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Original Research Article

Evaluation of transverse cerebellar diameter to abdominal circumference ratio in prediction of intrauterine growth retardation

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ABSTRACT

Background: Intrauterine growth restriction accounts for a significant increase in perinatal mortality rate as well as immediate neonatal morbidity and continuing long term disability in some of the survivors. A different clinical problem develops in infants of same weight but different gestational age therefore identification of high risk newborns based on gestational age and weight. Hence without an accurate knowledge of gestational age, the clinician is significant hampered in an attempt to differentiate truly growth restricted fetus from a patient with incorrect gestational parameters. TCD is emerging as a new sonografic parameter and least affected by fetal growth restriction while liver is most affected organ.
Methods: The patients were sonographically examined for TCD/AC ratio. The best cut-off value of TCD/AC ratio in predicting IUGR was determined by a receiver operating characteristic (ROC) curve. The fetus with a TCD/AC ratio greater than the cut-off value would be antenatally diagnosed as IUGR for every gestational week. Standard definition of IUGR was a low birth weight, less than the 10th percentile.
Results: Eighty pregnancies with suspected IUGR were analyzed. The prevalence of IUGR among the study group was 51.5%. The best cut-off value of the TCD/AC ratio for predicting IUGR was 15.87%, giving the sensitivity, specificity, positive predictive value and negative predictive value of 81.25%, 62.25%, 89.65%, and 45.45%, respectively.
Conclusions: The sonographic fetal TCD/AC ratio as a gestational age-independent, useful, feasible and sensitive method for antenatal diagnosis of IUGR, especially in pregnancy with uncertain gestational age. Routine TCD/AC ratio should be performed to diagnose IUGR.

Keywords: Abdominal circumference, Fetal transverse cerebellar diameter, Intra uterine growth restriction

INTRODUCTION

Intrauterine growth restriction accounts for a significant increase in perinatal mortality rate as well as immediate neonatal morbidity and continuing long term disability in some of the survivors.[1] A different clinical problem develops in infants of same weight but different gestational age therefore identification of high risk newborns based on gestational age and weight. Hence without an accurate knowledge of gestational age, the clinician is significant hampered in an attempt to differentiate truly growth restricted fetus from a patient with incorrect gestational parameters. TCD is emerging as a new sonografic parameter and least affected by fetal growth restriction while liver is most affected organ.[2]

TCD is claimed to be more equivalent in certain situations like extremes of growth abnormalities and variations of fetal head shape such as dolicocephaly and brachycephaly.[3-5] Therefore, it would seem reasonable to investigate any relationship between TCD and AC as a predictor of fetal growth abnormalities.

METHODS

This case control study was conducted at department of Obstetrics and Gynaecology, Mahila Chikitsalaya, SMS Medical College, Jaipur for a period of one year. Total 80 pregnant women in 3rd trimester was selected and divided in two groups

- Group A was control group consisted of 40 cases with normal singleton pregnancy
- Group B was study group consisted of 40 cases with clinical suspicion of IUGR.

A discrepancy of 4 weeks in period of gestation and clinical examination was taken as evidence of IUGR. Period of gestation determined by either LMP or USG of < 20 weeks if available. Multiple gestation and poly hydramnios are excluded from the study. In all cases, fundal height was measured in centimetres after that all patients underwent ultrasonography. TCD and AC was measured along with other parameters. TCD/AC*100 ratio was calculated for all cases.

TCD/AC ratio of study group was compared with mean TCD/AC*100 ratio of control group in accordance to gestation age. When it was two standard deviation (SD) above the mean it was taken as ultrasonographically IUGR case and is confirmed by post natal newborn assessment by expanded new Ballard score. New born weight was compared with weight normogram given by Meharban Singh. If it was <10th percentile for gestation age, it was diagnosed as a case of true IUGR.

RESULTS

Total no of 80 cases were studied. TCD/AC ratio was measured in all cases. TCD/AC ratio in control group with their mean TCD/AC ratio and mean ±SD according to gestational age (Table1).

Mean of the mean TCD/AC ratio was 14.220 and mean SD was 0.455. So, predictive value of TCD/AC ratio was 15.230 (Table 2).

TCD/AC ratio of all cases in study group was compared with mean TCD/AC ratio of control group according to gestational age and where it was >2SD above the mean TCD/AC ratio of control group, it was taken as ultrasonically IUGR case (Table 3).

Then result was compared with post-delivery examination.

Table 1: TCD/AC ratio in control group according to gestational age.

GA	TCD	AC	TCD/AC	TCD/AC mean	SD	Mean + 2SD
32	38	265	14.3	13.80	0.396	14.590
	38	280	13.5			
	36	270	13.3			
	38	270	14.07			
33	42	280	15.0	14.53	0.378	15.280
	40	275	14.54			
	38	270	14.07			
34	40	280	14.28	14.52	0.240	15.000
	42	285	14.7			
	43	290	14.82			
	40	280	14.28			
35	45	300	15	15.26	0.197	15.650
	46	300	15.3			
	48	310	15.48			
36	42	316	13.29	14.16	0.777	15.716
	40.7	313	13.0			
	44	312	14.1			
	41	276	14.8			
	45	300	15.0			
	41	276	14.8			
37	42	298	14.0	13.53	0.814	15.158
	46.2	321	12.12			
	42	299	14.0			
	42	298	14.0			
38	46	324	14.1	14.25	0.488	15.227
	41	305	13.4			
	42	383	14.84			
	46	310	14.8			
	45	320	14.06			
	46	320	14.3			
39	46	325	14.15	14.15		
40	43	351	12.25	13.82	0.811	15.440
	41.8	318	13.14			
	43	330	13.9			
	45	326	13.8			
	46	335	13.7			
	48	325	14.7			
	50	325	15.3			
	43	330	13.9			
	46	325	13.7			

Table 2: Relationship of TCD/AC Ratio and gestational age in control group

Weeks of gestation	No. of cases	Range of TCD/AC (%)	Mean±SD
32	4	13.33-14.30	13.80±0.396
33	3	14.07-15.00	14.53±0.378
34	4	14.28-14.82	14.52±0.240
35	3	15.00-15.48	15.26±0.197
36	6	13.00-15.00	14.16±0.777
37	4	12.12-14.00	13.53±0.814
38	6	13.40-14.84	14.25±0.488
39	1	14.15	-
40	9	12.25-15.30	13.82±0.811
Total	40		14.220±0.445

Out of 40 cases in study group 29 were diagnosed as IUGR by USG three false positive cases (Table 4). Out of 40 cases in study group 32 were true IUGR postnatally and 6 were missed by USG. According to this study sensitivity of this method is 81.25% and positive predictive value is 89.65% (Table 5).

Table 3: Relationship of TCD/AC Ratio and gestational age in study group.

Gestational age	No. of cases	TCD/AC Ratio	Cases with TCD/AC % >2SD	True SGA	AGA
32	1	14.678	SGA	SGA	
33	0	-	-	-	-
34	3	16.370	SGA	SGA	
		15.139	SGA	SGA	
		13.30	AGA	SGA	
35	0	-	-	-	
36	4	16.37	SGA	SGA	
		15.50	AGA		AGA
		13.60	AGA		AGA
		15.59	SGA	SGA	
37	3	16.43	SGA	SGA	
		17.17	SGA	SGA	
		14.93	SGA	SGA	
38	9	14.63	AGA		AGA
		14.16	AGA		AGA
		17.00	AGA	SGA	
		17.17	SGA	SGA	
		15.50	SGA		AGA
		15.70	SGA	SGA	
		15.90	SGA	SGA	
		17.30	SGA	SGA	
		16.53	SGA	SGA	
39	3	16.00	SGA	SGA	
		16.92	SGA	SGA	
		15.33	SGA	SGA	
40	17	17.00	SGA	SGA	
		14.17	AGA	SGA	
		16.78	SGA	SGA	
		15.90	SGA		AGA
		15.70	SGA	SGA	
		13.00	AGA	SGA	
		15.54	SGA		AGA
		15.70	SGA	SGA	
		16.15	SGA	SGA	
		15.70	SGA	SGA	
		16.07	SGA	SGA	
		16.42	SGA	SGA	
		14.68	AGA		AGA
		14.60	AGA	SGA	
		15.86	SGA	SGA	
		14.51	AGA	SGA	
		15.50	SGA	SGA	

DISCUSSION

Prenatal diagnosis of IUGR depends upon two factors.

- An estimate of gestational age.
- An accurate estimate of fetal size.

Unfortunately, the very biometric measurements used to demonstrate abnormal growth are also the once used to determine gestational age.

Table 4: Predictability of IUGR by TCD/AC ratio (%).

GA (weeks)	No. of cases	No. of cases with TCD/AC >2SD	No. of true IUGR cases	No. of false +ve	No. of false -ve
32	1	1	1	-	-
33	0	0	0	-	-
34	3	2	3	-	1
35	0	0	0	-	-
36	4	2	2	-	-
37	3	3	3	-	-
38	9	6	6	1	1
39	3	3	3	-	-
40	17	12	14	2	4
Total	40	29	32	3	6

Table 5: Sensitivity and positive predictive value of TCD/AC ratio for identification of IUGR.

Examination on delivery			
USG	IUGR+VE	IUGR-VE	
IUGR +ve	True +ve 26	False +ve 3	All test +ve 29
IUGR –ve	False –ve 06	True –ve 5	All test –ve 11
	All +ve 32	All –ve 8	40
Sensitivity=81.25% Positive predictive value (PPV)=89.65%			

Some biometric parameter unaffected by growth abbreviation, providing standard against which dispraise growth could be compared. The cerebellum last to be affects by a decrease in blood flow. Moreover, liver is the most severely affected organ in decrease fetal growth.[6]

Campbell et al studied 87 patients; the mean TCD/AC ratio was 16.6% for the IUGR cases. Significantly larger than non IUGR cases 14.8% ($p<0.05$). TCD/AC ratio was mentioned to have a sensitivity of 71%, specificity 77%, PPV 79% and NPV (negative predictive value)) 68%.[7,8]

Sagwan K studied 40 patients, sensitivity was 84 % and PPV was 100%. The mean value of TCD/AC ratio in study group was 14.92±1.28 and in patient with confirmed SGA babies it was 15.87±0.92 significantly higher than post delivery normal cases.[9]

Haller H et al studied TCD/AC ratio in 365 cases. A TCD/AC ratio more than 15.5 was present in 85% of SGA infants.[10]

William J et al studied 825 low risk obstetric cases and found TCD/AC ratio was gestational age independent between 14and 42 weeks with a mean of 13.68±0.96. A value exceeding 2 SD of mean was significantly associated with SGA infants.[11,12]

Tosnsong T and Wanapirak studied \one hundred and sixty-seven pregnancies with suspected IUGR were analyzed. The prevalence of IUGR among the study group was 51.5%. The best cut-off value of the TCD/AC ratio for predicting IUGR was 15.4%, giving the sensitivity, specificity, positive predictive value and negative predictive value of 73.26%, 80.25%, 79.75%, and 73.86%, respectively.[13]

In this study the mean value of TCD /AC ratio in control group was 14.22±0.91 and in patient with confirmed SGA on post-delivery examination was >15.87 significantly higher ($p<0.001$) then in post-delivery normal cases ($p<0.001$). In this study, out of 32 true IUGR cases were correctly diagnosed by TCD/AC ratio, hence sensitivity was 81.25%, specificity 62.50%, the PPV was 89.65% and NPV was 45.45%. the result in this study are higher than Campbell et al but lower than Sangwan K et al results are comparable to H Haller and William j et al.

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