

ORIGINAL REPORTS: CARDIOVASCULAR DISEASE AND RISK FACTORS

EPIDEMIOLOGIC PROFILE OF PERIPARTUM CARDIOMYOPATHY IN A TERTIARY CARE HOSPITAL

Background: An epidemiologic link between peripartum cardiomyopathy (PPCM) and customary puerperal practices have been described among Nigerians. It is not, however, known if these practices have changed and influenced the epidemiology of PPCM over the years.

Objectives: To describe the current epidemiologic profile of PPCM.

Methods: Cross sectional analysis of prospectively recruited 65 patients with PPCM seen from January 2003 to December 2005 in a tertiary care hospital in Sokoto, northwest Nigeria.

Results: Incidence rate was one case per 102 deliveries. Peripartum cardiomyopathy (PPCM) constituted 2.4% of total medical admissions, 32.5% of overall admissions for heart failure, and 60% of admissions for heart failure in females. Patients were predominantly (84.6%) of Hausa and Fulani ethnic groups; and 20 (30.8%) were primiparous and 45 (69.2%) were multiparous women aged 28.2 ± 8.1 years (range 15–45 years). Literacy rate was 6.2%. Sixty-one (93.8%) patients belonged to the low socioeconomic class. All patients presented during the postpartum period; the interval between delivery and presentation was 6.7 ± 10.3 weeks (range .25–40 weeks, median 4 weeks). Customary puerperal practices were observed in 53 (81.5%). Hospital admission peaked during the peaks of cold harmattan and rainy seasons.

Transient hypertension occurred in 18 (27.7%) patients. Complications included pericardial effusion (13.5%), intracardiac thrombosis (12.3%), and atrial fibrillation (3.1%). Stroke, pulmonary embolism, and acute lower extremity arterial occlusion each occurred in one (1.5%) patient. Mortality rate was 12.3%. Compared to the survivors, the deceased had significantly lower diastolic pressure (67.5 ± 10.4 mm Hg vs 83.4 ± 19.4 mm Hg; $P=.04$) and higher cardiothoracic index ($70.2\% \pm 14.4\%$ vs $60.9\% \pm 5.5\%$; $P=.007$). The outcome of PPCM correlated with cardiothoracic index ($r=.7$; $P=.007$), ejection fraction ($r=.5$; $P=.03$), and diastolic blood pressure ($r=.4$; $P=.04$).

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Conclusions: The epidemiologic profile of PPCM has not changed among the ethnic Hausa and Fulani groups of northwest Nigeria. Peripartum cardiomyopathy (PPCM) is an important cause of maternal morbidity and mortality in this population. (*Ethn Dis.* 2007;17:228–233)

Key Words: Custom, Epidemiology, Peripartum Cardiomyopathy

INTRODUCTION

Peripartum cardiomyopathy (PPCM) is a dilated cardiomyopathy of uncertain origin that occurs in women of childbearing age with no preexisting heart disease.¹ It is recognized as a separate entity from idiopathic dilated cardiomyopathy because of its distinct epidemiologic characteristics,¹ relatively rapid onset, and association with unique autoantigens and autoantibodies.² Population-based data on PPCM are rare; the incidence rate ranges from one case per 100 live births in Nigeria to one case per 15,000 live births in the United States.^{1,3} Multiparity, Black race, twin births, advanced maternal age, and gestational hypertension are known risk factors.¹ Viral myocarditis,⁴ abnormal

immune response,² and maladaptive response to hemodynamic stress in pregnancy⁵ are the leading theories in the etiology of PPCM.

Peripartum cardiomyopathy (PPCM) causes a high number of deaths in African women. In Nigeria, it is particularly common among the Hausa and Fulani tribes, in whom an incidence rate of one case per 100 deliveries has been reported.³ An epidemiologic link between PPCM and certain customary practices, including postpartum excess consumption of dried lake salt, warm water bath, and lying on heated mud bed, was described in these populations 30 years ago.^{3,6} Whether the epidemiology of PPCM has changed over the years is not known. We present a current epidemiologic profile of PPCM patients as seen in Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. This is a tertiary care hospital with a catchment population of ≈ 10 million in northwest Nigeria.

Population-based data on peripartum cardiomyopathy (PPCM) are rare; the incidence rate ranges from one case per 100 live births in Nigeria to one case per 15,000 live births in the United States.^{1,3}

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METHODS

Patients

The records of all women presenting with heart failure between January 1, 2003, and December 31, 2005, were kept in a registry in Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. Women with a diagnosis of PPCM were prospectively recruited.

Inclusion criteria¹ included:

- Heart failure developed in the last month of pregnancy or within the first five months postpartum.⁷
- Absence of heart disease prior to the last one month of pregnancy.
- Absence of identifiable cause of heart failure.
- Systolic dysfunction evidenced by left ventricular ejection fraction <50%.

Patients with cardiovascular risk factors, including diabetes mellitus, systemic hypertension, and alcohol and cigarette use, were excluded.

Demographic, Clinical, and Laboratory Data

We obtained information about age, tribe, literacy status, parity, pregnancy, and postpartum cultural practices, including dried lake salt (*kanwa*) consumption, warm water bath, and use of heated mud bed. A patient who had been educated beyond primary school was considered literate. Socioeconomic status was determined by using the British Registrar General Scale.⁸

Anthropometric indices, including height and weight, were measured with patients lightly clothed and without shoes. Body mass index was determined. Blood pressure was measured after at least 10 minutes of rest with a mercury sphygmomanometer. Systolic and diastolic pressures were recognized by using Korotkoff sound phases I and V, respectively. Korotkoff sound phase IV was used to recognize the diastolic pressure when Korotkoff sound phase V was at or near 0 mm Hg. Three

readings were taken, and the average of the last two was taken as the blood pressure. Systolic blood pressure ≥ 140 mm Hg and/or diastolic blood pressure ≥ 90 mm Hg constituted a diagnosis of systemic hypertension.⁹

Blood was obtained to determine electrolytes (sodium, chloride, and potassium), urea, creatinine, protein, fasting blood glucose, packed cell volume, and white blood cells.

Detailed contact addresses, and where available, telephone numbers of patients and/or their closest relatives were obtained. Patients were followed at two- to four-week intervals.

Statistical Analysis

Data were analyzed with SPSS software. Continuous variables are presented as means plus or minus standard deviations, while categorical variables are presented as percentages. Independent *t* test (two-tailed) was used to compare means between two groups. Proportions were compared by using chi-square test. The relationship between outcome of PPCM and clinical and hemodynamic variables was determined by using linear regression analysis. A *P* value <.05 was considered statistically significant.

RESULTS

During the study period, 65 cases of PPCM and 6,535 deliveries were recorded, for a PPCM incidence of one case per 102 deliveries. Peripartum cardiomyopathy (PPCM) constituted 2.4% of total medical admissions, 32.5% of overall admission for heart failure, and 60% of admission for heart failure in females. Idiopathic dilated cardiomyopathy, in contrast, accounted for 17.3% of hospitalization for heart failure in females during the same period.

The general characteristics and echocardiographic data of the study population are shown in Tables 1 and 2,

respectively. Patients were predominantly (84.6%) of Hausa and Fulani ethnic groups; 20 (30.8%) were primiparous and 45 were (69.2%) multiparous women 28.2 ± 8.1 years of age (range 15–45 years). Literacy rate was 6.2%, and 61 (93.8%) patients belonged to the low socioeconomic class. All patients presented during the postpartum period; the interval between delivery and presentation was 6.7 ± 10.3 weeks (range .25–40 weeks, median 4 weeks). Though 4 (6.2%) patients had past history of twin deliveries, none of the PPCM-related pregnancies were multiple. Traditional postpartum consumption of dried lake salt and warm water bath were observed in 53 (81.5%) and 45 (69.2%) patients, respectively. Lying on a heated mud bed was not observed in any patient. Duration of practice ranged from 1 to 53 days (mean 24.7 ± 14.0 days, median 30 days). Average monthly rate of hospitalization was 5.4. Hospital admission peaked during the peaks of the cold harmattan season (December) and the rainy season (August) (Figure 1).

Of the 65 PPCM patients, 18 (27.7%) had hypertension. Blood pressure ranged from 110–160 mm Hg systolic (mean 134.4 ± 15.0 mm Hg) and 80–120 mm Hg diastolic (mean 100.6 ± 12.1 mm Hg) in this group. Though blood pressures were higher among salt consumers than salt non-consumers (Table 3), the differences were statistically insignificant (119.2 ± 29.1 vs 111.9 ± 14.3 mm Hg systolic, *P*=.2), and (85.0 ± 20.7 vs 79.2 ± 16.2 mm Hg diastolic, *P*=.3). Apart from one (4.8%) patient who required chronic antihypertensive medication, blood pressures normalized among the hypertensives within 5–21 days of conventional antiheartfailure therapy.

Fifty-three (81.5%) patients were in New York Heart Association (NYHA) class IV heart failure, while the rest 12 (18.5%) were in NYHA class III heart failure. Complications associated with PPCM included pericardial effusion 9

Table 1. Characteristics of patients with peripartum cardiomyopathy

Characteristics	Values
	<i>n</i> (%)
Tribes	
Hausa and Fulani	58 (89.2)
Ibo	1 (1.5)
Yoruba	1 (1.5)
Others	5 (9.8)
Parity	
Primiparous	20 (30.8)
Multiparous	45 (34.2)
Socioeconomic class	
Lower	
Middle	61 (93.8)
Upper	4 (6.2)
Consumption of dried lake salt	0 (0)
	53 (81.5)
	Mean \pm SD
Age (years)	28.2 \pm 8.1
Parity	4.4 \pm 3.3
Body mass index (kg/m ²)	21.3 \pm 6.2
Systolic blood pressure (mm Hg)	113.2 \pm 17.9
Diastolic blood pressure (mm Hg)	80.3 \pm 17.1
Duration of consumption of dried lake salt (days)	24.7 \pm 14.7
Interval between delivery and onset of heart failure (weeks)	4.5 \pm 4.2
Packed cell volume (%)	35.2 \pm 5.5
Cardiothoracic index (%)	61.4 \pm 12.0
Serum albumin (mg/dL)	4.0 \pm .9
Serum sodium (mmol/L)	143.2 \pm 6.4
Serum potassium (mmol/L)	3.8 \pm .6
Serum urea (mmol/L)	4.8 \pm 2.3
Serum creatinine (mg/dL)	1.1 \pm .5

(13.5%), intracardiac thrombosis 8 (12.3%), and atrial fibrillation 2 (3.1%). Stroke, pulmonary embolism, and acute lower extremity arterial occlusion and gangrene each occurred in one (1.5%) patient. Two subsequent pregnancies were observed during the .5 to 36 months (mean 9.7 \pm 8.8 months) period of follow up. One was associated

with worsened heart failure. The outcome of the second pregnancy is not known.

Eight (12.3%) patients died. Compared to the survivors, the deceased had statistically significant higher cardiothoracic index (70.2% \pm 14.4% vs 60.9% \pm 5.5%, P =.007) and lower diastolic blood pressure (67.5 \pm 10.4 mm

Hg vs 83.4 \pm 19.4 mm Hg, P =.04). The outcome of PPCM correlated with cardiothoracic index (r =.7, P =.007), ejection fraction (r =.5, P =.03), and diastolic blood pressure (r =.4, P =.04). Outcome was not influenced by age and parity.

DISCUSSION

Peripartum cardiomyopathy (PPCM) is characterized by ethnic and regional variation in epidemiologic characteristics. In Africa, incidence rate ranges from one case per 100 deliveries in Nigeria to one case per 1000 deliveries in South Africa.^{3,10,11} Within Nigeria, PPCM is common among the Hausa and Fulani tribes in the northern belt, where it is the second-leading cause of heart failure,³ but rare among the Yoruba tribe in the southwest belt, where hospital based data shows that <10 cases are seen per year.¹²

A peak in the incidence of PPCM and heart failure during the cold, humid, rainy season in northern Nigeria has previously been described.^{3,13} We further observed an additional peak during the cold harmattan season. This finding is consistent with our published findings of two peaks of hospitalization for hypertension-related morbidities in northwest Nigeria.¹⁴ Seasonality of cardiac morbidity and mortality has been linked with climate-induced changes in blood pressure, vascular resistance, and plasma volume.¹⁵ The northwestern region of Nigeria, where the current study was done, is characterized by two distinct seasons: the cold harmattan season from November to February and the humid and hot climate during the remainder of the year.¹⁴

Traditional puerperal practices including postpartum consumption of excess dried lake salt (*kanwa*) (94%), warm water bath (97%), and lying on heated mud bed (99%) have been described among the Hausa and Fulani

Table 2. Echocardiographic profiles of peripartum cardiomyopathy (PPCM) patients

Parameters	Values
	Mean \pm SD (Range)
Left atrial diameter (cm)	4.0 \pm .7 (2.5–5.6)
Left ventricular end diastolic dimension (cm)	6.3 \pm 1.0 (4.1–7.9)
Left ventricular end systolic dimension (cm)	5.5 \pm 1.0 (3.6–7.3)
End diastolic volume (mL)	207.7 \pm 68.2 (87.7–364.1)
End systolic volume (mL)	162.9 \pm 66.6 (62.7–297.4)
Ejection fraction (%)	27.4 \pm 8.2 (16–48)
Fractional shortening (%)	13.0 \pm 5.0 (6.5–30.9)
E – point septal separation (cm)	2.6 \pm .6 (1.4–3.7)
E:A ratio	2.1 \pm .8 (.6–4.6)

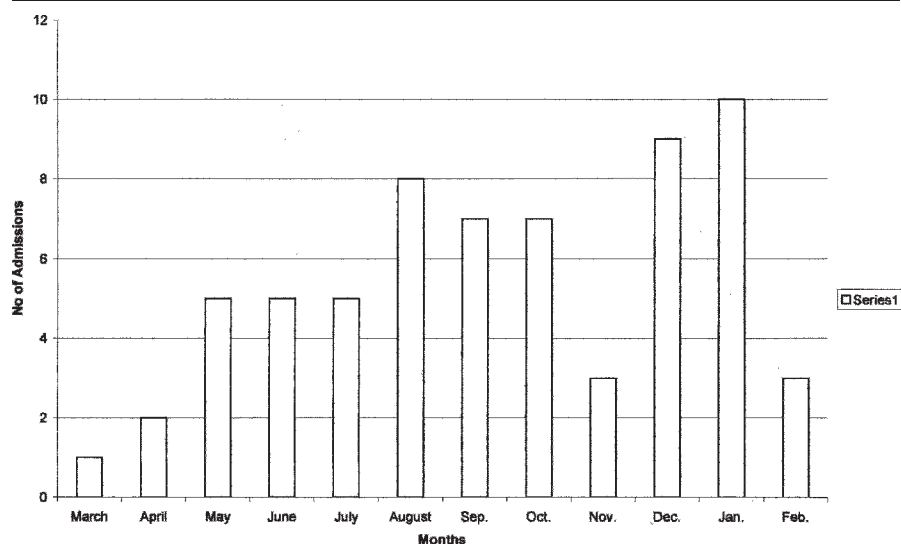


Fig 1. Hospital admission for PPCM (2003–2005)

tribes of Nigeria.^{3,6} *Kanwa* consumption was observed in >80% of our patients. Traditional puerperal practices are believed to enhance breast milk secretion, prevent infection, and keep the body warm, particularly during the cold weather. The resultant volume overload is thought to aggravate heart failure in a heart already stressed by the hemodynamic changes in pregnancy.⁶

The prevalence of hypertension in the current report is lower than the previously reported values of 80%–87% among Nigerians with PPCM^{3,12} (according to the current WHO/International Society of Hypertension defini-

tion of hypertension). Our result is, however, consistent with recently published prevalence rates of 25% – 45% among Caucasians.^{16–18} The pathogenesis of hypertension in PPCM has not been described. While acute salt loading causes hypertension in animals,¹⁹ the effects in humans are conflicting. Acute salt loading led to elevated blood pressure among the Zimbabweans²⁰ but not Nigerians.²¹ Mild hypertension has also been observed in patients with suspected idiopathic dilated cardiomyopathy, although whether this is a cause or consequence of cardiomyopathy is unclear.²² The argument that these

The high rate of intracardiac thrombosis in the current report may be due to the use of echocardiography as a diagnostic procedure, late presentation with severe left ventricular systolic dysfunction, and hypokinesis.

patients have chronic hypertension with hypertensive heart disease is persuasive.^{22,23}

The morbidity profiles of our patients are comparable with previously published data.^{3,16,24–26} The high rate of intracardiac thrombosis in the current report may be due to the use of echocardiography as a diagnostic procedure, late presentation with severe left ventricular systolic dysfunction, and hypokinesis. Thromboembolic phenomena, including cerebral embolism, acute embolic lower extremity arterial occlusion, and myocardial infarction,^{27–29} are increasingly being described in PPCM. Systolic dysfunction, hypokinesis, atrial fibrillation, and the hypercoagulable state of pregnancy are responsible for thromboembolic changes in PPCM.

Table 3. Comparison of consumers and nonconsumers of dried lake salt (*kanwa*)

Parameters	Salt Consumers <i>n</i> =53	Non-Salt Consumers <i>n</i> =12
	Mean ± SD	Mean ± SD
Age (years)	27.9 ± 7.9	29.6 ± SD
Parity	4.3 ± 3.4	4.6 ± 2.9
Body mass index (kg/m ²)	21.2 ± 6.9	21.4 ± 2.7
Systolic blood pressure (mm Hg)	119.2 ± 29.1	111.9 ± 14.3
Diastolic blood pressure (mm Hg)	85.0 ± 20.7	79.2 ± 16.5
Serum sodium (mmol/L)	143.6 ± 6.4	141.4 ± 6.4
Serum potassium (mmol/L)	3.9 ± .7	3.8 ± .5
Serum urea (mmol/L)	5.7 ± 2.8	4.5 ± 2.0
Serum creatinine (mg/dL)	1.2 ± .7	.9 ± .3
Cardiothoracic index (%)	62.1 ± 3.8	61.1 ± 3.8

P > .05 unless otherwise stated.

Table 4. Comparison of hypertensive and normotensive peripartum cardiomyopathy (PPCM) patients

Parameters	Hypertensive n=18	Normotensive n=47
Age (years)	27.2 ± 7.0	28.6 ± 8.5
Body mass index (kg/m ²)	22.4 ± 8.5	20.7 ± 5.0
Parity	4.3 ± 3.3	4.4 ± 3.3
Systolic blood pressure (mm Hg)*	134.4 ± 15.0	105.1 ± 10.8
Diastolic blood pressure (mm Hg)*	100.6 ± 12.1	72.5 ± 11.3
Duration of salt consumption (days)	29.0 ± 13.6	23.2 ± 14.9
Serum sodium (mmol/L)	143.5 ± 4.1	142.9 ± 7.3
Serum potassium (mmol/L)	3.9 ± .6	3.6 ± .5
Serum urea (mmol/L)	4.9 ± 2.3	4.8 ± 2.3
Serum creatinine (mmol/L)	1.1 ± .5	.9 ± .2
Cardiothoracic index (%)	64.0 ± 9.4	60.4 ± 12.8

* P<.05.

Published mortality of PPCM ranges from 9% to 56%.^{17,24–26,30,31} Left ventricular function and inflammatory markers are prognostic factors in PPCM.^{32,33} Significantly higher cardiothoracic index and diastolic blood pressure have previously been documented among the deceased more frequently than among survivors of PPCM in Nigeria.²⁵ We observed a significantly lower diastolic blood pressure among the deceased than among survivors. This finding may be due to impaired systolic function in our patients. Low blood pressure has been associated with poor prognosis among heart failure patients with impaired systolic function, while an opposite trend occurred in those with preserved systolic function.³⁴ The lack of influence of age and parity on the outcome of our patients is consistent with findings from Durban, South Africa.¹¹

In conclusion, the epidemiologic profile of PPCM, including customary puerperal practices, among northwest Nigerian women has not changed. Peripartum cardiomyopathy (PPCM) remains an important cause of cardiac morbidity and mortality in this population.

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AUTHOR CONTRIBUTIONS

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Data analysis and interpretation: Isezuo
Manuscript draft: Isezuo, Abubakar
Statistical expertise: Isezuo
Acquisition of funding: Isezuo
Administrative, technical, or material assistance: Isezuo, Abubakar
Supervision: Isezuo