

The correlation of intraoperative findings and foetal outcome in cases taken for caesarean section based on non-reassuring cardiotocographic changes-A review article

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ABSTRACT

An essential role played by cardiotocography (CTG), is promptly detecting non-reassuring foetal status during delivery, as these abnormal changes are a prime reason for women to undergo a caesarean section. But all abnormal changes in cardiotocography does not lead to poor outcome in terms of liquor that was meconium stained or a low APGAR score at birth. As a result, research is the need of the hour, to understand their correlation; hence, showing the benefit of CTG in the precise detection of non-reassuring foetal status is correlated from the intraoperative findings discovered later. This review article aimed to see if there was a link between perioperative findings and foetal consequences in women who had a caesarean section due to foetal condition, which was not reassuring according to cardiotocographic findings.

Keywords: APGAR, cardiotocography, cord around neck, meconium-stained liquor, non-reassuring foetal heart rate, non-reassuring foetal status

Introduction

Considerable trials that obstetricians get daily are the aim of delivering, for every labouring woman, a healthy infant while simultaneously avoiding unnecessary caesarean sections. A review of this topic is necessary because if this aim is not reached, then the doctor and the affected party cross-question the tools and reports of monitoring methods of labour thus used, like non-reassuring foetal heart rate (NRFHR) on cardiotocography (CTG).^[1]

Therefore, in this article, we review one of the tools used extensively for monitoring foetal heart rate (FHR) in delivery, viz cardiotocography. The non-reassuring cardiotocographic traces will then be assessed for their reliability in predicting hypoxic changes in the foetus in terms of intraoperative findings during caesarean section and foetal outcome.

Cardiotocography is a simple, non-intrusive way of assessing foetal status in labour. During parturition, 'non-reassuring foetal state' (foetal distress) caused by foetal hypoxia is a leading cause of severe perinatal outcomes such as stillbirth, neonatal mortality, cerebral palsy and seizures.

As a result of hypoxia occurring during delivery, foetal^[2] outcomes in terms of morbidity and death may occur. Various mechanisms,

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which can cause altered oxygenation, interfering with the arteriovenous supply of uteroplacental circulation, are constriction of the foetal cord during delivery and pressing of unmoulded head on the lower pole of the uterus which damages the embryonic brain's key centres. Lactic acidemia caused by perpetual and excessive hypoxia with anaerobic metabolism within the foetus worsens acidosis and thus NRFHR surveillance during the process of delivery is one of the most important signs for performing an urgent caesarean delivery to avoid ischaemic crisis leading to morbidities in the neonate.^[3]

As labour is itself a state of stress to the foetus, uterine contractions sometimes may adversely affect the foetus, especially in an already^[4] compromised state of poor placental reserves, oligohydramnios, meconium-stained liquor or cord around the neck or iatrogenic uterine hyperstimulation with injudicious use of prostaglandins and oxytocin.^[5]

Intraoperatively some discoveries like meconium-stained liquor, cord around the neck, uterine rupture or placental abruption among other things discovered later will be correlated with foetal hypoxia that is expressed by NRFHR recorded.

So correlating the need for a caesarean section based on non-reassuring changes in non-stress test (NST) with intraoperative findings as described above further potentiates the caesarean section that has taken place.^[6]

Innumerable studies have been conducted worldwide to establish the relation between non-reassuring foetal status on cardiotocography and intraoperative findings during caesarean section. With these issues in mind, we undertake this study with the aim to correlate discoveries made intraoperatively and the outcome of the foetus after a caesarean section taken up in an emergency for NRFHR.

Aim

This article aimed to study the correlation of intraoperative findings (like meconium-stained liquor, cord around the neck of the foetus, etc.) and foetal outcome (like APGAR score at birth and 5 min, neonatal intensive care unit (NICU) admission) in women undergoing an emergency caesarean section (C-section) for non-reassuring on cardiotocography.

Materials and Methods

A scoping review literature search of databases of PubMed, Web of Science, Embase, Medline and Cochrane was carried out.

Review of literature

Cardiotocographical changes

Due to unavoidable human errors in manual monitoring of foetus in labour, CTG is used instead, as it is a non-intrusive and recordable method.

In everyday hospital practise, continuous CTG monitoring in parturition was started with the assumption that it would decrease infrequent but dangerous scenes like the death of the foetus in the perinatal period and hypoxic injury in the brain in the neonatal period. It is of utmost importance to recognize the FHR pattern and the link between uterine contractions and FHR abnormalities.

After admission to the labour ward, during the active period of labour, a continuous CTG graph is performed. In labour, stress is caused by the contracting uterus on the circulation of the placenta. This defect in placental circulation is taken up by the brain of the foetus with the help of stimuli like baroreceptors, chemoreceptors among others. This affects the foetal heart and changes its rate. These differences in FHR are logged on cardiotocographic graphs.^[7]

We can evaluate the CTGs with a simple but classified perspective. Four signs of FHR alterations are examined, viz.:

- a) Accelerations
- b) Deceleration
- c) Baseline rate
- d) Variability

Furthermore, they are then categorized as normal, suspicious or pathological according to National Institute for Health and Care Excellence (NICE) guidelines for proper management. CTG can be evaluated electronically to augment the treating doctor's findings with a more objective perspective.

Therefore, CTG is a foetal test done in the intrapartum period that may be used to determine if early delivery is necessary to prevent foetal and newborn complications by considering the aberrant aspects of CTG individually.^[8]

Intraoperative findings

Certain intraoperative findings like cord around neck, meconium-stained liquor, macroscopic placenta abruption, uterine rupture and oligohydramnios may contribute towards non-reassuring foetal status on CTG.

A) Umbilical cord entanglements

The occurrence of an umbilical cord around the neck varies from 5% to 37%. One of the most typical discoveries at birth is the umbilical cord wrapped around the neck.^[9]

Several major umbilical cord malformations have been linked to intra and post-delivery problems, stillbirth and foetal growth reduction. Cord entanglements disrupt the blood flow in the umbilical cord either directly or indirectly during foetal descent, resulting in a momentary halt of cord blood flow.^[10]

B) Meconium-stained liquor

Foetal hypoxia, stimulation of the vagus nerve, the normal physiological function of a mature foetus, mesenteric

vasoconstriction-driven gut hyperperistalsis and declining umbilical venous saturation are all thought to cause meconium transit from the foetal digestive tract and lead to meconium-stained liquor. In most cases, an infant passes meconium within the first 2 days of life, which is a naturally planned phenomenon. But some foetuses, however, pass meconium before delivery. In roughly 12–14 per cent of all pregnancies, liquor is stained by meconium. According to reports, meconium contamination in amniotic fluid might be a warning of imminent hypoxia. As a result, acute respiratory difficulties and meconium aspiration may occur. Meconium aspiration syndrome (MAS) can cause infant mortality, and in up to 25%, long-duration respiratory impairment is a possibility.

As the gestational age rises (above 42 weeks), the proportion of umbilical cord around the neck and meconium-stained liquor rises.^[11]

C) Macroscopic placental abruption

The Latin phrase *abruptio placentae* refers to the partial or total separation of the placenta from its site of implantation before the birth of the foetus. Haemorrhage into the decidua basalis is the first thing that occurs in placental abruption. The decidua divides and the myometrium is left with only a fine sheet of its remnants. The decidual haemorrhage then grows, creating detachment and stress on the surrounding placenta. Even in the presence of ongoing bleeding and placental detachment, *abruptio placentae* may comprise either the partial placenta or the entire placenta. Placental abruption can be entire or partial even if there is ongoing bleeding and placental detachment. Blood is often trapped between the separated placenta and the uterus, causing occult bleeding and a delay in detection. The longer the wait, the higher the risk to the mother and foetus. On clinical suspicion, an abruption is visible on a freshly delivered placenta as a confined indentation on the maternal surface. Severe abruption is described by Ananth and collaborators (2016) as demonstrating one or more of the following: (1) Consequences in the mother such as disseminated intravascular coagulation, shocks, infusion, hysterectomy, failed kidneys or demise;

(2) Prenatal issues such as unreliable foetal status, growth restraint or mortality; or

(3) Neonatal consequences like mortality, premature birth or growth restraint.^[12]

D) Oligohydramnios

The quantity of amniotic fluid in the womb is scanty. Nearly 1% to 2% of pregnancies are affected by oligohydramnios. The term anhydramnios is used when no appreciable pocket of amniotic fluid is found. Oligohydramnios has been linked to poor birth outcomes. Those with oligohydramnios had a higher risk of foetal defects. Miscarriage, growth retardation, a non-reassuring FHR

pattern and MAS were all worse in affected pregnancies than in non-affected pregnancies.^[13]

Foetal outcome

‘The American College of Obstetricians and Gynaecologists and the American Academy of Paediatrics’ both approve APGAR grading as the standard evaluation technique.

Colour, heart rate, reflexes, muscular tone and breathing are all factors in the APGAR score.

All infants’ scores are noted at 1 and 5 min, with prolonged recording at 5-min interim for infants who score seven or less at 5 min and those who require resuscitation as a way of response surveillance.^[14]

Rising caesarean section incidence

For the last decade, the foetal non-reassuring state has been the most prevalent reason for a caesarean section. The determination of foetal non-reassuring state based on anomalies in the FHR observed by electronic monitoring of the foetus has resulted in a high proportion of caesarean births with no detrimental effects on the foetuses. The increased rate of caesarean sections for foetal distress can be related to the universal utilization of CTG for precisely detecting FHR alterations. However, not all foetuses with an aberrant FHR pattern observed by cardiotocography have an unfavourable birth result.^[15]

Some studies found related to this review article are as follows:

Intraoperative findings in the primary caesarean section for non-reassuring foetal status and its correlation with cardiotocography Nisha Bhatia*, Krishna Kumari M stated that cardiotocography is an essential non-invasive tool in monitoring intrapartum events. CTG abnormalities such as decelerations and decreased beat-to-beat variability are significantly associated with the presence of meconium-stained liquor and low APGAR at birth. Hence, the introduction of a non-invasive, universally acceptable and cost-effective method to diagnose intrapartum non-reassuring foetal status to bridge the gap between a cardiotocographic trace and the decision of emergency caesarean section is the need of the hour.

Role of cardiotocography in early detection of abnormal foetal heart rate patterns and their effect on perinatal outcome. A study conducted along the same lines concluded that labour is a state of physiological stress leading to acidaemia. It might become pathological if not monitored during the intrapartum period and a timely decision for delivery is not taken. Intrapartum foetal surveillance can best be done by electronic foetal monitoring (EFM) by cardiotocography. Cardiotocography is a useful monitoring tool for FHR monitoring during both antepartum and intrapartum periods for the best perinatal outcome. CTG abnormalities of category B with prolonged bradycardia, decelerations and decreased variability are

significantly associated with the presence of meconium-stained liquor, cord around the neck, oligohydramnios, placental infarction and low APGAR score at birth. Hence, it is proven in this research that CTG patterns are highly predictive of foetal hypoxia. However, CTG tracings should be properly interpreted, proper resuscitation measures taken, then reevaluation done as a whole. This will minimize unnecessary caesarean sections; all the same, cases of foetal distress should be picked up in time so that foetal outcome is improved many times.

Intraoperative findings, placental assessment and neonatal outcome in emergent caesarean deliveries for non-reassuring foetal heart rate Eran Weiner a, *, Jacob Bar a, Nataly Fainstein a, Letizia Schreiber b, Avi Ben-Haroush c, Michal Kovo said that in conclusion, the mechanisms that participate in the development of foetal hypoxia expressed by NRFHR monitoring necessitating emergent caesarean delivery (ECD) are different, and probably equally effect adverse neonatal outcome. In about half of them probably an acute event occurred, mainly involving the umbilical cord, and can be identified during the operation. In the remaining half, underlying placental compromise may be the contributing factor.

Abnormal cardiotocographic findings and perinatal outcome: a prospective study by Maitrayee Sen¹, Sunita Samal^{1*}, Sajal Datta², Melvin George³ concluded that the abnormal FHR features in a CTG (RCOG 2001) were related to the adverse perinatal outcomes, meconium staining of liquor, APGAR score 10 days. The specificities and sensitivities of each abnormal heart rate feature to detect adverse perinatal outcomes differ when considered individually. Large study samples and the addition of current modalities of intrapartum foetal monitoring can reduce the limitations of our study. Therefore, abnormal FHR features in an intrapartum CTG of a labouring mother >37 weeks can detect fetuses in distress with different sensitivity and specificity when considered individually.

The association between umbilical cord abnormalities and the development of non-reassuring foetal heart rate leading to emergent caesarean deliveries E Weiner¹, N Fainstein¹, L Schreiber², R Sagiv¹, J Bar¹ and M Kovo stated that in conclusion, umbilical cord (UC) abnormalities and mostly multiple UC entanglements are associated with the development of NRFHR and adverse neonatal outcome. The mechanisms that participate in the development of foetal hypoxia leading to NRFHR involve placental and UC macroscopic and microscopic abnormalities.

The umbilical cord complications of true knots, nuchal coils and cords around the body - Report from the collaborative study of cerebral palsy w. n. spellacy, m. d. h. gravem, b. a. r. 0. fisch, m. d. Minneapolis. Minnesota wrote in summary, it was found in a review of 17,190 deliveries, that in the cord complications, true knots occurred in 1.05 per cent, nuchal coils occurred in 24.6 per cent and cord around the body in 2.0 per cent. The incidence of these three cord complications is not related to

maternal age, parity or other congenital malformations, but was increased in Caucasian women and when there were long umbilical cords. They were less frequently associated with small infants and small placentas. There was an increased incidence of abruptio placentae with cords around the body. There was a lower 1 min APGAR score with these cord complications, but no difference was found in the 5 min APGAR scores or in the 1-year neurological examination in comparison with the control group. The APGAR score was lower at 1 min when the cords were pulled tightly around the neck than when they were loose. Stillbirth deliveries were associated with a higher incidence of true cord knots.

Correlation of meconium-stained liquor with cardiotocography and its foetal outcome Anam Khusrau Khan¹, Sandhya Pralhad Pajai state that increasing grades of meconium-stained liquor were associated with cardiotocography abnormalities. Increasing grades of meconium-stained liquor and cardiotocography abnormalities were associated with increased operative interference. Increasing grades of meconium-stained liquor and cardiotocography abnormalities were associated with low APGAR scores at 1 min and 5 min, increased need for NICU admissions, longer duration of NICU stay and neonatal morbidity and mortality.

Clinical foetal monitoring Richard H. Paul, James R. Huey Jr and Carl F. Yaeger. The perinatal patients who most benefited from intrapartum monitoring were those with a birth weight of 1,500 g or less. The monitored foetus apparently enjoys an enhanced survival over its unmonitored counterpart. In addition to mere survival, long-term benefits may include the prevention of brain injury, since foetal damage short of death should also be avoidable. The desirability and need for a well-designed perinatal study with long-term follow-up to further evaluate the role of clinical monitoring are evident.

Conclusion

Labour is a state of physiological stress leading to acidemia, which might become pathological if it is not monitored during the intrapartum period and consequently a failure to take a prompt decision for delivery occurs. Intrapartum foetal surveillance can best be done by EFM by cardiotocography.^[16] CTG abnormalities of category B with prolonged bradycardia, decelerations and decreased variability are significantly associated with the presence of meconium-stained liquor, cord around the neck, oligohydramnios, placental infarction and low APGAR score at birth. So, abnormal FHR features in an intrapartum CTG of a labouring mother are portrayed in different foetus distress patterns. So through this study, we identify which abnormal FHR pattern needs immediate attention with a caesarean section and which can be delayed so that an operative intervention can be prevented and normal vaginal delivery can be performed.^[17]

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Conflicts of interest

There are no conflicts of interest.

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