Dawit Bacha, Hailu Abera , Abdusamed Adem, Filagot Tadesse, Delayehu Bekele, *Ethiop Med J, 2019, Vol. 57, No. 4*

ORIGINAL ARTICLE

THE OCCURRENCE AND PATTERN OF CARDIOVASCULAR DISEASES AMONG PREGNANT MOTHERS ATTENDING SAINT PAUL'S HOSPITAL IN ADDIS ABABA

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ABSTRACT

Introduction*: Cardiovascular disease is one of the leading causes of non-obstetric maternal death during pregnancy. In our set up, there are limited studies conducted to assess hospital prevalence of the disease during pregnancy.*

Objectives*: To describe the occurrence and pattern of cardiovascular diseases among pregnant women attending antenatal care follow up at St Paul's hospital in Addis Ababa, Ethiopia.*

Methods*: A total of 398 pregnant mothers who were on follow up at the antenatal care were randomly selected for clinical and echocardiographic evaluation in their 3rd trimester of pregnancy. Sociodemographic and relevant clinical data were extracted using a structured questionnaire. Standard echocardiography was done by using GE Vivid E9 echocardiography machine.*

Results*: In general, 10.3% (n=41) pregnant mothers had cardiovascular disease. Thirty-three (8.3 %) of the mothers had at least one echocardiographic abnormality and nine (2.3%) had significant rheumatic valvular heart disease. Isolated moderate and severe mitral valve regurgitation were the most common rheumatic lesions; 1.0% (n=4), followed by moderate and severe mitral stenosis 0.75% (n=3). There were two pregnant mothers who were having combination of moderate to severe degrees of aortic and mitral valve regurgitation and mitral valve stenosis. Four (1.0%) of the mothers had moderate-severe pulmonary hypertension. Eight (2.0%) of them were found to have chronic hypertension*

Conclusion*: The study revealed a relatively high proportion of rheumatic heart disease among pregnant mothers in our set up. Primary care providers at the antenatal care clinics should be aware of this and do thorough clinical evaluation to detect and manage the condition in a timely manner.*

Key words: *rheumatic heart disease, pregnancy, proportion, echocardiography, hypertension, peripartal cardiomyopathy*

INTRODUCTION

Cardiovascular disease (CVD) complicates 1-3% of all pregnancies and is responsible for 10-15% of maternal mortality (1). During pregnancy, cardiac demands increase due to the placental circulation and hormonal effects, with a 30–50% increase in cardiac output, a 10–20 beats per minute (bpm) increase in heart rate, and 30–50% increase in blood volume. Despite the increase in cardiac output, blood pressure (BP) remains low due to decreasing of systemic vascular resistance. Moreover, owing to the increase in blood volume with an unchanged red cell mass, there is a fall in hematocrit (2-4).

Cardiovascular disease in pregnancy is a complex condition as women can present either pre- or postpartum due to a pre-existing heart disease.

According to the report of confidential enquiries into maternal and neonatal deaths in the United Kingdom between 2006-2008,there were 53 deaths due to heart disease in pregnancy making the rate for indirect maternal deaths 6.72/100,000 pregnancies and the rate for cardiac disease 2.31per 100,000 maternities (5).

One of the most common cardiovascular conditions encountered during pregnancy is hypertension either as hypertensive disease of pregnancy or chronic hypertension; pre-existing hypertension also complicates 1–5% of pregnancies (6). According to European society of cardiology 2011 report, hypertensive disorders are the most frequent cardiovascular events during pregnancy, occurring in 6–8% of all pregnancies (7).

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In United States, studies have indicated the prevalence of peripartal cardiomyopathy was around 0.46/1000 deliveries, although it varies with ethnic differences ranging from self-identified blacks one in 1,421 births to one in 9,861 for Hispanics (8-12). Rheumatic Valvular Heart Disease (VHD) is predominant in developing countries, accounting for 56–89% of all CVD cases in pregnancy (13). Rheumatic Heart Disease (RHD) is the most common cause of VHD in the developing world, but also still a common disease with 90% of all heart disorders in women of child-bearing age being of rheumatic origin in non-industrialized regions (14).

Data on maternal cardiovascular condition is very scarce in Africa, especially in East Africa, probably due to relatively poor health coverage, lack of awareness and inadequate trained man power. In a study done in Eritrea to assess subclinical rheumatic heart disease among pregnant women, 2.3% had subclinical RHD, of which rheumatic mitral regurgitation is the commonest lesion (15). According to Hospital based studies from South Africa, underlying cardiac disease ranges from 0.9-32% and VSD was the predominant lesion (14, 16). However, there is scarcity of data to indicate the prevalence and pattern of cardiovascular disease among Ethiopian pregnant mothers. Therefore, the study aimed to determine occurrence and pattern of cardiovascular diseases among pregnant women attending ANC follow up clinic at St Paul's hospital.

PATIENTS AND METHODS

Study setting and Study design

This study was conducted in St. Paul's Hospital Millennium Medical College (SPHMMC) with collaboration of faculties from the Department of Internal Medicine and Department of Gynecology and Obstetrics on mothers coming for ANC follow up. The Hospital is the second largest public hospital in Ethiopia, primarily serving those with relatively low income. The study was a hospital-based, cross sectional study designed to assess the occurrence and patterns of cardiovascular disease among pregnant mothers.

Sample size and sampling procedure

The pregnant mothers were selected from both regular and high-risk ANC clinics by using systematic random sampling based on the number of mothers visiting the clinics each day. After deciding to evaluate six of them a day, we systematically selected from both clinics by using their registration numbers during their enrollment every day morning until the pre-specified sample was achieved.

Sample size was determined by single population proportion formula considering 50% of the unknown proportion of cardiovascular disease in pregnant mothers in our set up. A margin of error of 5% and a 5% of non-response rate was considered.

Data collection

The selected pregnant mother's important obstetrics and general history was taken by using standardized questioners, physical examination and echocardiogphic study was done at the time of enrolment by using vivid E9, GE health care echocardiographic machine. We measured the BP of the patients twice; first at the ANC clinic and second at echocardiography room after making them rest for 30 minutes by using a manual BP measuring apparatus. The term raised BP was used if the patients had two of the measurements in the hypertensive range.

Standard echocardiography was done by utilizing 2D, continuous wave and Doppler parameters in quantifying the chambers and hemodynamic aspects based on the current international guidelines. Based on data from baseline characteristics and echocardiography parameters, cardiovascular disease was defined as the presence of hypertension, significant VHD (moderate-severe), left ventricular dysfunction of any cause, ischemic heart disease, cardiomyopathy, pericardial disease and pulmonary hypertension. For rheumatic VHD, we used the world heart federation (WHF) diagnostic approach 2012 as both definitive and probable rheumatic valve lesions for both categories of below and above 20 years of age during the time of evaluation. (17)

Ethical clearance was obtained from the institutional ethics review board of St. Paul's Hospital Millennium Medical College to conduct this study. All study subjects were well informed about the study and informed written consent was collected from each participant.

RESULTS

Socio Demographic Characteristics of participants

A total of 398 pregnant mothers who were on follow up at ANC clinic were included in this study. The mean (SD) age was 27 (±4.6) years and their age ranged between 18-40 years. The mean (SD) number of pregnancies was 2.4 (±1.39) the number ranging from 1-10. Majority of pregnant mothers in this study were from the Gurage ethnic group (Table 1)

Table 1: Cardiovascular diseases by socio demographic characteristics among pregnant Mothers attending antenatal care at Saint Paul's Hospital, Addis Ababa, Ethiopia.2018.

Variables	Category	Number	Percent
Age	Less than 20	8	2.1
	20-24	129	32.4
	25-29	158	39.7
	30-34	65	16.3
	35 and above	38	9.5
Ethnicity	Oromo	127	31.9
	Amhara	91	22.9
	Tigre	9	2.3
	Gurage	150	37.7
	Others	21	5.3
Address	Addis Ababa	273	68.8
	Outside Addis Ababa	124	31.2
Religion	Orthodox Christian	211	53
	Protestant	43	10.8
	Muslim	144	36.2
Educational level	Grade 1- 8	176	44.2
	Grade 9- 12	116	29.1
	College/University	49	12.3
	No formal Education	57	14.3
Gravidity	1-3 pregnancies	114	28.6
	4-5 pregnancies	188	47.2
	Above 5 pregnancies	96	24.1
Number of Spontaneous Abortion	One time	45	11.3
	Two times	7	1.8
	Three times	4	1.0
Number of Induced abortion	One times	11	2.8
	Two times	3	0.8

Comorbidities

Among the pregnant mothers who participated in the study, eight (2.0%) were known hypertensive patients and seven (1.8%) were diabetic at the time of the enrollment. The mean (SD) systolic BP at admission was 113 (±13) mmHg, the BP ranging between 80 and160mmHg. The mean (SD) diastolic BP was 69 (±9)mm Hg, the BP ranging between 50 and 110, making a total of 18(4.5%) pregnant mothers hypertensive at enrollment. Mean heart rate (SD) during echocardiography was 91 (±6.9),bpm ranging between 68 and 125.

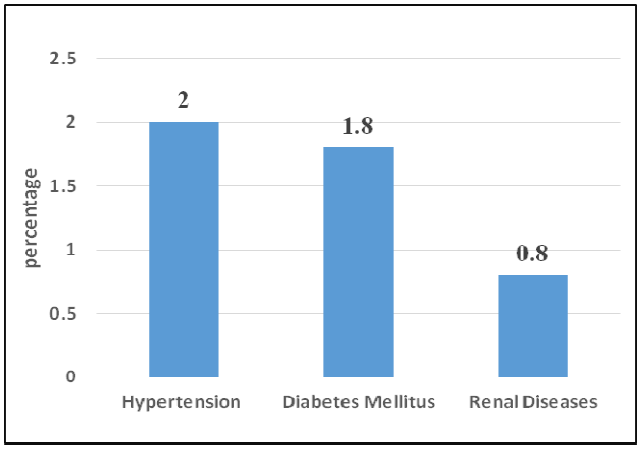

Figure 1: The Pattern of comorbidities among pregnant mothers attending

Based on the established criteria in methodology section, 41 (10.3%) of pregnant mothers were identified with some form of cardiovascular disease, of which 33 (8.3%) had at least one echocardiographic abnormality. Accordingly, nine (2.3%) of the participants had significant rheumatic VHD. The predominant lesion was found to be isolated mitral valve regurgitation which accounts for 1.0% (n=4) followed by moderate to severe degree of mitral stenosis accounting for 0.75% (n=3).

Two of the participants had combination of moderate-severe degrees of both mitral valve and aortic valve regurgitation and aortic valve stenosis. Twenty-two (5.5%) of the mothers have mild degree of mitral valve or tricuspid valve regurgitations with normal leaflet morphology. Eight (2.0%) of the pregnant mothers had systemic hypertension. There was one pregnant mother with possible peripartal cardiomyopathy and another one with moderate pericardial effusion. Details of echocardiographic abnormalities are shown in Table 2.

Table 2: Echocardiographic abnormalities identified among pregnant mothers attending ANC at St. Paul's hospital Addis Ababa, Ethiopia, 2018.

Echocardiographic abnormality	Parameters	Number	Percent
Valvular heart disease	Total	33	8.3
	Rheumatic cause	9	27.3
	Nonspecific cause	22	69.7
Cardiomyopathy	DCMP	1	0.3
Pulmonary hypertension	Mild	11	2.8
	Moderate	2	0.5
	Severe	2	0.5
Pericardial disease	Effusion	7	1.8
Left ventricular hypertrophy		5	1.3
Grade I diastolic dysfunction		13	3.3

DISCUSSION

According to this study, cardiovascular disease in pregnant mothers in our setup is 10.3%, of which VHD and hypertension were the predominant ones. Significant number, 26 (6.5%) of our study participants had raised BP, a finding which is similar to the global 'prevalence' estimate. This is important because of two main reasons: the first reason is the uncontrolled nature of BP among those with previously diagnosed hypertension and the second one is the finding of raised BP levels regardless of previous history of hypertension.

The other finding in our study is the relatively high prevalence of VHD. Because of the fluid overload and increased venous return associated with pregnancy, mild degree of regurgitation at the normal valve can occur in pregnancy.

However moderate-severe degrees of regurgitant lesions are associated with morphologic changes occurring on the valve leaflets or subvalvular structures, which include thickening and calcification of variable degrees. In our study, based on the standard echocardiographic evaluation and using guideline directed quantification and morphologic assessment, there were 22 (5.5%) pregnant mothers who had mild degree of mitral or tricuspid valve regurgitation with normal leaflet structure. We believe these were not severe enough to cause hemodynamic effect on both the mother and the newborn and we didn't consider them as clinically significant. This degree of regurgitation at mitral and/or tricuspid valve areas is a reflection of increased flow across these valves, which are part of the physiologic response of hemodynamic changes during pregnancy.

According to the WHF RHD diagnostic guideline 2012, we found nine (2.3%) participants with definite rheumatic involvement of either mitral or aortic valves. The predominant lesion either isolated or in combination with mitral stenosis or aortic regurgitation was mitral valve regurgitation, which accounted for six pregnant mothers with predominant mitral valve regurgitation of moderate-severe degree, is four (1%). Study participants diagnosed with combination of moderate-severe mitral regurgitation and moderate–severe mitral stenosis were four making about 1% but isolated moderate-severe mitral stenosis were three (0.8%). We didn't find significant aortic stenosis as stand alone or in combination with other valve lesion, while there were two participants who were having at least moderate degree of aortic valve regurgitation. This concurs with finding from international and national perspectives carried out in school children at different times but there are very few data on prevalence of RHD in pregnant mothers. One of such studies was from Eritrea which reported the prevalence of RHD in pregnant mothers to be 2.3% (15).

In different parts of the world prevalence studies have been done in school children, revealing prevalence's of 5.1% in India (18), 3.0% in Mozambique (19), 2.2% in Cambodia (19), 3.3% in Tonga (20) and 2.2% in Pakistan (21). In Ethiopia, auscultation based studies of rheumatic heart disease were done on school children almost two decades ago showing prevalence of 6.4/1000 school children in urban and 4.6/1000 school children for rural population (22). A large multicenter and echocardiography based study done few years ago showed prevalence of 1.4% for definite RHD and 0.5% for borderline rheumatic making the prevalence 19 cases per 1000 school children (23).

Our study showed slightly higher figure (2.3%) with the possible explanations might be increased risk of recurrent pharyngitis in the absence of adequate follow up and proper prophylaxis making neglected valve lesions to become detectable and hence relevant clinical entity at this age. Of note, this comparison should be seen with due caution as our study is a hospital-based study.

The finding of one participant with asymptomatic possible peripartal dilated cardiomyopathy is also remarkable and worth mentioning. Globally the incidence of this condition differs among geographic regions, with the incidence estimated at one in 1,150 - 3,200 live births in United States, 1 in 1000 in South Africa, 1 in 300 in Haiti and 1 in 100 in Nigeria (24).

The significant risks identified were black race, old age and multi fetus pregnancies.

Based on different risk scoring systems in pregnancies complicated with cardiovascular disease, severe pulmonary hypertension is the rate limiting to advice against continuation of pregnancy and subsequent pregnancies unless its cause is corrected. In our study, seven (1.8%) pregnant mothers were found to have pericardial effusion but only one participant had moderate degree. Mild degree of pericardial effusion in the form of hydropericardium can be detected during pregnancy, which is typically small, clinically silent and in the 3rd trimester of pregnancy (25). There is a general agreement that there is no adequate evidence that pregnancy affects susceptibility to pericardial disease and thus in cases of moderate-severe degrees of effusion a cause should be sought as in the case of non-pregnant women.

In general, this study revealed variable cardiovascular disease burden in pregnant mothers in our set up. These spectrums of occurrence require multiple entries of intervention although the question concerning long-term prognosis of asymptomatic patients with echocardiographically confirmed conditions remain unanswered and hence long-term follow up studies are required. In conclusion, we think this study has some limitations as it is done at a single center, which might make generalization to the national or regional level a bit difficult. The other possible limitation is that we used only echocardiography as a means of evaluation and hence we might not detect some cardiovascular disease like arrhythmias and hence cardiovascular disease in pregnant mothers in our hospital could be more than stated in this study.

Conclusion and Recommendations

The study revealed a relatively high proportion of cardiovascular disease among pregnant mothers in attending St. Paul's' Hospital. RHD occurrence among the pregnant mothers was found to be high. Primary care providers at ANC clinics should be vigilant in their clinical evaluation to detect the condition in a timely manner.

ACKNOWLEDGMENTS

We would like to thank SPHMMC research office for financial support. We are also thankful to our participants for giving us their time during evaluation and echocardiography.

Conflict of Interest: Authors have no conflict of interest to declare.

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