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Determination of ABO Blood Groups and Rhesus factorin Sudanese Patientswith Cardiovascular Diseases

تحديد الزمر الوظيفية للفصايل الدموية والعامل الريصي لدى السودانيين المصابين بأمراض القلب والأوعية الدموية

A Dissertation submitted in partial Fulfillment of Requirements of M.Sc degree in Medical Laboratory Science

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الآيـــة

قال تعالى:

(رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ

وَأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ)

صدق الله العظيم

سورة النمل الآية(19)

Dedication

- To…My beloved and blessed mother who gives meaning and light to my life.
- To…My wonderful beautiful half (my husband) for his support and encouragement.
- To…My wonderful supervisorDr.KhaldaMeirghani, who helped whenever I needed her.
- To…our teacher's very special friends and colleagues who were integral part of our support group.
- Special dedication to all patients from whom samples were collected.

I dedicate this work

Reela.

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I would like to express my deep thanks to my supervisor Dr. KhaldaMeirghani for her expertise, support and endless valuable advice.

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Abstract

Many reports have appeared in recent years suggesting an association between blood groups and various manifestations of heart diseases.

This a descriptive analytical study aimed to determine frequency of blood group and Rhesus factor of patients with cardiovascular diseases in Khartoum state during the period from May to August 2014.

Seventy patients with different types of cardiovascular diseases attended Khartoum State Hospital was enrolled in this study. An informed consent was obtained from each patient before blood sample collection.ABO and Rh factors were performed by slide techniques using specific anti-sera. The data were analyzed by SPSS computer program. The results showed that most common blood group in patients with cardiovascular was O followed by A, least frequent was AB.

Majority (91.4%) of patients with cardiovascular were Rh positive.

Most common blood group in males was O (54.5%) and least frequent was AB (6.1%), and most common blood group in females was O (45.9%) followed by A (40.6%) and least frequent was AB (2.7%), and most common cardiovascular disease in females compared to males and most common disease was found in elder patients with age between (51-85years).

Most common cardiovascular diseases were ischemic heart disease followed by heart failure and least frequent was vavular heart disease, and most common disease in males was ischemic heart disease (33.3%) and least frequent was permanent pacemaker (0.0%) , also most common disease in females was ischemic heart disease (27.0%) and least frequent was valvular heart disease, and most common disease in patients with age between (23-50) was dilated cardiomyopathy (33.3) and most frequent disease in patients more than 50 years was ischemic heart disease (34.7%).

Finally, the results of the present study showed that there is no association of ABO blood group and Rh factor with cardiovascular diseases. Although the frequent of ischemic heart disease (IHD) was higher in O group, the difference was statistically insignificant.

المستخلص

عدة تقارير أجريت حديثاً أظهرت إرتباط بين فصائل الدم والأنواع المختلفة لأمراض القلب والأوعية الدموية .

هذه دراسة وصفية تحليلية هدفت لتحديد تكرار زمر الدم في المرضى المصابين بأمراض القلب والأوعية الدموية في ولاية الخرطوم في الفترة من مايو إلى أغسطس 2014. سبعين من المصابين بمختلف أنواع امراض القلب والأوعية الدموية ضمنوا في هذه الدراسة. البراءة الأخلاقية أخذت من كل مريض على حدة قبل أخذ العينة منه.

إختبارات زمر الدم أجريت بإستخدام طريقة الشرائح بإسخدام أمصال مضادة بعد ذلك حللت البيانات بإستخدام نظام الحزم الإحصائية للمجتمع حيثوجد أن أكثر زمر الدم انتشارا في مرضى القلب والأوعية الدموية هو O يتبع بـ A واقله هو AB.

أكثر المصابين بأمراض والأوعية الدموية كانوا موجبي العامل الريصي.

وجد أن أكثر زمر الدم إنتشاراً في الرجال هو الـ O وأقله هو الـ AB ، كما أن أكثر زمر الدم إنتشاراً في النساء هو الـ O يتبع بـ A وأقله هو الـ AB

وجد أن أكثر أمراض القلب انتشاراً في النساء من الرجال و في المرضى ذوي الأعمار بين (51-85) أكثر من المرضى بين (8-50) ووجد أن أكثر أنواع أمراض القلب والأوعية الدموية انتشارا هو مرض القلب الإحتباسي (IHD)والأقل انتشارا هومرض القلب الصمامي (VHD).

وأن أكثر أمراض القلب انتشارا في الرجال هو مرض القلب الإحتباسي (IHD).

النتائج الحالية لهذه الدراسة أظهرت عدم وجود إرتباط بين فصائل الدم والعامل الريصي وأمراض القلب والأوعية الدموية .

بالرغم من أن تكرار حدوث مرض القلب الاحتباسي أعلى في فصيلة الدم O إلا أن الإختلاف إحصائياً ليس له دلالة .

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List of Abbreviations

CAD Coronary Artery Disease

CDC Centers of Disease Control and Prevention

CHD Congestive heart disease

CHF Congestive heart Failure

CVD Cardiovascular disease

DCM Dilated Cardiomyopathy

HIV Human immunodeficiency viral

HF Heart Failure

IgGImunoglobulin G

IgMImunoglobulin M

IHD Ischemic heart disease

ISBT International Society of Blood transfusion

K_2EDTA Potassium Ethylene Diamine tetra Acetic Acid

MI Myocardial Infarction

PPMPermanent Pacemaker

Rh Rhesus

VHD Valvular heart disease

SPSS Statistical Package of Social Science

Chapter One

Introduction and Literature Review

Chapter One

1. Introduction and Literature review

1.1. Introduction

Since the discovery of the ABO system in 1900, a multitude of blood group antigens have been identified and many different styles of terminology have been used. The International Society of blood transfusion (ISBT) recognizes 285 blood group antigens; 245 of these are classified into one of 29 blood group system. Forty years later, both Landsteiner and Wiener discovered Rh(D)antigen (Garratty, 2000;Mollison, 1994).

The genes of ABO and Rh(D) are located on chromosome 9 and 1 respectively. The bombardment of the red blood cells with A and /or B antigens occur as a consequence of the action of the glycosyltransferases enzymes that add specific sugars to the precursor substance (John, 1996).

The cardio vascular system includes the heart and the blood vessels. A functional cardio vascular system is vital for survival, because without blood circulation, the tissues lack oxygen and nutrients, and wastes accumulate. Under such conditions, the cells soon begin irreversible, which quickly leads to death. Cardio vascular disease (also called heart disease) is a class of disease that involves the heart, the blood vessels (arteries, capillaries and veins) or both. This study aimed to determine the frequency of ABO blood groups and Rhesus factor of cardio vascular patients and to correlate association of blood group with cardio vascular diseases. Results of this study may be useful in determines which blood group system is more susceptible to cardiovascular diseases(Bridget, 2010).

Table (1.1) BloodGroup System Recognized by ISBT (Hoff Brand *et al.*, 2000)

System number	System name conventional	System symbol ISBT	Chromosomal location	Gene(s)
001	ABO	ABO	gq34.1 – q34.2	ABO
002	MNS	MNS	4q28-q31	GYPA GYPB
003	P	P1	22q11.2-qter	P
004	Rh	RH	1p36.2-p34	PHD RHCE
005	Lutheran	Lu	19q12-q13	LU
006	Kell	KEL	7q33	KEL
007	Lewis	LE	19p13.3	FUT3
008	Duffy	Fy	1q22-q23	FY
009	Kidd	JK	18q11-q12	HUT11
010	Diego	DI	17q12-q21	SLC4A1
011	Yt	YT	7q22	ACHE
012	Xg	XG	Xp22.32	XG
013	Scianna	SC	1p36.2-p22.1	SC
014	Dombrock	DO	12p13.2-p12.1	GO
015	Colton	CO	7p14	AQP1
016	LW	LW	19p13.2-cen	LW
017	Chid/Rogers	CH/RG	6p21.3	C4A,C4P
018	H	H	19p13	FUT1
019	Kx	XK	Xp21.1	XK
020	Gerbich	GE	2q14-q21	GYPC
021	Cromer	CROM	1q32	GAF
022	Knops	KN	1q32	CR1
023	Indian	IN	11p13	CD44
024	Ok	OK	19pter –p13-2	OK
025	MER2	RAPH	11p15	MER2

International Society of Blood Transfusion (ISBT)

1.2. Literature Review

1.2.1. Blood physiology

Word blood is related to blowan means bloom or flourish. Blood is a vital fluid of our body and as such the life line of human body. It is a red colored viscid fluid slightly salty in taste. Blood is alkaline in reaction PH 7.4 and specific gravity ranges from 1.052 to 1.060. In adult human, blood volume ranges between 4.5 to 6.0 liters and is approximately about one thirteenth of adult human body weight. Temperature of circulating blood is 37˚7 C. Blood has two main components cells and plasma. Cells consist of 40 to 45% of the total amount of blood and plasma consists of 55 to 60% of total amount of blood. Cells are the formed elements and are of three types red cells (erythrocyte), white cells (leucocytes) and platelet (thrombocyte) and each has its own characteristic (Talib, 1995).

Blood is a fluid which is continuously on movement. This process of movement of blood is known as circulation and the system that sustains the process is known as circulatory system and Dr. William Harvey was first person to describe circulation in 1616. It consists of mainly the heart and blood vessels viz. arteries and vein _ cardio vascular system. The whole system works under supreme control of nervous system and cardio _ respiratory centre is believed to be located in medulla oblongata or brain stem. The circulatory activity is also indirectly influenced by some hormones produced in our body. So it is a co-operative function of nervous and humeral mechanism that co-ordinate various activities of heart and blood vessels ensuring proper supply of blood in every corner of our body there by feeding the vital organs and tissues with oxygen , nutrient and

other essential substances . Blood vessels are of three types – arteries, capillaries and veins. Arteries are vessel that carries blood away from the heart and are having thicker walls consisting tunica adventitia, media and intima from outside in ward respectively composed smaller arterioles tissue and endothelium. Artery gradual becomes smaller arterioles and then capillary as they move away from heart. Capillaries are very small, capillary wall consists single layer of endothelium through which inter change between blood and tissue fluid takes place. As blood flow through capillary wall into the tissue the arterial blood changes into venous blood after exchange of substance between blood and tissues. This changed blood drains into vein which is brought back to heart and thence to the lung for purification. So veins are also part of circulatory system but unlike arteries all the three coats of venous walls contains less elastic and less muscle tissue and so the veins are less resilient and easily collapses, it also consists of valves to allow uni directional flow of blood towards heart, valves prevents back flow of blood (Talib, 1995).

1.2.1.1. Blood group system

The clinical importance of a blood group system in blood transfusion lies in the frequency of its antibodies and in the possibility that such as antibodies will destroy in compatible cells in vivo. A B O system was the first to be recognized and remains the most important in transfusion and trance plantation (histo - blood group system). The reason for this is that almost everybody over the age of about 6months has clinically significant anti – A and anti –B in his or her serum if they lack the corresponding antigens on their red cells bence transfusions given without regard to ABO groups would

result in incompatibility patient will has in a vivo adverse hemolytic reactions (Hoff Brand *et al*., 2000) .

1.2.1.1.1. History of ABO discoveries

The two most significant blood group systems were discovered by Karl Landsteiner during early experiments with blood transfusion: the ABO group in 1901. Landsteiner and in Co-operation with Alexander S. Wiener and Rhesus group. (Landsteiner *et al.*, 1940) Development of the coombs test in 1945, (Coombs *et al*., 1945) the advent of transfusion medicine, and the understanding of hemolytic disease of the new born, led to discovery of more blood groups, and now 30 human blood group systems are recognized by the international society of blood transfusion (ISBT), (Lewis *et al*., 1990) and across the 30 blood groups, over 600 different blood group antigens have been found, (Lewis *et al*., 1991) many of these are very rare or are mainly found in certain ethnic groups. Landsteiner was in advertently the first individual to perform forward and reserve grouping. The forward grouping is defined as using known sources of reagent anti-sera to detect antigens on an individual red cells .Reverse grouping is defined as using reagent cells with known ABO antigens and testing the serum of patient for ABO group anti bodies (Denis and Hameening,1998).

1.2.1.1.2. The importance of ABO blood group system

The clinical significance of different red cell anti bodies depends partly on their destructive capacity importance in blood transfusion practice owing to its great Varity. Conversely, ABO and D anti bodies are by far the most significant, due to their high frequency and destructive capacity (Hoff Brand *et al*., 2000).

The O gene is a morph and does not transform the H-substance. Although there are six possible genotypes, the absence of a specific anti-O prevents the serological recognition of more than four phenotypes. The two major sub groups of A (A_1 and A_2).A_2 cells react more weakly than A_1 cells with anti-A and patients who are A_2B can be wrongly grouped as B. A, B and H antigens are present in most body cells including white cells and platelets. In 80% of the population who possess secretor genes, these antigens are also found in soluble forms in secretions and body fluids (e.g. plasma, saliva, semen and sweat).Naturally occuring anti bodies to A and/ or B antigens are found in the plasma of subjects whose red cells lack the corresponding antigens (Hoff Brand *et al*., 2000).

Table (1-2) The ABO Blood Group System. (Hoff brand *et al*., 2006)

Phenotype	**Genotype**	**Antigens**	**Naturally occurring anti bodies**	**Frequency (UR) (%)**
O	OO	O	Anti-A, Anti-B	46
A	AA or AO	A	Anti-B	42
B	BB or BO	B	Anti-A	9
AB	AB	AB	None	3

1.2.1.1.3. Classification of ABO blood group system

Classification of ABO blood groups was based on the redization hat agglutination had occurred because the red cells possessed an antigen and corresponding specific antibody was present in the serum, when no

agglutination had occurred, either antigen or the antibody was missing from the mixture from these observation land recognized four separate groups, named according to the antigen present on the red cells. Individual who possessed the A antigen where classified as belonging to group A and individual who possessed the antigen were classified as belonging to group B red cells from certain individuals showed no agglutination with either ant-A or anti-B and war classified as belonging were classified as belonging to group B- red cells from certain individuals showed no agglutination with either ant-A or anti-B and were classified as belonging to group O (the symbol O denoting zero or lack of A and B antigens on red cells). The red cells of individuals which showed agglutination with both anti- A and anti-B the blood group was called AB. Individuals who possessed the A antigen on their red cells also possessed the anti –A or B antigen (group o) individual who possessed A and B antigens (group AB) had neither anti-A nor anti –B in their serum (Race and Sunger,1975) .

Table (1-3) The ABO Group System (Dacie*et al.*, 2001)

Blood group	Subgroup	Antigens on red cells	Antibodies in plasma
A	A_1 A_2	$A+A_1$ A	Anti-B (Anti-A_1)
B	-	B	Anti-A, Anti-A_1
AB	A_1B A_2B	$A+A_1+B$ A+B	None Anti-A_1
O	-	$(H)^+$	Anti-A Anti-A_1 Anti-B Anti-AB

1.2.1.1.4. Antigens of ABO blood group system

They are mainly A, B and H antigens which are proteins in nature and various proteins are embedded in a mosaic pattern without any fixed position on fluid lipid layer of cell membrane. A, B and H antigen sites are greatest on band 3 of sialoglycoprotein and they are also found on poly glycosilceramides and the number of A, B simple glycolipid. The number of A, B and H antigens sites varies in newborn and adult. These antigenic sites are important because the antibody molecule gets attached to red cells at this site. The ABH antigens are widely distributed they are even found in animals plant and bacteria , in human body apart from the red cells it is also found in saliva , fluid of pseudomucinous ovarian cyst of secretors , me conium of secretor body, it was even discovered in Egyptian mummies , cornea and in the tissue epidermal and epithelial cells, in spermatozoa amongst blood component A,B and H were observed on norm oblast, the A, B antigens occur on platelets , white cells and serum (Talib, 1995).

1.2.1.1.5. Antibodies of ABO blood group system

Naturally occurring antibodies occur in the plasma of subjects who lack the corresponding antigen and who have not been transfused or been pregnant. The most important are anti-A and anti B- they are usually immunoglobulin M (IgM), and react optimally at cold temperatures (4ºC) so, although reactive at 37ºC, are called cold antibodies. Immune antibodies develop in response to the introduction – by transfusion or by transplacental passage during pregnancy- of red cells possess antigens that the subject lacks.These antibodies are commonly IgG, although some IgM , antibodies may also develop- usually in the early phase of an immune response.

Immune antibodies react optimally at 37ºC (worm antibodies). Only IgG antibodies are cable of transplacental passage from mother to fetus. The most important immune antibody is Rh antibody, anti-D (Hoff Brand *etal*., 2000).

1.2.1.1.6Sub groups of A

In addition to the common phenotypes A_1 and A_2 numerous phenotypes with weak expression of A on the red cells have been found and multitude of names has been adopted. Most of these phenotypes can be fitted into the following categories: A_3, Ax, Am, Ay and A_e . The serological characteristics of these phenotypes results from inheritance of a rare allele at the ABO locus, which can be detected when parried with our B, but not with A_1 or A_2 (Daniels *et al*., 2002) .

1.2.1.1.7. ABH secretor status

A bout 80% of the UK populations are ABH secretors as they have H antigen plus A or B according to their ABO genotype, in a water – soluble form in their body secretions. The remaining 20% are non – secretors and have no secreted ABH antigens, regardless of ABO phenotype (Hoff Brand *et al*., 2000).

1.2.1.2. The Rhesus System

The Rhesus system is the second most clinically important and complex blood group system. It consists of 50 different antigens, but only 5 antigens D, C, c, E and e are inherited in various combinations and account for most of the Rh-related problems encountered in practice. The Rh antigen with the strongest antigenicity is the Rh (D) antigen. As simple rule, it can be noted

that persons whose red cells express the D antigen are Rh (D) positive and individuals whose red cells lack the D antigen is Rh (D) negative. The different genotypes, their Rh status, and the frequency of these genotypes in Caucasians. About 85% of North American Caucasians are Rh (D) positive. After the discovery of the Rh system in 1940, various theories were postulated to explain the mode of inheritance and different nomenclatures were proposed. The winer system proposed that the gene product was a single entity with multiple serological specificities (Denisand Hamening, 1998).

Table (1-4): The most common Rh genotypes (Hoff brand *et al*., 2000)

CDE nomenclature	Short symbol	Frequency %	RhD status
Cde/cde	Rr	15	Negative
CDe/cde	R_1r	31	Positive
CDe/CDe	R_1R_1	16	Positive
cDE/cde	R_2r	13	Positive
CDe/cDE	R_1R_2	13	Positive
cDE/cDE	R_2R_2	3	Positive
Other genotypes		9	Positive(all most)

1.2.1.2.1. Discovery of Rh system

The Rhesus system in named after the Rhesus Macaqac, following experiment by Karl Landsteiner and Alexander S.Winer,(1940), which showed that rabbits, when immunized with rhesus monkey red cells, produce an antibody that also agglutinates this factor.The significance of the Rh

factor was soon realized.Dr. Philip Levine working at the Newark Beth Israel Medical center made a connection between the Rh factor and the incidence of erythroblastosis, and Weiner realized adverse reactions from the Rh factor. Weiner then pioneered the exchange transfusion technique saved the lives of many thousands of infants before intrauterine transfusion was invented which enabled much more severely affected fetuses to be successfully treated (Denisand Hamening, 1998).

1.2.1.2.2. The nomenclature of Rh blood group system

Several nomenclatures can be used to describe Rh genes and antigens. Fisher- Race nomenclature, which uses CDE terminology, more commonly is used for Antigens; Weiner nomenclature, which uses Rh designations, is favored for haplotypes and gene complexes. An individual who inherits (ce gene) from one parent and (D and cegnes) from the other parent expresses DC, c and e antigens on his or her erythrocyte (Hoffbrand*et al*., 2000).

1.2.1.2.3. The Fisher- Race nomenclature

Fisher- Race theory states that there are three closely linked loci, each with primary set of allelic genes D and d, C, c, E and e. these three loci are to be closely linked that crossing over occurs only very rarely,and the three Rh genes are inherited as a complex. The Rh genes complex was assumed to possess closely linked genes, which could be assembled in eight different ways: CDE, CDe, cDE, Cde, Cde, cDe, cdE, cde. Inter on nomenclature, the Rh antigens are therefore named: C, D, E, c, d, e. the antigen (d) and its corresponding antibody has never been discovered and is through not be exists. The symbol (d) is used to donate the absence of D antigen. All individuals who lack the D- antigen are Rh negative. Regardless of whether

the C or E or both are present, the most frequent genotype among D-negative individuals is cde.The theory of Fisher- Race was confirmed when the two unknown reactions CDE were shown to be as predicated by Murray and Cowkers in 1945 and when anti e was discovered by Mourant in same year. The only weakness in theory therefore was failure to find the expected antigen- d.Other antigens since found be a part of Rh system have been classified using the same basic principle (Nevillen*et al*., 1994).

1.2.1.2.4. The Weiner nomenclature

Weiner visualized multiple allele determining its won particular antigen. The antigen comprises multiple factors depending on which genes are present and are recognized by which ever factors are detectable. The two genes (i.e. one paternal and one maternal),have been alike (homozygous) or different (heterozygous). Therefore, multiple allele are called R1, R2, RO, r, r̀, r̀̀, RZ, RY.Rh- antigens are called Rho, h1, RH̀̀, rh̀. In simple terms, for example the Rh1 gene produces a complex antigen on the red cell that made up of at least three factors: Rh̀, Rho, rh̀̀ (Nevillen*etal*., 1994).

1.2.1.2.5. Rh blood group system antigens and antibodies

Rh antigen is aprotein surrounded by lipid, Rh activity is not lost when lipid is extracted from red cells membranes (the lipid doesn't carry the antigenic determination but may be essential for confirmation of the determinants) (Nevillen*et al.,*1994).

In the Rhesus blood group system, naturally occurring Rhesus antibodies are not found in the serum of individuals lacking the corresponding Rhesus antigens. Rhesus antibodies are formed by immunization. The most

important Rhesus antibodies is Anti- D, which can be formed when a Rh negative individual is transfused Rh positive blood or when a Rh negative woman becomes pregnant with a Rh positive infant and the red cells of the baby pass into her circulation particularly at the time of delivery, stimulating the production of anti- D antibody. Such circulating anti- D will not become immediately harmful unless the individual receives a transfusion of Rh positive blood, in such a situation the donor's D antigen red cells will be hemolyzed by the anti- D (Nevillen*et al*., 1994).

1.2.1.2.6. Other Rh blood group system antigens

Currently, 50 antigens have been described in the Rh group system, D, C, c, E and e antigens are the most important ones. The other antigens are much less frequently encountered or are rarely clinically significant. Each is given a number (Mark, 2005).

1.2.1.2.7. Rh Phenotypes

The completeness with which the Rh phenotype can be determined depends on the anti sera available; if anti- c is available but not anti- C, samples can be classified as c positive (i.e. cc or Cc) and c negative (i.e. CC). If anti- C is also available, Cc can be distinguished from cc. If a sample is tested with anti- D, anti- C, anti-c and anti- E and gives positive reactions with all for anti sera: the phenotype is written DCcE.Red cells that fail to react with aanti-D are described as dd. Mountran'notation is occasionally misleading for example , although anegative reaction with anti-E usually implies that the cells are ee (Mollison, 1997) .

1.2.2. Heart structure and function

The heart is one of the most important organs in the entire human body. It is really nothing more than a pump, composed of muscle which pumps blood throughout the body, beating approximately 72 times per minute of our lives. The heart pumps the blood, which carries all the vital materials which help our bodies function and removes the waste products that we do not need. For example, the brain requires oxygen and glucose, which, if not received continuously, will cause it to lose consciousness. Muscles need oxygen glucose and amino acids, as well as the proper ratio of sodium, calcium and potassium salts in order to contract normally. The glands need sufficient supplies of raw materials from which to manufacture the specific secretions. If the heart ever ceases to pump blood the body begins to shut down and after very short period of time will die.The walls of the heart are made up of three layers, while the cavity is divided into four parts, three are two upper chambers, called the right and the left atria, and two lower chambers, called the right and the left ventricles. The right atrium, as it is called, receives blood from the upper and lower body through the superior vena cava and the inferior vena cava, respectively, and from the heart muscle itself through the coronary sinus. The right atrium is the larger of the two atria, having very thin walls. The right atrium opens into the right ventricle through the right atrioventicular valve (tricuspid), which only allows the blood to flow from the atria into the ventricle, but not in the reserve direction. The right ventricle pumps the blood to the lungs to be reoxygenated. The left atrium receives blood from the lungs via the four pulmonary veins. It is smaller than the right atrium, but has thicker walls. The valve between the left atrium and the left ventricle, the left atrioventicular valve (bicuspid), is

smaller than the tricuspid. It opens into the left ventricle and again is a one way valve. The left ventricle pumps the blood throughout the body. It is the Aorta the largest artery in the body, which originates from the left ventricle.The heart works as a pump moving blood around in our bodies to nourish every cell. Used blood, that is blood that has already been to the cells and has given up its nutrients to them, is drawn from the body by the right half of the heart, and then sent to lungs to be reoxygenated. Blood that has been reoxygenated by the lungs is drawn into the left side of the heart and then pumped into the blood stream. It is the atria that draw the blood from the lungs and body, and the ventricles that pump it to the lungs and body. The output of each ventricle per peat is about 70 ml, or about 2 table spoons. In a trained athlete this amount is about double, with the average heart rate of 72 beats per minute the heart will pump about 5 liters per ventricle, or about 10 liters total per minute. This is called the cardiac output. In a trained athlete the total cardiac output is about 20 liters (Bridget, 2012)

1.2.2.1. Cardiovascular diseases

Cardiovascular disease (CVD) is the leading cause of death inthe world and accounts for well over one million deaths each year in the United States. Of the more than two million deaths in the United States in 1998, CVD was listed as the primary or contributing cause in 70% of cases.1 According to theCenters of Disease Control and Prevention (CDC) and the National Health and Nutrition Examination Survey III, the probability at birth of dying from CVD is 47%, compared to22% from cancer, 2% from diabetes, and less than 1% from human immunodeficiency virus (HIV) disease. The largest proportion of this high mortality is attributed to coronaryartery

disease (CAD) or coronary heart disease (CHD), whichwas the primary contributing cause of death in 459,841Americans in 1998. (Dallas, 2001)

CVD includes hypertension, coronary artery disease(CAD), congestive heart failure (CHF), congenital cardiovasculardefects, and stroke. Although these diseases are associated with a high mortality,the associated morbidity affects all walks of life and has agreat impact on the quality of life of affected individuals (Bridget, 2010).

1.2.2.2. Types of Cardiovascular diseases and risk factors

There are different types of cardiovascular diseases include: Coronary artery disease ,cardiomyopathy- diseases of cardiac muscle, hypertensive heart disease, heart failure, inflammatory heart disease, valvular heart disease ,cerebrovascular disease ,peripheral arterial disease ,congenital heart disease ,and rheumatic heart disease .Evidence suggests anumber of risk factors for heart diseases ;age,gender ,high blood pressure,hyperlipidemia,diabetes mellitus, tobacco smoking, processed meat consumption, family history,obesity, lack of physical activity, psychosocial factors, and air pollution (Bridget, 2010).

1.2.2.2.1 Coronary artery disease

Coronary artery disease (CAD) accounts for approximately 30to 50% of all cases of CVD. It is estimated that 12,400,000 .Americans alive today have already suffered a myocardial infarction (MI) or experienced angina pectoris (chest pain). Atherosclerosis, the most common cause of CAD, results froma wide variety of pathologic processes that interact with anddisrupt the vascular endothelium. The result is plaque formation,with the compromise of effective arterial luminalarea. In the coronary circulation, this process may cause achronic reduction in coronary blood

flow and ensuingmyocardial ischemia or it may cause acute plaque rupture with intracoronary thrombus formation and subsequent MI.Atherosclerosis may affect any vascular bed, including thecoronary, cerebral, renal, mesenteric, and peripheral vascularsystems. When end-organ blood flow is compromised, theresulting ischemia can cause subsequent organ dysfunction.The sudden rupture of an atherosclerotic plaque, with ensuingintracoronary thrombus formation that acutely reducescoronary blood flow, causes the acute coronary syndromes.This results in myocardial ischemia and subsequent infarctionif there is a prolonged and severe reduction in blood flow.Acute coronary syndromes represent a continuous spectrumof disease ranging from unstable angina to non-Q-wavemyocardial infarction to acute Q-wave myocardial infarction.If the intraluminal thrombus following acute plaque ruptureis not completely occlusive, the corresponding clinical presentationis that of unstable angina (Yeghiazarians Y., *et al* 2000).

1.2.2.2.2. Prosthetic Heart Valves

There are numerous types and models of prosthetic heartvalves, each with their own characteristics. These valves areeither mechanical or bioprosthetic. The mechanical valves,which are classified according to their structure, include thecaged-ball (Starr-Edwards) valve, the single tilting-disk(Björk-Shiley) valve, and bileaflet tilting-disk valves (ie, St.
Jude, Edwards-MIRA).Bioprosthetic valves are either (1)heterografts made from porcine or bovine tissue or (2)homografts from preserved human aortic valves. Patientswith mechanical valves are placed on anticoagulation therapytypically warfarin) to prevent thromboembolism,
according to the type of their replacement valve. The thrombogenic

potential is high for caged-ball valves, moderate forsingle tilting-disk valves, and low for bileaflet tilting-diskvalves. In patients with mechanical valves, the risk of systemicembolization is approximately 4% per patient per yearwithout anticoagulation, 2.2% with aspirin therapy, and 0.7to 1.0% with warfarin therapy. Patients with mitral valveprostheses are at approximately twice the risk of those with aortic valve prostheses (Cannegeister SC., *et al* 1995).

1.2.2.2.3. Heart failure

Congestive heart failure (CHF) is the common end point of many forms of heart disease; it is a pathologic state in which impaired cardiac function renders the heart unable to maintain output sufficient for the metabolic requirements of the body. CHF is characterized by diminished cardiac output (forward failure), accumulation of blood in the venous system (backward failure), or both. The major causes of left-sided failure are ischemic heart disease, hypertension, aortic and mitral valve disease, and myocardial disease. Right-sided heart failure is most commonly caused by left-sided failure .Pure right-sided heart failure can be caused by tricuspid or pulmonary valvular disease, or by intrinsic pulmonary or pulmonary vasculature disease causing functional right ventricular outflow obstruction (Mitchell R N ., *et al* 2005).

1.2.2.2.4. Congenital Heart Disease

Congenital heart disease refers to cardiac or great vessel abnormalities that are present at birth; most are attributable to faulty embryogenesis during gestational weeks 3 through 8, when major cardiovascular structures develop. Congenital heart disease likely has strong developmental basis; multifactorial genetic , environmental, and maternal factors probably

account for the majority of cases, Well-defined genetic or environmental influences are thus far identifiable in 10% of cases; trisomy 21is the most common known genetic cause, and congenital rubella infection or teratogens are common environmental factors (Mitchell ., *et al* 2005).

1.2.2.2.5. Ischemic Heart Disease

Ischemic heart disease(IHD) comprises a group of closely related syndromes resulting from ischemia-essentially a mismatch between cardiac demand and vascular supply of oxygenated blood .In most cases ,ischemia not only causes oxygen insufficiency(hypoxia, anoxia),but also reduces nutrient availability and metabolic removal. Ischemia can be cause by: reduced coronary blood flow due to some combination of coronary atherosclerosis, vasospasm, and thrombosis, or caused by increased myocardial demand and hypoxia due to diminished oxygen transport. There are four overlapping ischemic syndrome s, differing in severity and rate of onset:

- Myocardial infarction (MI) is the most important form of IHD; MI occurs when duration and severity of ischemia is sufficient to cause death of heart muscle.
- Angina pectoris is characterized by paroxysmal substernal pain .Three patterns of angina are recognized based on the nature of the provocation and severity of the pain: stable angina, prinzmetal angina and unstable angina.
- Chronic ischemic heart disease is seen typically in elderly patients with moderate to severe multivessel coronary atherosclerosis who develop CHF.

- Sudden cardiac death is defined as unexpected cardiac death within 1 hour of symptom onset (Mitchell.*et al*., 2005).

1.2.2.2.6. Myocardial Infarction (MI)

There are two types of MI, with different morphology, pathogenesis and clinical significance: transmural infarct is an MI involving the full thickness of the ventricular wall; it is usually caused by severe coronary atherosclerosis, with acute plaque rupture superimposed occlusive thrombosis, and subendocardial infarct is typically limited to the inner one third of the ventricular wall; it is caused by increased cardiac demand in the setting of limiting supply due to fixed atherosclerotic disease; alternatively, subendothelial infarction can occur in an evolving transmural infarct when the coronary obstruction is relieved in sufficient time to prevent transmural necrosis. Complications of an MI depend on the size and location of injury, as well as functional myocardial reserves. Overall mortality rate in the first year after MI is 30.0% and thereafter 5.0% to 10.0% per year. Typical complications include: Arrhythmias, CHF, Cardiogenic shock, Ventricular rupture, Papillary muscle infarction with or without rupture, Fibrinous pericarditis is common 2 to 3 days after MI, Mural thrombosis adjacent to a noncontractile area and repetitive infarction (Mitchell *et al*., 2005).

1.2.2.2.7.Valvular Heart Disease (VHD)

Valvular heart disease in adults is typically caused by degeneration, immunologic inflammatory processes or infection. The failure of compensatory hypertrophy mechanisms is heralded by angina, syncope or CHF. With onset of such symptoms, and if left untreated, there is a 50.0%

risk of death within 2 to 5 years; urgent surgical valve replacement is clearly indicated (Mitchell *et al*., 2005).

Although myocardial dysfunction can occur secondary to ischemic, valvular, hypertensive, or other heart diseases, the term myocardial disease implies principal cardiac dysfunction. When the abnormality is primary in and localized to the myocardium, the condition is called cardiomyopathy. Cardiomyopathy is not synonymous with CHF; the latter represents a consequence of many forms of cardiac disease. Cardiomyopathy is divided into three main categories: dilated, hypertrophic, and restrictive (Mitchell *et al*., 2005).

1.2.2.2.8. Dilated Cardiomyopathy (DCM)

Characterized by gradual four- chamber hypertrophy and dilation. Dilated cardiomyopathy (DCM) can occur at any age as slow, progressive CHF. Only 25.0% of patients survive more than five years. Although the cause is frequently unknown (idiopathic DCM), certain pathologic mechanisms may contribute: genetic defect, alcohol toxicity, peripartum cardiomyopathy and postviral myocarditis (Mitchell *et al*., 2005).

1.2.2.2.9. PERMANENT PACEMAKERS

Permanent cardiac pacing is used in a wide variety of cardiac conditions, including symptomatic heart block and bradycardia, brady-tachy syndrome, carotid hypersensitivity, neurocardiogenic syncope, heart failure, and hypertrophic cardiomyopathy. Single (typically ventricular) or dual chamber(atrial and ventricular) models are typically employed. Guidelines for the implantation of cardiac pacemakers have been established by the American College of Cardiology and the American Heart Association joint

task force on the basis of available evidence in the medical literature (Gregoratos G., *et al* 1998).

1.2.3. Previous Studies

Many reports have appeared in recent years showing an association between blood groups and cardiovascular diseases. Sheikh MK *et al*., (2009) investigated association between blood group B and myocardial infarction in Malaysia. In Bangladesh, Biswas J *et al*., et al (2008) showed the prevalence of coronary Artery Disease (CAD) was higher in blood group O than other blood groups. Allen and Dawson (1968) , Havlic RJ, *et al (*1969),Rosenberg L, *et al* (1983) and Wazirali H, *et al* (2005) all reported higher risk of Ischemic heart disease with blood group A as compared to group O.

1.3. Rationale

Various studies have been done trying to co-relate the ABO blood groups with diseases e.g. peptic ulcer, duodenal ulcer, pernicious anemia, gall stones, carcinoma of the stomach and ischemic heart disease (IHD) etc. But very few studies have been done in Sudan, to relate cardiovascular disease with ABO blood group and Rhesus factor. Since few published data regarding this subject is available, the results of this study may add new results for early prevention of cardiovascular diseases according to ABO and Rh blood group systems.

1.4.Objectives

1.4.1.General objective

To determine frequency of ABO and Rh blood group systems of Sudanese patients with cardiovascular diseases.

1.4.2. Spesific objectives

1. To determine frequency of ABO and Rh blood groups according to age and gender.
2. To determine frequency of ABO and Rh blood groups of patients with cardiovascular diseases.
3. To determine frequency of ABO and Rh blood groups according to types of cardiovascular disease.
4. To correlate association of ABO and Rh blood groups with types of cardiovascular diseases.

Chapter Two

Material and Methods

Chapter Tow

2. Material and Methods

2.1. Study design

This is a descriptive analytical study conducted in Khartoum State during the period of May to August 2014 in Sudanese patients with cardiovascular diseases to determine frequency of ABO and Rh blood groups in Sudanese patients and to correlate its association between ABO and Rh blood groups with cardio vascular diseases.

2.2. Study population

Seventy (70) patients with cardiovascular diseases with different age group both males and females were included.

2.3. Inclusion criteria

Patients who were diagnosed in different age group with cardio vascular diseases in Khartoum State hospitalswere included in this study.

2.4. Exclusion criteria

Healthy individuals or patients with other diseases (not cardiac diseases) were excluded from this study.

2.5. Data collection

Data were collected using self administered pre- coded questionnaires from a field survey. The questionnaires were specifically designed to obtain

informations about sex, Age, type of cardio vascular disease and presence of other diseases.

2.6Ethical consideration

Participant was informed in their simple language about the research and its benefits method of sample collection, and the approval consent was taken.

2.7. Materials

General Equipment and reagents:

- Syringe
- Cotton and gloves
- 70% alcohol
- EDTA containers
- Slides
- Antibody A
- Antibody B
- Applicator sticks
- Pipettes

2.8. Methods

2.8.1 Sample collection

Tow point five ml venous blood was drawn after make sterilization by 70% alcohol use 20 or 21 G needle with limited occlusion of the arm by the tourniquet. The blood was collected in K2 EDTA (Potassium Ethylene Di amine Tetra Acetic) and mix gently (Kathen*et al.*, 1998).

2.8.2. ABO slide agglutination test

2.8.2.1 Principle

When red cells were mixed with various reagents of antisera (soluble antibody), agglutination occurred on the slides containing cells positive (possessing the antigen) for the corresponding antigen. No agglutination occurred in the red cells did not contain the corresponding antigen (Walker *etal*., 1999).

2.8.2.2 Procedure

1. On the section of slide labeled anti- A one drop of antibody A was placed.

2. On the section of slide labeled anti- B one drop of antibody B was placed.

3. One drop of cells was placed in each antibody containing circle.

4. Mentioned solution was mixed carefully with a separate applicator stick.

5. The slide slowly was tilted for one minute, then agglutination was observed.

6. Result was recorded.

2.8.2.3. Interpretation

Agglutination (clumping) of the red blood cells is positive. No agglutination is negative- It's critical to read the results immediately as false positive can occur when the mixture begins to dry on the slide.

2.8.2.4. Controls

Known positive (+ve) and negative (-ve) (RBcs positive and ned negative for A, B antigen) were included in accordance with the relevant guide lines of quality assurance.

2.8.3. Rh (D) red blood cell typing

2.8.3.1. Principle

Rh (D) typing is based on the principle of agglutination. Normal human red blood cells prossessing antigen will clump in the presence of antibody directed toward the antigens.

Agglutination of patient or control red blood cells with anti- D serum and no agglutination with the control reagent is a positive test result, which indicates the presence of the D antigen on the red blood cells. Absence of agglutination is a negative test result, which indicates the D antigen is not demonstrable.

If Rh typing is negative, Du typing is automatically performed.

2.8.4. D^u Method (The indirect anti globulin)

2.8.4.1. Principle

The indirect anti globulin test is used for the detection of antibodies that may cause red cell sensitization in vitro. If both IgG antibodies and the corresponding antigens are present in serum, red cell mixture incubation will cause the antibody to attach antigenic receptor on red cell.

2.8.4.2. The technique of D^u method

1- Two drop of mixture (IgG and IgM) anti- D was placed in 10×75mm test tube.
2- One drop of washed 5% suspension of the test cell was added.
3- Mix well, and the tube was incubated at 37 ˚C for 15 minutes in LISS.
4- After incubation, the mixture was centerfuged and then he result was red and recorded.
5- The mixture was washed 3-4 times in large volume of saline, and then each wash was decanted completely.
6- Two drops of anti globulin reagent was added, mixed well and incubated for 4-5 minutes at room temperature.
7- The mixture was center fuged at 3400rpm for 15 seconds.
8- The final results were read and recorded (Walker *etal*., 1999).

2.8.4.3. Requirements

- Test tubes

- Water bath at 37 ˚C

- Anti- D sera

- Coomb's sera

- Pasteur pipette

- Microscope

- Bench centrifuge

2.8.4.4. Interpretation

Agglutination in test sample and negative reaction in control sample shows a positive test and the sample are labeled Rh (d) positive.

Chapter Three

Results

Chapter Three

3. Results

This was a descriptive analytical study aimed to determine frequency of ABO and Rh blood groups in Sudanese patients and to correlate their association with cardiovascular diseases, this study done on seventy patients 33 (47.1%) males and 37 (52.9%) females.

The results of this study showed that cardiovascular diseases have been found in females more than males table (3- 1), and also found in elder patients with age between (51- 85 years) table (3- 2).

Most common type of cardiovascular disease was ischemic heart disease (30.0%) followed by heart failure (17.1%) and least frequent was valvular heart disease as showed in table (3- 3).

According to table (3- 4) found that most frequent blood group in study was O (50.0%) followed by A (32.9%) and least frequent was AB (4.3%).

According to the results showed in table (3- 5) most frequent blood group in males was O (54.5%) followed by A (24.2%) and least frequent was AB (6.1%) and most frequent blood group in females was O (45.9%) followed by A (40.6%) and least frequent was AB (2.7%).

The majority of patients with cardiovascular diseases were Rh positive (91.4) which showed in table (3- 6).

Most common type of cardiovascular disease in females was IHD (27.0%) followed by HF (24.3%) and least frequent was VHD (2.7%), table (3- 7).

Most common type of cardiovascular disease in males was IHD (33.3%) followed by DCM and CHD (18.2) and least frequent was PPM (0.0%), table (3- 7).

Most common type of cardiovascular disease in elder patients with age between (51- 85years) was IHD (34.7%) followed by CHD (19.6%) and least frequent was VHD (0.0%), most common type of cardiovascular diseases in patients with age between (8- 50 years) was DCM (33.3) followed by IHD (20.8%) and least frequent was CHD and PPM (0.0%), table (3- 8).

Most common disease in blood group O was IHD and in group A was MI, table (3- 9).

According to table (3- 10), majority of patients with different types of cardiovascular diseases were Rh positive.

Table (3-1) Distribution of study group according to gender

Gender	Frequency	Percent %
male	33	47.1
female	37	52.9
Total	70	100.0

Table (3-2) Distribution of study group according to age group

Age group	Frequency	Percent %
8-50	24	34.3
51-85	46	65.7
Total	70	100.0

Table (3-3): Frequency of different types of cardiovascular diseases

Type of cardiovascular diseases	Frequency	Percent %
Dilated cardiomyopathy	11	15.7
Heart failure	12	17.1
Ischemic heart disease	21	30.0
Myocardial infarction	10	14.3
Coronary heart disease	9	12.9
Valvular heart disease	3	4.3
Permanent Pacemaker	4	5.7
Total	70	100.0

Table (3-4): Frequency of ABO among study group

Blood group	Frequency	Percent %	P-value
A	23	32.9	
B	9	12.9	
AB	3	4.3	0.547
O	35	50.0	
Total	70	100.0	

Table (3- 5) Distribution and frequency of ABO blood groups according to gender

Blood group	Male	Percent %	Females	Percent %
O	18	54.5	17	45.9
A	8	24.2	15	40.6
B	5	15.2	4	10.8
AB	2	6.1	1	2.7
Total	33	100.0	37	100.0

Table (3-6) Frequency of RH group in study group

Rh blood group	Frequency	Percent %
Positive	64	91.4
Negative	6	8.6
Total	70	100.0

Table (3- 7) Distribution of different types of cardiovascular diseases according to gender

Type of cardiovascular disease	Male	Percent %	Female	Percent %
IHD	11	33.3	10	27.0
HF	3	9.1	9	24.3
DCM	6	18.2	5	13.5
MI	5	15.2	5	13.5
CHD	6	18.2	3	8.2
VHD	2	6.0	1	2.7
PPM	0	0.0	4	10.8
Total	33	100.0	37	100.0

Table (3-8) Distribution of different types of cardiovascular diseases according to Age group

Type of Cardiovascular disease	Age(8- 50)	Percent %	Age(51- 85)	Percent %
IHD	5	20.8	16	34.7
HF	4	16.7	8	17.4
DCM	8	33.3	3	6.6
MI	4	16.7	6	13.0
CHD	0	0.0	9	19.6
VHD	3	12.5	0	0.0
PPM	0	0.0	4	8.7
Total	24	100.0	46	100.0

Table (3-9) Distribution of ABO blood groups of patients with different types of cardiovascular diseases

Blood group	DCM	HF	IHD	CHF	MI	CHD	VHD	PPM	NO	Percent %
A	2	2	6	1	7	1	2	2	23	32.9
B	2	1	2	1	0	1	1	1	9	12.9
AB	1	0	1	0	1	0	0	0	3	4.3
O	6	4	12	3	2	7	0	1	35	50.0
Total	11	7	21	5	10	9	3	4	70	100.0

Table (3-10) Distribution of Rh blood group of patients with different types of cardiovascular diseases

Type of cardiovascular diseases	RH		Total	Percent %
	Positive	Negative		
DCM	10	1	11	15.7
HF	11	1	12	17.1
IHD	19	2	21	30.0
MI	9	1	10	14.3
CHD	9	0	9	12.9
VHD	2	1	3	4.3
PPM	4	0	4	5.7
Total	64	6	70	100.0

Chapter Four

Discussion, Conclusion and Recommendations

Chapter Four

4. Discussion, Conclusion, and Recommendation

4.1. Discussion

This is a descriptive analytical study was conducted in Khartoum State during the period from May to August 2014 to determine frequency of ABO and Rh blood groups in Sudanese patients and to correlate their association with cardiovascular diseases.

Seventy samples were collected from patients with cardiovascular diseases 33 (47.1%) males and 37(52.9%) females.

Most common cardiovascular disease was Ischemic heart disease followed by heart failure and least frequent was vavular heart disease.

Most common cardiovascular disease in females was ischemic heart disease followed by heart failure and least frequent was valvular heart disease.

Most common disease in males was Ischemic heart disease and the least frequent was Permanent pacemaker. According to these results ischemic heart disease most common in males as compared to females.

Most common blood group in males was O followed by A and least frequent was AB.

Most common blood group in females was O followed by A and least frequent was AB.

Most common Rh blood group in males was Rh (D) positive and most common Rh blood group in females also was Rh (D) positive.

The results obtained in this study showed that the prevalence of ischemic heart disease (IHD) in blood group O is higher than in all other ABO blood groups, that may be due to the majority of Sudanese population were blood group O which is finding of Fathelrahman study concluded that blood group O was the predominant (52.7%) followed by A (23.3%), B (13.2%), while AB was the least frequent (10.8%). This finding in agreement with the only study done by Abo Algasim;et al (2007). In Aldinga Sudanese Ethnic group, where the workers reported highest frequency of blood group phenotype O (50%) followed by A (23%), B (18%) and AB (9%). (Fathelrahman, 2010).

Highest frequent were cardiovascular diseases found in females and highest frequent found in elder patients with age between (51- 85 years).

Bronte- Stewart. et al., (2003) found that blood group A (37.8%) and B (32.6%) are associated with higher risk of Ischemic heart disease as compared to group O (20.7%), this study disagree with my study which showed that blood group O (50.0%) and A (32.9%) are associated with higher risk of Ischemic heart disease as compared to blood group B (12.9%) and AB (4.3%).Whincup. et al., (1990) in 24 British towns notices higher incidence of Ischemic heart disease in blood group O (47%), this study agree with my study.

In this study found no association between cardiovascular disease and type of blood groups with p- value = 0.547.

4.2. Conclusion

- There is no association between cardiovascular diseases and type of blood groups with p- value = 0.547.
- Rh positive was higher frequent than Rh negative.
- Most common cardiovascular disease in males was Ischemic heart disease and most common cardiovascular disease in females also was Ischemic heart disease.
- O blood group was more frequent among patients with cardiovascular diseases followed by A blood group and least frequent was AB.
- Cardiovascular diseases were more common among females regard to males.
- From the results of this study may conclude that most common type of cardiovascular disease was Ischemic heart disease, followed by Heart Failure and least frequent disease was valvular heart disease.

4.3. Recommendations

1. ABO and Rh blood grouping should be done as routine investigations for patients with cardiovascular diseases.
2. Other studies should be conducted with using of advance techniques to confirm the results.
3. Other studies should be conducted with using of gel technique.
4. According to the results of this study, individuals with blood group O and A should aware of preventive measures against cardiovascular disease including diet and physical exercise.
5. Further study is required to give baseline data regarding distribution of ABO of patients with cardiovascular diseases.
6. Further investigations in other regional settings with much larger population may elucidate these findings.

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Appendices

Sudan University of Science and Technology

College of Graduate Studies

Medical Laboratory Science

Hematology department

Questionnaire about ABO blood group and Rh factor among patients with cardiovascular diseases

Sample No : ……..

Age : ……..

Gender : ……

Type of cardiovascular disease : …….

Laboratory Investigation :

Blood Group : ……..

Rh factor : ……

Date : / /

Signature : ……

بسم الله الرحمن الرحيم

جامعة السودان للعلوم والتكنلوجيا

كلية الدراسات العليا- برنامج الماجستير- مختبرات طبية

تخصص علم الدم ومبحث المناعة

اقرار موافقة

الاسم :.....

سوف يتم أخذ عينة من الدم(2.5)مل من الوريد بواسطة حقنة طعن وذلك بعد مسح مكان أخذ العينة بواسطة المطهر. كل الأدوات المستخدمة لأخذ العينة معقمة ومتبع فيها وسائل السلامة المعملية.

وأنا أقر بأن هذه العينات سوف يتم تحليلها فقط لغرض البحث.

أوافق أنا المذكورأعلاه بأخذ عينة لإجراء الدراسة.

الإسم:.....

الإمضاء:.....

Master sheet

Number	Sex	Age	Disease	ABO group	RH group	Other diseases	Age group
1	Female	44	DCM	A	Positive	No	23-50
2	Male	24	DCM	O	Positive	No	23-50
3	Female	52	DCM	B	Positive	Yes	51-85
4	Female	34	DCM	A	Positive	No	23-50
5	Male	80	HF	O	Positive	Yes	51-85
6	Female	60	DCM	O	Negative	No	51-85
7	Female	60	HF	O	Positive	No	51-85
8	Female	60	HF	A	Positive	Yes	51-85
9	Female	60	IHD	O	Positive	Yes	51-85
10	Female	46	HF	B	Positive	Yes	23-50
11	Female	50	IHD	O	Positive	Yes	23-50
12	Female	71	HF	O	Negative	No	51-85
13	Female	60	IHD	O	Positive	Yes	51-85
14	Female	35	VHD	A	Positive	No	23-50
15	Female	43	MI	A	Positive	Yes	23-50
16	Female	59	MI	A	Positive	No	51-85
17	Female	48	IHD	B	Positive	Yes	23-50
18	Female	62	IHD	O	Positive	Yes	51-85
19	Male	54	MI	A	Positive	No	51-85
20	Male	52	MI	O	Positive	Yes	51-85
21	Female	51	IHD	A	Positive	Yes	51-85
22	Male	60	IHD	O	Positive	Yes	51-85
23	Female	62	IHD	O	Positive	No	51-85
24	Male	70	IHD	A	Positive	Yes	51-85
25	Female	49	MI	A	Positive	No	23-50
26	Male	44	IHD	O	Positive	Yes	23-50
27	Male	60	IHD	B	Positive	Yes	51-85
28	Female	40	MI	A	Positive	No	23-50
29	Male	25	VHD	A	Positive	No	23-50
30	Male	65	IHD	O	Positive	Yes	51-85
31	Male	80	DCM	B	Positive	Yes	51-85
32	Male	78	CHD	O	Positive	Yes	51-85
33	Male	53	CHD	B	Positive	No	51-85
34	Male	72	CHD	O	Positive	No	51-85
35	Male	69	MI	A	Positive	No	51-85
36	Male	29	IHD	O	Positive	No	23-50
37	Female	75	CHD	O	Positive	No	51-85
38	Female	60	CHD	A	Positive	No	51-85
39	Male	67	IHD	A	Negative	No	51-85
40	Male	72	HF	A	Positive	Yes	51-85
41	Male	78	CHD	O	Positive	No	51-85
42	Male	48	DCM	O	Positive	Yes	23-50
43	Female	75	HF	O	Positive	No	51-85
44	Male	60	HF	O	Positive	No	51-85

45	Female	60	IHD	O	Positive	Yes	51-85
46	Male	48	DCM	O	Positive	No	23-50
47	Female	70	IHD	AB	Positive	No	51-85
48	Male	68	IHD	A	Positive	Yes	51-85
49	Female	39	MI	A	Positive	Yes	23-50
50	Female	42	DCM	O	Positive	No	23-50
51	Female	23	HF	A	Positive	Yes	23-50
52	Female	45	HF	O	Positive	No	23-50
53	Male	67	MI	AB	Positive	Yes	51-85
54	Female	63	IHD	A	Positive	No	51-85
55	Female	75	HF	O	Positive	Yes	51-85
56	Female	65	PPM	B	Positive	Yes	51-85
57	Male	30	DCM	AB	Positive	No	23-50
58	Mal	43	HF	B	Positive	Yes	23-50
59	Male	56	IHD	A	Negative	Yes	51-85
60	Male	52	IHD	O	Positive	Yes	51-85
61	Male	70	CHD	O	Positive	No	51-85
62	Male	80	CHD	O	Positive	No	51-85
63	Female	60	CHD	O	Positive	No	51-85
64	Male	23	VHD	B	Negative	No	23-50
65	Female	84	PPM	A	Positive	No	51-85
66	Female	60	PPM	A	Positive	No	51-85
67	Female	43	DCM	O	Positive	No	23-50
68	Female	57	PPM	O	Positive	No	51-85
69	Male	62	MI	O	Negative	Yes	51-85
70	Male	49	IHD	O	Positive	Yes	23-50

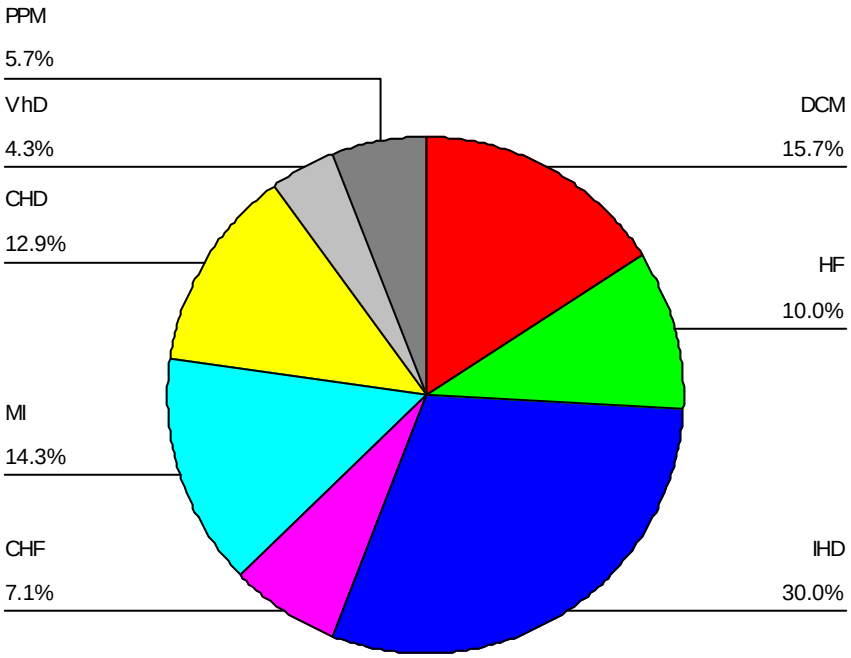

Figure (3-3) Frequency of different types of cardiovascular diseases

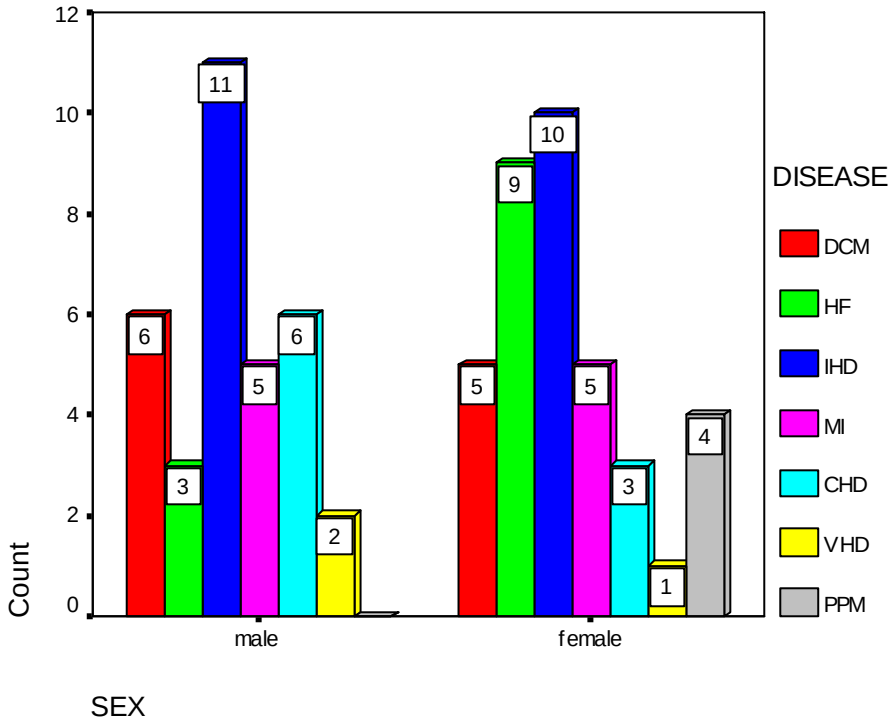

Figure (3-5) Distribution of ABO blood groups according to gender

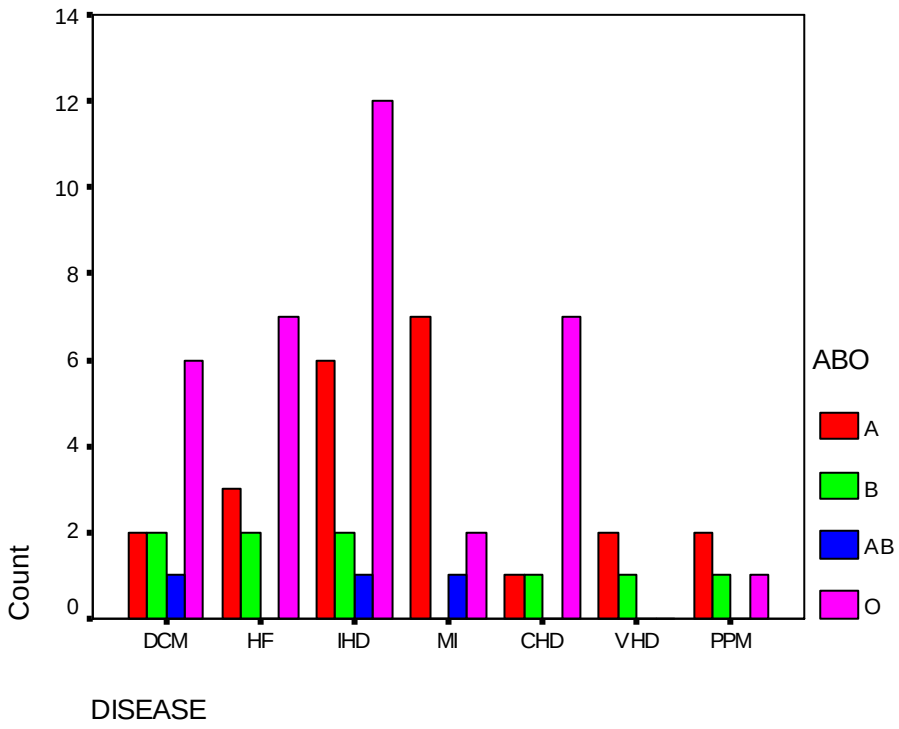

Figure (3-9) Distribution of ABO blood group of patients with different types of cardiovascular diseases

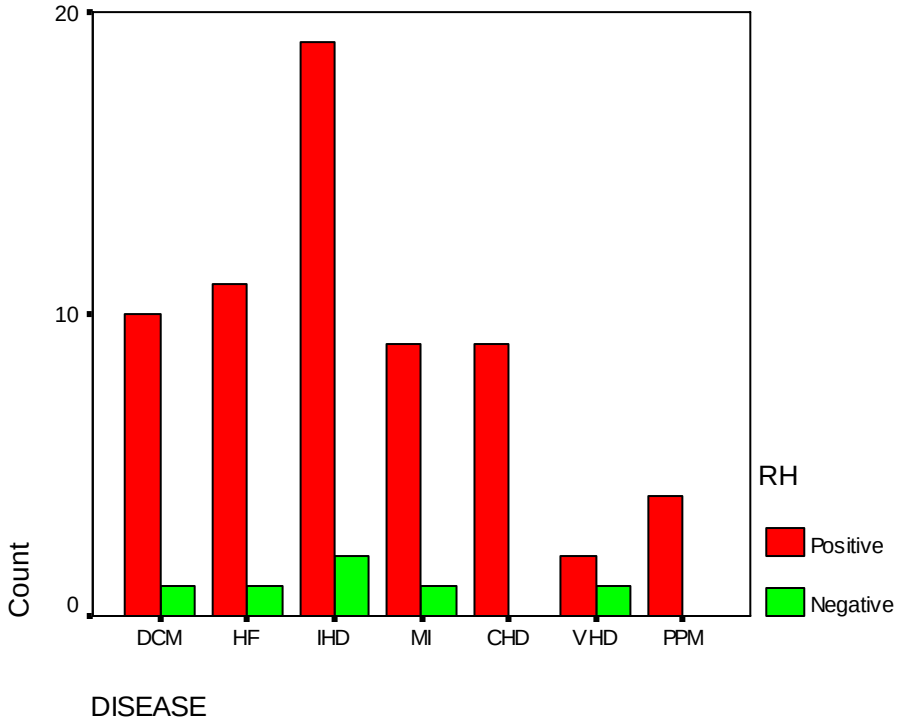

Figure (3-10) Distribution of Rh blood group of patients with different types cardiovascular diseases