Original Research Article

STUDY OF VARIATIONS IN HUMAN PLACENTAL ATTACHMENT OF UMBILICAL CORD AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT

Introduction: The word placenta comes from Latin - flat cake and Greek - "Plakous" which means "flat, slab like." Only eutherian mammals possess placenta. The human placenta is discoid, hemochorial and deciduate which functions as a fetomaternal organ. It is developed from chorion frondosum & decidua basalis. Abnormalities in the development and site of insertion of the umbilical cord can affect maternal and fetal well-being. The umbilical cord is usually attached near the centre of the placenta. The various types of umbilical cord attachment into the placenta are: central, eccentric, battledore (marginal), velamentous (membranous) and furcate. Hence knowledge about the variations in the placental attachment of umbilical cord is important for clinicians.

Aims and Objectives: The present study is undertaken to study various types of placental attachment of umbilical cord.

Materials and methods: The study was carried out on 10% formalin fixed 100 normal human placenta collected from department of Obstetrics and Gynaecology, Cheluvamba Hospital for children & women, Mysore medical college and research institute, Mysuru, Karnataka. The study was carried out in department of Anatomy, MMC&RI, Mysuru. Study of various types of placental attachment of umbilical cord was done by naked eye observation. The data obtained was tabulated & statistically analysed.

Observations and Results: Out of 100 placenta observed 68 placenta had central attachment of umbilical cord, 16 placenta had eccentric attachment, 12 placenta had battledore (marginal) attachment and 04 placenta had membranous (velamentous) attachment.

Conclusion: Variation in the placental attachment of umbilical cord is associated with various congenital anomalies. Therefore early prenatal ultrasonographic identification of anomalies helps in reducing risk in maternal and perinatal outcome.

KEY WORDS: Umbilical cord attachments – eccentric, battledore, velamentous, furcate, congenital anomalies, preterm labour.

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INTRODUCTION

The word placenta comes from Latin - flat cake and Greek - "Plakous" which means "flat, slab like." [1]. Only eutherian mammals possess

placenta. The human placenta is discoid, hemochorial and deciduate which functions as a fetomaternal organ. It is developed from chorion frondosum & decidua basalis.

The umbilical cord (also called navel string, birth cord or funiculus umbilicalis) is a conduit between the developing embryo or fetus and the placenta [2].

It is developed from the connective stalk or body stalk which connects the fetus & the placenta [3].

Abnormalities in the development and site of insertion of the umbilical cord can affect maternal and fetal well-being. It leads to congenital anomaly in fetus and also associated with intra uterine growth retardation (IUGR) and preterm labour.

The umbilical cord is usually attached near the centre of the placenta. It may insert at any point between its centre and margin, a condition known as a battledore placenta (marginal). Occasionally the cord fails to reach the placenta itself and ends in the membranes as a velamentous insertion. In such cases larger branches of the umbilical vessels traverse the membranes before they reach and ramify on the placenta. They travel unprotected through the membranes to the placenta, which puts the fetus at risk because compression or tearing of the vessels can disrupt blood flow to and from the fetus. The cord may branch off before the cord inserts onto the surface of the placenta resulting in a furcate cord insertion [4].

Knowledge about the variations in the placental attachment of umbilical cord is important for Clinical Anatomists, Obstetricians & Gynaecologists and Radiologists. Hence the present study is carried out to know the variations in the placental attachment of umbilical cord.

Aims and objectives: The present study is undertaken to study various types of placental attachment of umbilical cord: 1) Central 2) Eccentric 3) Battledore (Marginal) 4) Velamentous (Membranous) 5) Furcate.

MATERIALS AND METHODS

Source of data: The study was carried out on 10% formalin fixed 100 normal human placenta collected from department of Obstetrics and Gynaecology, Cheluvamba Hospital for children & women, Mysore medical college and research institute, Mysuru, Karnataka, India.

Study setting: The study was carried out in department of Anatomy, MMC&RI, Mysuru, Karnataka. Fully normal placenta was included. Damaged, mutilated, deformed placenta was excluded from present study. Study of various types of placental attachment of umbilical cord was done by naked eye observation. The data obtained was tabulated & statistically analysed.

Study design: It is a descriptive study.

OBSERVATIONS AND RESULTS

The pattern of placental attachment of umbilical cord was observed in all 100 specimens. Out of 100 specimens, 68 placenta had central attachment of umbilical cord, 16 placenta had eccentric attachment, 12 placenta had battledore (marginal) attachment and 04 placenta had membranous (velamentous) attachment. Furcate type of umbilical cord attachment was not observed in the present study

Fig. 1: Central attachment of umbilical cord

Fig. 2: Eccentric attachment of umbilical cord

Fig. 3: Battledore attachment of umbilical cord

Fig. 4: Velamentous attachment of umbilical cord

Table 1: Various types of umbilical cord attachment.

Sl.no	Various types of umbilical cord attachment	Total no. of placenta studied (100)	Percentage (%)
1	Central	68	68
2	Eccentric	16	16
3	Battledore (Marginal)	12	12
4	Velamentous (Membranous)	4	4
5	Furcate	----	----

Pie chart: Proportion of various types of placental attachment of umbilical cord

DISCUSSION

Deformities in the placental attachment of umbilical cord have been associated with complications of pregnancy and poor fetal outcome due to compression of umbilical vessels. These complications are also associated with intrauterine growth retardation (IUGR) and preterm labour.

There can be several variations with umbilical cord insertion (attachment) into the placenta [5]:

Central insertion (90%): normal situation

Eccentric cord insertion: lateral insertion of the umbilical cord >2 cm from the placental margin

Battledore (Marginal) cord insertion (7%): insertion of the umbilical cord <2 cm from the placental margin

Velamentous (Membranous) cord insertion (1%): insertion of the umbilical cord on the fetal (chorioamniotic) membranes.

Furcate cord insertion: when blood vessels divide before reaching the placenta.

The present study revealed that commonest type of attachment of umbilical cord was Central (68%), followed by Eccentric (16%), Battledore (Marginal) 12% and Velamentous (Membranous) 04%. This finding is almost similar with the findings of Jeyasingh T et al (2006) [6] and Yousuf et al (2015) [7].

Marginal cord insertion and velamentous cord insertions are categorized as abnormal umbilical cord attachment. Velamentous cord insertion occurs in approximately 1% of singleton pregnancies and Marginal cord insertion in approximately 7% (2011) [8]. In Velamentous cord insertion, the umbilical vessels are prone to compression and rupture due to the lack of protection from Wharton's jelly (2011) [9]. Velamentous cord insertion is eight times more common in twin than singleton pregnancies, with double the risk with monochorionic twins, and three times the risk in twin pregnancies with fetal growth restriction (2015) [10].

The pathogenesis of the abnormal umbilical cord attachment is not well understood. Three theories have been proposed: 1) The abnormal primary implantation or 'polarity theory', which postulates that umbilical cord insertion site is determined at initial implantation by the orientation of the fetal pole relative to the endometrial surface; 2) The theory of trophotropism which postulates that the placenta grows in areas with good blood supply and atrophies in areas where there is not; 3) The "abnormal placental development because of decreased chorionic vessel branching" theory, which posits that non-central insertion results from abnormal vasculogenesis in the placenta (2011) [8]. Advanced maternal age (>35 yrs) was significantly associated with an increased risk of velamentous umbilical cord attachment.

Donald N et al (1988) [11] conducted a ultrasonographic (USG) study in 46 pregnancies which included 38 singletons and 8 twins for a total of 54 placental umbilical cord attachments.

Table 2: Comparison of various types of umbilical cord attachment with previous studies.

Sl.no	Authors	No of placenta studied	Central (%)	Eccentric (%)	Battledore (Marginal) (%)	Velamentous (Membranous) (%)	Furcate (%)
1	Donald N et al [11] (1988)	54	70.37	--	22.22	7.41	--
2	Sepulveda W et al [12] (2003)	825	93	--	5.21	0.96	--
3	Manikanta R et al [13] (2012)	110	75.45	--	16.36	0.9	7.27
4	Yousuf et al [7] (2015)	150	24	66	2	8	--
5	Shrivastava S et al [14] (2018)	78	32.05	57.6	8.97	--	1.28
6	Arora NK et al [15] (2016)	32	18.75	59.38	15.62	3.12	3.12
7	Jeyasingh T et al [6] (2016)	50	22	70	8	--	--
8	Present study	100	68	16	12	4	--

They observed 38 (70.37%) normal attachments, 12 (22.22%) marginal and 4 (7.41%) velamentous attachments, which was almost similar to present study. Sepulveda W et al (2003) [12] conducted a colour Doppler ultrasonographic study in 825 pregnancies and observed 774 (93%) normal central attachments, 43 (5.21%) marginal attachments and 8 (0.96%) velamentous attachments, which are higher when compared to present study. Furcate type of umbilical cord attachment was not observed in present study but according to study conducted by Manikanta R et al (2012) [13], Shrivastava S et al (2018) [14], and Arora NK et al [15] observed 7.27%, 1.28% and 3.12% furcate type of umbilical cord attachment respectively.

CONCLUSION

The present study reveals the variations of human placental attachment of umbilical cord and the most common type was Central (68), followed by Eccentric (16), Battledore (Marginal) 12 and Velamentous (Membranous) 04. Variation in the placental attachment of umbilical cord is associated with various congenital anomalies such as preterm labor, low birth weight, intrauterine growth retardation (IUGR), oesophageal atresia, spina bifida and ventricular septal defect (VSD). Hence this study is useful for all the clinicians for proper diagnosis and treatment of disease. Therefore early prenatal ultrasonographic identification of these anomalies helps in reducing risk in maternal and perinatal outcome.

Conflicts of Interests: None

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