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Original Research Article

A comparative study of placental abnormalities in normal and specific high-risk pregnancies by using Doppler, histology and their fetal outcome

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ABSTRACT

Background: The placenta, a vital organ connecting mother and fetus, undergoes significant growth and facilitates essential exchange. Various placental pathologies, including issues with vascular processes, inflammation, and structural abnormalities, can impact pregnancy outcomes. Conditions like placenta accreta, placenta previa, and vasa previa pose significant risks. Diagnosis and evaluation of these abnormalities are primarily done through ultrasound imaging, doppler ultrasound for blood flow assessment, and histopathology after birth.
Methods: This two-year prospective observational study at Lt. Baliram Kashyap Memorial Govt. Medical College will investigate placental characteristics in 200 pregnant women (100 normal, 100 high-risk) over 28 weeks' gestation. It involves detailed examination of placentas and babies, with data analyzed using SPSS. The study has ethical approval and aims to identify associations between placental features and pregnancy outcomes.
Results: In this study of 200 pregnant women, high-risk pregnancies were associated with older maternal age (mean 26.5 vs 24.6 years, $p<0.01$) and a higher proportion of multiparous women ($p<0.01$). Key placental abnormalities (round shape, infarct, fibrosis) and umbilical cord abnormalities (edema, foul-smelling liquor) were significantly more prevalent in the high-risk group. Doppler findings showed that an abnormal Systolic/Diastolic ratio was significantly linked to adverse perinatal outcomes. Overall, various maternal and fetal factors contribute to high-risk pregnancies and their associated complications.
Conclusions: Placental abnormalities (infarcts, fibrosis, bleeding) and umbilical cord issues (edema, foul-smelling liquor, marginal insertion) are major indicators of high-risk pregnancies and poor neonatal outcomes. Conditions like pre-eclampsia and gestational hypertension also correlate with these placental issues. Early ultrasound and Doppler studies are crucial for detection, necessitating increased clinical caution in managing such pregnancies. Further research is vital to establish comprehensive guidelines for improved care.

Keywords: Placental abnormalities, High-risk pregnancies, Placenta accreta, Placenta previa

INTRODUCTION

The placenta is a vital, disc-shaped organ that acts as the sole physical connection between a mother and her developing fetus. It expands significantly throughout pregnancy, eventually reaching a weight of approximately 500 grams, a diameter of 15 to 20 cm, a thickness of 2 to 3 cm, and an impressive surface area of about 15 square meters by delivery.[1] The basic unit of the placenta is the chorionic villus, a fetal tissue projection encased by the

chorion, which comprises the outer syncytiotrophoblast (contacting maternal blood) and inner cytotrophoblast. As pregnancy progresses, the cytotrophoblast diminishes, leaving a single layer of syncytiotrophoblast to separate maternal blood from fetal capillaries.[2] Maternal blood flow to the uterus comes from the uterine and ovarian arteries, branching into arcuate, radial, and spiral arteries that supply the intervillous space, where chorionic villi are bathed in maternal blood. Pressure drops significantly from 80-100 mmHg in uterine arteries to 10 mmHg in the intervillous space, optimizing exchange.[2] On the fetal side, two umbilical arteries carry deoxygenated blood to the placenta, branching into chorionic arteries and then capillaries within the villi. Substance exchange occurs as maternal blood components move from the intervillous space through the syncytiotrophoblast, fetal connective tissue, and fetal capillary endothelium into fetal circulation.[2]

Placental conditions are categorized by international guidelines established in Amsterdam in 2014.[3] Placental vascular processes involve issues with blood vessels and flow, affecting both maternal and fetal sides. These include maternal stromal-vascular lesions (e.g., developmental issues, malperfusion like distal villous hypoplasia, and abruptio placenta) and fetal stromal-vascular lesions (e.g., villous capillary lesions, umbilical cord obstructions, and fetal hemorrhage).[3] Placental inflammatory immune processes involve inflammatory responses, such as infectious inflammatory lesions (acute like chorioamnionitis, or chronic like villitis) and immune/idiopathic inflammatory lesions (non-infectious conditions like villitis of unknown etiology).[3] Other conditions include massive perivillous fibrin (oid) deposition, abnormal placental shape or umbilical insertion, morbidly adherent placentas (accreta), and meconium-associated changes.[3]

Several critical placental conditions are detailed further. morbidly adherent placenta (MAP)/abnormal invasive placenta (AIP) is a severe complication where villi abnormally adhere to or invade the uterine wall. This includes placenta accreta (attachment to myometrium), placenta increta (penetration of myometrium), and placenta percreta (extension through uterine serosa or into adjacent organs). Its incidence has significantly risen (from 1:2500-1:7000 in 2007 to 1:533 in 2017), with risk factors including increased maternal age, previous Caesarean deliveries, and multiparity. Undiagnosed MAP can lead to life-threatening postpartum hemorrhage.[4,5] Placenta praevia, first described in 1685, occurs when the placenta covers the internal cervical os, risking maternal and fetal hemorrhage. It's categorized as complete, partial, marginal, or low-lying, with an incidence of about 1 in 200-250 pregnancies.[6] Vasa praevia is a rare (1:2500-5000 pregnancies) but critical condition where unprotected fetal blood vessels cross the lower uterine segment ahead of the fetus, risking severe fetal blood loss if membranes rupture or vessels are compressed.[7] Placenta variants include bilobed placenta (two equal-sized lobes, 2-8% incidence), circumvallate placenta (an extrachorial placenta with raised edges, 0.5-1.8% incidence), Placenta Membranacea (a rare, thin placenta covering the entire chorion, associated with abnormal adherence), and Succenturiate Placenta (a smaller, accessory lobe).[8-10] Chronic intervillositis is a rare anomaly with diffuse histiocytic inflammation in the intervillous space, linked to maternal diabetes, hypertension, and systemic lupus erythematosus.[11] Placental mesenchymal dysplasia is a rare vascular anomaly mimicking partial hydatidiform molar pregnancy on ultrasound, requiring histology for diagnosis.[12] A diabetic placenta shows adaptive changes due to hyperglycemia, including villous immaturity, fibrinoid necrosis, and increased angiogenesis.[13] Placental Chorioangioma is a benign vascular tumor found in about 1% of pregnancies.[14] Placental Infections involve various agents crossing from maternal circulation, potentially causing maternal and fetal complications, and placental examination is often recommended in cases of preterm delivery, fetal tachycardia, or stillbirth.[15] Chorioamnionitis is an infection of the membranes and amniotic fluid, typically bacterial and ascending from the cervix, which can be microscopic.[15] Hydatidiform mole (HM), or molar pregnancy, is an abnormal growth of placental tissue, usually benign but with a possibility of becoming cancerous. It's rare (1 in 1000-2000 pregnancies), with risk factors including maternal age extremes and prior molar pregnancy. It features placental cell overgrowth, villous swelling, and high hCG levels.[16]

Historically, placental abnormalities were assessed after delivery using traditional pathology techniques, offering insights into prenatal and neonatal events but limited understanding of lesion development. Placental Histopathology post-birth can indicate the timing and extent of adverse events and identify vascular or immunologic/infectious processes.[17] Placental imaging, primarily ultrasound (US), is the standard prenatal method due to its accessibility, safety, and cost-effectiveness. However, US limitations (e.g., implantation site, maternal body habitus) can lead to poor correlation with postnatal histopathology, and it's limited in predicting later placental compromise. The placenta is visible by US early in pregnancy, with changes in thickness, diameter, echogenicity, and shape, and both increased and decreased size are associated with abnormal development. Some common US-detected lesions, like placental lakes, have limited clinical significance.[17] Serum Biomarkers aim to identify women at risk of placenta-mediated complications early in gestation.[17] The role of doppler ultrasound in placental abnormalities is to assess blood flow patterns in maternal, fetal, and placental circulation, offering insights into maternal adaptation, placental resistance, and fetal cardiovascular status to guide pregnancy management. Doppler evaluation is categorized into arterial, venous, or cardiac. Arterial doppler flow waveforms depend on forward blood ejection, vessel elasticity, and blood viscosity, with key measures including peak systolic velocity (PSV) and end diastolic velocity (EDV). Semiquantitative, angle-independent indices like the

umbilical artery (UA) systolic/diastolic (S/D) ratio, pulsatility index (PI), and resistive index (RI) are commonly used, with PI being the most reproducible. UA doppler measures impedance in the fetal villous vascular tree.[18] Venous doppler typically shows a four-phase waveform, and the ductus venosus (DV) is the most commonly examined venous vessel, demonstrating antegrade flow throughout the cardiac cycle.[19]

METHODS

This prospective observational study, conducted from August 2022 to June 2024 at Lt. Baliram Kashyap Memorial Govt. Medical College, Jagdalpur, Chhattisgarh, investigates placental characteristics in pregnant women over 28 weeks' gestation. It divides participants into two groups: normal pregnancies (no complications) and high-risk pregnancies (maternal factors like severe anemia, diabetes, PIH, or delivery-related issues like pre-term delivery, abruptio placenta). Patients with IUFD, congenital anomalies, or eclampsia are excluded.

Sample size and data collection

The study aims for 100 consecutive patients in each group, totalling 200 participants, based on a calculated sample size of 83.1 from previous research. Data collection involves semi-structured proformas, detailed medical histories, examinations, and relevant investigations including doppler ultrasound.

Placenta and baby examination

Each placenta undergoes thorough gross examination (size, weight, cord) and histopathological examination (HPE) for various pathologies like infarction, calcification, and villous abnormalities. Babies are monitored for fetal distress, birth weight, APGAR scores, NICU admission, and neonatal morbidity/mortality. The study adheres to the Declaration of Helsinki, has Institutional Ethics Committee approval, and obtained written informed consent from all participants, incurring no additional costs or harm.

Statistical analysis

Statistical analysis will use descriptive methods, Chi-square tests for associations, and Student's t-tests for quantitative comparisons, with $p<0.05$ considered significant. All analyses will be done using SPSS version 24.0.

RESULTS

Comparison of high-risk and normal pregnancy groups based on maternal age

In the present study, 200 pregnant women were included. It was observed that 21 to 25 years was the most common age group and mean age of high pregnant women was significantly higher as compared to that of normal pregnancy women (26.5 vs 24.6 years, p value <0.01).

Table 1: Comparison of high-risk and normal pregnancy groups based on placental abnormalities.

Abnormalities		High-risk	Normal	Total	P value*
Round shape	N	16	0	16	< 0.01
	%	16.00%	0.00%	8.00%	
Placental infarct	N	69	27	96	< 0.01
	%	69.00%	27.00%	48.00%	
Placental fibrosis	N	17	0	17	< 0.01
	%	17.00%	0.00%	8.50%	
Placental bleeding	N	3	0	3	0.08
	%	3.00%	0.00%	1.50%	
White in color	N	0	10	10	< 0.01
	%	0.00%	10.00%	5.00%	
Total	N	100	100	200	
	%	100.00%	100.00%	100.00%	

*Significant

Comparison of high-risk and normal pregnancy groups based on parity

In the present study, 41.5% of all pregnant women were multiparous. It was observed that higher proportion of multiparous women were found in high-risk group as compared to normal group (p value < 0.01).

Comparison of high-risk and normal pregnancy groups based on placental abnormalities

It was observed that round shape (16% vs 0%, p value < 0.01), placental infarct (69% vs 27%, p value < 0.01) placental fibrosis (17% vs 0%, p value < 0.01) were significantly associated with high-risk pregnancies.

Table 2: Comparison of high-risk and normal pregnancy groups based on umbilical cord abnormalities.

Abnormalities		High-risk	Normal	Total	P value*
Marginal cord insertion	N	15	7	22	0.07
	%	15.00%	7.00%	11.00%	
False knot present	N	1	0	1	0.31
	%	1.00%	0.00%	0.50%	
UC edema	N	5	0	5	< 0.05
	%	5.00%	0.00%	2.50%	
UC color white	N	87	100	187	< 0.01
	%	87.00%	100.00%	93.50%	
Foul smelling liquor	N	6	0	6	< 0.05
	%	6.00%	0.00%	3.00%	
Total	N	100	100	200	
	%	100.00%	100.00%	100.00%	

*Significant; analysed using chi-square

Table 3: Comparison of high-risk and normal pregnancy groups based on doppler parameters.

Doppler pregnancy type					
Parameters	High-risk mean		Normal mean		
		SD		SD	P value*
Systolic diastolic ratio	2.8	0.4	2.5	0.3	< 0.01
Resistance index	2.3	11.4	0.7	0.0	0.15
Pulsatility index	1.2	0.4	1.4	0.3	< 0.01

*Significant

Table 4: Association of placental abnormalities with neonatal outcomes in normal pregnancy group.

Placental abnormalities		LSCS mode	Fetal distress	Low birth weight	NICU admission	Neonatal death
Round shape	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	NA	NA	NA	NA	NA
Placental infarcts	N	7	7	7	7	4
	%	100.00%	100.00%	40.00%	43.80%	100.00%
	P value	<0.01	<0.01	0.32	0.11	<0.01
Placental fibrosis	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	NA	NA	NA	NA	NA
Placental bleeding	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	NA	NA	NA	NA	NA
White in color	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	0.36	0.36	0.26	0.14	0.49
Total	N	7	7	10	16	4
	%	100.00%	100.00%	100.00%	100.00%	100.00%

Comparison of high-risk and normal pregnancy groups based on umbilical cord abnormalities

In the study sample, most common umbilical cord abnormality observed was white colored umbilical cord (187/200). It was observed that umbilical cord edema (5% vs 0%, p value < 0.05) and foul smelling liqor (6% vs 0%, p value < 0.05) were significantly associated with high-risk pregnancies. White color umbilical cord was significantly more common in normal pregnancies as compared to high-risk pregnancies (p value < 0.01).

Table 5: Association of umbilical abnormalities with neonatal outcomes in normal pregnancy group.

Umbilical abnormalities		LSCS mode	Fetal distress	Low birth weight	NICU admission	Neonatal death
Marginal cord insertion	N	0	0	5	0	0
	%	0.00%	0.00%	50.00%	0.00%	0.00%
	P value	0.45	0.45	<0.01	0.23	0.57
False knot present	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	NA	NA	NA	NA	NA
UC edema	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	NA	NA	NA	NA	NA
UC color white	N	7	7	10	16	0
	%	100.00%	100.00%	100.00%	100.00%	0.00%
	P value	NA	NA	NA	NA	NA
Foul smelling liqor	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	0.36	0.36	0.26	0.14	0.49
Total	N	7	7	10	16	4
	%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 6: Association of placental abnormalities with neonatal outcomes in high-risk pregnancy group.

Placental abnormalities		LSCS mode	Fetal distress	Low birth weight	NICU admission	Neonatal death
Round shape	N	4	4	14	14	0
	%	8.70%	15.40%	33.30%	22.20%	0.00%
	P value	<0.05	0.92	<0.01	<0.05	0.37
Placental infarcts	N	36	26	23	49	4
	%	78.30%	100.00%	54.80%	77.80%	100.00%
	P value	0.12	<0.01	<0.01	<0.05	0.17
Placental fibrosis	N	11	11	2	17	4
	%	23.90%	42.30%	4.80%	27.00%	100.00%
	P value	0.22	<0.01	<0.01	<0.01	<0.01
Placental bleeding	N	0	0	0	0	0
	%	2.20%	11.50%	4.80%	4.80%	0.00%
	P value	<0.05	<0.05	0.37	0.17	0.72
White in color	N	0	0	0	0	0
	%	0.00%	0.00%	0.00%	0.00%	0.00%
	P value	0.88	0.29	0.37	0.89	0.72
Total	N	46	26	42	63	4
	%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 7: Association of umbilical abnormalities with neonatal outcomes in high-risk pregnancy group.

Umbilical abnormalities		LSCS mode	Fetal distress	Low birth weight	NICU admission	Neonatal death
Marginal cord insertion	N	3	10	9	15	0
	%	6.50%	38.50%	21.40%	23.80%	0.00%
	P value	<0.05	<0.01	0.12	<0.01	0.39
False knot present	N	0	0	0	1	0
	%	0.00%	0.00%	0.00%	1.60%	0.00%
	P value	0.63	0.55	0.39	0.44	0.83
UC edema	N	3	4	2	4	0
	%	6.50%	15.40%	4.80%	6.30%	0.00%

Continued.

Umbilical abnormalities		LSCS mode	Fetal distress	Low birth weight	NICU admission	Neonatal death
	P value	<0.01	<0.05	0.92	0.41	0.64
UC color white	N	39	20	34	53	4
	%	84.80%	76.90%	81.00%	84.10%	100.00%
	P value	<0.01	0.19	<0.05	0.41	0.96
Foul smelling liqor	N	6	6	0	6	2
	%	13.00%	23.10%	0.00%	9.50%	50.00%
	P value	<0.05	<0.01	0.32	0.06	<0.01
Total	N	46	26	42	63	4
	%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 8: Association of doppler parameter findings with poor perinatal outcomes.

		LSCS mode	Fetal distress	Low birth weight	NICU admission	Neonatal death
Abnormal S/D ratio (≥3)	N	19	15	14	20	8
	%	36%	45%	27%	250%	100%
	P value	<0.01	<0.01	<0.05	<0.01	<0.01
Abnormal RI (<0.6 or >0.7)	N	25	15	14	33	2
	%	47%	45%	27%	42%	25%
	P value	0.09	0.31	0.06	0.31	0.45
Abnormal PI (≥1)	N	45	32	39	68	8
	%	85%	97%	75%	86%	100%
	P value	0.21	0.12	<0.01	0.21	0.32
Total		53	33	52	79	8

Comparison of high-risk and normal pregnancy groups based on Doppler parameters

On doppler study, it was found that mean systolic diastolic ratio was significantly higher among high-risk pregnancies (2.8 vs. 2.5, p value < 0.01) and mean pulsatility index was significantly lower among normal pregnancies as compared to high-risk pregnancies (1.2 vs. 1.4, p value < 0.01).

Association of placental abnormalities with neonatal outcomes in normal pregnancy group

In the normal pregnancy group, 100% of the LSCS deliveries, 100% of the fetal distress cases and 100% of neonatal deaths had placental infarcts.

Association of umbilical abnormalities with neonatal outcomes in normal pregnancy group

In the normal pregnancy group, 100% of the LSCS deliveries, fetal distress cases, LBW cases and NICU admission cases had white color umbilical cord. In addition, 50% of the LBW cases had marginal cord insertion.

Association of placental abnormalities with neonatal outcomes in high-risk pregnancy group

In high-risk pregnancies, round shaped placenta was significantly associated with LSCS deliveries, LBW babies, and NICU admission. Placental infarct was significantly associated with fetal distress, LBW babies and NICU admission. Placental fibrosis was significantly associated with fetal distress, LBW babies, NICU admission and neonatal deaths. Placental bleeding was significantly associated with LSCS deliveries, and fetal distress.

Association of umbilical abnormalities with neonatal outcomes in high-risk pregnancy group

In high-risk pregnancies, marginal cord insertion was significantly associated with LSCS deliveries, fetal distress and NICU admission. UC edema was significantly associated with LSCS deliveries, and fetal distress. White color umbilical cord was significantly associated with LSCS deliveries and LBW babies. Foul smelling liqor was significantly associated with LSCS deliveries, fetal distress and neonatal deaths.

Association of doppler parameter findings with poor perinatal outcomes

It was observed that abnormal S/D ratio was significantly associated with poor perinatal outcomes like LSCS, fetal distress, LBW, NICU admission and neonatal death. Abnormal PI was found to be significantly associated with LBW. Abnormal RI was not found to be significantly associated with any of the poor perinatal outcome assessed in the study.

DISCUSSION

This prospective cohort study, conducted at the Department of Obstetrics and Gynecology in Lt. Baliram Kashyap Medical Govt. Medical College, Jagdalpur, Chhattisgarh, aimed to compare placental abnormalities using Doppler and histology in two groups of 100 pregnant women each (all > 28 weeks gestational age): a normal pregnancy group with no complications and a high-risk pregnancy group with various maternal and delivery-related risk factors. The study sought to correlate these findings with fetal outcomes, with its results discussed below.

Baseline characteristics of the study subjects

The study observed that women in the high-risk pregnancy group were significantly older (mean age 26.5 vs. 24.6 years, p<0.01) and had a higher proportion of multiparous women (p<0.01) compared to the normal pregnancy group. They also exhibited significantly higher mean systolic (125.5 vs. 120.4 mmHg, p<0.01) and diastolic blood pressure (77.3 vs. 73.3 mmHg, p<0.01). The authors noted that such significant associations were expected, as the study groups were categorized based on factors like maternal age and parity. They further emphasized that hypertensive disorders of pregnancy, including various forms of pre-eclampsia and eclampsia, pose significant risks to both mother and fetus, aligning with general obstetric knowledge.[20]

Association of placental abnormalities with high-risk pregnancies

In the present study, round placental shape (16% vs. 0%, p<0.01), placental infarct (69% vs. 27%, p<0.01), and placental fibrosis (17% vs. 0%, p<0.01) were significantly associated with high-risk pregnancies. Specific high-risk conditions showed distinct placental maturity associations: pre-eclampsia with grade 2 and 3 maturity with hemorrhage, gestational hypertension with grade 3 maturity, IUGR with grade 2 maturity, and postdated pregnancies with grade 3 maturity with calcification. Additionally, mean placental gross weight (496.3 vs. 503.3 gm, p<0.01) and mean umbilical cord length (81.4 vs. 84 cm, p<0.01) were significantly lower in the high-risk group. Comparing with other studies, Daud et al found placental abnormalities at 20-22 and 30-32 weeks were not significantly associated with hypertensive disease, though abnormal lakes and thickness at 30-32 weeks showed a higher, albeit not statistically significant, risk.[21] McKenna et al and Proud & Grant highlighted that a grade 3 placenta at 36 weeks or earlier signifies placental dysmaturity and is associated with IUGR, gestational hypertension, low birthweight, and perinatal death, findings that resonate with the current study's observations.[22,23]

Association of doppler findings abnormalities with high-risk pregnancies

Doppler analysis in the current study revealed a significantly higher mean systolic/diastolic ratio (2.8 vs. 2.5, p<0.01) and a significantly lower mean pulsatility index (1.2 vs. 1.4, p<0.01) in high-risk pregnancies compared to normal ones. Ramachandra et al.[24] similarly reported a reduced feto-placental ratio in conditions causing chronic uteroplacental insufficiency like preeclampsia and IUGR, while Richard and Naeye et al also noted that this ratio increases in chronic placental insufficiency.[25] A recent study by Dixit et al strongly supported these findings, showing clinically significant differences (p<0.001) in mean RI, PI, and S/D ratios of the uterine and umbilical arteries, and MCA artery parameters, with high rates of abnormalities in the high-risk group (e.g., 80% for uterine artery PI).[26]

Association of placental abnormalities with adverse neonatal outcomes

In the normal pregnancy group of this study, placental infarcts were present in 100% of LSCS deliveries, fetal distress cases, and neonatal deaths. In high-risk pregnancies, a round-shaped placenta was significantly linked to LSCS, LBW, and NICU admission. Placental infarcts were significantly associated with fetal distress, LBW, and NICU admission, while placental fibrosis was tied to fetal distress, LBW, NICU admission, and neonatal deaths. Placental bleeding correlated significantly with LSCS and fetal distress. Chhabra et al observed fewer hypertensive disorders and FGR with anterior placentas compared to fundal placentas, and increased fetal distress with posterior and fundal placentas.[27] Kalanithi et al and Khan et al noted a higher likelihood of lateral or low-lying placentas in IUGR pregnancies.[28,29] Schwartz et al, Elchalal et al, and Thame et al highlighted correlations between placental measurements (2D, thickness, volume) and outcomes like SGA and perinatal mortality.[30-32] Biswas and Ghosh indicated macroscopic placental changes, including shape and cord insertion site, differ between normal and IUGR/pre-eclampsia cases, further supported by Toal M et al who showed abnormal placental shape increased odds of IUFD, preterm delivery, and IUGR.[40,41] Conversely, Daud et al and Reis et al found no significant association between abnormal placental lakes and IUGR or adverse obstetric outcomes, although Daud et al suggested a predisposition.[39,42] Krishnan et al also found that decreased mean placental weight was associated with fetal distress, and a positive correlation existed between placental weight/diameter and birth weight.[43] Cai et al reported a 3.69-fold increased risk of IUGR with abnormal umbilical cord insertion (UCI).[44]

Association of umbilical cord abnormalities with adverse maternal and neonatal outcomes

The most common umbilical cord abnormality found was a white-colored umbilical cord (187/200 cases). Umbilical

cord edema (5% vs. 0%, p<0.05) and foul-smelling liquor (6% vs. 0%, p<0.05) were significantly associated with high-risk pregnancies. A white-colored umbilical cord was more prevalent in normal pregnancies (p<0.01). In the normal pregnancy group, 100% of LSCS, fetal distress, LBW, and NICU admission cases had white-colored umbilical cords, and 50% of LBW cases showed marginal cord insertion. For high-risk pregnancies, marginal cord insertion was significantly linked to LSCS, fetal distress, and NICU admission. UC edema was significantly associated with LSCS and fetal distress, white-colored umbilical cord with LSCS and LBW, and foul-smelling liquor with LSCS, fetal distress, and neonatal deaths. Ramachandra et al also observed cord edema in all IUD cases. The discussion highlights that a single umbilical artery has a 0.5-1% incidence and is associated with congenital anomalies and increased perinatal morbidity/mortality.[33] Kulshresta et al found a significant increase in LSCS with umbilical cord abnormalities.[34] Studies by Rayburn WF et al Greenhill JP, and Sarwano E et al indicated that the risk of cord complications increased linearly with cord length.[35-37] Strong TH et al and other authors have noted a positive correlation between operative delivery and hypocoiling, which can reduce fetoplacental circulation due to cord compression.[38]

Limitations

This study on placental abnormalities in normal and high-risk pregnancies faced several limitations. Primarily, the follow-up period for neonates was short, which may have restricted the ability to observe longer-term fetal outcomes. Additionally, the study could not incorporate proteomic and genomic analyses of placental tissue, which could have provided deeper insights into the underlying biological mechanisms. Finally, doppler examinations, a key diagnostic tool in this research, were performed only once, potentially limiting the comprehensive assessment of placental blood flow dynamics throughout the pregnancies.

CONCLUSION

Placental abnormalities (infarcts, fibrosis, bleeding) and umbilical cord issues (edema, foul-smelling liquor, marginal insertion) are strongly linked to high-risk pregnancies and poor neonatal outcomes. Specific issues like pre-eclampsia, gestational hypertension, and post-datism are also associated with placental morphological abnormalities. Furthermore, an increased systolic-diastolic ratio, decreased pulsatility index, and abnormal placental weight and umbilical cord length are indicators of high-risk pregnancies. Therefore, understanding the underlying causes, symptoms, and outcomes of these placental and umbilical cord pathologies is crucial for predicting potential complications in both mothers and newborns during high-risk pregnancies.

To improve care for high-risk pregnancies, it's recommended that all high-risk pregnant women have detailed ultrasound and doppler studies early on to detect these abnormalities. Clinicians should also exercise increased caution when managing high-risk pregnancies, especially when these abnormalities are identified. Further research is necessary to develop comprehensive clinical guidelines for managing high-risk pregnancies effectively.

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