

## Epidemiology of Cardiac Disease during Pregnancy in Khartoum Hospital, Sudan

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### Abstract

Data was collected prospectively during the period of May 2011-through December 2012 at Khartoum Teaching Hospital from 75 pregnant women with heart diseases to investigate the epidemiology of cardiac disease in pregnancy. Means and proportions were calculated using student and X<sup>2</sup> test, respectively. Univariate and multivariate analyses were performed, confidence intervals of 95% were calculated and P<0.05 was considered significant. With regard to classification of the cardiac disease, 60%, 26.7% and 13.3% was rheumatic heart disease, congenital heart disease and other acquired heart disease respectively.

Ten cases were ended with therapeutic and spontaneous miscarriage and 65 cases reached viability. The reported medical problems that complicated the pregnancy of our patients included: congestive heart failure (14/75, 18.6%), arrhythmias (6/75, 8%), pulmonary embolism (4/75, 5.3%) and pulmonary oedema (2/75, 2.6%). There were two cases of maternal mortality (2.7%). In this study maternal cardiac complication were more common among women with past medical history of cardiac complication (OR=1.0; CI=, 1.0-1.0; P =0.023), NYHA class III & IV at booking (OR=15.9; CI=, 2.8-38; P =0.000), mitral stenosis without other valvular lesion (OR=5.3; CI=, 1.0-25.1; P =0.021), cardiomyopathy (OR=10; CI=, 1.1-88.6; P =0.036) and those without preconception counselling (OR=2.4; CI=, 1.3-4.2; P =0.002).

Cardiac surgery prior to pregnancy did not guarantee a complication-free course in subsequent pregnancies. Thus Rheumatic heart disease is the most dominant aetiology of heart disease during pregnancy in Sudan. Cardiac surgery prior to pregnancy is not a grantee for pregnancy free complication.

**Keywords:** Epidemiology; Cardiac disease; Pregnancy; Sudan

### Introduction

Globally, cardiac disease complicates approximately 1% to 4% of pregnancies and responsible for 10% to 15% of maternal mortality [1]. The number of women in childbearing age with congenital heart disease is increasing due to development in the diagnostic tools and care during childhood [2]. According to the Annual Health Statistical Report of Sudan in the discharge clinics 2004, 3.97% of the cardiac cases are due to rheumatic heart diseases, 51.7% of these cases were females, most of them in the reproductive age (15-45 years) [3]. Despite the increased workload of the heart during gestation and labour, the healthy woman has no impairment of cardiac reserve [4].

In contrast, for the pregnant women with heart disease and low cardiac reserve, the increase in the work of the heart may cause ventricular failure and pulmonary edema [4]. The presence of heart disease increases the risk of obstetric complication such as preterm delivery, postpartum haemorrhage; pre-eclampsia, increased the risk of cardiac de-compensation and death [5]. Also there is increased risk of infection, miscarriage, and congenital heart disease [6-8]. There are few published data -none is available in Sudan- concerning cardiac

disease during pregnancy. The aim of the present study was to investigate epidemiology of cardiac disease in pregnancy.

### Material and Methods

This was a cross sectional hospital based study carried out during the period of May 2011-through December 2012 to investigate the epidemiology of cardiac disease in pregnancy at Khartoum Teaching Hospital, which is a Tertiary Referral Hospital in Sudan. Data was collected prospectively from 75 pregnant women with heart diseases, who presented to the hospital with or without complications. Women with congenital heart disease, rheumatic heart disease, prior arrhythmias as well as other acquired heart diseases were approached and included in the study.

All women with heart disease were evaluated clinically by both Obstetrician and Cardiologist at first visit following which an ECG and Echocardiography were routinely performed. Additional investigations were performed when indicated and as advised by the Cardiologist. The diagnosis of cardiac disease, the nature of the lesion and the diagnosis of the complications were made after clinical assessment and investigations by the Cardiologist. Anticoagulants and

supportive management were given according to the hospital guidelines. Baseline characteristics of the women, such as socio-demographic data (age, residence, education) obstetric data and outcomes (preconception counselling, parity, gestational age, miscarriage, preeclampsia, postpartum haemorrhage, sepsis, death), neonatal outcomes (low birth weight, preterm birth, stillbirth) maternal cardiac complications (congestive heart failure, arrhythmias, pulmonary oedema, pulmonary embolism), NYHA classification at booking, history of cardiac complications before pregnancy, prior history of cardiac surgery/interventions were obtained after informed written consent using structured questionnaire.

Since some women had more than one lesion, nature of the lesions was classified according to the basic pathophysiology. The definitions of these were arrived at in consultation with the Cardiologist, taking in consideration the physiological changes occurring in pregnancy. The different variables were compared between the women with those who developed maternal cardiac complications and the group whose pregnancy was free of complications. Means and proportions were compared between the two groups of the study using student and x2 test, respectively. Univariate and multivariate analyses were performed. Maternal cardiac complication in the current pregnancy was the dependent variable; duration of the disease; past history of complication, cardiomyopathy, NYHA classification, preconception counselling and cardiac surgery prior to pregnancy were independent variables. Confidence intervals of 95% were calculated and  $P < 0.05$  was considered significant. In case of discrepancy between the results of the univariate and the results of multivariate analyses, the later was taken as final.

The study received ethical clearance from the Health Research Board at Khartoum Teaching Hospital, Sudan.

## Results

### Baseline Characteristics

During the study period a total of 75 pregnant women were reported with clinical and radiological evidence proven cardiac disease. Ten (13.3%) out of these 75 patients underwent mitral valve replacement; balloon valvotomy was performed in 4 (5.3%) patients and cardiac catheterization in 1 (1.3%) patient. According to NYHA classification 40 (53.3%) patients were in NYHA class I & II and 35 (46.7%) patients were in class III & IV. Sixty nine (92%) out of these 75 have been diagnosed prior to the index pregnancy. Their mean (SD) age, duration of the disease, parity, gestational age at booking and gestational age at delivery was 29.8 (6.4), 6.2 (1.9), 4.8 (2.6), 8 (2.9) and 36.8 (5.4). The majority of these patients had less than secondary education (51/75, 68%), housewives (73/75, 97.3%), of urban residence (48/75, 64%) and booked (52, 69.3%). Most (58/75, 77.3%) of our respondents were not received any counselling before their current pregnancy and their pregnancy was unintended one (59, 78.7%) (Table 1).

Characteristic	Mean or Number	SD or percentage
Age, years	29.8	6.4
Duration of disease, year	6.2	1.9
Parity	4.8	2.6

G.A at booking, weeks	8	2.9
G.A at delivery, weeks	36.8	5.4
Education, <secondary	51	68
Urban residence	48	64
counselling before pregnancy, yes	59	78.7
Booking, yes	52	69%
Total	75	100

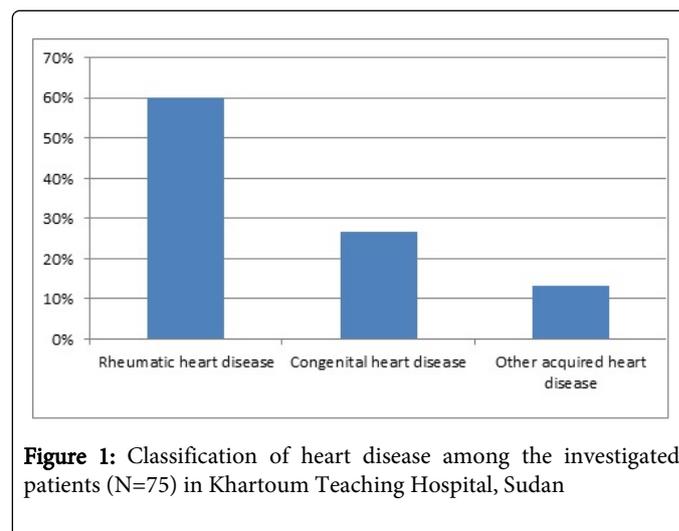
**Table 1:** Basic Characteristics of 75 pregnant women who were reported with clinical and radiological evidence proven cardiac disease in Khartoum Teaching Hospital, Sudan

Data was shown as mean (SD) or number (%) as applicable.

Abbreviation: G.A= gestational age; SD= Standard Deviation.

### Aetiology of the Heart Disease

With regard to classification of the cardiac disease, 60% (45/75), 26.7% (20/75) and 13.3% (10/75) was rheumatic heart disease, congenital heart disease and other acquired heart disease (Figure 1). Mitral stenosis, mitral valve regurgitation, mitral valve disease plus aortic valve regurgitation, mitral valve disease plus aortic valve stenosis and mitral regurgitation plus tricuspid regurgitation was reported in 20, 10, 7, 5 and 3 patients respectively. Among those with congenital heart disease the ventricular septal defect was reported in 7 patients, patent ductus arteriosus in 2 patients, pulmonary stenosis in 1 patient and arterial septal defect in 1 patient. The other acquired heart diseases rather than rheumatic disease included: peripatum cardiomyopathy in 6 patients, ischemic heart disease in 3 patients and pulmonary hypertension in 1 patient.



**Figure 1:** Classification of heart disease among the investigated patients (N=75) in Khartoum Teaching Hospital, Sudan

### Obstetric data and maternal cardiac complications

Ten cases were ended with therapeutic and spontaneous miscarriage and 65 cases reach viability. Among these 65 women 31 (47.7%) experienced vaginal deliveries, caesarean section was carried

out in 18 (27.7%) patients and in the remainder the delivery was assisted one (16, 24.6%). The reported medical problems that complicated the pregnancy of our patients included: congestive heart failure (14/75, 18.6%), arrhythmias (6/75, 8%), pulmonary embolism (4/75, 5.3%) and pulmonary oedema (2/75, 2.6%).

### Maternal and perinatal outcomes

There were two cases of maternal mortality (2.7%), one of them due to infective endocarditis, and the other one due to intractable congestive cardiac failure, late presentation (at time of 2nd stage of labour). Twelve percent (8/65) developed postpartum haemorrhage and (3/75, 4%) developed sepsis. Fifty four (83.1%) women out of 65 delivered women gave living birth, stillbirth and neonatal deaths was observed in 5 (7.7%) and 6 (9.2%) patients respectively. Low birth weight, preterm birth was reported in 24 (36.9%) and 16 patients (24.6%) respectively.

### Risk of maternal cardiac complications

In this study medical complications such as congestive heart failure, arrhythmia, pulmonary oedema were noticed more among women with previous history of cardiac complications, NYHA class III & IV at booking, mitral stenosis without other valvular lesion, longer duration of the disease  $\geq 5$  years and those without preconception counselling. Cardiomyopathy is another risk factor for maternal cardiac complications and cardiac surgery prior to pregnancy did not guarantee a complication-free course in subsequent pregnancies (Table 2).

Variable	With complication (N=26)	Without complication (N=49)	P
Past history of complication	12(46.2%)	6 (12.2%)	0.002
NYHA class III & IV	22 (84.6%)	8(16.3%)	<0.001
Duration of the disease, $\geq 5$ years	18 (69.2%)	8(30.8%)	<0.001
History of cardiac surgery, yes	3 (11.5%)	12 (24.5%)	0.151
Preconception counselling, yes	24 (92.3%)	34 (69.4%)	0.02
cardiomyopathy	6 (23.1%)	00 (00%)	0.001
Mitral stenosis	13 (50%)	7 (14.3%)	0.001

**Table 2:** Comparison between cardiac disease patients with maternal cardiac complications and those with free course pregnancy in Khartoum Teaching Hospital Sudan using chi-square test

Data was shown as number (%) as applicable

In logistic regression analysis maternal cardiac complication were more common among women with past medical history of cardiac complication (OR=1.0; CI=, 1.0-1.0; P =0.023), NYHA class III & IV at booking (OR=15.9; CI=, 2.8-38; P =0.000), mitral stenosis without other valvular lesion (OR=5.3; CI=, 1.0-25.1; P =0.021), cardiomyopathy (OR=10; CI=, 1.1-88.6; P =0.036)and those without preconception counselling (OR=2.4; CI=, 1.3-4.2; P =0.002) (Table 3).

Variable	Univariate analyses			Multivariate analyses		
	OR	95% CI	P-value	OR	95% CI	P-value
Past history of complication	1	1.0-1.2	0.033	1	1.0-1.0	0.023
NYHA class III&IV	7.4	3.9-22	0	15.9	2.8-38	0
Duration of the disease, $\geq 5$ years	1	0.3-2.3	0.101	0.4	0.1-1.4	0.155
History of cardiac surgery, yes	1.1	0.3-2.8	0.658	1.6	0.3-6.2	0.303
Mitral stenosis	5.8	1.7-20.1	0.004	5.3	1.0-25.1	0.021
cardiomyopathy	9.7	1.5-44.1	0.01	10	1.1-88.6	0.036
Preconception counselling, yes	3.1	2.0-5.0	<0.001	2.4	1.3-4.2	0.002

**Table 3:** Comparison between cardiac disease patients with maternal cardiac complications and those with free course pregnancy in Khartoum Teaching Hospital, Sudan using univariate and multivariate analyses

### Discussion

This study focused on epidemiology of cardiac disease during pregnancy, the rheumatic heart disease was the most dominant type. It is proved that heart disease due to rheumatic aetiology is the most common cause of maternal morbidity and mortality in developing nations [9] while its incidence has been decreasing in the developed world. The mean maternal age (29.89+6.42), which this study described, is similar to what was observed in Iran, but higher than that in India and Australia [8,10,11]. Cardiac disease with pregnancy is relatively common in Sudan. Sixty nine out of the 75 cases involved in this study were known to have cardiac disease prior to their index pregnancy, and about 15 (20%) had cardiac surgery. This represents the development in the diagnostic tools and care during childhood, which improves the survival rates, and overall health in Sudan. In this study, cardiac disease due to rheumatic aetiology predominates over congenital causes, this result is similar to reports from Malaysia [6] but much higher than that from Latin American countries [12] and lower than reports from Iran [9] and India [6]. The heart disease of congenital aetiology which was described in this study is similar to reports from India [6], however it is slightly lower than that from Brazil [12], and Malaysia [13]. Cardio-vascular disease in many studies was found to be determined by some maternal and neonatal determinants such as maternal age, weight, parity and preterm birth [9]. Peripartum cardiomyopathy was reported in 6 cases, this is expected because the condition is related to African races [5]. Patients with pre-existing cardiac disease should be counselled in advance about risk of pregnancy; in this study only 22.7% received preconception counselling. Many issues are going to be considered prior to pregnancy including the risk of pregnancy, cardiac disease medication or even the advisement against pregnancy. Certain pre-existing cardiac disease such as severe pulmonary hypertension, cardiomyopathy with NYHA Class III or IV symptoms, and severe uncorrected mitral stenosis carries an extremely high maternal risk. In consistent with what was observed by C.N. Sheila et al congestive cardiac failure and arrhythmias are the most common complications

seen in our investigated women [14]. In this study previous history of complication, NYHA class III & IV at booking, mitral stenosis without other valvular lesion, longer duration of the disease  $\geq 5$  years, those with no preconception counselling are the important risk factor for maternal cardiac complications. It is evident that those with class III and IV being at a higher risk of complications than class I and II [15,16]. It has previously been noted that the longer the duration of cardiac disease, the higher the NYHA grading and thus more complications. In our study, cardiomyopathy was other risk factors for maternal cardiac complications. Several studies evaluating peripartum cardiomyopathy have drawn similar conclusions [17-19]. The present study also revealed that cardiac surgery prior to pregnancy failed to reduce the risk of maternal cardiac complications. In the patient with heart disease, the increased blood volume and cardiac output in pregnancy may cause cardiovascular de-compensation [19]. This may explained our observation in women who underwent pre-pregnancy cardiac surgery, being at the same risk for the development of maternal cardiac complication in comparison with those who does not perform any surgical intervention. Thus; the surgery alone does not guarantee a complication-free course in subsequent pregnancies. In this study the adverse obstetric outcome included: maternal death (2.7%), postpartum haemorrhage (12%), sepsis (4%), low birth weight (36.9%) and preterm birth (24.6%). Mothers with cardiac disease had higher risk to give preterm birth and babies with low birth weight. Doshi et al [20,21] and Soma Pillay et al have reported similar results.

## Limitations

Limitation of this study is partly due to the small size sample and being confined to only one hospital which underestimate the actual burden the problem.

## Conclusion

Rheumatic heart disease is the most dominant aetiology of heart disease during pregnancy in Sudan. Previous history of cardiac complications, NYHA class III & IV at booking, mitral stenosis, longer duration of the disease  $\geq 5$  years, those without preconception counselling are the important risk factor for maternal cardiac complications. Cardiomyopathy is other risk factor for maternal cardiac complications and cardiac surgery prior to pregnancy is not a grantee for pregnancy free complication.

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