ANALYSIS OF LITERATURE SIGNIFYING IMPORTANCE OF UMBILICAL CORD COILING INDEX ON PERINATAL OUTCOME

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SOURCE:

SHARMA.B, BHARADWAJ.N,GUPTA.S,VERMA.A."Association of umbilical coiling index by colour doppler ultrasonography at 18-22wks of gestation and perinatal outcome", THE JOURNAL OF OBSTETRICS AND GYNAECOLOGY OF INDIA,December 2012,VOL.62.NO.6,pp 650-654,viewed OCTOBER 2013.

This review, reviews the article` Association of umbilical coiling index by colour doppler ultrasonography at 18-22wks of gestation and perinatal outcome'. This review will initially summarize the article. Then it is intended to analyse the article structure and find out the methods of investigation and whether the informations are clearly evident to the reader. Finally, the review will critically analyse the article and evaluate its authority, accuracy, updation , objectivity and coverage. The review will analyse the images, the tables before judging the articles accessibility and credibility. The article to be reviewed has been written very clearly and is clinically very relevant and innovative.

ARTICLE SUMMARY:

The article explores the pregnancy outcomes in relation to the distances between the coils in the umbilical cord, as detected in prenatal ultrasound. The outcomes that were considered were birth weight, mode of delivery, meconium staining of liquor, apgar scores of babies and gestational age of the foetus at the time of delivery. The article thus introduces a non invasive method of investigation to predict a few morbidities like preterm delivery, fetal distress, chance of caesarean section and admission in neonatal intensive care unit. The study was conducted in 600 uncomplicated pregnant mothers who had singleton pregnancies in whom the above pre natal complications, when occur, are otherwise unexplainable.

The article concludes that abnormal coiling was strongly associated with prenatal morbidities, especially low birth weight. The article leaves room for further researches towards assessment of underlying pathologies associated with normal and abnormal coiling of umbilical cord.

ARTICLE STRUCTURE:

The article commences with an abstract. The abstract provides a brief overview of the objectives of the study, the methods of investigation, statistical analysis and the results.

The introduction of the subject for assessment is very clear. The purpose of the study has been clearly defined. The methods undertaken in the study has been described in short paragraphs and in simple language and hence easily discernible. The tables provide a clear picture of the distribution of patients and the outcomes studied. The results have been depicted with clarity. The discussion relates the results to a few studies done before. The number of studies quoted are few and this may be due to the innovative topic of research with few past references only.

The conclusion developed at the end of the article is very short. The conclusion has not summarised the positive findings. It has neither provided information about avenues for future research which would further substantiate the findings extrapolated in the study. References were cited in text and set out clearly in the literature cited section The references were few, probably due to the fact that the earliest reference dates back only to 1995.

In effect, the article's structure has been developed well with the use of short paragraphs simple language, clear images and discernible tables.

ARTICLE CRITIQUE:

Authority:

The journal, The Journal of Obstetrics and Gynaecology of India, is an official publication of "The Federation of Obstetrics & Gynaecological Societies of India" It is a peer reviewed journal indexed in med INDIA.

The author's credibility has been well established. One of the authors is a Professor and Head of the Radiology Department of a Medical College, two of the authors are Associate Professors of the Department of Radiology and Obstetrics & Gynaecology of the same college. One of the author is a resident doctor who has had the opportunity to have the able guidance of the eminent professors.

Accuracy:

The hope of research is an innovative, non invasive approach to predict perinatal morbitities. It is a much sought after current topic and the article has been well supported by national and international references.

Currency:

The research was done in 2011. The article was accepted for publication in June 2012. It was published in this Journal in December 2012. The research topic is a novel one with only a few references. The references date from 1995-2006. Hence the article is current and has recent updates.

Relevance:

The article shows focused research in the association of umbilical coiling index and perinatal outcome. The important perinatal morbidities like birth weight, mode of delivery, meconium staining of liquor, apgar scores and gestational age at delivery has been addressed. The normal umbilical coiling index has been compared with increased and decreased coiling to emphasize greater degree of significance in associations. The article, hence, bears great relevance to the topic.

Objectivity:

The information in the article has been objectively developed. The description of measurement of umbilical coiling index has references dating back to 1995. There was no evidence of bias as the research methods tended to analyse normal coiling, over coiling and under coiling. The statistical methods adopted for analysis were also standard. The participants were clearly defined – 600 primigravida with uncomplicated singleton pregnancies. Thus bias, due to pregnancy complications like anemia, hypertensive disorder of pregnancies, diabetes mellitus – both pregestational and gestational, has been negated. The literature review has supported the research results.

Stability:

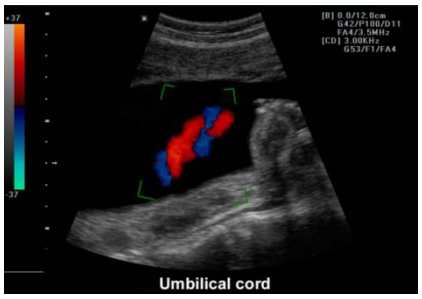
The article has been published on the Journal of Obstetrics and Gynaecology of India, which is the official journal of Federation of Obstetrics and Gynaecological Societies of India. It is also peer reviewed Journal indexed in medINDIA. The editors of this journal are senior professors in the field of Obstetrics and Gynaecology, who are renowned academicians, who have authored chapters in standard text books.

ANALYSIS OF IMAGE/TABLE

The colour Doppler images of the umbilical cord showing varying degrees of coiling are clear depictions of normal and abnormal coiling of umbilical cord. The images were self descriptive.

The tables are self explanatory as well. The association of abnormal coiling with certain morbidities has been shown clearly but details like the indications for caesarean section and whether they were directly related to the presence of abnormal coiling has been left to be speculated.

The normal umbilical cord coil index is one coil/5 cm, i.e., 0.2 +/- 0.1 coils completed per cm. The antenatal



umbilical cord coiling index is calculated as a reciprocal value of the distance between a pair of coils (antenatal umbilical cord coiling index = 1/distance in cm) The above picture shows normal coiling of umbilical cord.

The normal umbilical cord coiling index (UCI) is 0.17 (+/- 0.009) spirals completed per cm.

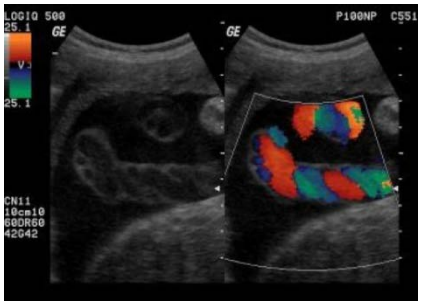
The above picture depicts both normal(UCI-0.17) and hypocoiling ,that is,UCI <0.07.

Abnormal cord coiling, i.e. UCI <10th centile (<0.07) or >90th centile (>0.30) is associated with adverse pregnancy outcome.

Hypocoiling of the cord is associated with increased incidence of fetal demise, intrapartum fetal heart rate decelerations, operative delivery for fetal distress, anatomic-karyotypic abnormalities and chorio-amnionitis.

This picture shows severe hypocoiling.

Hypercoiling of the cord is associated with increased incidence of fetal growth restriction, intrapartum fetal



heart rate decelerations, vascular thrombosis and cord stenosis. This picture shows hypercoiling of umbilical cord (UCI >0.30)

RECENT ADVANCES RELATED TO THE TOPIC:

Pathophysiological significance of abnormal umbilical cord coiling index

In this study, Cromi *et al*. report that sonographic assessment of cross-sectional umbilical cord area can predict fetal macrosomia1. This is the latest of numerous recent studies that have investigated the possible relationship between umbilical cord characteristics and fetal outcome, including cord thickness, but particularly in relation to umbilical cord coiling. The phenomenon of coiling of the vessels within the umbilical cord in a regular helical pattern has long been recognized, but its precise underlying causative mechanism and presumed developmental benefit remain uncertain.

In the pathology literature, focal tight twisting of the umbilical cord has been associated with a proportion of intrauterine deaths, although the clinical significance of this association has remained unclear. Some have suggested that focal coiling is a consequence, rather than a cause, of intrauterine demise, whereas others have postulated that the overcoiled cord may in itself be a contributory factor to fetal death2.

Numerous investigators have recently attempted to study further the relationship between the coiling pattern of the umbilical cord and a range of pregnancy complications, with initial studies focusing on the association between undercoiled cords and adverse outcomes3,4. Several subsequent larger pathological studies, based on examination of the delivered placenta, have confirmed these associations and, in conjunction with the recognition that umbilical cord coiling could be determined antenatally by ultrasound examination5, 6, additional reports have suggested a relationship between extremes of abnormal cord coiling and diverse adverse pregnancy outcomes 3–17.

This Opinion aims to place such findings in context and provide a summary of the current state of knowledge regarding cord coiling and pregnancy outcome. The generally accepted method of assessing the degree of the umbilical cord coiling is by calculation of the umbilical coiling index (UCI), defined as the number of complete coils per centimeter length of cord3. Using this criterion, studies to date have been remarkably consistent in reporting of the normal UCI, which is around 0.2 in the postpartum setting following examination of the delivered placenta and umbilical cord (pUCI) and 0.4when determined antenatally by sonography (aUCI)18,19.

This apparent discrepancy, with increased coiling identified *in utero*, presumably is simply a reflection of the fact that the umbilical vessels are distended with fetal blood antenatally and this simple mechanical distension will result in a tighter apparent coiling of helical vessels. In order to compare the results of various studies, undercoiled/hypocoiled cords have been defined as those with an UCI <10th centile, whereas overcoiled/hypercoiled cords are defined as those with an UCI >90th centile. Such studies have determined that the degree of cord coiling can be reliably identified sonographically from the first trimester and that the UCI is related to gestation and the site of sampling (coiling being greater towards the fetal end of the cord)20. The mechanism by which physiological coiling occurs still, however, remains undetermined, with speculation that it may be related to early fetal activity and hemodynamic factors (supported by the finding of increased coiling in the recipient twin in twin-to-twin transfusion syndrome), or other anatomical issues such as the presence of Roach muscle21,22.

Although an association between the aUCI and pUCI is present, which is not surprising as both are a measure of the same phenomenon, antenatal sonographic determination of UCI has a low sensitivity (40%) for predicting the presence of undercoiling or overcoiling as determined by postnatal cord examination16. Therefore, it appears that the antenatal and postnatal coiling indices may not represent measurements of exactly the same process (see previous comment regarding vascular distension *in utero*); some cases that appear overcoiled or undercoiled on antenatal examination are within the normal range after delivery, and vice versa.

Nevertheless, despite these findings of apparent discordance, numerous studies have reported a range of adverse outcomes in association with abnormal cord coiling, detected either prenatally or postnatally (Tables 1 and 2). Essentially,it appears that hypocoiled cords are predominantly associated with an increased frequency of intrauterine death, low Apgar score, the presence of fetal congenital anomalies such as trisomies, and other abnormalities of placental development such as velamentous insertion and presence of a single umbilical artery. Such undercoiled cords are not generally associated with intrauterine growth restriction, fetal acidosis or asphyxia.

Hypercoiled cords also appear to be associated with fetal abnormalities such as trisomies and single umbilical artery. However, in contrast to undercoiled cords, they are not associated with an increased likelihood of intrauterine death or low Apgar score, but rather show an association with intrauterine growth restriction, fetal acidosis and asphyxia. Although there are differences in the precise associations and their magnitude, these findings appear fairly consistent across studies, both antenatal and postnatal. Given that such data exist, the question arises as to whether

these are simply associations with no pathophysiological significance or whether the cord coiling pattern can lead directly to adverse pregnancy outcome.

Mechanisms by which this could be mediated include the possibility that undercoiled cords may be more susceptible to acute kinking and therefore abrupt and marked cessation of blood flow; in the case of hypercoiled cords, flow dynamic principles and studies suggest that flow through a coiled tube should be associated with greater resistance to flow than through a straight tube23.However, a study examining the relationship between a UCI and Doppler flow indices reported that increasing aUCI is in reality related to increased umbilical vein flow and reduced umbilical artery resistance24. Furthermore, mechanical data indicate no difference in the effect of kinking according to UCI, but clearly demonstrate that greater cord coiling is associated with increased susceptibility to external compression-related reduction of flow25,26. Therefore, it appears that increasing UCI may be potentially beneficial by increasing umbilical blood flow, probably as a result of localized pulsometer effects, but further increased coiling may predispose to compression mediated flow reduction and possible predisposition to the development of fetoplacental vascular thromboses17.

In summary, it can be concluded that the majority of pregnancies with overcoiled or undercoiled umbilical cords, as determined by assessment of UCI, have a normal outcome. However, there appear to be consistent and clinically significant associations between abnormal coiling and a range of adverse pregnancy outcomes. Hypocoiled cords are mainly associated with intrauterine death, fetal anomalies and abnormal insertion; they are therefore likely to represent a marker of underlying intrinsic abnormal development, and are also possibly associated with an increased risk of acute reduction in blood flow due to kinking.

Hypercoiled cords,in addition to being possible markers of abnormal development, are associated with other complications including intrauterine growth restriction, fetal acidosis and asphyxia. No conclusive hemodynamic mechanism to explain these associations has yet been determined but such overcoiled cords may be at increased risk of causing embarrassment to fetoplacental flow in association with external compression, such as nuchal coiling.Further studies are necessary to explore such mechanisms.At present, fetal medicine practitioners and perinatal pathologists should continue to record and investigate clinical features associated with abnormal cord coiling patterns but, on the basis of currently available data,should remain cautious in assigning causality of any adverse outcome purely on the basis of the UCI.

CONCLUSION:

The article that has been reviewed deals with an innovative topic –Association of umbilical coiling index determined prenatally with colour Doppler and perinatal outcome. The study has been done on 600 uncomplicated primigravidas recruited at 18-22 weeks.

The association of umbilical cord coiling index in these uncomplicated primigravidas with adverse perinatal outcomes has been described. It has not been elaborated as to whether all the 600 primigravidas recruited in 2nd trimester remained without complications till term or delivery.

So if pregnancy complication had occurred, the adverse outcomes could well have been related to the antenatal complications, which have not been detailed. The article structure, otherwise, has been developed well. The images and tables reflect the analysis done with clarity. The statistical methods used for analysis were standard methods and literature review supports the research results.

The article in effect reflects the validity of a non invasive test to predict adverse perinatal outcome. Noninvasive investigation are generally preferred in obstetric practice. As the recruitment of patients has been done in the second trimester, it gives room for appropriate interventions and prevention of perinatal morbidities.

Future research to substantiate the results would be a boon to Obstetricians to offer preventive measures and ensure good maternal and fetal outcome. The etiopathology leading to abnormal coiling indices and the underlying pathophysiology in abnormal coiling causing adverse perinatal outcomes need to be researched and validated as well.

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