

Evaluation of Placental Grading in 2nd and 3rd Trimester Using Gray Scale Ultrasound

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ABSTRACT

Background: Placental grading through gray-scale ultrasound provides valuable insight into the maturity and health of the placenta, offering a non-invasive method to monitor fetal well-being during pregnancy.

Aim of the study: To evaluate placental grading during the second and third trimesters using gray-scale ultrasound and to correlate placental maturity with gestational age and fetal outcomes.

Methods: This retrospective observational study was conducted at 250 Bedded general hospital Tangail, Bangladesh from 1/1/22 to 31/12/24 over a defined period. Forty-six pregnant women in their second and third trimesters, attending routine antenatal visits, were included. Placental grading was assessed using gray-scale ultrasound according to the Grannum classification. Data were collected using a structured pro forma and analyzed using SPSS-26.

Result: The mean age of the mothers was 27.9±2.9 years. The majority (80.43%) resided in rural areas. Placental maturity assessment revealed 36.96% each in Grades I and II, and 26.09% in Grade III. Most deliveries (71.74%) were vaginal, and 84.78% of the newborns were delivered at term. The mean birth weight was 2.59±0.4 kg. Live birth rate was 100%, with 10.87% of neonates experiencing birth asphyxia, oligohydramnios, or requiring SNCU admission.

Conclusion: Placental grading through gray-scale ultrasound in the second and third trimesters offers a reliable, non-invasive tool for assessing placental maturation and predicting fetal outcomes. However, it should be integrated with comprehensive clinical assessments for optimal perinatal care.

Keywords: Placental grading, Gray-scale ultrasound, Pregnancy, Fetal outcomes, Grannum classification.

I. INTRODUCTION

The placenta is a vital organ in pregnancy, serving as the interface between the mother and fetus, facilitating nutrient and gas exchange, and producing essential hormones [1]. Assessing placental health is crucial for monitoring fetal well-being and predicting potential complications [2]. One method of evaluation is placental grading via gray-scale ultrasound, which examines the placenta's maturity by identifying calcifications and structural changes [3]. Globally, placental abnormalities, such as placenta previa, occur in approximately 1 in every 200 pregnancies, underscoring the importance of accurate assessment techniques [4]. Placental grading, commonly referred to as the Grannum classification, is an ultrasound-based system that categorizes the placenta's maturity into four grades [5]. In Grade 0, typically observed before 18 weeks of gestation, the placenta exhibits uniform echogenicity with a smooth chorionic plate. By Grade I, which appears between 18 and 29 weeks, the placenta shows occasional parenchymal calcifications or hyperechoic areas, along with subtle indentations of the chorionic plate. As pregnancy advances to Grade II (30–38 weeks), there are occasional basal calcifications, deeper indentations of the chorionic plate that do not reach the basal plate, and comma-like densities at the chorionic plate. Grade III, observed at or beyond 39 weeks, is characterized by significant basal plate calcifications, with chorionic plate indentations extending to the basal plate, forming cotyledons [6]. An early progression to Grade III, termed hypermature placenta, is concerning and may be associated with placental insufficiency [7]. The progression of placental grading is generally correlated with advancing gestational age. However, an accelerated maturation, such as a Grade III placenta observed before 34 weeks, has been linked to adverse outcomes [8]. By 34–36 weeks of gestation, about 15% of unselected pregnant women exhibit a Grade

III placenta. Early placental maturation is linked to maternal smoking, low parity, younger age, and Caucasian ethnicity. These cases carry higher risks during labor and neonatal complications, including low birth weight, poor birth condition, and perinatal death [9]. While placental grading offers valuable insights, its routine use in obstetric practice has declined in some regions due to a weak correlation with adverse perinatal outcomes [10]. The visual assessment of placental maturity may not consistently predict complications, leading clinicians to rely on a combination of diagnostic tools and clinical judgment [6]. Gray-scale ultrasound remains a non-invasive, cost-effective method for evaluating placental structure and maturity [11]. Its widespread availability and real-time imaging capabilities make it a valuable tool in prenatal care [12]. However, the interpretation of placental grading should be contextualized within the broader clinical picture, considering maternal risk factors, fetal growth patterns, and other diagnostic findings [13]. Although gray-scale ultrasound offers valuable insights into placental maturity, its predictive utility for adverse perinatal outcomes remains limited [14]. Clinicians should integrate placental grading with comprehensive assessments to ensure optimal maternal and fetal health outcomes [15]. The aim of this study is to evaluate placental grading in the second and third trimesters using gray-scale ultrasound, assessing its correlation with gestational age, fetal well-being, and potential pregnancy outcomes.

II. METHODOLOGY & MATERIALS

This study was a retrospective observational study conducted at 250 Beded general hospital Tangail, Bangladesh from 1/1/24 to 31/12/24. The main objective was to evaluate placental grading in the second and third trimesters using gray-scale ultrasound. A total of 46 pregnant women participated in the study. These participants were selected from those attending routine antenatal checkups at hospital.

Inclusion Criteria

- Pregnant women in the second and third trimesters, aged 13 to 38 weeks of gestation.
- Married women.
- Women attending routine antenatal visits in the gynecology and obstetrics departments of the participating hospitals.

Exclusion Criteria

- Women in their first trimester of pregnancy.
- Patients with chronic hypertension or other pre-existing health conditions that could impact the study results.
- Patients with end-organ damage.

Ethical Considerations

The study was conducted after receiving approval from the Institutional Ethics Committee of hospital. Written informed consent was obtained from all participants or their legal representatives before enrollment in the study.

Data Collection

Data was collected using a pre-designed pro forma, which included detailed antenatal examination, medical history, and general physical and obstetric examinations. Grading of the placenta was done according to the classification system proposed by Grannum et al [16]. Ultrasonographic parameters and placental grading were recorded.

Ultrasound assessments were conducted using gray-scale ultrasound machines. The convex-shaped probe used had a frequency range of 4.6-6 MHz. These machines were employed to assess placental grading and evaluate its maturity during the second and third trimesters. The ultrasound method is non-invasive and provides valuable information about fetal development and placental condition.

Data Analysis

Data collected from the ultrasound scans were analyzed using SPSS-26 (Statistical Package for the Social Sciences) software. Descriptive statistics, such as frequency and percentages, were used to summarize the data and provide an overview of placental grading across different gestational ages. The findings were presented in terms of frequency distributions to understand the prevalence of placental maturation patterns.

III. RESULT

The mean age of the mothers was 27.9±2.9 years. 80.43% of participants were from rural areas and rest of them resided in urban locations. Regarding the mode of delivery, 71.74% of births occurred through vaginal delivery, and 28.26% required either lower uterine cesarean section (LUCS) or instrumental assistance. In terms of fetal maturity at birth, majority (84.78%) of newborns were delivered at term (Table 1). Figure 1 shows that a larger proportion of the study population (69.57%) was assessed during the third trimester, whereas 30.43% were

in the second trimester at the time of evaluation. Grade 1 and Grade 2 placental maturity were observed in 36.96% of participants each, with 17 cases documented for both grades. Grade 3 maturity was noted in 26.09% of cases, accounting for 12 participants (Figure 2). Fetal parameters among all newborns were analyzed and demonstrated that the mean birth weight was 2.59 ± 0.4 kg. All newborns were live births, resulting in a 100% live birth rate. Birth asphyxia was recorded in 10.87% of neonates, and oligohydramnios occurred in 10.87% of cases. Similarly, 10.87% of the newborns required Special Newborn Care Unit (SNCU) admission. Assessment of Apgar scores at 5 minutes indicated that 89.13% of neonates achieved a score of seven or more, while 10.87% had scores less than seven (Table 2).

Table 1: Baseline characteristics of the study population (n=46)

Parameters	Frequency (n)	Percentage (%)
Age of mothers (Years), Mean±SD	27.9±2.9	
Residence		
Urban	9	19.57
Rural	37	80.43
Mode of delivery		
Vaginal delivery	33	71.74
LUCS/Instrumental delivery	13	28.26
Fetal maturity at birth		
Term	39	84.78
Pre-term	3	6.52
Post-dated	4	8.70

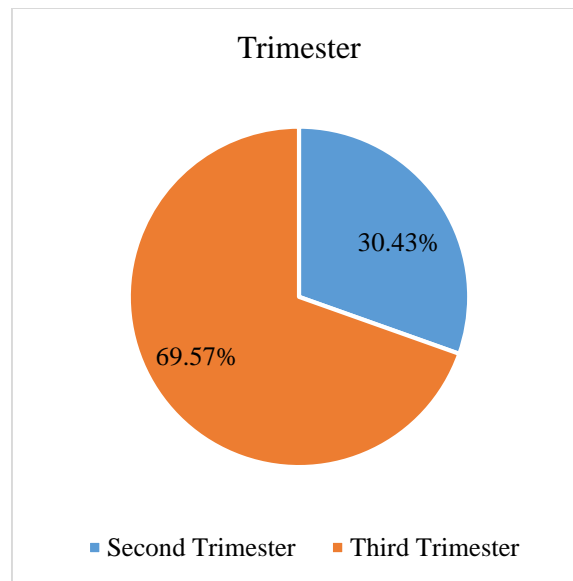


Figure 1: Number of participant according to trimester (n=46)

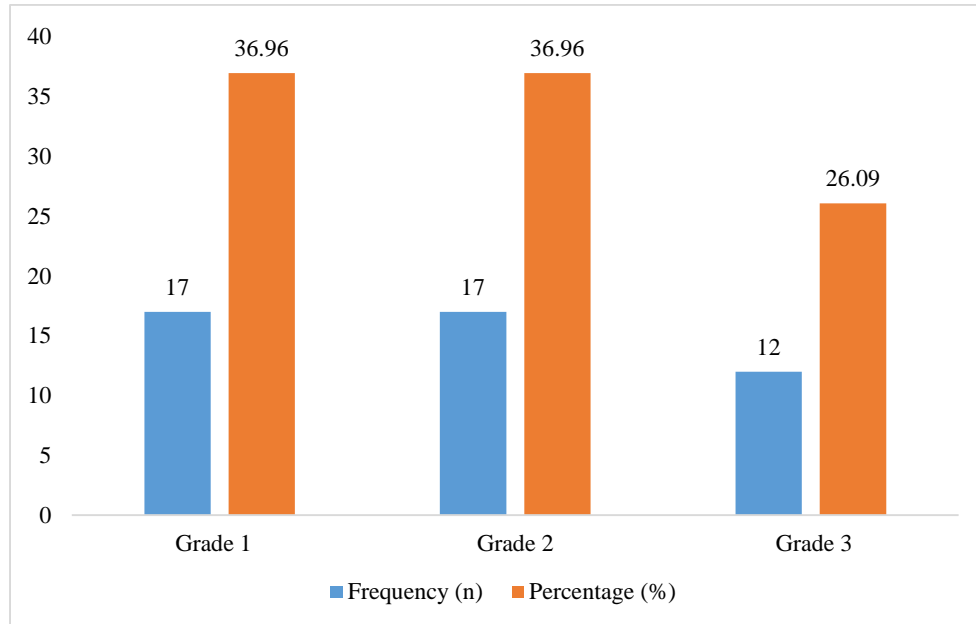


Figure 2: Placental grading by USG (n=46)

Table 2: Fetal parameters of the study population (n=46)

Parameters	Frequency (n)	Percentage (%)
Birth weight (kg), Mean±SD	2.59±0.4	
Birth asphyxia	5	10.87
Oligohydramnios	5	10.87
SNCU admission	5	10.87
Live baby	46	100.00
Apgar score at 5 min		
<7	5	10.87
7 or more	41	89.13

IV. DISCUSSION

Placental grading through gray scale ultrasound is a vital tool for assessing placental maturation and predicting fetal well-being during pregnancy. This study aims to evaluate the grading of the placenta in the 2nd and 3rd trimesters, providing insights into normal and abnormal developmental patterns. Understanding these changes is crucial for timely management of potential complications. The mean maternal age in our study was 27.9 ± 2.9 years. 80.43% of our study population resided in rural areas, and only 19.57% were from urban settings. Despite the majority being from rural regions, the outcomes were generally favorable, which indicate that access to routine antenatal care and ultrasound monitoring can positively impact pregnancy outcomes regardless of geographic location. According to our study, vaginal delivery accounted for 71.74% of cases, whereas LUCS (lower uterine cesarean section) or instrumental deliveries occurred in 28.26%. According to other study in Bangladesh, vaginal delivery remains the predominant mode of childbirth in rural settings [17]. Fetal maturity at birth revealed that 84.78% of deliveries were at term, 6.52% were preterm, and 8.70% were post-dated. This result is similar to the observation of Garain et al [18]. Out of these all participants, 69.57% participants were of second trimester and 30.43% were of third trimester. This is consistent with the findings of Aslam et al [19]. The percentage of placental maturity observed in Grade I is 36.96%, in Grade II is 36.96%, and in Grade III is 26.09%, as determined through ultrasound. Upon analyzing the collected data, the results revealed different percentages for placental classification across the 2nd and 3rd trimesters. A study by Farzana Begum and colleagues, initiated in 2020, focused on third-trimester placental grading using ultrasonography. The research concluded that a Grade III placenta on ultrasound is a reliable indicator of fetal lung maturity, offering a better alternative to amniocentesis, which is an invasive and time-consuming procedure with potential risks. In the study, ultrasonography revealed that 35% of women had Grade II placental maturity, 33.5% had Grade III, 25% had Grade I, and 6.5% had Grade 0. Most of the women (75%) were in good health and delivered healthy babies [20]. The mean birth weight in our study population was 2.59 ± 0.4 kg. Study by Proud and Adrian (1987) involving hypertensive pregnancies, have demonstrated a reduction in birth weight with advancing placental grades [21]. Oligohydramnios was observed in 10.87% of cases. Similar observations were made by Rabinovich A et al., who reported a low prevalence of oligohydramnios in their cohort [22]. Birth asphyxia was identified in 10.87% of neonates, with an Apgar score of less than 7 at 5 minutes also seen in 10.87% of cases. This pattern is similar to

findings by Vidyarth A et al., who also reported increased birth asphyxia with Grade III placental maturity but without a statistically significant difference [23]. In our study, 10.87% of neonates required SNCU admission. This observation is in line with previous research by Gowda SH et al., who found that early placental maturation was associated with a higher rate of NICU admissions [24]. All pregnancies in our study resulted in live births, and no stillbirths or neonatal deaths were reported. Chen et al. reported that Grade III placenta at earlier gestations (28–32 weeks) was associated with higher neonatal mortality, an association not observed in our normotensive cohort [25]. Several authors, including Jauniaux et al and Roberts et al, have emphasized that placental grading alone has limited predictive value and should be interpreted alongside other clinical and ultrasonographic parameters [4,10]. Furthermore, research by Suresh K (2020) and Yang et al suggests that whereas gray-scale ultrasound provides valuable information on placental thickness and structure, more advanced imaging techniques like three-dimensional sonoangiography and MRI offer superior diagnostic accuracy for certain placental pathologies [14,15]. This aligns with our observation that while gray-scale ultrasound remains an accessible, non-invasive modality, its role should be complementary rather than definitive in assessing fetal well-being.

Limitations of the study:

- The short duration of the study restricted the ability to assess long-term maternal and neonatal complications and mortality outcomes.
- The study was conducted at a single hospital in Bangladesh, which may not represent variations in healthcare access and practices across different regions or countries.
- Regional differences and healthcare disparities could influence the applicability of the study results to other settings.

V. CONCLUSION AND RECOMMENDATIONS

Placental grading using gray-scale ultrasound is a valuable, non-invasive tool in evaluating placental maturation during the second and third trimesters. Our study showed that most pregnancies with appropriate placental grading outcomes were associated with favorable fetal and maternal results. Although early placental maturation was observed in a subset of cases, the overall pregnancy outcomes remained largely positive, highlighting the importance of routine antenatal care and ultrasound monitoring. However, due to the limitations in sample size and study duration, larger multicenter studies are recommended to further validate these findings. Furthermore, placental grading should not be the sole determinant of fetal well-being but should be interpreted alongside other clinical and ultrasonographic parameters to guide comprehensive prenatal management.

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