



VARIATIONS OF UMBILICAL CORD INSERTION IN NORMAL AND HYPERTENSIVE PREGNANCIES

Anatomy

**Dr K. Shashi
Kantha**

Assistant professor, Department of Anatomy, Kakatiya Medical College Warangal

Dr G Madhavi*

Assistant professor, Department of Anatomy, Kakatiya Medical College Warangal
*Corresponding Author

ABSTRACT

Pregnancy induced hypertension is associated with placental morphological changes and adverse fetal outcome. Insertion of umbilical cord to placenta varies from central, eccentric, lateral and marginal. Few more rare variations like Velamentous or furcate are also present.

Methodology: 50 placentae from normal uncomplicated pregnancy and 50 from pregnancy induced hypertension are collected and the types of variation in insertion of umbilical cord to placenta are observed.

Results: central and eccentric insertions are common in both groups. Marginal insertion is more prevalent in PIH group which is associated with IUGR& IUDs.

Hence ultrasound study of placenta and insertion of umbilical cord is useful to assess the outcome of pregnancy and to counsel about the PIH and its complications.

KEYWORDS

placenta, PIH, insertion of cord, IUGR

INTRODUCTION

The intrauterine existence of fetus is dependent on one vital structure 'THE PLACENTA'. Placenta is an important organ for maintaining pregnancy and promoting normal fetal development⁽¹⁾. Placenta is a special characteristic feature of higher mammals, which is connected to the fetus, through the umbilical cord. Placenta is the sole interface between mother and the developing fetus. It is a very active organ having specialized mechanism to promote fetal growth and survival. Umbilical cord is the source of contact between fetus and placenta⁽²⁾.

Umbilical cord is also referred to as funniculus umbilicalis or birth cord. It is a flexible structure that connects the developing embryo to the fetal surface of placenta. The umbilical cord delivers oxygen and nutrients to the developing fetus throughout pregnancy. Thus the growth of fetus is highly dependent on development of umbilical cord⁽³⁾.

Umbilical cord is normally inserted in the central portion of placenta well away from placental edge. Sometimes it shows eccentric insertion. Other less common types of insertion are marginal, velamentous and furcated. In furcated insertion, umbilical cord branch before its insertion to placenta⁽⁴⁾.

The umbilical cord is attached eccentrically to placenta but may also be inserted at any point between center and margin called battledore placenta. Development of umbilical cord can have the potential to affect the maternal and fetal wellbeing⁽⁵⁾.

Occasionally the cord fails to reach the placenta and ends in the membranes. This is called 'velamentous insertion'. The vessels transport through the membranes to the placenta. The cord may branch off before insertion on the surface of placenta resulting in a 'furcate'cord insertion⁽⁶⁾.

There can be several variations with cord insertion into the placenta:

- central insertion
- eccentric cord insertion: lateral insertion of the umbilical cord >2 cm from the placental margin
- marginal cord insertion : insertion of the umbilical cord <2 cm from the placental margin
- velamentous cord insertion : insertion of the umbilical cord on the fetal (chorioamniotic) membranes

Variations in the site of insertion of umbilical cords are explained by two different theories. First is "placental migration theory or trophotropism", in which the placenta migrates towards the richly vascularised area with advancing gestation to achieve better perfusion. Another is the "blastocyst polarity theory", which hypothesizes that abnormal cord insertion results from malpositioning of blastocyst during implantation⁽³⁾.

Abnormal cord insertion seems to be associated with impaired development and function of placenta. Thus influences fetal growth and has been linked to placenta previa and pregnancy induced hypertension⁽⁷⁾.

The umbilical cord anomalies adversely affect the fetal outcome, more so in cases of PIH, where fetus is already in danger zone. In early period of gestation, probability of identifying congenital anomalies is much higher with careful cord examination⁽⁸⁾.

All anabolics needed by fetus and catabolites of fetus pass through the umbilical cord; cord deserves attention right from first trimester. Even if placenta is normal, any anomaly of umbilical cord seriously affects the maternal and fetal outcome⁽⁵⁾.

The purpose of this study is to observe the variations in the insertion of umbilical cord in normal and hypertensive pregnancies.

MATERIALS AND METHODS

The material for the present study consists of placentae collected from 50 normotensive pregnancies and 50 hypertensive pregnancies. The placentae were collected from Government Maternity Hospital Hanmakonda, Warangal from September 2015 to March 2017.

Antenatal history, Case history and blood pressure recordings were obtained from the case sheets in the department. Those women who recorded blood pressure more than 140/90 for at least two times were taken as pregnancy induced hypertensive group.

Two groups are made.

- 1- Women with normal recording of blood pressure are grouped under normotensive group or control group.
- 2- Women with blood pressure more than 140/90 for atleast 2 times are grouped under pregnancy induced hypertensive group or PIH group or hypertensive group.

INCLUSIVE CRITERIA

Normal and hypertensive pregnancies

EXCLUSIVE CRITERIA

Women with hypertension and diabetes prior to pregnancy

COLLECTION OF MATERIAL

The placentae are collected along with membranes and umbilical cord soon after delivery. Placenta is washed under running tap water to remove the blood and blood clots. It is then stored in 10%formalin.

OBSERVATIONS

The placenta is placed in a flat tray with fetal side facing up. The mode in insertion of umbilical cord is noted and catogerised into 4 groups. Central, marginal, eccentric and velamentous.

The placentae are grouped and shown in the table as below.

Table 1

Groups	Central	Marginal	Eccentric	Velamentous	Total
Normal	30	11	8	1	50
Hypertensive	18	22	10	-	50

The common site of insertion of umbilical cord in normotensive group is central where as in hypertensive group the more common site is marginal.

The central insertion is found in 60% (30) in normotensive group as compared to 36%(18)in PIH group.

The marginal insertion is more common in PIH group 44% (22) compared to 22% (11) in normotensive group.

The eccentric insertion is more common in PIH group 22% (11) as compared to normotensive group 11%(8).

Velamentous insertion is found in one normotensive placenta.

We observed that marginal insertion is 2 times more in PIH pregnancies as compared to normotensive group.



Central insertion of umbilical cord



Marginal insertion of umbilical cord



Velamentous insertion of umbilical cord



eccentric insertion of umbilical cord

It is observed that there is no specific variation in the insertion of

umbilical cord with the number of parity.

DISCUSSION

Abnormalities in the placental attachment of umbilical cord have been associated with number of complications of pregnancy and fetal outcome due to compression or rupture of unsupported umbilical vessels. These abnormalities are also associated with IUGR and preterm labour⁽⁹⁾.

Whilst central and eccentric insertions presumably represent normalcy and have no clinical importance, marginal insertion has been suggested as being more susceptible to vessel rupture and associated with intrauterine growth restriction, still birth, and neonatal death⁽¹⁰⁾.

Not always but frequently, these anomalous insertions are associated with congenital anomalies like oesophageal atresia, obstructive uropathies, congenital hip dislocation, spina bifida, VSD, single umbilical artery and so on⁽¹¹⁾.

In the present study we have evaluated the variations in the insertion of umbilical cords in normal and hypertensive pregnancies in 50 normal and 50 hypertensive pregnancies.

The common site of insertion of umbilical cord in normotensive group is central where as in hypertensive group the more common site is marginal. The central insertion is found in 60% (30) in normotensive group as compared to 36% (18) In PIH group. The marginal insertion is more common in PIH group 44% (22) compared to 22% (11) in normotensive group. The eccentric insertion is more common in PIH group 22% (11) as compared to normotensive group 11% (8). Velamentous insertion is found in one normotensive placenta.

We observed that marginal insertion is 2 times more in PIH pregnancies as compared to normotensive group.

Udainia A. et al⁽¹²⁾ reported that commonest site of the insertion of the umbilical cord is eccentric in both normal and pre-eclamptic pregnancies. They found that as the severity of pregnancy induced hypertension increases, insertion of the umbilical cord becomes marginal to velamentous in nature.

In contrast to above, present study showed that the commonest site of insertion of the umbilical cord was central in normal pregnancies, whereas, in PIH pregnancies, marginal insertion is more common (table no 1).

Ankit jain et al⁽³⁾ in their study, showed that the commonest site of insertion of the umbilical cord was central in normal pregnancies, whereas, in pre-eclamptic pregnancies, central and eccentric insertion were found in almost equal proportion. They found that prevalence of marginal cord insertions was 2.11 times more in pre-eclamptic pregnancies as compared to normal pregnancies, where as in this study the proportion is 2 times.

CK Lakshmi Devi et al⁽¹³⁾ found in their study that, the normal and the associated anomalies with relevance to the attachment of the umbilical cord are central, eccentric, marginal and velamentous. Out of 50 placentae 29 are central, 10 are eccentric, 10 are marginal and one is velamentous insertion.

Wynn⁽¹⁴⁾ 1974 have studied 940 placentae and found that there is no correlation between the birth weight and site of cord insertion in normal term infants.

According to Heifitz S.A⁽¹⁰⁾ 1996 the incidence of central attachment in 90% of cases, Marginal 8.7% of cases and 1.2% of velamentous type.

According to Benirschke & Kaufmann⁽¹⁵⁾ 1995, 7% incidence of marginal insertion of the cord and also the incidence of velamentous insertion is 1.1% in the review of 1,95,000 cases of singleton deliveries. According to them the incidence of velamentous insertion of the cord is more frequent with twins and almost the rule with triplets. In the present study we found 1 velamentous insertion of placenta in a singleton pregnancy.

According to S. Pathak et al, the difference between extreme eccentric umbilical cord insertion and marginal cord insertion may be small, but this differentiation may be important, as eccentric umbilical cord

insertion is the most common type of umbilical cord insertion in pregnancies with normal outcome while some studies have shown an increased incidence of marginal umbilical cord insertion in pregnancies with adverse outcomes such as miscarriage, fetal congenital anomalies, preterm labour and intrauterine growth restriction, with an increased incidence of marginal cord insertion in pregnancies with IUGR⁽¹⁴⁾.

Rath G. et al⁽¹⁷⁾ reported that marginal cord insertion is associated with hypertensive pregnancies. In their study, the marginal attachment of umbilical cord was seen in 27%, which is higher by 7% as noted by Perceival (1980). They classified the insertion of umbilical cord in to 4 categories wide central, medial, lateral and marginal. They found that the distribution of four categories of insertion of umbilical cord is almost equal in normotensive group and even amongst the mild and moderate hypertensive subgroups the distribution of four categories is almost similar. Only in the severe hypertensive cases the marginal attachment of umbilical cord was the highest with 42%.

Prabhjot kaur et al⁽¹⁸⁾ found that common sites of umbilical cord insertion are central or eccentric in both PIH and normotensive cases. They also observed that sites of insertion were almost same in both PIH and normotensive placentae, but in PIH placentae, marginal cord insertion was related to poor fetal outcome (8 IUGR and 5 IUDs).

Majumdar et al⁽¹⁹⁾ noticed significant increase in the incidence of marginal insertion in hypertensive group than in normal group by 15%.

CONCLUSION

A comparative study of variations in the insertions of umbilical cord is made between normal and PIH pregnancies. Present study emphasizes that central and eccentric insertions are more common both in normal and PIH pregnancies. Marginal insertion is more frequently found in PIH group. The marginal insertion is more frequently associated with poor fetal outcome such as IUGR and IUD.

Status of maternal vasculature is important for the growth of fetus. The hypertensive disorders of pregnancy restrict the blood supply to the placenta and thus cause impaired capacity of placenta to provide nutrients to the fetus leading to IUGR and IUD.

Study of insertions of placenta should be done in larger numbers and ultrasound imaging of placenta should be done to recognize insertion of placenta by which counseling can be done regarding future complications like PIH which leads to IUGR and IUD.

Abbreviations

PIH- pregnancy induced hypertension, **IUGR-** intra uterine growth retardation, **IUD-** intra uterine death, **VSD-** ventral septal defect.

REFERENCES

1. Udainia A and Jain ML, Morphological study of placenta in pregnancy induced hypertension with its clinical relevance J Anat Soc india 2001; 50(1):24-27
2. Sadaf Tufail, Sobia Nawaz, Maliha Sadaf, and Shagufta Saeed Sial Association Between Battledore Placenta and Perinatal Complications Journal of Rawalpindi Medical College (JPMC); 2012; 16(2):159-161
3. Ankit jain, sonia baweja, rashmi jain. study of the placental attachment of funiculus umbilicalis in normal and preeclamptic pregnancies and its effects on birth weight. int j anat res 2017, 5(1):3535-40. issn 2321-4287
4. Singh I and Pal, G P. Human Embryology. 8th ed. India, Macmillan Publishers India Ltd. 2009, pp59-75
5. Cunningham FG, Leveno KJ, Bloom SL et al, Williams Obstetrics, 22nd edition, newyork: Mcgraw hill; 2005. 68-69, 626-9
6. Standring & Johnson D Ellis :Churchill livingstone, Elsevier: GRAYs anatomy the anatomical basis of clinical practise 40th edition 292-94
7. Cathrine Ebbing, orvid Kiserud, Synnøve Lian Johnsen, Susanne Albrechtsen, Svein Rasmussen Prevalence, Risk Factors and Outcomes of Velamentous and Marginal Cord Insertions: A Population-Based Study of 634,741 Pregnancies PLOS ONE | www.plosone.org 7 PLOS ONE | www.plosone.org 7 July 2013 | Volume 8 | Issue 7 | e70380
8. Kinare A. Fetal environment. Indian J Radiol Imaging 2008, 18 (4), 326-344
9. V. Manikanta Reddy, SP Geeta, et al, J Anat. Soc, India 61(1) 1-4 (2012)
10. Heifetz. SA, The umbilical cord : obstetrically important lesions, clin obst gynaecol 1996;39(3):571-87
11. Robinson LK, Jones KL, Benirschke K, the nature of structural defects associated with velamentous and marginal insertion of the umbilical cord. Am J Obstetric Gynecol 1983; 146: 191-193
12. Udainia A, et al., Relation between umbilical cord insertion and foetal outcome in pregnancy induced hypertension. (International Journal of Basic and Applied Medical Sciences). 2014 Jan;4(1):332-7
13. C.K.Lakshmi devi, Shashank Neelam, N.S.Raghupathy IOSR-IDMS e -ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 6, Issue 3 (May- Jun. 2013), PP09-15
14. Wynn, R.M., 1974, Ultrastructural development of human decidua. Am: J. obstet. Gynaecol 118: 652 – 670.
15. Benirschke, K., Kaufmann, P. 1995, Pathology of the Human Placenta 2nd ed, pp 1-79. New York, Springer – Verlag,
16. S. Pathak et al. / Placenta 31 (2010) 963-968
17. Rath G, Garg K and Sood M. Insertion Of Umbilical Cord On The Placenta In Hypertensive Mother, J Anat. Soc. India 49(2) 149-152 (2000)
18. Prabhjot kaur et al. To Study Relationship of Umbilical Cord Insertion with Fetal Outcome in PIH and Normotensive Pregnancies, int.J. Pure. Appl Biosci. 2(6):108-111(2014)ISSN:2320-7051
19. Majumdar S, Dasgupta H, Bhattacharya K, Bhattacharya A, A study of placenta in normal and hypertensive pregnancies J. Anat. Soc. India 54 (2) 1-9 (2005)