

The Relationship between the Length, Diameter of the Umbilical Cord and Birth Weight of Neonate in Konaseema Area, East Godavari, Andhra Pradesh

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Abstract

Background: Umbilical cord plays a vital role in the development and growth of foetus. The perinatal outcome of foetus mainly depends on the placenta and Umbilical cord growth.

Method: 208 placentae with their umbilical cords from the women with uncomplicated pregnancies of age group between 20 to 35 years were collected from the obstetrics and gynaecology department. Umbilical cord length and diameter were measured at delivery. The birth weight recorded from parturition register.

Study Type: Cross sectional Study.

Conclusion: There was significant positive correlation between umbilical cord diameter and fetal weight

Keywords: Foetal Weight; Umbilical Cord Length; Umbilical Cord Diameter;

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Introduction

The umbilical cord attaches the foetal surface of placenta to the umbilicus of the foetus. After about four weeks of gestation the only link of the foetus to the placenta is the umbilical cord which begins to form around this time replacing the yoke sac. It develops from the extra embryonic mesoderm and becomes the channel for blood vessels, through which all exchanges and other activities of the mother and the foetus via the placenta are carried out. It is a cylindrical structure

made up of a single layer of amniotic epithelium within which are two

arteries and one vein embedded in a gelatinous Wharton's jelly which is mainly amucopolysaccharides [1]. At term the normal umbilical cord is about 55-65 cm in length [2] with a diameter of 2.0-2.5 cm which normally insert centrally or eccentrically on the foetal side of the placenta.

It provides the means by which oxygen, carbon dioxide, steroids and other products are carried to and from the foetus, and it also allows free movement of the foetus within the uterus and protects the umbilical blood vessels from mechanical injury [3]. Due to its peculiar role of being the link between the placenta and the foetus, any abnormality of this cord, be it in the length, the amount of Wharton's jelly, number of vessels or its amniotic epithelium may lead to abnormal foetal outcome [4]. For example short cords are associated with less foetal activity, myopathic and neuropathic diseases, prolong second stage of labour, cord rupture, breech presentation, placenta abruption and Down's syndrome [5].

In contrast very long cords which are due to hyperkinesis are associated with cord thromboses, entanglement, and torsion as well as knot formation [6]. Thus abnormalities in cord length associated with intrauterine factors could lead to abnormalities that are only detected later in life [4].

It is estimated that more than 7.6 million perinatal deaths occur each year worldwide; 4.3 millions of these are foetal deaths [7]. Ninety-eight percent of perinatal deaths have been said to take place in developing countries, and the perinatal mortality rate is estimated to exceed 55 per 1000 births, which is five times higher than in developed countries [2]. Several studies have been conducted in the developed countries and Asia which have suggested that placenta indices have a significant role in foetal growth in terms of weight, body length, and cord length [8]. Currently very little is known about the incidence of fetal deaths resulting from placenta malformation therefore the present study was designed to provide some information on the relation between umbilical cord length, diameter and foetal weight.

The present study shall therefore be undertaken to record data on length and

diameter of umbilical cord in correlation with foetal weight in tertiary care hospitals of konaseema area due to lack of this type of study in this area.

Materials and Methods

Specimen Collection and Preparation

Two hundred and eight placentae with their attached umbilical cords from the uncomplicated pregnant women of age group between 20 and 35 years were collected (Figure.2) from the obstetrics and gynecology department of konaseema institute of medical sciences and research foundation and other hospitals in konaseema area. In all cases, after separating the baby from the umbilical cord, the specimens were tagged with numbers that corresponded with the numbers indicated in the data of the perinatal outcomes and placed in a container of 10% formalin. Samples were picked up and washed clean of blood and stored again in a solution of 0.5% formaldehyde in saline for further detailed examination and measurements. The birth weight of normal babies recorded from the parturition register of above mentioned hospitals. Patients gave informed consent in the labour room before being included in the present study the study was approved by the Institutional ethical clearance committee and head of the obstetrics and gynecology department. After collection of specimen's Umbilical cord length, umbilical cord diameter and foetal weight were measured.

Umbilical cords were examined and measurements made while it is still attached to placenta. The cord length was measured its entirety including the length of placental end of cord and umbilical stump on the baby. On the basis of cord length cords were grouped into three; Length less than 40 cm, between 40 and 70 cm, and greater than 70 cm as short, normal and longer than normal respectively. The cord diameter was measured by spreading caliper. (Figure.1)

All measurements were in centimeters using standard tape measure.

Inclusion criteria:

Women with normal and uncomplicated pregnancy.-consecutive singleton normal deliveries, cesarean sections and mothers of age group 20-35 years

Exclusion criteria

Women with complicated and abnormal pregnancy congenital anomalies, maternal diseases like diabetes mellitus, hypertension, anemia, multiple pregnancies

Type of Study

Cross sectional study.

Statistical Analysis

All the collected data was tabulated in excel spreadsheet, processed and analysed, .cord length and diameter were expressed in mean standard deviation and correlated with fetal weight using correlation coefficient r value, student t test and pearson correlation. p value less than 0.05 will be considered as statistically significant.

Results

Table 1: Mean \pm SD of Umbilical cord parameters

Umbilical cord parameters	Fetal weight	
	< 2.5 kgs	> 2.5 kgs
	Mean \pm SD	Mean \pm SD
Length	53.0 \pm 14.704	52.86 \pm 15.413
Diameter	1.39 \pm 0.49	1.54 \pm 0.43

Table 2: Range of Umbilical cord parameters

Umbilical cord parameters	Fetal weight			
	< 2.5 kgs (N=56)		> 2.5 kgs (N=152)	
	Minimum	Maximum	Minimum	Maximum
Length	27	74	38	82
Diameter	0.42	2.20	0.42	2.30

1. The mean umbilical cord length was 53.0 \pm 14.70 (SD) in fetal weight < 2.5 kgs with range of 27cm to 74cm and 52.86 \pm 15.413 (SD) in fetal weight >2.5 kgs with a range of 27 cms to 82 cms.
2. The mean umbilical diameter was 1.39 \pm 0.49 (SD) in fetal weight <2.5 kgs with range of 0.42cm to 2.20c and 1.54 \pm 0.43. with range of 0.42 cms to 2.3 cms .

Table 3: Student Test

Umbilical cord parameters	T-Test	P Value
Length	0.055	0.956
Diameter	2.147	0.033

Umbilical cord parameters and fetal weight were analysed with student 't' test and pearson correlation to find out the association between them.

Table 4: Correlation coefficient

	Cord Length	Cord Diameter
r value	0.106	0.667
P value	0.126	0.03

Corelation between umbilical cord diameter and fetal weight:

There was significant positive correlation between umbilical cord diameter and fetal weight ($r=0.667$, $p= 0.03$)

There was no significant correlation between umbilical cord length and fetal weight ($r=0.106$, $p= 0.126$)

Corelation between umbilical cord length and fetal weight



Figure 1: Materials for present study



Figure 2: Collected placental specimens for present study



Figure 3: Length of umbilical cord 45cms



Figure 4: Diameter of umbilical cord 2cms

Discussion

Umbilical Cord Length

In the present study the mean cord length was $53.01 \text{ cm} \pm 14.70 \text{ cm}$ (SD) in foetal weight $> 2.5 \text{ kg}$ with range of 38 to 82cm and 52.86 ± 15.41 (SD) (Table-1) in foetal weight $< 2.5 \text{ kg}$ with range of 27 to 74cm (Table-2). There was no significant correlation with fetal weight ($r=0.106$ $p=0.126$) (Table-4). This is higher than most of the reported averages in the literature, more than the 44.3 cm (SD 9.2) and $47.04 \text{ cm} \pm 12.8$ obtained by Gupta et al. (2006) and Abaidoo et al. (2008) respectively. A large majority of the cords were between 40 cm and 50.00 cm in length. [8-13] A mean cord length of 40cm as reported in the literature was used as a marker to differentiate between short cords and long cords (Gupta et al., 2006). Cords less than 40.0 cm were classified as short, whilst those greater than 40.0 cm were categorized as long. The prevalence of short cords in the present study was 30.7%. Although reference standards for cord length have been reported, variation exists in the definition of short cords. [14-17] The umbilical cord at term has been reported to have an average length of 55 to 60 cm and normal length in the range of 40-70 cm (Yetter, 1998) and cords of length up to 300cm have also been reported (Valsamakis et al., 2006). A study in Nigeria by Mutihir and Pam (2006) also indicated an average cord length of 52.9

cm (SD 7.3). Naeye (1985) adopted a cord length of 40 cm and Yetter (1998) adopted a cord length less than 40 cm. Considering the reported prevalence of Naeye (1985) who used comparable reference standard as the present study, it can be said that the 39.80 % prevalence in the present study I is not very high. [18]

This study also indicated that 66.8 % (139) of the umbilical cords fell within the range of 40-70 cm (Figure 3) whereas 2.4% were long ($>70 \text{ cm}$). This supports the assertion that normal cord length must be in the range of 40-70 cm (Yetter, 1998). Although it is not fully understood what controls cord length, various authors correlate cord length with foetal activity and movement. It is suggested that sufficient space in the amniotic cavity for movement and the tensile force applied to the umbilical cord during foetal movements are two main factors that determine cord length (Yetter, (1998); Benirschke (2004). According to Benirschke (2004), cords of fetuses that have severely diminished motions are remarkably short and twins have slightly shorter cords probably due to a reduced space for movement. [19]

In studying umbilical cord length as a correlate of perinatal outcomes, this study showed that cord length does not correlate significantly with birth weight ($r = 0.106$, $p < 0.126$). This is not in agreement with the finding by Wu et al. (1996) who found

that birth weight correlates significantly with cord length with no association between cord length and gestational period, birth length and Ponderal index.

Umbilical Cord Diameter

The mean cord diameter was 1.54 cm (SD 0.43) with a range of 0.4 to 2.3 cm in birth weight >2.5kg (Table-1) and 1.39±0.49 (SD) with range of 0.42 to 2.20cm (Table-2) there was significant positive correlation with fetal weight ($r=0.667$ $p=0.03$) (Table-4). This is similar to the finding of Collins et al. (2002), who reported that, on the average a normal cord has a circumference of 3.7 cm (diameter of 1.2 cm) and a range of 3 to 5 cm (diameter of 0.95 to 1.59 cm). According to Collins et al. (2002), cord diameter range of 1 to 3 cm can suggest oedema, tumor or hernia and that, cords with circumference greater than 6cm (D= 1.9cm) should prompt an examination of the umbilical cords and fetuses. The present study showed that about 77.4% of the cords had a diameter in the range of 1.0 to 2 cm (Figure-4). Yetter (1998), however, reported a diameter range of 2 to 2.5 cm. Cord diameter also correlated positively with birth weight ($r=0.667$ $p=0.03$) (Table-4).

Conclusion

The study on Umbilical cord length and diameter is of great importance because this is the key point from where information about the fetus can be gained. In the present study the higher incidence of normal cord length, in the range of 40-70 cm, suggests that 'normal' cord length should be between 40 cm and 70 cm in length. The present study also shows that cord diameter correlate positively with birth weight but not length. Correlation of cord parameters with perinatal outcomes suggests that antenatal detection of umbilical cord abnormalities may be useful in the detection of fetuses at risk for cord related complications.

Even though the best indicator of foetal weight is placental weight, the Critical examination of the umbilical cord immediately after delivery should be used to determine the wellbeing of the baby.

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