Editorial

Foetal monitoring during surgery unrelated to pregnancy

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This issue includes an article by Lui *et al.* titled "Foetal monitoring in parturients undergoing surgery unrelated to pregnancy."¹ The authors used an external cardiotocometer to monitor five parturients undergoing various surgical procedures. Their observations provide some baseline data for future monitoring of obstetrical patients. For others who may wish to use this type of monitoring there are some additional points that require clarification, however.

First, there are several technical details that need to be considered. The monitoring of the foetal heart rate and uterine contractions on a continuous basis requires tocodynameters that are quite large (5–6 cm in diameter) if a written recording is to be obtained. The Hewlett-Packard Cardiotocograph 8030A used by Liu *et al.*, is probably the most commonly used instrument for this purpose.² The monitor must be lubricated and firmly attached to the maternal abdomen. Movement of the "toco" or poor contact will decrease the quality of the tracing.

The best position of the monitor on the abdomen will depend on the position and size of the foetus. Usually the right or left lower quadrant is best for monitoring the foetal heart rate, while the midline position just below the umbilicus is the best site for monitoring uterine contractions. Monitoring of both these variables on a continuous basis is usually not feasible until at least 26–28 weeks gestation, because prior to this the foetus is too small and too mobile. In the five cases presented by Lui *et al.* the foetuses were 28 weeks gestation or older. The

authors mention the difficulty of placing the monitors if intraabdominal surgery is required. The best tracings of the study, and the only ones included in the paper, are from a patient who underwent a mastectomy.

Some other technical pitfalls with the doppler monitoring technique include "slurring" of the signal, and the problem of "half-counting" or double counting³ of the foetal heart rate. The signal obtained with this ultrasound type of recording is not as high quality as that obtained by electronic means. (The electronic internal electrode or scalp clip can only be used once the membranes are ruptured.) The poorer quality of the doppler device makes assessment of beat-to-beat variability more difficult. When beat-to-beat variability is being assessed with the doppler, only changes from the reference tracing should be considered rather than the minute-to-minute variations in beat-to-beat variability. The problem of half-counting or double-counting can arise with either very low or very high foetal heart rates. For example, a heart rate of 60 or 240 may appear on the graph as 120. If this problem is suspected, auscultation of the foetal heart is necessary to determine the rate.

Monitoring of contractions with the doppler technique also has limitations. The intensity of the contractions cannot be determined, only the frequency. For example, in a very slender parturient the contractions may appear of greater intensity than those of an obese patient, simply due to the variation in the thickness of the abdominal wall. The doppler device can also pick up Braxton-Hicks contractions in some patients. When a contraction pattern appears on the monitor careful manual palpation of the abdomen may help to determine the strength of the contractions. The contraction pattern may also disappear if the parturient changes posi-

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tion, so careful repositioning of the tocodynamometer is often required in the awake patient.

In the very obese patient undergoing surgery, monitoring of either the foetal heart or uterine contractions may be impossible due to the thickness of the anterior abdominal wall.

If the various technical problems can be overcome during surgery, we still must take into account the normal physiological variations that occur in the foetal heart rate if we are to be able to recognize abnormal tracings. At term a heart rate of 120–160 is considered to be within the normal range. Heart rates in the premature foetus tend to be at the higher limits of this range.⁴ The foetal heart rate changes by 10–20 beats/minute with movement, breathing, and sleep states. Sudden accelerations in the foetal heart rate occur with foetal movements and the increase in heart rate may last 30–60 seconds. This is normal and actually is indirect evidence of foetal well-being.⁴

Sustained increases in foetal heart rate, especially if the rate is between 160–180 beats/minute may indicate foetal stress. This can be seen with maternal fever, or fetal hypovolemia. Some authors consider that a foetal tachycardia may occur with mild degrees of hypoxia.⁵

Slow declines in foetal heart rate to a range of 110–120 beats/minute may occur with foetal sleep states. Abrupt bradycardias are not normal and should be considered a sign of foetal compromise.

Beat-to-beat variability is seen in all healthy foetuses after 28 weeks' gestation. Normal beat-to-beat variability depends not only on a healthy cardiovascular system but also requires an intact central nervous system. Beat-to-beat variability may be decreased by drugs such as narcotics, barbiturates, general anaesthetics and, in some cases, magnesium sulfate or even local anaesthetics.⁶ In the absence of drug effects a decrease in beat-to-beat variability may be due to hypoxia, acidosis or any situation where marked foetal tachycardia occurs.⁷

In the five cases presented by Lui *et al.*, foetal beat-to-beat variability decreased markedly with the onset of general anaesthesia and returned 60–180 minutes following cessation of anaesthesia. Considering the eventual good outcomes for these infants, this decreased beat-to-beat variability was most likely due to the foetuses being anaesthetized. Intra-operatively then, beat-to-beat variability like-

ly cannot be used to monitor foetal well-being, if a general anaesthetic is used. In all of these patients foetal heart rate also declined – usually by 10–30 beats/minute. The decline was gradual, so it may, as the authors suggest, be an effect of the inhalational anaesthetics on the foetus. In no case did the heart rate drop abruptly or out of the normal range.

Lui *et al.* suggest that monitoring of foetal heart rates and uterine contractions should be routine in all parturients having surgery during pregnancy. As these authors have demonstrated, this is not always easy to do, especially for intra-abdominal procedures. Even if the technical problems can be overcome, and these are considerable, the information gained may still be difficult to interpret. As in the labouring patient, I think that a normal tracing is probably significant. In labour 85–95 per cent of foetuses who have a normal pattern have a good outcome. If the tracing is abnormal, however, only 25–35 per cent of these foetuses will have a poor outcome.⁸ Thus, a normal tracing is reassuring. An abnormal tracing is difficult to interpret.

The question then is whether or not we should monitor all pregnant patients who require surgery during pregnancy. I would suggest the following as being a practical approach to this problem. First, someone, either the anaesthetist or other consultant familiar with this method of monitoring, should be available to correctly interpret the tracing and help correct technical problems. Second, a baseline tracing prior to administration of any medication is essential. Third, for intraabdominal procedures, pre- and postanaesthesia monitoring periods of 30–60 minutes should be used to assess the foetus and look for contractions. Fourth, the monitors can be used intraoperatively for non-abdominal procedures. Sudden increases or decreases in foetal heart rate (i.e., rates less than 120 or greater than 160) should alert the anaesthetist to a potential problem. Then, maternal blood pressure, oxygenation, and positioning should be re-assessed to rule out a compromising situation to either patient.

The other precautions mentioned by Lui *et al.*, such as left lateral tilt, a rapid sequence induction, and careful monitoring of maternal vital signs, are still the mainstays of foetal protection during surgery on the mother.