e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(10); 46-50

Original Research Article

Anatomical Pattern of Placenta and Umbilical Cord in Relation to Fetal Adverse Outcome: A Hospital Based Descriptive Cross-Sectional Study

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Received: 25-07-2024 / Revised: 23-08-2024 / Accepted: 26-09-2024

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Conflict of interest: Nil

Abstract:

Background: The highly specialized organs of pregnancy, the placenta and umbilical cord, aid in the healthy growth and development of the foetus. Any change in the umbilical cord's length, entanglement, nuchal cord, knots, thickness, insertion, and total number of umbilical blood vessels, as well as the placental appearance, location, weight, thickness, and circumference, could have a negative impact on the fetus's health and affect factors like birth weight, Apgar score, and condition. It is common practice not to inspect the placenta and umbilical cord's gross anatomy.

Objective: The goal of the study was to ascertain the placenta's and the umbilical cord's morphological patterns in connection to unfavorable foetal outcomes at a Medical College hospital in Central India.

Methodology: A quantitative cross-sectional research with pregnant patients hospitalized to the labour and delivery ward was conducted. To gather the sample size of 300 term singleton pregnant females lacking any co-morbidities, simple random sampling procedure was used. Data were gathered using a structured questionnaire, an ultrasound machine equipped with a colour Doppler system, and SPSS version 21 for data entry and analysis.

Result: The study's mean age was 25.47, and the median age was 23.03±7.019, with the majority of participants being between the ages of 21 and 30. The foetal status was substantially correlated with BMI, cord entanglement, and cord length ($P<0.05$). Additionally, it was discovered that the Apgar score was substantially correlated ($P<0.05$) with BMI, placental appearance, cord entanglement, and cord length. Additionally, there was a significant BMI, parity, cotyledon number, placental shape, and placental circumference correlation ($P<0.05$) with birth weight.

Conclusion: According to a study, defects of the placenta's and the umbilical cord's gross anatomical pattern significantly affect the outcomes of the foetus. Hence, the best results will come from combined efforts to avoid stillbirth, low Apgar scores, and abnormal birth weight prior to and throughout pregnancy, as well as from efficient monitoring measures during pregnancy.

Keywords: Apgar; Birth weight; Fetal; Placenta; Ultrasound; Umbilical cord.

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Introduction

Maintaining proper foetal development and sustaining the pregnancy are greatly aided by the placenta. Placental functions will be impacted by any changes to the placental anatomical arrangement. [1] Placental growth restriction and stillbirth are two examples of foetal poor outcomes that may be linked to variations in the placenta's morphological pattern as shown by morphometric assessment of the placenta. A variety of obstetrical problems, including early membrane rupture, irregularities in cord length, malpresentation, excessive foetal movement, and external cephalic version, might put the cord at risk for mishaps. [2] Additionally, it has been demonstrated that aberrant velamentous cord insertion, which is thought to be brought on by a lack of Wharton's jelly protection at the placental insertion site, increases the risk of vesicular rupture and compression, particularly when covering the cervical ostium. [3] According to Miwa et al. (2014), an umbilical chord is deemed lengthy if it is longer than 70 cm. This length increases the risk of umbilical cord accidents;

including cord entanglement, true knots, and torsion. [4] Different parameters for defective umbilical cords that can be assessed by sonographic imaging, including aberrant insertion, vasa previa, abnormal composition, cysts, haematomas, and thrombosis, cord coiling, collapse, knotting, and prolapse, have been defined by the American Association of Ultrasound Technologists. Anatomical examinations of the placenta and the umbilical cord can provide information on treatment methods and poor foetal outcomes.

Additionally, a placenta's gross structure examined anatomically may help identify recurrence risks so that more sophisticated preventative measures may be maintained for future pregnancies. [5] Even though there are more pregnancies being delivered in poor nations, virtually all of them, including India, do not fully prevent unfavorable foetal outcomes as a result of the placenta's and the umbilical cord's gross anatomical patterns. Thus, the goal of the current study was to evaluate the relationship between the foetal outcome and the general anatomical pattern of the placenta and umbilical cord.

Aim and Objectives

The objective of the current study was to ascertain the anatomical configuration of the placenta and umbilical cord and their correlation with unfavorable foetal outcomes at a Medical College Hospital in Central India.

Material and Methods

All pregnant women who had given birth at the time of the research and had their placenta and umbilical cord admitted to the labour ward at the Obstetrics and Gynaecology department of a Medical College Hospital in Central India were the subjects of this descriptive cross-sectional study.

Inclusion criteria: By means of obstetric ultrasonography and computed gestational age, all pregnant women admitted to the labour hospital with a single tone pregnancy and a gestation age between 37 and 42 weeks were included.

Exclusion criteria: Women with diabetes mellitus, multiple pregnancies, pregnancy-induced hypertension, and other medical disorders were not included in the research. Preterm births less than 37 weeks and post-term pregnancies with gestations more than 42 weeks were also not included in the research.

Sampling technique and sample size: The research participants were chosen by a lottery-style approach using simple random selection. N=T2 X p (1-P)/E2, Kish and Leslie's formula, was used to determine the sample size. Three hundred expectant mothers in a labour department with their babies and placentas made up the minimal sample size needed.

Methodology: Upon reaching the second stage of labour, all women who fulfilled the inclusion criteria had ultrasonography screening using colour Doppler equipment. Estimations of gestation age, the number of foetuses, foetal viability, foetal weight, placenta physical appearance, placental mass or tumour, placenta anomalies, nuchal cord, and cord entanglements were all made using obstetric ultrasonography. A radiology specialist performed each sonographic imaging.

The placenta's weight, completeness, number of cotyledons, thickness, circumference, form, and anomalies in placenta morphology were among the placental findings.

The condition of the umbilical cord's length, knots, diameter, insertions, coiling, and the total number of umbilical blood vessels were all noted.

Baby status, baby Apgar score at the first and fifth minute, and birth weight were all included in the foetal outcome assessment instrument.

In order to assess the foetal outcome, the anatomical pattern of the placenta and umbilical cord were recorded using a standard questionnaire and checklist. With the use of a checklist and written structure questionnaire, quantifiable data were gathered.

Statistical Analysis: Data processing, analysis, and input were done using SPSS version 20, a statistical package for social sciences program. The study employed descriptive analysis to examine the demographic characteristics of the mothers involved, as well as the frequency and proportion of the placenta and umbilical cord anatomical patterns.

The relationship between maternal demographic characteristics, placental and umbilical cord morphological patterns, and foetal outcome was examined using chi-square and binary logistic regression analysis. The results were displayed in tables with a significant ($P<0.05$) level.

Results

A sample of 300 expectant women was chosen in order to identify various maternal socioeconomic demographic and obstetrics clinical variables that may have an influence on varying foetal outcomes. [Table 1]

Table 1: Maternal demographic and clinical variables

Variables		N	%
Age groups	15-20 years	103	34.33
	21-30 years	119	39.66
	31-40 years	70	23.33
	>41 years	08	02.66
Marital status	Single	26	08.66
	Married	274	91.33
Educational level	No formal education	41	13.66
	Primary education	148	49.33
	Secondary education	90	30.00
	Graduation	21	07.00
Occupation	Unemployed	276	92.00
	Employed	24	08.00
Residential area	Rural	147	49.00
	Urban	153	51.00
Anemia	Normal Hb	74	24.66
	Mildly anemic	201	67.00
	Moderately anemic	22	07.33
	Severely anemic	03	01.00
BMI	Underweight	17	05.67
	Normal	272	90.67
	Overweight	11	03.66
Parity	Primi	156	52.00
	Multipara	131	43.66
	Grand multipara	13	04.33
Antenatal visits	1-2	22	07.33
	3-4	64	21.33
	>4	214	71.33

There was a strong correlation (P<0.001) between study participants who had calcified placenta and poor Apgar scores. Additionally, poor Apgar scores were linked to those with cord entanglement (P=0.007). Additionally, a research found the individuals with aberrant chord length had a considerably higher likelihood to have a poor Apgar score (P<0.001). [Table 2]

Table 2: Association between anatomical pattern of placenta and umbilical cord versus Apgar score

Variables		P-value	AOR Apgar score	P-value
Placenta appearance	Calcified (ref)	0.009	17.268	<0.001
	Normal	<0.001		
Cord entanglement	Yes (ref)	0.072	11.751	0.007
	No	0.001		
Cord length	Abnormal (ref)	0.069	0.073	<0.001
	Normal	<0.001		

Participants in the study who had an abnormally high number of cotyledons on their placenta had a substantial correlation with an abnormal birth weight (P<0.001). The study also showed a strong correlation (P<0.001) between abnormal birth weight and those with abnormal placenta shape. Additionally, a research revealed a strong correlation between improper birth weight and study participants with placentas of aberrant circumference (P=0.051). A significant correlation was also found (P=0.042) between abnormal birth weight and those with abnormal placenta thickness. [Table 3]

Table 3: Association between maternal factor, anatomical pattern of placenta and umbilical cord versus birth weight

Variables		P-value	AOR Birth weight	P-value
Number of cotyledons	Abnormal (ref)	0.006	0.069	<0.001
	Normal	<0.001		
Placenta shape	Abnormal (ref)	0.073	0.104	<0.001
	Normal	<0.001		
Placenta circumference	Abnormal (ref)	0.044	0.103	0.051

	Normal	0.017		
Placenta thickness	Abnormal (ref)	0.033	4.625	0.042
	Normal	<0.001		

Discussion

The results of this study showed that the majority of placentas (99.3%) were implanted or located normally in relation to the fundus; 88.0% had a normal placenta appearance, which could be distinguished from placenta calcifications on ultrasound examination during pregnancy; 37.7% were located on the fundus' anterior wall; and 82.7% had a normal weight (400–700 grammes).Nonetheless, 90.0% of the placentas had normal thickness and 89.3% of the cotyledons (15–25 counts) had a normal number.

This research contradicts the findings of a study conducted in Japan by Miwa et al., (2014) [4], which reported that only 4.3% of the 3,183 patients who satisfied the study's eligibility requirements had thick placentas. Our discrepancy might be attributed to sample size differences; the study conducted in Japan used a high sample size (3,183), whereas the sample size in our study was smaller (300). The two studies conducted in Nigeria by Afodun, Ajao, & Enaibe [6] and Adesina et al. [7], where the average placental weight was 529g and 560.0g, respectively, and this study's average placental weight of 555.16g, show similarities with each other. The similarity in the research population may account for this compatibility, since all the studies included mothers who were of reproductive age and single-tone. This study also has similarities to two Tanzanian investigations conducted by Lilungulu [8] and Russa & Kaziri [9], in which over 80% of the placenta had normal cotyledon thickness (2-4 cm), normal weight (400–700g), and normal weight.

More than two thirds of the umbilical cords in this research were typical in length and diameter, but only a small percentage (89.7%) had aberrant chord insertions (velamentous and marginal). Additionally, the majority of the umbilical cords (36.0%) exhibited normal coiling, but approximately thirty percent had aberrant coiling (hyper and hypo coiling). However, the majority (98.0%) did not have any cord entanglement, and all of them had the usual number of umbilical vessels and no genuine knots in the cord.

This study contradicts the findings of studies conducted in the UK and Japan by Peregrine, O'Brien, & Jauniaux [10] and Imai [11], which reported that around 25% of study participants had nuchal cord; in contrast, no cases of nuchal cord were discovered in this investigation. This discrepancy might be attributed to the two studies' differing sample sizes; the UK and Japan research utilised larger sample sizes, whereas this study employed a smaller one. This study does, however, align with the findings of Balkawade & Shinde [12] and Adesina et al. [7], which discovered that the most prevalent form of cord attachment was eccentric, or normal, whereas very few cases included aberrant cord attachment, such as marginal and velamentous insertion.

The number of cotyledons did not raise the Apgar 1st min (p value=0.78) or Apgar 5th min (p=0.38), according to Russa & Kaziri [9]. Foetal weight and placenta weight were strongly correlated (P<0.001). It also agrees with a research by Lilungulu [8], which found a positive correlation (p<0.001) between the number of cotyledons, placental weight, and placental thickness and foetal birth weight. According to Asgharnia, Esmailpour, Poorghorban, and Atrkar-Roshan, low birth weight appears to be associated with low placental functional tissue mass. This is further accompanied by a reduction in the area available for exchange between the mother and the foetus at the foetal capillary surface area as well as at the villi. As a result, placentas are more likely to be dysfunctional. [13]

According to this research, a baby's poor Apgar score following birth was substantially correlated with both aberrant cord length and cord entanglement (P=0.001 and P<0.001, respectively). This research is consistent with that conducted by Balkawade & Shinde [12], who found that the frequency of birth asphyxia was considerably higher in cords that were long or short than in cords that had a normal cord length (p < 0.001). It also agreed with a research by Tahmasebi et al. [14], which found that there was no statistically significant correlation (P>0.05) between the umbilical coiling index, thickness, and cross-sectional area of the umbilical cord and the Apgar score of newborns.

Conclusion

According to the study's findings, there is a substantial correlation between poor foetal outcomes and the physical morphology of the placenta and umbilical cord. This could be evaluated from intrauterine times, when ultrasound machines could be used to identify the placenta's and the umbilical cord's gross structural pattern, to preventing additional perinatal deterioration by making sure that timely treatment and care was provided. This method may also be crucial for the advancement of further histology investigations for the early detection of perinatal issues. Future research should concentrate on precise ultrasonography, histological anatomical patterns, and morphometric evaluation of placenta and umbilical cord features. This will enable studies to

trace the foundations of the neonate's prenatal and postnatal outcomes.

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