Sudan University of Science and Technology
College of Graduated Studies

Study of Congestive heart failure (CHF) Disease using chest x-ray and Electrocardiogram (ECG) in Sudanese patients.

دراسة مرض احتقان القلب باستخدام صور اشعة الصدر ونبضات القلب الكهربائية لدي المرضي السودانيين.

Thesis Submitted for the Award of M. Sc. Degree Requirements in Diagnostic Radiology

By:

Jamal Hassan Yousuf Alhassan

B. Sc. Diagnostic Radiology – 1995 - SUST

Supervisor:
Assoc. Prof. Dr. Mohammed Ahmed Ali

(2016)

قال تعالي:

ويسئلونك عن الروح قل الروح

من امر ربي وما أوتيتم من

العلم الا قليلًا...

سوره الاسراء 85

DEDICATION

This thesis is dedicated to my parents, family and my close friends

And specially dedication to my spiritual as well as the lumiition of my

home my sincere wife “Hanan Taifour”

And to my kids

.

ACKNOLOWEDGMENT

First of all, I would like to say Alhamdulillah for Almight God, for giving me the strength and health to fulfill this project completely.

I express my gratidue to **Assoc. Prof. Dr. Mohammed A. Al**i my chief supervisor for this study and for his steadfast support was greatly needed and deeply appreciated.

I would like to express my utmost gratitude to **Dr. Mohammed Elfadil** for twhat he has tought me durig B. Sc. course (1991-1995)

And warm thanks to my colleagues who have been supporting me to

Abstract

The aim of the following study was to study the congestive heart failure (CHF)disease by using chest x-ray and ECG in Sudanese Patients ,the study taking a sample of 120 patients from Khartoum, Omdurman, Aljazeera, and Kosti hospitals. And the variables were: the age, gender, and clinical history, etiology, habits, BMI, heart/chest ratio, enlarged chamber and the relative deviated wave in ECG. The data analysis showed that: CHF is predominant among male with a percent of 56% relative to 44% among female. CHF have been increased following the age increment and the high incidence of heart disease has occurred among age group of 65-77 years. The majority of the sample was either obese representing 57% or over weight representing 35%. The most common cofactors for induction of CHF were the social stress, diabetes, hypertension and overweight which representing 28%, 22%, 16% and 14% respectively, with less impact of obesity and smoking which representing 13% and 7% respectively. Khartoum state was the most endemic with CHF showing a percent of 40% of the total sample, Aljazeera state showed 25%, White Nile showed 20%, Red Sea showed 10% and West of Sudan showed 5%. The common type of heart diseases was the coronary arteries diseases representing 45% of the total sample, Valves diseases represent 17%, Myocardial infarctions represent 23% and congestive heart failure was 15%. The common signs of patient's Heart Diseases in Sudan during June 2014 – June 2015, which were
Hypertension, Diabetes mellitus, High Cholesterol, breathing rate, edema, palpitation with relative frequencies 9%, 11%, 6%, 12%, 8% and 10% respectively. The cardiothoracic ration increases and hence increase the breathing rate/min. and the correlation could be fitted in the following equation: $y = 0.020x + 0.202$, where y refers to cardiothoracic ratio and x refers to breathing rate/min. and all the patients have CTR exceeding the normal range (0.5) which in turn has direct impact on the breathing rate increment beyond the normal rang 12-20bpm. There is increasing proportional relationship between the age and respiratory rate/min; such relation fits the following equation: $y = 0.205x + 12.84$, where y refers to respiratory rate/min and x refers to age in years which is significant as $R^2 = 0.7$. The cardiothoracic ration increases and hence increase the peak of the R wave. And the correlation could be fitted in the following equation : $y=29.724x+9.9295$.where y refers to peak of R wave and x refer to the cardiothoracic ratio. The common deviated ECG waves were QRS and T

with frequencies of 39.1% and 25.5% respectively, with consideration that: the QRS wave represents the state of left ventricle (depolarization of ventricles) while T wave state the re-polarization of the ventricles. The enlarged chamber in the heart was the left ventricle that representing 55% relative to other chambers as 19%, 15%, and 11% for the left atrium, right ventricle and right atrium respectively. The most of the sample were overweight as 45%, obese as 40%, and the normal as 15%. The most common stage of CHF was stage III that showing 55% among the sample relative to stage I (2%), II (30%) and IV (13%).

ملخص الرسالة

عنوان البحث : دراسة مرض احتقان القلب باستخدام صور اشعة للصدرونبضات القلب الكهربائية لدي المرضي السودانيين ,استخلصت الدراسة من عدد 120 مريضا بامراض القلب من مستشفيات مختلفة لولايا ت الخرطوم,الجزيرة،البحر الاحمر،وغرب السودان.

اوضحت الدراسة سيادة مرض احتقان القلب عند الرجال بنسبة 56% وعند النساء بنسبة 44% ،وان الفئة العمرية الاكثر اصابة بالمرض تتراوح اعمارهم مابين 56-77 سنة، وان غالبية المصابين بالمرض يعانون من السمنة بنسبة 57% او لديهم زيادة بالوزن بنسبة 35% .

اظهرت الدراسة ان العومل المساعدة السائدة في العينة لمرضي فشل القلب الا حتقاني هي الضغوط الاجتماعية ،ارتفاع السكر في الدم ، ارتفاع ضغط الدم و زيادة الوزن وهي بنسب علي النحو التالي 28 %،22%و14% مع انخفاض بنسب التدخين والسمنة 13% و 7% علي التوالي.

اوضحت الدراسة ان ولاية الخرطوم هي الاكثر اصابة بالمرض ودلك بنسبة 40%تليها ولاية الجزيرة 25% ، النيل الابيض 20%،البحر الاحمر 10% وولاية غرب السودان 5%، وان مرض القلب الاكثر شيوعا هو مرض الشرايين التاجية بنسبة 45% ، امراض الصمامات 17%،مرض عضلات القلب الاحتشائي 23% ومرض فشل القلب الاحتقاني 15% .

اظهرت الدراسة ان العلامات المرضية السائدة في السودان في الفترة ما بين 2014/6 الي 2015/6 تتمثل في ارتفاع ضغط الدم،ارتفاع سكر الدم, ارتفاع الكلسترول بالدم ،زيادة معدل التنفس، الادمة الدموية وارتفاع نبضات القلب ودلك بنسب 9%,11 ،% 6% ،12%، 8% و10%.

وجدنا بالدراسة زيادة النسبة بين حجم القلب وحجم الصدر مع زيادة معدل التنفس بالدقيقة وهدا التطابق تمثله المعادلة التالية : ص=020, س+202 حيث ان س تمثل النسبة بين حجم القلب والصدر وص تمثل معدل التنفس بالدقيقة. كدلك وجدنا ان كل المرضي يعانون من زيادة نسبة حجم القلب لحجم الصدر باكثر من 5و0 ولدلك تأثير علي زيادة معدل التنفس في الدقيقة اكثر من المعدل الطبيعي والدي يتراوح بين 21-20نفس بالدقيقة. كما وجدنا ان هنالك علاقة طردية بين زيادة العمر والزيادة في معدل التنفس في الدقيقة ممثلا في المعادلة التالية: ص=205,س+ 12,84حيث ان ص تمثل معدل التنفس في الدقيقة وس تمثل عمر المريض ويدل علي دلك المعادلة R^2= 0.7 .اوضحت الدراسة زيادةالنسبة بين حجم القلب وحجم الصدرفي اشعة الصدر مع زيادةقمة طول الموجة(ر) في التخطيط الكهربائي للقلب ممثلا في المعادلة ص=29.724س +9.9295 حيث ان س تمثل النسبة بين حجم القلب والصدروص تمثل قمة الموجة ر. اظهرت الدراسة ان الموجتين الاكثر انحرافا في تطبيقات تخطيط القلب علي المرضي هما QRS و Tبنسب 1, 39و25,5% حيث ان الموجة QRS تمثل حالة انقباض البطين الايسروالموجةتمثل انبساط البطينين.

كما وجدنا ان غرفة القلب الاكثر تضخما هي البطين الايسر بنسبة 55% مقارنة ب 19%,15% و11% لكل من الادين الايسر,البطين الايمن والادين الايسر علي التوالي .

غالبية المرضي يعانون من زيادة الوزن بنسبة 45% والدين يعانون من السمنة نسبتهم 40% واصحاب الوزن المثالي بنسبة 15% . غالب المرضي اتي تصنيفهم في المرحلة الثالثة للمرض بنسبة 55% اما الدين صنفوا بالمرحلة الاولي فنسبتهم 2%, والمرحلة الثانية 30% والمرحلة الرابعة 13% .

TABLE OF CONTENTS

		Page
DEDICATION		
ACKNOWLEDGEMENTS		iii
ABSTRACT		iv
الخلاصه		v
TABLE OF CONTENTS		vii
LIST OF FIGURES		viii
LIST OF Tables		ix
		xi
cHAPTER		
1	**INTRODUCTION**	
	1.1 Introduction	1
	1.2 Problem of the study	3
	1.3 Hypothesis	3
	1.4 Objectives of the study	3
	1.5 Thesis outlines	3
2	**CHAPTER TWO**	
	LITERATURE REVIEW	4
3	**CHAPTER THREE METHODOLOGY**	
	Tools and equipment, Patient preparation and Method of the study.	24
		24
4	**CHAPTER FOUR-Section One**	26
	RESULTS	26
	Chapter Four-Section Two	
	Discussion & Analysis	32
5	**CHAPTER FIVE**	
	CONCLUSION AND RECOMMENDATION	
	5.1 Conclusion.	38
	5.2 Recommendations.	39
	References	40
	APPENDICES	44

LIST OF FIGURES

Figure	Figure Caption	Page
2.1	Percent distribution of hospitalization for CHF by age in years in USA during 2000 and 2010 (CDC/NCHS, National Hospital Discharge Survey, 2000–2010).	18
2.2	shows the various causes of electrocardiographic ST segment depression. (A) ST segment depression related to non-infarction ischemia, horizontal in morphology. (B) Reciprocal ST segment depression in lead III in a patient with acute anterior wall AMI. (C) Lead V2 STD attributable to posterior wall AMI. (D) Digoxin effect (E) Left ventricular hypertrophy. (F) Left bundle branch block.	19
2.3	shows atrial fibrillation, Normal QRS duration, Left axis deviation (LAD) noted and Paced atrial rhythm	20
2.4	shows an ECG with obvious Normal cardiac axis, Normal QRS duration, and Lateral wall infarction.	20
2.5	Shows 5CXR findings: cardiomegaly, Edema and haziness of vascular margins.	21
2.6	CXR finding: cephalization on vessels in upper lobes of the lungs which is more prominent as manifestation on pulmonary venous hypertension (vascular phase).	21
2.7	CXR finding: Hilar fullness with haziness enlarged pulmonary veins with perivascular fluid collection leads to full hazy hilar and vessels	22
2.8	CXR shows bilateral diffuse soft fluffy alveolar infiltrates with each other in abutterfly distribution (alveolar phase).	22
2.9	CXR shows cardiomegaly, bilateral hilar congestion, fuzzy full hilum and bilateral pleural effusion.	23
4.1	Shows the incidence percent of Heart Diseases (CHF) based on gender in Sudan 2015.	26
4.2	Shows the Heart Diseases (CHF) distribution in Sudan based on age group during June 2014 – June 2015	26
4.3	Shows the body mass index BMI and the relevant frequency% among population during June 2014 – June 2015.	27
4.4	Shows the common cofactor for cardiovascular diseases among Sudanese population during June 2014-June 2015.	27
4.5	Shows the incidence percent of Heart Diseases (CHF) in the states of Sudan during June 2015 up to June 2015.	28

4.6	Shows the common types of Heart Diseases in Sudan during June 2015 up to June 2015	28
4.7	shows the common symptoms of patient's Heart Diseases in Sudan during June 2014 – June 2015.	29
4.8	shows the correlation between the cardiothoracic ratio and the breathing rate	29
4.9	shows the correlation between the respiratory rate/min and the age in years	30
4.10	shows the deviated wave of ECG for CHF patients distributed based on frequency%	30
4.11	shows the heart chambers enlargement frequency % for CHF patients	31
4.12	shows the stages of CHF distributed based on frequency%	31
4-13	Shows the correlation between the cardiothoracic ratio and the peak of the R wave.	32

LIST OF TABLES

Table	Table Caption	Page
2.1	Table 2.1: shows the common congestive heart failure presentation signs and symptoms	11
2.2	Table 2.2: shows the classification of heart failure by structural abnormalities by American heart association (AHA) or by symptoms relating to functional capacity by New York heart association (NYHA).	14