RESEARCH ARTICLE

COMPARATIVE STUDY OF PLACENTAL VOLUME IN IUGR COMPLICATING AND NORMAL PREGNANCY AND ITS CORRELATION WITH FETAL OUTCOME

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ABSTRACT

Background: IUGR is a condition where the foetus fails to achieve its genetic growth potential. In our study we aim to compare placental volume in IUGR and normal pregnancy and its correlation with fetal outcome.

Methods: A group of 50 women with IUGR complicating pregnancy and 50 women with normal pregnancy were selected and the placental volumes measured before and after delivery and the results were correlated with perinatal outcome

Results: When comparing the average placental volume of all gestational age groups in IUGR group(332cm3) with that of normal group(603cm3), it was observed that the volume was significantly less with a P value of <0.001. Adverse outcomes were seen in 80% of babies in IUGR group (MSAF, IUD and low APGAR scores).

Conclusion: This study showed positive correlation between the placental volume and severity of IUGR. Hence, antenatal measurement of placental volume can be taken as one of the methods of predicting adverse neonatal outcome in women with IUGR complicating pregnancy.

INTRODUCTION

IUGR can be defined as a condition in which the foetus fails to achieve its genetic growth potential and is at increased risk of perinatal morbidity and mortality. The incidence varies from 4-7% in developed countries and 30% in developing countries. Foetal growth depends on two components- genetic potential and substrate supply i.e. placenta function. A foetus is considered growth restricted when ultrasonographically measured foetal dimensions (particularly AC or EFW), fall below a certain gestational age specific threshold (1). The most commonly used threshold is 10th percentile. Over the last few decades, ultrasonogram and Doppler have come to play a major role in evaluation of foetal wellbeing in utero.

Aim of Study

A group of 50 women with IUGR complicating pregnancy and 50 women with normal pregnancy were selected. Placental volume was measured before delivery using 2D ultrasound by Convex Concave Shell formula and immediately following delivery by Ellipse formula. The volumes were compared to determine the accuracy and reliability of USG measurement. Then the volumes were correlated with the perinatal outcome. This study was done to establish if placental volume measurement by 2D USG is an effective method of predicting fetal outcome. This prospective analytical study was conducted at The Department of Obstetrics and Gynaecology of Rajah Muthiah Medical College and Hospital from 2015 to 2017. Ethical committee clearance was obtained to undertake the study. The patients referred as IUGR beyond 34 weeks up to term were analysed.

Inclusion Criteria

1. Singleton pregnancy
2. Confirmed gestational age
3. Without any maternal medical complications,
4. Cases having first trimester ultrasound for confirming the gestational age and second trimester ultrasound to rule out foetal anomaly and serial ultrasound to see the interval growth.

Exclusion Criteria

1. Patients with multiple pregnancy, abnormal placentation and foetal malformations.
2. Patients with severe oligohydramnios which causes inaccurate localisation of placenta.

3. Patients in whom there is difficulty in localising as well as measuring the placenta due to fundal or lateral wall implantation.

MATERIALS AND METHODS

Detailed antenatal history was taken, clinical examination and routine laboratory investigations were done for all the cases selected as per the inclusion criteria. All the patients selected were subjected to ultrasound examination. Measurement of placental volume was done using the Convex-Concave shell formula.(8)
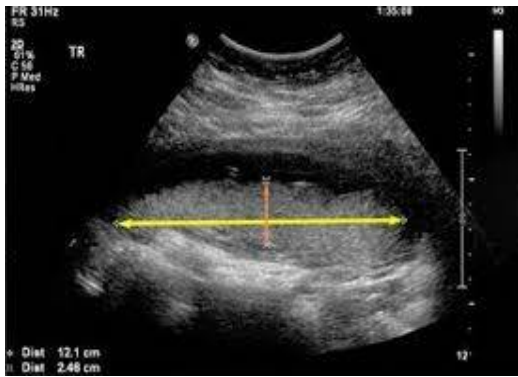

$V=(\pi T/6)[4H(W-T) +W(W-4T)+4T^2]$

H=Placental height,
T= Placental thickness,
W= Placental width.

All the cases were followed up till delivery. After delivery, the placenta was kept on a flat surface and maximum, minimal width and maximum height were measured with an inch tape. With all these measurements, placental volume was calculated by the following Ellipse formula;

$V=\pi ABH/3$
A=Major width,
B=Minor width,
H=Height.
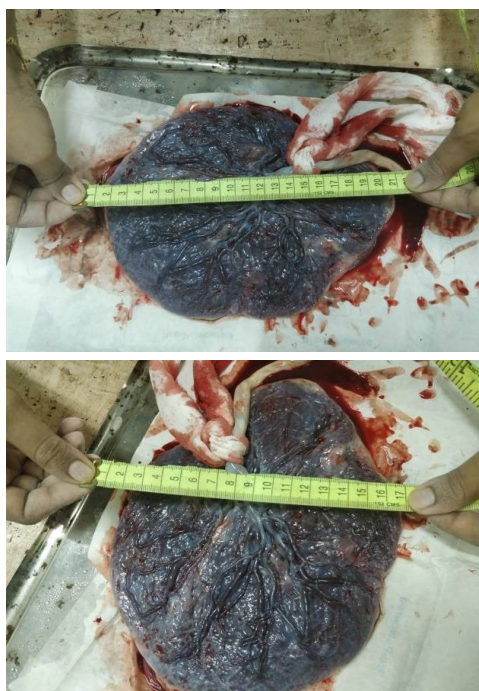
The placental volume measured before delivery was compared with that after delivery for IUGR group and for the control group.

RESULTS AND ANALYSIS

Table 1 Placental Volume by USG in IUGR and control group

GA	IUGR group Mean(cm^3)	Control group Mean(cm^3)
34-36 weeks	316. 05	579. 42
36-37 weeks	325. 68	599. 49
37-38 weeks	329. 37	603. 19
38-40 weeks	333. 45	606. 82
40-42 weeks	372. 60	649. 29
Total	**332. 76**	**599. 66**

Table 2 Placental Volume after delivery in IUGR and control group

GA age	IUGR group Mean(cm^3)	Control group Mean(cm^3)
34-36 weeks	293. 35	565. 86
36-37 weeks	316. 75	586. 63
37-38 weeks	311. 07	596. 08
38-40 weeks	324. 98	593. 08
40-42 weeks	367. 30	638. 08
TOTAL	**322.69**	**595. 95**

Table 3 Comparison of Placental volume before and after delivery

	Placental volume before delivery by USG(cm^3)	Placental volume after delivery (cm^3)	Difference (cm^3)
IUGR group	332.76	322.69	10.07
Control group	599.66	595.95	3.71

There was no significant difference noted statistically between the placental volume measured before delivery by 2D ultrasound and that measured after delivery in both the IUGR group and control group with P value >0.001 showing that placental volume estimation by USG is a reliable method.

Table 4 Comparison of placental volume by USG in IUGR and control group

GA	Control group	IUGR Group	Difference
34-36 weeks	579. 42	316. 05	263. 37
36-37 weeks	599. 49	325. 68	273. 81
37-38 weeks	603. 19	329. 37	273. 82
38-40 weeks	606. 82	333. 45	271. 37
40-42 weeks	649. 29	372. 60	276. 69

Group	N	Mean(cm^3)	Std. Deviation	P value
IUGR	50	332.76	60.45571	<0. 001
Control	50	599.66	30.91083	Highly significant

The average placental volume by USG before delivery in normal pregnancy was 599.66cm^3 and that in IUGR pregnancy was 332.76cm^3. The volume of placenta in IUGR group was significantly less when compared to that of normal group. On statistical analysis, this showed significant difference P<0. 001 (highly significant; Levines T-Test).

Table 6 Mode of Delivery In IUGR Group

Vaginal		LSCS	
Spontaneous	Induced	Emergency	Elective
7 (14%)	5 (10%)	30 (60%)	8 (16%)

The incidence of LSCS in the IUGR group was 76% of which emergency LSCS was 60% as against elective LSCS (16%).

Table 7 Birth Weight Distribution

Baby weight	Group		Total
	IUGR	Normal	
<1 kg	1	-	1
1-1. 5 kg	6	-	6
1. 6-2. 0 kg	20	1	21
2. 1-2. 5 kg	22	15	37
2. 6-3. 0 kg	1	27	28
>3. 0 kg	0	7	7
Total	**50**	**50**	**100**

The birth weight of 84% babies among IUGR group was between 1.5-2.5kg.

1 fetus weighed 925gms which resulted in IUD due to severe fetoplacental insufficiency. Only one fetus was above 2.5kg

Table 8 Outcome of Babies in IUGR group

	No. of cases	Percentage
Good	20	40. 0
IUD	2	4. 0
Low APGAR	20	40. 0
MSAF	8	16. 0
Total	50	100. 0

Of the IUGR group of babies 60% had adverse outcomes as shown which corresponded to lower volumes of placenta. Good outcome was seen in 40% of babies. A 5 min APGAR score of <7 was seen in another 40%. 2 were IUDs due to very low weight and severe IUGR. 8 babies had meconium stained liquor during delivery.

DISCUSSION

Our study was done to compare the placental volume in IUGR complicating and normal pregnancy using 2D ultrasound and to correlate it with the perinatal outcome. The placental volume measured by ultrasound was compared with that measured after delivery. The results were compared with that of normal pregnancy. The average placental volume in normal pregnancy was 599.66cm³. The average placental volume in IUGR pregnancy was 332.76cm³. On statistical analysis, this showed significant difference P<0. 001 (highly significant; Levines T-Test). In 2002 Hafner, Phillip, Schuchter and Baure inferred that placental volume estimation in predicting IUGR had 82.5% sensitivity & 52.5% specificity and prognostic influence could be shown for placental volume (p<0.0001)(7)
The placental volume done by ultrasound before delivery was compared to that measured after delivery. The average placental volume measured after delivery in normal pregnancy was 595.95cm³. The average placental volume after delivery in IUGR group was 322.69 cm³.These values did not show much of a difference to that measured by ultrasound before delivery.(5) . This is in concordance with a prospective study done by Humberto Azpurua, Edmund F. Funai, Luisa M. Coralluiz involving 29 3ʳᵈ trimester pregnancies. They concluded that placental volume can be accurately predicted by 2 dimensional ultrasound with volumetric calculation. The incidence of LSCS was high in the IUGR group (76%) of which emergency LSCS was 60% as against elective LSCS

(16%). This significant difference indicates intrapartum foetal asphyxia that occurred with induction of labour which is a well expected complication in IUGR.The birth weight of 84% babies among IUGR group was between 1.5-2.5kg. 60% of them had adverse outcomes which corresponded to lower volumes of placenta. In a study done by Marana LR they showed that 20% of all stillborns showed evidence of IUGR.(3)

Further in 2000, Ira, Jeffery, Gary and Agnetta studied the association between intrauterine growth restriction and adverse neonatal outcomes in a population of 19,759 singleton very-low-birth-weight neonates. There was a statistically significant association of intrauterine growth restriction with neonatal death, necrotizing enterocolitis and respiratory distress syndrome and hypoxic ischemic encephalopathy.(13) Our study showed that the placental volume had good correlation with the fetal outcome. Hence placental volume measurement by ultrasound can be taken as one of the methods of predicting adverse neonatal outcome in IUGR.

CONCLUSION

Healthy baby and healthy mother are the goal of obstetric management. Ultrasonography plays a major role in early diagnosis of IUGR. Placental volume determined by 2D ultrasound has positive correlation with birth weight of the baby and perinatal complications and hence could be an effective method of antenatal fetal surveillance in IUGR.

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