

ULTRASONIC STUDY OF FOETAL CARDIAC GROWTH IN NORMAL AND HIGH RISK PREGNANCY

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SUMMARY

Ultrasonic study of foetal cardiac growth was done in 30 normal and 30 high risk pregnancy cases. Ventricular size was measured serially by using the technique of DeVore. Both diastolic and systolic ventricular size increased linearly with increase in BPD and FL. R/L ventricular ratio remained <1 in all cases except 4 high risk patients who showed right ventricular dominance. Foetal outcome was poor in these patients. The incidence of foetal distress during labour and meconium staining of liquor was 75%. Instrumental delivery was done in 75% cases. Apgar score was poor in 75% cases at 1 min. and 25% cases at 5 min. Nursery care was required in 50% of babies and there was one neonatal death. Interventricular septum showed insignificant change. In 15.4% cases there was failure to obtain satisfactory scan.

INTRODUCTION

To produce intelligent and healthy individuals it is important to detect foetal hypoxia at an early stage and

prevent cerebral damage by timely intervention. For the detection of foetal hypoxia real time directed M-mode foetal echocardiography is a recent advancement and is proving to be quite useful. It can detect structural anomalies and also gives good idea

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about performance of the heart. Foetal hypoxia can be picked up by several tests but they have the limitation of becoming positive only in the later stage i.e. when the left side of the heart is failing. DeVore et. al. (1984) using echocardiography found that both systolic and diastolic ventricular size increases linearly with the increase in BPD and right to left ventricular ratio on normal foetus remains 1:1 throughout pregnancy. He first demonstrated that earliest change to occur following foetal hypoxia is dilatation of right ventricle and abnormal septal movement followed by dilatation of left ventricle. Agarwal et. al. (1992) further stressed that preponderance of right ventricle is an indicator of foetal anoxia.

However, foetal echocardiography has not been studied extensively probably because of difficulty of orientation of foetal heart within the thorax and also the experience required to obtain accurate readings. Keeping this in view, the study was undertaken to establish the technique of foetal echocardiography and to assess cardiac growth and correlate R/L ventricular ratio with foetal outcome.

MATERIALS AND METHODS

Sixty pregnant women, 30 normal and 30 high risk pregnancy cases were included in the study and their serial scans were done from 32 weeks onwards. Crosssectional studies were also done any time after 32 weeks. The equipment used was General Electric Model RT-3000 having a 3.5

MHz transducer and facility of displaying real time and M-mode simultaneously.

Ventricular dimensions were assessed by using the technique advocated by DeVore et. al. (1982). Patients were placed in semirecumbent position. Four chamber view was first obtained, then the simultaneous M-mode display was switched on and the cursor was directed perpendicular to the septum at the level of atrioventricular valves. Left and right ventricular dimensions at endsystole and enddiastole were taken and interventricular septal thickness was also recorded. Right and left ventricular enddiastole and endsystole ratio was calculated later. Biparietal diameter (BPD) was measured by the technique used by Halock & Deter (1982) and femur length (FL) was measured by method described by O'Brien et. al. (1981). In addition to this routine ultrasound scanning of foetus was also done.

All patients were followed up till delivery. Meconium staining of liquor, foetal distress during labour, mode of delivery, Apgar score at one and five minutes and any congenital anomaly was recorded. Any problem during hospital stay was also noted.

OBSERVATIONS

A total of sixty cases in age group of 15-35 years were selected in their third trimester from 32 weeks onwards. 30 cases were of normal pregnancy and 30 were high risk pregnancy cases. Total 204 scans were done, 104 for normal cases and 100 for high

risk cases. Maximum scan done on one patient was four and minimum was one. In 15.04% of cases there was failure to obtain satisfactory scan.

to BPD and FL at different gestational age in normal cases :

All normal cases had R/L ventricular ratio < 1. Mean cardiac dimensions, BPD and FL are shown in Table-I at

Mean cardiac dimensions in relation

TABLE I
MEAN CARDIAC DIMENSIONS, BPD AND FL AT DIFFERENT GESTATIONAL AGE IN NORMAL CASES

Gest. age (weeks)	RVED (cm)	LVED (cm)	RVES (cm)	LVES (cm)	RVED/LVED	RVES/LVES	IVS (cm)	BPD (cm)	FL (cm)
32-34	1.09	1.12	0.86	0.89	0.97	0.96	0.35	8.01	6.07
34-36	1.22	1.25	0.99	1.02	0.97	0.97	0.33	8.35	6.33
36-38	1.35	1.38	1.12	1.15	0.97	0.97	0.35	8.76	6.77
38-40	1.48	1.51	1.25	1.28	0.98	0.97	0.36	9.66	7.48

RVED & LVED - Right and left ventricular enddiastole.

RVES & LVES - Right and left ventricular endsystole

IVS - Interventricular septum.

TABLE II
MEAN CARDIAC DIMENSIONS, BPD AND FL IN SUB GROUP A (n = 26)

Gest. age (weeks)	RVED (cm)	LVED (cm)	RVES (cm)	LVES (cm)	RVED/LVED	RVES/LVES	IVS (cm)	BPD (cm)	FL (cm)
32-34	1.04	1.06	0.83	0.84	0.98	0.98	0.32	7.76	5.66
34-36	1.12	1.14	0.93	0.94	0.98	0.98	0.33	8.2	6.27
36-38	1.20	1.22	1.13	1.14	0.98	0.99	0.33	8.5	6.65
38-40	1.34	1.34	1.28	1.28	1.00	1.00	0.35	8.9	6.98

different gestational age. It is seen that ventricular dimensions increased linearly with increase of BPD and FL with increasing gestational age. R V E D and L V E D increased 1.3 times, R. V. E. S. and L V E S increased 1.4 times. I V S had a slight change. BPD and FL increased 1.3 times.

High risk cases :

Of 30 high risk cases 4 patients had 7 readings of R/L ventricular ratio > 1 and rest had ratio of < 1 thus dividing the high risk cases in two subgroups.

1. R/L ventricular ratio < 1-sub-group A- 26 cases

2. R/L ventricular ratio < 1-sub-group B- 4 cases

Mean cardiac dimensions in relation to BPD and FL in cases having R/L ventricular ratio one or less than one (sub group-A).

As shown in Table-II ventricular dimensions increased linearly with BPD and FL with increasing gestational

age. However these dimensions were towards lower side as compared to normal cases. Increase in dimensions are RVED and LVED - 1.2 times, RVES and LVES - 1.5 times, BPD - 1.23 times, FL- 1.15 times, IVS-insignificant increase.

Mean cardiac dimensions in relation to BPD and FL in cases having R/L ventricular ratio more than one (sub group-B) :

There are only 4 patients in this group. All the dimensions increased linearly upto 36 weeks, but were on lower side. At 36-38 weeks and 38-40 weeks RVED and RVES increased more giving RVED/LVED and RVES/LVES ratio more than one (Table - III). Increase in dimensions were RVED - 1.7 times, LVED - 1.2 times, RVES- 2.1 times, LVES - 1.5 times, BPD and FL - 1.17 times. Increase in IVS thickness was insignificant.

Correlation of R/L ventricular ratio with foetal outcome :

The findings were correlated with

TABLE III
MEAN CARDIAC DIMENSIONS, BPD AND FL IN SUB
GROUP B (n=4)

Gest. age (weeks)	RVED (cm)	LVED (cm)	RVES (cm)	LVES (cm)	RVED/LVED	RVES/LVES	IVS (cm)	BPD (cm)	FL (cm)
32-34	0.90	0.91	0.70	0.71	0.98	0.98	0.32	7.61	5.9
34-36	0.96	0.97	0.73	0.74	0.97	0.98	0.32	8.22	6.1
36-38	1.26	1.05	1.25	1.04	1.10	1.10	0.33	8.62	6.5
38-40	1.53	1.13	1.51	1.19	1.35	1.34	0.34	8.9	6.9

meconium staining of liquor, foetal distress during labour, mode of delivery, Apgar score and perinatal outcome.

Meconium staining of liquor and foetal distress during labour :

In normal pregnancy group only 3 patients (10%) had foetal distress and 3 patients (10%) had meconium staining of liquor. Whereas in high risk sub group A, 4 patients (15.2%) had meconium staining and 3 patients (11.5%) had foetal distress. In high risk sub group B with R/L ventricular ratio >1 the incidence of meconium staining and foetal distress was significantly higher, meconium staining -3 patients (75%) and foetal distress -3 patients (75%) - Table - IV.

Mode of delivery :

In normal pregnancy cases only 3 patients (10%) underwent LSCS. In high risk group A, 3 patients (11.5%) had LSCS while in high risk group

B with R/L ventricular ratio >1 instrumental delivery was higher. 2 patients (50%) underwent LSCS and 1 patient (25%) had forceps delivery for foetal distress. One patient (25%) had premature delivery at 36 weeks of gestation.

Apgar score and Perinatal outcome :

In normal pregnancy group only one patient (3.3%) had baby with Apgar score < 7 at 1 min. and all of them had good Apgar score at 5 min. There was one IUD at 35 weeks which was attributed to hydrocephalus. In high risk group A, only one baby (3.8%) had low apgar score at 1 min. which improved at 5 min. All babies were alive and healthy and did not require nursery care. In high risk group B with R/L ventricular ratio > 1, 3 babies (75%) had Apgar score < 7 at 1 min. of which one baby (25%) had poor score even at 5 min. Of the 3 babies with poor score at 1 min., 2 required intensive

TABLE IV
RELATION OF R/L VENTRICULAR RATIO WITH MECONIUM STAINING AND FOETAL DISTRESS

Group	No.	Mec. staining		Foetal distress	
		No.	%	No.	%
Normal Preg. group	30	3	9.99	3 1 IUD	9.99
High risk group A	26	4	15.2	3	11.5
High risk group B	4	3	75	3	75

TABLE V
RELATION OF R/L VENTRICULAR RATIO WITH APGAR
SCORE AND PERINATAL OUTCOME

Group	No.	Apgar score <7				Nursery care		Expired	
		No.	%	No.	%	No.	%	No.	%
Normal Preg. group	30	1	3.33	0	0	0	0	0	0
		1 IUD							
High risk group A	26	1	3.8	0	0	0	0	0	0
High risk group B	4	3	75.0	1	25	2	50	1	25

nursery care. One of them improved and the other with poor score even at 5 min. expired after one day due to severe birth asphyxia. This baby was growth retarded also.

DISCUSSION

Identification of foetuses at risk and their timely intervention helps to improve perinatal outcome. Foetal echocardiography is recently being used to predict intrauterine foetal status. This study was undertaken to determine the usefulness of foetal echocardiography.

The study was carried out in 60 patients, 30 normal and 30 high risk, from 32 weeks onwards. All normal pregnancy cases had R/L ventricular ratio <1. Of 30 high risk cases 4 had R/L ventricular ratio >1.

In normal cases all ventricular

parameters increased linearly with increase in BPD and FL from 32 weeks till term. R/L ventricular ratio remained <1. These findings are similar to other workers. Wladimiroff & McGhie (1981) showed linear increase from 27 weeks to 41 weeks. Allen et. al. (1982) measured only RVED and LVED from 16 weeks till term. There was 3 fold increase in dimensions and it was a linear increase. R/L ventricular ratio was 1. Similar observations were obtained by Sutton et. al. (1984). R/L ventricular ratio was 0.96. DeVore et. al. (1984) in a study of 82 normal foetuses between 18-41 weeks also found linear increase in ventricular dimensions and R/L ventricular ratio remained 1. Agarwal et al (1982) had similar results. Shime et al (1986) also observed linear increase but the R/L ventricular ratio was more than one. Ventricular dimensions in our

study were towards lower side. This could be due to Indian babies being smaller and lighter than their western counterparts. Allen et al. (1982) and Sutton et al (1984) observed linear increase in interventricular septal thickness also. However, present study did not show significant change as observed by Agarwal et al (1982) also.

In high risk group also there was a linear increase of ventricular dimensions. R/L ventricular ratio was <1 throughout the gestation period except in 4 cases in which the ratio became >1 after 36 weeks. Interventricular septal thickness showed insignificant change. The review of literature fails to reveal any study done in high risk cases. However, when compared with normal group of present study and also of other workers the rate of growth was on lower side, more in patients with R/L ventricular ratio of >1 which could be explained by the fact that foetal circulation is already compromised in these patients.

The incidence of foetal distress during labour was significantly higher (75%) in high risk sub group B with R/L ventricular ratio >1 . DeVore et al. (1984) and Agarwal et al. (1992) also observed the same in their studies in normal cases. Meconium staining was also higher (75%) in these patients. This has not studied by other workers.

The instrumental delivery was higher in high risk group B cases. Two patients (50%) had LSCS and 1 patient (25%) had forcep delivery.

One patient had premature delivery. Mode of delivery has not been studied by other workers. However, DeVore et al. (1984) and Agarwal et al. (1992) demonstrated poor outcome and emphasized that timely intervention will improve foetal outcome.

The incidence of low Apgar score was higher in high risk group B cases (75% at 1 min. and 25% at 5 min.). Nursery care was required in 50% (2 cases) of babies, of which one (25%) expired after one day. DeVore et al. (1984) and Agarwal et al. (1992) also demonstrated poor Apgar score and poor foetal outcome in these patients.

Hence, it can be concluded that foetal echocardiography is a reliable index of foetal status and it could be used in the management of high risk pregnancy cases to improve perinatal outcome by timely intervention. However, it has a failure rate of 15.4% and a large scale studies are required to further establish its efficacy.

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