Is fetal blood sampling and pH estimation helpful or harmful?

The role of continuous electronic monitoring of the fetal heart rate (EFM) in the prevention of intrapartum damage continues to be controversial.¹ If all fetuses are monitored in this way, about one third will have an abnormal cardiotocogram at some stage during labour. Uncritical resort to operative delivery if this happens is therefore inevitably associated with high rates of caesarean section and forceps delivery. While a high rate of intervention may result in low perinatal mortality and morbidity, the mother has to shoulder the increased rate of complications, discomfort, and loss of satisfaction which often accompanies operative delivery.²

How then can the rate of false positive EFM be reduced? When EFM is done in conjunction with fetal blood sampling and estimation of pH there is undoubtedly a lower rate of operative delivery than when it is used alone.¹⁻³ There is also some evidence that high rates of fetal blood sampling reduce the proportion of neonates born with a low pH. For example, Sykes *et al* reported that in 899 births with a rate of fetal blood sampling of only 4% mean umbilical cord arterial blood pH was 7.20.⁴ A similar study at St Mary's Hospital, Paddington, of 790 births with a 12% rate of fetal blood sampling reported a mean pH of 7.26.⁵ Van den Berg *et al* reported 2669 births with a rate of 22% and a mean pH of 7.30.⁶

Despite this evidence of the benefits of fetal blood sampling, however, and despite the fact that in 1979 more than 90% of obstetric units in the United Kingdom used EFM, fetal blood sampling was used in only 40%.⁷ The main reason for this is probably logistical, in that fetal blood sampling is time consuming and uncomfortable for both obstetrician and mother. Attempts to produce an electrode which can be attached directly to the fetus and provide a continuous measurement of pH continue, but a practical system has not yet been produced. There are, however, more fundamental issues complicating the interpretation of fetal blood pH in relation to predicting neonatal outcome and the need for intervention.

Impaired gaseous exchange leading to hypoxia and acidosis remains a major problem for the fetus

during labour, but the fetus may also be adversely affected by infection, drugs administered to the mother, haemorrhage, and trauma (caused, for example, by breech delivery, shoulder dystocia, difficult forceps delivery, a tight nuchal cord, and prolonged head compression). In a recent study of 56 babies of more than 32 weeks' gestation at delivery who required resuscitation by intubation and ventilation only 43% had any evidence of hypoxia or acidosis shown by cardiotocographic abnormality and analysis of umbilical cord blood.⁸ Even when acid base balance is disturbed, the importance of this for the fetus will depend on factors such as gestational age,⁹ centile birth weight,¹⁰ and exposure to other hazards such as meconium aspiration,¹¹ and trauma.¹² Thus measurement of the acid base status of the fetus alone is not a sufficient basis on which to predict outcome or decide management.

Several studies have shown that 80% of babies with a pH in fetal blood of less than 7.2 will have an Apgar score at one minute of less than 7, compared with an overall incidence of only 10-15%.¹³⁻¹⁴ If a clinical indication for sampling is present, such as an abnormal cardiotocogram or meconium staining of the liquor, however, even babies with a fetal blood pH value of less than 7.3 still have about twice the risk of having a low Apgar score at birth than if the cardiotocogram is normal.¹³ This may be related to other factors such as difficult delivery, anaesthetics given to the mother, infection, and prematurity, which are not reflected in fetal acid base balance.

Even when the pH is low, the long term implications for the fetus are uncertain. Intact survival has been reported despite an arterial pH of only 6.6.¹⁵ This is because the likelihood of an abnormal outcome increases as pH falls but there is no definite cut off point between normal and abnormal; rather prognosis depends on many factors.¹⁶

There are also problems in interpreting pH measurements in the fetus. Inexperienced clinicians may easily misinterpret a reversible short term episode of fetal respiratory acidosis after an acute incident (such as maternal hypotension) as chronic metabolic acidosis unless blood gas or lactate

measurements are also made.¹³ On the other hand, a well grown fetus can maintain his pH for up to 90 minutes even in the presence of marked hypoxia, thus providing the clinician with false reassurance;¹⁷ unless repeated sampling is performed, the development of serious acidosis may be missed.

These caveats do not mean that fetal blood sampling and estimation of pH are not worth while. What they should mean is that labour should be managed by staff well trained in the pathophysiology of the fetus and capable of interpreting acid base state in the context of all the other measurements available. While such interpretation is difficult and imprecise, it is no more so than the interpretation of the data available for the neonate in the intensive care baby unit. It is unrealistic to expect any single measure to provide a complete description of the condition of the fetus. Fetal blood sampling with blood gas and pH estimation must, however, remain the cornerstone of any scientific attempt to assess the health of the fetus in labour.

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