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Impact of Placenta Previa on Fetal Growth

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Placenta Previa refers to the presence of placental tissue that extends over the internal cervical is during pregnancy. The incidence of this condition is reported to be 2% at 20 weeks of gestation and decreases to around 4–6 per 1000 births between 34 and 39 weeks through trophotropism. The aim of the work is to evaluate fetal growth in pregnancies complicated by placenta Previa.
Methods: This cross-sectional study was done on 100 pregnant females with placenta Previa aged 18-35 years. Cases were defined as patients with gestational age 24-40 weeks, BMI 18-30 kg/m^2, Singleton fetus and diagnosed having placenta Previa; confirmed by trans-vaginal ultrasound in the second and third trimester. Complete history, vital signs and complete obstetric examination, laboratory and radiological investigations (ultrasound done trans-abdominally to evaluate fetal weight, biometry and Doppler studies) were taken.
Results: The gestational age ranged from 34-39 weeks with a mean value 36.03 ± 1.23 weeks and a median value 36 weeks (IQR = 35-37 weeks). The femur length ranged from 33.14-39.14 weeks with a mean value 35.44 ± 1.56 weeks and a median value 35.14 weeks (IQR = 34-36.9 weeks).The abdominal circumference ranged from 32.86-39.14 weeks with a mean value 35.43 ± 1.65 weeks with a median value 35.14 weeks (IQR = 33.9-36.7 weeks).
As regard to umbilical (UA) and middle cerebral (MCA) arteries Doppler resistant index (RI), UA ranged from 0.48-0.58 with a mean value 0.53 ± 0.03 and a median value 0.53 (IQR = 0.51-0.55).

MCA ranged from 0.75-0.85 with a mean value 0.80 ± 0.03 and a median value 0.79 (IQR = 0.77-0.82).
Conclusion: Placenta Previa led to preterm delivery (<36 weeks) in about one third of the study cases. Femur length was <36 weeks in 65 patients. Abdominal circumference was <36 weeks in 61 patients. Placenta Previa had insignificant effect on umbilical (UA) and middle cerebral arteries Doppler resistant index.

Keywords: Placenta Previa; fetal growth; femur length; abdominal circumference.

1. INTRODUCTION

Placenta Previa refers to the presence of placental tissue that extends over the internal cervical is during pregnancy [1]. The incidence of this condition is reported to be 2% at 20 weeks of gestation, and through the process of placental migration known as trophotropism, decreases to around 4–6 per 1000 births between 34 and 39 weeks [2]**.**

The primary risk factors for the development of placenta Previa include a prior history of placenta Previa, previous cesarean delivery, multiple gestations, use of fertility treatments and increasing maternal age, among others [3]. The risk of recurrence in subsequent pregnancies is reported at 4–8% [4].

Given its location over the cervical os, a proportion of the placental surface is exposed and lacks a proper uteroplacental interphase. Well-established sequelae of this condition include the potential for severe antenatal bleeding and preterm birth, as well as the need for cesarean delivery [3, 5]. The risk of bleeding is thought to occur when uterine contractions or gradual changes in the cervix and lower uterine segment apply shearing forces to the inelastic placental attachment site, resulting in partial detachment. The risk of placenta Previa increases after a single Cesarean delivery and rises further with increasing number of Cesarean deliveries [6, 7].

Epidemiological data suggest that the scar left following a Cesarean delivery in the myometrium of the lower uterine segment encourages both implantation of the blastocyst in the area of the scar and abnormal adherence or invasion of placental villi within the scar tissue [8].

Poor vascularization and tissue oxygenation in the area of a Cesarean scar is associated with local failure of re-epithelialization and decidualization, which has an impact on both implantation and placentation, as well as a possible effect on placental development and, subsequently, fetal growth [9, 10].

Women with a previous Cesarean delivery have been shown to have increased uterine artery resistance in a subsequent pregnancy compared with those with previous vaginal delivery only [10]. Recent studies have suggested that pregnancies complicated by placenta Previa are at higher risk of delivering a small-for-gestational-age (SGA) neonate and are associated with a higher incidence of placental vascular supply lesions [10].

The aim of the work is to evaluate fetal growth in pregnancies complicated by placenta Previa.

2. PATIENTS AND METHODS

This cross sectional study was done on 100 pregnant females with placenta Previa attended outpatient clinic and /or inpatient department of obstetrics and gynecology at Tanta university hospitals from April 2020 to April 2021.

Inclusion criteria was defined as patients aged 18-35 years, gestational age 24-40 weeks, BMI 18-30kg/m^2, singleton fetus and diagnosed having placenta Previa; confirmed by trans-vaginal ultrasound in the second and third trimester.
While patients with fetal anomalies, morbid maternal obesity, gestational diabetes, cases with chronic hypertension, pregnancy induced hypertension, cases with autoimmune disorders, cases with thyroid abnormalities (Hypothyroidism- Hyperthyroidism) were excluded.

All selected participants were subjected to the following:

History

Complete history taking with special emphasis to maternal age
Parity

Maternal weight
Presence of any disease
Last menstrual date(LMD)
Any medication during pregnancy
Any medical problem
Drug allergy
Previous operations
Family history

Examination

Vital signs measuring:
Blood pressure
Pulse
Temperature
Complete obstetric examination:
Symphyseal fundal height (SFH)
Lie
Presentation
Pelvic examination

Investigations

Laboratory

CBC
Blood group, Rh factor
Liver function tests
kidney function tests
Urine analysis

Radiologically

Ultrasound: Have been done trans-abdominally to evaluate fetal weight, biometry and Doppler studies. Umbilical artery (Um.A), Middle Cerebral artery (MCA), Uterine artery (Ut.A) indices, was examined by Color Doppler ultrasound:

Trans-abdominal Ultrasound is used for initial placental localization.

Trans-vaginal Ultrasound is used for confirmation in suspected cases of placenta previa.
Sonography was performed by a single well-trained observer using ultrasound machines (Mindray DC-30) with a multifrequency volumetric trans-abdominal transducer.

2.1 Statistical Analysis

Statistical analysis was done by SPSS v27 (IBM©, Chicago, IL, USA). Quantitative data were presented as mean, standard deviation (SD) and median and interquartile range (IQR) and were analysed by unpaired student t-test or Mann Whitney-test. Qualitative variables were presented as frequency and percentage (%) and were analysed utilizing the Chi-square test or Fisher's exact test when appropriate. A two tailed P value < 0.05 was considered statistically significant.

3. RESULTS

As regard to the maternal age, 56 (56%) patients were ≥ 30 years and 44 (44%) patients were < 30 years. The maternal age ranged from 18-43 years with a mean value 28.46 ± 5.65 years and a median value 28 years (IQR = 24.5-33 years). Table 1.

As regard to the gestational age, 36 (36%) patients were <36 weeks (12 (12%) patients were ≥ 34 and <35 weeks and 24 patients were from ≥ 35 and < 36 weeks) and 64 (64%) patients were ≥36 weeks (29 (29%) patients were ≥ 36 and <37 weeks, 24 (24%) patients were ≥ 37 and <38 weeks, 9 (9%) patients were ≥ 38 and < 39 weeks and 2 (2%) patients were ≥ 39 weeks). The gestational age ranged from 34-39 weeks with a mean value 36.03 ± 1.23 weeks and a median value 36 weeks (IQR = 35-37 weeks) Table 1.

There were 8 (8%) primiparous patients and 92 (92%) multi parous patients. The parity ranged from 1-7 with a mean value 3.44 ± 1.55 and a median value 3 (IQR = 2-4). Table 1.

There were 11 (11%) didn't experience any previous C.S, 30 (30%) patients experienced one previous C.S, 37 (37%) patients experienced 2 previous C.S, 16 (16%) patients experienced 3 previous C.S and 6 (6%) patients experienced 4 previous C.S. The previous C.S ranged from 0-4 with a mean value 1.76 ± 1.05 and a median value 2 (IQR = 1-2). Table 2.

There were 48 (48%) patients who had previous abortion and 52 (52%) patients who didn't have abortion. Abortion ranged from 0-4 with a mean value 0.77-0.99 and a median value 0 (IQR = 0-1). Table 2.

The femur length was < 36 weeks in 65 (65%) patients and ≥ 36 weeks in 35 (35%) patients. The femur length ranged from 33.14-39.14 weeks with a mean value 35.44 ± 1.56 weeks and a median value 35.14 weeks (IQR = 34-36.9 weeks). There was a significant difference between GA by femur length and GA by LMP [Table 3, Fig. 1].

Abdominal circumference was < 36 weeks in 61 (61%) patients and ≥ 36 weeks in 39 (39%) patients. The abdominal circumference ranged from 32.86-39.14 weeks with a mean value 35.43 ± 1.65 weeks with a median value 35.14 weeks (IQR = 33.9-36.7 weeks). There was a significant difference between GA by abdominal circumference and GA by LMP [Table 3].

Symphysial fundal height was < 36 weeks in 51 (51%) patients and ≥ 36 weeks in 49 (49%) patients. Symphysial fundal height ranged from 33-38 weeks with a mean value of 35.42 ± 1.37 weeks with a median value 35 weeks (IQR = 35 – 36weeks). There was a significant difference between GA by symphysial fundal height and GA by LMP [Table 3].

Table 1. Distribution of the studied cases according to demographic data and parity (n = 100)

	No.	**%**
Maternal age		
≥ 30	56	56.0
< 30	44	44.0
Min. – Max.	18.0 – 43.0	
Mean ± SD.	28.46 ± 5.65	
Median (IQR)	28.0 (24.5 – 33.0)	
Gestation age (week)		
<36	**36**	**36.0**
34-	12	12.0
35-	24	24.0
≥36	**64**	**64.0**
36-	29	29.0
37-	24	24.0
38-	9	9.0
39-	2	2.0
Min. – Max.	34.0 – 39.0	
Mean ± SD.	36.03 ± 1.23	
Median (IQR)	36.0 (35.0 – 37.0)	
Parity		
Primi Parous	8	8.00
Multi Parous	92	92.00
Min. – Max.	1.0 – 7.0	
Mean ± SD.	3.44 ± 1.55	
Median (IQR)	3.0 (2.0 – 4.0)	

SD: Standard deviation, IQR: Inter quartile range

Table 2. Distribution of the studied cases according to CS and previous abortion (n = 100)

Previous C.S	**No.**	**%**
No C.S	11	11.0
1	30	30.0
2	37	37.0
3	16	16.0
4	6	6.0
Min. – Max.	0.0 – 4.0	
Mean ± SD.	1.76 ± 1.05	
Median (IQR)	2.0 (1.0 – 2.0)	
Abortion	**No.**	**%**
No Abortion	52	52.0
Previous abortion	48	48.0
Min. – Max.	0.0 – 4.0	
Mean ± SD.	0.77 ± 0.99	
Median (IQR)	0.0 (0.0 – 1.0)	

SD: Standard deviation, IQR: Inter quartile range

Biparietal diameter (BPD) was < 36 weeks in 52 (52%) patients and ≥ 36 weeks in 48 (48%) patients. BPD ranged from 33 – 38 weeks with a mean value 35.27 ± 1.46 weeks with a median value 35.00 weeks (IQR = 34.0 – 36.0 weeks). There was a significant difference between GA by BPD and GA by LMP [Table 3 Fig. 2].

GA was significantly lower in cases with placenta accrete Table 4.

UMA RI ranged from 0.48-0.58 with a mean value 0.53 ± 0.03 and a median value 0.53 (IQR = 0.51-0.55). UMA PI ranged from 0.82 – 1.10 with a mean value 0.92 ± 0.05 and a median value 0.92 (0.88 – 0.96). Table 5 Fig. 3.

MCA RI ranged from 0.75-0.85 with a mean value 0.80 ± 0.03 and a median value 0.79 (IQR = 0.77-0.82). UMA PI ranged from 1.30 – 2.10 with a mean value 1.63 ± 0.17 and a median value 1.60 (1.5 – 1.8). UTA RI ranged from 0.59 – 0.65 with a mean value 0.61 ± 0.01 and a median value 0.61 (0.60 – 0.62). UTA PI ranged from 0.82 – 1.09 with a mean value 0.93 ± 0.07 and a median value 0.94 (0.87 – 0.99). Table 5 Fig. 3.

4. DISCUSSION

The prevalence of this condition is estimated to be 2% at 20 weeks of pregnancy, decreasing to around 4–6 per 1000 births between 34 and 39 weeks due to the process of placental migration known as trophotropism [11].

Table 3. Distribution of the studied cases according to femur length, abdominal circumference, symphysial fundal height and biparietal diameter (n = 100)

	Femur Length (week)		**GA**		**P value**
	No.	%	No.	%	
<36	65	65.0	36	36.0	<0.001
≥36	35	35.0	64	64.0	
Min. – Max.	33.14 – 39.14		34.0 – 39.0		0.003
Mean ± SD.	35.44 ± 1.56		36.03 ± 1.23		
Median (IQR)	35.14(34.0 – 36.9)		36.0 (35.0 – 37.0)		
	Abdominal circumference (week)		GA		**P value**
	No.	**%**	**No.**	**%**	
<36	61	61.0	36	36.0	<0.001
≥36	39	39.0	64	64.0	
Min. – Max.	32.86 – 39.14		34.0 – 39.0		0.004
Mean ± SD.	35.43 ± 1.65		36.03 ± 1.23		
Median (IQR)	35.14 (33.9 – 36.7)		36.0 (35.0 – 37.0)		
	Symphysial fundal height (week)		GA		P value
	No.	%	No.	%	
<36	51	51.0	36	36.0	0.032
≥36	49	49.0	64	64.0	
Min. – Max.	33 – 38		34.0 – 39.0		0.001
Mean ± SD.	35.42 ± 1.37		36.03 ± 1.23		
Median (IQR)	35.00 (35 – 36)		36.0 (35.0 – 37.0)		
	BPD (week)		GA		P value
	No.	%	No.	%	
<36	52	52.0	36	36.0	<0.001
≥36	48	48.0	64	64.0	
Min. – Max.	33 – 38		34.0 – 39.0		<0.001
Mean ± SD.	35.27 ± 1.46		36.03 ± 1.23		
Median (IQR)	35.00 (34.0 – 36.0)		36.0 (35.0 – 37.0)		

BPD: Biparietal diameter, GA: gestational age, SD: Standard deviation, IQR: Inter quartile range

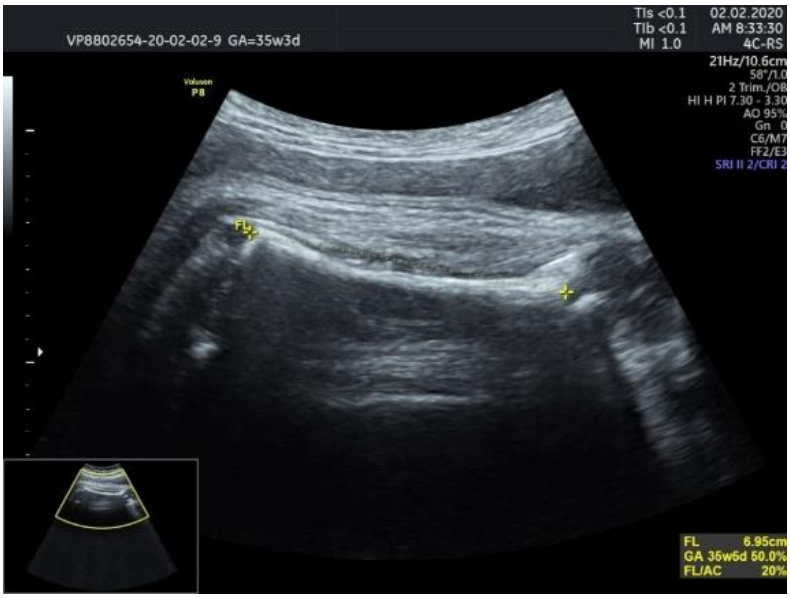

Fig. 1. Ultrasound Showing Femur Length (FL)

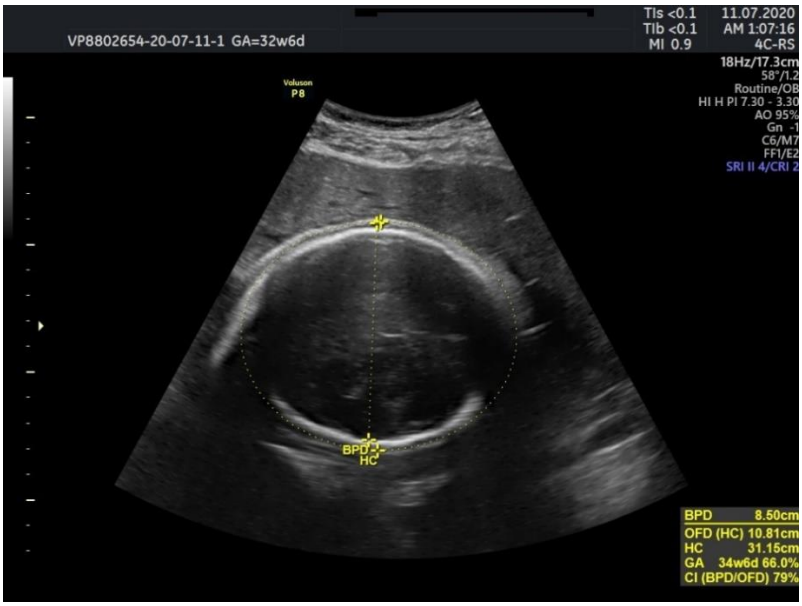

Fig. 2. Ultrasound showing biparietal diameter (BPD)

Table 4. Distribution of the studied cases according to association with placenta accreta spectrum by gestational age (n = 100)

Placenta Accreta Spectrum	positive (n = 14)		negative (n = 86)		P value
	No.	%	No.	%	
<36	8	57.1	23	26.7	0.041
≥36	6	42.9	63	73.3	
Min. – Max.	34 – 37		34 – 39		0.021
Mean ± SD.	35.41 ± 0.43		36.48 ± 1.13		
Median (IQR)	36.00 (35.0 – 36.0)		36.0 (35.0 – 37.0)		

SD: Standard deviation, IQR: Inter quartile range

Table 5. Descriptive analysis of the studied cases according to umbilical artery (UMA), middle cerebral artery (MCA) and uterine artery (UTA) Doppler studies done preoperative (n = 100)

	RI	PI
UMA		
Min. – Max.	0.48 – 0.58	0.82 – 1.10
Mean ± SD.	0.53 ± 0.03	0.92 ± 0.05
Median (IQR)	0.53 (0.51 – 0.55)	0.92 (0.88 – 0.96)
MCA		
Min. – Max.	0.75 – 0.85	1.30 – 2.10
Mean ± SD.	0.80 ± 0.03	1.63 ± 0.17
Median (IQR)	0.79 (0.77 – 0.82)	1.60 (1.5 – 1.8)
UTA	0.59 – 0.65	0.82 – 1.09
Min. – Max.	0.61 ± 0.01	0.93 ± 0.07
Mean ± SD.	0.61 (0.60 – 0.62)	0.94 (0.87 – 0.99)
Median (IQR)		

UMA: umbilical artery, MCA: middle cerebral artery, UTA: uterine artery

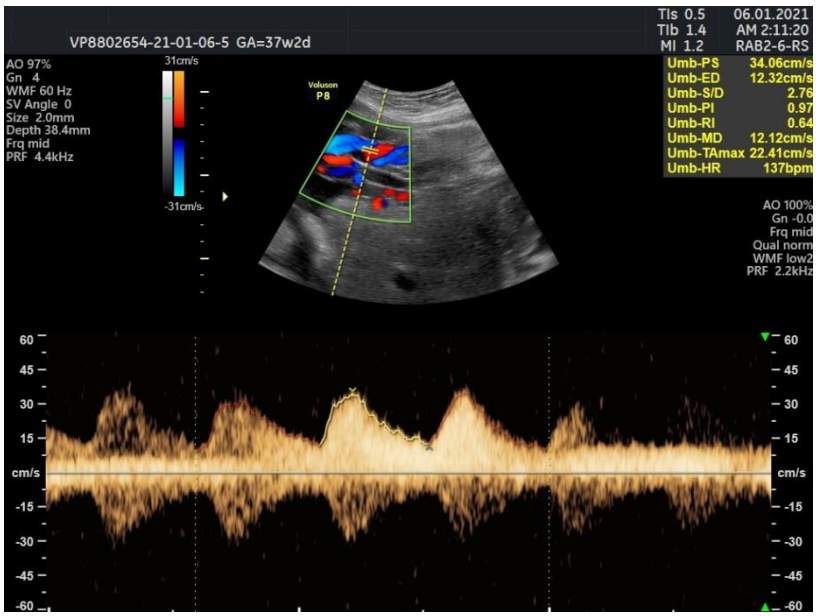

Fig. 3. Ultrasound showing umbilical artery Doppler (RI, PI)

Prior history of placenta Previa, previous caesarean delivery, multiple gestations, use of fertility therapies, and rising maternal age are all major risk factors for the development of placenta Previa. The chance of recurrence in subsequent pregnancies is estimated to be 4–8% [12].

The current study revealed that as regard to the gestational age, 36 (36%) patients were <36 weeks (12 (12%) patients were ≥ 34 and <35 weeks and 24 patients were from ≥ 35 and < 36 weeks) and 64 (64%) patients were ≥36 weeks (29 (29%) patients were ≥ 36 and <37 weeks, 24 (24%) patients were ≥ 37 and <38 weeks, 9 (9%) patients were ≥ 38 and < 39 weeks and 2 (2%) patients were ≥ 39 weeks). The gestational age ranged from 34-39 weeks with a mean value 36.03 ± 1.23 weeks and a median value 36 weeks (IQR = 35-37 weeks).

Adere et al (2020) stated that almost half of the cases (151 (49.9%)) tend to deliver preterm where 89 (29.4%) was early preterm and 62 (20.5%) late preterm. The percentage of cases that delivered at term was 152 (50.2%).After adjusting for confounders with a backward elimination model, preterm birth was significantly associated with placenta Previa [12].

Weiner et al (2016) reported that women in the Previa group gave birth at earlier gestational

ages (35.8 ± 4.4 vs. 38.8 ± 2.9 weeks, P<0.001) as compared with controls [13].

Yeniel et al (2012) stated that presence of placenta Previa increased risk for PTB, late PTB and early PTB but did not affect FGR or stillbirth significantly [14].

Statistical analysis of current study revealed that as regard to parity, there were 8 (8%) primiparous patients and 92 (92%) multi parous patients. The parity ranged from 1-7 with a mean value 3.44 ± 1.55 and a median value 3 (IQR = 2-4).

Adere et al (2020) stated that with regard to parity, 158 (52.1%) of cases of placenta Previa were multiparous who gave birth to two or more neonates followed by primiparous 75 (24. 8%). They stated that significant risk factor that associated with placenta praevia after adjusting for potential confounder in multivariate logistic regression was multiparity. Women with multiparity (AOR 2.2; 95% CI: 1.46, 3.46) had an increased odds of placenta praevia [12].

Weiner et al (2016) reported that women in the Previa group were less likely to be nulliparous (P<0.001) as compared with controls [13].

Yeniel et al (2012) stated that mean gravida and parity were higher in presence of placenta Previa, while mean birth weight and gestational age were lower significantly [14].

Harper et al (2010) stated that patients with placenta Previa tended to have more pregnancies, gravidity 2.7 ± 1.6 vs. 3.1 ± 1.7, p < .01 and parity 1.1 ± 1.2 vs. 1.2 ± 1.2, p < .01 [15].

Regarding fetal biometry, statistical analysis of current study revealed that as regard to femur length, the femur length was < 36 weeks in 65 (65%) patients and ≥ 36 weeks in 35 (35%) patients. The femur length ranged from 33.14-39.14 weeks with a mean value 35.44 ± 1.56 weeks and a median value 35.14 weeks (IQR = 34-36.9 weeks). In regard to abdominal circumference, abdominal circumference was < 36 weeks in 61 (61%) patients and ≥ 36 weeks in 39 (39%) patients. The abdominal circumference ranged from 32.86-39.14 weeks with a mean value 35.43 ± 1.65 weeks with a median value 35.14 weeks (IQR = 33.9-36.7 weeks).

Zhonghua and his colleague in (1992) conducted a retrospective study of 151 fetuses born of mothers with placenta Previa. They stated that placenta Previa affected fetal weight gain, especially from 33rd week and the chest circumference, in the last three weeks. This study aimed to determine whether placenta Previa affects growth and to what extent. They recorded the birth weight, crown-heel length, head and chest circumferences of each of the 151 fetuses. After calculating the average of each item. According to gestational week and type of placenta Previa, they were compared with the 50th percentile numbers in normal fetuses of the same gestational age. The results were among the 151 features, born of mothers with placenta Previa 19 (12.6%) suffered from intrauterine growth retardation, 80(53.0%) with birth weight less than normal fetuses, and 52(34.4%) with birth weight basically the same as normal fetuses. Most of the fetuses with birth weight less than normal were born of mothers with total or partial placenta Previa while most of those with birth weight basically the same as normal fetuses. At 28th to 32nd week were born of mothers with lowly placenta Previa of gestation and there was no obvious difference between the birth weights of fetuses of placenta Previa mothers and normal pregnancies (P greater than 0.05). But from 33rd week to 40th week, the difference became obvious (P less than 0.05); the chest circumference in fetuses of total and partial placenta Previa cases obviously less (P less than 0.05) [16].

Adere et al (2020)stated that birth weight was also evaluated where 166 (54.8%) was ≥2500 g, 132 (43.6%) was 1500-2499 g, and 5 (1.7) was <1500 g [12].

Balayla et al (2019) aimed to assess the relation between placenta Previa and the risk of intrauterine growth restriction. They stated that neonates from pregnancies with placenta Previa have a mild increase in the risk of IUGR/SGA. They obtained 357 records, of which 13 met the inclusion criteria. All study designs were retrospective in nature, and included 11 cohort and two case-control studies. A total of 1,593,226 singleton pregnancies were included, of which 10,575 had a placenta Previa. The incidence of growth abnormalities was 8.7/100 births in cases of placenta Previa vs. 5.8/100 births among controls. Relative to cases with alternative placental location, pregnancies with placenta Previa were associated with a mild increase in the risk of IUGR/SGA, with a pooled OR [95% confidence interval (CI)] of 1.19 (1.10–

1.27). Statistical heterogeneity was high with an I2 = 94% [11].

Weiner et al (2016) reported increased rates of SGA neonates, below the 10th percentile and below the 5th percentile, were observed in the Previa group as compared with controls (15.1% vs 3.4%, P=0.003 and 6.7% vs 0%, P=0.005, respectively). Composite neonatal outcome was worse in the Previa group as compared with the control group (45.3 vs 11.8%, Po0.001). Using multivariate logistic regression analysis, SGA ⩽10th percentile (aOR 10.09, 95% CI 2.3–44.2, P=0.002) remained independently associated with placenta Previa after controlling for background maternal confounders (maternal age, gestational age, parity, smoking, thrombophilia and BMI) [13].

Yeniel et al (2012) stated that presence of placenta Previa increased risk for LBW but did not affect FGR or stillbirth significantly [14].

Harper et al (2010) stated that patients with placenta Previa tended had intrauterine fetal demise 415 (0.7%) vs. 13 (1.8%), p < .01.Of the 724 women with placenta Previa on second-trimester ultrasound, 51 (7.2%) had an infant with a birth weight less than the 10th percentile, compared with 4026 (7.2%) in patients without placenta Previa (risk ratio [RR], 1.0; 95% confidence interval [CI], 0.77–1.3) [15].

Statistical analysis of current study revealed that as regard to umbilical (UA) and middle cerebral (MCA) arteries Doppler resistant index (RI), UA ranged from 0.48-0.58 with a mean value 0.53 ± 0.03 and a median value 0.53 (IQR = 0.51-0.55). MCA ranged from 0.75-0.85 with a mean value 0.80 ± 0.03 and a median value 0.79 (IQR = 0.77-0.82). According to our knowledge, there were no previous studies assessed this outcome.

5. CONCLUSIONS

Placenta Previa led to preterm delivery (<36 weeks) in about one third of the study cases. Femur length was <36 weeks in 65 patients. Abdominal circumference was <36 weeks in 61 patients. Most of cases of placenta Previa were multi parous patients especially with a history of 2 previous CS. Previous abortion rate had insignificant effect on incidence of placenta Previa. Placenta Previa had insignificant effect on umbilical (UA) and middle cerebral (MCA) arteries Doppler resistant index (RI).

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

An informed written consent were taken after informing the patients about the procedure.

ETHICAL APPROVAL

All procedures involving human participants performed in this study was in accordance with the ethical standards of Tanta University's ethical committee and its later amendments or comparable ethical standards.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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