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Original Research Article

A Study of Umbilical Cord in 50 Specimens in Palghar Population

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Abstract:

Introduction: The mother-fetus umbilical cord transfers nutrients and waste. The umbilical ring, primitive umbilical cord, yolk sac vessels, and allantois form throughout embryogenesis. The permanent umbilical cord grows into Wharton's jelly. By the sixth week, the midgut loop joins the cord, causing a physiological hernia that resolves by the 10th month of pregnancy.

Aims and objectives: This study aims to investigate the characteristics and potential implications of umbilical cords within the Palghar population, utilizing a sample size of 50 specimens.

Methods: A study included placenta and umbilical cord samples from 19-32-year-old moms. The presence of a nuchal cord, umbilical cord length and width, coiling, knots, cysts, haematomas, and cord attachment was evaluated. Infants had many cord wrappings. The coiling index and vascular patterns were calculated using Indian ink. Histology examined selected samples. Haematoxylin and eosin stains were applied to paraffin-embedded tissue sections for microscopic investigation.

Results: Table 1 shows newborns' length, diameter, false knots, attachment, cord coiling, para, nuchal cord, coiling index, birth weight, and sex. Birth weight, cord characteristics, and size vary. False knots and nuchal cords indicate delivery risks. Their effects on neonatal health and development need further study. Table 2 depicts cord coiling patterns, coiling index, and attachment kinds, providing insight into umbilical cord variability and prospective fetal development therapies. Cord features and birth outcomes need further study.

Conclusion: This study found that shorter umbilical cords may decrease embryonic development and death, while longer cords are associated with nuchal cords. Hypo-coiling can cause preterm birth and fetal discomfort.

Keywords: Primitive umbilical cord, Hypo-coiling, False knots, nuchal cords.

Introduction

The umbilical cord is thought to symbolise the mental and emotional connection between a mother and the unborn chord. This arrangement allows for the removal of waste products from the foetus' blood as well as the exchange of nutrients and oxygen from the mother's blood into the foetus' blood for elimination by the mother. Mothers, on the other, Feel a connection to the foetus on an emotional level through the chord. It could be something to think about as a kind of affection and attention throughout pregnancy. Some writers use it as the "string of life." [1].

A bundle of at the beginning of the embryo's growth, the network of blood vessels known as the umbilical cord develops. It consists of a tubular amnion sheath that surrounds one umbilical vein and two sets of paired umbilical arteries. The umbilical arteries are essential for the development of the foetus by transporting the placenta receive deoxygenated blood via the foetus. However, a significant portion of the distal portion of the umbilical artery deteriorates. after birth. The medial umbilical ligament is created when these remnants eventually vanish. Additionally, the distal end of each umbilical artery is where the anterior internal iliac veins branch out [2]. Superior vesical arteries, which are derived from the internal iliac arteries, are those that eventually grow to feed the ureters, ductus deferens, and seminal vesicles in men. The placenta functions as the major blood vessel between the foetus & placenta, connecting the foetus to both of these structures umbilical cord is an essential part of the body throughout the whole time of development [3].

Umbilical Cord Anatomical Details

The umbilical cord has a smooth amnion outer layer and is a delicate, tangled chord. It moves from the foetal' umbilicus to the centre of the placenta. It has a diameter of roughly 1 cm as well as a 50–60 cm length range. The major substance

of the umbilical cord has been identified as substantial gelatine funiculi umbilicalis, sometimes referred to as Wharton's jelly. It is formed of mucopolysaccharides, which are created when chondroitin sulphate and hyaluronic acid are mixed. Two arteries and one vein make up two of the three vessels that make up the umbilical cord, as was already mentioned. Additionally, it encompasses the urachus, an allantois relic. In the Retzius gap, which is located in between the longitudinal fascia in the front and the peritoneum posteriorly, is the urachus, an elastic Allantois remains can be seen. Through the umbilical cord, it reaches. For the fetus's urine bladder, the urachus acts as a drainage canal [4].

Function

Deoxygenated Blood travels through the placenta's placental circulation in the umbilical arteries. When both a type of vascular connection known as Hyrtl's anastomosis develops when the umbilical arteries confluence, which is roughly 5 mm from wherever the umbilical cord is inserted. To equalise blood circulation and blood pressure within the placental & umbilical arteries is the primary objective of Hartl's anastomosis. As each artery penetrates the placenta, it divides into a smaller branch called a chorionic artery [5].

Embryology

Early in embryonic development, a process called gastrulation divides germinal tissues into three groups: the inner endoderm, intraembryonic mesoderm, and the outer ectoderm. The process of gastrulation happens concurrently with the three stages that make up the umbilical cord's development [4].

I. Development of the earliest umbilical ring

The embryonic disc's folding coincides with this developmental stage. At this point, the folding of the embryonic disc causes it to protrude into the amniotic cavity. The embryo's ventral region develops concurrently with the formation of the amnio-ectodermal junction, an intricate link between the ectodermal layer and the embryonic amnion. The primitive umbilical ring then forms along the reflection axis that passes through the ectoderm and amnion [6].

II. Development of the earliest umbilical cord

In the course of the primordial umbilical ring's contraction, a tubular sheath forms during the fifth week of pregnancy, which marks the beginning of this stage of development. The term "primitive umbilical cord" refers to the tubular sheath. It encloses the yolk sac, its vessels, and the allantois in addition to the body stalk [7].

III. Development of the Permanent Umbilical Cord

The umbilical cord elongates and goes through initial structural changes during this period. For instance, the body stalk's extraembryonic mesoderm begins to develop into Wharton's jelly, a mucoid material. The primary portion The umbilical cord is mostly made of Wharton's jelly which develops gradually. The umbilical cord's extraembryonic coelom segments gradually deteriorate. the stomach and the yolk sac are connected via the vitellointestinal duct also perishes along with the yolk sac. Similar to this, The allantois' distal part vanishes. But the allantoic vessels continue to develop and enlarge to become the umbilical vessels. Finally, the midgut loop reaches the umbilical cord around the sixth week, causing a physiological hernia. This section During the 10th month of pregnancy, of the midgut frequently returns to the abdominal cavity, correcting the physiological hernia [8].

Materials and Methods

The study was conducted in Palghar, Maharastra. The study was conducted from June, 2022 to February, 2023. Specimens of placenta with umbilical cord were obtained from mothers aged between 19 to 32 years, with the distribution as follows: two specimens were collected from mothers over 20 years old, 47 specimens from mothers between 21 to 30 years old, and one specimen from a mother above 30 years old. A parity distribution of 50 specimens has been done like 30 Placentae samples with umbilical cord specimens collected from primigravida and 12 specimens from second gravida and 8 specimens from third gravida. In the present study, after delivery uniformly 10 cm of umbilical cord was left at the fetal end and then the cord was clamped, cut and serially numbered. The accompanying perceptions were produced using the examples, utilizing forceps, scissors, surgical tools, string and measuring tape.

1. Nuchal cord.
2. Length of the cord.
3. Diameter of the cord.
4. Cord coiling.
5. Presence of knots
6. Presence of cysts and Haematoma.
7. Attachment of umbilical cord.

The infants brought into the world with their umbilical lines wrapped at least multiple times

around the neck were noticed and noted. The length of the cord was estimated from the cut finish of the line up to its placental connection by using string and afterwards, the length of the string was estimated by involving estimating tape in centimetres. With this perusing 10 cm was added for the umbilical string which was left towards the

fetal end. The cross-over width of the string was estimated by taking one perusing at the fetal end and one more perusing at the placental end. The presence of cord snaking was examined and the following perceptions were made by Hypo wound cord, Hyper wound cord and Straight cord. The number of coils present in every umbilical cord was counted. The coiling index was determined as;

Coiling index = Total number of coils /Length of Umbilical Cord

- The cord was looked for the presence of valid and bogus bunches.
- Along the course of the umbilical cord, the presence of blisters and haematomas were noticed.
- The placental connection of the umbilical cord was concentrated as Central attachment, Eccentric attachment and Marginal attachment.

The above reports were taken from the new examples. Then the placentae with umbilical rope were washed well in faucet water and put away in 10% formalin answer for 15 days.

1. Manual analysis was finished in 45 umbilical cord specimens.
2. Indian ink was infused in 5 umbilical cord examples to study the vascular design.
3. Histological examination of the veins was finished in four of the 50 placentas.

It has been figured out that the presence of a number of vessels in connection with the placenta. The vessels were followed further to notice the vascular example in the placenta. Five examples were washed well by utilising Heparin and afterwards Indian ink was infused in the veins of the umbilical cord and put away in 10% formalin for 15 days. Then, at that point, manual analysis was finished to concentrate on the vascular example. Four specimens of umbilical cord with placentae were taken. Pieces of tissue about half to one cm in length, one at the fetal end and another at the placental end were taken. After fixing and hardening, a paraffin block was prepared. Section cutting was done, floated on warm water and smeared in a slide. Ehrlich's haematoxylin stain tested for 5 to 7 minutes and water-soluble eosin stain tested for ½ to 1 minute, Coplin jars containing xylol, absolute alcohol, 100% alcohol, 90% alcohol, 70% alcohol, 1% acid alcohol, Canada balsam, slide rack, burner, coverslip, tap water and blotting paper etc. Before proceeding with staining, the side of the tissue on the slide was determined. The slide was warmed on the reverse side of the tissue on a burner to dissolve the paraffin completely and The slide was dipped in xylol for 2-3 minutes to remove the paraffin. The slide was dipped in descending series of alcohol i.e. absolute alcohol, 100% alcohol, 90% alcohol, 70% alcohol and water for one minute each. The slide was placed on the slide rack and covered with drops of haematoxylin stain for 5 to 7 minutes, the nucleus and the cytoplasm of the tissue to stain. washed after Stained with a few drops of water-soluble eosin solution for ½ to 1 minute. The slide was passed through alcohol, i.e. 70% alcohol, 90% alcohol, and 100% ascending grades of alcohol absolute alcohol for one minute each. after that slide was dipped in Xylol and blotted. A clean coverslip was placed and dried for microscopic examination after One drop of Canada Balsam was put on the slide.

Results

Table 1 provides information regarding many physical characteristics and attributes of infants, encompassing their Length, Diameter, False Knots, Attachment, Cord Coiling, Para, Nuchal Cord, Coiling Index, Birth Weight, and Sex. The dataset in question pertains to the field of obstetrics or neonatology, as evident from the available information. The data indicates that there are variances observed among newborns in terms of size, cord features, and birth weight. This study includes both male and female infants. The identification of false knots and nuchal cords may suggest potential hazards that could arise during the process of childbirth. Additional analysis and investigation are necessary in order to derive significant conclusions on potential correlations or implications for the health and development of newborns.

The coiling manner, coiling index, and attachment of umbilical cord specimens are shown in the table 2. Cord coiling includes hypo coiling (33 specimens), hyper coiling (13 specimens), and straight coiling (4 specimens). The bulk of specimens coil anti-clockwise (35 specimens, 7%), followed by clockwise (10 specimens, 2%), and a minor number without coils (5 specimens, 1%). Hyper-coiled cords have a coiling index of 0.14 to 0.18, compared to 0.08 to 0.12 for hypo-coiled cords. Most umbilical cords (38 specimens) have an eccentric attachment, followed by central (7 specimens) and marginal (5 specimens). These findings provide valuable insights on umbilical cord diversity, which may be crucial to fetal development and therapeutic implications. Cord characteristics may affect newborn outcomes, but further research is needed.

Table 1: Physical characteristics and attributes of infants

SL No.	Length	Diameter		False Knots	Attachment	Cord Coiling	Para	Nuchal Cord	Coiling Index	Birth Weight in kg	Sex
		FE	PE								
1	61.1	1.2	1.5	NP	EC	HYPER	II	P	0.14	3	M
2	45.1	0.8	1.5	NP	MAR	HYPO	I	NP	0.12	0.3	M
3	54.7	1.3	1.5	NP	EC	HYPO	III	NP	0.12	3	M
4	57.8	1.1	1.5	NP	EC	HYPO	I	P	0.11	3.7	M
5	54.3	1.2	1.5	P	EC	HYPER	I	NP	0.14	2.75	M
6	56.4	1.2	1.5	NP	EC	HYPO	II	NP	0.11	3.75	F
7	57.6	0.8	1.4	NP	EC	HYPO	I	NP	0.11	2.7	F
8	48.8	1.2	1.5	NP	EC	HYPO	III	NP	0.11	3.7	M
9	47.1	0.8	1.4	NP	MAR	HYPO	I	NP	0.11	3.3	M
10	59.8	0.9	1.5	NP	EC	HYPER	I	P	0.14	2.8	M
11	55.1	1.3	1.5	NP	EC	HYPO	II	NP	0.11	3	M
12	43.2	1.1	1.5	P	EC	HYPO	I	NP	0.08	3.25	M
13	47.1	0.8	1.4	P	MAR	HYPO	II	NP	0.11	3.2	M
14	52.5	0.9	1.5	NP	EC	HYPO	I	NP	0.09	3	F
15	59.5	0.8	1.4	P	EC	HYPO	I	P	0.08	2.75	F
16	55.5	0.8	1.3	NP	MAR	HYPER	III	NP	0.14	3.5	M
17	49.3	1.2	1.5	NP	EC	HYPO	II	NP	0.13	3	F
18	48.7	1.4	1.5	NP	EC	HYPO	III	NP	0.10	2.7	F
19	56.1	1.3	1.5	NP	CENT	HYPO	I	NP	0.08	2.75	M
20	53.8	1.2	1.6	P	EC	HYPO	I	NP	0.09	3	M
21	47.9	1.2	1.5	NP	EC	STRAIGHT	II	NP		2.75	F
22	51.8	1.2	1.5	NP	EC	HYPO	I	NP	0.09	2.5	F
23	54.2	0.7	1.6	P	EC	HYPER	II	NP	0.14	3.75	M
24	56.3	1.2	1.5	NP	EC	HYPO	I	NP	0.08	2.75	F
25	55.1	1.1	1.2	NP	CENT	STRAIGHT	I	NP		2.75	F
26	54.3	1.2	1.6	NP	EC	HYPER	II	NP	0.14	3	M
27	50.2	1.1	1.4	NP	EC	HYPO	I	NP	0.10	2.9	F
28	51.9	1.2	1.5	NP	EC	HYPO	II	NP	0.09	3	M
29	53.2	1.3	1.4	NP	EC	HYPO	I	NP	0.09	3.1	M
30	54.1	1.2	1.6	P	EC	HYPER	III	NP	0.17	4	F
31	58.4	0.8	1.5	P	EC	HYPER	I	NP	0.15	2.8	F
32	56.1	1.2	1.6	P	EC	HYPO	I	NP	0.11	2.7	F
33	52.8	1.3	1.4	P	EC	HYPER	III	NP	0.15	3.7	F
34	57.8	1.2	1.6	P	EC	HYPER	II	NP	0.14	2.5	F
35	52.7	1.3	1.6	NP	EC	HYPO	I	NP	0.12	2.7	F
36	45.2	1.2	1.4	NP	EC	HYPO	I	NP	0.12	3.3	F
37	48.1	1.2	1.6	NP	CENT	HYPO	I	NP	0.11	2.6	F
38	53.2	1.2	1.5	NP	EC	STRAIGHT	I	NP		3.2	F
39	54.1	1.2	1.4	NP	CENT	HYPO	I	NP	0.09	3.3	M
40	57.8	0.9	1.4	P	EC	HYPO	I	NP	0.11	2.8	M
41	53.6	1.2	1.6	NP	EC	HYPER	III	NP	0.15	3.3	M
42	54.9	1.3	1.5	P	EC	HYPO	I	NP	0.09	2.8	M
43	60.2	1.2	1.6	P	EC	HYPO	II	P	0.1	3	M
44	59.1	1.3	1.5	NP	EC	HYPO	I	NP	0.09	2.7	M
45	58.2	1.3	1.5	NP	EC	HYPO	I	NP	0.09	3.2	M
46	54.4	1.3	1.6	P	CENT	HYPO	II	NP	0.09	3	F
47	59.9	1.3	1.6	P	CENT	HYPO	III	P	0.10	2.6	M
48	73.2	1.4	1.7	NP	EC	HYPER	I	P	0.18	2.75	M
49	59.2	1.3	1.6	NP	EC	HYPO	I	P	0.1	3.5	M
50	54.1	1.3	1.6	NP	EC	HYPO	I	NP	0.09	3	M

Table 2: Findings of the cord status after studying the specimens of umbilical cords

Coiling of Cord	**No. of Specimens**	
Hypo Coiling	33	
Hyper Coiling	13	
Straight	4	
Coiling Manner	**No. of Specimens**	**%**
Anti Clockwise	35	7%
Clockwise Coils	10	2%
Absence Coils	5	1%
Coiling Index	**Hypo-Coiled Cord**	**Hyper-Coiled cord**
Maximum	0.12	0.18
Minimum	0.08	0.14
Mean	0.01	0.014
Attachment of Umbilical Cord	**No. of Specimens**	
Eccentric	38	
Central	7	
Marginal	5	

Discussion

These Haematological "Reference Intervals (RIs)" can alter based on a variety of factors. variables, including Age, gender, financial status, elevation, etc. These ideals are crucial for interpreting test results and choosing the appropriate clinical course of action. India currently lacks a reliable RI for the haematological characteristics of cord blood from newborns. These intervals will be determined from Mumbai, India, through this study. In Mumbai, India, In cord blood from infants, the initial haematological reference intervals were created. Newborns from this region can use the values. A more extensive examination across the nation is necessary [9].

In a study, the association between umbilical cord height & foetal attributes like Apgar score, sex, pounds, or length was investigated. as well as how this affects the course of labour. The umbilical cord was checked for coils around the neck, the trunk, and other areas. or other areas; the number of loops and their locations; cord knots (True or false); and any abnormalities in the chord. The newborn's sex, weight, and length were recorded as foetal parameters. Study of foetal outcome using the 1- and 5-minute Apgar scores. The current study shown even though the majority of cases had a normal chord length, the umbilical cord's length does vary. Cases with long and short cords were examples of unusual chord lengths. How often do cord problems occur, surgical intervention, intrapartum issues, foetal heart rate anomalies, and the likelihood of delivery hypoxia were all higher in these cases. However, the chord length was unaffected by the baby's weight, length, or sex [10].

A study was conducted to investigate the idea the length of the umbilical cords has been shown to be related to certain intrapartum issues more commonly depending on whether they were short or lengthy. inspected in 536 full-term births. The umbilical chord was typically 55 centimetres long, ranging from 14 to 129 cm. 35 cm or less was considered a short chord (lower sixth percentile). The existence of a lengthy cord was associated with an increased risk of umbilical cord accidents (20 of 32 cases, or 62%). When a lengthy chord or a really small cord (lower first percentile, 25 cm or less) was discovered, inadequate foetal descent was noticeably more frequent [11]. In order to test the theory that specific intrapartum problems are more frequently related to having an umbilical cord that is either short or long length was investigated in 536-period births. The average umbilical cord measured 55 cm, 35 cm or less (lower sixth percentile) was deemed to be a short chord. Long cables were connected to a higher chance of umbilical cord accidents. When a lengthy cord or an extremely short cord (25 cm or less, lower first percentile) was identified, the likelihood of inadequate foetal descent increased noticeably. Short or long cords were significantly more common than normal-length cords in terms of foetal heart rate (FHR) anomalies that predominantly mirrored patterns of cord compression. It takes very little time and money to measure the length of the umbilical cord, and it can help to understand why some intrapartum FHR anomalies or foetal descent arrests occur [12].

A study was conducted to determine the outcomes and risk factors related to a short umbilical cord. There were no identified Modifiable risk factors that might lead to the emergence of a short chord. Labour and delivery difficulties are more likely to affect case moms and newborns. Tighter postpartum monitoring of these infants is suggested by the term's 2-fold higher chance of mortality case newborns [13].

A study was conducted to find the shortest length of the umbilical cord that will allow for spontaneous vaginal delivery. 166 randomly

selected women who spontaneously gave birth at or after 37 weeks and had no evident antepartum problems were included in this prospective, observational study. Immediately upon delivery, the cord was clamped at the maternal introitus. The cord segment's length was calculated from placental implantation to introitus. To determine the placental implantation site (fundal or lateral), we looked at recent foetal imaging. The birth canal and uterine axis are not long enough to stop spontaneous vaginal birth. There is a short umbilical cord present. Except possibly when there is an extremely short cord present, the placental position does not interfere with delivery [14].

Conclusion

This study has concluded that it is assumed that longer lines are generally associated with showing rope around the neck, which leads to intrauterine passage of the embryo. The line around the neck was a rare cause of antepartum fetal death, according to prior writing. As shown, short lines are associated with placenta transport issues. However, no short string related to placenta transportation issues has been mentioned as a substantial complexity in previous writing. However, such short lines are associated with unfavourable pre-birth outcomes including fetal development limitation, inborn deformity, intrapartum complications, and a twofold risk of death. If hypo coiled, preterm birth and fetal discomfort are possible. Hypocoiled lines are linked to preterm delivery and poor birth weight, according to previous research. It is shown that a low umbilical curling file is linked to low apgar score, meconium staining, and pregnancy-induced hypertension. Additionally, ropes may have sores and haematomas. The current selection shows that any rope-to-placenta connection need not cause problems. Previous research has linked a single umbilical conduit to malformation and poor birth weight. We must look for chromosomal anomalies and tracheoesophageal fistula in two-vessel designs. In comparable circumstances, we must check for renal aplasia, appendage reduction abnormalities, and empty organ atresia. Single vessel example may be related to string. Finally, umbilical line study realities may be hidden. To illuminate and improve current factual knowledge, which must be brought to light.

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