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A comparative Study of Sonographic Parameters with Neonatal Ponderal index as a predictor of IUGR

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Abstract
Background: *Intrauterine growth restriction is one of the commonest problems which increases the perinatal morbidity. The diagnosis of impaired fetal growth is still a challenge as the standards of fetal measurements of growth ,both clinical and ultrasonographic parameters vary depending on the race and geographic location*

Materials and Methods: *This is a prospective study conducted at SAT hospital Thiruvanthapuram. Cases fulfilling the inclusion criteria were included in the study over a period of 6 months. Clinical and ultrasound parameters at the time of detection of IUGR was noted. These patients were followed up till delivery. At the time of delivery the neonatal ponderal index was calculated.*

Results: *Among the sonographic parameters abdominal circumference and estimated fetal weight was found to be highly sensitive in predicting IUGR. .*

Conclusions- Serial USS follow-up of abdominal circumference and estimated fetal weight can help obstetricians in early detection of IUGR before asking for costly investigations like Doppler, thus making checkups cost effective.

Keywords: *IUGR, Abdominal circumference, sonographic estimated fetal weight, neonatal ponderal index.*

Introduction

A growth restricted infant is defined as an infant who has not achieved its genetic growth potential in utero. The ability to reach an optimal birth weight results from the interaction between fetal growth potential and its environment

The diagnosis and management of impaired fetal growth is a problem because of the lack of a precise definition of intrauterine growth restriction and our ignorance about the individual fetal growth potential.

Currently accepted classification Of FGR is for *very small for gestational age* (VSGA); <3rd percentile) and, *small for gestational age* (SGA); <10th percentile. But this misses growth restricted fetus with normal birth weight. The Ponderal index (PI) and mid arm/head circumference (MAC/HC) ratio are two other measurements of body proportionality used to identify atrisk IUGR infants[1,2,]

The ponderal index ([birth weight in grams/crown heel length]$^3 \times$ 100) has a high accuracy for the identification of SGA. It correlates more closely with perinatal morbidity and mortality than

traditional birth weight percentiles. Miller andHassanein[3] proposed that a full term infant is growth retarded if his PI is <2.2. According to Man Mohan *et al.*[4] in a term infant PI < 2.25 should be an indicator of intrauterine undernutrition. Ponderal index relies on the principle that length is spared at the expense of weight during period of acute malnutrition; In this study Fetal growth retardation has been confirmed by calculating the neonatal ponderal index in all antenatally detected IUGR cases.

Aims and Objectives

1. To find out the sensitivity of symphysiofundal height measurement in predicting IUGR.
2. To find out the sensitivity of HC/AC, FL/AC, Abdominalcircumference, AFI<5 and sonographic estimated fetal weight in predicting IUGR.
3. To assess the mode of delivery of IUGR fetuses
4. To assess the perinatal outcome of IUGR fetuses.

Materials and Methods

This is a prospective study conducted in department of obstetrics and gynecology, SAT hospital, GMC, Thiruvananthapuram, Kerala.

Inclusion Criteria

All singleton pregnancies who were identified as IUGR clinically or by USS.

1) Clinically symphysiofundal height, gestational age discrepancy of $\geq$ 4 weeks.
2) Clinically suspected decreased liquor volume
3) USS parameters include
   i) Abnormal HC/AC ratio ($\geq$ 1)
   ii) Abnormal FL/AC ratio (> 22.1)
   iii) Oligamnios AFI $\leq$ 5.

Exclusion Criteria

1. Multiple Pregnancy
2. Those who are unsure of their LMP.

Conduct of study

All consecutive cases admitted in SAT Hospital during the period of study were recruited. The patients who matched the criteria of induction were selected and examined. Symphysiofundal height was measured. Any measurement of fundal height falling 3cms or below the regression line was considered predictive of 1UGR. The regression line by Mathai[5] et al was taken as standard. Presentation of the fetus and fetal heart was noted.

USS was done at SAT Hospital itself using B mode ultra sound machine with 3.5 MH3 probe (Aloka) available in this hospital BPD, HC, AC, FL, AFI and EFW was measured.[6] Estimated fetal weight is measured in our machine using the Hadlock's formula.

After the sonogram, the patients are followed up till delivery, Mode of delivery was noted. Growth restriction was confirmed by physical examination of neonate at birth and neonatal ponderal index was calculated using the formula

Weight in grams

(Height in cm)^3

Weight of the baby was recorded with in 24 hrs of delivery using electronic fetal weighing machine, with a digital readout. This machine is said to have an accuracy of ± 5 g. Length of the baby was also measured within 24 hours of delivery using the infantometer available in NlCU.

All infants with neonatalponderal index <2.25 was taken as abnormal[4]. This data was computed along with each of the sonographic parameters in a two by two table and sensitivity and specificity of each sonographic parameter was calculated.

Any complications requiring admission to NlCU was noted. These babies were followed uptillimmediate perinatal period & outcome was assessed.

Observations and Results

Table 1 Distribution according to age

Mean	24.4
S.D	4.4
Median	23
Range	19-37 years

Of the 75 cases, mean age distribution was

24.4 yrs. Maximum age was :17 years minimum age was 19 years.

Table II Distribution according to parity

Parity		%
Primi	53	70.7%
Multigravida	21	28
Grandmulti	1	1.3%
	75	100%

Distribution according to parity

Majority of women were Primisie 70.7%

Table III Distribution according to referral status

Booked	27	36%
Un Booked	1	1.3%
Booked outside	47	62.7%
	75	100%

Majority of cases were booked outside ie 62.7%. one unbooked case of an illiterate elderly primi was there.

Table IV Distribution of risk factors

Hypertension complicating pregnancy	5	6.7
PIH	18	24
Overt diabetes	1	1.3
PIH c Co-existing GDM	2	2.7
Hypertension with other medical disorders	2	2.7
Uterine anomalies	1	1.3
Idiopathic	46	61.3
	75	100%

% Distribution of Risk factor
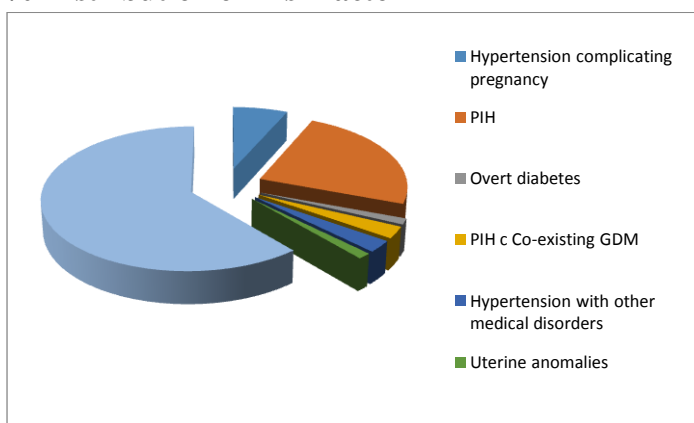
Table V Distribution according to Hb

Mean	11.1
SD	1.1
Median	11
Range	9 – 13.5

Mean hemoglobin was found to be 11.1mg%. Minimum Hemoglobin was 9gm% and maximum level was 13.5gm%.

Table VI Distribution of mode of delivery

		%
Spontaneous labour	9	12
Induced labour	30	40
Elective CS	19	25.3
Emergency CS	17	22.7
	75	100

Of the 75 cases 12% went in for spontaneous labor, 40% had induction of labour. Majority of paientsie 48% had casarian section either, emergency or lective 35.3% had elective CS and 22.7% had emergency CS.

Table VII Indications for emergency ceasarean

Placenta previa	1	5.9%
Fetal distress	8	47%
Abnormal Doppler	2	11.8%
Abnormal presentation	3	17.6%
Abruption	1	5.9%
Failed induction	2	11.8%

Out of the 17 emergency caesarian section 47.05% were for fetal distress defected during labour.

Table VIII Indications for elective caesarean

Abnormal Doppler	4	21%
Previous LSCS	2	10.5%
Malpresentations	4	21%
Placenta previa	1	5.3%
IUGR	8	42.2%
Total	19	100

Elective caesarians were done for 42.2% of cases for severe IUGR and 21% cases were done for abnormal Doppler report.

Table IX Distribution of Birth weight

> 2.5kg	5	6.7%
2 – 2.5	30	40%
1.5 – 2	25	33.3%
< 1.5	15	20%
	75	100%

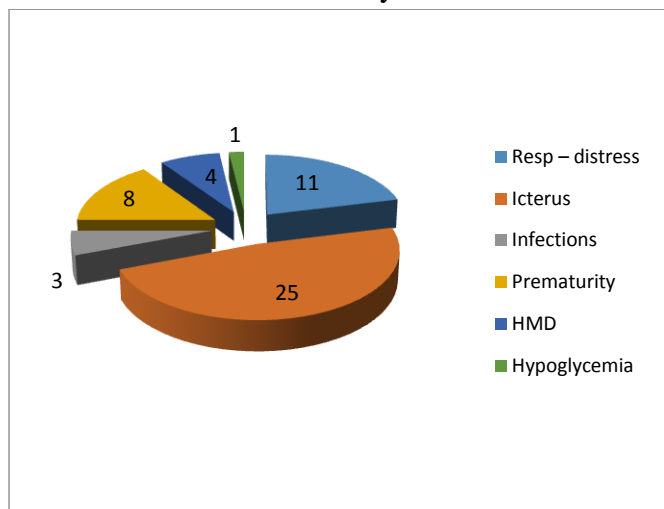Mean distribution of birth weight was 1898 gm with minimum birth weight ranging from 875 gmto maximum of 2800 gm.

Table X Perinatal outcome

a) Apgar at 1 minute

> 8	64	88.9%
4 – 7	7	9.7%
< 4	1	1.4%
	72	100%
b) Perinatal morbidity	52	69.3%
c) Perinatal mortality	5	6.6%

Table XI Perinatal mortality

Still born	1	20
IUD	2	40
Perinatal death	2	40

Table XII Perinatal morbidity

No morbidity was present in 28% of babies

Discussion

Out of 75 subjects the mean age distribution was found to be 24.4 yrs. This nearly corresponds to the meanage distribution of all females delivering in our hospital (ie. 21.3 yrs). Thus in our study the concept that extremes of maternalage increases the risk of FGR is not substantiated.

Among the 75 cases, commonest incidence of IUGR was in primiparas (70.66%). This high incidence can be explained by the fact that hypertensive disorders of pregnancy forms a major risk factor for IUGR[7]. Generally preeclampsia is thought of as disease of first pregnancies.

62.70% of cases were booked outside which is very high compared to general statistics our hospital showing 13% of all cases as booked outside. This can also be explained by the fact that detection of IUGR renders the pregnancy to be of high risk and need for referral to a tertiary care center becomes inevitable.

In this study 61.3% of pregnancies did not have any risk factor to account for their IUGR of fetus. Hypertensive disorders of pregnancy[7] was found to be the most common

risk factor associated with IUGR (36.1%) of these PIH alone accounted for by 24%, chronic hypertension complicating pregnancy was 6.7% PIH co-existing with GDM was found in 2.7% and Hypertension associated with other medical disorder and also 2.7%. We had 2 cases of antiphospholipid antibody syndrome, who developed PIH in the 6th month of pregnancy. Though Anemia was analyzed as a separate risk factor in the study mean hemoglobin distribution among subjects were 11.1 gm%. In the study by Ounsted et al, anema was not found to be an important risk factor. This substantiated in this study.

In this study, the sensitivity of symphysiofundal height is found to be 74.5%. this is agreement with results of many studies.[8,9]

Even though symphysiofundal height is said to be a simple, inexpensive screening method of IUGR, low sensitivity, high false positive rate, significant intra - inter observer variation makes this test along unsuitable for diagnostic purpose.[9] Therefore if SGA is suspected it is necessary to supplement, fundal height measurement with ultrasonic biometry

Use of a customised fundal height chart improves accuracy to predect an SGA fetus[19].

Sensitivity of HC/ AC ratio is found to be 35.6% in this study and specificity was found to be 62,5%. Study by Ott[10] et al in 1997 showed a sensitivity of 82% and Campbell and Thomas[11] showed a sensitivity of 70%

Colley[12] NV et al 1991 showed by their study that HC/ AC ratio are poorer than AC or EFW alone in predicting SGA or NPI $< 25^{th}$ centile.

FL/AC ratio sensitivity is found to be9.6% but Benson et al and Brown et al called it a poor predictor of IUGR[12,13,14]

In this study, abdominal circumference with sensitivity of 84.9% has emerged as the best sonographic parameter in predicting IUGR. Many studies have shown this and proposed AC as the best predictor of IUGR.[14,15,16,17,18]. Serial measurement of AC after 14 days improves

the sensitivity of IUGR detection[18]

In this study sensitivity of AFI <5 in predicting IUGR is 25.4% According to RCOG[19] guidelines Amniotic fluid volume has a minimal value in diagnosing fetal growth restriction. A serial measurement of AFI have similarly disappointing results.

As the study by Philipson[20] et a and Manning et al[21], if oligohydramnios is detected on an ultrasound examination, the chance that IUGR is present is increased about fourfold and the sensitivity in these studies were shown to be 83%. The clinician should have a heightened index of suspicion, seek confirmatory evidence and monitor fetal status carefully through delivery. Routine sonographic screening to detect oligamnios is not warrented.

In this study, estimated fetal weight is found to have a sensitivity of 84.7% as supported by many studies.[14,15,16,17,18]

Thus in this study Abdominal circumference and estimated fetal weight have emerged as the best predictor for IUGR fetus. This view has been supported by many studies.[10,16] Infact serial measurement of AC and EFW (growth velocity) are superior to single estimate of AC or EFW.[16]

Abdominal circumference has both the highest sensitivity and greatest negative predictive value for the sonographic diagnosis of IUGR whether defined postnataly by the birth weight percentile or the ponderal index. The positive predictive value of a low AC percentile for growth restriction is about 50% in any given population. It is best not to label a fetus growth restricted and trigger expensive fetal surveillance unless the AC and sonographic estimate of weight is also abnormal.[17] The positive predictive value of estimated fetal weight is greater. Such a patient should be followed up with doppler.

47% of the above subjects were delivered by Caesarian section. This is much higher than the hospital caesarian rate of 27% during this period. 40% of the subjects had induced delivery. This is

also higher than the general rate of induction in our hospital Because of the higher detection rate of intrauterine fetal asphyxia by doppler, the delivery rates by induction of labour is also higher. Majority of emergency cesareans were performed for fetal distress (47.1%). This is also related to the intrapartum fetal monitoring in the labour room using CTG machine which is highly necessary as an IUGR baby is prone for severe fetal distress and neonatal birth asphyxia. Abnormal presentations were also seen in these subjects as the decreased liquor volume may restrict the mobility of fetus (17.6%). 42% of the elective caesareans were done for severe IUGR oligamnios. 21% cases had abnormal Doppler vclocimetry these babies could not have withstood the stress of labour had they been induced.

The perinatal mortality was 6.6% and found to be comparable to other studies [22,23]Of these two cases of intrauterine death was present.

Perinatal morbidity was very much increased in this study ie 69.3% compared to Bollapragada et al where morbidity is only 35%. This could be explained by the increased intervention rates due to increased detection of intrauterine fetal distress by doppler study.

Conclusion

This study was conducted with an aim to find out the sensitivity of various sonographic parameters used routinely in our hospital tnpredicting IUGR. Most of the studies had used the gold standard of diagnosis as the immediate birth weight. But the main drawback of this outcome was that it failed to differentiate between the low birth weight infant from a growth retarded infant.

The present study utilized neonatal ponderal index as the gold standard in diagnosing lUGR.

Among the songraphic parameters, Abdominal circumference, and the sonographic estimated fetal weight was found to be highly sensitive in predicting IUGR, which is comparable to many other studies.

Thus a fall in abdominal circumference less than 2 standard deviations from mean for that gestational age or a fall in estimated fetal weight less than 10th percentile from a mean for that gestational age should caution the obstetrician that fetus is going in for growth retardation.

Detection of fetal growth restriction helps in deciding the management of the case. If early onset to seek for congenital anomalies, if late onset to start strict fetal surveillance in order to detect early inutero fetal compromise.

FL/AC ratio was also found to have a sensitivity of 79.6%. In detecting. IUGR, Thus FL/ AC ratio can also be used for prediction of IUGR. Symphysio fundal height if plotted using a customized chart could act as a good predictor of FGR.

Commonest risk factor leading to IUGR was found to be hypertensive disorders of pregnancy. Thus in such patients, obstetrician should be on the outlook of IUGR

As IUGR is a condition which warrants early intervention during early gestational age, increasing number of premature babies poses a great problem for the neonatologist and Neonatal ICU's equipped with better provisions of preterm care should be brought up.

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