

# Maternal heart disease and pregnancy outcome: Experience of a single unit in a tertiary care hospital in Sri Lanka

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## Abstract

**Introduction:** Heart disease complicating pregnancy is a leading cause of maternal morbidity and mortality in Sri Lanka. Understanding the pattern and outcomes of heart disease complicating pregnancy will help to optimise the care.

**Objective:** Describe maternal and fetal outcomes of heart disease complicating pregnancy in a tertiary care unit from 2013 to 2017.

To compare the pattern of heart disease complicating pregnancy over the years from the same unit to assess whether there is a change in the pattern of cases presenting in pregnancy.

To study the reasons for termination of pregnancy in patients with cardiac disease during the study period

**Method:** Retrospective analysis of secondary data collected from clinical notes of pregnancies complicated with heart disease.

**Results:** A total of 248 cases with diagnosis of cardiac disease complicating pregnancy were included in the study. 15 patients had termination of pregnancy in the first trimester due to severe heart disease. Two hundred thirty three (233) patients continued the pregnancy until the delivery. Out of these 233, heart disease was diagnosed during the index pregnancy in 18.9% (n=44) of the patients. Heart disease was categorised as acquired (47.2%), congenital (28.2%), mitral valve prolapse (15%), cardiac arrhythmias (9.4%). Among acquired heart disease 89% was rheumatic in origin. Mitral valve (89.7%) was the commonest valve affected amongst women with rheumatic carditis (n=98). Cardiac decompensation at delivery occurred in 7.7%. Pulmonary hypertension was present in 22.9% with acquired heart disease and 31.7% with congenital heart disease. Three intra uterine fetal demise and two maternal deaths occurred during this period.

**Conclusion:** Rheumatic heart disease remains the commonest heart disease in pregnant women in Sri Lanka. There is an increase proportion of women with congenital heart disease. A significant number required therapeutic termination which highlights the need for improved pre-pregnancy preparation.

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## Introduction

Heart disease complicating pregnancy remains a leading cause of maternal mortality in Sri Lanka and is associated with high morbidity and mortality risk for the mother and the fetus<sup>1</sup>. In 2014 there were 2590 pregnant women with heart disease out of an average of 350,000 births<sup>1</sup>. Heart disease in pregnancy remains a major challenge to health care providers even in developed countries with an escalation of maternal-fetal risks. In the United Kingdom (UK), maternal mortality from heart disease in pregnancy has risen from 7.3/million births in 1982-84 to 22.7/million births in 2003-05<sup>2</sup>. Cardiovascular disease has been the single leading cause of maternal death in the UK since the 2000-02 triennium. From 2015-17 maternal mortality rate from cardiac disease in the UK was 2.10 per 100,000 maternities which is lower, but not significantly so, than the rate for 2012-14 (2.39 per 100,000 maternities)<sup>3</sup>. Cardiac disease therefore remains the commonest indirect cause of maternal death. Undiagnosed cardiac disease, inadequate attention to warning signs and inadequate care has been some of the main contributing factors<sup>3</sup>. This indicates reducing maternal deaths due to heart disease is a global challenge.

During pregnancy, cardiovascular system undergoes progressive, significant haemodynamic changes. These include an increase of 50% in plasma volume and reduction in peripheral vascular resistance. The cardiac output increase by 30-40% during antenatal period and increase further up to 80% during the expulsive stage in labour. This is achieved initially by increasing the stroke volume and then from 28 weeks onwards by increasing the heart rate<sup>4</sup>. This ultimately increases the work load on the heart which adds to the burden of pre-existing heart disease.

Sri Lanka, as a lower middle-income country in South Asia has overcome many challenges in maternal survival over the past five decades despite many resource limitations. Nevertheless, pregnancy complicated by heart disease has remained a major management challenge to health care providers from pre conception to postpartum. The university obstetric unit of the De Soysa Hospital for Women, Colombo has served as a referral unit in Sri Lanka for severe maternal heart disease over the past decades. In order to optimize care and prevent maternal morbidity and mortality it is important to evaluate the current case-mix and adverse outcomes of patients with heart disease complicating pregnancy.

## Objectives

To describe maternal and fetal outcomes of heart disease complicating pregnancy in a single tertiary care reference unit in Colombo from 2013 to 2017.

To compare the pattern of heart disease over the years from the same unit to assess whether there is a change in the pattern of cases presenting in pregnancy.

To study the reasons for termination of Pregnancy in patients with cardiac disease during the study period.

## Method

Data was collected retrospectively from all women with a diagnosis of maternal cardiac disease admitted to Professorial Unit of De Soysa Hospital for Women from 2013 to 2017. Two hundred and forty eight (248) patient's were studied. During this period there were 26056 deliveries in the unit giving an incidence of cardiac disease complicating pregnancy as 0.95%.

Data was extracted retrospectively from clinical notes of patients using a pre-tested standardized data sheet. The data extraction sheet comprised of sections which included demographic details, index pregnancy details, details of maternal heart disease, maternal, fetal and obstetric outcome. Comorbidities were also extracted from the clinical records.

Details of the maternal heart disease was recorded according to the previous echocardiogram findings in patients who had cardiac surgery prior to pregnancy and in others based on the findings of the most recent echocardiogram carried out.

Data was analysed using SPSS statistics software version 21 and described using descriptive statistics. Approval for the study was obtained from the Ethics Review Committee of Faculty of Medicine, University of Colombo (ERC number EC-17-063).

## Results

Out of 26056 women delivered, 248 pregnancies were categorized as having 'maternal cardiac disease'. 15 patients who had therapeutic terminations are described separately. Remaining 233 patients continued their pregnancy until delivery. Characteristics of the study population who continued the pregnancy till delivery (n=233) are depicted in Table 1.

**Table 1. Characteristics of the study population who continued the pregnancy (n= 233)**

		Number (n)	Percentage
Age	less than 20	12	5.1
	20 - 24	38	16.3
	25 - 29	65	27.8
	30 - 35	82	35.1
	more than 35	36	15.4
Ethnicity	Sinhala	155	66.5
	Tamil	40	17.1
	Muslim	35	15.0
	Others	3	1.2
Parity	Primiparous	117	50.2
	Multiparous	116	49.8
Comorbidity	Hypertension	10	4.3
	Diabetes in pregnancy	30	12.9
	Anaemia	45	19.3
	Epilepsy	4	1.7
	Autoimmune disease	2	0.9
	Bronchial asthma	26	11.2
	Thyroid disease	12	5.2

### Cardiac lesion

The principal cardiac lesions were categorised as acquired and congenital, mitral valve prolapse and cardiac arrhythmias as depicted in Table 2.

**Table 2. Classification of cardiac lesions of patients who continued the pregnancy (n-233)**

Category	No	Percentage
Acquired	110	47.2%
Congenital	66	28.3%
Mitral valve prolapse	35	15.0%
Arrhythmia	22	9.4%
Total	233	100%

The acquired category consisted of patients with rheumatic heart disease, representing the majority (n=98, 89.09%). While 7.27% (n=8) had cardiomyopathy and 3.63% (n=4) had ischaemic heart disease.

Mitral valve (89.7%, n=88) was the commonest valve involved in rheumatic heart disease. Table 3 compares the pattern of cardiac lesions reported in the same unit in the past.

There were 66 (28.3%) patients with congenital cardiac lesions. The different types of congenital heart lesions seen in the study population are represented in Table 4. Twenty four (37.8%) had undergone corrective surgery prior to the index pregnancy.

**Table 3. Valvular lesions in patients with rheumatic heart disease who continued the pregnancy**

	University of Colombo Obstetrics and Gynaecology Unit 1974-77 <sup>5</sup>	University of Colombo Obstetrics and Gynaecology Unit 1989-92 <sup>2</sup>	University of Colombo Obstetrics and Gynaecology Unit 2013-17
Mitral stenosis and mitral regurgitation	5 (13%)	18 (16%)	27 (27.6%)
Mitral stenosis	25 (64%)	71 (61%)	2 (2.0%)
Mitral stenosis and aortic regurgitation		3 (3%)	2 (2.0%)
Mitral stenosis and aortic stenosis		5 (4%)	
Mitral stenosis, mitral regurgitation and aortic regurgitation	5 (13%)	3 (3%)	9 (9.2%)
Mitral regurgitation	4 (10%)	11 (9%)	21 (21.4%)
Mitral regurgitation and aortic regurgitation		1 (1%)	7 (7.1%)
Aortic regurgitation		1 (1%)	3 (3.1%)
Aortic stenosis		3 (3%)	
Tricuspid regurgitation			2 (2.0%)
Mitral stenosis, mitral regurgitation, aortic stenosis and aortic regurgitation			4 (4.1%)
Aortic stenosis and aortic regurgitation			
Mitral regurgitation tricuspid regurgitation			4 (4.1%)
Mitral regurgitation with mitral valve prolapse			10 (10.2%)
Mitral regurgitation aortic stenosis and aortic regurgitation			2 (2%)
Unclassified (Only mentioned as rheumatic heart disease)			5 (5.1%)
Total number of rheumatic heart disease patients	39	116	98

**Table 4. Congenital heart disease in pregnancy who continued the pregnancy (N=66)**

Type of congenital heart disease	n	Surgically corrected
Atrial septal defect (ASD)	38	18
Ventricular septal defect (VSD)	11	3
ASD (Sinus venosus type)	1	-
ASD, Trans pulmonary gradient	1	1
ASD, VSD	1	1
Bicuspid aortic valve	6	-
Double outlet single ventricle	1	-
Ostium primum ASD	1	-
Partial AV canal defect, ostium primum ASD	1	-
Patent ductus arteriosus (PDA), VSD	1	-
Pink tetralogy of fallot	1	-
Situs inversus	1	-
Tetralogy of fallot (TOF)	1	-
TOF, VSD	1	1

### Cardiac arrhythmias

There were twenty two patients (9.4%) patients who were diagnosed as having cardiac arrhythmias. Eighteen patients out of twenty two had supra-ventricular tachycardia (SVT) while two patients had permanent pacemaker inserted for sick sinus syndrome and two patients had temporary pace maker inserted due to complete heart block. Five out of eighteen patients with SVT had correction of cardiac arrhythmia by ablation techniques prior to pregnancy and one patient underwent ablation during the pregnancy. Other patients were managed with oral medications.

### Management

After multidisciplinary team input, patients considered to be very high risk were offered therapeutic termination of pregnancy (TOP). Fifteen patients with severe heart disease (Table 5) accepted and underwent TOP. All these terminations were done in the first trimester. These patients were analysed separately since they did not continue the pregnancy. Details of heart disease in patients who underwent TOP are described in Table 5, fourteen patients (93.3%) had permanent sterilization prior to discharge from the ward.

**Table 5. Type of heart disease in mothers who underwent therapeutic termination**

Case	Heart disease	Associated conditions
1	Large ostium secundum atrial septal defect	severe PHT
2	Large ostium secundum atrial septal defect and bidirectional shunt	Severe PHT
3	Ostium secundum atrial septal defect with left-right shunt and grade II tricuspid regurgitation	Severe PHT
4	Large ventricular septal defect	Severe PHT
5	Tetralogy of Fallot, pulmonary atresia and severe ventricular septal defect	Severe PHT
6	Ventricular septal defect and Eisenmenger syndrome	Severe PHT
7	Tight mitral stenosis	Mitral valve replacement performed and has severe left ventricular dysfunction
8	Moderate mitral stenosis, mild mitral regurgitation	Awaiting PTMC
9	Grade II-III Mitral regurgitation	Diagnosed patient with systemic lupus erythematosus having lupus nephritis and cerebral lupus
10	Moderate – tight aortic stenosis	Has undergone atrial valve replacement
11	Aortic re stenosis	History of cardiac surgery
12	Supravalvular aortic stenosis	
13	Grade III Aortic regurgitation, calcified mitral valve (normal MV function)	Mitral valve replacement done. Awaiting aortic valve replacement
14	Ischaemic heart disease	Diabetes mellitus and hypertension
15	Dilated cardiomyopathy and Grade I mitral regurgitation	

Two hundred and thirty three patients (233) continued pregnancy until delivery. In 44 (18.9%) patients, heart disease was diagnosed during the index pregnancy. Out of the patients with rheumatic heart disease (n-98), thirty (30.6%) patients had received surgical treatment (PTMC, valvular repair or valve replacements) and 39 (39.8%) received medical treatment prior to pregnancy.

Ninety six (41.2%) patients received Intensive Care Unit (ICU) care during their hospital stay. The commonest complication seen during the hospital stay was cardiac decompensation, which was seen in 13 (5.5%). Other complications observed were acute pulmonary oedema in 6 patients and thrombo-embolism in one.

Anticoagulation treatment either prophylactically or for therapeutic purposes was received by 74 (31.7%) patients.

NYHA (New York Heart Association classification) class 3 or 4 at delivery was seen in 7.7% (n=18) of patients. Twelve patients with acquired heart disease underwent Percutaneous Trans venous Mitral Commissurotomy (PTMC) during index pregnancy.

### Maternal outcome

There were two maternal deaths during the study period. One death was reported from a primigravida who had double outlet single ventricle with moderate to severe pulmonary hypertension. She delivered a live baby at 30 weeks and 2 days of gestation by elective caesarean section. She developed MRSA (Methicillin Resistant Staphylococcus Aureus) and ESBL (Extended Spectrum Beta Lactamase) positive lower respiratory tract infection and heart failure while in the ICU. She succumbed on day 6 post-partum despite optimal treatment. This patient died mainly due to worsening cardiac condition with the infection.

The second death was reported from the primi gravid mother whose antenatal period was complicated with gestational hypertension, bronchial asthma, perimembranous VSD and severe pulmonary hypertension. She delivered a live baby at 33 weeks and 4 days by elective caesarean section. She developed post-partum heart failure and died on day 3 in the ICU.

Both patients presented to our unit in the second trimester and it was decided to continue the pregnancy since the second trimester termination is likely to have high mortality and morbidity.

Pulmonary hypertension (PHT) was present in 22.9% of women with acquired heart disease and 31.7% of women with congenital heart disease. Severe PHT was present in 4 women. Pulmonary hypertension was detected in 7 out of the 15 women with heart disease who underwent medical termination of the index pregnancy during the study period.

Percutaneous Transvenous Mitral Commissurotomy (PTMC) was performed during pregnancy in 12 patients and two had insertion of temporary pacemaker. Double valve replacement was performed at 28 weeks of gestation on a mother who had grade IV mitral stenosis, aortic stenosis and grade I aortic regurgitation.

### Delivery

Vaginal delivery was observed in 131 (56.2%) patients while 102 (43.8%) underwent caesarean section. Among the patients who underwent caesarean section, combined spinal and epidural anaesthesia, spinal anaesthesia, epidural anaesthesia and general anaesthesia were given to 32%, 31%, 18% and 19% respectively. Twenty (15.26%) of patients who had vaginal delivery, delivered in the ICU setting. The rest delivered in the labour ward in the high dependency unit.

The postpartum period was complicated with haemorrhage in 10 patients and 5 patients developed heart failure.

### Fetal outcome

Three intrauterine fetal demises were documented during the study period. 58 (24.8%) babies had a birth weight less than 2.5kg in the study population. Only one baby required NICU admission and seven babies' required SCBU admission while 14 babies were resuscitated at birth due to low Apgar score. Fetal outcome is described in Table 6. Twenty three babies were delivered before 37 completed weeks.

There were 9 babies with murmurs out of which two were confirmed as having Atrial Septal Defect (ASD) and one as having ASD and Patent Ductus Arteriosus (PDA). All 3 babies who were detected to have congenital heart disease were born to mothers with acquired heart disease. Others had normal echocardiography. Two babies also had non cardiac congenital defects (spinal dermal cleft sinus).

### Contraception

Advice on contraception was provided to all patients. However only 129 (55.4%) patients decided on a contraceptive method prior to discharge. Out of the patients who decided on a contraceptive method forty four (34.1%) patients consented for permanent female sterilisation. Sub-dermal implants were inserted to 69 (53.5%) of patients. Intrauterine device was accepted by 12 (9.3%). Four patients had it inserted during the post-partum period within first 48 hours and other 8 wished to have it inserted after 6 weeks. Other four patients decided to use the barrier method and depomedroxy progesterone acetate injections. One hundred and four (44.6%) patients were referred to the local clinic to initiate a family planning method since the patients were undecided at the time of discharge.

**Table 6. Fetal outcome (n=233)**

	Number	Percentage
Maturity at Birth		
Extreme preterm (< 28 weeks)	1	0.4
Very preterm (28 - 32 weeks)	3	1.2
Moderate to late preterm (32 - 37 weeks)	19	8.1
Term	207	88.8
Post term	3	1.2
Complications at birth		
Respiratory distress syndrome	2	0.8
Intrauterine death	3	1.2
Birth defects	5	2.1
Birth weight		
< 2.5 kg	58	24.8
2.5 - 3.5 kg	162	69.5
>3.5 kg	13	5.5

## Discussion

The incidence of heart disease complicating pregnancy in the present series was 0.95% compared to 1.46% in the same unit from 1989-1992<sup>6</sup>.

Rheumatic heart disease remains the commonest type of acquired cardiac disease complicating pregnancy according to the current as well as the previous studies conducted in Sri Lanka<sup>5,6</sup>. In the present study 42.06% (n=98) of patients had rheumatic heart disease compared to 70% in the same unit during the period 1989-92<sup>6</sup>. Although incidence of rheumatic heart disease has declined possibly with advancing socio-economic conditions, the present series shows that in Sri Lanka rheumatic heart disease still remains a significant problem. Mitral stenosis is the commonest valvular lesion in this category in similar studies conducted in Sri Lanka<sup>5,6</sup>. This is in keeping with the pathological involvement of cardiac valves in acute rheumatic fever<sup>7</sup>. In the study conducted from 1989-1992 pure mitral stenosis accounted for 61% of

rheumatic valvular lesions where as in the present study the commonest was combined mitral stenosis and mitral regurgitation (27.6%). Mitral valve involvement in rheumatic fever leads to development of complications such as pulmonary hypertension and acute pulmonary oedema<sup>7</sup>. A study of all maternal deaths caused by heart disease in 2004 in Sri Lanka show that rheumatic mitral valve disease was the most common cause of maternal death due to heart disease<sup>8</sup>.

In the global context, congenital heart disease is the commonest heart disease to complicate pregnancy. In Sri Lanka over the past decades advancement of therapies especially surgeries for patient with congenital cardiac disease has given many children the chance to survive to their reproductive age. A research on outcome of heart disease in pregnancy conducted in 28 countries by European Society of Cardiology showed that most patients had congenital heart disease (66%) followed by valvular heart disease (25%), cardiomyopathy (7%), and ischaemic heart disease in

2%<sup>9</sup>. Studies conducted in recent years in Sri Lanka and in the current study, it is shown that Atrial Septal Defect (ASD) is the commonest congenital heart defect among pregnant women<sup>6</sup>. However, in the current study ASD was not corrected in 20 (52.6%) and 13 (65%) of these patients were detected to have pulmonary hypertension during the index pregnancy. It is important to note that similar situation was seen in the previous study where 46.7% of patients did not have corrective surgery for ASD<sup>6</sup>. These patients would have benefited from surgical correction as uncorrected ASD can lead to pulmonary hypertension (PHT) which will lead to poor maternal and fetal outcome. It is important that all medical officers including the primary care physician encourages women to undergo corrective surgery to avoid development of these complications.

In the current study 22.2% (n=26) of primiparous and 15.5% (n=18) of multiparous women with cardiac disease was diagnosed during the index pregnancy. Even with a well-established antenatal services in Sri Lanka, the diagnosis of heart disease in 15.5% (n=18) of women were missed in previous pregnancies despite their contact with the health care system. Therefore screening for heart disease during the school health screening programmes and antenatal period should be emphasized among health care providers and especially among the primary care physicians.

During the study period 15 women underwent medical termination of pregnancy due to severe maternal heart disease. Most of these pregnancies were unplanned and in multiparous women. This emphasises the need for pre pregnancy advice on a reliable contraceptive method if pregnancy is contraindicated.

Pulmonary Hypertension (PHT) is considered as a contraindication to pregnancy<sup>10</sup>. Despite availability of advance therapeutic modalities, it still carries a high risk for increase morbidity and mortality<sup>11</sup>. Our study also showed that the presence of PHT is a significant factor in affecting pregnancy outcome as both maternal deaths and one out of the three fetal deaths were seen in the group with PHT. PHT was present in 22.9% of women with acquired heart disease and 31.7% of women with congenital heart disease. Pulmonary hypertension was detected in 7 out of the 15 women with heart disease who underwent medical termination of the index pregnancy during the study period.

Therefore it is evident that PHT in pregnancy is still a common occurrence resulting in maternal morbidity and mortality. This confirms the need of individualised pre pregnancy counselling and suitable family planning for patients with heart disease in the reproductive age group. In addition pregnant women with heart disease should be referred to a tertiary care centre for comprehensive evaluation of the disease status to decide on continuing the pregnancy and formulating a personalised management plan.

Surgical interventions done during pregnancy in our study included, Percutaneous Transvenous Mitral Commissurotomy (PTMC), insertion of temporary pacemaker and double valve replacement. Double valve replacement was performed on a mother who had grade IV mitral stenosis, aortic stenosis and grade I aortic regurgitation at 28 weeks of gestation. She suffered from persistent tachycardia and atrial flutter following the surgery. Her pregnancy resulted in an intrauterine death where she delivered a macerated fetus at 34 weeks of gestation. This indicates the poor fetal outcome in open cardiac surgery compared to PTMC or insertion of a pacemaker. Previous studies have shown that surgical correction of cardiac lesion prior to pregnancy was associated with a better outcome<sup>6</sup> and that patients who undergo valvular surgery prior to pregnancy appear to have fewer complications<sup>12</sup>.

Cardiac arrhythmias are more frequently detected and managed during the current study compared to the previous studies. This is most likely due to increase recognition of these conditions and availability of newer management options.

The advantages of reduced blood loss, reduced metabolic demands, reduced stress response and lower incidence of postoperative and pulmonary complications are reasons for vaginal delivery being preferred over caesarean section<sup>13</sup>. Close monitoring in the intensive care unit, meticulous fluid management, adequate pain relief and shortening the second stage have shown to reduce the cardiac burden during vaginal delivery<sup>14</sup>. However in a high risk situation delivery by planned caesarean section enhances safety<sup>6</sup>. In our study population the mode and time of delivery was determined by a multi-disciplinary care team. The cardiac lesions for which elective caesarean section was carried included complicated rheumatic mitral valve disease, complicated congenital lesions and persistent cardiac arrhythmias.

Heart failure increases the morbidity and mortality of pregnant women with heart disease<sup>15</sup>. Congestive heart failure may develop in the first 24-72 hours after delivery<sup>16</sup>. Therefore prevention, prompt detection and proper management play a significant role in reducing the morbidity and mortality associated with cardiac failure. Close monitoring; optimum management of complications and emergencies during labour and immediate postpartum period with multidisciplinary team input can significantly reduce morbidity and mortality from cardiac disease complicating pregnancy. This can be achieved by providing intrapartum and postpartum care in an intensive care unit (ICU). In the current study, significant number of women received ICU care as a routine practice. It is important to manage patients with heart disease in setting with facilities for ICU care; preferably in a tertiary care hospital.

Women with heart disease who have a poor cardiac reserve may become symptomatic following delivery due to fluid shift and auto blood transfusion from placenta. Diuretics plays a key role in reducing these effects<sup>16</sup>.

Out of the 13 women who developed heart failure in the index pregnancy 8 had babies with low birth weight. A cohort study suggested a significant reduction in fetal growth rate with maternal heart disease which is associated with reduced birth weight and that the most significant predictors are the maternal cyanosis and reduced cardiac output<sup>17</sup>. Even though there were 3 intrauterine deaths, considering the other fetal parameters such as prematurity, birth weight, complications at birth and birth defects the overall fetal outcome has been satisfactory in the study population. There were 9 babies with murmurs out of which two were confirmed as having Atrial Septal Defect (ASD) and one as having ASD and Patent Ductus Arteriosus (PDA). All 3 babies who were detected to have congenital heart disease were born to mothers with acquired heart disease. Two babies also had non cardiac congenital defects (spinal dermal cleft sinus). Even though a previous prospective multicentre study stating that the risk of inheriting heart disease from mothers with congenital heart disease ranges between 4% and 8%<sup>18</sup>, the mothers with congenital heart disease did not have babies with diagnosed congenital heart disease in this study.

Contraception is an important part of the prepregnancy counselling and management plan of women with heart disease. This will help to reduce the number of unplanned pregnancies and terminations<sup>17,19</sup>. Furthermore providing contraception is a low cost strategy to reduce maternal mortality in Sri Lanka and other low income countries<sup>8</sup>. In our study all women with severe pulmonary hypertension underwent sterilization at the time of delivery. Our study revealed that contraception was arranged for 55.4% of mothers prior to discharge (Tubal ligation and resection, sub dermal implants, postpartum IUCDs) and the remaining were referred to field clinics for family planning services. However, it is our recommendation that all women with heart disease should have a plan for family planning at the time of discharge.

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