

SONOGRAPHIC ASSESSMENT OF FETAL PLACENTAL LOCATION IN GESTATIONAL DIABETIC PATIENTS IN THIRD TRIMESTER

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Keywords

Placental location, Gestational Diabetes, Second trimester, Pregnancy, Ultrasound assessment, Fetal growth, Prenatal imaging, Obstetric ultrasound, Placenta Previa.

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Abstract

Background: Pregnancy involves complex physiological adaptations to support fetal growth and development. The placenta plays a vital role as the interface for nutrient, gas, and waste exchange between mother and fetus. Its structure and function directly influence fetal outcomes. Placental location plays a crucial role in maternal and fetal outcomes, especially in high-risk pregnancies such as those complicated by gestational diabetes mellitus (GDM). Abnormal placental position has been associated with increased risks of placenta previa, abnormal placental adherence, and adverse perinatal outcomes. Ultrasonography remains the most reliable, safe, and non-invasive modality for evaluating placental location.

Objective: My study aimed to assess the placental location in pregnant women diagnosed with gestational diabetes mellitus using ultrasound and to determine the frequency of various placental positions in this high-risk population.

Methodology: It was cross-sectional study conducted at Arif Memorial Teaching Hospital. A total of 196 pregnant females in third trimester were scanned. This cross-sectional study will include pregnant women diagnosed with GDM after 24 weeks of gestation. A standardized obstetric ultrasound examination will be performed to determine placental location, categorized as anterior, posterior, fundal, low-lying, or placenta previa. Relevant maternal and clinical data was also recorded. Data were analyzed using Pearson's correlation to assess the relationship between placental thickness and fetal weight.

Results: The study is expected to identify the distribution of placental locations among GDM patients and explore any associations between GDM and abnormal placental positioning.

CHAPTER 1

INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the most common medical complications of pregnancy and is characterized by glucose intolerance that is first recognized during pregnancy [1]. The condition is associated with an increased risk of maternal and fetal complications, including hypertensive disorders, excessive fetal growth, macrosomia, preterm birth, birth trauma, and adverse neonatal outcomes [1,2]. Appropriate antenatal surveillance is therefore essential in pregnancies complicated by GDM to identify potential maternal and fetal complications and to support appropriate obstetric management.

The placenta plays a fundamental role in pregnancy by providing oxygen and nutrients to the developing fetus and facilitating maternal-fetal exchange. Maternal metabolic abnormalities, including hyperglycaemia, may influence placental development, vascularity, morphology and function. Alterations in placental structure and function have been reported in diabetic pregnancies and may contribute to abnormal fetal growth and other adverse pregnancy outcomes [3]. However, the relationship between gestational diabetes and the anatomical location of the placenta remains comparatively less investigated.

Ultrasonography is an important and widely used imaging modality for antenatal assessment of the fetus and placenta. It is non-invasive, does not use ionizing radiation, is relatively inexpensive, and can be performed repeatedly during pregnancy. Obstetric ultrasound enables assessment of fetal viability, presentation, biometry, growth, amniotic fluid volume, placental morphology and placental location. In pregnancies complicated by diabetes, ultrasound is particularly valuable for monitoring fetal growth and wellbeing because GDM is associated with an increased risk of excessive fetal growth and other pregnancy complications [2,4]. The World Health Organization also recommends additional ultrasound growth assessment after 24 weeks when clinically indicated in women with diabetes during pregnancy [4].

Assessment of placental location is an important component of obstetric ultrasonography. The placenta may be situated on the anterior, posterior, lateral, fundal or lower uterine wall. Ultrasound allows the sonographer to determine placental position and evaluate its relationship with the internal cervical os. A low-lying placenta or placenta previa may increase the risk of antepartum haemorrhage and may influence decisions regarding the mode and timing of delivery. Current International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) guidelines recommend that placental location and its relationship with the internal cervical os should be assessed during third-trimester ultrasound examinations [5]. When the placenta is low-lying, ultrasound follow-up can be used to determine whether the placental edge has moved away from the internal cervical os as pregnancy progresses [5].

The third trimester is particularly important for evaluating placental location because assessment at this stage can provide clinically relevant information for delivery planning. Ultrasonography can accurately demonstrate the placental position and, when required, transvaginal ultrasound provides improved assessment of the relationship between the lower placental edge and the internal cervical os, particularly in suspected posterior placenta previa [5]. In addition to placental assessment, third-trimester ultrasound provides an opportunity to evaluate fetal growth, amniotic fluid and fetoplacental Doppler parameters, which are particularly relevant in pregnancies affected by diabetes [4,5].

Research Gap

Although numerous studies have investigated the effects of gestational diabetes mellitus on fetal growth, placental morphology, and pregnancy outcomes, limited research has specifically focused on the distribution of placental location among women with GDM. Furthermore, there is a lack of local evidence from Pakistan regarding the relationship between gestational diabetes and

placental location. Most available studies have been conducted in different populations with varying demographic characteristics, making their findings difficult to generalize to the local population. This study seeks to address this gap by providing data on fetal placental location in gestational diabetic patients within the local healthcare setting.

Rationale of Study

Gestational diabetes mellitus (GDM) is one of the most common medical complications of pregnancy and is associated with adverse maternal and fetal outcomes. The placenta plays a vital role in fetal growth by facilitating the exchange of oxygen and nutrients between the mother and fetus. Changes in placental development and implantation may occur in pregnancies complicated by gestational diabetes due to altered maternal metabolism and vascular function. Assessing fetal placental location in women with GDM may provide valuable information regarding placental adaptation and pregnancy outcomes. Ultrasonography offers a safe, non-invasive, and reliable method for evaluating placental location during pregnancy. Therefore, this study aims to assess fetal placental location in gestational diabetic patients and contribute to a better understanding of its clinical importance in antenatal care.

Significance

This study will provide valuable information regarding fetal placental location in pregnancies complicated by gestational diabetes mellitus. The findings may help healthcare professionals better understand placental distribution in GDM patients and support more effective antenatal assessment using ultrasound. The study will also contribute to the limited local literature on this topic and may serve as a reference for future researchers. Additionally, the results may assist radiologists, sonologists, obstetricians, and other healthcare providers in improving prenatal monitoring and optimizing maternal and fetal care in pregnancies affected by gestational diabetes.

OBJECTIVE

- To assess the relationship between third-trimester placental location and gestational diabetic patients as a predictor of its effect.
- To determine the frequency of different placental locations (anterior, posterior, fundal, lateral, and low-lying placenta) in gestational diabetic patients.

CHAPTER 3

MATERIAL AND METHODS

Study design:

This study was done utilizing a cross-sectional design to sonographic assessment of fetal placental location in gestational diabetic patients.

Sampling Technique = Convenient Non Probability Sampling

Sample size:

The Sample size of 140 was calculated by using the following formula

$$n = \frac{z^2 \cdot \frac{1}{2} \cdot P(1-P)}{d^2}$$

n = Sample size= 140

Study setting:

All the patients of obstetrical ultrasound during their pregnancy were referred to radiological department of Arif Memorial Teaching Hospital over the time of 6 months. The patients were enrolled in trial after signing a consent from containing name, address, marital status among all other relevant details. Any abnormality was noted with the aid of ultrasound.

Study duration:

The duration of study was 6 months.

Inclusion Criteria:

- Patient should carry a single fetus to avoid the complexities.
- Patients should be in the third trimester of pregnancy, as between 28 and 40 weeks of gestation.
- Patient should have an uncomplicated pregnancy without significant maternal or fetal conditions.

- Patient must provide informed consent to participate in the study, acknowledging their understanding of the study's purpose and procedures.

Exclusion criteria:

- Exclude participants carrying twins, triplets, or higher-order multiples and pregnancies with known fetal structural or chromosomal abnormalities.
- Cases with significant maternal health issues as Gestational diabetes mellitus, Hypertensive Disorders of Pregnancy and Chronic Maternal Conditions.
- Exclude cases where the mother is on medications or undergoing treatments that could affect fetal growth or placental development (e.g., certain steroid therapies).
- Consider excluding cases with severe substance abuse (e.g., alcohol, illicit drugs) that might impact fetal development and placental health.

Data collection procedure:

The data was collected through interview and ultrasound scan. After taking the consent form, they will be evaluating through clinical interviews and ultrasound scans. A complete examination of fetus, placental location and gestational age will be done with the help of high-resolution ultrasound imaging.

Obstetrical ultrasound scan:

A transabdominal ultrasound was performed with the patient in a supine position using a curvilinear transducer (3.5–5 MHz). A coupling gel was applied to the abdomen to ensure optimal acoustic contact. The placental thickness was measured at the level of the umbilical cord insertion site in the longitudinal plane, perpendicular to the placental surface, avoiding areas of focal thickening, contractions, or myometrial compression. Fetal biometric parameters such as biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL) ,and placental location (PL), were recorded to estimate placental location using standard formulas (e.g., Hadlock's formula). Care was taken to avoid excess transducer pressure, which could compress the placenta and give falsely low readings. All measurements were taken during periods of fetal inactivity, with the mother holding her breath briefly to reduce motion artifacts.

Data analysis:

The data entered and analyzed by using the statistical package SPSS (version 26). Quantitative data will present as mean standard deviation. While percentage will calculate through SPSS. Data will be interpreted in the form of graphs and tables

CHAPTER 4**RESULT ANALYSIS**

Table 4.1: Frequency distribution of participants according to their age group.

	Age (Years)				Total
	18-24	25-30	31-35	36-40	
Frequency	33	44	34	29	140
% age	23.6	31.4	24.3	24.3	100

INTERPRETATION

Table 4.1 shows age distribution of most patients (31.4%) were between 25–30 years, followed by 31–35 years (24.3%), 36–40 years (24.3%), and

18–24 years (23.6%). This demonstrates that gestational diabetes was most frequently observed among women aged 25–30 years in the study population.

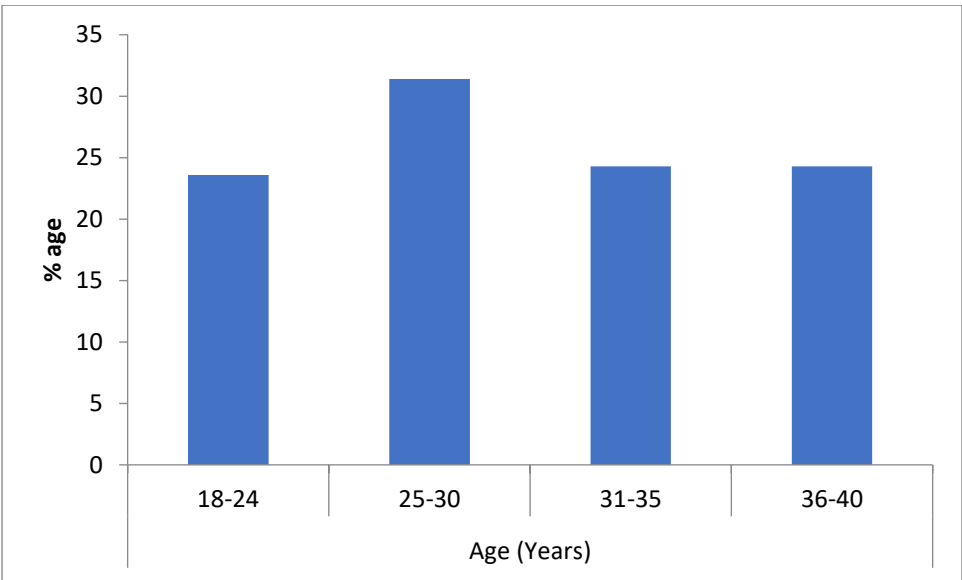


Figure 4.1: Graphical distribution of participants according to their age group.

INTERPRETATION

Fig 4.1 shows most patients (31.4%) were between 25–30 years, followed by 31–35 years (24.3%), 36–40 years (24.3%), and 18–24 years (23.6%). This

demonstrates that gestational diabetes was most frequently observed among women aged 25–30 years in the study population.

Table 4.2: Descriptive statistics of gravidity and parity of patients

	N	Mean ± SD
Gravidity	140	3.07 ± 1.37
Parity	140	1.84 ± 1.32

INTREPRETATION

Table 4.2 shows the mean gravidity of the participants was 3.07 ± 1.37, while the mean parity was 1.84 ± 1.32. This indicates that, on average, the women had experienced

approximately three pregnancies and had delivered nearly two children. The findings suggest that most participants were multigravida and multiparous women.

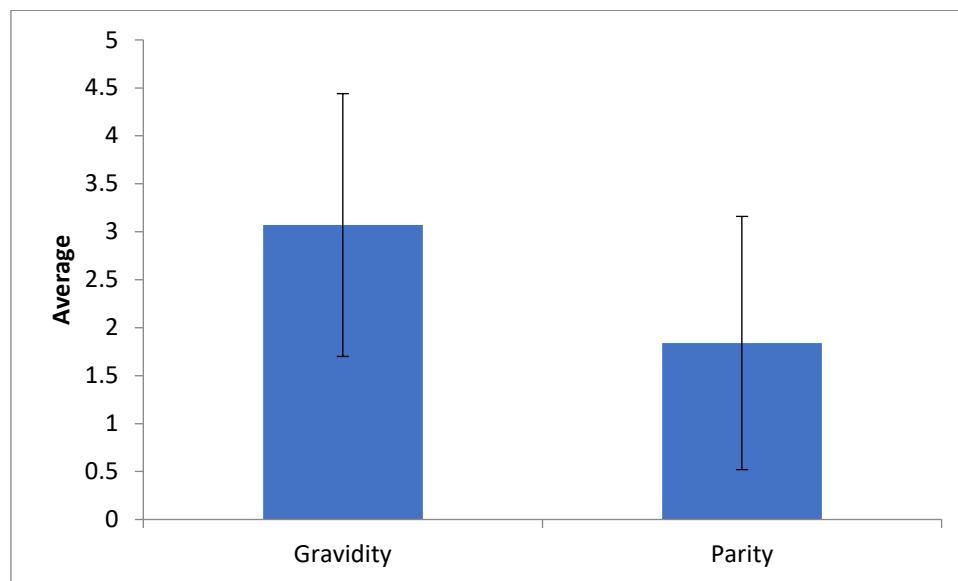


Figure 4.2: Graphical distribution of participants according to descriptive statistics of gravidity and parity in study population.

INTREPRETATION

Fig 4.2 shows the mean gravidity of the participants was 3.07 ± 1.37 , while the mean parity was 1.84 ± 1.32 . This indicates that, on average, the women had experienced

approximately three pregnancies and had delivered nearly two children. The findings suggest that most participants were multigravida and multiparous women.

Table 4.3: Frequency distribution of participant according to their history of gestational diabetes in study populatio

History of Gestational Diabetes					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	35	25.0	25.0	25.0
	Yes	105	75.0	75.0	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.3 shows a previous history of gestational diabetes was reported by 75.0% of participants,

whereas 25.0% had no previous history. This suggests that recurrence of gestational diabetes was common among the studied women.

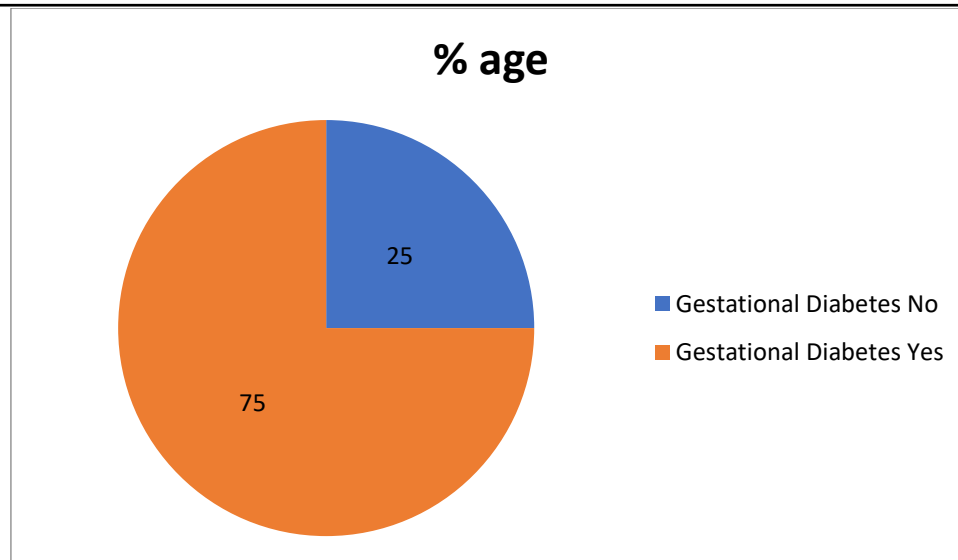


Figure 4.3: Graphical distribution of participant according to their history of gestational diabetes in study population.

INTERPRETATION

Fig 4.3 shows a previous history of gestational diabetes was reported by 75.0% of participants,

whereas 25.0% had no previous history. This suggests that recurrence of gestational diabetes was common among the studied women.

Table 4.4: Frequency distribution of participants according to fasting blood sugar history in the study population.

Fasting Blood Sugar (mg/dL)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<100	11	7.9	7.9	7.9
	>150	45	32.1	32.1	40.0
	100-126	44	31.4	31.4	71.4
	126-150	40	28.6	28.6	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.4 shows most participants had elevated fasting blood sugar levels. The highest proportion (32.1%) had values >150 mg/dL, followed by

100-126 mg/dL (31.4%) and 126-150 mg/dL (28.6%). Only 7.9% had fasting blood sugar below 100 mg/dL, indicating poor glycemic control in the majority of patients.

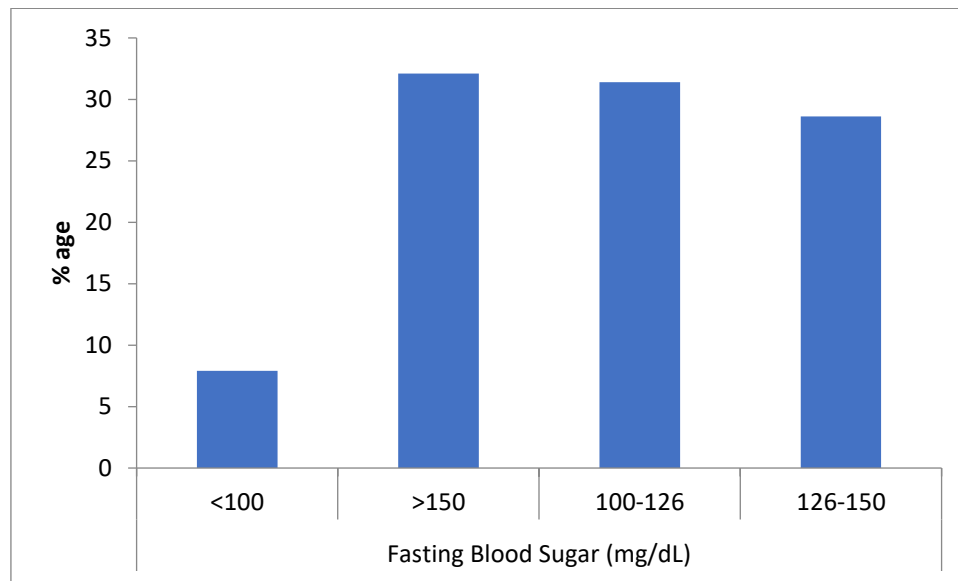


Figure 4.4: Graphical representation of participants according to fasting blood sugar history in the study population.

INTERPRETATION

Fig 4.4 shows most participants had elevated fasting blood sugar levels. The highest proportion (32.1%) had values >150 mg/dL, followed by

100–126 mg/dL (31.4%) and 126–150 mg/dL (28.6%). Only 7.9% had fasting blood sugar below 100 mg/dL, indicating poor glycemic control in the majority of patients.

Table 4.5: Frequency distribution of participants according to HbA1c history in the study population.

		HbA1c (%)			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	≥6.5%	79	56.4	56.4	56.4
	4.9–5.7%	29	20.7	20.7	77.1
	5.7–6.4%	32	22.9	22.9	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.5 shows more than half of the patients (56.4%) had HbA1c ≥6.5%, while 22.9% had HbA1c between 5.7–6.4% and 20.7% had

normal HbA1c levels. These findings indicate that long-term blood glucose control was inadequate in most participants.

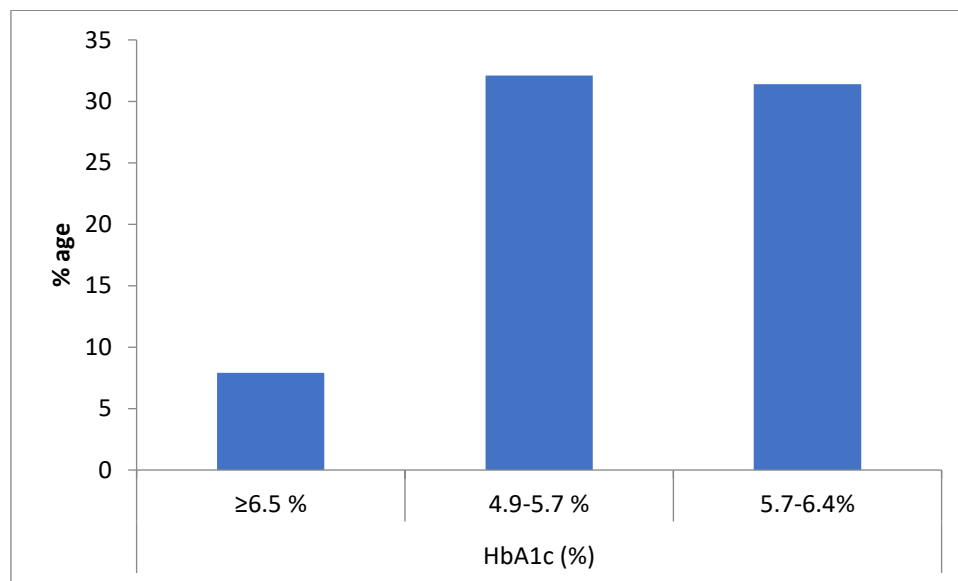


Figure 4.5: Graphical representation of participants according to HbA1c history in the study population.

INTERPRETATION

Fig 4.5 shows more than half of the patients (56.4%) had HbA1c $\geq 6.5\%$, while 22.9% had HbA1c between 5.7–6.4% and 20.7% had

normal HbA1c levels. These findings indicate that long-term blood glucose control was inadequate in most participants.

Table 4.6: Frequency distribution of participants according to blood pressure history in the study population.

Blood Pressure (mmHg)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Elevated	12	8.6	8.6	8.6
	Hypertension	116	82.9	82.9	91.4
	Normal	12	8.6	8.6	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.6 shows hypertension was observed in 82.9% of the patients, whereas 8.6% had elevated blood pressure and another 8.6% had normal

blood pressure. This finding suggests a high prevalence of hypertension among women with gestational diabetes.

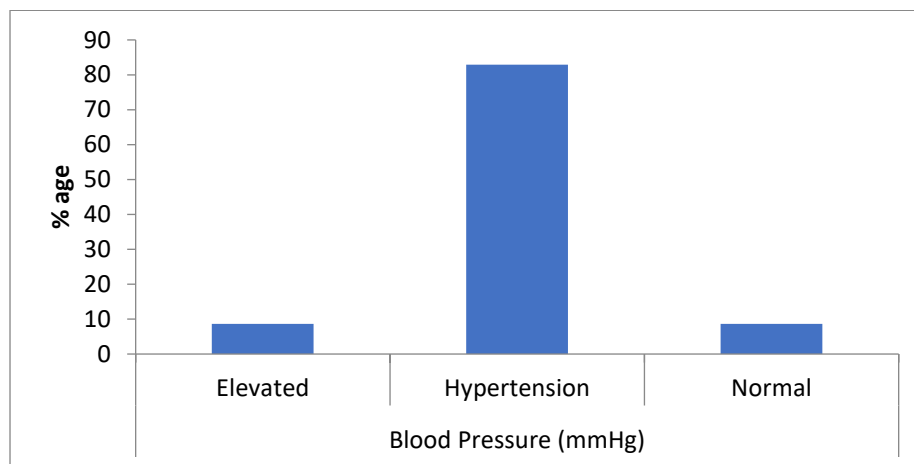


Figure 4.6: Graphical representation of participants according to blood pressure history in the study population.

INTERPRETATION

Fig 4.6 shows hypertension was observed in 82.9% of the patients, whereas 8.6% had elevated blood pressure and another 8.6% had normal blood

pressure. This finding suggests a high prevalence of hypertension among women with gestational diabetes.

Table 4.7: Frequency distribution of participants based on placental location in the study population.

Placental Location					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Anterior	66	47.1	47.1	47.1
	Fundal	9	6.4	6.4	53.6
	Low-lying	7	5.0	5.0	58.6
	Placenta Previa	1	.7	.7	59.3
	Posterior	57	40.7	40.7	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.7 shows the most common placental location was anterior (47.1%), followed by posterior (40.7%). Fundal, low-lying placenta, and placenta previa were relatively uncommon. This

indicates that anterior and posterior placental positions predominated in women with gestational diabetes.

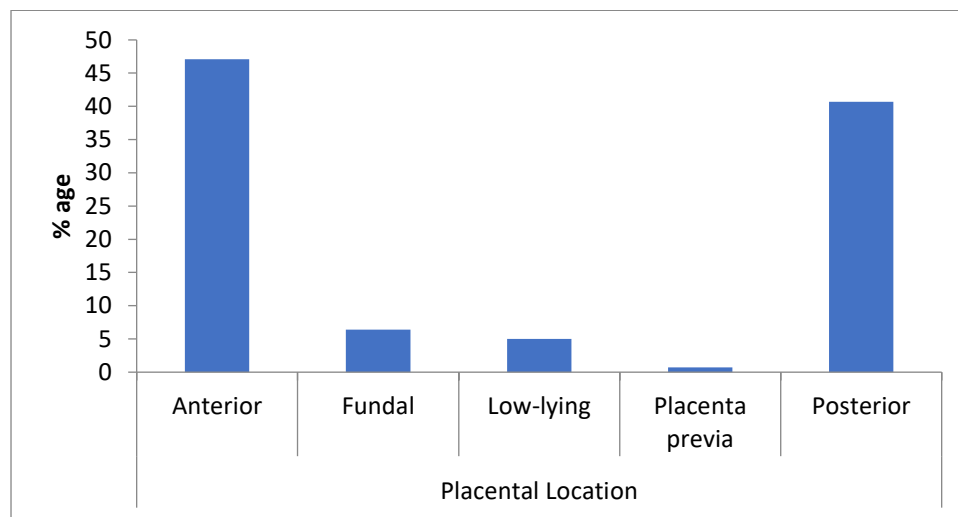


Figure 4.7: Graphical representation of participants based on placental location in the study population.

INTERPRETATION

Fig 4.7 shows the most common placental location was anterior (47.1%), followed by posterior (40.7%). Fundal, low-lying placenta, and placenta

previa were relatively uncommon. This indicates that anterior and posterior placental positions predominated in women with gestational diabetes.

Table 4.8: Frequency distribution of participants based on placental thickness measurements in the study population.

Placental Thickness (cm)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<2 cm	2	1.4	1.4	1.4
	>4 cm	42	30.0	30.0	31.4
	2-2.5 cm	20	14.3	14.3	45.7
	2.6-4 cm	76	54.3	54.3	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.8 shows more than half of the patients (54.3%) had placental thickness between 2.6-4 cm, while 30.0% had thickness greater than 4 cm. Only a small proportion had placental thickness

below 2 cm. These findings suggest that most placentas were within the normal to increased thickness range.

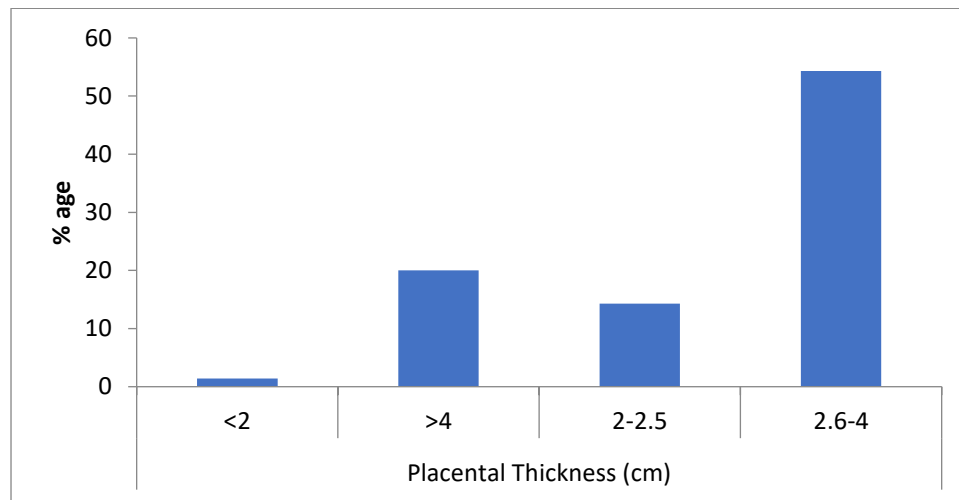


Figure 4.8: Graphical representation of participants based on placental thickness measurements in the study population.

INTERPRETATION

Fig 4.8 shows more than half of the patients (54.3%) had placental thickness between 2.6-4 cm, while 30.0% had thickness greater than 4 cm.

Only a small proportion had placental thickness below 2 cm. These findings suggest that most placentas were within the normal to increased thickness range.

Table 4.9: Frequency distribution of participants according to amniotic fluid index in the study population.

Amniotic Fluid Index (cm)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>25 cm	33	23.6	23.6	23.6
	17-25 cm	51	36.4	36.4	60.0
	5-17 cm	56	40.0	40.0	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.9 shows the majority (40.0%) had an amniotic fluid index of 5-17 cm, followed by 36.4% with 17-25 cm, while 23.6% had AFI >25

cm, indicating polyhydramnios in nearly one-quarter of participants.

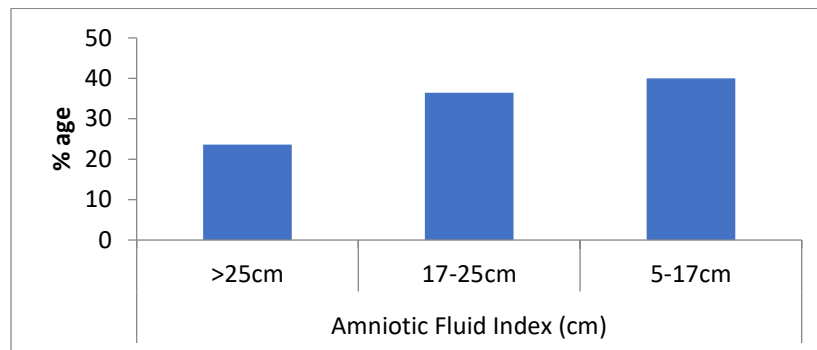


Figure 4.9: Graphical representation of participants according to amniotic fluid index in the study population.

INTERPRETATION

Fig 4.9 shows the majority (40.0%) had an amniotic fluid index of 5-17 cm, followed by 36.4% with 17-25 cm, while 23.6% had AFI >25

cm, indicating polyhydramnios in nearly one-quarter of participants.

Table 4.10: Frequency distribution of participants according to fetal weight in the study population.

Estimated Fetal Weight (kg)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>3.5 kg	35	25.0	25.0	25.0
	2-2.5	35	25.0	25.0	50.0
	2.5-3	39	27.9	27.9	77.9
	3-3.5	31	22.1	22.1	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.10 shows the largest proportion (27.9%) had an estimated fetal weight of 2.5-3.0 kg, followed by 25.0% weighing 2-2.5 kg and 25.0%

weighing >3.5 kg. These findings indicate variation in fetal weight, with a considerable proportion showing fetal macrosomia.

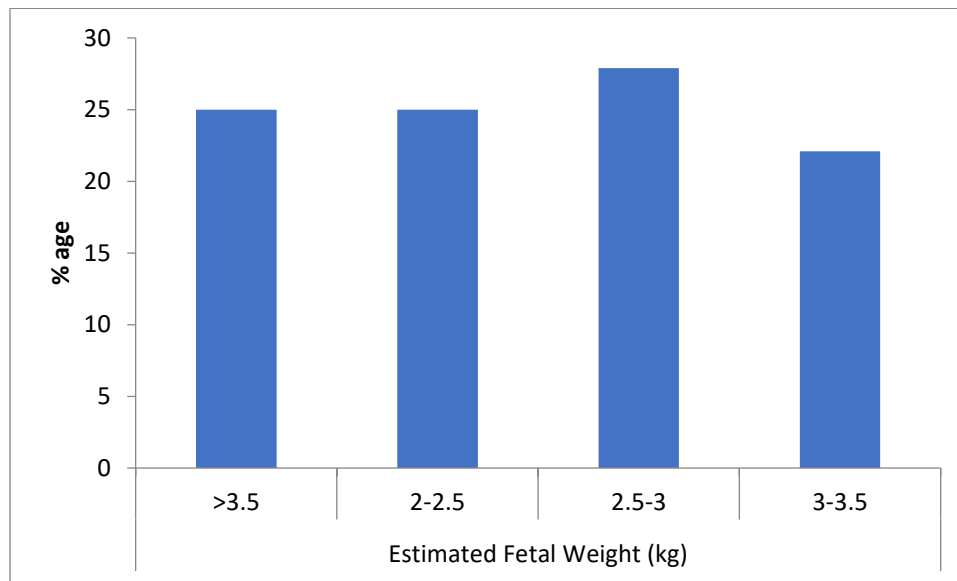


Figure 4.10: Graphical representation of participants according to fetal weight in the study population.

INTERPRETATION

Fig 4.10 shows the largest proportion (27.9%) had an estimated fetal weight of 2.5–3.0 kg, followed

by 25.0% weighing 2–2.5 kg and 25.0% weighing >3.5 kg. These findings indicate variation in fetal weight, with a considerable proportion showing fetal macrosomia.

Table 4.11: Frequency distribution of participants based on biparietal diameter measurements in the study population.

Biparietal Diameter (cm)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>8	114	81.4	81.4	81.4
	7–8	26	18.6	18.6	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.11 shows most fetuses (81.4%) had a biparietal diameter greater than 8 cm, while 18.6%

had measurements between 7–8 cm, suggesting that fetal head growth was appropriate in the majority of pregnancies.

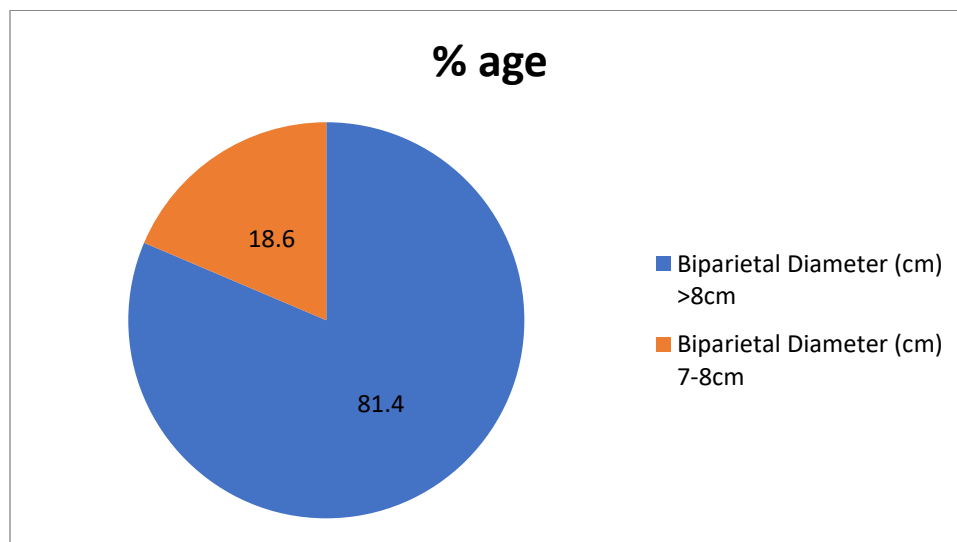


Figure 4.11: Graphical representation of participants based on biparietal diameter measurements in the study population.

INTERPRETATION

Fig 4.11 shows most fetuses (81.4%) had a biparietal diameter greater than 8 cm, while 18.6% had measurements between 7–8 cm, suggesting that fetal head growth was appropriate in the majority of pregnancies.

Table 4.12: Frequency distribution of participants based on femur length measurement in the study population

Femur Length (cm)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>7	51	36.4	36.4	36.4
	5–7	89	63.6	63.6	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.12 shows most fetuses (63.6%) had a femur length of 5–7 cm, whereas 36.4% had femur

lengths greater than 7 cm, indicating generally normal fetal skeletal growth.

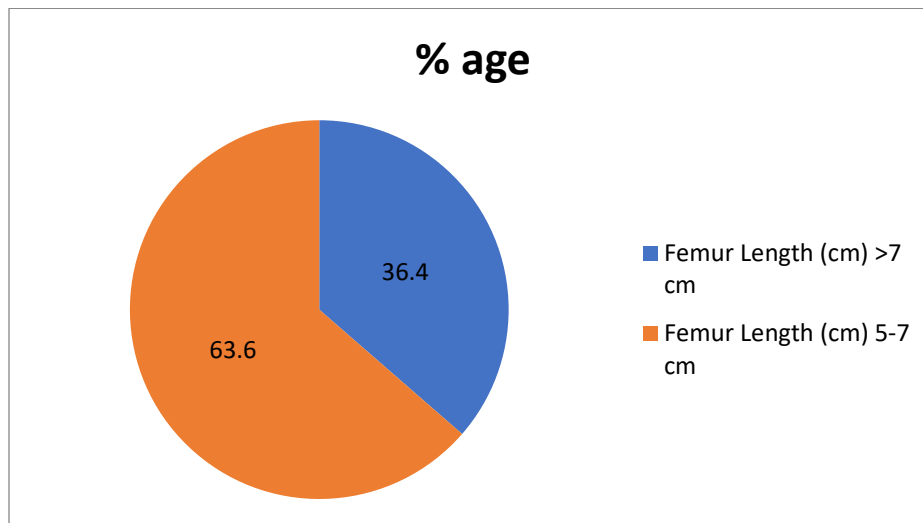


Figure 4.12: Graphical representation of participants based on femur length measurement in the study population

INTERPRETATION

Fig 4.12 shows most fetuses (63.6%) had a femur length of 5-7 cm, whereas 36.4% had femur

lengths greater than 7 cm, indicating generally normal fetal skeletal growth.

Table 4.13: Frequency distribution of participants according to gestational age (weeks) in the study population

Gestational Age (Weeks)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	31-36	83	59.3	59.3	59.3
	37-40	57	40.7	40.7	100.0
	Total	140	100.0	100.0	

INTERPRETATION

Table 4.13 shows most participants (59.3%) were between 31-36 weeks of gestation, while 40.7%

were between 37-40 weeks, indicating that the majority were assessed during the late third trimester.

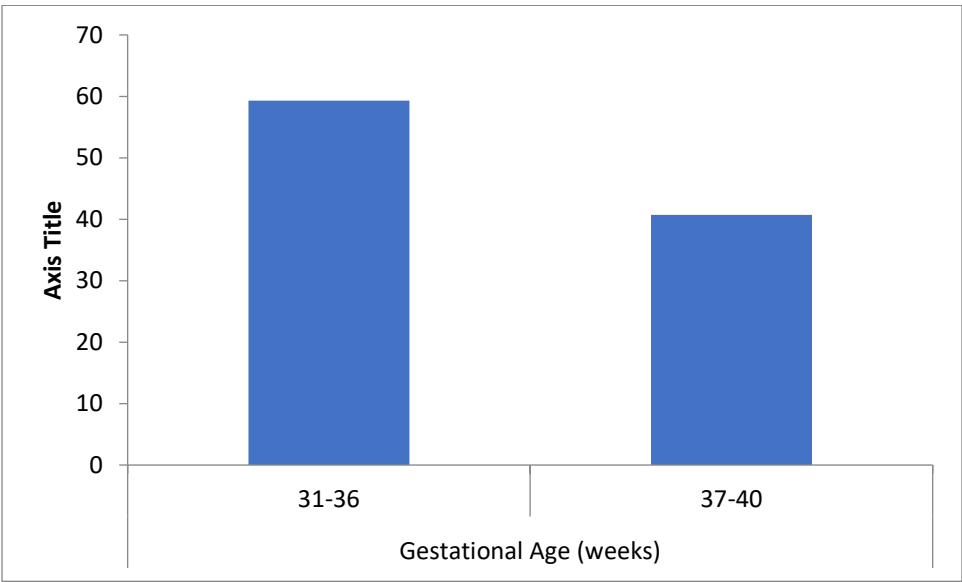


Figure 4.13: Graphical representation of participants according to gestational age (weeks) in the study population

INTERPRETATION

Fig 4.13 shows most participants (59.3%) were between 31–36 weeks of gestation, while 40.7%

were between 37–40 weeks, indicating that the majority were assessed during the late third trimester.

Table 4.14: Correlation Between Gestational Diabetes and Placental Location

Gestational Diabetes	Placental Location					p-value
	Anterior	Fundal	Low-lying	Previa	Posterior	
No	17	3	2	0	13	0.927
Yes	49	6	5	1	44	

INTERPRETATION

Table 4.14 shows Chi-square analysis showed no statistically significant association between gestational diabetes and placental location ($p = 0.927$). The distribution of anterior, posterior,

fundal, low-lying placenta, and placenta previa was comparable among women with and without gestational diabetes, suggesting that placental location was independent of gestational diabetes status.

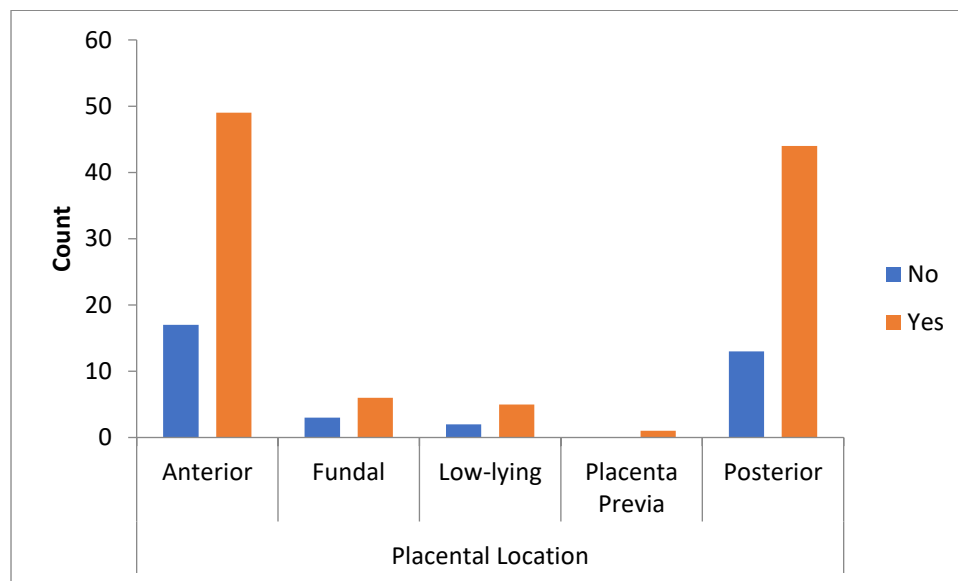


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CHAPTER 5

DISCUSSION

The present study was conducted to evaluate the sonographic assessment of fetal placental location in patients diagnosed with Gestational Diabetes Mellitus and to determine the frequency of different placental positions in this high-risk population. Pregnancy complicated by gestational diabetes is associated with multiple maternal and fetal complications, and placental abnormalities are considered one of the major contributing factors affecting pregnancy outcomes. Since the placenta plays a central role in fetal nourishment, oxygen transfer, hormonal regulation, and metabolic exchange, any alteration in placental

morphology or implantation site may significantly influence maternal and fetal health. The findings of this study highlighted the importance of routine ultrasonographic evaluation of placental location in pregnancies complicated by gestational diabetes mellitus (GDM).

In the current study, anterior and posterior placental locations were the most commonly observed placental positions among gestational diabetic patients, while fundal, lateral, low-lying placenta, and placenta previa were observed less frequently. These findings are consistent with previous population-based studies conducted by M. Granfors and colleagues, who reported that anterior placenta was present in approximately 47.8% of pregnancies, posterior placenta in 46.4%, fundal placenta in 3.3%, and lateral placenta in 2.5% of cases. Similar observations were also reported by Fung TY et al., where central placentation including anterior and posterior positions represented the majority of placental implantations. These similarities support the concept that anterior and posterior placental implantation remain physiologically predominant even in diabetic pregnancies.

The present study demonstrated that abnormal placental locations such as lateral placentation and low-lying placenta occurred less frequently but may still carry important clinical significance. Previous studies have indicated that lateral placentation may be associated with increased uterine artery resistance and reduced placental perfusion, potentially contributing to adverse pregnancy outcomes including preeclampsia, fetal growth restriction, and intrauterine hypoxia. Kofinas AD and colleagues reported that pregnancies with lateral placentation demonstrated increased uterine artery resistance and a higher risk of hypertensive disorders and intrauterine growth restriction. Likewise, Ambika Rai et al. observed that lateral placenta was significantly associated with the later development of preeclampsia, suggesting that placental implantation site may serve as an early sonographic predictor of adverse maternal outcomes.

Gestational diabetes mellitus is known to produce multiple structural and functional alterations within the placenta. Chronic maternal hyperglycemia exposes the placenta to oxidative stress, inflammatory mediators, vascular dysfunction, and metabolic disturbances that may influence placental growth and implantation characteristics. Histopathological studies have reported placental villous immaturity, fibrinoid necrosis, chorangiosis, syncytial knot formation, increased angiogenesis, and abnormal vascular remodeling in diabetic pregnancies. Patrycja Jarmuzek and colleagues concluded that placentas from gestational diabetic mothers commonly exhibit adaptive and pathological changes secondary to chronic hyperglycemia and altered placental perfusion. These findings suggest that placental abnormalities in diabetic pregnancies are not only structural but may also affect placental function and fetal wellbeing.

In this study, the relationship between placental location and maternal factors such as age, parity, and previous cesarean section history was also evaluated. It was observed that gestational diabetes occurred more frequently among women of advanced maternal age and multiparous women,

which is consistent with established literature identifying maternal age and parity as important risk factors for GDM. Previous epidemiological studies conducted in Pakistan and internationally have demonstrated increasing prevalence of gestational diabetes with advancing maternal age due to increased insulin resistance and metabolic dysfunction during pregnancy. Similarly, prior cesarean deliveries may influence placental implantation through uterine scarring and altered endometrial vascularization, thereby increasing the risk of abnormal placental positioning such as placenta previa or low-lying placenta.

Another important finding of this study was the utility of ultrasonography as a reliable, safe, and noninvasive imaging modality for placental localization. Obstetric ultrasound allows accurate identification of placental position, placental thickness, fetal growth parameters, and placental relation to the internal cervical os without exposing the mother or fetus to ionizing radiation. Ultrasonography has become the gold standard investigation for placental assessment because of its accessibility, reproducibility, affordability, and diagnostic accuracy. The use of transabdominal ultrasonography in this study successfully identified placental locations and associated findings in the majority of patients. Previous studies have also emphasized the superiority of ultrasonography, particularly transvaginal ultrasound, in diagnosing low-lying placenta and placenta previa with high sensitivity and specificity.

The present study also supports the concept that placental location may have predictive value regarding pregnancy outcomes. Studies conducted by Lucy E. G. Kalanithi et al. demonstrated that pregnancies complicated by intrauterine growth restriction were significantly more likely to have lateral placentation compared to normal pregnancies. Similarly, other researchers have linked anterior placentation with gestational diabetes, placental abruption, intrauterine fetal death, and pregnancy-induced hypertension. Although the present study primarily focused on placental localization rather than pregnancy

outcome, these previous findings highlight the clinical importance of recognizing abnormal placental positions early during pregnancy.

Placental implantation is strongly influenced by uterine vascular supply and trophoblastic invasion during early pregnancy. The uterine blood supply is not uniformly distributed, and therefore placental location may determine the adequacy of maternal-fetal perfusion. Centrally located placentas generally receive balanced perfusion from both uterine arteries, whereas lateral placentas rely predominantly on unilateral uterine blood supply. Reduced collateral circulation in laterally implanted placentas may predispose pregnancies to impaired perfusion, placental hypoxia, and fetal growth abnormalities. This pathophysiological mechanism explains why several studies have associated lateral placentation with preeclampsia and fetal growth restriction.

The findings of this study emphasize the importance of routine placental localization during antenatal ultrasound examinations, particularly in pregnancies complicated by gestational diabetes mellitus. Early identification of abnormal placental positioning allows appropriate antenatal monitoring, timely obstetric interventions, and better delivery planning. In cases of low-lying placenta or placenta previa, repeat ultrasound examinations in the third trimester are essential because placental migration may occur with advancing gestation. Failure to identify persistent placenta previa may lead to severe maternal hemorrhage, preterm delivery, and increased cesarean section rates. Therefore, sonographic assessment of placental location should be considered an integral component of obstetric care in diabetic pregnancies.

The present study had certain limitations that should be acknowledged. The study was conducted at a single center with a relatively limited sample size, which may affect the generalizability of the findings. Additionally, the use of two-dimensional ultrasonography may introduce measurement inaccuracies compared with advanced three-dimensional placental imaging techniques. Operator dependency and

sonologist experience may also influence the accuracy of placental measurements and localization. Despite these limitations, the study provides valuable local data regarding placental location patterns in gestational diabetic pregnancies and contributes to the growing evidence regarding placental assessment in high-risk obstetric populations.

Assessment according to gestational age revealed that placental localization becomes more accurate as pregnancy advances because placental margins and uterine anatomy are better visualized during the second and third trimesters. Ultrasonography proved to be a safe, noninvasive, and reliable imaging modality for placental assessment in gestational diabetic patients.

The occurrence of low-lying placenta or abnormal placental positioning was comparatively less frequent in this study. However, when present, abnormal placental location may increase the risk of complications such as antepartum hemorrhage, placental insufficiency, and delivery-related complications. Early identification through routine obstetric ultrasound can therefore assist clinicians in monitoring high-risk pregnancies more effectively.

In conclusion, this study demonstrated that anterior and posterior placental positions were the most common placental locations among gestational diabetic patients, while abnormal placental positions such as lateral placenta and placenta previa occurred less frequently but may be associated with adverse pregnancy outcomes. Ultrasonography proved to be an effective, safe, and reliable method for placental assessment. The study reinforces the clinical importance of routine placental localization in gestational diabetic pregnancies to improve maternal and fetal monitoring, facilitate early diagnosis of complications, and optimize pregnancy outcomes.

CONCLUSION

On the basis of my study, it was conducted to evaluate the sonographic assessment of fetal placental location in pregnant women diagnosed with Gestational Diabetes Mellitus and to

determine the frequency of different placental positions in this high-risk group. The findings of my study demonstrated that anterior and posterior placental locations were the most commonly observed placental positions among gestational diabetic patients, while lateral, fundal, low-lying placenta, and placenta previa were less frequently observed.

The study highlighted the important role of ultrasonography as a safe, reliable, noninvasive, and effective imaging modality for assessing placental location during pregnancy. Sonographic evaluation allowed accurate identification of placental implantation sites and helped in detecting abnormal placental positions that may contribute to adverse maternal and fetal outcomes.

Gestational diabetes mellitus was found to be associated with various maternal factors including increased maternal age, parity, and previous obstetric history, which may influence placental implantation and pregnancy outcomes. Abnormal placental locations, although less common, may increase the risk of complications such as preeclampsia, fetal growth restriction, antepartum hemorrhage, placenta previa, and cesarean delivery.

The findings of my study emphasize the clinical importance of routine placental localization in pregnancies complicated by gestational diabetes mellitus. Early identification of placental abnormalities through ultrasound can improve antenatal monitoring, assist in timely obstetric management, and reduce maternal and fetal complications.

LIMITATIONS

Using a two-dimensional ultrasound to obtain the thickness, and diameter of the placenta and calculating the volume would have introduced errors. This is because such calculations would be based on the formula for calculating the volume of a sphere which the placenta approximates to in shape. Potential influence of inexperienced sonologists on the accuracy and reliability of the ultrasound measurements is another major

limitation of this study. The quality of measurements depends heavily on the expertise and experience of the sonologist performing the procedure.

RECOMENDATION

- All pregnant women diagnosed with gestational diabetes mellitus (GDM) should undergo a detailed ultrasound to assess placental location, ideally between 20–28 weeks of gestation. More training of obstetrician on estimation of fetal weight and placental thickness by ultrasound.
- Patients with findings such as low-lying placenta or placenta previa should receive repeat ultrasound examinations in the third trimester to monitor placental migration and prevent delivery complications.
- Placental localization should be included as a standard component of ultrasound protocols for patients with GDM, as they may have a higher risk of abnormal placental implantation.
- Healthcare providers should receive updated training on identifying and reporting placental location, especially in high-risk pregnancies like GDM.
- Women with GDM should be informed about the possible complications related to abnormal placental positions, such as bleeding or need for cesarean delivery, to improve preparedness.
- Ultrasound findings regarding placental position should be consistently documented to establish hospital-level data that can improve future risk prediction.
- Collaboration between radiologists, obstetricians, endocrinologists, and diabetes educators can improve overall maternal and fetal outcomes.
- Larger, multi-center studies should be conducted to evaluate the association between GDM severity and abnormal placental location, and to assess long-term outcomes.

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