

# Role of Ultrasonography Placental Thickness in Third Trimester in the Prediction of Fetal Outcome

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## ABSTRACT

**Introduction:** The Placenta is a functional unit between the mother and foetus. Placental thick play's important role in foetal outcome. This study conducted to assess Placental Thickness ultra-sonographically at 32nd and 36th weeks of gestation and to assess the role of placental thickness in the prediction of foetal outcome.

**Methodology:** The present study was conducted among 237 women to study the relationship of ultra-sonographically assessed Placental Thickness in the third trimester with Foetal Outcome and its correlation with Placental Pathology.

**Results:** Among 237 women. Highest number of women (48.5%) were from age group 25 to 29 years followed by 20 to 24 years (42.6%). Mean birth weight increases with along with placental thickness at 32<sup>nd</sup> week ( $p < 0.01$ ) as well as at 36<sup>th</sup> week ( $p < 0.01$ ). Cases with  $< 7$  APGAR score at 5 min were significantly higher in placental thickness less than 10<sup>th</sup> percentile at 32<sup>nd</sup> week ( $p < 0.01$ ). Newborn having lower placental thickness at 32<sup>nd</sup> or at 36<sup>th</sup> week gestation required NICU more often ( $p < 0.01$ ).

**Conclusion:** From the present study we conclude that there was a significant positive correlation between placental thickness and birth weight. Neonatal outcome was good (higher APGAR score and less NICU admission rate) when placental thickness was within normal range Lower birth weight was significantly higher in less than 10<sup>th</sup> percentile placental thickness group.

## INTRODUCTION

The Placenta is a functional unit between the mother and foetus. Any pathological process that involves the mother or the foetus will impact the normal functioning of the placenta. This results in morphological and histopathological changes in placenta. Defective functioning of the placenta may lead to various complications in the mother and the growing foetus and may cause adverse outcome of the foetus. [1] This study attempts to co relate the USG derived placental thickness with the foetal out-

come and establish a relationship between this and the histopathological changes occurring in the placenta.

It is measured that the weight of the placental is about one-fifth that of foetal weight and abnormally thin or thick placenta is associated with higher incidence of perinatal morbidity and mortality. [2]

Earlier there are some studies tried to co-relate placental thickness, foetal and neonatal outcome, and placental pathology all together, however such studies are very less.

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The foetus and the placenta undergo similar stress in utero life. Any pathological event that affects the mother will have similar adverse outcome on both the foetus and the placenta. [2] Hence, placental specificities such as placental thickness and the histopathological findings of the placenta has to reflect the changes occurring in the foetus during its period of growth and there must be a correlation between this and foetal outcome.

It is thickest at the centre and thinnest at the periphery. [3] Placental thickness is to be measured perpendicularly at the level of the umbilical cord. Many pathological changes can cause placentomegaly due to oedema, inflammation or compensatory hypertrophy. [4]

How well the thickness of placenta can determine the foetal outcome is not fully understood yet. [5] Most of the studies done earlier were retrospective and single point studies. So, what we need is a follow up prospective study to establish placental growth as a measure of foetal outcome.

Similarly, macroscopic and microscopic histopathological findings of the placenta provide pivotal details about the pathological events that occur in the placenta which may influence the normal functioning of the placenta. [6]

Hence, it is indeed important to find a correlation between ultrasonographically assessed placental thickness and placental histopathology and to see if they have any role in determining foetal and neonatal outcome.

The study was conducted to assess Placental Thickness ultrasonographically at 32nd and 36th weeks of gestation and to assess the role of placental thickness in the prediction of foetal outcome.

## MATERIALS AND METHODS

The study was conducted in the Obstetrics and Gynaecology department of Krishna Institute of Medical Sciences (KIMS) Hospital located in Karad, Maharashtra. The study was conducted among antenatal women visiting ANC OPD in KIMS, Karad, Maharashtra.

This was a prospective observational study conducted during June 2020 to Dec 2022.

**Eligibility Criteria:** The ANC women attending OPD having 30 weeks of gestation with a first trimester dating scan, age between 20 and 35 years of age, who were sure of their last menstrual period, had Singleton pregnancy and had BMI (18.5 to 25 kg/m<sup>2</sup>) within normal range were included in the study. The women with associate condition like diabetes, hypertension, chronic renal disease, multiple pregnancy, congenital abnormalities of foetus, eccentric insertion of the umbilical cord, low lying placenta or placenta previa were excluded.

**Sample size:** All eligible women visiting OPD during the study period were explained about the study and those who gave written consent for participation were included in the study. A total 237 pregnant women were included.

**Data collection:** Detailed History of the patients was taken and general, systemic and obstetric examination was done. Each enrolled patient in this study underwent USG for measurement of Placental Thickness at the level of umbilical cord insertion, at 32<sup>nd</sup> and 36<sup>th</sup> weeks of gestation and were followed up after delivery.

Patients whose placental thickness remained linear with gestational age, are considered as Normal thickness (10<sup>th</sup> to 95<sup>th</sup> percentile), Thin Placenta (<10<sup>th</sup> percentile), and Thick Placenta (>95<sup>th</sup> percentile).

Those with thin and thick placentae will be closely monitored for the development of IUGR, Oligohydramnios, Preterm Labour, Maternal development of PIH, Gestational Diabetes Mellitus.

**Ultrasound Technique:** Ultra sound Machine: Siemens Acuson x 300, Trans-abdominal probe frequency 2-3 MHz Trans-abdominal longitudinal scan of the placenta was performed with the women in the supine position and with partially full bladder. The placental thickness was obtained by measuring the antero-posterior diameter of the placenta at the level/point of insertion of the umbilical cord. The mean of three different values for placental thickness was recorded. Each enrolled patient in study was undergo ultrasonography for placental thickness at 32<sup>nd</sup> and 36<sup>th</sup> week of the third trimester and variation between them was assessed. As a rule, placental thickness should be approximately equal in thickness (in mm) to gestational age (in weeks) +/- 10mm.

All included patients were followed till delivery and foetal outcome were studied. Foetal outcome was studied in terms of foetal growth appropriate for gestational age, need for NICU, APGAR score, maturity of foetus at birth, Intra Uterine Foetal Demise, development of maternal PIH/ GDM/ Others, and mode of delivery.

**Data Analysis:** Descriptive and inferential statistical analysis was carried out in present study. The Microsoft Excel 2007 and SPSS 22.0 version software package be used for data entry and analysis. The categorical factors are represented by the number and frequency (%) of cases. The continuous variables be represented by measures of central frequency (like mean) and deviation (SD and range) wherever appropriate. Statistical analysis was done by unpaired student's t-test, chi-square test and Univariate analysis of variance. P-value <0.05 was considered as statistically significant.

## RESULTS

The present study was conducted among 237 women. Highest number of women (48.5%) were from age group 25 to 29 years followed by 20 to 24 years (42.6%). Lowest women were in age group 30 to 35 years, 8.9%. Around 75% i.e. three fourth women were primipara and 15% women were second para. Third para and more were 10.1%. At 32<sup>nd</sup> week the mean placental thickness was 33.50 ± 1.78 mm. At 36<sup>th</sup> week the mean placental thickness was 35.8 ± 2.28 mm.

**Table 1: Cases according to 95<sup>th</sup> and 10<sup>th</sup> percentile of mean Placental thickness at 32<sup>nd</sup> week and 36<sup>th</sup> week**

Placental Thickness	Criteria for categories	Women	Percentage
32 Week Placental Thickness			
29.7 mm or less (A)	< 10th Percentile	47	19.8%
29.8mm-35.7mm (B)	Between 10 <sup>th</sup> to 95 <sup>th</sup> Percentile	154	65.0%
35.8mm or more (C)	> 95th Percentile	36	15.2%
Total		237	100.0%
36 Week Placental Thickness			
30.9 mm or less (A)	< 10th Percentile	46	20.3%
31mm-39.9mm (B)	Between 10 <sup>th</sup> to 95 <sup>th</sup> Percentile	158	69.6%
40mm or more (C)	> 95th Percentile	23	10.1%
Total		227	100.0%

**Table 2: Complication during pregnancy and placental thickness categories**

Placental thickness	Cases	Preeclampsia	GDM	IUGR	Oligohydramnios	Rh isoimmunization	NICU Admission
At 32 weeks							
A	47	25	3	13	3	0	15
B	154	31	10	10	2	1	10
C	36	6	15	5	0	0	4
Total	237	62	28	28	5	1	29
At 36 weeks							
A	46	27	5	7	3	0	10
B	158	26	11	15	0	1	8
C	23	7	9	2	1	0	4
Total	227	60	25	24	4	1	22

**Table 3: Various outcome measures according to placental thickness**

Placental Thickness	Type of delivery		Estimated Foetal wt. (kg)	Birth weight (kg)			Apgar at 5 min		NICU admission	
	Caesarean	Normal		<2.5	2.5 - 3.9	≥4.0	<7	≥7	Required	Not required
32nd week										
A	16 (34)	31 (66)	1.56 ± 0.51	31 (66.0)	16 (34.0)	0 (0.0)	12 (25.5)	35 (74.5)	15 (31.9)	32 (68.1)
B	21 (13.6)	133 (86.4)	1.81 ± 0.58	23 (14.9)	131 (85.1)	0 (0.0)	16 (10.4)	138 (89.6)	10 (6.5)	144 (93.5)
C	19 (52.8)	17 (47.2)	2.24 ± 0.7	0 (0.0)	32 (88.9)	4 (11.1)	0 (0)	36 (100)	4 (11.1)	32 (88.9)
Total	56 (23.6)	181 (76.4)	1.83 ± 0.58	54 (22.8)	179 (75.5)	4 (1.7)	28 (11.8)	209 (88.2)	29 (12.2)	208 (87.8)
36th week										
A	15 (32.6)	31 (67.4)	1.9 ± 0.57	22 (47.8)	24 (52.2)	0.0)	6 (13)	40 (87)	10 (21.7)	36 (78.30)
B	24 (15.2)	134 (84.8)	2.21 ± 0.6	26 (16.5)	132 (83.5)	0.0)	14 (8.9)	144 (91.1)	8 (5.1)	150 (94.95)
C	13 (56.5)	10 (43.5)	2.45 ± 0.66	0 (0.0)	19 (82.6)	4 (17.4)	0 (0)	23 (100)	4 (17.4)	19 (82.61)
Total	52 (22.9)	175 (77.1)	2.17 ± 0.6	48 (21.1)	175 (77.1)	4 (1.8)	20 (8.8)	207 (91.2)	22 (9.7)	205 (90.3)

Values in parenthesis indicate percentage; Estimated foetal weight values are in Mean ± SD

Caesarean vs Normal delivery at 32 weeks and 36 weeks were statistically significant. (p<0.001)

Estimated foetal weight at 32 weeks and 36 weeks were statistically significant. (p<0.001)

Birth weight groups at 32 weeks and 36 weeks were statistically significant. (p<0.001)

APGAR score at 5min at 32 weeks were statistically significant. (p<0.001)

APGAR score at 5min at 36 weeks were statistically not significant. (p>0.05)

NICU admission requirement at 32 weeks and 36 weeks were statistically significant. (p<0.000)

Table 1 shows categories according to placental thickness at 32<sup>nd</sup> week and 36<sup>th</sup> week. At 32<sup>nd</sup> week, cases less than 10<sup>th</sup> percentile (A) and more than 95<sup>th</sup> percentile (C) were 19.8% and 15.2% respectively. Cases in between were 65% (B). At 36<sup>th</sup> week, cases less than 10<sup>th</sup> percentile (A) and more than 95<sup>th</sup> percentile (C) were 20.3% and 10.1% respectively. Cases in between were 69.6% (B).

Pregnancy Induced Hypertension (PIH) was the most common complication during ANC period found in 26% cases. GDM was found in 32 cases. However, nearly half of the women there was no complication during pregnancy.

Those patients who had thin placenta at 32 weeks of gestation had complications like Pre-eclampsia, IUGR and oligohydramnios at a significantly higher rate than those with normal placental thickness (Table 2).

Those patients who had thick placenta at 36 weeks of gestation had complications like GDM at a significantly higher rate than those with normal placental thickness. Also, those patients who had placenta with normal thickness at 32 weeks of gestation had least number of complications than those with thin or thick placenta at 32 weeks of gestation. Those patients who had thin placenta at 36<sup>th</sup> of gestation had complications like Pre-eclampsia, IUGR and oligohydramnios at a significantly higher rate than those with normal placental thickness.

Those patients who had thick placenta at 36 weeks of gestation had complications like GDM at a significantly higher rate than those with normal placental thickness

At 32<sup>nd</sup> week the difference in CS rate is significantly different in group A, B and C ( $p < 0.01$ ) indicating that CS rate is significantly low in group B. Similarly, at 36<sup>th</sup> week also, the CS rate is significantly low in middle group ( $p < 0.01$ ). This indicates that chances of CS increase with less than 29.8mm and more than 35.7mm placental thickness at 32<sup>nd</sup> week. (Table 3)

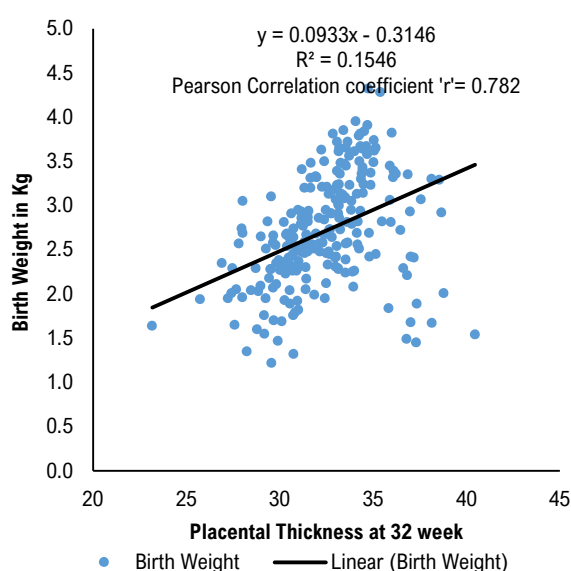
Lower birth weight was significantly higher ( $p < 0.01$ ) in less than 10<sup>th</sup> percentile placental thickness group while normal birth weight babies were higher in 10<sup>th</sup> to 95<sup>th</sup> percentile and more than 95<sup>th</sup> percentile. (Table 3)

Cases with  $< 7$  APGAR score at 5 min were significantly higher in placental thickness less than 10<sup>th</sup> percentile at

32<sup>nd</sup> week ( $p < 0.01$ ). Cases with  $< 7$  APGAR score at 5 min were higher in placental thickness less than 10<sup>th</sup> percentile at 36<sup>th</sup> week, however the difference among three group was statistically non-significant ( $p > 0.05$ ). (Table 3)

Newborn having lower placental thickness at 32<sup>nd</sup> week gestation required NICU more often than those having placental thickness above 10<sup>th</sup> percentile at 32<sup>nd</sup> week ( $p < 0.01$ ). Similar to this newborn having lower placental thickness at 36<sup>th</sup> week gestation required NICU more often ( $p < 0.01$ ). (Table 3)

Mean birth weight increases with along with placental thickness at 32<sup>nd</sup> week. This rise was statistically significant ( $p < 0.01$ ) (Fig 1). Similarly, mean birth weight also increases with along with placental thickness at 36<sup>th</sup> week. This rise was also statistically significant ( $p < 0.01$ ) (Fig 2).



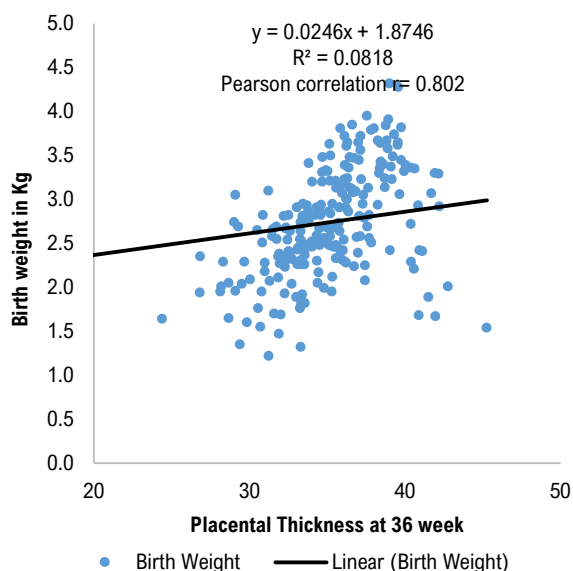
**Figure 1: Linear regression model of birth weight and placental thickness at 32<sup>nd</sup> week**

Coefficient ( $r$ ) of 0.782 indicate good strength of association between birth weight and placental thickness at 32<sup>nd</sup> week, however, the regression model  $r^2$  value is 0.1546 shows that the prediction equation does not well fit to the to the present study data.

Coefficient ( $r$ ) of 0.802 indicate good strength of association between birth weight and placental thickness at 36<sup>th</sup> week, however, the regression model  $r^2$  value is 0.0818 shows that the prediction equation does not well fit to the to the present study data.

## DISCUSSION

Structure normal and functionally normal placenta is required for normal growth and development of the foetus. Placental thickness is the simplest measurement of placental size and can be measured at any centre equipped with ultrasound machine. The correlation of placental



**Figure 2: Linear regression model of birth weight and placental thickness at 36<sup>th</sup> week**

thickness with gestational age has been documented by many observers. [7-10]

In the present study placental thickness significantly increases with advancement in gestational at, at least in last trimester.

In a study by Kashika et al [2] the mean placental thickness at 32 week of gestation and at 36 weeks of gestation were  $33.45 \pm 1.62$  and  $35.7 \pm 2.08$  mm. In a study by Ahmed N et al [11], ultrasonographic measures of placental thickness in second and third trimester and changes between them were  $21.6 \pm 4.5$  (range: 14.9-35 mm),  $36.2 \pm 6.4$  (range: 20-79 mm) and  $14.67 \pm 5.67$  mm respectively. The correlation of placental thickness with gestational age has been documented by many observers. Schwartz N et al [10] and Ohagwu CC et al [9] also found in their studies that placental thickness increases with gestational age.

The present study shows that, at 32<sup>nd</sup> week, cases with thin placenta and thick placenta were 19.8% and 15.2% respectively. At 36<sup>th</sup> week, thin placenta was found in 20.3% cases and thick placenta found in 10.1% cases. The prevalence of ultrasonographically thick placentas reported in the literature varies from 0.6% to 7.8% (Jauniaux et al [12], Thompson et al [13]; Elchalal et al [14]; Dombrowski et al [15] and Miwa I et al [16]). Thick placentas were found to be related to adverse prenatal outcomes. The neonatal conditions associated with thick placentas were also worse than those that in cases without thick placentas.

In the present study mean birth weight significantly increases with placental thickness at 32<sup>nd</sup> week as well as 36<sup>th</sup> week. Afrakhteh et al. in their study of 250 Iranian women found a significant positive correlation of placental thickness in both second and third trimesters with birth weight [4]. Kashika et al [2] in their study found that there was a strong positive correlation between placental thickness and birth weight according to Pearson's correlation analysis ( $r = 0.55$  at 32 weeks and  $r = 0.740$  at 36 weeks). Ahn KH in 2017 published that the higher placental thickness to estimated foetal weight ratio at 18–24 weeks gestation was associated with small-for-gestational-age infants [7].

Sharma et al [17], they study the correlation of placental thickness with gestational parameters like femur length, Biparietal thickness, Head circumference, abdominal circumference. Placental thickness has a significantly high correlation with all the gestational parameters. The linear regression model of placental thickness with each of the parameters is presented in this study and they found positive significant correlation between foetal weight and biparietal diameter, femur length and abdominal circumference.

In a study by Ahmed N et al [11], there was a significant positive correlation between placental thickness and birth weight in the 2<sup>nd</sup> and 3<sup>rd</sup> trimesters ( $r=0.15$ ,  $p=0.03$ ;  $r=0.14$ ,  $p=0.04$  correspondingly). However, no correlation was observed with placental thickness change ( $p=0.7$ ).

In research held in Nigeria, significant positive correlation was found between placental thickness and estimated foetal weight in the second and third trimesters ( $r=0.61$  and  $r=0.57$  respectively) [18]. Miwa I et al [16] found that Gestational age at delivery was earlier and birth weight was smaller in the cases with thick placenta than in those without thick placenta.

In the present study lower placental thickness is associated with lower APGAR score at 5 min at 32<sup>nd</sup> week placental thickness but not at 36<sup>th</sup> week placental thickness. Kashika et al [2] observed increased incidence of perinatal morbidity in terms of low Apgar scores in those with placental thickness  $>4.0$  cm at 36 weeks. Miwa I et al [16] found that the values of Apgar score at 1 minute with thick placenta were significantly lower than in those without thick placenta.

The present study found that lower placental thickness at 32<sup>nd</sup> week as well as 36<sup>th</sup> week is associated with higher NICU admission rate.

Kashika et al [2] observed higher occurrence of perinatal morbidity i.e. lesser Apgar scores and higher NICU admissions in those with placental thickness more than 4.0 cm at 36<sup>th</sup> weeks of gestation, and the study showed higher incidence of LBW babies in women with thick placenta. Kashika et al [2] concluded that neonatal outcome was good when placental thickness was between 31.1 and 39.9 mm (10<sup>th</sup>–95<sup>th</sup> percentile) at 36<sup>th</sup> week of gestation

It was concluded in study by Kaushal lovely et al [19], that initial growth of placenta being much more rapid than that of the foetus. Thin placenta was associated with increased morbidity, poor APGAR score and higher incidence of in NICU admission. In a study by Hamidi et al [20], found that there was no association between placental thickness and NICU admission [OR = 1.06, 95% CI = (0.99, 1.14),  $P=0.10$ ] or Apgar scores. In Sadler [21] study, we observed increased incidence of perinatal morbidity in terms of low Apgar scores and increased NICU admissions in those with placental thickness 4.0 cm at 36 weeks.

## CONCLUSION

From the present study we conclude that there was a significant positive correlation between placental thickness and birth weight. Neonatal outcome was good (higher APGAR score and less NICU admission rate) when placental thickness was within normal range at 32<sup>nd</sup> week (29.8–35.7mm) as well as 36<sup>th</sup> week gestation (31.0–39.9mm). CS rate is less in normal placental thickness. Lower birth weight was significantly higher in less than 10<sup>th</sup> percentile placental thickness group. Placental thickness on ultrasound can be used along with other biometric parameters in predicting neonatal outcome.

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