Fetal intrapartum pulse oximetry for fetal assessment in labour

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RHL Summary

Key findings

- Fetal pulse oximetry (PO) in addition to routine cardiotocography did not reduce overall caesarean section (CS) rates
- One trial found that women undergoing fetal electrocardiography (ECG) plus cardiotocography (CTG) had significantly less CS births than fetal pulse oximetry plus cardiotocography
- Adverse perinatal outcomes were too few for assessment

Evidence included in this review

Seven randomized trials involving 8,013 women were included - six trials comparing routine CTG with PO versus CTG alone, and one trial comparing CTG with PO versus CTG with ECG.

Quality assessment

Overall, evidence for primary outcomes was of moderate to high quality. There was a lack of blinding in the use of PO in all trials.

Clinical implications

Fetal pulse oximetry represents a major advance in real-time monitoring of oxygenation. Low-cost devices, such as using cellphones for data analysis and display, make this technology affordable in low-resource settings. Unfortunately, to date pulse oximetry has not proven useful for fetal assessment during labour. In low-resource settings, fetal heart rate auscultation with the Pinard stethoscope or inexpensive hand-held Doptone (to detect late fetal heart rate decelerations) is the mainstay of fetal assessment during labour.

Further research

Innovative research is needed to overcome technical limitations of fetal pulse oximetry. In the meantime, research in low-resource settings should focus on low-cost methods of fetal assessment, such as the effects of clinical fetal arousal tests using simple vibro-acoustic or scalp stimulation on fetal movements and/or auscultated fetal heart rate accelerations.

Cochrane review
Abstract

The use of conventional cardiotocographic (CTG) monitoring of fetal well-being during labour is associated with an increased caesarean section rate, compared with intermittent auscultation of the fetal heart rate, resulting in a reduction in neonatal seizures, although no differences in other neonatal outcomes. To improve the sensitivity of this test and therefore reduce the number of caesarean sections performed for nonreassuring fetal status, several additional measures of evaluating fetal well-being have been considered. These have demonstrated some effect on reducing caesarean section rates, for example, fetal scalp blood sampling for pH estimation/lactate measurement. The adaptation of pulse oximetry for use in the unborn fetus could potentially contribute to improved evaluation during labour and therefore lead to a reduction in caesarean sections for nonreassuring fetal status, without any change in neonatal outcomes.

To compare the effectiveness and safety of fetal intrapartum pulse oximetry with other surveillance techniques.

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (31 May 2014), contacted experts in the field and searched reference lists of retrieved studies. In previous versions of this review, we performed additional searches of MEDLINE, Embase and Current Contents. These searches were discontinued for this review update, as they consistently failed to identify any trials that were not shown in the Cochrane Pregnancy and Childbirth Group's Trials Register.

All published and unpublished randomised controlled trials that compared maternal and fetal outcomes when fetal pulse oximetry was used in labour, (i) with or without concurrent use of conventional fetal surveillance, that is, cardiotocography (CTG), compared with using CTG alone or (ii) with or without concurrent use of both CTG and other method(s) of fetal surveillance, such as fetal electrocardiography (ECG) plus CTG.

At least two independent review authors performed data extraction. We sought additional information from the investigators of three of the reported trials.

We included seven published trials: six comparing fetal pulse oximetry and CTG with CTG alone (or when fetal pulse oximetry values were blinded) and one comparing fetal pulse oximetry plus CTG with fetal ECG plus CTG. The published trials, with some unpublished data, were at high risk of bias in terms of the impractical nature of binding participants and clinicians, as well as high risk or unclear risk of bias for outcome assessor for all but one report. Selection bias, attrition bias, reporting bias and other sources of bias were of low or unclear risk. The trials reported on a total of 8013 pregnancies. Differing entry criteria necessitated separate analyses, rather than meta-analysis of all trials.

Systematic review of four trials from 34 weeks not requiring fetal blood sampling (FBS) prior to study entry showed no evidence of differences in the overall caesarean section rate between those monitored with fetal oximetry and those not monitored with fetal pulse oximetry or for whom the fetal pulse oximetry results were masked (average risk ratio (RR) 0.99 using random-effects, 95% confidence intervals (CI) 0.86 to 1.13, n = 4008, I² = 45%). There was evidence of a higher risk of caesarean section in the group with fetal oximetry plus CTG than in the group with fetal ECG plus CTG (one study, n = 180, RR 1.56, 95% CI 1.06 to 2.29). Neonatal seizures and neonatal encephalopathy were rare in both groups. No studies reported details of long-term disability.

There was evidence of a decrease in caesarean section for nonreassuring fetal status in the fetal pulse oximetry plus CTG group compared to the CTG group, gestation from 34 weeks (average RR (random-
effects) 0.65, 95% CI 0.46 to 0.90, n = 4008, I² = 63%). There was no evidence of differences between groups in caesarean section for dystocia, although the overall incidence rates varied between the trials.

The addition of fetal pulse oximetry does not reduce overall caesarean section rates. One study found a higher caesarean section rate in the group monitored with fetal pulse oximetry plus CTG, compared with fetal ECG plus CTG. The data provide limited support for the use of fetal pulse oximetry when used in the presence of a nonreassuring CTG, to reduce caesarean section for nonreassuring fetal status. A better method than pulse oximetry is required to enhance the overall evaluation of fetal well-being in labour.

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