

Umbilical Cord Abnormalities in Cases of Stillbirth**Haider A¹, Siddiqui SM², Agrawal S³, Zaidi AS⁴**^{1,2}Department of Obstetrics and Gynaecology, Ram Manohar Lohiya Institute of Medical Sciences, Lucknow, UP, India³Department of Obstetrics and Gynaecology, King George Medical University, Lucknow, UP, India⁴Department of Physiology, Ram Manohar Lohiya Institute of Medical Sciences, Lucknow, UP, India

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Conflict of interest: Nil

Abstract:

Background: Stillbirth has a great detrimental impact on the overall maternal health as well as the society. To prevent such adverse pregnancy outcomes, every effort should be made to find their cause. The umbilical cord plays a central role in maintaining the health of the developing fetus, and its abnormality has been implicated in causing stillbirths. However, no definite diagnostic criterion on umbilical cord abnormalities leading to stillbirth has been developed. Thus, this study was planned to understand the umbilical cord abnormalities in cases of stillbirth, so that such adverse outcomes can be prevented in subsequent pregnancies.

Methodology: A descriptive study was conducted on 42 women, in the Department of Obstetrics and Gynaecology, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow; over a period of 18 months after taking informed consent. A detailed questionnaire was used to collect data from study participants and their umbilical cords were examined for their dimensions, gross appearance and any abnormalities. Data were analysed using SPSS version 23.0 for Windows.

Results: Out of 42 women in our study, majority were primigravida (40.5%) with mean maternal age of 28.38± 4.9years. Among 42 study participants, 41 (97.6%) had no antenatal checkups, 14 (33.3%) of them had associated comorbidities of which preeclampsia was most common (26.2%). The umbilical cord length was maximum in the gestational age group of 31-35weeks i.e. 41.27cm (SD- 21.48cm). Out of 42 women with stillbirth 38 (90.5cm) had normal appearing, centrally placed umbilical cord and mean placental thickness was 4.61±/2.01cm at term.

Conclusion: In our study, it could be concluded that umbilical cord abnormalities may not be directly linked to the cause of stillbirth as most of the stillbirth women have normal-appearing umbilical cords. However, detailed histopathological examination and comparative studies are necessary for finding a definite association between them.

Keywords: Umbilical Cord, Stillbirths, Antepartum, Postpartum, Placenta, Pregnancy Complication.

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Introduction

Death of the baby, before or during delivery, is termed as stillbirth. Stillbirths can have detrimental effect on the overall health of the mother; be it physical, emotional, psychological, mental or social. Therefore, every effort is made to find its cause and prevent such adverse outcomes in future pregnancy. Stillbirth is defined as “Fetal death before complete expulsion or extraction of the product of human conception from the womb irrespective of the duration of pregnancy and which, is not an induced termination of pregnancy. The death is indicated by the act that after such expulsion or extraction, the fetus does not breathe or show any other evidence of life such as the beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles”[1,2].

Globally, almost 2.6 million stillbirths occur every year, of which maximum occur in low and middle income countries [3]. In order to reduce the burden of stillbirths, it is imperative to find out its cause. Umbilical cord abnormality can compromise the blood supply to the fetus to such an extent that it can cause the fetus to die. Such causes of stillbirth are termed as cord accidents [4]. It is through the umbilical cord that the fetus gets oxygen and nutrient supply as well as clears the waste metabolites. Cord abnormalities can lead to either sudden cessation of these functions, or the compromise can be chronic. Almost 2.5- 30% of the cases of stillbirths are reported to be due to umbilical cord abnormalities [5-7]. Despite umbilical cord abnormalities being a significant

cause of stillbirths, no diagnostic criteria have been developed to clearly define such causes. Also, conducting autopsy and placental examination to confirm the role of cord abnormalities in stillbirth cases is not a common practice. Therefore, it is important to understand the umbilical cord abnormalities in cases of stillbirth, so that such adverse outcomes can be prevented in subsequent pregnancies.

Material and Methods

Study design, period and area: A descriptive study was conducted in the Department of Obstetrics and Gynaecology, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, in collaboration with the Department of Pathology; in the duration of one and a half years (from November 2022 to April 2024). A total of 42 women with stillbirth (ante partum or intra partum fetal death), who met the inclusion criteria and agreed to participate, were recruited in the study. Ethical approval for this study was obtained from the Institutions' Ethical Committee (IEC no.152/22). Details of the patients and their umbilical cord samples were recorded in a structured proforma.

Inclusion and Exclusion Criteria:

- Inclusion Criteria: The study included all pregnant women with gestational age of 20 weeks or above, with fatal death before or during delivery and who agreed to participate in the study.

-The Exclusion Criteria:

1. Woman and her family, not consenting to participate in the study
2. Sudden obstetric complications like rupture uterus and cord prolapse
3. Congenitally anomalous fetus.

Sample size, study variables and data collection:

According to the NHFS 5 (National Family Health Survey-5), the proportion of stillbirth babies was found to be 9.7%, and the proportion of stillbirths observed in the Dept of Obstetrics and Gynae Dr. RMLIMS, was 13.7%.

The minimum of 42 women with stillbirths was obtained as the sample size required to achieve a confidence interval of 95%, assuming a non-response rate of 10%.

The study variables included age of the patient, her education level, marital status, medical or surgical problems, parity, previous history of stillbirths or obstetric complications, any history of addictions,

total number of antenatal visits, any high –risk factors like pre-eclampsia, preterm premature rupture of membranes, antepartum haemorrhage, etc. These findings were recorded on the basis of a detailed structured questionnaire.

Gross examination of the placentae of study participants was done findings were recorded. Umbilical cord was examined for its length, site of attachment, knots, torsion, any retroplacental hematoma etc. They were then preserved in formalin and sent for histopathological analysis.

Statistical Analysis: Analysis of data was done using SPSS version 23.0 for Windows. Quantitative data were presented as arithmetic mean and standard deviation while qualitative data represented as percentages. Categorical variables were compared using Chi square test (between the two groups) and ANOVA test was used to assess intra-group variations. Bivariate logistic regression was used to study the independent risk variables, and odds ratio was employed to evaluate the relationship between each component and the incidence of stillbirths.

Results

Among the 42 mothers included in the study, the majority were in the age group of 26 to 30 years with mean maternal age of 28.38±4.90 years. The minimum age observed was 20 years, while the maximum age recorded was 46 years.

Majority of them i.e., 38 (90.5%), had no previous stillbirths, while 4 (9.5%) reported a history of previous stillbirth. Similarly, most mothers, 37 (88.1%), had no history of previous abortion, either induced or spontaneous, while 5 (11.9%) reported having experienced abortion in the past. Maximum study participants were primigravida, i.e, 17 (40.5%) out of 42, 15 (35.7%) were second gravida; while 21 out of 42 (50%) were nullipara.

Among the 42 study participants, 28 (66.7%) had high risk factors. Among these 28 women, 10 (23.8%) had preeclampsia, 2 (4.8%) had eclampsia, 4 (9.5%) had prelabour rupture of membranes (PROM), 3 (7.1%) each had gestational diabetes and anemia, 2 (4.8%) each had type 2 diabetes and intrahepatic cholestasis of pregnancy and previous history of Cesarean, while 1 (2.4%) each had hypothyroidism, Hepatitis C, antepartum hemorrhage. Majority of these women (52.4%) had gestational age of 36-40 weeks, and 7 (16.7%) out of 42 had history of tobacco addiction. Out of 42 women with stillbirth, 41(97.6%) had no previous antenatal visits. (Table1)

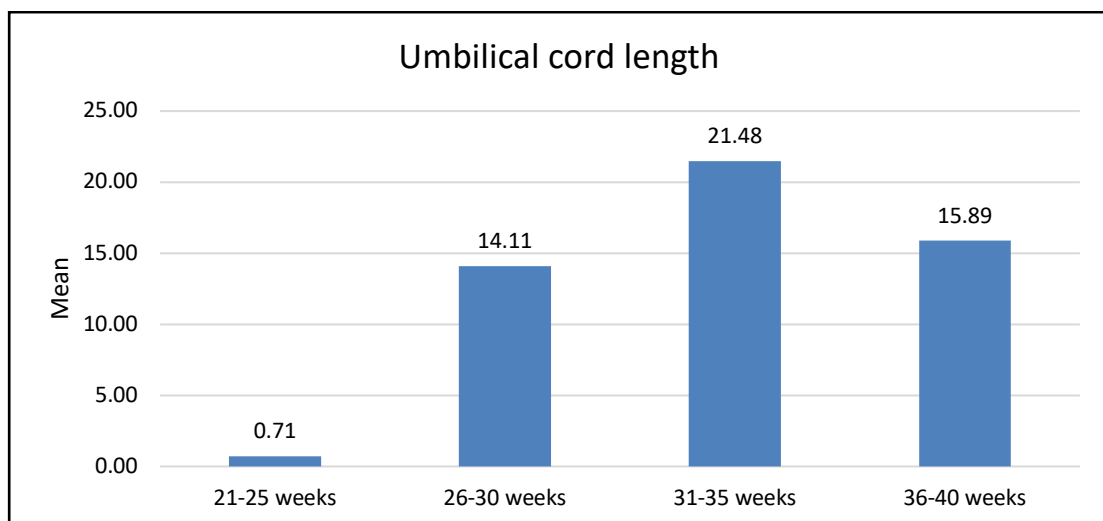
Table 1: Socio-demographic characteristics of the study participants:

Characteristics	Frequency (n=42)	Percentage (%)	
Age (years)	20-25	12	28.6
	26-30	17	40.5
	31-35	11	26.2
	>35	2	4.8
Gravida	G1	17	40.5
	G2	15	35.7
	G3	3	7.1
	G4	4	9.5
	G5	3	7.1
Parity	P0	21	50.0
	P1	13	31.0
	P2	2	4.8
	P3	5	11.9
	P4	1	2.4
History of abortions	5	11.5	
History of previous stillbirth	4	9.5	
High risk factors	28	66.7	
Gestational age (weeks)	21-25	2	4.8
	26-30	7	16.7
	31-35	11	26.2
	36-40	22	52.4
Addiction	Tobacco	7	16.7
	Alcohol	0	0
No. of ANC visits	0	41	97.6
	2	1	2.4%

Out of 42 women with still births, the mean length of umbilical cord in 21-25 weeks gestation group was 19.50cm, in 26-30 weeks gestation group was 33.57cm that in 31-35weeks gestation group was 41.27cm and in 36-40 weeks gestation age group was 30.67cm. On comparing the mean of umbilical cord length in these groups, the p value came out to be non-significant, i.e., 0.256 (>0.05). (Table 2, Figure 1)

Table 2: Length of umbilical cord with respect to gestational age

Gestational age (weeks)	Umbilical cord length		F value	p value
	Mean	Std. Deviation		
21-25 weeks	19.50	0.71	1.405	0.256
26-30 weeks	33.57	14.11		
31-35 weeks	41.27	21.48		
36-40 weeks	30.67	15.89		

**Figure 1: Length of umbilical cord with respect to gestational age**

On examination of the umbilical cord of 42 study participants, 38 appeared normal, thrombosis was seen in 2 of them while 2 were dark in colour. On observing the location of umbilical cord attachment on the placenta, 38 were centrally placed, 3 had paracentral location while 1 was attached marginally on the placenta. (Table3)

Table 3: Findings on gross examination of the umbilical cord of the study participants:

Findings		Frequency (n=42)	Percentage (%)
Appearance	Normal	38	90.5
	Thrombosed	2	4.8
	Dark Colored	2	4.8
Location	Central	38	90.5
	Paracentral	3	7.1
	Marginal	1	2.4

Among the placental samples examined, the mean length of placenta was found to be 12.92±2.90 centimetres, the mean width was 10.90±2.91 centimetres, and the mean thickness was found to be 4.30±1.72 centimetres. The mean weight of the placenta was 435.95±423.21 grams, ranging from 180 to 2300 grams. Out of 42 study participants, 2 were in the gestational age group of 21-25 weeks, 7 were in 26-30 weeks group, 11 were in 31-35 weeks group and 22 women had gestational age of 36-40 weeks. In the gestational age group of 21-25 weeks, the mean length of placenta was 9.5cm, width was 7.5cm and thickness was 4.5cm. Among

those with gestational age 26-30 weeks, the mean length, width and thickness was 12.14cm, 9.21cm and 3.43cm respectively. Those women with gestational age of 31-35weeks had the mean length of placenta as 14.05cm, width as 12.64cm and thickness as 4.09cm. The largest group of study participants was in the gestational age of 36-40 weeks with the mean length of placenta as 12.91cm, width as 10.91cm and thickness as 4.41cm. On comparing these dimensions in the above groups, difference in the width was found to be statistically significant (F value 3.569 and p value 0.023 i.e., <0.05). (Table 4, Figure 2)

Table 4: Findings on gross examination of the placenta with respect to gestational age

	Gestational age (weeks)	Frequency (n=42)	Mean(cm)	Std. Deviation	F value	p value
Length	21-25 weeks	2	9.50	4.95	1.738	0.176
	26-30 weeks	7	12.14	2.34		
	31-35 weeks	11	14.05	3.37		
	36-40 weeks	22	12.91	2.51		
Width	21-25 weeks	2	7.50	2.12	3.569	0.023
	26-30 weeks	7	9.21	1.63		
	31-35 weeks	11	12.64	3.03		
	36-40 weeks	22	10.91	2.74		
Thickness	21-25 weeks	2	4.50	2.12	0.893	0.453
	26-30 weeks	7	3.43	1.10		
	31-35 weeks	11	4.09	1.30		
	36-40 weeks	22	4.61	2.01		

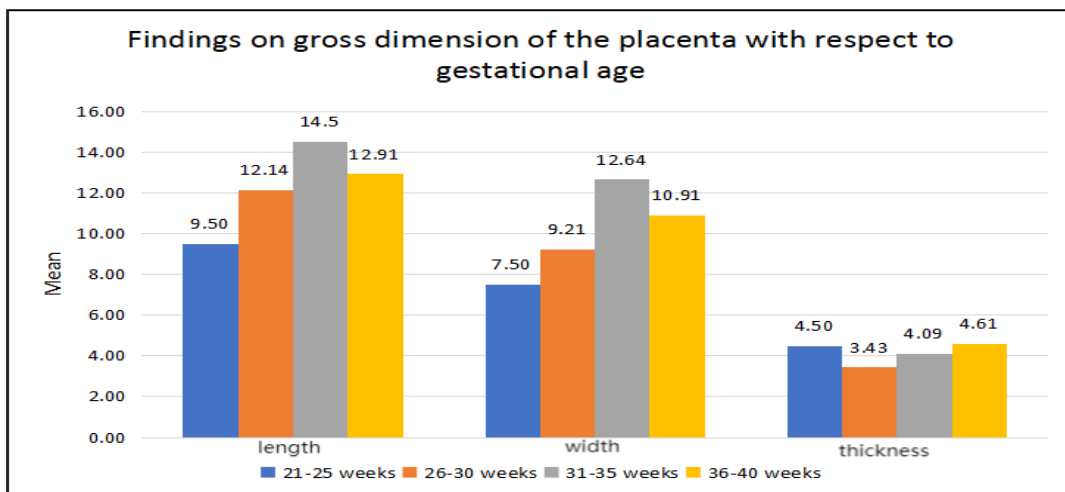


Figure 2: Findings on gross dimension of the placenta with respect to gestational age

Discussion:**Umbilical cord length and appearance:**

Umbilical cord abnormalities which can cause adverse perinatal outcome include cord entrapment, cord prolapse, strictures, torsions, true knots, vasa previa, fetoplacental insufficiency etc. Cord entrapment in the form of body, shoulder or nuchal cord, usually does not cause stillbirth, but can lead to adverse intrapartum events [8,9]. Umbilical cord torsions, knots and strictures are seen in about 0.3-2.1% of pregnancies and can cause stillbirths in 8-11% cases [10,11]. As nuchal cords and true knots are a common finding in healthy live births; these umbilical cord abnormalities cannot be implicated as a cause of stillbirth directly, without any histopathological confirmation [8]. Cord prolapse usually presents as an unpredictable obstetric event and accounts for almost 9% stillbirths due to umbilical cord abnormalities. It is mostly seen in cases of premature rupture of membranes and malpresentations like transverse lie and breech presentation [12]. Another umbilical cord abnormality which is associated with high risk of stillbirth is vasa previa. In this rare condition, fetal vessels traverse the membranes overlying internal cervical os. This is usually seen in cases of marginal cord attachment, and if diagnosed prenatally; the chances of perinatal mortality are low [13-15].

In our study, 7.4% cases of stillbirth had paracentral attachment of cord while, marginal attachment was still rarer, accounting for only 2.4% stillbirth cases. Previous retrospectively reviewed case series and case-control studies have reported that contribution of umbilical cord abnormalities to stillbirths varied from 8% to 65%, which is a wide range [16-18]. Hence, it is very difficult to ascertain the causative role of umbilical cord abnormalities in stillbirths. This could be seen in our study also where, 90.5% cases of stillbirth had centrally located umbilical cord, with no structural abnormality.

In our study the mean length of umbilical cord was maximum in the gestational age group of 31-35 weeks, i.e., 41.27 cm; and the mean umbilical cord length at term (36-40 weeks) was 30.67 cm (SD- 15.89 cm). This data was comparable to the findings of Mishra et al., where the average cord length was 50-60 cm [19]. The incidence of umbilical cord complications is known to increase as the length of cord increases.

As shown in both the studies by Rayburn et al. [20] and Greenhill et al [21], there was statistically significant ($p < 0.001$) association between cord complications and long cord. As per the study by Mishra et al [19], criteria of short cord was < 20 cm and that of long cord was > 100 cm. In our study, none of the women with stillbirth had exceptionally

long cords (i.e., > 100 cm). Thus, the cause of stillbirth cannot be directly related to the length of the umbilical cord.

Placental thickness: The placenta is a fetomaternal organ that maintains a healthy pregnancy, and the role of the umbilical cord in pregnancy cannot be separated from the placental function. The gross examination of the placenta, especially its dimensions and weight, closely relates to the pregnancy outcome. Kulman and Warsoff stated that a placental thickness of < 25 mm at term was associated with fetal growth restriction (FGR) [22]. At term, a placental thickness of > 4.0 cm was found to be associated with abnormalities like gestational diabetes, intrauterine infections, and hydrops fetalis [23]. Habib et al. found that the incidence of perinatal mortality and fetal anomalies was higher in subjects with increased placental thickness [24]. In our study, the average thickness of the placenta was 4.61 cm (SD- 2.01 cm) at term. We observed that women who experienced stillbirth had significantly thicker placentas, potentially due to placental edema and other histopathological abnormalities related to stillbirth. Nevertheless, determining the precise cause was challenging without comprehensive microscopic analysis of the placental samples.

The limitations of this study include its relatively small sample size and that it is based in a single hospital in Lucknow, making it difficult to generalize the results to the broader population. This descriptive study focused on women who experienced stillbirth. To better establish the impact of umbilical cord abnormalities on stillbirth, a comparative study design would be more effective.

Conclusion

In our study, we concluded that umbilical cord abnormalities are likely not directly linked to the causes of stillbirth, as many women with stillbirth have normally appearing umbilical cords. However, thorough histopathological examinations and comparative studies are essential to establish a definitive association between them.

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