



Original Article

Third Trimester Placental Grading by Ultrasonography and its Relationship with Fetal Outcome

Farzana Begum,¹ Shahela Jesmin,² Rokeya Khatun,³ Somerose Parvin,⁴ Anisur Rahman⁵

Abstract

Background: Antenatal ultrasound assessment of placental morphology plays an important role in evaluating fetal health, revealing abnormalities, such as infarct & calcification.

Abnormal placental maturity is associated with poor pregnancy outcome. In some high risk pregnancy placental maturity is accelerated as in pregnancy –induced hypertension (PIH), intrauterine growth retardation (IUGR), whether in other high risk cases like diabetes and Rh-isoimmunization there is delayed placental maturation.

Objectives: This was a cross sectional type of descriptive study. The study was carried out to assess placental grading by USG in high risk and normal pregnancy for predicting neonatal outcome.

Material and method: The study was carried out in the Department of Obstetrics & Gynaecology in collaboration with the Department of Radiology & Imaging of Rajshahi Medical College Hospital from January 2012 to December 2013. : A total 200 pregnant mother, attending the inpatient department constituted study population who delivered their babies at Rajshahi Medical College Hospital were selected in antenatal period for USG examination to detect placental grade.

Result: Ultrasonography showed, 35% had Grade-II placental maturity, 33.5%- Grade-III, 25% Grade - I and 6.5% had Grade-0 maturity. Majority of the mother (75%) were normal and had healthy baby. The relationship of placental maturity with gestational age of mother in normal pregnancy and in high risk pregnancy was found to be statistically significant. Placental maturity and fetal outcome in normal pregnancy was found significantly associated ($p < 0.001$) but in high risk pregnancy it was not associated significantly ($p > 0.5$). Early maturation of placenta in hypertensive women and delayed maturation in diabetic women were observed.

Conclusion: Sonographic diagnosis of grade-III placenta has been reported to be as excellent predictor of fetal lung maturity than difficult and hazardous invasive procedure like amniocentesis.

Key Words: Ultrasonographic placental grading, fetal outcome

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Introduction

Fetus and placenta together called as fetoplacental unit. Proper functioning of placenta, growth and maturational change is a must for the proper

growth and development of the fetus in utero. Morphological changes of the placenta can be documented with gray scale serial ultrasound examination as pregnancy advances.

¹ Registrar, Department of Gynae & Obstetrics, Rajshahi Medical College Hospital.

² Professor & Head, Department of Gynae & Obstetrics, Rajshahi Medical College Hospital.

³ Associate Professor, Department of Gynae & Obstetrics, Rajshahi Medical College Hospital.

⁴ Consultant, Model Family Planning Clinic, Rajshahi Medical College Hospital.

⁵ Assistant Professor, Department of Radiology & Imaging, Rajshahi Medical College Hospital.

Since placenta is a fetal organ it seems logical that it should mature in fashion similar to that of other fetal organ system.

A degree of placental calcification is normal as the fetus approaches term; however accelerated placental maturation is associated with pregnancy induced hypertension, fetal growth restriction (IUGR) and fetal distress in labour – all factors which contribute to an increased risk of prenatal morbidity and mortality.^{1,2}

McKenna et al (2005)^{3,4} confirmed that detection of a grade III placenta at 36 weeks gestation assists in identifying the at risk pregnancy.

Abnormal placental calcification is also thought to be associated with diabetes and Rhesus incompatibility, with delayed placental maturation occurring in these conditions.⁵ Delayed placental maturation has been shown to be significantly associated with antenatal and intrapartum death.

The association of ultrasonically detectable placental changes with increasing gestational age was reported by a scientist (Winsberg 1973) but later on grading system based on the ultrasonographic appearance placenta was introduced by a group of scientists.⁶ They graded placenta from 0 (immature) to III (mature) on the basis of changes in the appearance of the chorionic plate, Placental substance and Basal layer.

Grade 0:

Chorionic plate – Straight and well defined

Placental substance – Homogenous

Basal layer – No densities

Grade I:

Chorionic plate – Subtle undulation

Placental substance – Scattered echogenic area

Basal layer - No densities

Grade II:

Chorionic plate – Indentation extending into placenta but not to basal layer.

Placental substance – Linear echogenic densities

Basal layer – Basal stippling

Grade- III:

Chorionic plate- Indentation extending all the way to the basal layer.

Placental substance- Large irregular densities casting acoustic shadow.

Basal layer – Echogenic densities become larger and denser.

A pregnancy is considered high risk when there are potential complications that could affect the mother, the fetus or both. The factors for which a pregnancy is considered high risk includes maternal age, medical conditions like hypertension, DM, kidney or heart problem, PE, multiple pregnancy, placenta previa etc.

USG provides a noninvasive technique for the evaluation of fetal gestational maturity. In 1979 Grannum and associates demonstrated a good correlation between maturational changes in placenta and fetal pulmonary maturity as determined by lecithin/sphingomyelin (L/S) ratio. Pstrucha and associates confirmed this findings and reported 100% correlation between a grade-III placenta and a mature L/S ratio. The present study was carried out to assess placental grading by sonography in high risk and normal pregnancy for predicting neonatal outcome.

Materials and Methods

This was a cross sectional type of descriptive study which was carried out in the Department of Obstetrics & Gynaecology in collaboration with the Department of Radiology & Imaging of Rajshahi Medical College Hospital. The duration of study was 2 years from January, 2012 to December 2013.

Pregnant women of 28 weeks gestation and onwards attending at the inpatient department of Obstetrics & Gynaecology of RMCH constituted study population. The sample size of the study was 200.

Data Collection

By systematic sampling technique data were collected from the respondents by face to face

interview through a partially structured questionnaire. Baseline information on some selected sociodemographic and biological characteristics of the responding pregnant mothers were collected. Ultrasonographic examinations of the responding pregnant mothers were done in the Radiology department and finally reports were recorded in the concerned section of the

questionnaire. Inclusion criteria of the respondents were pregnant women of 28 weeks and onwards having singleton pregnancy. Exclusion criteria were pregnant women in 3rd trimester having medical disorders like severe anaemia, heart disease, kidney disease, unwilling to participate in the study, do not like to do USG for placental grading.

Results

Total 200 Gravid women of 28 weeks gestation and onwards attending at the inpatient Department of Obstetrics & Gynaecology were examined in this study. Among them 43% belongs to high risk group and 57% had normal pregnancy. Among the high risk mother (43%) – 23.5% were Hypertensive, 10% diabetic, 6% Rh-isoimmunized and 3.5% had IUGR.

Table-I: Distribution of respondents by risk status

Risk status	Respondents	
	No.	%
Normal	114	57.0
High risk	86	43.0
Total	200	100.0

Table-I showed that 57% of respondents had normal pregnancy and 43% had high risk pregnancy.

Table-II: Relation between gestational age of the respondents and placental maturity by USG

Gestational age in weeks	Placental Grading by USG								Total	
	Grade-0		Grade-I		Grade-II		Grade-III			
	No	%	No	%	No	%	No	%	No	%
28-31	10	35.7	11	39.3	02	07.1	05	17.9	28	14%
32-37	03	3.0	37	37.4	48	48.5	11	11.1	99	49.5
>37	00	0.0	02	02.7	20	27.4	51	69.9	73	36.5
	13	6.5	50	25.0	70	35.5	67	33.5	200	100

$\chi^2=124.4$, $df= 6$, $p<0.001$

Table-II showed that among the respondents who had gestational age of 28-31 weeks – 35% had Grade-0, 39.3% had grade-I, 7.1% had grade-II and 17.9% had grade-III placental maturity estimated by sonography. Similarly among the respondents having gestational age of 32 to 37 weeks placental maturity of Grade-0, I, II, & III were 3%, 37.4%, 48.5% and 11.1% respectively. Among the gestational age group of 37 or more, placental maturity of Grade-0, I, II and III were also found by 0.0%, 2.7%, 27.4% & 69.9% respectively. So, placental grading detected by sonography was directly proportional to the gestational age of the patient which was found statistically significant ($p<0.001$).

Table-III: Placental grading at different gestational age in normal & high risk cases

SL No	Gestational age (weeks)	Normal pregnancy (n=114)		High risk pregnancy (n=86)	
		No.	%	No.	%
01.	28-31	Grade-0 -09 (81.8)		Grade-0 -01 (5.9)	
		Grade-I -01 (9.1)		Grade-I -10 (58.8)	
		Grade-II -00 (0.0)		Grade-II -02 (11.8)	
		Grade-III -01 (9.1)		Grade-III -04 (23.5)	
02.	32-37	Grade-0 -00 (0.0)		Grade-0 -03 (7.0)	
		Grade-I -24 (42.9)		Grade-I -13 (30.2)	
		Grade-II -29 (51.8)		Grade-II -19 (44.2)	
		Grade-III -03 (5.9)		Grade-III -08 (18.6)	
03.	>37	Grade-0 -00 (0.0)		Grade-0 -00 (0.0)	
		Grade-I -00 (0.0)		Grade-I -02 (7.7)	
		Grade-II -12 (25.5)		Grade-II -08 (30.8)	
04.	Significance	Grade-III -35 (74.5)		Grade-III -16 (61.5)	
		$\chi^2=17.48$, df= 6, p<0.001		$\chi^2=17.48$, df= 6, p<0.001	

Table-III showed different placental grading in both normal and high risk pregnancies in different gestational age groups. Sonographically detected placental grade in both high risk and normal pregnancies was found significantly associated with gestational age in weeks ($p<0.001$, $p<0.001$).

Table-IV: Relation between placental maturity by USG & fetal outcome in normal pregnancy

Placental maturity	Normal		Fetal outcome				Total	
	No.	%	No.	%	No.	%	No.	%
Grade-0	05	55.6	00	0.0	04	44.4	09	7.9
Grade-I	24	96.0	00	0.0	01	04.0	25	21.9
Grade-II	38	92.7	00	0.0	03	7.3	41	36.0
Grade-III	31	79.5	08	20.8	00	0.0	39	34.2
Total	98	86.0	08	7.0	08	7.0	114	100.0

$\chi^2=38.08$, df= 6, p<0.001

Table-IV showed that in normal pregnancy in placental maturity of grade-0, 55.6% had normal healthy fetal outcome, 44.4% had IUD/still birth. In grade-I placenta-96% had normal healthy fetal outcome and 4% had IUD, in grade-II placenta 92.7% had healthy fetus and 7.3% had IUD/still birth and in grade-III placenta 79.5% had healthy fetus and 20.8% had asphyxiated baby and no IUD. The result was found statistically significant ($p<0.001$)

Table-V: Relation between placental maturity by USG & fetal outcome in high risk pregnancy

Placental maturity	Normal		Fetal outcome				Total	
	No.	%	No.	%	No.	%	No.	%
Grade-0	04	10.0	00	0.0	00	0.0	04	4.7
Grade-I	18	72.0	07	28.0	00	0.0	25	29.1
Grade-II	18	62.1	11	37.9	00	0.0	29	33.7
Grade-III	12	42.9	13	46.4	03	10.7	28	32.6
Total	52	60.5	31	36.0	03	3.5	86	100.0

Table-V showed that in placental maturity of grade-0,100% had normal healthy fetal outcome in grade-I, 72.0% had normal healthy fetus and 28.0% had asphyxiated baby, in grade-II 62.1% had normal healthy fetus and 37.9% had asphyxiated baby and in placental maturity of grade-III 42.9% had normal healthy fetus, 46.4% had asphyxiated baby and 10.7% had IUD. So the relationship between placental maturity and fetal outcome in high risk pregnancy was found statistically insignificant ($p>0.005$)

Discussion

This cross sectional type of descriptive study provided some important information regarding the importance of detection of placental grade at different gestational age by ultrasonography both in normal and high risk pregnancies.

In this study the mean age of the respondents was 28-38 years, majority of the respondents (52.0%) had primary education. Maximum respondents (77.0%) were housewives and majority of them were from lower economic class and 41% were from middle class.

About 43% of the respondents had high risk pregnancy. Among them 23.5% had hypertension, 10% had diabetes mellitus, 6% had Rh-incompatibility and 3.5% had IUGR. About 43% of the respondents had regular antenatal check visit and 45% had irregular antenatal visit. In this study it was also found that 58% of the respondents were mildly anemic and 34% were moderately anemic.

75% of the respondent mother had normal healthy fetal outcome, 19.5% had outcome of asphyxiated babies and 5.5% had still births or IUD. Among the delivered babies 89% had birth weight of 2.5 to 3.9 kg, 8% had low birth weight and 3% had weight of 4 kg or more.

The average birth weight of Bangladeshi neonate was found to be between 2.48 to 2.53 kg.⁷ In the present study only 8% of the singleton birth were LBW and the average birth weight was 2896 gm. It indicates that the situation in Bangladesh has been improved to a greater extent and it may be due to day by day increasing maternal and child health care facilities in Bangladesh.

In normal pregnancy a researcher⁸ showed that in gestational age of 28 to 31 weeks 50% are of grade-I placenta, while in gestational age of 32-37 weeks about 54% are of grade-II and at more than 37 weeks 54% are of grade-II and 45% of grade-III placenta.

In high risk pregnancy at the gestational age of 28 to 31 weeks grade-II and grade-III placenta were found in hypertensive and IUGR. At the 31 to 36 weeks. Grade-II and grade-III placenta in APH cases might be a result of uteroplacental ischemia.

If the placenta appeared to be grade-I prior to 27 weeks, grade-II prior to 32 weeks and grade-III prior to 34 weeks of gestation the pregnancy would likely to be complicated with IUGR and Pre-eclampsia.^{9,10}

In this study, in total samples placental maturity was found significantly associated with fetal outcome ($p<0.001$), also in normal pregnancy

($p < 0.001$) but found not associated with fetal outcome in high risk pregnancies ($p > 0.05$).

In present study it was also found that there was a tendency of early maturation of placenta in hypertensive mother ($p < 0.001$), delayed maturation in diabetic mothers but statistically found not significant ($p > 0.05$). Rh-factor was found directly associated with placental maturation ($p < 0.05$) but IUGR was not found significantly associated ($p > 0.05$).

Our study, like other studies,^{1,8} showed that hypertension, APH and IUGR cases showed accelerated placental maturity, however Rhesus negative cases showed delayed placental maturity.

Conclusion

This study provided some basic information regarding placental grading by USG both in normal and high risk pregnancies. Though this was a cross sectional study, yet this work strived to depict a precise picture on sonographic placental grading and its relationship with high risk pregnancies, fetal outcome and some bio-social factors of pregnant mothers. From the study it is clear that accurate sonographic image of placenta can provide information earlier regarding its maturity and fetal outcome. Further research in this area is vital if progress is to be made in utilizing the placenta as part of the assessment of fetal health.

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All correspondence to

Dr. Farzana Begum

Registrar

Department of Obstetrics & Gynaecology

Rajshahi Medical College Hospital

Email: azana463@gmail.com