with 95% C.I; and 15% of the CKD case are less likely to develop cardiac Arrhythmia than those not CKD with [AOR=0.155; 95%CI (0.035-0.690)]. In relation to the serum electrolyte level, the COVID-19 patients' serum chloride level was found to be significant. Patients who have a high serum Cl - level were 3.8 times more likely to develop arrhythmia than those who have a normal serum chlorine level [AOR =3.88; 95%CI (1.17-12.85)].

Regarding oxygen requirement, patients with increased oxygen requirements were significantly associated with arrhythmia. Hence, patients on high oxygen requirements were less likely to develop arrhythmia than low oxygen-requiring patients, with [AOR = 0.002; 95%CI (0-0.008)].

Table 5: Association Between Socio-Demographic Factors and Co-morbidity with Car-diac Arr-hythmia at Public COVID-19 Treatment centers Of A.A, Ethiopia, 2021 (n=422).

Variable	**Cardiac Arrhythmia**		Odds Ratio at (95% CI)			
	No	Yes	COR (95%CI)	P- Val-ue	AOR (95%CI)	P- Val-ue
Age in years						
16-31	61	18	**0.22(0.08-0.63)***	0.005	**0.24(0.08-0.68)***	0.007
32-46	42	28	**0.28(0.10-0.75)***	0.011	**0.29(0.11-0.77)***	0.013
CKD						
Yes	2	15	0.15(0.034-0.7)*	0.013	0.15(0.035-0.69)*	0.014
No	189	216	1			
Serum chlo-ride						
High	4	21	**5.02(1.67-15.0)****	0.004	**3.88(1.17-12.9)****	0.027
Low	56	73	**1.24(0.081-1.902)**	0.307		
Normal	131	137	1			
Oxygen re-quirement						
High (above 201)	17	67	**0.009(0.004-0.021)***	0.000	**0.002(0-0.008)****	0.00
Low (below 20 l)	174	164	1			

1-Reference, variables with P-value <0.2 included in multivariate linear regression

CHAPTER 6

6. DISCUSSION

In this paper, we have explored and described the prevalence of cardiac arrhythmias and associated risk factors among admitted COVID-19 patients who were attending treatment care at four public COVID-19 treatment centers in Addis Ababa, Ethiopia.

The study revealed that more than half (54.7%) of the study participants' medical records had revealed cardiac arrhythmias. The remaining 45.3% of patients didn't suffer from cardiac arrhythmias. A meta-analysis result reported from the USA by Gopinathannair R. et.al. indicated that the prevalence of arrhythmia in fatal COVID-19 cases was 60% (24) compared to this study's higher than (54.7%). The meta-analysis studies conducted in Taiwan, Egypt, USA, USA- Texas and hospital based studies in Italy revealed the prevalence of arrhythmias to be 17.3%, 19.7%, 9.3%, 33% and 24.5% (17, 13, 25, 24, and 26) respectively. In contrast, these reports indicate that the level is significantly lower than our findings. This discrepancy might be due to the study setting differences (may have advanced hospitals, advanced equipment and advanced health care system), socio-demographic differences (age, gender, income and so) and study time gap (early emerge of COVID-19 most of the study not emphasis the involvement of COVID-19 on cardiac arrhythmia rather on COVID-19 treatment). In addition, it could also be secondary to considering a myriad of arrhythmias in unison under an umbrella diagnosis, which might not be the case in other studies. As the COVID-19 treatment center, care facility, personnel, as well as other inputs in our setups are considered to be rudimentary compared to the developed nations. Thus, because of the shortage of ECG machines, accurate early detection and timely diagnosis of cardiac arrhythmias is difficult in our case. To the contrary, the less evolved arrhythmia treatment setup of ours could be the reason why so many patients develop cardiac arrhythmias. Epidemiology of preadmission diagnosis among our participants could also play a role.

Patients that are in the age range of 16–31 were found to be 24% less likely to have cardiac arrhythmia [AOR = 0.24; 95%CI (0.08–0.68)]. In addition, patients that are in the age range of 32–46 were found to be 29% less likely to have cardiac arrhythmia compared to their older counterparts [AOR = 0.29; 95%CI (0.11-0.77)]. Coromilas et al also stated that the older age

group developed cardiac arrhythmia compared to the younger (38). Meanwhile, the gender of participants was not found to have a significant correlation.

Moreover, the current study shows that those participants who had a previous history of heart disease were found to be 42% more likely to have cardiac arrhythmias compared with their counterparts [AOR = 0.58; 95%CI (0.37-0.9)]. These findings are consistent with findings by Tisdale JE et.al, which reported that cardiovascular diseases are risk factors for atrial fibrillation, which is a type of arrhythmia (27) and the Coromilas et al report also supported our result, while 30.8% of those who developed cardiac arrhythmia had a history of heart disease (38). In addition, patients with prior or post admission history of CKD were found to be 15% less likely to have cardiac arrhythmias [AOR = 0.15; 95%CI (0.035-0.69)]. In contrast, Coromilas et al reported that 21% more people associated with CKD develop cardiac arrhythmia (38).

According to the study by Krista et.al serum levels of minerals such as potassium, magnesium, and calcium play a role in the heart's normal function. Those same minerals may cause arrhythmias when their levels are too high or too low (32). These reports go in unison with our findings, which reported that patients with high serum chloride levels were found to be about four times more likely to have cardiac arrhythmia compared with participants with normal serum values [AOR = 3.88; 95%CI (1.17–12.9)].

According to Mottola FF et al., arrhythmias in COVID-19 may occur as a result of hypoxia caused by direct viral tissue involvement of the lungs, myocarditis, or an abnormal host immune response, or as a result of myocardial ischemia and myocardial strain (21). The current study shows that those participants who had high oxygen requirements greater than 20l/min were found to be 2% less likely to have cardiac arrhythmias compared with their counterparts that required low levels of oxygen [AOR = 0.002; 95%CI (0-0.008)].

6.1. STRENGTH AND LIMITATIONS

6.1.1 Strength

The study was able to collect data on hospitalized COVID-19 patients from high capacity hospitals across Addis Ababa, which enhances the generalizability of the results. The data

was collected by experienced BSc nurses at each hospital, which decreased the chance of misinformation from patients' charts.

6.1.2 Limitation

The study is retrospective in design and may not show the true prevalence of arrhythmias. The findings of the study are confined to a group of COVID-19 patients who reside in urban areas, which means they do not necessarily reflect the situation among patients in rural areas. Furthermore, this study was conducted on patients visiting just four selected public hospitals, and thus, may not portray the full picture of the prevalence of cardiac arrhythmia among COVID-19 patients in the entire capital city or the country.

CHAPTER 7

7. CONCLUSION

The study revealed that about half of the reviewed records had cardiac arrhythmias. Young patients group and also patients with previous history of CKD were less likely to develop cardiac arrhythmia. High serum Cl-was shown to have a significant association with cardiac arrhythmia.

CHAPTER 8

8. RECOMMENDATION

Based on the findings of this study the following recommendations are made to minimize the prevalence of cardiac arrhythmias.

For Federal Ministry of Health: The Federal Ministry of Health engages in training practitioners and guideline preparation towards COVID-19 related complications, particularly cardiac arrhythmias.

For Ethiopian Public Health Institution: Continuous education programs on COVID-19 complications through conferences, workshops, research, and lectures are needed to raise the awareness of health care workers about arrhythmias and their complications, especially arrhythmias.

For Other Health Researchers: The study could be replicated in other urban areas in Ethiopia, and a comparison made with the current study to establish if the problem is widespread and not a unique problem to A.A. Other researchers are also encouraged to further study identified gaps by mitigating the limitations of this report.

For A.A. public treatment center: COVID-19 treatment centers in A.A should work more on cardiac arrhythmias diagnosis and management providing a high quality care through optimal diagnosis services by ongoing training and support focusing on nurse practitioners working in the ICU.

For nurses working in the ICU of COVID-19 treatment centers: Nurses should engage themselves in continuous medical education (CMEs) towards COVID-19 complications, especially arrhythmia, so as to update themselves on optimal practices.

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ANNEXES

Annex A: Information Sheet

Project overview

Project Title: prevalence of arrhythmias and associated factors among COVID-19 patients in the ICU at COVID-19 centers, Addis Ababa, Ethiopia

Duration the project: February 15- April 15, 2021

Study area: Addis Ababa COVID 19 centers

Sponsor: Addis Ababa University

Investigator: Gobu Letemu (BSc nurse)

Project objective: The aim of this study is to assess prevalence of arrhythmias and associated factors among COVID-19 patients in ICU at COVID-19 centers, Addis Ababa, Ethiopia

In order to meet the objective, I will use formal standard checklist that fill by data collectors.

Duration: The time that need to complete questionnaire is 20 to 30 minute per chart

Risk and Confidentiality: There is no risk for anyone who participate in the study. Name, title and work place will not be record anywhere.

If you have question or concerns or for information you can call! Please speak to principal investigator - Gobu Letemu (BSc Nurse)

Mobile number: 251947403792

E-mail: gobuletemu@gmail.com/gobuletemu@yahoo,com

Annex B: Consent Form

In signing this document, I as a department head, am giving my consent for patient records to participate in the study. I have been informed that the objective of this study is to assess prevalence of arrhythmias and associated factors among COVID-19 patients in the ICU at COVID-19 centers, Addis Ababa, Ethiopia. I have understood that participation in this study is entirely confidential. I have been told that my answers to the questions will not be given to anyone else and no reports of this study ever identify me in any way. I understood that participation in this study does not involve risks except the time spent on completing the questionnaire. I understood that Gobu Letemu is the contact person if I have questions about the study or my rights as a study participant. The following is his contact address. Address of principal investigator:GobuLetemu, Mobile phone- +251947403792 E-mail-gobuletemu@gmail.com/gobuletemu@yahoo,com

Dep't Headsignature: _____date: _____

Thank You for your willingness to participate!!!

Annex C: English Version Check List

Investigator name_____ Date__/___/___

Patient code_____

Part I: Personal Information

1. Age _____
2. Sex
   A) Male
   B) Female

Part II: Health Related Question

3. Have diabetes mellitus?
   A) Yes
   B) No
4. Have hypertension?
   A) Yes
   B) No
5. Have history of thyroid problem?
   A) Yes
   B) No
6. Have history of heart disease or disorder?
   A) Yes
   B) No
7. If question 9 answer is yes; what types of heart disease or disorder have? _____
8. Have history of chronic kidney disease?
   A) Yes
   B) No
9. K+ result

A) Low_____

B) Normal_____

C) High_____

D) Other _____

10. Ca++ result

A) Low_____

B) Normal_____

C) High_____

D) Other _____

11. Cl- result

A) Low _____

B) Normal_____

C) High _____

D) Other _____

12. Na+ result

A) Low_____

B) Normal_____

C) High_____

D) Other _____

13. Troponin level

A) Normal

B) High_____

14. Body temperature

A) Low T^o _____

B) Normal_____

C) High T^o_____

15. Has electrocardiogram (ECG) examination?

A) Yes

B) No

16. If question 19 answer is yes; what was the result? _____

17. Have echo examination?

A) Yes

B) No

18. If question 21 answer is yes; what was result?

A) Normal

B) Abnormal

19. If question 22 answer is abnormal; what kind of abnormality present?

_____

20. How long does arrhythmia normally last?

A) Less than1 hour

B) 1 hour – less than 7 hours

C) 7 hours – less than 24 hours

D) 24 hours – less than 2 days

E) 2 days - 7 days

F) More than 7 days

21. What is the longest time have experienced arrhythmia?

A) Less than 1 hour

B) 1 hour – less than 7 hours

C) 7 hours – less than 24 hours

D) 24 hours – less than 2 days

E) 2 days - 7 days

F) More than 7 days

22. How many times have experienced arrhythmia in the ICU?

A) None

B) Less than 5 times

C) Between 5 and 15 times

D) Between 16 and 30 times

E) More than 30 times (but not every day

F) I experience arrhythmia on and off every day

G) I suffer from persistent arrhythmia

23. Have ever fainted in connection with arrhythmia?

A) Yes

B) No

24. Was taken antiarrhythmic drug(s)?

A) Yes

B) No

25. If question 30 answer is yes; what kind of drug(s) was taken?

A) Digoxin

B) Amiodarone

C) Atropine

D) Beta blocker

E) Other_____-

26. Was on medication?

A) Yes

B) No

27. If question 34 answer is “Yes”, please note what medicine(s) take on a regular basis

A) _____
B) _____
C) _____
D) _____

28. Was the patient on mechanical ventilator?

A) Yes
B) No

29. Was cardiac arrest occur?

A) Yes

B) No

30. What was the last result of the patient?

A) Discharge
B) Transfer to high facility Hospital
C) Death