

Study of Corelation Between Ultrasonographically Observed Grade 3 Placenta at 36 Weeks Gestation and Fetal and Maternal Outcomes

Dr. Shashikala H Gowda¹, Dr. Asmita Singh², Dr. Sowmya K.³

¹Associate professor, Department of OBG, KIMS Hospital and Research Centre, VV Puram, Bangalore, Karnataka, India

²Post Graduate, Department of OBG, KIMS Hospital and Research Centre, VV Puram, Bangalore, Karnataka, India

³Assistant Professor, Department of OBG, KIMS Hospital and Research Centre, VV Puram, Bangalore, Karnataka, India

Abstract: *Current ultrasound assessment of placental calcification relies on Grannum grading. The ultrasonographic appearance of grade III placental maturation, if it occurs before 36 weeks, may signify placental dysfunction and is found to be associated with development of pre-eclampsia and low birth weight, meconium stained liquor, admissions to NICU and apgar less than 7 at 5 min of birth. Owing to increased incidence of preeclampsia and IUGR and fetal distress, the knowledge regarding the association between the grade of placenta at a particular gestational age and its association with maternal and fetal outcome is worth knowing.*

Keywords: Placental Grading, Gestational Age, Grannums Study

1. Introduction

The placenta is essential to fetal well-being, growth and development; it can be demonstrated reliably and accurately by ultrasound (1). The association of ultrasonically detectable placental changes with increasing gestational age was first reported by Winsberg (2), but it was Grannum et al. (3) who introduced a grading system based on the ultrasonographic appearance of placentas. They graded placentas from 0 (Immature) to III (mature) on the basis of changes in the appearance of the chorionic plate, placental structure and basal layer. By 38 gestational weeks, 5-10% of placentas present as grade III (3, 4). It used to be thought that a Grannum grade III placenta was associated with mature fetal lung and placental dysfunction (5). Furthermore, in the unselected obstetric population a grade III placenta at or below 35 weeks' gestation has been shown to be associated with subsequent development of pre-eclampsia (7) and pregnancies so identified are at increased risk of neonatal morbidity and mortality (8, 9). McKenna et al. in 2005 suggested a link with accelerated placental maturation and maternal disease (10). It has been substantiated by smaller studies (11). A recent study by Cooley et al. in 2010 further substantiates this association (12).

This study was designed to look at the prevalence of grade III placentas at 36 weeks' gestation in a low-risk obstetric population, to evaluate the relationship between a grade III placenta at 36 weeks' gestation and maternal characteristics that may be considered relevant in pregnancy and to determine the impact of placental architecture on pregnancy outcome in this low-risk obstetric population.

2. Materials and Methods

a) **Study Design** - prospective Study

b) **Study Period** - 1 year (june 2013 – june 2014)

c) **Study Place** - KIMS Hospital And Research Centre, Bangalore

d) **Subjects**-Patients who presented to Out Patient Department of Obstetrics and Gynaecology, or referred from other departments, in KIMS Hospital and Research Centre, Bangalore.

The local ethics committee approved the study. The inclusion criteria to the study were singleton pregnancies and known gestational age confirmed by ultrasound at less than 20 weeks of gestation.

The exclusion criteria were multiple pregnancy; known maternal medical problem; obstetric complication in a previous pregnancy; obstetric complication in this pregnancy prior to 36 weeks' gestation; and known fetal abnormality. All recruited pregnant women gave informed consent to participate in this study.

The ultrasound examination was performed at 36 weeks' gestation to determine placental maturity using a 2.0-5.0 MHz curvilinear transabdominal probe, of SIEMENS G-50 equipment. Particular attention was directed to the placenta. Placental maturity was determined using the Grannum classification by grading the placenta on a scale of 0 through III.

Grading was done according to the sonographic appearance of the chorionic plate, the placental substance, and the basal plate. The grading was based on the appearance of the bulk of the placenta rather than the edges.

For the purpose of the study, the original Grannum grades 0 and I was combined into a single category named grade I.

A grade 0 placenta has an easily delineated, relatively straight chorionic plate and a homogeneous texture throughout.

A grade I: placenta is characterized by an undulatory chorionic plate and scattered echogenic areas within.

A grade II: placenta is recognized by the presence of small echogenic areas along the basal layer of the placenta and the division of the placenta by comma-like echogenic densities that originate at the chorionic plate.

A grade III: placenta is characterized by echogenic indentations extending from the chorionic plate to the basal layer dividing the placenta into discrete components, resembling cotyledons.

The studied pregnant women were allocated into two groups: grade III placenta group comprised those patients demonstrating a grade III placenta at 36 weeks' gestation; and the grade 0-II placenta group comprised patients not demonstrating a grade III placenta. Both groups were compared for maternal age, parity, maternal smoking, proteinuric pregnancy-induced hypertension, fetal distress in labour, mode of delivery, Apgars, need for neonatal resuscitation at delivery, birth weight and admission to NICU.

Statistical analysis: Data were analyzed using the computer facility with the available statistical software packages of Epi-Info version 6 (WHO recommended). Data were presented as frequency and percentage. Odds ratio (OR) and its 95% confidence interval (CI) was calculated for the part one data, while relative risk (RR) and its 95% confidence interval (CI) was calculated for the part two data. P value was calculated using the χ^2 -test and a $P \leq 0.05$ was considered a significant difference.

3. Results

In this low-risk obstetric population scanned at 36 weeks' gestation, placentas from 200 patients were examined, of which 8 demonstrated a grade III placenta (Grannum classification). A grade II placenta was demonstrated in 36 of patients and 54 demonstrated a grade 0 or grade I placenta.

Table 1: Maternal and Fetal characteristics:

characteristics	Grade 3 placenta n = 8	Grade 0 to 2 n = 90	Odds ratio (95 % CI)	P value
nulliparous	4	34	1.87	0.139
Maternal age <25 years	4	24	2.88	0.01
smoking	1	7	1.03	0.967
Male fetus	4	46	1.24	0.619

A grade III placenta was more likely to be found in a nulliparous patient, 56.5% (4/8) vs. 41% (37/90), but the differences were insufficient to reach statistical significance (Table 1). A grade III (age placenta at 36 weeks was found to be significantly associated with young maternal age (age less than 25 ; 4 (52.2%) grade III vs. 24 (27.5%) grades 0-II), $P = 0.01$. A non-significant association with maternal smoking was observed: 1 (8.7%) women with grade III placentas were smokers compared with 7 (8.5%) women with grades 0-II. Also a non-significant association was found with fetal

sex: 4(56.5%) women with grade III placentas were pregnant with male fetus compared with 46 (51.2%) women with grades 0-II.

Table 2: Pregnancy Outcomes

	Grade 3 placenta n = 8	Grade 0 to 2 placenta (n = 90)	Relative risk	P value
Proteinuric PIH	1	2	4.94	0.021
Induction for suspected fetal compromise	2	3	4.7	0.001
Abnormal CTG	2	11	1.39	0.490
Meconium stained liquor	2	11	1.06	0.918
Apgar less than 7 at 5 min	0	4	1.07	0.943
Birth weight < 10 centile	4	5	3.19	0.017
Admissions to NICU	0	4	1.03	0.977

4. Discussion

The placenta mediates the intrauterine interaction between a mother and her baby. As the placenta ages, it begins to thin and in the third trimester may calcify. These changes are variable, but in approximately 15% of cases the calcifications extend completely through the substance of the placenta, completely outlining the cotyledons. These are termed grade III changes and should not occur before 34 weeks. In this low-risk population scanned at 36 weeks, 3.9% of placentas demonstrated a grade III placenta. This finding was comparable to the work done by McKenna et al. (10), who demonstrated a grade III placenta in 3.8% of a low-risk population at 36 weeks' gestation. A grade III placenta was associated with pregnancies that we know are more likely to be complicated: the young, nulliparous patient, who smokes (6, 10). This study has confirmed a statistical significant association between the presence of a grade III placenta and young maternal age. The study also confirmed that a mother demonstrating a grade III placenta at 36 weeks' gestation on scan was nearly about two times more likely to be nulliparous although the latter did not reach statistical significance. In addition, a non-significant association between a grade III placenta at 36 weeks' gestation and maternal smoking was observed, this disagree with the findings reported by McKenna et al (10). This may be explained by the fact that Asian women almost invariably did not smoke. In fact, smaller numbers were smokers in our study population in comparison to the numbers reported by McKenna et al. The study findings also confirmed a non-significant association of a grade III placenta with male fetus. This was also the case in the work done by McKenna et al (10). Premature placental maturation to a grade III configuration has been found in patients with chronic hypertension, preeclampsia, and IUGR.. A recent study by Cooley et al. in 2010 also suggested that higher Grannum grades were associated with an increase in the incidence of preeclampsia, obstetric intervention, and small for gestational age (SGA) infants (12)

5. Conclusion

Ultrasound detection of a grade III placenta at 36 weeks' gestation in a low-risk population helps to identify the "at risk" pregnancy. It appears to predict subsequent

development of pre-eclampsia and may help in identifying the growth-restricted baby. It may be used as an appropriate screening tool in the low-risk obstetric population, to verify the low-risk and identify the high-risk fetus.

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