Patterns and Factors Associated with Cardiovascular Disorders at Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia

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Abstract

Background: Cardiovascular diseases are major public health concern worldwide. The pattern of cardiovascular disorders is different across the globe; Ischemic heart disease being the commonest in developed world, rheumatic and congenital heart disease predominates in the developing countries.

Objective: Examine the pattern of cardiovascular disorders and identify associated factors in Ayder Comprehensive Specialized Hospital, Tigrai, and Northern Ethiopia.

Method: A cross sectional evaluation of data from patients with cardiovascular disorders in Ayder Comprehensive Specialized Hospital, Northern Ethiopia was made from January 01, 2015 to June 30, 2015. Structured data collection checklist was used to collect the data. The International Classification of Diseases and Related Health Problems (ICD-10) was used to classify the cardiovascular diseases. Descriptive statistics like percentage, mean, standard deviation and Chi-square test of association was used to examine the pattern of cardiovascular disorders. Inferential statistics, logistic regression, was applied to identify associated factors of cardiovascular diseases. Data was analyzed using SPSS (statistical Package for Social Sciences) software version 20.

Results: A total of 1000 participants were included in the study. The age ranged from 22 days to 87 years. The mean (SD) age of the study participants was 32.3±23.8 years. About 375 (37.5%) participants were less than 18 years of age. More than half 522(52.7%) were females and close to half (49%) of the study participants had valvular heart disease. Rheumatic valvular heart disease accounted for 41.1% of participants whereas, non-rheumatic valvular heart disease accounted for 8%. Hypertension was seen in 15.1% of the participants and It was present in 42% of patients with ischemic heart disease. Rheumatic heart disease was common in females and patients who came from rural areas. For the rheumatic valvular heart disease (RVHD), age was found to be a statistically negatively associated with the odds of developing the disease (AOR=0.97, 95% C.I: 0.97-0.98). This implies, as age increases the likelihood or odds of developing rheumatic valvular heart disease (RVHD) decreases. Being female decreases the odds of developing rheumatic valvular heart disease. Being a rural resident decreases the odds of developing the rheumatic valvular heart disease as compared to the reference category urban (AOR=.709, 95% C.I: 0.54-0.93). Family size and diabetes were not found statistically significant.

Conclusion: Rheumatic heart disease and congenital heart disease are the leading causes of cardiac disease inthe setting. Emphasizing the need of early detection and treatment of throat infections, and strengthening cardiac surgery services and catheter based treatments in the region are recommended. Residence place, age and gender were found to be statistically significantly associated with the risk of developing the rheumatic valvular heart disease.

Key Words: Cardiovascular disorders, valvular heart disease, Ayder Comprehensive Specialized Hospital.

Introduction

Cardiovascular diseases are major public health concern worldwide [1, 2]. Sub-Saharan Africa is facing an epidemiological shift from AIDS to cardiovascular diseases being the leading cause of death. There is a unique pattern of cardiovascular diseases in the region. The Emergence of diseases related to changes in living habits (hypertension and stroke, ischemic heart disease), the huge number of uncorrected congenital heart defects and the persistence of conditions associated with poverty and infections which have not yet been controlled (rheumatic heart disease, endomyocardial fibrosis, corpulmonale due to (schistosomiasis and tuberculosis), pericarditis, pulmonary hypertension, cardiomyopathy) [1, 2].

The pattern of cardiovascular disorders is different across the globe; Ischemic heart disease being the commonest in developed world, rheumatic and congenital heart disease predominates in the developing countries [3-5]. A study in Tikura Abessa Hospital (6)showed Valvular Heart Disease 62.0%, hypertension 14.7%, cerebro-vascular diseases or stroke 11.5%, congenital heart disease 8.5% and ischemic heart disease 7.4%. A similar study [7] in Jimma university specialized hospital concluded that Rheumatic heart disease accounted for 32.8%, hypertensive heart disease 24.2% and cardiomyopathy 20.2% of the cardiac follow up patients. Tamirat M. (8) in their review of pattern of pediatric cardiac illness in Zewditu Memoral Hospital showed that rheumatic heart disease was the most common diagnosis (57%) in that hospital. Congenital heart disease was the next common cardiac diagnosis [25]. A recent study on Spectrum of cardiovascular diseases in six main referral hospitals of Ethiopia [9] showed, rheumatic heart disease (34.6%),congenital heart disease (17.8%), hypertensive heart disease (13.6%), coronary artery disease (9.6%) and cardiomyopathy (8%)

Studies in other parts of Africa: spectrum of cardiovascular disorders in a national referral centre, Ghana [10] showed hypertensive heart disease (18.8%), rheumatic heart disease (17.3%), idiopathic cardiomyopathy (14.6%), congenital heart disease (12.7%) and coronary artery disease (11.3%). Rheumatic heart disease (RHD) remains a major public health problem in developing countries. The prevalence of RHD in school children of age 6-18 years was 19 cases per 1000 on an echocardiography based screening in six major sites in Ethiopia [9, 11].

The data of this study is included in the Spectrum of cardiovascular diseases in six main referral hospitals of Ethiopia [9]. Yet, we believe that we need separate analysis to know the regional difference and risk factor associations for our site using some more advanced statistical models that support our data characteristics. Thus, the objective of this study was to examine the pattern of cardiovascular disorders and identify associated factors in patients from Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia.

Methodology

Study setting: The study was conducted in Ayder Comprehensive Specialized Hospital (ACSH), located in Mekelle City, Tigrai, Northern Ethiopia. ACSH started its operation as a referral hospital in 2008 currently covers around 8 million populations from Tigrai, Afar and North East part of Amhara Regional States. It provides a broad range of medical services to both in and out patients of all age groups. It is structured into four major clinical departments namely Internal Medicine, Pediatrics, Surgery and Gynecology and Obstetrics and other units. It is the second largest hospital in the nation and has 500 inpatient beds. It is staffed with close to 100 specialists in the various areas of medical specialization and fairly adequate numbers of all the other health professionals. It also serves as

a teaching hospital to students from medicine, dental medicine, nursing, midwifery, public health, pharmacy, anesthesia and medical laboratory students in both undergraduate and postgraduate programs. The study was conducted from January 01, 2015 to June 30, 2015.

Design: A facility based cross-sectional study was conducted.

Sampling strategy: All adults and pediatric patients who visited the adult and pediatric cardiac clinics between January and June 2015 were included in the study and the sample size was found to be 1000.

Data collection: The clinical data of the patients was collected by physicians working in the units. The types of cardiovascular diseases were evaluated and all patients had echocardiography results. Data was collected from patients when they come for initial evaluation or follow up. Socio demographic and risk factor data was collected from the patients using structured questionnaire by trained nurses. In case the patient is unable to give history, data were obtained by enquiring family members accompanying the patient. Clinical variables (type of cardiovascular diagnosis and echo-cardiographic data) was also collected. The International Classification of Diseases and Related Health Problems (ICD-10) were used for classification of the cases. In case of difficult handwritings, missing values and inconsistent data, the supervisors identified the records and rechecked what was written with the co-investigators.

Data analysis: Data was entered and analyzed using statistical package for social sciences (SPSS) version 20 software. Descriptive statistics such as mean, frequency, percentage, standard deviation and Chi-square test of association were used to describe the data. Inferential statistics, logistic regression, was applied to identify associated factors of cardiovascular diseases. Data was analyzed using SPSS (statistical Package for Social Sciences) software version 20.

Chi-square test of Independence: In this study, associations between the dependent variables namely ischemic heart disease (IHD) and rheumatic valvular heart disease (RVHD) and independent variables such as patient gender, residence, hyper-tension, diabetic status, smoking status, dyslipidemia status and family history were investigated.

Binary Logistic Regression Model: The overall significance of the binary logistic regression model was checked by using Omnibus test of model coefficient and goodness of fit test was used to determine the goodness of the model or to check whether the model fit well or not [13].

Ethics: Ethical clearance was obtained from the Institutional Review Board (IRB) of the College of Health Sciences of Mekelle University and approval letter was secured from ACSH. The information from the medical record was kept confidential, only the data collectors had the access to information which talks about the patient information other than the topic of interest. When labeling information exists within the data collected it was made anonymous by removing the labels and coding during transcribing the data

Results

A total of 1000 participants were included in the study. The age ranged from 22 days to 87 years. The mean (SD) age of the study participants was 32.3 with SD of 23.8 years. More than half, 522(52.7%) were females. Hypertension was seen in 15.1% of the participants and It was present in 42% of patients with ischemic heart disease. Rheumatic heart disease was common in females and patients who came from rural areas (Table 1).

Table 1: Socio-demographic and clinical characteristics of cardiovascular disease patients in Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia, 2015 (n =1000).

Variables		Frequency	Percent
Sex	Male	473	47.3
	Female	527	52.7
Age	<18 years	375	37.5
	>=18 years	625	62.5
Residence	Urban	485	48.5
	Rural	515	51.5
Hypertension	Yes	151	15.1
	No	849	84.9
Diabetes	Yes	23	2.3
	No	975	97.7
Smoking	Yes	12	1.2
	No	988	98.8
Dyslipidemia	Yes	7	0.7
	No	993	99.3
Family History	Yes	41	4.1
	No	959	95.9

Pattern of cardiovascular disorders

Almost half 491(49.1%) of the study participants had valvular heart disease. Rheumatic valvular heart disease accounted for 41.1% of participants whereas non-rheumatic valvular heart disease accounted for 8% About 160(16%) had congenital heart disease and 94(9.4%) had hypertensive heart disease (Table 2).

Table 2: Types of cardiovascular diseases in Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia, 2015 (n=1000).

Variable		Frequency	Percent
VHD	RVHD	411	41.1
	NRVHD	80	8
IHD		50	5.0
Cardiomyopathy	Dilated	51	5.1
	Hypertrophied	3	0.3
HHD		94	9.4
Arrhythmia	AF	6	0.6
	Other SVT	1	0.1
	Bradyarrythmias	3	0.3
Congenital		160	16
Pericardial Disease		28	2.8
Cor-Pulmonale		23	2.3
Others		90	9

VHD=Valvular heart disease, RVHD = Rheumatic valvular heart disease, NRVHD=Non- Rheumatic valvular heart disease, IHD= Ischemic heart disease, HHD = Hypertensive heart disease, AF=Atrial fibrillation; VT=Supraventricular tachycardia.

Types of cardiovascular diseases by age

When cardiovascular diseases are seen across the different age groups, Rheumatic heart disease was common in the age group between 10-19 and 20-29 years. None rheumatic valvular heart disease and ischemic heart disease were commonly seen in the age group>50 years where nearly 85% of congenital heart diseases were seen below the age group less than 20 years. Hypertensive heart diseases, arrythemias and corepulmonale were

peaked at age group >50 years where as cardiomyopathy was seen more at extreme age groups (Table 3). For under 5 children, congenital heart disease accounted for 90(70.9%) followed by Rheumatic heart disease 11(8.7%) and cardiomyopathy 5(3.9%).

Table 3: Types of cardiovascular diseases by age in Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia, 2015 (n=1000).

Variable	Age in years, n(%)					
	0-9	10-19	20-29	30-39	40-49	>=50
RVHD	53(12.9)	153(37.2)	78(19)	53(12.9)	43(10.5)	31(7.5)
NRVHD	1(1.2)	4(5)	2(2.5)	-	8(10)	65(81.2)
IHD	-	-	-	4(8)	7(14)	39(78)
Cardiomyopathy	6(11.3)	5(9.4)	5(9.4)	4(7.5)	5(9.4)	28(52.8)
HHD	1(1.1)	-	3(3.2)	9(9.7)	15(16.1)	65(69.9)
Arrhythmia	-	-	-	-	1(11.1%)	8(88.9)
Congenital	115(71)	24(14.8)	13(8)	6(3.7)	2(1.2%)	2(1.2)
Pericardial Disease	1(3.6)	2(7.1)	4(14.3)	10(35.7)	5(17.9%)	6(21.4)
Cor-Pulmoanle	1(4.3)	2(8.7)	3(13)	2(8.7)	4(17.4%)	11(47.8)
Others	3(3.3)	4(4.4)	6(6.6)	8(8.9)	12(13.3)	57(63.3)

VHD=Valvular heart disease, RVHD = Rheumatic valvular heart disease, NRVHD=Non- Rheumatic valvular heart disease, IHD=Ischemic heart disease, HHD = Hypertensive heart disease.

Distribution of congenital heart diseases in children and adults

Ventricular septal defect, Patent Ductus Arteriosus and Atrial septal defect were the leading congenital heart lesions in both children and adults. But, there were equal number of Ventricular septal defect and Patent Ductus Arteriosus cases in adults and different congenital lesions were seen in children. Pulmonary stenosis and teratology of fallot were seen in the 6 month periods in adults in addition to the above three (Table 5).

Congenital heart diseases
Out of the total 160 congenital cases, 59(36.8%), 45(28.1%) and 27(16.9%) were VSD, Patent Ductus Arteriosus and ASD respectively (Table 4).

Rheumatic valvular involvement
Mitral regurgitation was present in 370(90%) patients while Mitral stenosis was seen 151(36.7%) participants. Aortic valve involvement was the second type with Aortic regurgitation (AR) seen in 273(66.4%) and Aortic stenosis (AS) accounted for 49 (11.9%) patients. Pulmonary and Tricuspid valve involvements were rare. Among mixed valvular involvement, MR with AR was the most common (179 patients) followed by AR with MS (14 patients).

Table 4: Cases of congenital CVDs in Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia, 2015 (n = 160).

Category	Frequency	Percent
Secundum ASD	23	14.4
Primum ASD	4	2.5
VSD Membranous	57	35.6
VSD Muscular	1	0.6
VSD Supracristal	1	0.6
Patent Ductus Arteriosus	45	28.1
Aorto-Pulmonary Window defect	1	0.6
Pulmonary Valvular Stenosis	10	6.3
PulmonarySupravalvular Stenosis	2	1.3
Aortic Stenosis	2	1.3
Coarctation of the Aorta	2	1.3
Congenital Mitral Stenosis	1	0.6
Congenital Mitral Regurgitation	1	0.6
Tetralogy of Fallot (TOF)	3	1.9
TOF with Pulmonary atresia	4	2.5
Single Ventricle (DILV)	2	1.3
Hypoplastic left heart Syndrome	1	0.6

ASD = Atrial septal defect, VSD = Ventricular septal defect

Table 5: Distribution of congenital heart diseases in children and adultsof the patients from Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia, 2015 (n = 160)

Congenital heart disease	Age category		Total
	<18 years	>=18 years	
Secundum ASD	18	5	23
Primum ASD	4	0	4
VSD Membranous	48	9	57
VSD Muscular	1	0	1
VSD Supracristal	1	0	1
Patent Ductus Arteriosus	36	9	45
Aorto-Pulmonary Window defect	1	0	1
Pulmonary Valvular Stenosis	8	2	10
PulmonarySupravalvular Stenosis	2	0	2
Aortic Stenosis	2	0	2
Coarctation of the Aorta	2	0	2
Congenital Mitral Stenosis	1	0	1
Congenital Mitral Regurgitation	1	0	1
Tetralogy of Fallot	1	2	3
TOF with Pulmonary atresia	2	2	4
Single Ventricle (DILV)	2	0	2
Hypoplastic left heart Syndrome	1	0	1
Total	131	29	160

ASD = Atrial septal defect, VSD = Ventricular septal defec.

Factors associated with ischemic heart disease and rheumatic valvular heart disease

There was a significant difference in ischemic heart disease (IHD) and rheumatic valvular heart disease (RVHD) among individuals across different characteristics. This is explained by age, sex, residence, hypertension, diabetic, smoking, dyslipidemia and no. of rooms. But, there was no significant difference on family history (Table 6).

Table 6: Chi-square test of independence/association between independent variables with IHD and RVHD in Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia, 2015 (n = 1000).

Variable		IHD		P-value	RVHD		P-value
		Yes, n(%)	No, n(%)		Yes, n(%)	No, n(%)	
Sex	Male	33(66)	435(46.3)	0.006	172(42.1)	296(50.9)	0.006
	Female	17(34)	505(53.7)		237(57.9)	285(49.1)	
Residence	Urban	38(76)	446(47)	<0.0001	173(42.2)	311(52.9)	0.001
	Rural	12(24)	502(53)		237(57.8)	277(47.1)	
Hypertension	Yes	21(42)	128(13.6)	<0.0001	11(2.7)	138(23.7)	0.000
	No	29(58)	812(86.4)		397(97.3)	444(76.3)	
Diabetic	Yes	7(14)	16(1.7)	<0.0001	3(0.7)	20(3.4)	0.006
	No	43(86)	932(98.3)		407(99.3)	568(96.6)	
Smoking	Yes	5(10)	7(0.7)	<0.0001	3(0.7)	9(1.5)	0.378
	No	45(90)	943(99.3)		408(99.3)	580(98.5)	
Dyslipidemia	Yes	3(6)	4(0.4)	0.004	1(0.2)	6(1)	0.25
	No	47(94)	946(99.6)		410(99.8)	583(99)	
Family History	Yes	4(8)	37(3.9)	0.143	21(5.1)	20(3.4)	0.179
	No	46(92)	913(96.1)		390(94.9)	569(96.6)	

IHD=ischemic heart disease; RVHD= rheumatic valvular heart disease.

Factors associated with rheumatic valvular heart disease

For the rheumatic valvular heart disease (RVHD), age was found to be a statistically negatively associated with the odds of developing the disease (AOR=0.97, 95% C.I: 0.97-.98). This implies, as age increases the likelihood or odds of developing rheumatic valvular heart disease (RVHD) decreases. Being female decreases the odds of developing rheumatic valvular heart disease. Being a rural resident decreases the odds of developing the rheumatic valvular heart disease as compared to the reference category urban (AOR=0.71, 95% C.I: 0.54- 0.93). The family size and diabetes were not found statistically significant.

Table 7: Factors affecting rheumatic valvular heart disease (RVHD) in Ayder Comprehensive Specialized Hospital, Tigrai, Northern Ethiopia, 2015 (n = 1000).

Variable	Coef.	S.E	p-value	AOR	95% C.I. for AOR	
					Lower	Upper
Gender (1=Female)	-0.396	0.139	0.004	0.673	0.513	0.884
Residence (1= Rural)	-0.344	0.140	0.014	0.709	0.539	0.933
Diabetes (1=Yes)	0.752	0.635	0.236	2.121	0.611	7.365
Family size	0.017	0.036	0.637	1.017	0.948	1.092
Age	-0.027	0.003	0.000	0.973	0.967	0.980
Constant	-0.002	0.677	0.997	0.967		

Discussion

The result of this study showed rheumatic heart disease is the leading cause of cardiovascular disease in Ayder Comprehensive Specialized Hospital. This accounted for 41.1 % of cardiovascular diseases in the study area. The finding is similar to previous reports from other hospitals in Ethiopia and sub-Saharan Africa [9, 14-19]. However, studies from Nigeria, Ghana and Cameroon reported hypertensive heart disease as the commonest cardiac disease [22 – 25]. This shows the epidemiologic transition appears different with in African countries and there is a need for further study in the are The most common age group affected by Rheumatic heart disease was between 10-19 (37.2%) followed by 20-29(19%)years which is in agreement with the other studies [10]. This shows that it affects the young and productive group of the population and eventually leading to disability and death of the productive groups of patients. The 8.7% prevalence of Rheumatic heart disease in the under 5 children age group was an uncommon finding of this study. Similar to the other studies, mitral valve regurgitation was the most common finding followed by aortic valve regurgitation. Rheumatic heart disease was commonly observed in patients from the rural areas and female. However, in a logistic regression analysis, being female decreases the odds of developing rheumatic valvular heart disease (AOR=0.67, 95% C.I: 0.51-0.88) and being a rural resident decreases the odds of developing the rheumatic valvular heart disease as compared to the reference category urban (AOR=0.71, 95% C.I: 0.54-0.93). A review of the pattern of pediatric cardiac illness in Zewiditu Memorial Hospital from Ethiopia showed Rheumatic heart disease to be the most common diagnosis (57%). Congenital heart disease was the next common cardiac diagnosis in patients from the Memorial Hospital [20].

In agreement with other studies [10], Ventricular septal defect, Patent Ductus Arteriosus and Atrial septal defect were the leading congenital lesions in our study. In the Malawi study [21, 22)], Ventricular septal defect, Tetralogy of Fallot and Patent Ductus Arteriosus were

the common congenital heart diseases. However, the Malawi study included children and our study included all age groups so that Atrial septal defect was more common in adults than Tetralogy of Fallot.

Hypertensive heart disease was the third common cardiovascular disease in ACSH (9.4%) while it was the second in the other studies [9, 18] and leading cardiac morbidities in studies from West Africa [10, 21, 23, 24].

More than 90% of Non-Rheumatic valvular heart diseases were degenerative heart diseases occurring in the elderly. Ischemic heart disease occurred in 5% of the participants and the main risk factor was hypertension, which was seen in 42% of Ischemic heart disease patients.

Dilated cardiomyopathy was the most common type of cardiomyopathy (5%) and hypertrophic cardiomyopathy was seen in 0.3% of participants. Cardiomyopathy was seen the extreme ages in age less than 10 years (11.3%) and in age above 50 years (52.8%). Pericardial diseases commonly pericardial effusion and constrictive pericarditis were seen in 2.8% of the participants. There was no report of restrictive cardiomyiophy or endomyo-cardial fibrosis in the cardiac patients from ACSH.

Arrhythmias like atrial fibrillation and Brady arrhythmias were reported as sole causes of heart problem in 0.9% of the patients. However, those arrhythmias associated with known underlying heart diseases were not counted. Cor-pulmonale was also reported in 2.3% of our patients. Others, like diastolic dysfunction and pulmonary hypertension without obvious underlying structural heart diseases, atrial myxomas, infective endocarditis, sub aortic membranes and mitral valve prolapse were documented.

Our study has limitations. Arrhythmias occurring in structural heart diseases were not included and hence patterns of arrhythmias need further investigation. Asymptomatic cardiac patients were not addressed in this study as some patients might have been missed due to the short study period. As the study was conducted 4 years ago there might be some changes in the pattern like increase in the prevalence of Patent Ductus Arteriosus (PDA) and ischemic heart disease due to referral bias as we have started PDA device closure service and coronary angioplasty in our hospital. Vascular disorders like stroke, peripheral arterial diseases are not included in this study. Though the data presented in this report are based on hospital study and therefore highly selective and unrepresentative for the general Ethiopian population, they nevertheless provide useful information regarding cardiovascular morbidity, which may be helpful to health planners and policy makers in the region and the country in general.

Conclusion and Recommendations
Rheumatic heart disease and congenital heart disease are the leading causes of cardiac diseases in patients from ACSH, emphasizing the need for early detection and treatment of throat infections, and establishing cardiac surgery services and catheter based treatments in the region. Residence place, age and gender were found to be statistically significantly associated with the risk of developing the rheumatic valvular heart disease.

Author contributions: HT, TH and SB were involved in data collection, data analysis and developing first draft of manuscript. HG was involved in data

analysis and interpretation. HT, HG, TH, AL and AH were involved in developing the final manuscript. All authors approved the manuscript.

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