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Correlation Between Placental Thickness on Ultrasonography and Histopathological Findings with Perinatal Outcome: A Prospective Observational Study

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Abstract

Background: The placenta plays a crucial role in fetal development, influencing both maternal and fetal health. Its morphology and pathology are increasingly recognized as indicators of perinatal outcome. Placental thickness measured by ultrasonography (USG) has emerged as a non-invasive parameter potentially predictive of fetal complications. Histopathological examination (HPE) post-delivery further reveals detailed insights into placental health, offering diagnostic confirmation.

Objective: This study evaluates the correlation between placental thickness as assessed on USG and placental histopathology with perinatal outcomes in singleton pregnancies, aiming to identify predictive markers for adverse neonatal events.

Methods: A prospective observational study was conducted over a one-year period at Gauhati Medical College and Hospital (GMCH), Guwahati. A total of 120 pregnant women with singleton pregnancies at ≥34 weeks gestation were enrolled. Placental thickness was measured ultrasonographically and categorized as thin (<30 mm), normal (30–40 mm), or thick (>40 mm). After delivery, all placentas were subjected to detailed histopathological examination. Perinatal outcomes analyzed included birth weight, Apgar score, meconium-stained liquor, neonatal intensive care unit (NICU) admission, and presence of birth asphyxia. Statistical analysis was performed using chi-square and ANOVA tests, with significance defined as $p<0.05$.

Keywords: Placental thickness , histopathological finding and perinatal outcome

INTRODUCTION

The placenta is a vital fetal organ that performs metabolic, immunological, endocrine, respiratory, and nutritional activities. It also helps to safeguard the fetus by functioning as a barrier against infections and toxins. Normal placental anatomy and function are necessary for proper fetal growth and development. During term pregnancy, the placenta weighs approximately one-fifth of the fetus. Changes in maternal metabolism influence placental function and morphology, which in turn influence birth weight during delivery. Maternal weight gain during pregnancy has a direct impact on the developing fetus and, indirectly, adult health outcomes. 1,2 The advent and advancements in ultrasonography have revolutionized obstetric care by enabling detailed Doppler imaging of the placenta. This technology allows clinicians to assess placental morphology and uteroplacental circulation, which is crucial in managing complicated pregnancies. By visualizing blood flow patterns, Doppler imaging helps identify abnormalities in placental function, such as poor perfusion or vascular resistance, which are often associated with conditions like preeclampsia and intrauterine growth restriction (IUGR). Early detection through Doppler imaging facilitates timely interventions, improving maternal and fetal outcomes in high-risk pregnancies.3 —The normal range for placental thickness is roughly consistent with number of gestational weeks. It has been observed that

placental thickness increases with increasing gestation. There was discovered to be a linear relationship between its thickness at the place of cord insertion and gestational age. Furthermore, differences in placental thickness were discovered to be linked to higher rates of perinatal morbidity and mortality. Low birth weight (LBW) has long been recognised as a risk factor for long-term consequences, particularly cardiovascular and metabolic diseases.4 Numerous factors that contribute to aberrant newborn birth weight—both high and low—have recently been found by experts.5-7 Preeclampsia, chorioamnionitis, intrauterine growth restriction (IUGR), and thick placenta are associated with these conditions, while thin placenta is associated with Rh negative pregnancy, intrauterine infections, gestational diabetes, and fetal hydrops.5 Few research have shown how placental thickness affects fetal outcome prediction, and even fewer have found a link between birth weight and placental thickness at various gestational ages‖‖. 1,2

To further explore the clinical significance of the USG findings, histopathologic investigation of the placenta post-delivery has proven invaluable.8 Histopathology delves deeper, moving beyond just the gross morphological assessment to microscopic tissue examination, revealing intricate details about placental health, tissue architecture, and any underlying pathologies.9 Such examinations have elucidated connections between placental morphology and conditions like chronic villitis, infarctions, or chorioamnionitis, all of which can profoundly impact fetal and neonatal outcomes.10 A close examination of the association between placental thickness on USG, its histopathological features, and their collective impact on perinatal outcomes could shed light on potential prognostic indicators during pregnancy. Such knowledge may enhance the accuracy of antenatal care, guiding interventions when necessary and ensuring optimal fetal outcomes.11 The role of placental thickness—whether classified as normal, thin, or thick— in determining fetal outcomes remains inconclusive. Although some studies suggest that abnormal placental thickness may be linked to adverse outcomes, such as intrauterine growth restriction, preterm birth, or low birth weight, the evidence is not definitive. Thin placentas have been associated with poor placental function and inadequate nutrient supply, potentially leading to fetal growth restriction, while thick placentas may indicate gestational diabetes, fetal macrosomia, or placental insufficiency. Despite these observations, the relationship between placental thickness and neonatal outcomes has not been fully established, largely due to a lack of comprehensive prospective and longitudinal studies. Most of the current research is cross-sectional, offering only a snapshot of placental development at a specific gestational age, which limits the ability to predict long-term fetal outcomes accurately. To draw clearer conclusions, there is a need for more follow-up studies that track placental development across various stages of pregnancy and its direct impact on neonatal health. This would help determine whether deviations from normal placental thickness are predictive of specific complications and improve the clinical management of pregnancies at risk for poor fetal outcomes. Thus, this study was intended to evaluate association of placental thickness and placental histopathology with perinatal outcome.

RESULTS

1. Distribution of Placental Thickness

Among the 120 pregnant women included in the study:

Table 1. Distribution of Placental thickness at USG

Placental Thickness	Frequency	Percent
<30 mm	3	2.5%
30-40 mm	114	95%
>40 mm	3	2.5%
Total	120	100%

- 3 women (2.5%) had placental thickness less than 30 mm.
- 114 women (95%) had placental thickness between 30–40 mm.
- 3 women (2.5%) had placental thickness greater than 40 mm.

The placental thickness in the study population ranged from 28 mm to 42 mm, with a mean value of 35.81 ± 2.72 mm.

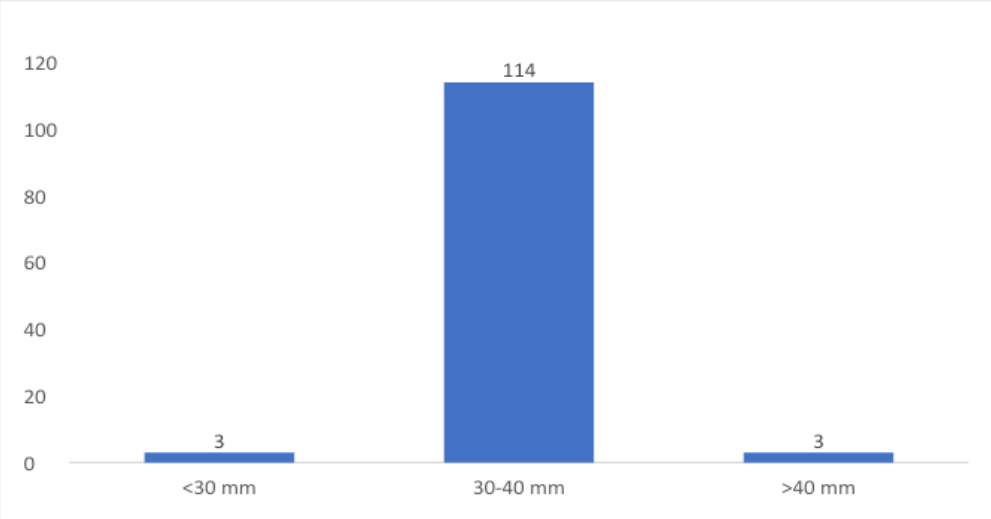

Figure 1. Distribution of Placental thickness at USG

2. Gestational Age and Placental Thickness

The gestational age of the study participants was distributed as follows:

Table 2. Distribution of Gestational Age at USG (weeks)

Gestational Age at USG	Frequency	Percent
34-36 weeks	76	63.3%
36-38 weeks	44	36.7%
Total	120	100%

- 76 women (63.3%) were between 34–36 weeks.
- 44 women (36.7%) were between 36–38 weeks.

The mean gestational age was calculated to be 35.67 ± 1.27 weeks. A statistically significant positive correlation was observed between gestational age and placental thickness ($p = 0.031$), indicating that placental thickness tends to increase with advancing gestation.

3. NICU Admission and Placental Thickness

A total of 24 neonates (20%) required admission to the Neonatal Intensive Care Unit (NICU). The distribution of NICU admissions in relation to placental thickness was as follows:

Table 3 Comparison of Placental Thickness and NICU admissions

Placental Thickness	NICU Admission				
	Yes	No	Total	P value	Test used
<30 mm	0(0%)	3(3.1%)	3(2.5%)	0.002	
30-40 mm	21(87.5%)	93(96.9%)	114(95%)		
>40 mm	3(12.5%)	0(0%)	3(2.5%)		
Total	24	96	120		

					Chi Square

- 0 admissions were reported in the <30 mm group.
- 21 admissions (87.5%) occurred in the 30–40 mm group.
- 3 admissions (12.5%) were from the >40 mm group.

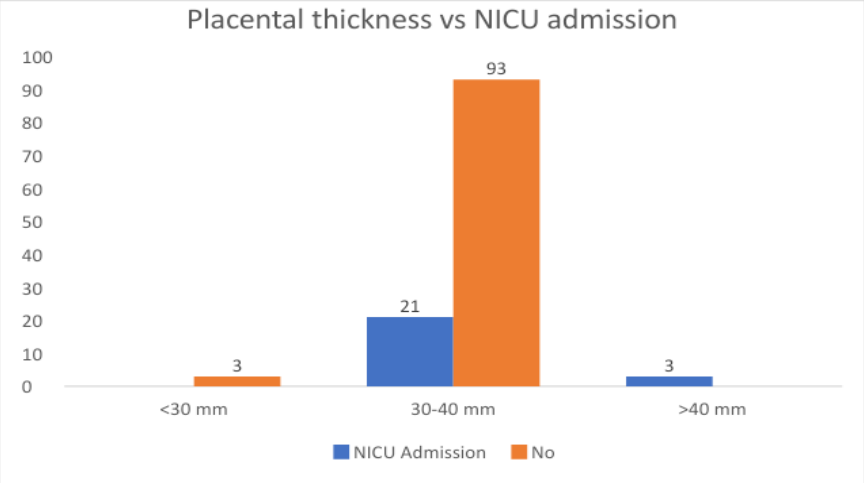

Figure 3 Comparison of Placental Thickness and NICU admissions

There was a statistically significant association between placental thickness and NICU admissions ($p = 0.002$), suggesting that abnormal placental thickness may be linked to adverse neonatal outcomes.

4. Fetal Complications and Placental Thickness

Various fetal complications were analyzed in relation to placental thickness:

Table 4. Distribution of Fetal Complications

Fetal Complications	Frequency	Percent
Low birth weight	11	9.2%
Birth asphyxia	03	2.5%
MSL	08	6.6%
Normal	98	81.6 %

- Low Birth Weight (LBW) was observed in 11 neonates (9.2%), all within the 30–40 mm group ($p = 0.727$).
- Birth Asphyxia was reported in 3 neonates (2.5%), again only in the 30–40 mm group ($p = 0.922$).
- Meconium-Stained Liquor (MSL) occurred in 8 cases (6.6%), all within the 30–40 mm group ($p = 0.798$).
  No cases of these complications were recorded in the <30 mm or >40 mm groups. However, none of these associations were statistically significant.

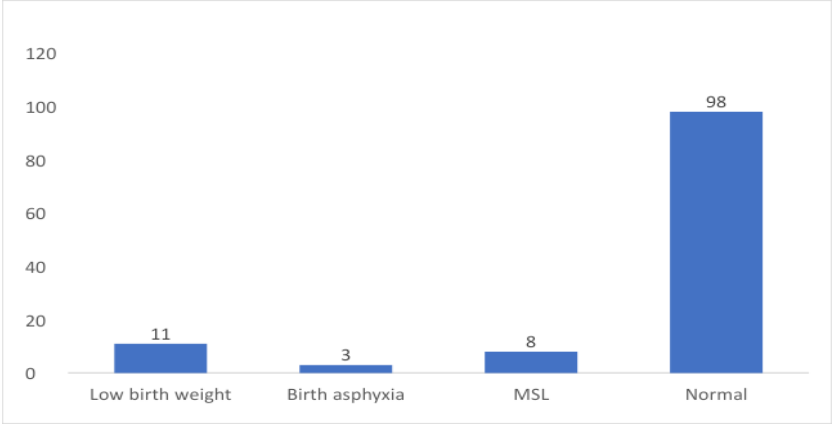

Figure 4. Distribution of Fetal Complications

5. Apgar Scores

The Apgar scores at 1 and 5 minutes were assessed for the neonates:

Table 5. Distribution of Apgar score at 1 minute

Apgar score at 1 minute	frequency.	Percent
<7	5	4.2%
>=7	115	95.8%
Total	120	100%

- At 1 minute, 5 neonates (4.2%) had a score less than 7. The mean score was 7.67 ± 0.78.
- At 5 minutes, 3 neonates (2.5%) had a score less than 7. The mean score improved to 8.80 ± 0.68.
- Most neonates showed favorable outcomes by the 5-minute assessment.

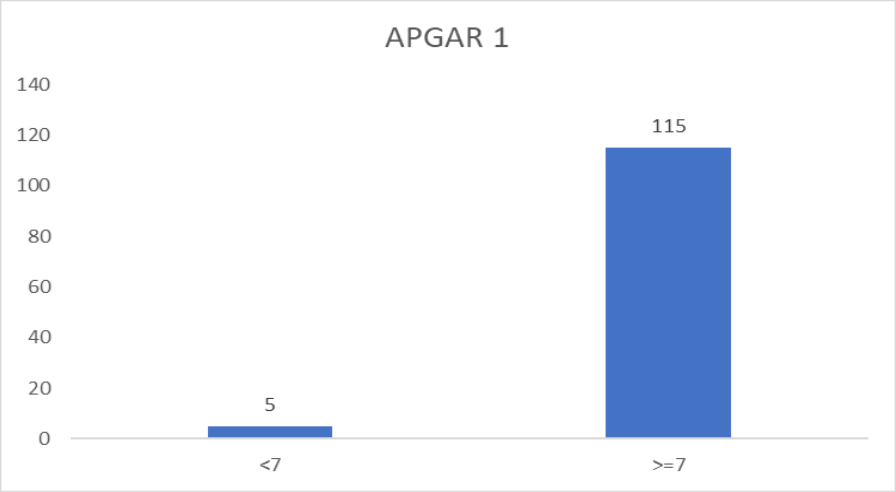

Figure 5. Distribution of Apgar score at 1 minute

6. Birth Weight

The recorded birth weights among the neonates ranged from 2000 grams to 3400 grams. The average birth weight was 2890.17 ± 352.27 grams, indicating a predominance of normal birth weight in the study population.

Table 6. Distribution of fetal weight

FBW	Frequency	Percent
2000-2400g	12	10%
2401-2800g	33	27.5%
2801-3200g	51	42.5%
>3200g	24	20%
Total	120	100%

"Table 6 illustrates distribution of fetal weight , The weight distribution is as follows: 12 individuals fall within the 2000-2400g range, accounting for 10%; 33 individuals are in the 2401-2800g range, representing 27.5%; 51 individuals fall into the 2801-3200g category, making up 42.5%; and 24 individuals weigh above 3200g, which is 20%. In total, there are 120 individuals. The birth weights vary between 2000.00 grams and 3400.00 grams, with a mean birth weight of 2890.41 ± 352.27 grams."

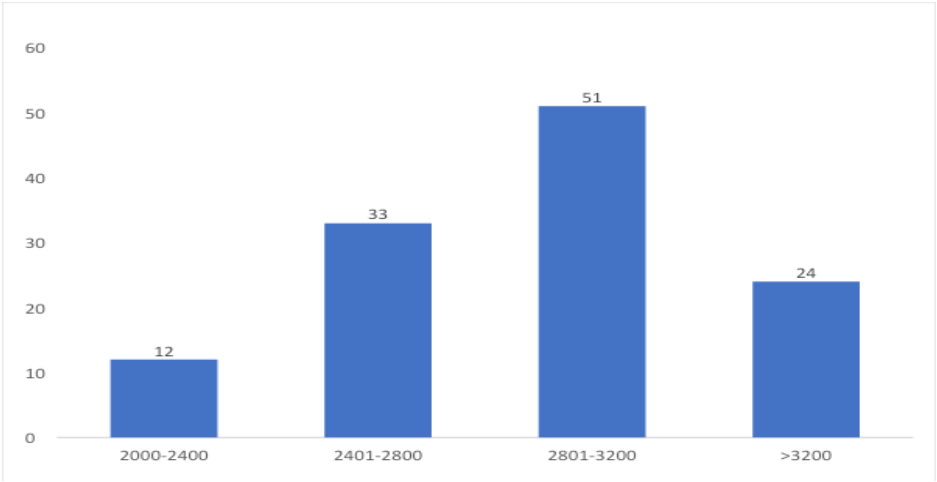

Figure 6. Distribution of fetal weight

7. Histopathological Findings

Upon histopathological examination of the placentas, the following findings were recorded:

Table 7. Distribution of Histopathological Findings

Histopathological Findings	Frequency	Percent
Calcification	02	1.7%
Chorioamnionitis	04	3.3%
Ischemia	06	5%
Placental infarct	03	2.5%
Thrombosis	05	4.2%
Villitis	09	7.5%
Normal	91	75.8%

- Normal placental histology: 75.8%
- Villitis: 7.5%
- Ischemia: 5%
- Chorioamnionitis: 3.7%
- Thrombosis: 4.2%
- Placental infarction: 2.5%
- Calcification: 1.7%

These findings suggest that a significant minority of the cases had underlying pathological changes that could influence perinatal outcomes.

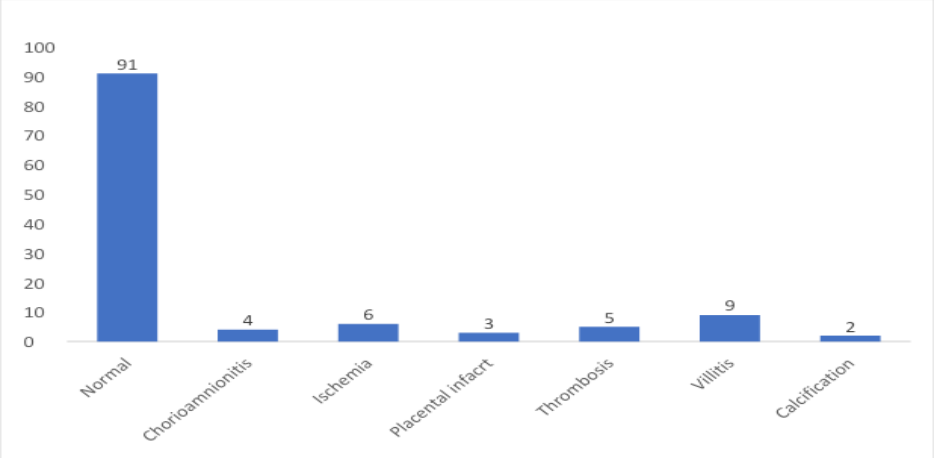

Figure 7. Distribution of Histopathological Findings

8. Correlation of Histopathology with Neonatal Outcomes

Out of the 24 neonates admitted to the NICU, 17 had placentas with abnormal histopathological findings. A strong and statistically significant correlation was observed between abnormal histopathological findings and adverse neonatal outcomes such as NICU admission ($p < 0.001$). This highlights the importance of placental histopathology in predicting neonatal morbidity.

DISCUSSION

This study underscores the limited predictive utility of placental thickness alone in forecasting adverse perinatal outcomes. While thick placentas were linked to increased NICU admissions, birth weight and fetal complications did not show a statistically significant association. These findings are consistent with studies by Hamidi et al. (2016) and Ghosh et al. (2013), who also reported ambiguous correlations between placental thickness and fetal well-being.

Histopathological examination, however, emerged as a more reliable diagnostic tool. Conditions like chronic villitis, infarctions, and increased fibrin deposition were significantly correlated with adverse neonatal outcomes such as NICU admission and birth asphyxia. These findings affirm the work of Sarode et al. (2021), Ramachandran et al. (2018), and Sachan et al. (2022), who emphasized the role of placental histology in understanding neonatal morbidity and mortality.

Recent reviews by Strebeck et al. (2022) and Shinde et al. (2021) also reinforce the importance of combining imaging and pathology for more comprehensive perinatal risk stratification. This dual-assessment approach is particularly valuable in resource-limited settings, where maximizing diagnostic information from routine examinations is critical.

Nonetheless, the study has certain limitations. The sample size, though adequate for initial correlation, may be underpowered for detecting subtler associations. Confounding maternal variables such as pre-eclampsia, diabetes, anemia, and infections were not individually controlled for, which may have influenced the outcomes. Further, the study did not evaluate long-term neurodevelopmental outcomes or post-discharge morbidity in neonates.

Future research should include larger, multicenter cohorts and explore longitudinal tracking of infants to correlate placental findings with long-term developmental outcomes. Incorporation of Doppler velocimetry and advanced imaging techniques may also improve the accuracy of placental assessment during pregnancy.

CONCLUSION

Placental thickness measured via USG, while useful for general gestational assessment, may not suffice as a standalone predictor of adverse neonatal outcomes. In contrast, histopathological examination provides valuable insights into the etiopathogenesis of perinatal complications. Routine incorporation of placental histopathology, particularly in high-risk pregnancies or adverse neonatal events, could significantly enhance postnatal diagnosis and parental counseling. A multidisciplinary approach integrating radiological and pathological assessments may improve the quality of antenatal care and neonatal prognosis.

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