

## Role of prenatal fetal echocardiography in maternal medical disorders

N. Hephzibah Kirubamani

Obstetrics & Gyneacology, Stanley Medical College & Deputy Superintendent, Govt. RSRM Lying. In Hospital, Chennai-600 013, India.

hepsi1002@yahoo.co.in

### Abstract

Cardiac defects are the most common structural abnormalities seen in 8 per 1000 infants born alive. Prenatal diagnosis of a congenital cardio vascular malformation by fetal echocardiography influences the management of pregnancy, labour and delivery and post natal care. Prospective study was conducted on 180 pregnant women by fetal echocardiography at 20 weeks of gestation at Govt. R.S.R.M. Hospital, Royapuram, Chennai-13 with known risk factors for congenital heart disease in their offspring and with underlying maternal medical disorders. Four chamber view made out in 172 cases, congenital cardiac lesion were detected in 14 cases following detailed examination. Sensitivity 95.6%, Positive predictive value 92.5%, Specificity 22.2%, Negative predictive value 33.3% .Cardiac anomalies diagnosed in 18 cases diagnosed prenatally. Our sensitivity was 94%, specificity 100% positive predictive value 100%, positive negative value 91.7% .20 cases of lethal extra cardiac anomalies were detected one case of TRAP was diagnosed and in 81% cases showed normal karyotyping and 19% cases showed abnormal karyotyping. In all 20 cases of lethal anomalies termination was offered. For TRAP embolization was done for acardiac twin. 134 cases delivered vaginally, 25 cases LSCS done for obstetrics cause. Postnatal follow-up of two cases of fetus showed interventricular septal thickness and cardiomyopathy died in utero. For VSD case autopsy done. All 11 live babies and the one case of VSD missed prenatally were referred to the cardiologist .Fetal echo is a useful noninvasive tool which can predict "Fetus at Risk" whenever there is underlying maternal medical disorder.

**Keywords:** Prenatal disorder, cardiac defects, echocardiography, human fetal.

### Introduction

Cardiac defects are the most common structural abnormalities seen in infants born alive. They occur with a frequency of 8 per 1000 live birth and are seen four to five times more frequently in stillbirths. Prenatal diagnosis of a congenital cardio vascular malformation by fetal echocardiography influences the management of pregnancy labour and delivery and post natal care.

A number of universally known risk factors for congenital heart disease have been recognized as an indication for an extensive prenatal examination. The outcome of fetal echocardiography may prompt additional diagnostic tests and subsequent adjustment of obstetric management.

In the present study we attempted to evaluate the efficacy of fetal echocardiography in women at known increased risk for congenital heart disease in their offspring.

### Materials and methods

Prospective study was conducted on 180 pregnant women by fetal echocardiography at Govt. R.S.R.M. Lying.In Hospital, Royapuram, Chennai-600013 with a known risk factors for congenital heart disease in their offspring.

Fetuses were scanned with Aloka 243,3.5mhz/5mhz transducer. The fetal echo was done for pregnant women at 20 weeks to term with underlying maternal medical disorders. The maternal medical disorders included are diabetes mellitus, heart diseases both congenital and

acquired, anaemia, epilepsy, collagen disorders, maternal infection (TORCH) Bronchial asthma and essential hypertension. Both singleton and twins were screened. A case of Twin Reversal Arterial perfusion (TRAP) was also induced within study.

### Selection criteria

Pregnant women with the underlying maternal medical disorders mentioned earlier which places the fetus at a greater risk for congenital heart disease and for compromised cardiac function were included in this study. These patients were being treated by the concerned specialist for the medical disorders. The exclusion criteria was smokers, alcoholics, patients with multiple medical disorders taking medication other than for the existing disease, patients suffering from infectious disease like jaundice, varicella were excluded in this study.

In every patient included in this study the maternal medical disorder was confirmed clinically and with the use of relevant investigations. All patients underwent biometric examination of the fetus; Followed by two dimensional fetal echocardiography and out flow tract evaluation and real time Doppler flow mapping. Every case of cardiac anomaly we examined the fetus for extra cardiac anomaly and *vice versa*. We combined karyotyping of the fetus when both cardiac and extracardiac anomalies were present.

### Results

Table 1 shows analysis of the gestational age at which fetal echo was done. Maximum

Table 1. Gestational age in which fetal echo done

20-24	25-28	29-32	33-36	37-40
5	10	25	60	80
(2.7%)	(5.5%)	(13.8%)	(33.3%)	(44.4%)

Table 2. Maternal medical disorders in which fetal echo was done

Diabetes Mellitus	30	16.6%
Congenital heart Diseases	20	11.1%
Acquired heart diseases	31	17.2%
Anaemia	39	21.6%
Essential Hypertension	16	8.8%
Epilepsy	12	6.6%
Broprnchial Asthma	11	6.1%
Collagen disease	2	1.1%
Maternal infection (TORCH)	19	10.5%

number of cases was done between 37 week to term. This is because of the late antenatal registration prevalent in patients attending this hospital. Table 2 shows fetal echo was done for the patients with the disorders mentioned in Table 2. These medical disorders place the fetus at increased risk for congenital heart disease and for compromised cardiac function.

Table 3. Results of four chamber view

No.	Positive	Anomalies detected	No.	Negative	Anomalies detected
172	95.5%	14	8	4.5%	4

Table 4. Types of structural cardiac anomalies diagnosed and gestational age detected

Type	Gestational Age(weeks)	No.	%
Dextrocardia	36,37	2	11.1
VSD	32,34,36,38	4	22.2
ASD	34,36,37,38	4	22.2
Pulmonary Atresia with VSD with right ventricle dilatation	32	1	5.5
Fallots Tetralogy	36,37	2	11
Hypoplastic Rt.Ventricl	36,38	2	1
Pulmonary Stenosis	36	1	5.5
IVS thickened with cardiomyopathy	35,37	2	11

Table 5. Associated extra cardiac anomalies detected

Extracardiac Anomaly	No.	Type of cardiac lesion	No.	%
Hydrocephalous	4	ASD	2	19
Holoprocencephaly	1	ASD	2	4.7
Anencephaly	4	VSD	1	19
Osteogenesis Imperfecta II	1	ASD	1	4.7
Wrist deformity	1	VSD	1	4.7
Omphalocele	1	VSD	1	4.7
Renal Dysplasia	1	PAC	1	4.7
Cystocleidy	1	PAC	1	4.7
Cystic hygroma	1	ASD	1	4.7
Nuchal oedema thickening of skin	1	VSD	1	4.7
TRAP	1	-	1	4.7
NIH	4	Pericardial effusion, complete heart block	1	4.7

Table 3 shows results of four chamber view. Out of 180 cases four chamber view made out in 172 cases and congenital cardiac lesion were detected in 14 cases due to subsequent out flow tract examination and detailed M.mode tracing. Four chamber view was not done in 8

cases. Out of 8 cases, one case was due to obesity, 1 case of oligohydramnios, 2 cases of polyhydramnios, and 4 cases due to cardiac lesion, giving risk to sensitivity 95.6%, positive predictive value 92.5%, specificity 22.2% and negative predictive value 33.3%.

Table 4 shows types of structural cardiac anomalies diagnosed and gestational age detected. Among 18 cases diagnosed prenatally, 2 were false positive and both were A.S.D. Or sensitivity was 94%, specificity 100%, positive predictive value 100% and positive negative value 91.7%.

Table 5 indicates the associated extra cardiac anomalies detected. Our study clearly indicates that it is important to examine the heart in every case of cardiac anomalies with extra cardiac anomaly and *vice versa*. 20 cases of lethal extra cardiac anomalies were detected and one case of TRAP was diagnosed.

Table 6. Type of arrhythmias

Lesion	No
Complete Heart block	1
Perinatal A trial contraction	2

Table 6 shows two cases of premature atrial contraction were detected with gross oligohydraminos and kidney anomalies and both fetus died *in utero*. A case of complete heart block was diagnosed in NIH.

Table 7. Results of karyotyping

Normal	Abnormal
17 (81%)	4 (19%) Trisomy 18,13,21 Tetraploidy

Table 7 shows results of Karyotyping in 'lethal anomalies'. In prenatal assessment of fetus whenever there are abnormalities in fetal echo or associated with extra cardiac anomalies, karyotyping should be done. In our study we found Trisomy 21, 18 and 13 were found and also one case of laboratory induced tetraploidy. Cases of 81% showed normal karyotyping and 19% cases showed abnormal karyotyping.

Table 8. Obstetric management

Mode of Delivery	No
Termination (Lethal Anomalies)	20
Embolization(TRAP)	1
Vaginal Delivery	134
LSCS	25

Table 8 indicates obstetric management. In all 20 cases of lethal anomalies termination was offered. For TRAP embolization was done for acardiac twin. 134 cases delivered vaginally and 25 cases had LSCS done for obstetrics cause.

Table 9 shows postnatal follow up. In two cases of maternal diabetic mellitus the fetus showed interventricular septal thickness and cardio myopathy and both the fetuses died in utero. Out of 3 neonatal death one case of VSD underwent autopsy. One case of hypoplastic right ventricle

Table 9. Postnatal follow-up

Total cases true +ve	Intrauterine death	Neonatal death	Alive
16	2 (12.5%)	3(18.7%)	11(68.7%)

with pulmonary atresia and other with fallouts tetralogy, parents were not willing of a autopsy. All 11 live babies and the one case of VSD which was missed prenatally were referred to the cardiologist for further follow up.

### Discussion

The results of this study suggests that whenever there is a normal appearing heart the new born is most likely to be normal at delivery. These findings are similar to that observed by Carl Nimrod *et al.* (1984). The incidence of cardiac anomalies occur in patients with no risk factors and also only 20% occur in women with risk (Anandakumar *et al.*,1992). In our study the incidence of cardiac anomalies were 10% and extra cardiac anomalies 11.4%.

We observed the incidence of both cardiac and extra cardiac anomalies are much higher being 3 and 6 respectively out of 30 maternal diabetes mellitus screened. We studied 50% incidence of anomalies detected through 4 chamber view. Janet Kirk *et al.* (1994) have reported a 47% incidence.

In our study, one case of VSD was missed similar to Marasini *et al.* (1992) series. We also recorded the incidence of extra cardiac anomalies as 17.5% but Bryann Bromley *et al.* (1992) have reported 36% incidence of non-cardiac anomalies. It was observed that the incidence of abnormal chromosomal pattern is 16% in our study. This is in accordance to Bryan Bromley *et al.* (1992) and Ferrazzi *et al.* (1992) ranging from 13%-19%.

### Conclusion

Fetal echo is extremely useful to detect “fetus at risk“ whenever there is underlying maternal medical disorder.

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