Intrapartum Electronic Foetal Monitoring : Does it Lead or Mislead?

Lt Col Shakti Vardhan*, Col TK Bhattacharyya⁺, Col SK Kathpalia[#], Col SPS Kochar^{**}

MJAFI 2006; 62 : 51-55

Key Words : Electronic foetal monitoring, Foetal distress

Introduction

The importance of foetal monitoring during labour is well recognised. The stress of uterine contractions affects the foetus adversely especially if the foetus is already compromised, when the placental reserves are suboptimal, or when cord undergoes compression as in diminished liquor amnii, maternal metabolic and haemodynamic alterations (e.g. hypotension due to epidural labour analgesia) or iatrogenic uterine hyperstimulation due to injudicious use of oxytocin.

Auscultation of the foetal heart sounds with stethoscope or the use of Doppler is the commonly available method of intrapartum foetal monitoring. However, its intermittent nature led to the feeling amongst obstetricians, that this form of monitoring is inadequate. Hence, continuous electronic foetal monitoring (EFM) came in vogue in the late 1960s. It came with very high expectations that it will be able to pick up all cases of intrapartum foetal distress early in labour and prevent neonatal deaths, with improved Apgar-score and decreased Neonatal Intensive Care Unit (NICU) admissions.

Shortcomings of EFM

However it became apparent in a few years that EFM has not lived upto its expectations. Some of the reasons are :

- 1) Its interpretation is erroneous in a significant number of cases. Interobserver and intra observer variations are far too many. Definitions for fetal heart rate (FHR) patterns lack consistency [1], compounding this problem further.
- 2) There were no standardized guidelines for interpretation for a long time, till National Institute of Child Health and Human Development (NICHD) fetal monitoring workshop, promulgated guidelines in 1997. The guidelines help only if they are applied appropriately for interpretation of EFM tracings before formulating any management decisions.
- 3) Its limitations need to be clearly understood. It detects the absolutely healthy and gravely sick fetuses with great certainty. The problem lies in the interpretation of EFM patterns which are not so typical of either of these two extremes i.e. the intermediate category, comprising a large fraction of labouring mothers displaying the so called "Non Reassuring" patterns of EFM. This is the "grey zone".
- 4) The inability to understand the limitations of EFM by the health care providers further aggravates this problem and the "Play Safe" attitude adopted today often results in "Unjustified Caesarean Sections" for certain patterns of EFM which show only slight deviation or aberrations from the absolutely normal tracings. These patterns do not imply imminent foetal jeopardy. They require close observation and tend to disappear with time as labour progresses or with positional changes in the mother. Variable decelerations due to cord compression are the most commonly observed pattern during labour occurring in 40- 80 % of patients in labour. They are vagally mediated due to baroreceptor and chemoreceptor activity. Positional changes like putting the patient in left lateral position, often relieve cord compression leading to return of FHR to normal. Similarly, in the majority of cases, late decelerations are transient and are associated with fetal hypoxia only in a minority of them. Often, either stopping or readjusting the rate of oxytocin infusion along with administration of a tocolytic like injection Terbutaline helps the patients with hypertonic uterine contractions whereas repositioning the patient and IV fluids helps

*Readers, *Profesor & H O D, **Senior Advisor, Dept of Obstetrics & Gynecology, AFMC, Pune-411 040. *Senior Advisor (Obstetrics & Gynecology), CH (CC), Lucknow.

who receive epidural analgesia resulting in peripheral pooling of blood.

Continuous EFM versus Intermittent Auscultation

The commonly asked question is – “Is EFM superior to intermittent auscultation for intrapartum foetal monitoring?” : Both methods continue to be used for intrapartum monitoring today, although EFM is being used more extensively and frequently in the Western countries. The American College of Obstetrics & Gynecology (ACOG) also approves both as accepted modalities for intra partum foetal monitoring in low risk as well as in high risk cases. Then when does EFM score over intermittent auscultation?

EFM appears a better option than intermittent auscultation where a one to one nurse to patient ratio is not available or possible, as in certain high risk cases like severe preeclampsia, IUGR and post caesarean pregnancy where VBAC (Vaginal Birth After Caesarean Delivery) is planned. In these cases FHR abnormalities may be the earliest indicator of a scar rupture or dehiscence. Early and timely detection of these can be made with continuous EFM. Berkus et al [2] have analysed the reassuring aspects of EFM. Although debate continues regarding the advantages of EFM, it offers one conclusively proven benefit i.e. a definite reduction in neonatal seizures [3].

Patterns of EFM Tracings

The EFM is carried out using a cardiotocography (CTG) machine where one probe is meant to pick up continuous tracing of FHR and the other one is for monitoring the uterine contractions. During normal labour

at least three contractions greater than 25 mm of Hg occur every ten minutes. FHR decelerations are termed as early, late or variable depending on their relation to the uterine contractions. Early deceleration begins with the onset of uterine contraction recovering to the baseline by the end of the contraction. They are due to head compression and never associated with fetal hypoxia or academia. Late decelerations begin at or after the peak of contraction and return to normal only after the contraction has passed off. They may be associated with uteroplacental insufficiency. The onset of variable decelerations varies with successive contractions and are often associated with cord compression. Some of these tracings are depicted in Figs. 1, 2 and 3.

The commonly described EFM patterns are –

“Normal” or “Reassuring” pattern of FHR

Baseline foetal heart rate 110 -160 beats per minute (bpm)

Beat-to-beat variability 6 – 25 bpm

Presence of accelerations

Absence of decelerations

“Intermediate” or “Non reassuring” pattern

Persistent mild (100 – 110 bpm) and moderate (80 – 100 bpm) variable decelerations.

Late decelerations with adequate variability (6 – 25 bpm)

Moderate to severe (< 70 bpm) variable decelerations during the second stage.

Decreased but not absent variability without decelerations.

Fig 1 : Early decelerations. Patient had an uneventful vaginal delivery and baby cried soon after birth (Apgar score 9/10 at 1' after birth).

Fig 2 : Late decelerations : There was thick meconium stained liquor following ARM. Underwent Emergency LSCS. Baby was depressed at birth but recovered well after neonatal resuscitation.
(Apgar score 3/10 & 7/10 at 1' & 5' after birth respectively)

Fig 3 : Variable decelerations : The decelerations disappeared after the patient was put in left lateral position and given oxygen inhalation. She had an uneventful vaginal delivery and the baby did not show any signs of asphyxia at birth.

“Severely abnormal” or “Ominous” pattern

Recurrent variable decelerations or late decelerations with no variability.

Severe bradycardia < 80 bpm for 3 minutes or more with no variability.

Delinger et al [4] have demonstrated that intrapartum FHR patterns correlate well with foetal acidemia and umbilical blood gases. Sameshima et al [5] have shown these ominous patterns to be consistently associated with increased incidence of foetal distress, foetal acidemia, resulting in caesarean delivery or admission to Neonatal Intensive Care Unit (NICU). Decreased variability less than 5 bpm or absent variability alongwith frequent

severe variable or late decelerations is constantly associated with fetal hypoxemia & acidemia. Such extreme forms of fetal distress are very rare, which explains why the benefits derived from continuous electronic fetal monitoring are not very convincing [6]. Further, Ahn et al have shown that there is no unique FHR pattern which is associated with brain damage in the foetus [7].

What are the ways to enhance the utility of EFM?

The following have been suggested as additional means to reduce the false positive predictions of foetal distress compared to when EFM is used alone :

1) Foetal scalp blood pH

Although the concept of detecting foetal acidosis using fetal scalp blood appears attractive, practical difficulties in carrying it out have restricted its use. Goodwin et al have shown that it does not offer significant benefits in intrapartum foetal monitoring [8].

2) Foetal pulse oximetry

Is a new concept utilizing placement of a specially devised oximeter over the fetal face after rupture of membranes. It is a new modality and availability is limited. Foetal oxygen saturation varies from 30-70%. The lower limit of normal oxygen saturation has been established as 30% [9]. Bloom et al have demonstrated that transient episode of foetal oxygen saturation less than 30% are common but such levels are associated with fetal acidemia only if they last for two minutes or longer [10]. Garite and co-workers [11] have reported a significant decrease in caesarean delivery rate for non reassuring FHR patterns when fetal pulse oximetry was used as an adjunct. However, it will take sometime for this technique to get established in day to day clinical practice.

3) Foetal scalp stimulation and vibroacoustic stimulation.

FHR acceleration in response to manual stimulation and sound is a reliable indicator of fetal well being. If the accelerations are absent in an EFM tracing, foetal scalp stimulation with an Allis forceps may stimulate foetal heart accelerations thereby giving assurance about foetal health. If the foetal heart rate accelerates by 10-15 beats or more for at least 15 seconds following foetal scalp stimulation, fetal acidosis can be ruled out in more than 95% of the cases [12,13]. Vibroacoustic stimulation (VAS) to the foetus has been successfully used as a supplement to antepartum foetal monitoring and it can also be usefully employed for intrapartum fetal monitoring. FHR acceleration of 15 beats with VAS, lasting for at least 15 seconds excludes fetal acidosis with 100% accuracy [14,15].

These are simple and useful procedures.

4) Fetal electrocardiography

Fetal electrocardiography may prove to be a useful adjunct to cardiotocography (CTG). According to Strachan et al [16] adding PR interval analysis to conventional CTG does not offer any advantage. However, Noren et al [17] have shown that addition of ST segment analysis to CTG provides precise information about intrapartum hypoxia and may thereby prevent intrapartum asphyxia and neonatal encephalopathy in a significant number of cases. The invasive nature of the procedure which involves rupture of membranes and placement of fetal scalp electrodes

alongwith conflicting reports regarding its utility restricts its widespread use.

- 5) The patient needs to be evaluated as a whole keeping in mind the entire clinical profile including the presence of intra uterine growth restriction (IUGR), oligohydramnios, preeclampsia, diabetes mellitus, meconium stained liquor etc. Any EFM alterations in presence of these conditions carry greater significance.

Conclusion

The EFM patterns indicating normal and the grossly abnormal (compromised) foetus are quite explicit and the ability of EFM to predict foetal jeopardy or absence of it, at these two extremes of the spectrum of fetal health is well established. In these circumstances EFM will certainly lead and not mislead the clinician. However, these form a relatively small fraction of the mothers going into labour.

For the majority of the women in labour who display "Non Reassuring Patterns" the EFM will lead a clinician only if he or she is familiar with its limitations and views the patient in totality. The obstetrician's clinical discretion is of paramount importance to put EFM to effective use.

Cardiotocography machines are certainly required in the labour room but proper interpretation of the CTG tracings is equally important so that unjustified caesarean sections can be minimized and at the same time picking up cases of fetal distress in time which improves fetal outcome.

References

1. Parer JT, Quilligan E J. Lack of consistency in definitions of fetal heart rate (FH) patterns. *Am J Obstet Gynecol* 1996;174:698-702.
2. Berkus MD, Langer O, Samueloff A, Xenakis EKJ, Field NT. Electronic fetal monitoring: What's reassuring? *Acta Obstet Gynecol Scand* 1999;78: 15-18.
3. Thacker SB, Stroup DF, Peterson HB. Efficacy and safety of intrapartum electronic fetal monitoring : An update *Obstet Gynecol* 1995;86: 613-5.
4. Deligner EH, Boehm FH, Crane MM. Electronic fetal heart rate monitoring : Early neonatal outcome associated with normal rate, fetal stress and fetal distress. *Am J Obstet Gynecol* 2000;182: 214-98.
5. Sameshima H, Ikenoue T, Ikeda T, Kamitomo M, Ibara S. Unselected low risk pregnancies and the effect of continuous intrapartum fetal heart rate monitoring on umbilical blood gases and cerebral palsy. *Am J Obstet Gynecol* 2004;190: 118-23.
6. Horbuckle J, Vail A, Abrams KR, Thornton J G Bayesian interpretation of trials. The example of intrapartum electronic foetal heart rate monitoring. *BJOG* 2000;107: 3-7.
7. Ahn MO, Korst L, Pheln JP. Intrapartum fetal heart rate patterns in 209 brain damaged infants. *Am J Obstet Gynecol* 1996;174: 492-5.

8. Goodwin TM, Milner ML, Paul RH. Elimination of fetal scalp blood sampling on a large clinical service. *Obstet Gynecol* 1994;83: 971-5.
9. Yam J, Chua S, Arulkumaran S. Intrapartum fetal pulse oximetry : Principles and technical issues. *Obstet Gynecol Surv* 2000;55: 163-7.
10. Bloom SL, Swindle RG, McIntire DD, Leveno KJ. Fetal pulse oximetry : Duration of desaturation and integration outcome. *Obstet Gynecol* 1999;93: 1036-9.
11. Garite TJ, Didly GA, Mc Namara H, Nageotte MP. A multicenter controlled trial of fetal pulse oximetry in the intraprtum management of non-reassuring fetal heart rate patterns. *Am J Obstet Gynecol* 2000;183: 1049-53.
12. Clark SL, Gimovksy ML, Miller FC. The scalp stimulation test : A clinical alternative to fetal scalp blood sampling. *Am J Obstet Gynecol* 1984;148 : 274-7.
13. Elimian A, Figueroa R, Tejani N. Intrapartum assessment of fetal well being. A comparison of scalp stimulation with scalp pH sampling. *Obstet Gynecol* 1997;89 : 373-6.
14. Smith CV, Nguyen HN, Phelan JP. Intrapartum assessment of fetal well being : A comparison of fetal acoustic stimulation with acid base determinations. *Am J Obstet Gynecol* 1986;115 : 726-8.
15. Lin CC, Vassollo B, Mittendorf R. Intrapartum fetal heart rate responses to vibroacoustic stimulation versus fetal blood pH studies to predict outcome in labour. *Am J Obstet Gynecol* 1999;180: 91-3.
16. Strachan BK, Wijngaarden WJ, Sahota D, Chang A, James DK. Cardiotocography only versus cardiotocography plus PR-interval analysis in intrapartum surveillance : A randomized multicenter trial. *Lancet* 2000;355 : 456-8.
17. Noren H, Wahlin IA, Hagberg H, Herbst A, Kjellmer I, Marsal K, Olofsson P, Rosen KG. Fetal electro cardiography in labour and neonatal outcome. Data from the Swedish randomised controlled trail on intrapartum fetal monitoring. *Am J Obstet Gynecol* 2003;188: 183-92.

Erratum

Hepatitis G virus : Prevalence in blood donors in Armed Forces. Original Article Vol 61 (4), 2005, Pg 334 Fig. 1 Reverse transcriptase polymerase chain reaction confirming Hepatitis G virus is erroneous. Corrected Fig. 1 is printed below. The error is regretted

- Editor

Fig. 1 :