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Frequency of Different Perinatal Outcomes Across Grade II and Grade III Placental Maturity

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ABSTRACT

Background: The placenta is a vital, multifunctional organ essential for fetal growth and development, serving as an indicator of intrauterine fetal status. Pathological placental changes can lead to adverse outcomes such as intrauterine growth restriction (IUGR), preterm birth, and perinatal mortality. Placental maturity, assessed sonographically, is an important predictor of perinatal outcomes. This study aimed to evaluate the impact of placental maturity (Grade II and Grade III) on perinatal outcomes in pregnancies at or beyond 34 weeks of gestation.

Methods: A total of 110 pregnant patients at ≥34 weeks of gestation were included. Maternal demographics, parity, gestational age, mode of delivery, and placental maturity grades were documented. Perinatal outcomes—low APGAR score, stillbirth, low birth weight, NICU admission, and preterm birth—were assessed. Associations between placental maturity grades and perinatal outcomes were analyzed and compared with findings from previous studies.

Results: The mean maternal age was 27 years (±7.211); 37% were primiparous and 63% multiparous. Of the participants, 45% were between 34–35 weeks and 55% between 36–37 weeks of gestation. Most deliveries (86%) were normal vaginal deliveries. Grade III placental maturity was present in 65% of patients, and Grade II in 35%. Overall, 4.5% of neonates had low APGAR scores, 4.5% were stillborn, 2.7% had low birth weight, 5.45% required NICU admission, and 2.7% were preterm. In Grade II placentas, 8% had low APGAR scores, 11% were stillborn, and 8% required NICU admission. In Grade III placentas, 3% had low APGAR scores, 1% were stillborn, and 4% required NICU admission. Comparative evidence from previous studies (Dash S et al., Jamal A et al.) similarly demonstrates an association between advanced placental maturation and increased risk of adverse outcomes.

Conclusion: Advanced placental maturity is significantly associated with adverse perinatal outcomes, including low APGAR scores, stillbirth, low birth weight, and NICU admissions. The findings are consistent with earlier research and underscore the importance of monitoring placental grading in late gestation to identify pregnancies at risk and optimize perinatal care.

Keywords: Placental Maturity, Perinatal Outcomes, Grade III Placenta, Low APGAR Score, NICU Admission.

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INTRODUCTION

Placenta is a vital organ that connects the fetus to the uterine lining and ensures the proper development of the fetus throughout pregnancy. It performs several essential functions, including nutrient and gas exchange, hormone production, and waste removal. The placenta also serves as a crucial indicator of the intrauterine environment, with any abnormalities potentially leading to adverse fetal outcomes. Placental dysfunction, often indicated by pathological changes, is linked to a range of pregnancy complications, including perinatal mortality, fetal growth restriction (IUGR), and preterm birth^1. Placental calcification, particularly in the third trimester, is considered a normal physiological phenomenon, but when it occurs prematurely, it may signal placental insufficiency. Grade III placental maturity, characterized by advanced calcification, is often seen as a risk factor for adverse pregnancy outcomes. Studies have shown that grade III placental calcification, detected around 36 weeks, is associated with complications like pregnancy-induced hypertension, fetal distress, and low birth weight^2. Early identification of grade III placental changes helps to determine the need for closer monitoring and timely interventions to reduce perinatal morbidity and mortality^3. The prevalence of grade III placenta by 36 weeks is relatively low, at around 3.9%, but its occurrence is significantly higher in pregnancies with complications such as preeclampsia and IUGR. The incidence of adverse perinatal outcomes in these cases is considerable, with preterm birth, low birth weight, and NICU admission being some of the most common issues observed^4. For instance, in pregnancies with preterm placental calcification, the incidence of low birth weight and preterm birth increases significantly, with a higher risk of neonatal complications and mortality^5. These findings highlight the importance of understanding placental changes and their potential implications for fetal health^6. However, there is conflicting evidence in the literature regarding the clinical significance of placental calcification. Some studies argue that placental calcification represents a normal aging process, particularly in pregnancies approaching term, while others suggest that preterm calcification is an indicator of placental dysfunction that warrants careful monitoring^7. The lack of consensus in the literature underscores the need for further research to clarify the relationship between placental calcification and pregnancy outcomes, and to develop clearer guidelines for managing pregnancies with grade III placental changes^8. Placental calcification often leads to a clinical dilemma, particularly when it is detected prematurely. The perception of calcification as a sign of placental aging or insufficiency can result in unnecessary interventions, such as labor induction or cesarean delivery, even when these measures may not be required. These interventions, while aimed at preventing complications, can introduce their own risks, including maternal morbidity, neonatal complications, and emotional distress for families^9. Therefore, a more nuanced approach to managing pregnancies with grade III placental changes is necessary, focusing on individualized

assessment and monitoring rather than routine intervention[10]. The objective of this study is to explore the relationship between placental calcification and perinatal outcomes, with a specific focus on grade II and III placental maturity. By examining the frequency and severity of perinatal complications in pregnancies with these placental changes, this study aims to provide valuable insights that can guide clinical decision-making. The findings will help establish clearer guidelines for managing pregnancies with placental calcification, ensuring that interventions are only made when truly necessary, and that maternal and neonatal health is optimized[11]. Placental development begins early in pregnancy and is essential for establishing a healthy maternal-fetal environment. The placenta is formed from the trophoblast, which gives rise to the syncytiotrophoblast, a multinucleated structure responsible for nutrient and gas exchange[12]. As pregnancy progresses, the placenta undergoes several changes to support fetal growth. By the end of the first trimester, the placenta has developed a complex vascular network, which increases in size and complexity as the pregnancy continues[13]. The placenta functions as both an endocrine and metabolic organ, with the syncytiotrophoblast playing a crucial role in regulating maternal metabolism and providing nutrients to the fetus. Placental hormones, such as human placental lactogen and placental growth hormone, have significant effects on maternal metabolism, including increasing food intake, fat deposition, and insulin resistance, which are necessary for supporting fetal growth[14]. At the same time, the placenta acts as a selective barrier, protecting the fetus from harmful substances, including maternal stress hormones and environmental toxins[15]. Despite its vital functions, the placenta is also susceptible to pathological changes, particularly in the presence of maternal complications such as hypertension, diabetes, or infections. These changes, such as placental infarction, retroplacental hematomas, and placental calcification, can interfere with placental function and compromise fetal health. In cases of preeclampsia, for example, the placenta may show signs of ischemia, reduced blood flow, and increased oxidative stress, which can lead to fetal growth restriction, preterm birth, and other complications[16]. A thorough understanding of the normal and pathological changes in the placenta is essential for managing high-risk pregnancies. The use of diagnostic tools, such as ultrasound and placental imaging, can help identify placental abnormalities and guide clinical decision-making. Early detection of placental dysfunction can lead to timely interventions, including closer monitoring of fetal well-being, more frequent ultrasounds, and in some cases, early delivery[17]. The goal is to improve maternal and fetal outcomes while minimizing unnecessary interventions[18]. In conclusion, placental calcification, particularly grade III changes, is a key factor in assessing pregnancy risk. While some degree of placental aging is normal, premature calcification may indicate placental insufficiency and increase the risk of adverse outcomes such as preterm birth, low birth weight, and fetal distress. This study aims to clarify the role of placental calcification in pregnancy outcomes and provide evidence-based guidelines for managing pregnancies with these changes[19]. By addressing

the gaps in the current literature, this research will contribute to improving the care of high-risk pregnancies and reducing perinatal morbidity and mortality[20].

METHODS

This descriptive case series study was conducted at the Obstetrics and Gynecology Department of MTI/Lady Reading Hospital, Peshawar, from May 18, 2022, to November 18, 2022, with a sample size of 110 patients calculated based on a 95% confidence level, a 4.8% prevalence of low Apgar score^6, and 4% absolute precision. Patients with a gestational age of 34 weeks or more, singleton pregnancies, and placental maturity changes identified via ultrasound were included, while those with congenital anomalies, multiple gestations, placenta previa, previous cesarean sections, uterine anomalies, or other conditions affecting fetal outcomes were excluded to minimize bias. All participants gave informed consent, and demographic data such as maternal age, parity, and gestational age were recorded. Placental maturity was assessed through ultrasound, and patients with grade II or III placental maturity changes were followed until delivery, noting the mode of delivery and perinatal outcomes, including stillbirth, early neonatal death, birth weight, and 5-minute Apgar score. Data were analyzed using SPSS version 20, with quantitative variables presented as means ± standard deviation, and categorical variables as frequencies and percentages. Stratified analysis based on maternal age, gestational age, parity, placental maturity, and delivery mode was conducted, with the chi-square test used to assess the significance of differences between groups ($p \leq 0.05$). This methodology aimed to comprehensively assess the relationship between placental maturity changes and perinatal outcomes

RESULTS

When analyzing the mode of delivery, 95 (86%) patients had a normal vaginal delivery (NVD), and 15 (14%) patients underwent a cesarean section (Table 4). Placental maturity was categorized, with 38 (35%) patients having grade II placental maturity, and 72 (65%) having grade III placental maturity (Table 5). The perinatal outcomes were also assessed, with 5 (4.5%) neonates having a low Apgar score, 5 (4.5%) experiencing stillbirth, 3 (2.7%) having low birth weight, and 6 (5.45%) being admitted to the NICU. Notably, there were no cases of early neonatal death, and 3 (2.7%) neonates were preterm (Table 6). Stratification of perinatal outcomes based on placental maturity changes showed that in grade II placental maturity, 3 (8%) neonates had a low Apgar score, 4 (11%) had stillbirth, and 2 (5%) had preterm birth, while in grade III placental maturity, 2 (3%) neonates had a low Apgar score, 1 (1%) had stillbirth, and 1 (1%) had preterm birth (Table 11). Perinatal outcomes were further stratified by age, with a significantly higher incidence of low Apgar scores in the 31–

40-year age group (p = 0.0067) (Table 7). The stratification by parity indicated no significant differences in outcomes between primi and multiparous patients (Table 8). Analysis by gestational age revealed no significant differences in perinatal outcomes between the 34-35 weeks and 36-37 weeks groups, though the incidence of preterm birth was slightly higher in the 36-37 weeks group (p = 0.5577) (Table 9). Finally, stratification by mode of delivery showed no significant differences in perinatal outcomes between normal vaginal deliveries and cesarean sections (Table 10). These findings highlight the importance of placental maturity in predicting perinatal outcomes, particularly with regard to stillbirth, low Apgar scores, and NICU admissions.

Table 1. Demographic and Clinical Distribution

Variable	Frequency	Percentage
Age Group		
20-30 years	80	73%
31-40 years	30	27%
Parity		
Primi Para	41	37%
Multi Para	69	63%
Gestational Age (POG)		
34-35 weeks	50	45%
36-37 weeks	60	55%
Mode of Delivery		
Normal Vaginal Delivery	95	86%
Cesarean Section	15	14%

In this study, the age distribution of the participants revealed that 80 (73%) patients were between 20-30 years of age, while 30 (27%) patients were in the 31–40-year age range, with a mean age of 27 years (±7.211) (Table 1).

Table 2. Placental Maturity and Perinatal Outcomes

Placental Maturity	Grade II	Grade III	Total	P Value
Low APGAR Score	3 (8%)	2 (3%)	5 (4.5%)	0.2205

Stillbirth	4 (11%)	1 (1%)	5 (4.5%)	0.0286
Low Birth Weight	1 (3%)	2 (3%)	3 (2.7%)	0.9642
NICU Admission	3 (8%)	3 (4%)	6 (5.45%)	0.4129
Preterm Birth	2 (5%)	1 (1%)	3 (2.7%)	0.2355

Regarding parity, 41 (37%) patients were primiparous, and 69 (63%) were multiparous (Table 2).

Table 3. Stratification of Perinatal Outcomes by Age

Perinatal Outcome	20-30 Years	31-40 Years	Total	P Value
Low APGAR Score	1 (1%)	4 (13%)	5 (4.5%)	0.0067
Stillbirth	5 (6%)	0 (0%)	5 (4.5%)	0.1610
Low Birth Weight	1 (1%)	2 (7%)	3 (2.7%)	0.1203
NICU Admission	2 (3%)	4 (13%)	6 (5.45%)	0.0258
Early Neonatal Death	0 (0%)	0 (0%)	0 (0%)	0.0000
Preterm Birth	2 (3%)	1 (3%)	3 (2.7%)	0.8111

The gestational age distribution showed that 50 (45%) patients were in the 34-35 weeks period of gestation (POG), while 60 (55%) patients were in the 36-37 weeks POG (Table 3).

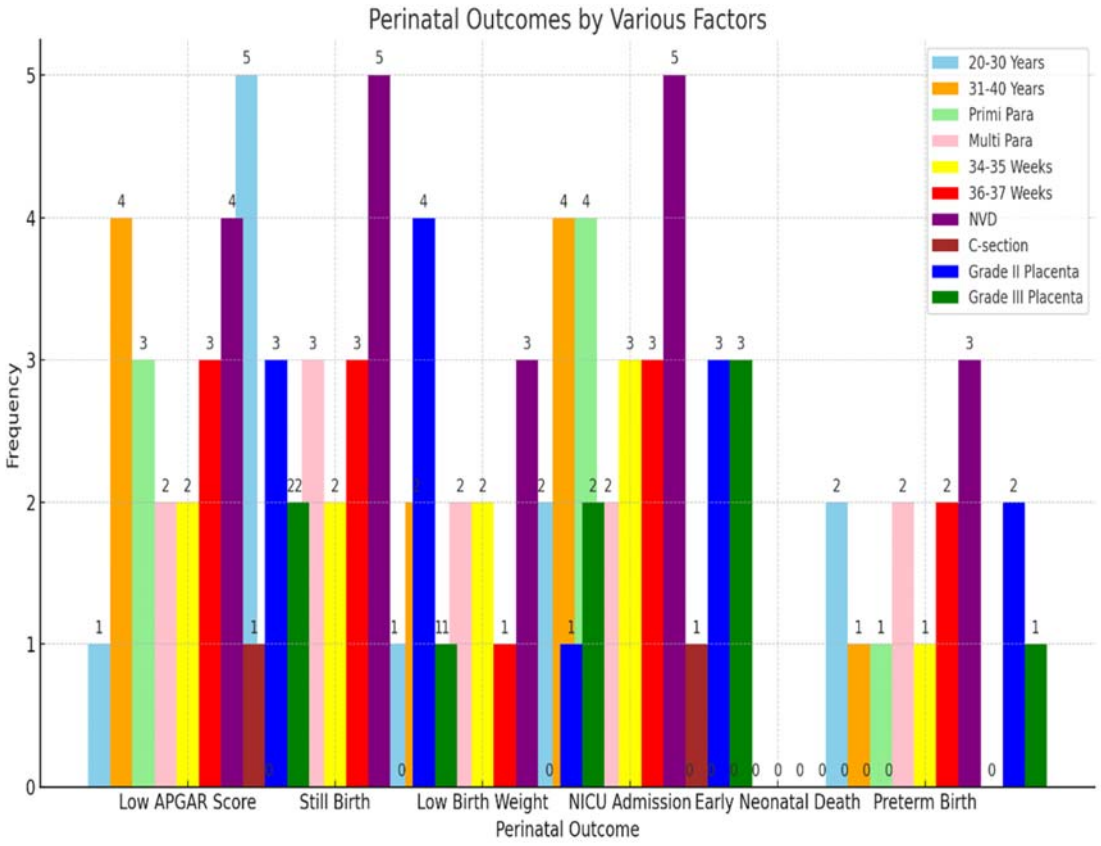
Table 4. Stratification of Perinatal Outcomes by Parity

Perinatal Outcome	Primi Para	Multi Para	Total	P Value
Low APGAR Score	3 (7%)	2 (3%)	5 (4.5%)	0.2820
Stillbirth	2 (5%)	3 (4%)	5 (4.5%)	0.8972
Low Birth Weight	1 (2%)	2 (3%)	3 (2.7%)	0.8862
NICU Admission	4 (10%)	2 (3%)	6 (5.45%)	0.1256

Early Neonatal Death	0 (0%)	0 (0%)	0 (0%)	0.0000
Preterm Birth	1 (2%)	2 (3%)	3 (2.7%)	0.8862

Table 5. Stratification of Perinatal Outcomes by Mode of Delivery
(n=110)

Perinatal Outcome	Normal Vaginal Delivery (NVD)	Cesarean Section (C/section)	Total	P Value
Low APGAR Score	4 (4%)	1 (7%)	5 (4.5%)	0.6712
Stillbirth	5 (5%)	0 (0%)	5 (4.5%)	0.3631
Low Birth Weight	3 (3%)	0 (0%)	3 (2.7%)	0.4852
NICU Admission	5 (5%)	1 (7%)	6 (5.45%)	0.8239
Early Neonatal Death	0 (0%)	0 (0%)	0 (0%)	0.0000
Preterm Birth	3 (3%)	0 (0%)	3 (2.7%)	0.4852



DISCUSIION

Placenta is a complex multifunctional organ joined to the coating of the womb, which maintains pregnancy and promotes normal fetal development. Pathological changes in the placenta adversely affect fetal outcomes since it is a mirror reflecting the intrauterine status of the fetus. Placental anomalies are considered a leading cause of perinatal mortality[21]. Proper functioning of the placenta, its normal growth, and timely maturational changes are essential for the normal growth and development of the fetus in utero. The fetus and placenta together form the fetoplacental unit. A mild 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 labor—factors that contribute to an increased risk of perinatal morbidity and mortality[22,23]. Detection of grade III placenta at 36 weeks gestation helps identify at-risk pregnancies and requires close monitoring to continue pregnancy[24].

In this study, the mean age was 27 years (±7.211). Of the patients, 41 (37%) were primiparous, and 69 (63%) were multiparous. A total of 50 (45%) patients had a POG of 34–35 weeks, while 60 (55%)

had a POG of 36–37 weeks. Regarding mode of delivery, 95 (86%) patients had a normal vaginal delivery (NVD), and 15 (14%) patients had a cesarean section. Placental maturity was analyzed, showing that 38 (35%) patients had grade II placental maturity and 72 (65%) had grade III placental maturity.

Perinatal outcomes included 5 (4.5%) neonates with a low APGAR score, 5 (4.5%) neonates with stillbirth, 3 (2.7%) neonates with low birth weight, 6 (5.45%) neonates admitted to the NICU, no early neonatal deaths, and 3 (2.7%) neonates with preterm birth. Additionally, in grade II placental maturity, 3 (8%) neonates had a low APGAR score, 4 (11%) neonates had stillbirth, 1 (3%) neonate had low birth weight, 3 (8%) neonates were admitted to the NICU, with no cases of early neonatal death, and 2 (5%) neonates had preterm birth. In grade III placental maturity, 2 (3%) neonates had a low APGAR score, 1 (1%) neonate had stillbirth, 2 (3%) neonates had low birth weight, 3 (4%) neonates were admitted to the NICU, with no cases of early neonatal death, and 1 (1%) neonate had preterm birth.

In a study, it was reported that grade II and grade III placental maturity was associated with several adverse outcomes, including a low APGAR score (6.8% versus 14.3%; $p = 0.004$), NICU admission (4.2% versus 7.1%; $p = 0.026$), abnormal cardiotocography (11% versus 18.5%; $p = 0.024$), meconium-stained liquor (8.7% versus 17.8%; $p = 0.004$), and low birth weight (24.01% versus 32.8%; $p = 0.04$). These outcomes were associated with a relative risk (95% CI) of 2.10 (1.2639 to 3.4647), 2.10 (1.0927 to 4.0634), 1.68 (1.0684 to 2.6597), 2.03 (1.2503 to 3.3258), and 1.36 (1.0130 to 1.8484), respectively[25].

Similarly, another study reported that the incidence of grade III placental maturity by 36 weeks gestation is 3.9%. The population-based prevalence of preterm placental calcification (PPC) ranges between 3.8% and 23.7%. The study found that preterm birth (<37 weeks) occurred in 43.5%, low birth weight (<2500 g) in 34.8%, NICU admission in 14.5%, low APGAR score (<7 at 5 minutes) in 5.8%, and mortality in 2.9%. The incidence of IUGR was 4.4% in grade I, 7.1% in grade II, and 27.8% in grade III[26]. These results highlight the significant relationship between placental maturity and perinatal outcomes, stressing the need for close monitoring in cases of advanced placental maturation.

CONCLUSION

Placental maturity, particularly grade III, is strongly linked with adverse perinatal outcomes, including low APGAR scores, stillbirth, low birth weight, and NICU admissions. Early detection of grade II and III placental maturity changes can help identify high-risk pregnancies, enabling closer

monitoring and timely interventions to improve fetal outcomes. This study emphasizes the importance of regular monitoring of placental maturity, especially in pregnancies nearing term, to mitigate risks associated with placental dysfunction. Further research is needed to refine management protocols for pregnancies with advanced placental maturation to optimize maternal and fetal health.

LIST OF ABBREVIATIONS

None

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

This study was approved by Lady Reading Hospital Medical Teaching Institution Ethical Review Committee (Approval No: 206/LRH/MTI).

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE policy

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