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FIGO News

Intrapartum surveillance: recommendations on current practice and overview of new developments

FIGO Study Group on the Assessment of New Technology

The FIGO Study Group on Assessment of New Technology in Obstetrics and Gynecology, with Professor Ermelando V. Cosmi, Chairman, established the Expert Committee on Intrapartum Surveillance[1]*, which met in Rome and Fuji-Yoshida to develop recommendations on intrapartum surveillance. The following document was authored by Jason Gardosi, M.D., Nottingham, UK, and Professor Kazuo Maeda, Hamamatsu, Japan, and was endorsed by the the Expert Committee on Intrapartum Surveillance. The Report was subsequently presented for information to the Executive Board and the General Assembly of FIGO on the occasion of the XIVth FIGO World Congress of Gynecology and Obstetrics in Montreal, Canada, September 1994. These recommendations do not reflect an official position of FIGO.*

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1. General comments

1.1. Introduction

It is recognized that priorities of obstetric care vary considerably between different countries and even between individual maternity units. Often, the prime priority and front-line of battle is that of maternal mortality, poor hygiene, lack of education, insufficiently trained staff and inadequate facilities and resources. While recognizing such overall limitations within the global context, the Committee nevertheless wants to draw attention to the importance of adequate fetal monitoring during labor. This paper represents our consensus view on where, given adequate conditions, the state of the art is considered to be today, and summarizes the main new directions which are being explored in attempts to improve fetal monitoring technology and its application for the management of labor.

1.2. The aim of intrapartum monitoring

Labor is a period of stress for the fetus, and the major challenge and aim of fetal monitoring is to differentiate physiological stress from distress. Fetal distress is a sign of inability to withstand the stress of labor, and a condition which may lead to asphyxia, defined here as significant hypoxia and acidosis.

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Often, fetal damage has occurred antenatally, before the onset of labor, and intrapartum events are considered to be responsible for only a minority of cases with adverse neurological sequelae. Yet, these are the cases which may be the most avoidable by timely intervention to expedite delivery.

Adequate information and up-to-date equipment needs to be available for the obstetric team to be able to reach management decisions. However, excessive monitoring may interfere with maternal mobility, cause unnecessary concern, lead to inappropriate decisions and excessive interventions, and may interfere with the whole birth experience. Intrapartum surveillance should be seen as an integral part of the overall care and support during labor and should be conducted in a manner suited to the individual needs and wishes of the woman. A major challenge for obstetrics today is that more and more women want to have 'natural childbirth' and be left to their own devices, while the expectation of a perfect child as the outcome of each pregnancy is stronger than ever. Childbirth is a physiological process but, as every obstetrician knows, 'normal labor' is a retrospective diagnosis. Clearly, a balance needs to be achieved. There should be an appropriate discussion with each woman regarding the options for fetal monitoring and intrapartum care, and the conclusions arising from these discussions should be documented in the clinical notes.

1.3. High versus low risk labor

It is generally accepted that high risk cases require more intensive monitoring, while others can receive less supervision. Risk factors may be maternal (e.g. medical disorders; poor obstetric history; uterine scars; antenatal complications) or fetal (e.g. malpresentation; prematurity; growth retardation or reduced liquor volume). It is important to try to assess the fetal reserve for withstanding the stresses of labor. To this end, antenatal information about fetal well-being is of vital importance. This includes the mother's experience of fetal movements; serial assessment of fetal growth by fundal height measurement and, where indicated, by ultrasound biometry; examination of liquor volume, and fetal heart rate (FHR) assessment, biophysical profile scoring and Doppler flow measurements in high risk cases. (Recommendations on Doppler were the subject of a previous report published in *Int J Gynecol Obstet* 1992; 17: 221–228).

Early in labor, an admission cardiotocograph (CTG) for ~30 min is considered a good predictor of subsequent progress. A normal CTG suggests a low risk labor where, in the absence of other indications and unless the labor is prolonged, intermittent monitoring is likely to be sufficient. If the admission CTG is equivocal, there is a higher chance that fetal distress may develop later, and these labors should be monitored more closely. A clearly abnormal admission test may identify those fetuses which are already asphyxiated at the beginning of labor. An estimation of liquor volume and fetal weight-for-gestation can also contribute to an assessment of fetal reserve.

The threshold for applying close intrapartum surveillance and early intervention should be much lower for babies who are considered to have a low reserve. During labor, intravenous oxytocin for induction or augmentation and epidural analgesia will increase the need for close surveillance, as will the presence of fresh meconium at any time during labor.

1.4. The significance of meconium

The passage of meconium may be due to a number of causes, but most commonly it is a physiological chance defecation in utero, the incidence of which increases with fetal maturity. Hypoxia is the other major cause, and possibly mediated by vasoconstriction in the fetal gut, hyper-peristalsis and relaxation of the anal sphincter.

A distinction needs to be made between the types of meconium passed and the circumstances of the situation. In the presence of a normal fetal heart rate pattern, a fetus can tolerate labor well with the passage of thin meconium. Thick meconium however is associated with an increased likelihood of decelerations, hypoxia and acidosis, and is an indication for intensive monitoring during labor. Fetal asphyxia increases the risk of meconium aspiration, which can occur in utero or with the first breaths after birth.

2. Fetal heart rate monitoring (FHR)

The mainstay of fetal surveillance during labor and the method of screening for problems is to monitor the fetal heart rate.

2.1. Intermittent monitoring

This is usually done with an obstetric stethoscope between uterine contractions. Auscultation during a contraction may be uncomfortable to the mother. Alternatively, an ultrasound Doppler transducer can be used with the advantage that the mother and her partner can listen in as well. The characteristic sound from the fetal heart valve movements need to be distinguished from the souffle of blood flow in the maternal vessels. Auscultation should be carried out after uterine contractions for at least 1 min every 15 min during the first stage, and following each contraction during the second stage.

Intermittent monitoring allows the mother more mobility during labor. However, the information which can be derived is limited and auscultation is an insufficient indicator of fetal distress except in the extreme degree. Acoustic monitoring also leaves no record of the fetal heart signal if the baby is subsequently born in a poor condition. In a climate of increasing litigation, proof of a normal heart trace may be important evidence that an unsatisfactory outcome was not due to the standard of intrapartum management. As an alternative, therefore, if a fetal monitor is available, intermittent monitoring by Doppler ultrasound may be employed and segments of heart rate recorded on the chart. For low risk labors with a satisfactory admission CTG, intermittent monitoring during the following 6 h of labor has become the preferred method in many units. The mother is left to ambulate and 'mobilize' and intermittently — say every hour — a short fetal heart trace is recorded on the cardiotocograph strip.

2.2. Continuous monitoring

Continuous monitoring can be achieved externally, by Doppler ultrasound, or internally with a fetal scalp electrode (electronic fetal monitoring, EFM). External monitoring is less invasive, but requires belts on the maternal abdomen for the heart rate Doppler and the tocogram transducer for contractions. It may give a poorer picture of fetal heart rate variability than electronic monitoring via a scalp electrode, and signal loss can be masked although the quality has been improved considerably with recent model monitors. The main disadvantage is that gaps in the trace may occur due to maternal or fetal movement or descent in the birth canal, and close attention to the quality of the signal and adjustments of the external transducer are required throughout labor.

Often, external monitoring is used in early labor before the membranes are ruptured spontaneously or artificially, whereupon a fetal scalp electrode is applied. It is suggested that all labors which are not low risk are routinely monitored with continuous EFM, or improved models of external monitors. Application of a skin-penetrating fetal scalp electrode is contra-indicated in the presence of any established maternal infection such as HSV, HBV, HCV and HIV.

Telemetry systems have been devised to increase maternal mobility while permitting continuous monitoring. They can transmit the signal to a central monitor while the mother is ambulant during labor.

2.3. The role of FHR monitoring

The FHR can be used as a screening test for fetal well-being during labor, and is usually classified as either normal, suspicious or pathological. The usual features of the FHR pattern which are used for this assessment include the baseline heart rate and its variability, and the pattern and frequency of accelerations and decelerations. A detailed description and definitions are given in FIGO News: Guidelines for the use of fetal monitoring, *Int J Gynecol Obstet* 1987; 25: 159–167; and Br J Obstet Gynaecol 1993; Suppl. No. 9: 100.

The FHR is generally regarded as a sensitive measure of fetal well-being. If there is fetal distress, there is a good chance (>90%) that the intrapartum CTG will show some abnormality, and if the FHR is normal, there is a high chance that the baby is tolerating labor well. However, an abnormal trace has a poor predictive value for fetal compromise and is false positive (i.e. abnor-

mal despite the absence of fetal distress) in the majority of cases. It is not surprising therefore that monitoring based on FHR alone may lead to excessive intervention and therefore increased maternal morbidity, including trauma, risk of anesthetic, blood loss, lengthy stay in hospital, and implications for the management of future labors. An abnormal FHR trace is not synonymous with fetal distress, and in most instances adjunct measures such as fetal scalp blood sampling are required to make a firm assessment (see section 3.).

The poor predictive value of the FHR pattern needs also to be remembered when teaching interpretation. As a primary screening test for fetal distress, a normal outcome in the face of a suspicious or pathological trace may be confusing and discouraging for the clinician. It is therefore much more important that a consensus is reached for prospective interpretation which can be adapted and applied within individual maternity units.

3. Fetal scalp blood sampling

Fetal scalp blood sampling is used to make fetal heart rate monitoring more specific. It should, where possible, be an integral part of intrapartum monitoring. Management of labor with FHR monitoring alone may result in increased operative deliveries without improvement in outcome.

3.1. Method

The fetal scalp skin is punctured through an amnioscope, and a micro-sample of blood is collected in a heparinized tube. A blood gas analyzer assesses the pH, Po_2, Pco_2, HCO_3, O_2sat. and the base deficit. The most important values for the clinician are pH together with the calculated extracellular base deficit, which together with the Pco_2 gives an indication whether a low pH is a respiratory or metabolic acidosis. Po_2 and O_2sat. measurements have limited value because the scalp sample has an unknown mix of arterial and venous blood. It may also be affected by the blood drop being exposed to air. A pH of <7.20 is defined as acidotic, and >7.25 as normal. A more detailed discussion of pH and blood gas analysis is found in 'Guidelines for blood gas sampling and measurement of pH and blood gas values in obstetrics' *Eur J Obstet Gynecol Reprod Biol* 1994; 54(3): 165–176.

Fetal blood sampling (FBS) is not a continuous measurement but a spot check and as such requires at least one repeat measurement to establish a trend. If the first pH is normal but the FHR abnormality continues, the FBS needs to be repeated to gain a picture of how the fetus is tolerating the hypoxic insult suspected on the basis of the FHR abnormality. In this sense, even a normal pH which has dropped from say 7.35 to 7.27 may suggest a significant deterioration and should indicate another FBS soon to demonstrate the continued direction of the trend. A pH between 7.20–7.25 is regarded as borderline, and also requires an early repeat assessment. In the second stage of labor, instead of taking an FBS, consideration should be given to whether delivery should be expedited if a doubt about the fetal condition does exist.

The procedure should be avoided in cases of maternal infection with HSV, HBV, HCV and HIV to reduce the chance of vertical transmission of infection.

3.2. The role of FBS

Fetal scalp blood sampling is currently the best method to assess fetal acid/base balance during labor, but it is an invasive procedure both for the fetus and the mother, who should be fully informed about the procedure and the purposes of blood sampling before consent is obtained. FBS requires special equipment and trained personnel, and a blood gas analyzer — preferably situated on labor ward — which needs regular maintenance to be in a calibrated state at all times.

This is perhaps one reason why many units are reluctant to introduce fetal scalp blood sampling during labor, although it has been well documented that management of labor with CTG alone may result in increased operative deliveries without improvement in outcome. On the other hand, fetal scalp pH and blood gas analysis is an invasive test which should only be performed on clear indications, and its primary function during labor is to help with the interpretation of a suspicious or equivocal FHR. The availability of FBS should not diminish the importance of good, standardized CTG analysis.

4. Fetal stimulation tests

These are designed to elicit a reaction from the fetus. 'Reactivity' or accelerations on the fetal heart trace suggest fetal well-being, and are often seen with fetal movement or uterine contractions. It is also often observed that scalp stimulation with the scalpel during FBS may evoke a fetal heart rate acceleration. Babies who react in this way tend to have normal acid base balance. Other stimuli, e.g. pinching the scalp, or trans-abdominal acoustic stimulation have been employed to assess the fetus by its reaction. Such methods may reduce the need to carry out fetal scalp blood sampling for suspicious FHR traces, although some questions remain about whether these tests can give a real, physiological assessment about the condition of the fetus.

5. Uterine activity

The cardiotocograph is a joint recording of the fetal heart rate and uterine contractions. Both parameters are required for appropriate interpretation during labor. Uterine activity can be monitored by external or internal means.

5.1. External tocography

Manual external assessment by palpation can ascertain the frequency and intensity of contractions as well as the baseline tonus. For continuous recording, a toco-transducer is held on the abdomen near the uterine fundus, usually by means of a belt around the maternal girth. This method provides a qualitative assessment of uterine activity, and in particular that of the frequency of contractions. The amplitude of the plot is not an index of amniotic pressure and can vary with the tightness with which the transducer is applied. It is inexpensive, as there are no disposable parts, and non-invasive, although the belt can be restrictive if the mother wants to mobilize. The recording may be of poor quality if insufficient supervision is provided by the birth attendant and the transducer may need frequent re-adjustments as labor progresses. Further difficulties in obtaining an accurate recording may be caused by maternal obesity.

5.2. Internal monitoring of uterine pressure

Intra-uterine pressure catheters can provide a more accurate and quantitative assessment of uterine activity and many units recommend their use especially for high risk labors and where uterine contractions are induced or augmented artificially by oxytocin. However, repeat use of such catheters cause concern regarding adequate sterilization and possible transfer of infection, and single-use devices add to costs. They are also invasive to the mother and require the membranes to be ruptured. Insertion requires strict aseptic conditions and accurate calibration.

Open fluid catheters measure the pressure in the amniotic fluid column and are connected to an external pressure transducer which is re-usable. They can get blocked by air bubbles, thick meconium or vernix and fail to register the correct pressure which may inadvertently lead to overdosage of oxytocin and uterine hyper-stimulation. Catheters with integrated pressure transducers at their tip do not have these problems but are more expensive. Both systems can give a more precise assessment of baseline tonus and the intensity of contractions, although this is also known to vary between different amniotic fluid pockets.

5.3. The role of uterine activity assessment

Many modern units subscribe to a policy of active management of labor, where time limits are set and partographs are used to ensure that adequate progress is made. Failure of progress during labor is usually designated 'cephalo-pelvic disproportion' (CPD) or 'dystocia' and is often associated with insufficient or ineffective uterine contractions. It is the most commonly stated reason for first time cesarean sections and, therefore, also a major contributor to the high rate of repeat cesarean sections today. Usually, lack of progress is diagnosed late, when sequential vaginal assessments find a delay in the rate of cervical dilatation and descent of the presenting part. Adequate assessment of the strength and effectiveness of uterine activity, and early intervention to augment labor as necessary, is therefore recommended.

Careful and precise monitoring of uterine activity is of particular importance during medically induced or augmented labors, on the one hand to

ensure that sufficient oxytocics are given by titrated infusion, but more importantly, to avoid excessive doses which can lead to uterine hyperstimulation. This complication is seen more and more frequently in modern practice, and not infrequently represents the cumulative effect of a sequence of events which may include repeated prostaglandins for ripening of the cervix, artificial rupture of membranes which releases endogenous prostaglandins, stimulation with an oxytocin infusion to induce uterine contractions, and further, endogenous oxytocin release once labor has been established and the cervix is dilating. A contraction rate of more that 4 per 10 min is likely to lead to insufficient time for placental perfusion between contractions and abnormalities of the FHR trace amounting to iatrogenic 'fetal distress'.

6. Documentation and assessment of outcome

6.1. Neonatal outcome measures

It is important to make a clear record of the surveillance of labor and the interpretation of the condition of the baby both intrapartum and at birth. Full documentation is important for the neonatologist as well as for medico-legal reasons and will also allow the maternity unit to audit its methods of intrapartum surveillance and management. Apgar scores may reflect the adaptation of the baby to the stresses it experienced during labor, although they may also be depressed due to drugs administered during labor or due to antenatal causes. The need for resuscitation and/or intensive care in the neonatal period, the presence of hyperexitability and seizures, or hypoxic-ischemic encephalopathy or other evidence of neurological compromise are important immediate measures of neonatal outcome.

6.2. The FHR record

Together with detailed notes on labor, the cardiotocogram is an important document and should be stored carefully for individual assessment as well as for teaching purposes and audit. Ideally, the fetal heart rate record should be stored permanently to disk but this has hitherto been difficult because of large memory requirements. Modern techniques allow storage of large amounts of data on non-rewritable and memory-protected optic or magneto-optical disks.

6.3. Umbilical cord blood analysis

Cord blood sampling immediately after birth gives biochemical information of the fetal adaptation to respiratory function of the placenta before delivery and may give important information about the neonatal condition. A full discussion is given in *Eur J Obstet Gynecol Reprod Biol* 1994; 54(3): 165–176.

The technique requires double clamping of the cord immediately after delivery, before the first breath. The specimen can be stored in room air for up to 1 h without the blood gas values being affected. A small amount of blood ($\sim$1 ml) should be taken anaerobically. Usually a sample of one of the umbilical arteries is preferred to reflect the acid/base status in the fetal circulation at delivery. The blood in the syringe can be stored in room temperature for up to 30 min, and on ice for up to 2 h, without the blood gas values being affected. A sample from the umbilical vein provides information about the quality of blood supplied from the placenta. A large arterio-venous difference in pH (i.e. arterial blood more acidotic than venous) suggests that the acidosis has an acute onset; a smaller difference with both sides of the circulation acidotic suggests that the insult has been more chronic.

Cord blood analysis is particularly indicated in cases where there have been signs suggestive of fetal compromise, e.g. a pathological FHR trace, thick meconium, or a low Apgar score. Whereas many babies with acidemia have no clinical problems during the neonatal period, the risk of neonatal encephalopathy is increased with severe acidemia, especially below a pH of 7.05. Conversely, a record of normal cord gas values may be important documentation that any handicap which becomes subsequently apparent was not likely to be associated with intrapartum events. This is an argument for routine recording of cord blood values after every delivery, if resources and facilities permit.

7. Improvements of current technologies

There is often considerable disagreement on the interpretation of CTGs even amongst clinicians who claim to have special training and knowledge in their use. Computerized CTG analysis aims to standardize its use and several systems are currently undergoing development and evaluation. Apart from standardization in description and interpretation, such expert systems can serve to remind the clinician that even at its best, the CTG alone has inherent shortcomings and is a screening rather than a diagnostic tool. There are also moves afoot to integrate such expert systems within commercial fetal monitors. which would be a welcome warning tool for midwives and doctors working on busy labor wards. Similar expert systems are being devised for blood gas analysis and for overall labor ward management protocols.

Algorithms, fuzzy logic systems and neural networks are also attempted to be applied to CTG interpretation and analysis. One of the inherent problems however stems from the poor predictive value of the CTG, which makes it difficult to establish cause-effect relationships and feed-back loops to train and test such expert systems. Computer aided learning modules are being devised to teach CTG assessment and should also assist in standardizing nomenclature and interpretation.

8. New technologies under development

8.1. General comments

Research into new technologies is active but has to contend with several factors which are particular to intrapartum surveillance, such as:

1. limited access to the fetus; problems with fluid, hair, caput, and movement artefact;
2. the limitations of research on human volunteers, while animal models are often unrepresentative and not able to reflect the physiology of human parturition;
3. the fortunately rare occurrence of severe compromise as endpoints of study, and the difficulty in defining other reliable measures of outcome;
4. labor ward policies that call for early intervention, often on medico-legal rather than scientific grounds;
5. uncertainty and disagreement about what parameters should be monitored and where to draw the line between 'stress' and 'distress'.

There is also a paucity of information exchange and collaborative efforts between centers. Multidisciplinary workshops such as the International Symposium of Intrapartum Surveillance (ISIS) have been organized recently to address this issue.

Several new technologies have been proposed in an attempt to improve the status quo. All of them have in common that their eventual intended use aims to go hand in hand with cardio-tocography, as the well established and sensitive screening tool for intrapartum distress. Combining a new modality with a CTG has the potential of assisting in two main respects:

a. to assess fetal status and reserve at the beginning of labor, while the CTG is normal
b. to distinguish between fetal well-being and distress when the CTG is suspicious.

8.2. Fetal ECG waveform analysis

Conventional monitors concentrate on the fetal heart rate, i.e. the R-R interval, and the rest of the information from the ECG is filtered out. Analysis of the complete ECG wave form is now possible with computerized signal processing equipment and microchip technology. A number of different time-segments of the ECG wave form have been defined and studied. Two main approaches have concentrated either on the PR interval and the 'conduction index' (PR/RR ratio), or ST-analysis, using the T wave height and changes in the ST segment. Clinical trials are in progress to assess correlations with fetal asphyxia and other measures of outcome. Some preliminary data have been contradictory and the results of multicenter trials will be needed to determine whether the ECG waveform will prove eventually to be useful for fetal monitoring.

8.3. Continuous assessment of pH and blood gases

In principle, continuous rather than intermittent assessments of acid base status would be most welcome to monitor and guard against asphyxia. pH scalp electrodes have been tried over a number of years but had to contend with technical difficulties and artifacts. The tissue of the presenting scalp is subject to changes during labor due to cervical pressure and edema. The pH values are also dependent on the depth of the needle sensor within the tissue, which may vary between cases and also during the progress of an individual labor. New, ion-selective or fibre-optic pH electrodes are being tried in an attempt to overcome problems of calibration and baseline drift.

Transcutaneous P_{CO_2} and P_{O_2} electrodes have also been tried but are dependent on tissue perfusion and required shaving of hair and 'vascularization' by warming of the scalp tissue to which the probe is applied. Unlike the measurement of oxygen saturation by pulse oximetry (see section 8.4.), transcutaneous P_{O_2} measurement on its own has a conceptual and theoretical problem in its relevance for fetal monitoring: in a system where the degree of both hypoxia and acidosis are unknown variables and important contributors to asphyxia and fetal compromise, the Bohr shift of the oxygen dissociation curve under conditions of increasing acidosis may release oxygen into peripheral tissues and thus hide the presence of hypoxia.

8.4. Fetal pulse oximetry

Pulse oximeters can non-invasively measure arterial oxygen saturation and have found widespread acceptance within anesthesia, intensive care and neonatology. Fetal application needs to overcome the fact that the fetal signal is much smaller, and it is important to confirm that the pulsations detected on the plethysmograph actually reflect the fetal arterial pulse rate. Adaptation for intrapartum monitoring also requires that the light emitting diodes (LEDs) and photodiodes are placed in reflectance rather than transmission mode. This however may result in direct shunting of light between the sensors if they are not in good contact with skin or if they are over fetal hair.

If such problems can be overcome, the potential of fetal pulse oximetry to make a significant contribution is considerable. It is a sensitive measure of hypoxia but early results also suggest that the baseline saturation level between contractions may even be able to reflect acid/base status because of the concomitant changes in the p50 of the oxygen dissociation curve.

8.5. Near-infrared spectroscopy

This method looks at the changes of absorption of wavelengths in the near-infrared range, from which measures of cerebral hemodynamics and oxygenation can be calculated, including cerebral blood volume and blood flow, relative concentrations of oxygenated and reduced hemoglobin, and cytochrome oxidase. After initial research on the neonatal unit, attempts are being made to adapt this technique for intrapartum application, although the parameters which may be useful for prospective management have yet to be defined.

8.6. Aims of research into new technologies

The above and several other new technologies which are currently undergoing investigation have in common that, in contrast to intermittent fetal scalp blood analysis, they aim to provide a continuous measurement. For trend analysis, absolute values are less important than the assessment of change, which can be noted relative to the pre-existing condition of a baby early in labor.

Research in this field has to take care to identify and exclude artifacts which are particularly easy to obtain within a system which is so dynamic and where the subject — the fetus — is so inaccessible. It has to

1. concentrate on developing specialized sensors and probes for reliable signals;
2. ensure reliability and reproducibility of readings;
3. define normal values and significant deviations;
4. establish correlations with intrapartum events which are statistically as well as clinically significant;
5. assess critically whether this information adds anything over and above already available techniques when they are optimally applied; and finally

6. test the new method against a current 'gold standard' management in controlled clinical trials with sufficient numbers and clearly defined endpoints.

The needs for intrapartum surveillance are not the same as those in the neonatal unit, where the degree of compromise can be more clearly assessed and where therapeutic measures can be undertaken as appropriate. During labor, our range of treatments are limited, and mostly consist of rectifying iatrogenic causes such as maternal ketosis and hypoxia, incorrect posture, or uterine hyperstimulation. The main question asked of the obstetrician and midwife is whether labor can be allowed to proceed with minimum interference; when is there a risk that normal 'stress' is becoming 'distress'; and when should we actively intervene to avoid asphyxial damage to the baby. New technology will be most successful if it can not only improve neonatal outcome but also reduce the rate of unnecessary interventions during labor.