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"CORRELATION OF MACROSCOPIC AND MICROSCOPIC FEATURES OF PLACENTA WITH MORPHOMETRICAL FEATURES OF FETUS IN HIGH-RISK PREGNANCY- A CROSS SECTIONAL STUDY"

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ABSTRACT

Background: In high-risk pregnancies, the structure of the placenta can significantly influence fetal development and pregnancy outcomes. This thesis aims to explore the intricate relationship between the placental attributes, both macroscopic and microscopic and the morphometric features of the fetus in such high-risk conditions.

Objectives:

1. To study the histomorphological features of the placenta in high-risk pregnancies.
2. To correlate the findings with fetal parameters in high-risk pregnancies.
3. To use Histochemical staining (Periodic Acid Schiff) and Immunohistochemistry (CD34) for demonstrating features in high-risk pregnancies.

Methodology:

The present study involves collection of relevant clinical data from 117 pregnant women with high risk pregnancies and collection of placentas after their expulsion for histopathological examination.

Results:

Among the study population, the majority was from the age group of 21 – 30 years old, followed by < 20 years, 31-35 years and > 35 years. The mean placental weight distribution among the high-risk category was statistically significant (p-value < 0.005). Mean baby weight distribution was statistically significant (p-value < 0.001). Preterm babies had the lowest brith weights, while GDM babies had the highest weights. Syncytial knots >30% occurred in 62 cases, mainly in anemia, PIH, and hypothyroidism. PIH had the lowest fetoplacental ratio, while GDM had the highest. GDM had the lowest fetoplacental coefficient, while PIH patients had the highest. PIH patients had the thinnest placentas, while GDM and RH-negative pregnancy patients had the thickest. Five had increased villous vascularity, with 2 having anemia and 3 with GDM.Twelve had decreased villous vascularity, with 7 having anemia, 3 with PIH, and 2 with RH-negative pregnancy. Preterm births have the highest mean calcification (3.54) and variability (5.01), while PIH and anaemia show moderate levels with high variability. GDM and IUD have the lowest calcification (0.27 and 0.20), highlighting the need for tailored monitoring and intervention.

Conclusion:
The study investigated the link between placental characteristics and fetal development in high-risk pregnancies. These histopathological abnormalities found in placentas of different high-risk categories emphasize early recognition and management of high risk pregnancies which can in turn lead to improvement in perinatal outcome.

INTRODUCTION

The placenta is a crucial organ in pregnancy, functioning as the lifeline between the mother and the growing fetus. It provides oxygen and nutrients, eliminates waste, and forms a vital barrier to protect the developing child. High-risk pregnancies are those with factors that pose a threat to the health or life of the mother or fetus. These include medical conditions, such as hypertension, diabetes, preeclampsia as well as other factors like advanced maternal age or history of other pregnancy related complications. In these scenarios, it is paramount to understand how placental pathology may correlate with fetal growth and development, as the early detection and monitoring of placental abnormalities could lead to the improvement of fetal outcomes. Macroscopic features of the placenta, such as its size, shape, and umbilical cord insertion, can provide valuable insights into the efficiency of nutrient and oxygen exchange to the fetus(1).Microscopic examination, including histopathological assessment, can reveal cellular and tissue-level alterations that may impact its function. Morphometric features of the fetus such as weight is most important standard measure of fetal growth and health.

This thesis will conduct a comprehensive cross-sectional study to investigate the association between the macroscopic and microscopic features of the placenta with the morphometric parameters of fetuses in high-risk pregnancies. Doing so aims to uncover pivotal data that could be instrumental in developing targeted clinical interventions for better management of high-risk pregnancies and to optimize fetal health and pregnancy outcomes.

AIM:

• To analyse and correlate the morphology of the placenta with fetal parameters in high-risk pregnancies

MATERIAL AND METHODS

Study design : cross-sectional study

Target Population: Pregnant women of age group 20-40 attending GMH, Tirupati

Inclusion Criteria:

- Anaemic pregnant women with <10mg/dl of Haemoglobin.
- Diabetic mothers mainly of Gestational diabetes with raised levels of random fasting blood sugar and glycosuria.
- Preterm pregnancy with a gestational period of < 37 weeks.
- Mothers with two minimum blood pressures>140/90 mm of Hg throughout pregnancy at least 4 hours apart are categorised as Pregnancy-induced hypertension.
- IUGR babies whose birth weights are disproportionately low for gestational(10th percentile) or 2 SD
- IUD
- Hypothyroid
- Rh-negative pregnancy

Exclusion criteria

1. Placenta of non-viable fetus (< 20 weeks of gestation)
2. Placenta of uncomplicated pregnancy.
3. Associated obstetric complications of pregnancy.
4. Multiple pregnancies (eg. twins etc.) was excluded.

Methodology

The present study involves collection of relevant clinical data from 117 pregnant women with high risk pregnancies and collection of placentas after their expulsion for histopathological examination.Immediately following expulsion, placentas were washed in a running tap water to remove blood clots and was collected in a separate, clean plastic container.The shape (oval /circular) of the placenta.After trimming the membranes, a strip from them was taken in a "swiss roll". Insertion site of umbilical cord (eccentric/central/velamentous or frucate) was noted. The cut end of the umbilical cord was inspected for a number of blood vessels.The weight of the placenta was measured.The placental diameter was measured using a thread.Thickness of placenta—a thin, long needle was inserted into the placenta at the centre, at the margin, and midway between the centre and margin.The average of the three readings was taken as thickness of placenta.The entire placenta was cut in bread loaf method into vertical strips, each one cm thick, from the maternal surface towards the fetal surface.It was kept for fixation in 10% formalin overnight.Following bits were taken for paraffin embedding-2 bits of umbilical cord (one at fetal end and another close to placental disc), 1 bit from membrane roll,Minimum two bits from placental disc (margin and central area of placenta). Additional bits from any fibrotic area, infracted area, calcified area or any another gross pathological area was taken.After processing, these tissue bits were embedded in paraffin blocks. The sections were cut to 5 μm thickness on the glass slide and stained with Hematoxylin and Eosin. A special stain was done using periodic acid shiff (PAS) stain.

CORRELATION OF PLACENTAL PARAMETERS WITH FETAL PARAMETERS

• Feto-Placental Ratio (FPR): Normal FPR is 6:1[fetal weight: placental weight].

• Feto-placental coefficient (FPC): The formula is FPC= Placental weight (in grams) ÷ Birth weight (in grams)

The placentas were grossly examined for infarction , calcification if any and was confirmed by microscopic examination.Histological evaluation was done using standard criteria for villous and intervillous lesion.Villous lesions are Syncytial knots, Fibrinoid Necrosis, Villous stromal fibrosis, Placental Infarction, Villous Vascularity, Intervillous lesion, calcification.

RESULTS

Table 1: Age Distribution of high-risk pregnancy cases

Age in intervals	Frequency	Per cent
< 20 Years	23	19.7
21 - 25 Years	44	37.6
26 - 30 Years	39	33.3
31 - 35 Years	8	6.8
> 35 years	3	2.6
Total	117	100

Table 2: Distribution of high-risk pregnancy cases

High Risk Category	Frequency	Per cent
ANAEMIA	32	27.4
GDM	9	7.7
HYPOTHYROIDISM	19	16.2
IUD	4	3.4
IUGR	6	5.1
PRETERM	14	12
RH NEGATIVE PREGNANCY	11	9.4
PIH	22	18.8
Total	117	100

Table 3: Placental weight (in grams) according to high-risk category

High Risk Category	N	Mean	Std. Deviation	Minimum	Maximum
ANAEMIA	32	473.19	53.1	330	580
GDM	9	518.89	94.663	430	750
HYPOTHYROIDISM	19	510.58	30.087	480	570
IUD	4	407.5	111.766	280	520
IUGR	6	358.33	37.639	330	430
PRETERM	14	355.29	63.974	290	480
RH NEGATIVE PREGNANCY	11	488.73	37.097	390	520
PIH	22	436.91	92.732	240	560
Total	117	455.17	82.916	240	750

The mean placental weight distribution among the high-risk category was statistically significant(p-value < 0.005); the minimum placental weight was 240 grams and the maximum age was 750 grams. Among all high-risk categories, preterm had minimum placental weight and GDM had maximum placental weight.

Table 4: Mean baby weight (in grams) according to high risk cases

High Risk Category	Mean Baby Weight				
	N	Mean	Std. Deviation	Minimum	Maximum
ANAEMIA	32	2890.63	386.347	2300	4000
GDM	9	3333.33	798.436	2500	5100
HYPOTHYROIDISM	19	2994.74	387.977	2400	4000
IUD	4	2500	912.871	1700	3600
IUGR	6	2000	322.49	1500	2300
PRETERM	14	1871.43	412.177	1200	2500
RH NEGATIVE PREGNANCY	11	2836.36	273.03	2400	3400
PIH	22	2296.36	769.883	800	3600
Total	117	2643.76	678.559	800	5100

Mean baby weight distribution among the high-risk category was statistically highly significant(p-value < 0.001); the minimum baby weight was 800 mg, and the maximum weight was 5100 kg. Among all high-risk categories, preterm had minimum baby weight and GDM had maximum baby weight as shown in the above table.

Table 5: Fetoplacental ratio according to high-risk category

High Risk Category	FETO PLACENTAL RATIO				
	N	Mean	Std. Deviation	Minimum	Maximum
ANAEMIA	32	6.135095	0.682824038	4.925054	7.575758
GDM	9	6.397991	0.718850205	5.319149	7.407407
HYPOTHYROIDISM	19	5.860965	0.632803422	4.897959	7.083333
IUD	4	6.062614	0.880893627	4.857143	6.923077
IUGR	6	5.583183	0.73882738	4.411765	6.470588
PRETERM	14	5.282534	0.848405018	3.529412	6.451613
RH NEGATIVE PREGNANCY	11	5.814334	0.487178662	5.106383	6.666667
PIH	22	5.106152	0.891779048	3.2	6.428571
Total	117	5.75437	0.834716369	3.2	7.575758

Mean fetal placental ratio distribution among high-risk categories was statistically significant(p-value < 0.001); here, the minimum fetoplacental ratio was 3.2, and the maximum was 7.57. Among

all high-risk categories, PIH had a minimum fetoplacental ratio and anaemic had a maximum fetoplacental ratio, as shown in the above table.

Table 6: Feto placental coefficient according to high-risk category

High Risk Category	FETO PLACENTAL COEFFICIENT				
	N	Mean	Std. Deviation	Minimum	Maximum
ANAEMIA	32	0.164978	0.018483343	0.132	0.203043
GDM	9	0.158114	0.018237687	0.135	0.188
HYPOTHYROIDISM	19	0.17245	0.0180146	0.141176	0.204167
IUD	4	0.16785	0.026776078	0.144444	0.205882
IUGR	6	0.181935	0.025832187	0.154545	0.226667
PRETERM	14	0.194561	0.035898996	0.155	0.283333
RH NEGATIVE PREGNANCY	11	0.173043	0.013893775	0.15	0.195833
PIH	22	0.202907	0.043132437	0.155556	0.3125
Total	117	0.178061	0.030817254	0.132	0.3125

Mean fetal placental coefficient distribution among high-risk categories was statistically highly significant(p-value < 0.001); here, the minimum fetoplacental coefficient was 0.132, and the maximum was 0.3125. Among all high-risk categories, anaemic had a minimum fetoplacental coefficient and PIH patients had a maximum fetoplacental coefficient as shown in the above table

Table 7: Diameter of placenta (in cm) according to high risk category

High Risk Category	Diameter				
	N	Mean	Std. Deviation	Minimum	Maximum
ANAEMIA	32	16.56	2.271	12	23
GDM	9	18.67	3.122	16	24
HYPOTHYROIDISM	19	16.68	2.311	13	23
IUD	4	15.25	1.893	14	18
IUGR	6	13.5	1.225	12	15
PRETERM	14	13.5	1.454	12	16
RH NEGATIVE PREGNANCY	11	15.55	1.695	13	18
PIH	22	14.27	2.567	9	19
Total	117	15.65	2.644	9	24

The mean diameter of the placenta(cm) distribution among the high-risk category was statistically highly significant(p-value < 0.001); here, the minimum diameter of the placenta(cm) was 9 cm, and the maximum was 24 cm. Among all high-risk categories, PIH patients had a minimum diameter of the placenta(cm) and GDM patients had a maximum diameter of the placenta(cm) as shown in the above table.

Table 8: Thickness of placenta (in cm) according to high risk category

High Risk Category	Thickness				
	N	Mean	Std. Deviation	Minimum	Maximum
ANAEMIA	32	3.1662	0.4179	2.5	4.4
GDM	9	3.4	0.49497	3	4.5
HYPOTHYROIDISM	19	3.2211	0.26787	3	4
IUD	4	2.9	0.4761	2.2	3.2
IUGR	6	2.6167	0.17224	2.3	2.8
PRETERM	14	2.6143	0.42941	2	3.5
RH NEGATIVE PREGNANCY	11	3.1727	0.64512	2.4	4.5
PIH	22	2.8727	0.53379	1.9	4.3
Total	117	3.0352	0.49856	1.9	4.5

The mean thickness of the placenta(cm) distribution among the high-risk category was statistically highly significant(p-value < 0.001); here, the minimum thickness of the placenta(cm) was 1.9cm, and the maximum was 4.5cm. Among all high-risk categories, PIH patients had a minimum thickness of the placenta(cm) and GDM and RH-negative pregnancy patients had a maximum thickness of the placenta(cm) as shown in the above table.

Table 9: Frequency distribution of Umbilical cord insertion according to high risk category

High Risk Category	UC Insertion					
	Central	Per cent	Eccentric	Per cent	Marginal	Per cent
ANAEMIA	24	20.50%	6	5.10%	2	1.70%
GDM	7	6.00%	2	1.70%	0	0.00%
HYPOTHYROIDISM	17	14.50%	2	1.70%	0	0.00%
IUD	2	1.70%	2	1.70%	0	0.00%
IUGR	4	3.40%	2	1.70%	0	0.00%
PRETERM	12	10.30%	1	0.90%	1	0.90%
RH NEGATIVE PREGNANCY	9	7.70%	1	0.90%	1	0.90%
PIH	13	11.10%	6	5.10%	3	2.60%
Total	88	75.20%	22	18.80%	7	6.00%

Among high-risk pregnancies, 88 patients had central UC insertion observed. Among them, 24 were anaemic, followed by hypothyroidism, PIH, preterm and others. 22 patients were observed with Eccentric UC insertion. Among them anaemia and PIH were the majority of the patients, followed by other categories. Total of 7 patients were observed with marginal UC insertions and the majority of them were PIH cases

Table 10: Frequency distribution of presence of Umbilical Cord Knots according to high-risk category

High Risk Category	UMBILICAL CORD KNOTS			
	Absent	Percentage	Present	Percentage
ANAEMIA	32	27.40%	0	0.00%
GDM	9	7.70%	0	0.00%
HYPOTHYROIDISM	19	16.20%	0	0.00%
IUD	2	1.70%	2	1.70%
IUGR	5	4.30%	1	0.90%
PRETERM	13	11.10%	1	0.90%
RH NEGATIVE PREGNANCY	11	9.40%	0	0.00%
PIH	21	17.90%	1	0.90%
Total	112	95.70%	5	4.30%

The table presents data on the presence and absence of umbilical cord knots across various high-risk pregnancy categories. The vast majority of cases (95.70%) had no umbilical cord knots, with only 4.30% showing knots. Anaemia, GDM, hypothyroidism, and Rh-negative pregnancies had no cases with knots. IUD cases had the highest incidence of knots (1.70%). IUGR, preterm, and PIH showed a small presence of knots, each with less than 1% of cases affected. Overall, umbilical cord knots are uncommon in high-risk pregnancies but more notable in intrauterine death cases.

Table 11: Frequency distribution of Infarction according to high-risk category

HIGH-RISK CATEGORY	INFARCTION							
	0	1	6	7	8	9	10	Total
ANAEMIA	25	1	2	2	1	0	1	32
	21.40%	0.90%	1.70%	1.70%	0.90%	0.00%	0.90%	27.40%
GDM	9	0	0	0	0	0	0	9
	7.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.70%
HYPOTHYROIDISM	19	0	0	0	0	0	0	19
	16.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	16.20%
IUD	2	0	1	0	0	1	0	4
	1.70%	0.00%	0.90%	0.00%	0.00%	0.90%	0.00%	3.40%
IUGR	5	1	0	0	0	0	0	6
	4.30%	0.90%	0.00%	0.00%	0.00%	0.00%	0.00%	5.10%
PRETERM	14	0	0	0	0	0	0	14
	12.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.00%
RH NEGATIVE PREGNANCY	11	0	0	0	0	0	0	11
	9.40%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	9.40%
PIH	14	2	2	1	1	1	1	22
	12.00%	1.70%	1.70%	0.90%	0.90%	0.90%	0.90%	18.80%
Total	99	4	5	3	2	2	2	117
	84.60%	3.40%	4.30%	2.60%	1.70%	1.70%	1.70%	100.00%

Table 12: Frequency distribution of Syncitial Knots according to high-risk category

High Risk Category	Syncitial Knots	
	> 30%	< 30%
ANAEMIA	22	10
GDM	7	2
HYPOTHYROIDISM	9	10
IUD	0	4
IUGR	6	0
PRETERM	0	14
RH NEGATIVE PREGNANCY	1	10
PIH	17	5
Total	62	55

Table 13: Frequency distribution of Fibrinoid Necrosis according to high risk category

High Risk Category	FIBRINOID NECROSIS	
	< 5 %	> 5%
ANAEMIA	20	12
GDM	7	2
HYPOTHYROIDISM	17	2
IUD	0	4
IUGR	1	5
PRETERM	14	0
RH NEGATIVE PREGNANCY	11	0
PIH	13	9
Total	83	34

Table 14: Frequency distribution of Cytotrophoblastic hyperplasia, Intra Vascular Thrombus, Villitis

High Risk Category	Cytotrophoblastic Hyperplasia	Intra Vascular Thrombus	Villitis
ANAEMIA	0(0%)	0(0%)	0(0%)
GDM	0(0%)	0(0%)	0(0%)
HYPOTHYROIDISM	0(0%)	0(0%)	0(0%)
IUD	0(0%)	3(2.60%)	3(2.60%)
IUGR	3(2.60%)	0(0%)	0(0%)
PRETERM	0(0%)	0(0%)	3(2.60%)
RH NEGATIVE PREGNANCY	3(2.60%)	0(0%)	0(0%)
PIH	3(2.60%)	2(1.70%)	0(0%)
Total	9(7.70%)	5(4.30%)	6(5.10%)

Table 15: Frequency distribution of Villious Vascularity among High-risk category

High Risk Category	Villous Vascularity		
	Increased	Decrease	Total
ANAEMIA	2(11.80%)	7(41.20%)	9(52.90%)
GDM	3(17.60%)	0(0%)	3(17.60%)
RH NEGATIVE PREGNANCY	0(0%)	2(11.80%)	2(11.80%)
PIH	0(0%)	3(17.60%)	3(17.60%)
Total	5(29.40%)	12(70.0%)	17(100%)

Table 16: Frequency distribution of Perivillous Fibrin Deposition among High-risk category

High Risk Category	PERIVILLOUS FIBRIN DEPOSITION	
	Absent	Present
ANAEMIA	30	2(Focally)
GDM	8	1(Focally)
HYPOTHYROIDISM	19	0
IUD	1	3(Ext-2, Foca- 1)
IUGR	2	4(Ext-1, Foca- 1)
PRETERM	14	0
RH NEGATIVE PREGNANCY	11	0
PIH	16	6(Ext-4, Foca- 2)
Total	101	16

It was observed that out of 117 patients, previous fibrin deposition was observed among 16 patients; among them, the majority of the patients were with PIH(6) (4 Extensive and 2 Focal), followed by IUGR(Extensive-1, Focal- 1), IUD(Extensive-2, Focal- 1), anaemia (2Focal), and one with GDM(Focal) and this distribution among high-risk pregnancy were statistically highly significant(P-value<0.001)

17:PLACENTAL CALCIFICATIONS:

High Risk Category	CALCIFICATION	
	Mean	SD
ANAEMIA	1.94	2.50
GDM	0.27	1.03
HYPOTHYROIDISM	1.00	2.32
IUD	0.20	0.65
IUGR	1.07	2.19
PRETERM	3.54	5.01
RH NEGATIVE PREGNANCY	1.44	2.36
PIH	2.44	2.53

Preterm births exhibit the highest mean calcification (3.54) and variability (5.01), indicating frequent and inconsistent calcification. Pregnancy-induced hypertension (PIH) and anaemia show moderate mean calcification (2.44 and 1.94, respectively) with high variability, suggesting common but inconsistent occurrences. In contrast, gestational diabetes mellitus (GDM) and Intrauterine Death (IUD) have the lowest mean calcification (0.27 and 0).

DISCUSSION

The intricate interplay between maternal and fetal health is epitomised in the placenta, a vital organ that not only sustains the fetus but also reflects the milieu of high-risk pregnancies. This research aims to unravel the complex associations underpinning fetal development in adverse conditions by meticulously analysing the placental characteristics and fetal weight.

DISTRIBUTION OF AGE:

In this study group, most participants were aged between 21 and 30. The subsequent largest groups were those under 20, followed by those aged 31 to 35, and finally, individuals over 35.

DISTRIBUTION OF HIGH-RISK CASES:

The prevalence of high-risk conditions among the study participants was highest for anaemia, succeeded by pregnancy-induced hypertension (PIH), hypothyroidism, preterm births, Rh-negative pregnancies, gestational diabetes mellitus (GDM), intrauterine growth restriction (IUGR), and intrauterine death (IUD).

PLACENTA WEIGHT AMONG THE HIGH-RISK PREGNANCY

This study showed various high-risk pregnancy categories, presenting the number of cases (N), mean values, standard deviation, and range (minimum to maximum) for each. Anaemia (32 cases) has a mean of 473.19 with moderate variability. GDM (9 cases) shows a higher mean of 518.89 with significant variability. Hypothyroidism (19 cases) has a consistent mean of 510.58. IUD (4 cases) has a lower mean of 407.5 with high variability. IUGR (6 cases) and Preterm births (14 cases) have lower means of 358.33 and 355.29, respectively, with moderate variability. Rh-negative pregnancies (11 cases) have a mean of 488.73 with low variability. PIH (22 cases) shows a mean of 436.91 with high variability. Overall, the total mean across 117 cases is 455.17, with considerable variability ranging from 240 to 750.This finding aligns with our data, indicating that maternal anaemia adversely affects placental growth and function, which is critical for optimal fetal development.

They highlight the significant impact of maternal health conditions such as anaemia, GDM, and hypothyroidism on placental development and fetal outcomes, emphasising the need for careful monitoring and management of these conditions to ensure optimal pregnancy outcomes.

BABY WEIGHT IN VARIOUS HIGH-RISK PREGNANCIES:

The findings revealed significant variability in mean birth weights across different conditions, underscoring the diverse impact these conditions can have on fetal growth. Anaemia: 2890.63 grams, Gestational Diabetes Mellitus: 3333.33 grams, Hypothyroidism: 2994.74 grams, Intrauterine Death (IUD): 2500 grams, Intrauterine Growth Restriction (IUGR): 2000 grams, Preterm Birth: 1871.43 grams, RH Negative Pregnancy: 2836.36 grams, Pregnancy-Induced Hypertension (PIH): 2296.36 grams

Gestational Diabetes Mellitus (GDM): This study's mean birth weight of 3333.33 grams aligns with the known association between GDM and larger birth weights, as maternal hyperglycemia can lead to fetal hyperinsulinemia and overgrowth (2).

Hypothyroidism: A mean birth weight of 2994.74 grams is indicative of the potential for hypothyroidism to affect fetal growth, although the impact can vary based on the timing and severity of maternal thyroid dysfunction (2).Our finding of a mean birth weight of 2994.74 grams is

within the range observed in other studies, which have shown both low and average birth weights in hypothyroid pregnancies.(3).
Intrauterine Death (IUD): The reported mean weight of 2500 grams reflects the tragic outcome of fetal demise, where growth ceases at the point of death. The mean weight of 2500 grams with minimum weight being 1700 gms and maximum 3600 gms .
Intrauterine Growth Restriction (IUGR): This finding of a mean birth weight of 2000 grams is characteristic of IUGR, where placental insufficiency leads to inadequate fetal growth.
Preterm Birth: The mean birth weight of 1871.43 grams in this study highlights the significant impact prematurity has on birth weight, as these infants have not had the full gestational period to grow(4).
RH Negative Pregnancy: A mean birth weight of 2836.36 grams suggests that Rh incompatibility can affect fetal growth, potentially through hemolytic disease of the fetus and newborn.. Effective management of RH-negative pregnancies has improved outcomes, though some reduction in birth weight remains common. This study found a mean birth weight of 2836.36 grams with minimum being 2400 gms and maximum 3400gms reflecting these managed outcomes.
Pregnancy-Induced Hypertension (PIH): The lower mean birth weight of 2296.36 grams in PIH patients in this study is in line with previous findings that hypertension can restrict fetal growth due to compromised placental blood flow(2). These results underscore the importance of targeted management and monitoring in high-risk pregnancies to optimise fetal outcomes and mitigate adverse effects on fetal growth and development.

FETOPLACENTAL RATIO :
Overall, our results emphasise the FPR's critical role in understanding the placenta's efficiency and its impact on fetal outcomes in high-risk pregnancies, underscoring the importance of tailored monitoring and management in these conditions.

FETOPLACENTAL COEFFICIENT:
Anaemia cases exhibited a relatively stable FPC with a mean of 0.165, suggesting that placental function remains balanced despite the maternal condition.Similarly,gestational diabetes mellitus (GDM) cases showed a slightly lower mean FPC of 0.158, indicating a higher placental weight in accordance with higher fetal weight, likely due to compensatory mechanisms for altered nutrient transport.
Hypothyroidism cases demonstrated a mean FPC of 0.172 with low variability, indicating consistent placental efficiency. Intrauterine growth restriction (IUGR) cases had a mean FPC of 0.182, suggesting less efficient placental function relative to fetal growth needs,
Preterm births exhibited the highest mean FPC of 0.195 with significant variability, indicating inconsistent placental efficiency. Rh-negative pregnancies showed a mean FPC of 0.173, reflecting stable placental function. Overall, the mean FPC across all categories was 0.178, with considerable variability, indicating diverse placental efficiencies in high-risk pregnancies. These findings underscore the critical role of FPC in understanding placental function and its impact on fetal outcomes, highlighting the need for tailored monitoring and management of high-risk pregnancies to ensure optimal placental and fetal health.

PLACENTA THICKNESS AND HIGH-RISK PREGNANCIES:
Our cross-sectional study revealed a statistically significant difference (p-value < 0.001) in mean placental thickness among high-risk pregnancy categories. The observed placental thickness ranged from a minimum of 1.9 cm to a maximum of 4.5 cm.Our study found that GDM and hypothyroidism patients had the most significant placental thickness (3.4 cm and 3.22 cm, respectively).
The observed thickness for Rh-negative pregnancies (3.17 cm) and anaemia (3.16 cm) was slightly lower than GDM and hypothyroidism but still thicker than other categories. More research is

needed to confirm these findings, but these conditions may trigger mild compensatory placental growth mechanisms.

Intrauterine Death (IUD), Preterm Birth, Intrauterine Growth Restriction (IUGR), and Pregnancy-induced Hypertension (PIH): These categories displayed the lowest placental thickness (2.61 cm to 2.9 cm). This is consistent with previous studies.

These observations are generally in line with previous research. Further studies are needed to explore the cause-and-effect relationships and potential clinical implications of these variations in placental thickness.

UMBILICAL CORD INSERTION AND HIGH-RISK PREGNANCIES

- Central Insertion: The most frequent insertion site (88 patients) was central, considered the standard and optimal position. This is consistent with the general prevalence of central insertion reported in 70-80% of pregnancies (5).
- Eccentric Insertion: This occurred in 22 patients. While less common than central insertion, eccentric insertions are generally considered low-risk as long as the velamentous vessels are adequately protected within the Wharton's jelly(6). Data on the specific prevalence of eccentric insertions in high-risk pregnancies is limited, and further research is needed.
- Marginal Insertion: Only 7 cases displayed marginal insertion, the least common type. Marginal insertion can be associated with an increased risk of complications like intrauterine growth restriction (IUGR) due to potential compromise in blood flow (7). However, the limited number of cases in our study makes it difficult to draw definitive conclusions.

HIGH-RISK PREGNANCIES AND UC INSERTION:

Our study observed that anaemia and PIH were the most common risk factors in both eccentric and marginal insertion groups. More research is needed to confirm these associations and understand the underlying mechanisms (5). The findings on central insertion are consistent with existing literature. While eccentric and marginal insertions were observed, further research is needed to explore potential links with specific high-risk conditions and pregnancy outcomes.

UMBILICAL CORD KNOTS IN HIGH-RISK PREGNANCIES

5 cases (4.3%) were identified with umbilical cord knots.Umbilical cord knots were found in 2 cases of IUD(1.7%). Some studies suggest a possible link between increased fetal activity and cord knots.However, more research is needed to confirm these associations and understand the underlying mechanisms.

PLACENTAL HISTOPATHOLOGICAL CHANGES IN HIGH-RISK PREGNANCY:

PLACENTAL INFARCTIONS:

Placental infarctions are areas of dead tissue found in the placenta due to a lack of blood flow and oxygen that can significantly affect placental health.For instance, this study shows a relatively high incidence of placental infarctions in cases of anemia (27.04%) and PIH (18.8%), which suggests a strong correlation between these conditions and placental damage.

SYNCYTIAL KNOTS:

The presence of increased syncytial knots has been linked to hypoxic or hypoxia-reperfusion injury to the placenta, suggesting a response to suboptimal conditions within the uterine environment.This study's observation that a higher percentage of syncytial knots (>30%) is predominantly associated with anemia, followed by pregnancy-induced hypertension (PIH), hypothyroidism, and other conditions aligns with previous findings indicating a correlation between placental pathology and maternal complications.

PERI VILLOUS FIBRIN DEPOSITION :

Perivillous fibrin deposition is a placental lesion characterized by extensive deposits of fibrin in the intervillous space, which can be associated with adverse pregnancy outcomes. In this study, the observation of perivillous fibrin deposition among 16 patients, with a significant number associated with pregnancy-induced hypertension (PIH), intrauterine growth restriction (IUGR), intrauterine death (IUD), anemia and gestational diabetes mellitus (GDM) suggests a strong correlation between this placental change and high-risk pregnancy conditions.The distribution of these findings among high-risk pregnancies being statistically significant (P-value<0.001) indicates a clear association worth further investigation. This aligns with previous studies that have documented the association of massive peri villous fibrin deposition (MPFD) with adverse pregnancy outcomes such as preterm delivery, severe IUGR, spontaneous abortion, and fetal death(8).

For instance, a study published in 2016 presented clinical and pathological features of MPFD cases and documented its association with adverse pregnancy outcomes and antenatal risk factors. Another study highlighted that both MPFD and maternal floor infarction (MFI) are associated with IUGR and be associated with a high incidence of fetal death(9).

CYTOTROPHOBLASTIC HYPERPLASIA AND INTRAVASCULAR THROMBUS/VITILITIS

Cytotrophoblastic hyperplasia, intravascular thrombus, and villitis are all histopathological changes observed in the placenta during high-risk pregnancies. These changes can be indicative of various underlying conditions affecting the pregnancy.

In this study, the finding that nine patients had cytotrophoblastic hyperplasia, with three associated with intrauterine growth restriction (IUGR), three with Rh-negative pregnancies and three with PIH suggests a correlation between this placental change and these specific high-risk conditions. Similarly, the observation of intravascular thrombus in 5 patients, with three associated with intrauterine death (IUD) and 2 with PIH, indicates a possible link between thrombotic events in the placenta and adverse pregnancy outcomes.

Villitis was observed in 6 patients, half associated with IUD and half with preterm deliveries. This aligns with literature indicating that villitis, particularly villitis of unknown aetiology (VUE), can significantly negatively impact fetal outcomes. For example, studies have shown that acute villitis can be an infectious process characterised by leukocytic infiltrate in the chorionic villi or intervillous space(60), which may lead to adverse fetal and neonatal outcomes as described in placental pathology reports(11).

FIBRINOID NECROSIS:

Anaemia cases had a significant occurrence of fibrinoid necrosis, with 12 out of 32 cases (>5%), indicating chronic placental stress. GDM cases showed a lower prevalence of >5% fibrinoid necrosis (2 out of 9 cases), Hypothyroidism also showed low incidence (>5% in 2 out of 19 cases). Notably, all IUD cases (4) had >5% fibrinoid necrosis.IUGR and PIH showed higher incidences of >5% fibrinoid necrosis (5 out of 6 and 9 out of 22 cases, respectively). Overall, 34 out of 117 cases had >5% fibrinoid necrosis, highlighting the need for careful monitoring of placental health in high-risk pregnancies to prevent adverse outcomes. The study aimed to determine the extent of fibrinoid necrosis in placentas observed in normal, diabetic, and hypertensive pregnancies.(10). Although this study does not directly correlate with these findings, it does suggest that fibrinoid necrosis is a factor observed in various pregnancy conditions.

VILLOUS VASCULARITY:

In cases of anaemia, we observed a high incidence of decreased villous vascularity (41.20%)indicating impaired placental blood flow due to hypoxia-induced stress. In GDM, 17.60% of cases showed increased villous vascularity reflecting the placenta's adaptation to heightened metabolic demands. Rh-negative pregnancies showed an 11.80% incidence of decreased vascularity

indicating immune-mediated placental damage. PIH cases had a 17.60% incidence of decreased vascularity, indicating impaired placental perfusion from high blood pressure. Overall, 12 cases of high-risk pregnancies had decreased villous vascularity, and 5 cases had increased vascularity, highlighting the variability in placental adaptations and emphasizing the need for tailored monitoring and interventions to improve maternal and fetal health outcomes.

CALCIFICATIONS :

Preterm births exhibit the highest mean calcification (3.54) with substantial variability (SD = 5.01), indicating frequent and inconsistent calcification. Pregnancy-induced hypertension (PIH) and anaemia also show moderate mean calcification (2.44 and 1.94, respectively) with high variability, suggesting common but inconsistent occurrences. In contrast, Gestational Diabetes Mellitus (GDM) and Intrauterine Death (IUD) show low mean calcification (0.27 and 0.20, respectively), indicating infrequent calcification. The variability underscores the need for tailored monitoring in high-risk pregnancies to address potential complications associated with placental calcification.

SUMMARY OF THE STUDY :

- Age Distribution:Majority of the study population were within the age group of 21–30 years, followed by <20 years, 31–35 years, and >35 years.Significant age differences were observed among high-risk categories (p-value = 0.005).
- Placenta weightThe mean placental weight distribution among the high-risk category was statistically significant(p-value < 0.005);The minimum placental weight was 240 grams and the maximum weight was 750 grams. Among all high-risk categories, preterm had minimum placental weight, and GDM had maximum placental weight
- Baby Weight:Mean baby weight distribution was statistically significant (p-value < 0.001).Preterm babies had the lowest brith weights, while GDM babies had the highest weights.
- Fetoplacental ratio:Statistically significant differences were observed (p-value < 0.001).PIH had the lowest fetoplacental ratio, while GDM had the highest.
- Fetoplacental coefficient:Statistically significant differences were observed (p-value < 0.001).GDM had the lowest fetoplacental coefficient, while PIH patients had the highest.
- Placental Diameter and Thickness:Diameter and thickness showed statistically significant differences (p-value < 0.001).PIH patients had the least placental diameter, while GDM patients had the largest.PIH patients had the thinnest placentas, while GDM and RH-negative pregnancy patients had the thickest.
- Umbilical Cord Insertions:Central UC insertion was observed in 88 high-risk pregnancies, with anemia and PIH being most common.Eccentric UC insertion was seen in 22 cases, primarily associated with anemia and PIH.Marginal UC insertions were observed in 7 patients, mostly with PIH.
- Umbilical Cord Knots and Syncytial Knots:Umbilical cord knots were absent in 122 high-risk pregnancies, frequently.Syncytial knots >30% occurred in 62 cases, mainly in anemia, PIH, and hypothyroidism.Syncytial knots <30% were seen in 55 cases, often in preterm deliveries.
- Placental Fibrinoid Necrosis :Fibrinoid necrosis <5% occurred in 83 cases, primarily in anemia, hypothyroidism, and preterm births.Fibrinoid necrosis >5% was observed in 34 cases, often associated with anemia and PIH.
- Cytotrophoblastic Hyperplasia:Nine cases exhibited cytotrophoblastic hyperplasia.Among them, 3 had IUGR, 3 were RH-negative pregnancies and 3 were PIH.
- Intravascular Thrombus:Five cases showed intravascular thrombus.Among them, 3 were IUD cases and 2 were PIH.
- Villitis:Six cases showed villitis.Among them, 3 were IUD and 3 were preterm deliveries.
- Villous Vascularity:A total of 17 cases exhibited alterations in villous vascularity.Five had increased villous vascularity, with 2 having anemia and 3 with GDM.Twelve had decreased villous vascularity, with 7 having anemia, 3 with PIH, and 2 with RH-negative pregnancy.

- Perivillous Fibrin Deposition:Among 117 patients, 16 showed perivillous fibrin deposition.The majority were associated with PIH
- Calcification: Preterm births have the highest mean calcification (3.54) and variability (5.01), while PIH and anaemia show moderate levels with high variability. GDM and IUD have the lowest calcification (0.27 and 0.20), highlighting the need for tailored monitoring and intervention.

CONCLUSION:

The study investigated the link between placental characteristics and fetal development in high-risk pregnancies. In this study, significant difference is noted in placental weight, fetal weight and microscopic features such as PIH (preeclampsia) cases associated with smaller placentas ,low mean baby weight and abnormal blood vessel development, while GDM (gestational diabetes) with larger placentas, high mean baby weight and increased blood vessel formation. These histopathological abnormalities found in placentas of different high risk categories emphasize early recognition and management of high risk pregnancies which can in turn lead to improvement in perinatal outcome.

REFERENCES:

1. Ebbing C, Kiserud T, Johnsen SL, Albrechtsen S, Rasmussen S. Prevalence, Risk Factors and Outcomes of Velamentous and Marginal Cord Insertions: A Population-Based Study of 634,741 Pregnancies. PLoS One [Internet]. 2013 Jul 30 [cited 2024 Apr 18];8(7):e70380. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0070380
2. Kumar JS, Sajja P, Narayan Pattar P, L SB. Fetal Birth Weight Estimation In High Risk Pregnancies. 2023 [cited 2024 Jun 19]; Available from: www.ijnrd.org
3. Kumar JS, Sajja P, Narayan Pattar P, L SB. Fetal Birth Weight Estimation In High Risk Pregnancies. 2023 [cited 2024 Jun 18]; Available from: www.ijnrd.org
4. Dodd JM, Louise J, Deussen AR, Mitchell M, Poston L. Rethinking causal assumptions about maternal BMI, gestational weight gain, and adverse pregnancy outcomes. BMC Med [Internet]. 2024 May 15 [cited 2024 Jun 19];22(1):1–12. Available from: https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-024-03410-2
5. Ward S, Sun Z, Maresse S. Current practice of placental cord insertion documentation in Australia – A sonographer survey. Australas J Ultrasound Med [Internet]. 2023 Aug 1 [cited 2024 Jun 19];26(3):157–68. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/ajum.12360
6. Siargkas A, Tsakiridis I, Pachi C, Mamopoulos A, Athanasiadis A, Dagklis T. Impact of velamentous cord insertion on perinatal outcomes: a systematic review and meta-analysis. Am J Obstet Gynecol MFM [Internet]. 2023 Feb 1 [cited 2024 Jun 19];5(2). Available from: http://www.ajogmfm.org/article/S2589933322002427/fulltext
7. Siargkas A, Tsakiridis I, Pachi C, Mamopoulos A, Athanasiadis A, Dagklis T. Impact of marginal cord insertion on perinatal outcomes: a systematic review and meta-analysis. Am J Obstet Gynecol MFM [Internet]. 2023 Apr 1 [cited 2024 Jun 19];5(4). Available from: https://pubmed.ncbi.nlm.nih.gov/36708965/
8. Qi M, Chang KTE, Lian DWQ, Khoo CK, Tan KH. Placental massive perivillous fibrinoid deposition is associated with adverse pregnancy outcomes: a clinicopathological study of 12 cases. Case Reports in Perinatal Medicine [Internet]. 2016 Mar 1 [cited 2024 Jun 19];5(1):35–9. Available from: https://www.degruyter.com/document/doi/10.1515/crpm-2015-0087/html?lang=en
9. Weber MA, Nikkels P, Hamoen KE, Duvekot JJ, De Krijger RR. Massive perivillous fibrin deposition and chronic intervillositis: frequently missed diagnoses with a high recurrence risk.
10. METHODOLOGY. 2008;
11. The placental pathology report - UpToDate [Internet]. [cited 2024 Jun 19]. Available from: https://www.uptodate.com/contents/the-placental-pathology-report