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STUDY FROM EASTERN INDIA

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Research Article

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ABSTRACT

Background: The physiologic hemodynamic alteration in cardiovascular system during pregnancy can result in a poor maternal outcome including mortality in patients with preexisting cardiac diseases.
Objectives:
Aims of this study were to identify direct and indirect causes of maternal mortality in pregnant women dying due to cardiac causes and to identify avoidable factors if any.
Materials and methods: This is a retrospective analysis of four years data of mothers with preexisting cardiac diseases was conducted in the Dept. of Obstetrics & Gynaecology of IPGME&R in collaboration with Dept. of cardiology.
Results: A total of fifty pregnant women dying due to cardiac causes were included as subjects. Fifty age & parity controls with successful outcome were compared. Mean age the subjects was 25.36±4.34 years. Among mortality cases 34% had rheumatic heart disease, then followed by peripartum cardiomyopathy in 18%, congenital heart disease in 6% and others (hypertensive cardiac diseases, idiopathic dilated cardiomyopathy and systemic lupus erthymatosus etc.) in 42%. Direct causes of maternal mortality included right heart failure, left heart failure, pulmonary emboli, cardiomyopathy, ventricular tachycardia etc. Indirect causes observed were sepsis, heart failure during labour, postpartum stress, anaemia etc. Noticed avoidable factors were referral status, type of referral facility, regularity of ANC, logistical problems, availability of cardiological support and awareness status of patients and clinicians etc.
Conclusion: Whether maternal mortality in women with cardiac disease can be prevented or not is a debatable issue. Pregnancy outcome mainly depends on disease itself, nature of lesion, presence of facilities &other associated morbidities.

INTRODUCTION

Pregnancy encompasses increase in the circulating estrogen and progesterone resulting huge hemodynamic alteration in the whole physiology including the cardiovascular system. Thus a mother with preexisting heart disease will be more affected by this unavoidable physiological change. The fate of cardiac mothers depend on their timely diagnosis, preconception care, antenatal and postnatal care, availability of tertiary care centers with all multidisciplinary approach and judicious interventions for complications that usually affect the pregnancy.

India despite being a low income country has a maternal mortality rate of 178maternal deaths/100000live births [1]. Cardiac diseases contribute as a consistent & major non obstetric cause of maternal mortality. The global figure for maternal heart disease in pregnancy is around 1% [2]. Hence for a further reduction in maternal mortality, it is important to understand the causes of death in a mother with preexisting cardiac disease & the factors predisposing to poor outcome in these patients.

We discussed here 50 mothers with preexisting cardiac diseases succumbing to maternal death and compared them with another set of women with successful pregnancy outcome in spite of preexisting cardiac disease. It is a retrospective evaluation of direct & indirect causes of maternal mortality in women with preexisting cardiac diseases. Another important objective of the study was identification of avoidable factors that could lower down mortality in these cases. This would in turn help to understand the areas that have scope for betterment in the care being provided to these patients. It would also help to formulate strategies to further bring down mortality rates.

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MATERIALS AND METHODS

The study was a retrospective case control study conducted in the Department of Obstetrics & Gynaecology in a tertiary care set up in Eastern India in collaboration with department of Cardiology in the same hospital over a period of 4 years.

Cases included 50 maternal deaths in women with preexisting cardiac diseases. Maternal death in this study being defined as per the WHO definition as "death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes"[3]. Controls included 50 age & parity matched pregnant women with preexisting cardiac diseases who are alive and had a favorable pregnancy outcome.

After proper institutional ethical clearance & informed consent from the patient data were collected. It included age, parity, demographic details, gestational age and nature of cardiac lesion, fetal outcome, direct & indirect cause of death in cases. The cause of death was established clinically with the help of investigations but not confirmed by postmortem examination. When two possibly lethal causes were found in the same case, the apparently more important cause has been named.

The avoidable factors were classified as the type of facility where patient was being referred from, irregularity of antenatal checkup, delayed referral, substandard care in terms of health personnel problems, health service communication defects etc. All the results were tabulated & analyzed statistically. Software used Statistica version 6 [Tulsa, Oklahoma: StatSoft Inc., 2001]. Calculation of p value was done by Student's unpaired t test, Mann-Whitney U and Fisher's exact test.

RESULTS

Baseline characteristics: the baseline characteristics of the study population were shown in table 1. Age didn't have any significant effect on the outcome as there was no particular age distribution. Mean age distribution in study population was 23.36 years.

Table 1 Baseline characteristics of both groups

Parameter	Cases(n=50)	Controls(n=50)	P value
Age (mean ±SD)	25.36+/-4.34	23.56+/-4.01	0.812
Primi	26(52%)	28(56%)	0.841
Multi	24(48%)	22(44%)	
Rural	38	37	1.00
Urban	12	13	

Cardiac lesions: The distribution of cardiac lesions was tabulated in table 2. Patient profile in the study group including both cases & cohorts resembled that of a developing country with valvular lesions secondary to childhood rheumatic heart disease being the most predominant lesions (34%). Among them organic mitral stenosis (MS) was the most common (76%) pathology, followed by mital regurgitation (MR), aortic regurgitation and pulmonary arterial hypertension. We observed only 3 congenital heart disease in the study group (one patient with ventricular septal defect, MR and pulmonary arterial hypertension, another with Endocardial Cushion's defect, pulmonary stenosis, MR, tricuspid regurgitation, sever outflow tract defect and other with Ebstien's anomaly). Among myopathy, peripartum cardiomyopathy (PPCM) was

observed in 9 cases. Others included pregnancy related diseases with cardiac complications like hypertensive cardiac diseases (18), dilated cardiomyopathy with VSD(1) , systemic lupus erythematosus & grade IV lupus nephritis (1), primary pulmonary artery hypertension & deep vein thrombosis(1).

Table 2 Distribution of cardiac lesions in both groups

Cardiac lesions	Cases(n=50)	Controls(n=50)
RHD*	17(34%)	21(42%)
CHD*	3(6%)	4(8%)
PPCM*	9(18%)	1(2%)
Others	21(42%)	24(48%)

*Rheumatic heart disease, * Congenital heart disease,*Peripartum cardiomyopathy

Direct and indirect cause of death: Table 3 identified left ventricular failure & classical congestive cardiac failure were the most common direct causes of death in 40% & 26% of cases respectively. Intrapartum and postpartum stress were very much highlighted in the indirect causes. Sepsis was also an associated finding among 14 mothers.

Table-3 Direct and indirect cause of maternal death in the cardiac disease

Direct causes	Numbers of cases(n=50)	Indirect causes	Number of cases(n=50)
CCF &Pulmonary hypertension	7(14%)	PPH &DIC	2(4%)
Aspiration pneumonia	1(2%)	Anaemia	5(10%)
Cardiac arrest	3(6%)	Acute kidney injury(AKI)	3(6%)
Cardiac tamponade	1(2%)	Atrial fibrillation	1(2%)
Cardio respiratory failure	7(14%)	DIC	1(2%)
Sudden cardiac death & CCF	1(2%)	Embolism	1(2%)
Dilated cardiomyopathy & left heart failure	9(18%)	HELLP	1(2%)
DIC	1(2%)	Sepsis	9(18%)
DIC & heart failure	1(2%)	During labor heart failure	8(16%)
DIC with cardiorespiratory failure	2(4%)	Operative interference	4(8%)
Right heart failure &infective endocarditis	1(2%)	Magnesium toxicity& AKI	2(4%)
		Multiple pregnancy	1(2%)
		Multiple organ failure	1(2%)
		Sepsis, anaemia & obstetric cholestasis	1(2%)
		Eclampsia	18(36%)
		Postpartum stress	5(10%)
		Premature preterm rupture of membrane	1(2%)
		Pulmonary TB	1(2%)
		Antepartum haemorrhage & thalassemia trait	1(2%)

Obstetric outcome: Table 4 summarized the obstetric outcome. There was higher incidence of operative intervention in the control group (80%) in comparison to the cases (58%). Mean gestational age of the delivery in the case group was 35.43± 2.47 weeks. Deliver death interval was 74.79±93.49 hours. Majority of the women died in the postpartum phase and only 20% died during pregnancy.

Table 4 Obstetric outcome in the mortality cases

Obstetric outcome	Cases(n=50)	Controls(n=50)	Pvalue
Mode of delivery			
VD*	18(36%)	10(20%)	0.03
LSCS*	29(58%)	40(80%)	
Gestational age at delivery (Mean ± SD)	35.43+/-2.47	36.38+/-2.29	0.043
Delivery death interval hours (Mean ±SD)	74.79±93.49	--	

*Vaginal delivery, *Lower segment cesarean section

Neonatal outcome: Table 5 revealed higher number of preterm deliveries in control group (44%) than cases (24%). Mean birth weight of babies in the case group was 2.38±0.526 kg and there was no significant difference between two group's birth weight (p=0.442). Perinatal mortality was 16% in the group of women with mortality.

Table 5 Neonatal outcome

Parameters	Cases(n=50)	Controls(n=50)	Pvalue
Birth weight(kg) (mean ± SD)	2.38+/-0.526	2.31+/-0.401	0.442
Fetal growth restriction	3(6%)	0(0%)	
Preterm deliveries	12(24%)	22(44%)	
Twin pregnancy	1(2%)	0(0%)	
Low birth weight babies	7(145)	13(26%)	
IUD	4(8%)	1(2%)	0.018
Still births	4(8%)	0(0%)	
Normal	19(38%)	14(28%)	

Avoidable factors: Avoidable factors were tabulated in table6: delayed referral (94%vs 34%;p<0.001), ICCU facility availability(34%vs 62%; p=0.009), personal problems (96%vs 14%;p<0.001), logistical problems(60% vs 10%; p<0.001), facility problems (60%vs 10%;p<0.001) and health service communication defect (58%vs 4%;p<0.001).

Table 6 Avoidable factors

Factors	Cases	Controls	pvalue
Referred	47(94)	17(34%)	<0.001
ICCU availability	17(34%)	31(62%)	=0.009
Personnel problems	48(96%)	7(14%)	<0.001
Logistical problems	30(60%)	3(6%)	<0.001
Facility problems	30(60%)	5(10%)	<0.001
Healthservice	29(58%)	2(4%)	<0.001
communication defect	6(12%)	35(70%)	<0.001

DISCUSSION

This study provides a contemporary estimate of cause of mortality in pregnant women with heart disease. The lack of mortality in the setting of comprehensive antenatal care as observed in the control group emphasizes the importance of greater vigilance in the care of these women.

In these four years we have faced 108 maternal deaths for various reasons, among them 48% had mortality with preexisting cardiac problems. Our finding is almost similar to Subsaharan Africa which reported 34% maternal death for cardiac reason [4]. In Pritoria the available data was 3.3% [5]. In Sri Lanka cardiac disease was second only to postpartum haemorrhage as the cause of maternal deaths in 2004[6]. In Egypt authors revealed 1.16% maternal mortality due to cardiac problems [7]. Confidential Enquiries into Maternal and Child Health (CEMACH) blamed cardiac cause to be a consistent major cause of maternal mortality [8]. We could draw out a conclusion from the above data that cardiac disease with pregnancy was a life threatening event even in the good set up of developed countries.

Regarding distribution of cardiac pathology in this study, it was markedly different from Western countries. In series from North America or Europe, congenital heart disease is the most frequent heart disease during pregnancy followed by valvular heart disease [2, 9]. Similarly, most cases of maternal deaths in

UK were related to congenital heart disease, cardiomyopathy, ischeamic heart disease and aortic aneurysm and death due to valvular disease being rare [8]. Study conducted in Sub-Saharan Africa by Diao *et al* revealed that 92% of pregnant women with heart disease had RHD [6]. Similar finding were there in data from Pritoria and Sri Lanka [5, 7]. The present study observed nine cases of PPCM in the mortality group. These striking differences in the geographic distribution of heart disease could be the result of early diagnosis and treatment of childhood sore throat and rheumatic fever in western countries, vigilant antenatal care including fetal echocardiography and other amenities to diagnose the heart disease at fetal level, better awareness among patients regarding congenital heart diseases & the level of care being provided to the patient.

Left ventricular failure & pulmonary edema emerged as the greatest causes of mortality in the studies conducted in African countries [4,5,7] . The present study showed left heart failure in 17 cases and right heart failure in 9 cases. It however proved that whatever may be the type, left or right, heart failure can definitely be considered as an important direct cause of mortality. Other indirect causes observed were associated septicemia in 10 cases, anaemia in 5 and intra and postpartum stress in 13 cases. All nine PPCM cases who died had very poor functional capacity of heart with ejection fraction <30% and among them 5 had a subsequent pregnancy Majority of the patients with MS had valve area of ≤ 0.9 cm^2 and none had history percutaneous transvenosus commissurotomy (PTMC). Researchers had opined that when symptoms persist despite use of beta-blockers, diuretics, PTMC should be considered before delivery [10,11]. Thus it is important to know that difference exists between western countries & developing countries in the frequency & risk of hemodynamic decompensation leading to mortality in women with MS. These differences may be due to diagnosis at an earlier stage & use of therapeutic resources.

So in our setup we considered important primary predictors of maternal mortality as heart failure, functional capacity of the heart and exact nature of lesion itself. Secondary predictors were septicemia and maternal stress in labor and afterwards. Study from Egypt correlated maternal mortality to maternal cardiac functional classification [7]. They stated that all complications occurred in patients with functional classes III and IV. Samuel C. Siu *et al* analyzed the risk and predictors for pregnancy related complications in women with heart disease and concluded that poor maternal functional class or cyanosis, myocardial dysfunction, left heart obstruction, prior arrhythmia and prior cardiac events were predictive of maternal cardiac complications [12]. It is vital to diagnose underlying cardiac disease in time to prevent decompensation during pregnancy & intensively treat those who decompensate.

More operative interventions resulting in higher number of preterm babies in the control group in comparison to cases is suggestive of earlier intervention being carried out in the control group before acute decompensation sets in leading to a more favorable maternal outcome but a poorer fetal outcome. All cesarean sections were done with graded epidural anesthesia. Immediate post-operative care was carried out in the intensive coronary care unit (ICCCU) with the help of cardiologists. Intra uterine death and still births were more observed in the case group (p=0.018). Acute decompensation

in mothers with heart disease has a definite effect on fetal outcome. The study showed higher percentage of patient related avoidable factors in cases as compared to controls e.g majority of the cases being unbooked or being booked late in the course of pregnancy, having irregular antenatal care or no proper antenatal cardiological consultation and almost no awareness regarding the disease. Important administrative factors that were identified included logistical & health personnel based problems, lack of ICCU availability, delayed referral & health service communication defects.

From these analysis we felt, there needs to be education and awareness at three levels of our level health sectors. Primary level is the woman with cardiac disease contemplating pregnancy who should be educated about the disease & the potential mortality & morbidity that pregnancy holds. If possible family members should also be taken part in this process.

The secondary level involved the doctors, nurses and peripheral health workers who should recognize the symptoms and how early to refer to higher centers and also should have a basic idea of heart failure management. The tertiary level includes team of staffs and amenities of a tertiary care center which should be prepared well enough to carry out vigilant antenatal care, for timely admissions and to take timely decisions for termination. There should be good communication between patients and staffs and among care giving staffs themselves.

As present study showed RHD is how much burdening to the society, health department should address rheumatic fever as global concern and implement awareness regarding rheumatic heart disease and its effect on the community and also should stress on that fact that it is well preventable.

Limitations of the present study were, as autopsy wasn't carried out, diagnosis of cause of death was majorly based on clinical grounds. Detailed data regarding anesthetic interventions & hence mortality due to same could not be delineated in the referred cases. The study was a univariate analysis & hence multiple factors influencing the outcome could not be studied.

Because of the continuing fall in direct obstetric causes of death in India, rheumatic MS has emerged as a significant contributor of mortality in pregnancy.

Hence all women with heart disease should receive preconceptional counselling regarding maternal functional status, need for optimum prenatal care, plan to minimize risk before conception, risks to the fetus, anticipated hospitalization& the potential chance of mortality. Keeping all this in view the woman should make a decision as to whether to embark on a pregnancy or not. Once pregnant, patient should be managed by a multidisciplinary team including obstetrician, cardiologist, anesthetist, pediatrician etc.

CONCLUSION

Cardiac disease in pregnancy is associated with high morbidity & mortality rate for the mother.

Regular ANC, close hemodynamic monitoring during labor & puerperium & early intervention to prevent the onset of decompensated heart failure is crucial to the management of these patients. Pregnancy should be contemplated only after optimization of maternal condition & role of contraception should be discussed with all patients. Preventable factors that can reduce mortality significantly should be given special attention.

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