



GUIDELINES FOR THE USE OF FETAL MONITORING*

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1. Introduction

The FIGO Workshop on Guidelines for the Use of Fetal Heart Rate Monitoring (FHR) met at the Department of Obstetrics, University of Zurich, Switzerland, on March 28-29, 1985.

The Chairman, Prof. G. Rooth, welcomed the participants on behalf of himself and the other organizers of the Workshop, Prof. A. Huch and Prof. R. Huch. Dr. P. M. Dunn and Dr. H. Schneider were appointed rapporteurs jointly with the Chairman. Various aspects of Fetal Monitoring were introduced by the invited speakers and discussed by them and by the audience.

The following conclusions and recommendations were agreed upon and adopted by the FIGO Subcommittee on Standards in Perinatal Medicine and subsequently by the FIGO Standing Committee on Perinatal Mortality and Morbidity.

The purpose of these guidelines is to assist in the proper use of electronic fetal heart rate monitoring.

1.1. The fetal heart rate has been used as an indicator of fetal well-being for 160 years. Until recently intermittent auscultation using a stethoscope was the only method available. During the last quarter of a century electronic methodology has made continuous monitoring possible.

1.2. While continuous electronic monitoring provides much more accurate information than intermittent auscultation, it is relatively expensive in terms of apparatus, the need for technical personnel to ensure correct functioning of the equipment, and for medical staff able to interpret the data. Without this backup, electronic fetal heart rate monitoring may even be counterproductive. Until a country has developed an infrastructure of public health, professional attendance during pregnancy, labor and delivery, programs of adequate nutrition for pregnant women and care of the newborn infant, electronic fetal heart rate monitoring adds so little to fetal salvage as to make the cost of its introduction and general utilization in a developing country unjustified. However, for teaching and research purposes electronic fetal heart rate monitoring obviously has the same value in the developing countries as elsewhere.

1.3. In preparing these guidelines, it has been assumed that all the necessary resources, human and material, required for FHR are readily available. This is not the case in all hospitals even in developed countries. In developing countries the highest priority should be given to the provision of basic antenatal care and ensuring appropriate skills and facilities for dealing with the major causes of maternal mortality.

Unexpected hazards may occur during labor also in patients without prior evidence of risk. Therefore, every delivery unit needs trained staff and adequate equipment to assess carefully the status of each fetus in labor and to take appropriate action.

The lower the perinatal mortality, the higher the relative frequency of perinatal losses and damage due to these unpredictable risks during labor.

1.4. Certain patterns of electronically monitored FHR recordings are strongly associated with specific changes in fetal condition. However, not infrequently uncertainty exists in respect to interpretation. Unnecessary operative interventions might be the result of incorrect interpretation and overestimation of the diagnostic potential of electronic FHR monitoring. Therefore it cannot be emphasized enough that understanding and interpretation of a FHR record is not an easy matter and that formal training in the underlying physiology and the practise of FHR monitoring is indispensable for all those supposed to make decisions on FHR records. Furthermore it needs to be stressed that whereas certain FHR patterns are sensitive indicators of fetal hypoxia, the specificity is low. It is rarely possible to quantitate hypoxia on the basis of FHR records alone and information derived from FHR records only represents one piece of information which always has to be interpreted in the context of the clinical situation.

1.5. As commonly practised at the present time, fetal heart rate monitoring has some disadvantages such as the tendency to immobilize the mother in order to obtain an optimal recording. This may be overcome by the use of telemetry. Further improvement of external non-invasive methods should also reduce the need for application of internal electrodes.

1.6. Antepartum, i.e. before labor, electronic fetal heart rate monitoring is, at present, the only established method of identifying fetuses with intrauterine hypoxia. Consequently, the use of antepartum electronic fetal heart rate monitoring is indicated in high risk pregnancies. There is lack of evidence that antepartum electronic fetal monitoring reduces morbidity and mortality in low risk pregnancies.

The value of intrapartum, i.e. during labor, electronic fetal heart rate monitoring for high risk women is certain. Differences of opinion exist as to the value of routine electronic fetal heart rate monitoring in all women during labor.

1.7. Electronic fetal heart rate monitoring should never be regarded as a substitute for clinical observation or as an excuse for leaving the mother unattended during labor.

1.8. Mothers should have the opportunity to discuss the use of electronic fetal heart rate monitoring during antepartum care and again upon admission to hospital in labor, so that they are able to give or to withhold informed consent.

1.9. The following guidelines will be addressed to methodological issues and to the indications for using FHR. They will not include management considerations.

1.10. While the guidelines relate primarily to fetal heart rate monitoring, two other methods of monitoring will be considered briefly. The simultaneous recording of uterine contractions is indispensable to the interpretation of FHR records. Measurement of fetal blood pH is the best method available for validating a suspicious intrapartum FHR pattern and guiding clinical management.

2. Terminology

Definitions of FHR currently are expressed in beats/min. In many respects a terminology based on the heart periods (beat-to-beat intervals) may be more appropriate and is used by some research groups, but is not used in clinical practice.

2.1. Baseline fetal heart rate is the mean level of the fetal heart rate when this is stable, accelerations and decelerations being absent. It is determined over a time period of 5 or 10 min and expressed in beats/min (bpm).

2.2. Variability. Under physiological conditions the fetal beat-to-beat intervals are constantly subject to small changes. This is called short term variability. Due to a certain periodicity in the direction and size of these changes they result in oscillations of fetal heart rate around its mean level. These oscillations are called long term variability.

In the FHR tracings short term variability is superimposed on long term variability in the form of minimal deflexions. However, these cannot be reliably interpreted by the naked eye using the standard equipment. Therefore, in clinical practice variability means long term variability. This is how the term will be used in these guidelines.

Long term variability is characterized by the frequency and the amplitude of the oscillations. Although the frequency may be important, it is difficult to assess correctly. Therefore variability is usually only quantitated by description of the amplitude of the oscillations around the baseline heart rate.

2.3. Accelerations. Transient increase in heart rate of 15 beats/min or more and lasting 15 s or more.

2.4. Decelerations. Transient episodes of slowing of fetal heart rate below the baseline level of more than 15 beats/min and lasting 10 s or more.

3. Technical considerations

3.1. The basis for fetal heart rate monitoring is the beat-to-beat recording. For practical purposes this is only possible when direct fetal electrocardiograms are recorded with a scalp electrode. An adequate approximation is usually obtained by ultrasound with autocorrelation. Thereby external monitoring is possible.

3.2. It should be remembered that there may be some danger in positioning a direct scalp electrode, particularly on a very small preterm fetus.

3.3. The paper speed is important. The speeds commonly used are 1, 2 or 3cm/min. The speed selected will be that familiar to the obstetricians and midwives in that particular service. Some experts feel that 2 cm/min would seem a happy medium from the three commonly used paper speeds. This avoids crowding together of the record which makes baseline variability difficult to interpret in some patients at 1 cm/min, and the possible accusation of waste of paper at 3 cm/min.

3.4. Many experts feel that 1 cm/min gives sufficiently good records for clinical purposes and this has the advantage of limiting the cost and the amount of paper to store

3.5. Where there is any record which is difficult to interpret at slow speed, i.e. during the second stage of labor, the option to use a paper speed of 3 cm/min is favorable.

3.6. The fetal heart rate record is part of the case record of a patient and should be preserved as such.

4. Indications for antenatal fetal heart rate monitoring

4.1. Antepartum monitoring should only be performed for clinical indications. Antepartum monitoring gives one additional information about the wellbeing of the fetus during pregnancy and has to be interpreted in conjunction with information derived from clinical observation and possibly other paraclinical (or technical) examinations such as ultrasound.

4.2. When to start antepartum monitoring during pregnancy. This depends on the indications. When indicated it should be started 2 weeks before there is reasonable chance of extrauterine survival. The time of gestation at which this will occur will depend upon the experience and the capacity of the local or regional perinatal unit (obstetrics and neonatology).

4.3. Intervals of antepartum monitoring. This depends upon the clinical situation and the degree of fetal risk. The main target of antepartum FHR monitoring is the detection of chronic fetal hypoxia related to chronic placental dysfunction. Experience has shown that - unless acute events like premature separation of the placenta occur or regular contractions are present evolution of chronic fetal hypoxia is slow. In general, abnormal fetal heart rate patterns are observed one or several weeks before antepartum fetal death. Thus for ambulatory patients, in a risk pregnancy where fetal heart rate is found to be normal, an interval of about 1 week to the next recording may be adequate, unless the clinical situation deteriorates. Shorter intervals should be used when indicated by those responsible on the basis of their clinical judgement and when there are abnormal or suspicious records.

If a mother is in hospital, an initial monitoring at admission is recommended. Hospital patients with increased risk for fetal distress should be monitored at least once daily.

5. Technique of the antepartum monitoring

- 5.1.** The best technique at present available is monitoring of fetal heart rate with ultrasound and autocorrelation technique. Thereby a fetal heart rate record is obtained which very closely approaches that of beat-to-beat monitoring from direct fetal electrocardiogram. The following points should be kept in mind.
- 5.2.** A close approximation to beat-to-beat monitoring is always a prerequisite for the correct interpretation of the fetal heart rate pattern.
- 5.3.** Fetal heart rate monitoring, like all other techniques, has limitations. The main risks, when using autocorrelation, are the missing of fetal arrhythmia or to mistake maternal heart rate for fetal heart rate. Consequently a minimum requirement is that when using such equipment, every suspiciously abnormal fetal heart rate should be checked by stethoscope or by a simple doppler device with acoustic display.

6. Indication for intrapartum fetal heart rate monitoring

- 6.1.** Continuous electronic fetal heart rate monitoring is beneficial in high risk patients and should be instituted from the time the patient is admitted in the hospital.
- 6.2.** A short term, non-invasive electronic fetal heart rate monitoring at admission to identify the "low risk patient" with unexpected chronic fetal hypoxia is considered by many to be of benefit.
- 6.3.** The evidence for the benefits of continuous electronic heart rate monitoring for all women in labor is scientifically inconclusive. Therefore it must be decided upon on an individual basis.
- 6.4.** Intermittent monitoring (or intermittent auscultating) may be justified provided that:
- 6.4.1.** the initial record, lasting not less than 30 min, is normal, and
 - 6.4.2.** the membranes are not ruptured, and
 - 6.4.3.** the clinical situation is normal.
- 6.5.** If the record is suspicious or abnormal, or the patient is in any respect at risk, continuous monitoring is indicated.
- 6.6.** The late part - of the first stage and the second stage of labor is the period of maximum risk for any fetus. This should be taken into consideration for all decisions concerning monitoring.

7. Technique of intrapartum monitoring

- 7.1.** Provided that an acceptable record is obtained, i.e. that the baseline and the variability may be clearly read off at least 80% of the time, external monitoring is recommended as long as the membranes are intact. If an acceptable record cannot be obtained by external monitoring, and if there is a strong indication for monitoring on the basis of fetal risk, a fetal scalp electrode should be applied, rupturing the membranes where these were intact.
- 7.2.** Telemetry, which is now available, has the advantage of not forcing the mother to stay in bed. Therefore it is suggested that when new equipment is needed, a telemetry unit should be considered.

8. Position of the mother during fetal heart rate monitoring

8.1. Maternal position may strongly affect fetal heart rate pattern and the recording should therefore always be made in the lateral recumbent or in the half sitting position or upright position.

9. Technique for monitoring uterine contractions

9.1. The simultaneous recording of uterine contractions is necessary for interpreting the fetal heart rate curve. Therefore, whenever feasible, contractions should be monitored at the same time as fetal heart rate. External monitoring only indicates the frequency and suggests the duration of a contraction. It gives no reliable information about the intensity of the contractions, i.e. the pressure at the peak of the contractions, or of the tonus, this being the lowest pressure between contractions.

9.2. Antenatally contractions can only be recorded externally.

9.3. Internal pressure recording with a fluid filled catheter or some other newer techniques requires the intrauterine positioning of the probe under antiseptic conditions. This gives quantitative information about the intensity of the contractions and about uterine tone.

9.4. Some feel that quantitative evaluation of the intensity of the contractions is especially important in stimulated labor.

9.5. There are contra-indications to the insertion of an intrauterine pressure catheter, e.g. antepartum hemorrhage with low lying placenta, or when the membranes have been ruptured for some time, i.e. where there might be some danger of infection.

9.6. Since the clinical value of intrauterine pressure measurements is inconclusive, further research including randomized clinical trials is desirable.

10. Interpretation of fetal heart rate records

10.1. Four main factors should be taken into account:

- (a) gestational age
- (b) maternal position
- (c) the state of fetal activity
- (d) drugs administered to the mother, including anesthesia and analgesia.

10.2. There is a small gradual decrease in mean baseline fetal heart rate from the 28th week of gestation. This decrease is about 1 bpm/week and is of little practical importance.

10.3. When the mother is in the upright position baseline fetal heart rate is higher than when she is horizontal, although the difference usually is without clinical significance. When the mother is horizontal she should always be monitored in the left lateral position. Supine position may lead to profound changes in fetal oxygenation and fetal heart rate pattern.

10.4. Distinct types of fetal activity states exist:

10.4.1. Quiet pattern with stable baseline heart rate, absence of accelerations or decelerations and relatively low variability.

10.4.2. Active pattern with somewhat variable baseline heart rate and intermittent accelerations (active sleep) or more continuous accelerations (active state).

10.4.3. The above states come in cycles. A quiet pattern may last up to 40 min.

10.5. Coordination and expression of fetal motor, respiratory and FHR activity is a function of fetal maturity, i.e. gestational age. For instance 16% of the normal fetuses at 28-33 weeks gestation have less than 2 (i.e. 0 or 1) accelerations of 15 bpm in 1 h. At 34-40 weeks gestation the figure is 7%. Especially before 28 weeks of gestation low FHR activity with low amplitudes of variability and rarity of accelerations is normal and the respective criteria for interpretation of fetal heart rate records listed in §11 are not applicable for this gestational time. On the other hand, the changes occurring from about 32 weeks of pregnancy until term are relatively small and more or less the same criteria of interpretation may be applied throughout this time period.

10.6. Several drugs commonly used before or during delivery such as pethidine and valium decrease the amplitude of heart rate variability.

11. Interpretation of fetal cardiotocograms

11.1. It is convenient to classify fetal heart rate patterns as:

- (a) normal
- (b) suspicious
- (c) pathological.

11.2. Although on many points the interpretation of antepartum and intrapartum fetal heart rate records are similar, there are differences.

Definition of antepartum fetal cardiotocograms

11.3. Normal patterns

11.3.1. Baseline heart rate between 110 and 150 beats/min.

11.3.2. Amplitude of heart rate variability between 5 and 25 beats/min.

11.3.3. Absence of decelerations except for sporadic, mild decelerations of very short duration.

11.3.4. Presence of two or more accelerations during a 10-min period.

Once these accelerations are observed, and provided the variability is normal and there are no decelerations, then no further recording is necessary at that time.

11.4. Suspicious pattern

Fetal heart rate patterns are suspicious if any of the following signs are present:

11.4.1. Baseline heart rate between 150 and 170 beats/min or between 110 and 100 beats/min.

11.4.2. Amplitude of variability between 5 and 10 beats/min for more than 40 min.

11.4.3. Increased variability above 25 beats/min.

11.4.4. Absence of accelerations for more than 40 min.

11.4.5. Sporadic decelerations of any type unless severe.

11.4.6. If suspicious patterns are noted, various types of stress tests may possibly help to define the condition of the fetus better, although on this point opinion differs. Some use stress tests, others consider them superfluous or even unsuitable.

11.5. Pathological pattern

Fetal heart rate patterns are pathological when any of the following signs are present:

11.5.1. Baseline heart rate below 100 or above 170 beats/min

11.5.2. Persistence of a heart rate variability of less than 5 beats/min for more than 40 min.

11.5.3. Periodically recurring and repeated decelerations of any type.

11.5.4. Sporadic and non-recurrent decelerations of the following types: severe variable decelerations; prolonged decelerations; late decelerations.

11.5.5. A sinusoidal pattern. A sinusoidal pattern is regular with cyclic changes in the fetal heart rate baseline, such as the sine wave. The characteristics of the pattern being: the frequency is less than 6 cycles/min, the amplitude is at least 10 beats/min and the duration should be 20 min or longer.

11.6. Definition of intrapartum fetal cardiotocogram

11.7. Normal pattern

11.7. 1. Baseline heart rate between 110 and 150 beats/min.

11.7.2. Amplitude of heart rate variability between 5 and 25 beats/min.

11.8. Suspicious pattern

11.8.1. Baseline heart rate between 170 and 150 beats/min or between 110 and 100 beats/min.

11.8.2. Amplitude of variability between 5 and 10 beats/min for more than 40 min.

11.8.3. Increased variability above 25 beats/min.

11.8.4. Variable decelerations.

11.9. Pathological pattern

11.9.1. Baseline heart rate below 100 or above 170 beats/min.

11.9.2. Persistence of heart rate variability of less than 5 beats/min for more than 40 min.

11.9.3. Severe variable decelerations or severe repetitive early decelerations.

11.9.4. Prolonged decelerations.

11.9.5. Late decelerations: the most ominous trace is a steady baseline without baseline variability and with small decelerations after each contraction.

11.9.6. Sinusoidal pattern as described in § 11.5.5.

12. Definition of pathological uterine activity

The influence of the contractions on the fetus vary depending upon the conditions of the fetus. Whereas a well oxygenated fetus may stand fairly strong and frequent contractions, a fetus with low oxygen reserves might, with the same intensity and frequency of the contractions become severely asphyxic. It is therefore difficult to give detailed rules about pathological uterine activity. However, it should be remembered that more than 5 contractions per 10 min are abnormal.

13. Special problems regarding heart rate monitoring during labor

13.1. If suspicious or pathological heart rate patterns are noted and the clinical situation does not necessitate immediate delivery, the best way to validate fetal heart rate monitoring is by fetal scalp blood sampling.

13.2. Fetal heart rate monitoring is also important in high risk cases during the second stage of labor but interpretation may be difficult and the following factors should be taken into account.

13.2.1. Each bearing down effort tends to generate a deceleration. If the bearing down is too frequent and prolonged, a long and deep deceleration is seen.

13.2.2. If baseline heart rate falls below 80 beats/min - whether this is due to bradycardia or prolonged decelerations -and if there is also a loss of variability, this indicates fetal distress. Confirmation may be obtained by fetal scalp blood pH estimation.

14. A general consideration

These guidelines should be considered as an attempt to standardize the clinical use of electronic monitoring of fetal heart rate. If they are accepted and implemented in the international obstetrical care, an important step forward will have been achieved in perinatal medicine.

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