

Prevalence, Aetiology And Factors Associated With Heart Failure Among Pregnant And Postpartum Women Admitted To A Tertiary Hospital In Ghana

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Abstract

Introduction: Heart failure in pregnancy has been associated with poor outcomes in both mother and foetus/neonate. Maternal mortality remains a huge global challenge. Several studies have found higher rates of maternal mortality and morbidity as well as poor foetal and neonatal outcomes among pregnant women with heart failure. This study therefore sought to assess the aetiology and associated factors of heart failure among pregnant and postpartum women admitted into the Korle-Bu Teaching Hospital.

Aim: To assess the prevalence, aetiology and associated factors of heart failure in pregnancy and the postpartum period.

Methods: A cross-sectional study was carried out in the obstetric and medical wards of the Korle-Bu Teaching Hospital. One hundred and thirty- one confirmed cases of heart failure in pregnancy or within six months of the postpartum period were recruited over a 15-month period from February 2021 to June 2022. Data collected with a structured questionnaire including history, physical and clinical examination, were analysed using IBM

SPSS version 24 software. The results obtained were presented as texts, tables or graphs, and significance was set at 0.05.

Results: The prevalence of heart failure in pregnancy and the postpartum period was 0.9% during the study period. Common causes of heart failure included peripartum cardiomyopathy (69, 52.7%), hypertensive heart disease/disorders (41, 31.3%), valvular heart disease (8, 6.1%), and severe anaemia (5, 3.8%). Associated factors were Pregnancy Induced Hypertension (PIH) in an earlier pregnancy (69, 52.7% or current history of PIH (36, 27.5%), and chronic hypertension (41, 31.3%). Most participants presented with New York Heart Association (NYHA) class III (67, 51.1%), followed by class II (44, 33.6%), and class IV (20, 15.3%).

Conclusion: A history of PIH in a previous pregnancy and the presence of chronic hypertension were the most commonly associated factors with heart failure. Strict surveillance and monitoring by attending clinicians of pregnant women for early detection of heart failure is highly recommended.

Keywords: Heart failure, hypertensive heart disease, preeclampsia, pregnancy-induced hypertension, post-partum.

Introduction

Heart failure in pregnancy continues to pose a growing threat around the globe. Globally, cardiovascular disease is estimated to be present in 0.1- 4% of all pregnancies.¹ Heart failure and cardiovascular disease in general, has been reported to be among the top indirect or non-obstetric causes of maternal morbidity and mortality in many countries.²⁻⁶ Heart failure is known to account for about a quarter of maternal deaths in industrialised countries and even higher rates in Southern Asia and Sub-Saharan Africa: 29.3% and 28.6% respectively.⁴ While most developed countries have been able to largely eliminate obstetric complications such as ante-partum and post-partum haemorrhage that may lead to heart failure during pregnancy with severe anaemia, Ghana and other developing countries still have to grapple with these factors. Many studies have shown congenital heart disease to be the leading cause of maternal cardiac disease resulting in heart failure during pregnancy, which accounts for 75% of cases in the developed world.⁷⁻¹¹ In developing countries, rheumatic heart disease has been reported to be the leading cause of maternal cardiac disease leading to heart failure, accounting for as much as 72% of cases, as per findings of the Registry Of Pregnancy And Cardiac (ROPAC) diseases and Registry of Maternal Heart Failure.¹²⁻¹⁴ Pregnancy in itself is associated with important haemodynamic changes that can lead to decompensation of a previously compensated underlying pathology.^{1,15,16} It can also set up a series of mechanisms, not fully understood, which can lead to an acute decompensation in a previously healthy heart with no structural or functional abnormality, often seen in the entity known as peripartum cardiomyopathy.^{16,17,18} Heart failure generally has a poor prognosis.^{19,20} Heart failure in pregnancy has been associated with poor outcomes in both mother and foetus/neonate. Several studies have found higher rates of maternal mortality, increased caesarean section rates as well as operative vaginal delivery.²¹ Poor foetal and neonatal outcomes such as foetal death, low Apgar scores, preterm births, low birth weight and foetal growth restriction have all been associated with

heart failure in pregnancy.^{21,22} Much attention needs to be paid to this condition in order to achieve the Sustainable Development Goal (SDGs) of the United Nations, to reduce global maternal mortality to fewer than 70 maternal deaths per 100,000 live births by the year 2030.²³ The aim of this study therefore was to assess the aetiology and associated factors of heart failure among pregnant and postpartum women admitted into the Korle-Bu Teaching Hospital.

Methods

The study was a hospital based cross-sectional study carried out in the obstetric and medical wards of the Korle-Bu Teaching Hospital (KBTH), which generally receives referrals from hospitals in the Greater Accra region and oversees an average of 11,000 deliveries annually (2019 annual report of the department, unpublished).

The study population were all pregnant in-patients of the obstetric department or post-partum women within six months of delivery on medical wards with a confirmed diagnosis or differential diagnosis of heart failure within the period of February 2021 to April 2022.

Consecutive patients with confirmed de-novo heart failure during pregnancy or within six months of the post-partum period were recruited into the study without any form of stratification from the obstetric and medical wards of the KBTH concurrently, till the required number of participants was obtained.

Using a prevalence rate of 8% for pregnancy related heart failure from previous studies.²⁴ A sample size of 113 was obtained using the Cochran's sample size formula for single proportion.²⁵ With the assumption of 15% non-response rate, a total of 131 patients with heart failure in pregnancy and the postpartum period were recruited into the study.

Inclusion criteria were Pregnant and postpartum women with confirmed heart failure above 18 years. Exclusion criteria were pregnant and postpartum women having heart failure with other confounding causes of acute pulmonary oedema, like End Stage renal disease (ESRD) and pregnant or postpartum

women whose current diagnosis of heart failure was unrelated to the most recent pregnancy.

Participants' histories were obtained using a standard structured questionnaire, covering demographic characteristic, reproductive and clinical histories. Specific heart failure symptoms including dyspnoea, paroxysmal nocturnal dyspnoea, orthopnoea, pedal oedema, easy fatigability, nocturnal cough) were documented. Clinical diagnosis of heart failure was based on Framingham's criteria.

Data was analysed using IBM SPSS version 22. Descriptive analysis of demographic parameters including age, ethnicity, religion, marital status, and level of education was done and displayed in tabular form. Continuous variables are presented as mean $\pm$ and standard deviation. Relevant data is also appropriately displayed in bar graphs when indicated. A p-value less than 0.05 is considered statistically significant.

Ethical approval was obtained from the Korle-Bu Teaching Hospital Ethical Review Committee (KBTH-IRB 00025/21). Written permission was also obtained from the heads of departments where the study was carried out. The purpose and

details of the study was explained clearly to the participants in a language they could understand, an interpreter was provided where necessary. Participants were reassured of their prerogative to choose to participate in the study or not and the fact that enrolment into the study was wholly voluntary and that their care was not going to be jeopardized by refusing to participate in the study. Written informed consent was subsequently obtained before subjects were enrolled in the study.

Results

During the study period, a total of 14,539 pregnant women in-patients were admitted into the obstetrics department. Prevalence was thus 135/14539 which comes to a prevalence rate of 0.9% or 9 in 1000 pregnant in-patients over the period of study.

The mean age of the participants was 32.6 ± 6.2 years. Akan's formed the majority of Ethnic representation 42% and for educational background, 39.7% were secondary school (SHS) leavers and formed the bulk of respondents (Table 1). Most (44.3%) of the respondents were petty traders, 15.3% were unemployed. Other demographics parameters are summarized in Table 1.

Table 1 Demographic characteristics of women with heart failure in pregnancy and post-partum period at KBTH

Variable	Participants (N=131)
Age (years)	32.6±6.2
Ethnicity, n (%)	
Akan	55 (42.0)
Ga	18 (13.7)
Ewe	35 (26.7)
Northern tribe(Hausa, Dagomba and Frafra)	18 (13.7)
Others	4 (3.9)
Educational Level, n (%)	
Primary	34 (26.0)
Secondary	52 (39.7)
Tertiary	34 (26.0)
Post-tertiary	2 (1.5)
No formal education	8 (6.1)
Occupation, n (%)	
Unemployed	20 (15.3)
Petty trader	58 (44.3)
Civil servant	18 (13.7)
Business owner	2 (1.5)
High income professionals	6 (4.6)
Others	27 (20.6)
Residence, n (%)	
Urban	126 (96.2)
Rural	5 (3.8)
Religion, n (%)	
Christianity	112 (85.5)
Islamic religion	18 (13.7)
Traditional religion	1 (0.8)
Marital status, n (%)	
Single	33 (25.2)
Married	96 (73.3)
Separated	1 (0.8)

Abbreviation: n,number; %, Percent

The most common aetiology of heart failure from this study was Peripartum cardiomyopathy 69 (52.7%) followed by hypertensive heart disease 23 (17.6%) and pregnancy-induced hypertension with 18 (15.3%) valvular heart disease 8 (6.1%) and severe anaemia 5 (3.8%) (Figure 1). These were classified as major causes as found in this study. The other rare aetiologies were congenital heart disease, sickle cell cardiomyopathy, core pulmonale and mixed aetiology. The two patients with mixed aetiology of disease were one case of severe anaemia and valvular heart disease and the other of valvular and congenital heart disease (Figure 1).

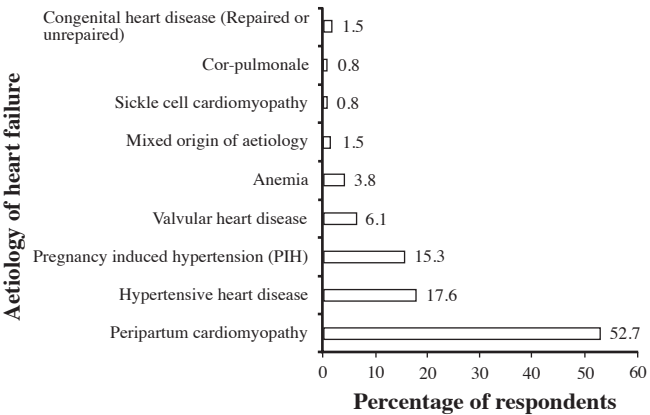


Figure 1 Aetiology of heart failure in pregnant and postpartum women at KBTH

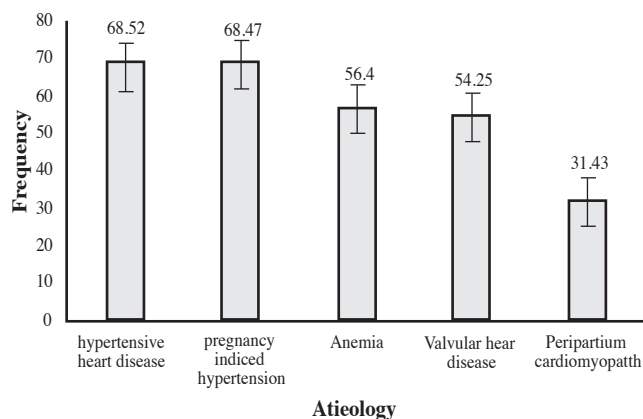
The most common factors found to be associated with heart failure among pregnant and post-partum women in the study were a history of PIH or Pre-eclampsia or Eclampsia in an earlier pregnancy (52.7%). History of dyslipidemia and smoking were found to be least risk factors (Table 3).

Table 2 Factors associated with heart failure in pregnancy and postpartum period

Variable	Frequency (%)
PIH/Pre-eclampsia/eclampsia in an earlier pregnancy	69 (52.7)
Personal history of chronic hypertension	41 (31.3)
Current history of PIH/pre-eclampsia/eclampsia	36 (27.5)
Family history of hypertension	36 (27.5)
Personal history of structural heart disease	11 (8.4)
Family history of heart disease	10 (7.6)
Family history of diabetes	10 (7.6)
History of alcohol intake	5 (3.8)
History of diabetes	4 (3.1)
History of dyslipidemia	1 (0.8)
History of smoking	1 (0.8)

More than half, 67 (51.1%) of study participants presented with New York Heart Association (NYHA) class III heart failure, 44 (33.6%) were in NYHA class II heart failure and 20 (15.3%) had NYHA class IV heart failure.

The mean Ejection Fractions (EF) for the five most frequent aetiologies of heart failure in pregnant and postpartum women is shown in figure 2 below: Patients who had peripartum cardiomyopathy had the least EF (mean 31.4%) while patients with hypertensive heart disease had highest EFs of 68.5% (Figure 2).

**Figure 2. Mean ejection fraction of the 5 major aetiologies among patients (p< 0.001)**

Discussion

The aim of this study was to assess the aetiology and associated factors of heart failure among pregnant and postpartum women admitted into the Korle Bu Teaching Hospital.

The prevalence rate of 0.9% pregnant women over the period of the study generally falls within the worldwide estimate of cardiovascular disease in pregnancy (including heart failure) which is estimated to be present in 0.1-4% of all pregnancies.¹ The prevalence of 0.9% in this study is however much lower than that in northern Nigeria where 4.2% of all patients referred for echos had Peripartum Cardiomyopathy (PPCM).²⁶ In fact Northern Nigeria has been reported in other studies to have the highest global prevalence of peripartum cardiomyopathy.^{27,28} Postpartum customary birth practices are associated with this high figure.

Akinwusi et al., also found hospital based incidence of maternal heart failure to be 2.2/1000 in South-west Nigeria.²⁹ Moreover, incidence rates of PPCM leading to heart failure in pregnancy was found to be 1 in 1000 pregnant women in South Africa and 1 in 3800 deliveries in Burkina Faso.^{22,30}

Peripartum cardiomyopathy was the leading cause of heart failure in pregnancy in this study (52.5%) followed by hypertensive heart disease (17.6%), Gestational hypertension (15.3%), valvular heart disease (6.1%) and severe anaemia (3.8%). Less common causes were congenital heart disease, sickle cell cardiomyopathy and core pulmonale. Comparing the present finding with most studies done in Sub-Saharan Africa, rheumatic valvular heart disease is a major aetiological cause of heart failure in pregnancy while this study found only 6% of respondents.^{13,31,32} This can be accounted for by the urban setting in which the study was conducted and the averagely high educational status of the women (at least SHS). It could also be accounted for by the fact that most of these studies were done over ten years ago and there could have been a major epidemiological shift in terms of aetiology since the time of those studies.

Nonetheless, rheumatic valvular heart disease remains a relevant challenge to be tackled in Sub-Saharan Africa as shown in a more recent study by Lumsden et al., who reported rheumatic heart disease among 75.3% of participants in Western Kenya³¹, compared to more industrialized countries where most of cardiac decompensation in pregnancy was due to repaired (mostly) or unrepaired congenital heart lesions as well as ischemic heart disease resulting often from advanced maternal age of childbearing.^{14,15}

Karaye and colleagues noted that Peripartum cardiomyopathy was common in North-western Nigeria.²⁶ In their study, 54 newly diagnosed patients with PPCM from 3 referral hospitals in Kano, Nigeria were followed up to assess 1 year survival in these patients. In a hospital-based study on incidence of maternal heart failure during pregnancy in Nigeria by Akinwusi et al.,²⁹ found 10 cases of heart failure over a 7-year review of hospital records. Seven out of the 10 (70%) had hypertensive heart failure.

This study found multiple preventable risk factors leading to heart failure in pregnant and postpartum women presenting to the Korle Bu Teaching Hospital. In this study, a history of PIH/Pre-Eclampsia/Eclampsia in a previous pregnancy was the most common risk factor associated with the development of heart failure from both hypertension and peripartum cardiomyopathy. However, patients with heart failure secondary to underlying hypertension were mostly found to have high blood pressure readings in the current admission. According to Ngayana et al., women with early onset pre-eclampsia are at an increased risk of future cardiovascular events.³³ Pre-Eclampsia/eclampsia has been shown to have a strong association with the development of peripartum cardiomyopathy from studies.^{33,34}

Patients with PIH and hypertensive heart disease had the highest mean of EF 68.4% and 68.5%, respectively. Builler et al., noted in their study that chronic hypertension and hypertensive disorders of pregnancy such as PIH and pre-eclampsia were

most frequently associated with preserved left ventricular ejection fraction³⁵ while patients with PPCM had the lowest mean ejection fraction of 31.4%, which fits in the definition for the PPCM criteria³⁶ of EF of less than 45%.

Conclusion

The prevalence of heart failure in pregnancy was 0.9% in this study, which is much lower than that in Northern Nigeria, but comparable to that of South Africa which was about 1% and much higher than that of Burkina Faso which was approximately 0.03%. The commonest aetiology of heart failure in this study was peripartum cardiomyopathy. Multiple preventable factors leading to heart failure in pregnant and postpartum women presenting to the Korle Bu Teaching Hospital were found in this study, chief among them being PIH and chronic hypertension.

Some limitations of the study included the fact that B-type Natriuretic Peptide (BNP) or N-terminal pro B-type Natriuretic Peptide (NT-pro BNP) which is very useful in excluding patients with non-cardiac causes of pulmonary edema could not be done owing to cost and accessibility challenges coupled with long waiting time for results during the time of the study. In addition, because study design was cross-sectional, causality could not be established.

Recommendations include conducting further longitudinal studies with controls to properly assess risk factors among this study population and possibly conducting a well-funded study to incorporate the use of useful biomarkers such as BNP and NT-pro BNP.

Conflict of Interest

The authors declare that they have no competing interest.

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