Fetal Outcome in Pathological Cardiotocography

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ABSTRACT

Objective: To determine fetal outcome in patients having pathological CTG.
Study design: Descriptive case series.
Setting: Dept of Obs & Gynae Hameed Latif Hospital, Lahore
Duration: Six months from 7th may 2009 to 8th Nov 2009
Subjects: Women were included in the study if 20-35 years of age with any parity and having Gestational Age ≥37 weeks by dating scan.
Conclusion: Fetus having apgar score at (5min) <7 are less likely to develop pathological CTG and as compared to those having apgar score greater than 7 (at 5min)
Keywords: Cardiotocography, fetal outcome,

INTRODUCTION

Cardiotocographic (CTG) monitoring is a primary biophysical method of evaluating the condition of a fetus during pregnancy and labour. It includes simultaneous recording and analysis of three signals: fetal heart rate, contractile activity of uterine muscle and fetal movements. The fetal heart rate (FHR) is usually regarded as of primary diagnostic significance. Nevertheless, the visual analysis of signal patterns describing the FHR variability is very difficult due to the complexity of waveforms shape. At the same time, the FHR signal contains a number of diagnostically relevant information that is hidden for the naked eye and can only be quantitatively described with computer analysis. Modern systems for computer-aided cardiotocography offer the automated quantitative description of the CTG records, but the development of methods ensuring effective support for the qualitative assessment are is the aim of many studies[1,2,3]. Various attempts were made to formalize the clinical guidelines for the interpretation of CTG recording on the basis of its quantitative analysis. Nevertheless, the criteria provided by the International Federation of Obstetrics and Gynecology [4] defined the standards used in the perinatal medicine.

During the CTG monitoring they assess the actual (at the time of recording session) fetal state. Unfortunately it is not possible to verify the evaluation result at the time of the CTG monitoring using any other reference technique. The information is to be revealed after the delivery only. Nevertheless, the prediction of fetal outcome during pregnancy is possible, because in perinatology it is assumed that

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the fetal state cannot change rapidly. Therefore, the newborn state just after delivery can be retrospectively assigned to the condition of the fetus at the time of the CTG recording[5].

More than 30 years after the introduction of antepartum cardiotocography into clinical practice, the predictive capacity of the method remains debatable. In a review of 45 articles published on this subject, Devoe et al found that its reported sensitivity varies between 2 and 100%, and its specificity between 37 and 100%[6].

Similar outcomes are reported in other reviews[7,8]. There are many possible explanations for these discrepant numbers. Different cardiotocographic equipment was used in the studies, as well as different criteria for interpreting fetal heart rate (FHR) tracings, and varying definitions of poor neonatal outcome.

Many studies were performed before important aspects of FHR analysis started to be taken into account, such as FHR variability and the existence of fetal behavioral states. Another important issue is the time interval that elapsed between the end of the study tracing and evaluation of neonatal state at delivery. In some studies this interval surpassed 1 week, in some it is not revealed, and in others it consist of situations capable of inflicting a significant stress to the fetus, such as labor. Intervention bias can also be a difficulty, in what is known as the "treatment paradox": when FHR tracings associated with fetal stress, but not distress, are considered a "positive test" and an intervention is performed, a high number of false positives may arise, because poor outcome was effectively avoided by intervention. Finally, interpretation of these results must take into account the well-demonstrated poor reproducibility of visual analysis[9].

Randomized trials on antepartum cardiotocography have failed to show a difference in the incidence of low Apgar scores, elective caesareans, induced labours, neonatal neurological outcome, intensive care unit admissions or perinatal mortality. However, it must be stressed that all these trials were conducted in the early 1980's when other methodologies for fetal evaluation were common practice, they evaluated a relatively small number of cases, and used very different FHR monitoring intervals. A detailed analysis of clinical records in the few cases of fetal death showed that mortality in both groups could largely be clarified by intrapartum events[9].

Computer analysis of cardiotocographs has the theoretical advantage of providing a reproducible and objective interpretation of FHR tracings, quantifying parameters that are difficult to assess by the human eye, such as short- and long term variability. Such systems have been developed since the late 1970's[10] but have still to gain wide clinical acceptance. This may be related to the limited demonstration of their validity and efficacy, as well as to the poor practicality of their routine clinical use. SisPorto1 2.0 is a program for automated analysis of tracings, developed over the last 14 years at the University of Porto. FHR baseline is designed using a complex algorithm developed to identify the mean FHR during stable segments, in the absence of fetal movements and uterine contractions[11].

Accelerations are defined as increases in the FHR above the baseline, lasting 15–120 and reaching a peak of at least 15 bpm. Decelerations are defined as reductions in the FHR under the baseline, lasting at least 15 s and with an amplitude exceeding 15 bpm. They are classified as mild if shorter than 120 s, prolonged if they last 120–300 s, and severe if they go beyond 300 s. Points with abnormal short-term-variability (STV) are recognised when the difference to adjacent FHR signals is less than 1 bpm. Points with abnormal long-term variability (LTV) are identified whenever the difference between maximum and minimum FHR values of a sliding 60-s window centered on them, does not exceed 5bpm. The system is widely described elsewhere[11].

Almost every natural phenomenon, such as pregnancy, has statistical features which are not presently characterized. Improved prenatal care is essential in order to maintain a healthy mother and baby which is the primary focus of obstetrics. Furthermore, approaches such as developing new software by applying new algorithms for collecting new variables or computerized objective assessment of FHR analysis have been reported. It has been shown that there is a poor inter-observer and intra-observer consistency for interpreting the FHR patterns because there is no standardized directive. Computer-assisted analysis of the FHR was presented about three decades ago, to overcome this reliability problem in FHR interpretation. Since then, various techniques have been used for the automated, objective analysis. Recently, computer-assisted analysis of NSTs and FHR parameters has been developed, and its efficacy in analysis of FHR patterns has been demonstrated.

Fairly accurate entropy (ApEn), a mathematical approach to quantify the complexity of a system, has been introduced in order to analyze FHR tracing[12], based on a novel systematically biological theory[13]. This theory suggests that healthy dynamic stability arises from the mixture of specific feedback mechanisms and spontaneous properties of interconnected links, and the weak connection between systems or within a system is the mechanism of disease, which is characterized by an increased irregularity of vital sign time series. Chaffin et al. reported that hypoxic fetal sheep study provides basic scientific/bench support for the association of decreased complexity and lowered ApEn with compromised physiology. Correlation dimension has been fruitful in quantifying the periodic and complex dynamics in heart rate variability[14].

MATERIAL AND METHODS

This descriptive case series conducted in the Department of Obstetrics & Gynaecology, Hameed Latif Hospital, Lahore for a period of six months from May 2009 to November 2009. The calculated sample size is 240 cases, with 5% margin of error, 95% confidence level taking expected percentage of low apgar score > in pathological CTG i.e. 18.86%. The sampling technique was non-probability purposive.

Inclusion criteria:
1. Women were eligible to join the study if 20-35 years of age with any parity.
2. Gestational Age ≥ 37 weeks by dating scan
3. Patients with Pathological CTG as per Operational Definitions.

Exclusion criteria:
1. Diagnosed cases of essential hypertension, pre-eclampsia, maternal diabetes on the basis of history, examination & previous investigations.
2. Placental abruption or praevia or viginal bleeding of unknown origin: on history & USG.
3. Multiple pregnancies on USG
4. Previous caesarean section.
5. Breech Presentation on USG.
6. Rhesus isoimmunization.
7. IUGR on USG

Patients fulfilling inclusion & exclusion criteria will be recruited from the labour room. An informed

consent for the study will be taken, women will be told this information will be used in study and their confidentiality and anonymity will be addressed. 275 mothers in labour with pathological CTG will be monitored using continuous cardiotocography. Recordings will be interpreted by one registrar to eliminate the issue of concordance between different observers. Effect modifiers such as cord around the neck, mode of Delivery (vaginal section) fetal cardiac malformation will be studied using stratification. Patients will be managed according to standard protocol. The clinical condition of the newborn will be assessed by the fetal outcome i.e. Apgar scrore ≤7 at 5 minute will be recorded in a pre designed proforma.

Data will be entered and analyzed using SPSS version 11.0. The quantitative variables like age gestational age will be presented by calculating Mean and S.D. The qualitative variables like Parity Apgar score ≤7 at 5 min (yes, no) will be presented by calculating frequency and percentages. Data will be stratified for mode of delivery, cardiac malformation and cord around the neck to address effect modifiers.

RESULTS

The mean age of the patients was 27.74±4.39 years. There were 75(31.3%) patients in the age range of 20-25 years, 102(42.5%) patients were in age group of 26-30 years, 50(20.8%) in the age group of 31-35 and 13(5.4) patients in the age group of 36-40 years old.

The mean Gestational age was 37.94±2.11. There were 5(2.1%) patients within the Gestational age range of 30-32 weeks, 29(12.1%) were in the range of 33-35 weeks, 89(37.1%) were in the range of 36-38, 117(48.8%) were in the range of 39-41 weeks. Among 240 patients 112(46.7%) were having Primigravida and 128(53.3%) were having Multigravida.

There were 124(51.7%) patients having normal vaginal delivery and 116(48.3%) were having C-sections. There were 30(12.5%) fetus with cardiac malformation and 210(87.5%) were having no Cardiac Malformation. 151(62.9%) fetus were having Cord around the Neck and 89(37.1%) were not having Cord around the neck. Among 240 patients 102(42.5%) were having reactive CTG and 138(57.5%) were having non-reactive CTG.

There were 29 Fetus which were having apgar score at (5min) <7 with normal vaginal deliveries and 63 were having apgar score less than 7 and C-section, where as 80 fetus were having apgar score greater than 7 and normal vaginal delivery , 38 were having apgar score greater than 7 and C-section.

There were 15 Fetus which were having apgar score at (5min) <7 with cardiac Malformation and 77

were having apgar score less than 7 and without cardiac malformation, where as 12 fetus were having apgar score greater than 7 with cardiac malformation , 106 were having apgar score greater than 7 without cardiac malformation.

There were 65 Fetus which were having apgar score at (5min) <7 with cord around the neck and 27 were having apgar score less than 7 without cord around the neck, where as 6 fetus were having apgar score greater than 7 with cord around the neck , 52 were having apgar score greater than 7 without cord aroung the neck. There were 105(43.8%) fetus having Apgar Score at (5 min) less than 7 where as 135 (56.3) were not having Apgar Score at (5min) less than 7.

There were 51 Fetus which were having apgar score at (5min) <7 with reactive CTG and 41 were having apgar score less than 7 and without reactive CTG, where as 67 fetus were having apgar score greater than 7 with reactive CTG , 51 were having apgar score greater than 7 with non-reactive CTG.

DISCUSSION

When a fetus is small for gestational age there is a concern that there can be intrauterine growth retardation. This leads to closer observation of small fetuses to try and detect early hypoxaemia. This would preferably allow intervention while appropriate and avoid intervention in small other than healthy fetuses.

Cardiotocography has been the ordinary clinical tool used to monitor at risk pregnancies in spite of a lack of evidence from randomised controlled trials to support its use[30]. Randomised trials are available suggest outpatient use of CTG increases morbidity[30] and mortality.

Doppler umbilical artery velocimetry has been revealed in randomised controlled trials to improve perinatal outcome in at risk pregnancies, both in terms of perinatal death and morbidity[31,32].

The major reason for the introduction of continuous CTG monitoring in clinical practice was a confidence that it would decrease perinatal deaths and hypoxic brain injury. That analysis found no statistically significant difference in perinatal deaths among continuous CTG and intermittent auscultation. It does, however, seem unrealistic to expect that any intrapartum intervention in current maternity care will result in a statistically significant improvement in perinatal deaths.

For decades, low Apgar scores have been used as a surrogate measure for birth asphyxia and subsequent adverse neurodevelopmental outcome. This review establishes no evidence that continuous CTG monitoring has an impact on Apgar score.

However, there were very few babies with clinically significant low Apgar scores in studies that evaluated this outcome. Therefore, potentially important dissimilarities between the two groups cannot be ruled out[27].

The caesarean section rate in included trials varied from 2.3% in Dublin 1985 to 35% in Pakistan 1989. We have therefore carried out a 'post-hoc' sensitivity analysis relating the effects of continuous CTG monitoring on caesarean section in trials with low caesarean section rate (less than 10%) with those with caesarean section rate of greater than 10%. The admission test first described by Ingemarsson et al is a short strip of CST during labour[19]. It is a dynamic screening test for the state of oxygenation of the foetus on admittance of the mother into labour room. It evaluates the placental reserve by checking the response of the foetal heart during the phase of temporary occlusion of the utero-placental blood supply under physiological stress of repeated uterine contractions. It thereby evaluates the ability of the fetus to withstand the process of labour. The Admission CTG therefore has two potential roles. It can be used as a screening test in early labour to detect compromised foetuses on admission and to select the females in need of continuous foetal electronic monitoring during labour[20].

The Cochrane assessments recommend that continuous electronic fetal monitoring be limited to high risk pregnancies[21]. Detractors of electronic fetal monitoring like Impey et al[22] believe that neonatal outcome is not significantly improved by the use of admission testing as compared to intermittent fetal heart rate auscultation during labour.

Thacker et al[23] believes that the use of electronic fetal monitoring is of limited effectiveness and carries an increased risk of interventions. According to them increased information at admission will not necessarily lead to better clinical results. This may be true for a population provided comprehensive antenatal care and receiving personal attention during labour. The same may not be true for a situation where the antenatal care is inadequate and deliveries are conducted in crowded settings and inadequate health care provider to patient ratios. The controversial question is, should admission CTG testing be carried out where this facility is available or has this test been introduced without proper valuation. We found that the admission test is useful in forecasting the foetal outcome in high risk patients. The main value of the admission test was its high specificity. The high specificity of the admission test means that a normal test accurately excludes adverse fetal status at the time of testing. another study[24] supports a role for admission testing in a high risk population. A reassuring CTG tracing at admission to the delivery suite is a reliable indicator of fetal well being.

Another study[25] of 2434 pregnant women was included. This trial was of sound methodological quality. The number of operative deliveries for fetal distress was reduced by half in the electrocardiographic waveform and cardiotocography group. There was no obvious effect on the rate of operative delivery for poor progress of labour. The use of the electrocardiographic waveform analysis monitor had no obvious effect on the condition of the newborn.

In study by Shiekh SM[26] Apgar score was <7 at 1 minute in 34 (64.15%), while it was >7 at 1 minute in 19 (35.84%). Low Apgar score persisted at 5 minutes in 10(18.86%) cases of pathological CTG. But in our study Apgar Score at (5min) <7 was 43.8% and in 56.3% Apgar Score at (5min) was not <7.

We are confident that ongoing research initiatives will reveal features of the fetal cardiac signal that identify the presence of insult and imminent injury at the level of the myocardium, the brainstem, or the cerebrum. Such endeavors will be quantitative, and we are hopeful that this simple system for quantifying FHR variability will facilitate these important initiatives designed to wring more clinical value from the fetal cardiac signal – the only continuously reachable fetal physiologic signal during labor.

CONCLUSION

Fetus having apgar score at (5min) <7, are less likely to develop pathological CTG and as compared to those having apgar score greater than 7 (at 5min)

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