Intrapartum Fetal Surveillance

Clinical Guideline – Fourth Edition 2019

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists

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The Royal Australian and New Zealand College of Obstetricians and Gynaecologists

www.ranzcog.edu.au

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Introduction

Australia and New Zealand are both safe places in which to give birth, or be born, and both countries compare favourably with other OECD countries. [1] Despite this, there is a continual challenge in maternity care to maintain and improve current perinatal outcomes, as the age of first time mothers increases. In addition, hospitals have to cope with an epidemic of diabetes and obesity which are both associated with a worsening in perinatal outcomes. [2, 3] There are also an increased number of choices of models of maternity care now available to women, performed by practitioners with different skill sets and training. It is important that safe care of women and their babies in labour is underpinned by consistent, evidence-based practice in intrapartum fetal surveillance.

Clinical guidelines are an increasingly familiar part of clinical practice. Their principal aim is to improve the effectiveness and efficiency of clinical care through the identification of good clinical practice and desired clinical outcomes. The specific aim of this Guideline, in combination with continuing education, training and credentialing, is to reduce adverse perinatal outcomes related to inappropriate or inadequate intrapartum fetal surveillance.

Background

Development of the Guidelines: 2000–2002

In September 2000, the Victorian Managed Insurance Authority (VMIA) provided RANZCOG with a confidential report into obstetric cases reported to the Authority between 1993 and 1998. The report identified cases in which the reviewers considered there were potentially avoidable factors resulting in an adverse outcome. Issues relating to the use and interpretation of cardiotocographs (CTGs) represented a high proportion of these cases. In response to this report, the RANZCOG Council endorsed a submission from its Practice Improvement and Medico-legal Committees to develop an evidence-informed clinical practice guideline in intrapartum fetal surveillance. This submission was approved for funding by VMIA.

In 2001, Professor Bruce Barraclough, Chair, Australian Council for Safety and Quality in Health Care at the launch of the National Action Plan 2001, argued that improving the quality and safety of patient care was the most important challenge facing health professionals; "we must stop blaming individuals and put much greater effort into making our systems of care safer and better". [4]

The Douglas Report: Inquiry into obstetric and gynaecological services at King Edward Memorial Hospital 1990–2000, published in November 2001, also highlights key clinical governance issues in obstetric and gynaecology services. [5] The report emphasises the importance of clinical risk management strategies based on the identification and analysis of risk in a framework that enables the establishment of processes to minimise risk. It was hoped that the development of clinical practice guidelines, along with strategies to ensure their implementation via an effective education and credentialing process, would provide a framework to support health professionals in the provision of safe, quality health care.

RANZCOG established a Guideline Development Group and contracted The Royal Women's Hospital Division of Research and Education to assist in the development of the first edition of this evidence-informed guideline in 2001. While this project was funded and developed in Victoria, there was an extensive consultation process across Australia and New Zealand when developing the original Guideline. A draft was circulated throughout Australia and New Zealand to Fellows, Diplomates, Midwives, the Royal Australian College of General Practitioners (RACGP), the Australian College of Rural and Remote Medicine (ACRRM) and consumers.

The initial phase of this project involved a search and critical appraisal of recent publications addressing the topic of intrapartum fetal surveillance. In view of the release in May 2001 of the United Kingdom of the Royal College of Obstetricians and Gynaecologists (RCOG) / National Institute for Clinical Excellence (NICE) Guidelines on the use of electronic fetal monitoring [6] (which included a comprehensive bibliography and evaluation of the literature), it was agreed to restrict the literature search and appraisal to articles published from July 2000 onwards and to integrate new literature with the existing evidence to that date.

In the opinion of the Guideline Development Group, the environment in which obstetrics is practised in Australia and New Zealand differed sufficiently from that of the United Kingdom to require a guideline for use in the Australian and New Zealand setting. In particular, the health care system has a different public / private split and maternity care is provided in a range of facilities defined within a Hospital Capability Framework from 1- 6 [7-9] and in New Zealand with District Health Boards, with varying degrees of obstetric expertise and back-up. In addition, rural and provincial practitioners often provide services in isolation both professionally and geographically. There was also concern that the numbers of health care professionals practising obstetrics and midwifery in Australia were diminishing [10, 11] and that local guidelines might have a role in mitigating this trend. Accordingly, the Guideline was produced in order to provide a foundation on which clinicians providing intrapartum care in Australia and New Zealand should base their practice.

In December 2002, the Clinical Guidelines for Intrapartum Fetal Surveillance (First Edition) were published with a planned revision in 2004. Copies of the Guideline were widely circulated and freely available on the College website (www.ranzcog.edu.au). Users of the Guideline were encouraged to provide feedback on any aspects that required clarification and any barriers or problems they expected or experienced in implementing the Guideline. The feedback from users was collated and held at College House.

Revision of the Guidelines: 2004–2006

In 2004, a Guideline Review Group was convened to oversee the revision process of the Guideline. This process involved a number of distinct but related steps including the review of feedback from clinicians (both medical and midwifery), a further literature update appraisal (from 2002-2005), an expert panel workshop and further drafting. Following the revision, a workshop was convened where k 7hDtakeholders were invited to participate in multidisciplinary discussion of the revis gs m gs q 10 0 CE)

The clinical question relating to risk factors associated with poor outcomes (antenatal and intrapartum) was not subject to a full systematic review of the literature as initial searches on this topic demonstrated a lack of Level I evidence in this area. Therefore, a more general literature search through Ovid MEDLINE was carried out on risk factors associated with poor outcomes (antenatal and intrapartum).

The clinical question relating to risk factors associated with poor outcomes (antenatal and intrapartum) was not subject to a full systematic review of the literature as initial searches on this topic demonstrated a lack of Level I evidence in this area. Therefore, a more general literature search through Ovid MEDLINE was carried out on risk factors associated with poor outcomes (antenatal and intrapartum).

Following review of the new published literature, the Guideline Review Working Party met and drafted a new expanded third edition IFS Clinical Guideline. The Working Party took into account calls for changes to the Guideline that were made by relevant bodies, for example, the Victorian Coroner's court, and changes to the overall profile of women having babies in Australia and New Zealand (for example, older first time mothers and higher obesity rates among pregnant women).

The draft Guideline was sent to relevant stakeholders for consultation and amended accordingly following feedback.

Revision of the Guideline 2017-2019

Revision of this Guideline was commenced in 2017, as previously planned, in order to identify changes in the evidence base for intrapartum fetal surveillance. This was conducted under the auspices of the RANZCOG Women's Health Committee with input from the RANZCOG Fetal Surveillance Education Program Steering Committee.

A broad literature search was undertaken for articles published between January 2013 and January 2019 regarding any aspect of intrapartum fetal surveillance. Sixty-two articles were identified of direct relevance to this Guideline and were reviewed in detail, with minor changes being made to several of the recommendations.

Much of the literature of the past five years has assessed the role of technological adjuncts to traditional CTG monitoring. Overall, the literature does not strongly support the use of tools such as computerised CTG assessment, ST-segment analysis, or fetal oximetry as systematic reviews do not consistently show a benefit of such techniques. Ongoing research is assessing the role of alternatives to fetal heart rate assessment such as continuous assessment of fetal metabolic products, but such approaches have not yet been evaluated in the clinical setting and are not discussed further in this Guideline.

Following initial revision by RANZCOG, stakeholder consultation was undertaken and further amendments made following feedback.

A further review of this guideline is planned for 2022 unless a significant change is identified prior to this.

The principal aim of intrapartum fetal surveillance is to prevent adverse perinatal outcomes arising from fetal metabolic acidosis and cerebral hypoxia related to labour. However, many factors contribute to the development and severity of an asphyxial injury (e.g. tissue perfusion, tissue substrate availability, the duration and severity of the insult, the fetal condition prior to the insult) such that the relationship between metabolic acidosis and cerebral damage is complex. Therefore, the degree of tissue damage and subsequent injury does not necessarily relate directly to the extent of fetal metabolic acidosis arising during labour. Furthermore, it is clear that most often damage is actually sustained during pregnancy, distantly prior to labour, rather than arising de novo during labour and birth.

Nonetheless, the practice of fetal surveillance during labour would be expected to detect those fetuses at risk of compromise, allowing appropriate intervention and thereby increasing the likelihood of favourable perinatal outcomes. Monitoring the health of the fetus during labour has therefore become a key component of modern maternity care. Traditionally, this was undertaken by simple regular auscultation of the fetal heart with a stethoscope. However, this approach was considered by many to be inadequate, particularly for women with identifiable risk factors in their pregnancies. Therefore, in an effort to reduce the incidence of intrapartum fetal mortality and morbidity, the use of intrapartum electronic fetal monitoring (EFM), particularly continuous CTG, has steadily increased over the last 35 years.

The use of CTG for intrapartum fetal surveillance has now become entrenched in practice without robust randomised controlled trial (RCT) evidence to support it. The RCTs of continuous CTG which have been undertaken have suggested that its use is not associated with statistically significant improvements in long-term neonatal outcomes such as cerebral palsy, but that it is associated with significantly increased rates of (unnecessary) operative delivery. Nonetheless, not surprisingly, concerns about maternal hazards and small or absent perinatal benefit have led some authorities to advise against the routine use of continuous CTG for low risk labours. [6, 12, 13]

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in differences in practice. [20] However, the avoidance of adverse outcomes from intrapartum insult remains the objective of intrapartum fetal surveillance. This objective should be the same at all facilities and practitioners providing maternity services, regardless of the volume or case-mix of their population. How this objective is met may vary according to local resources and patient mix but it is more likely to be met, and met consistently, through the provision of clinical guidelines pertaining to the practice of intrapartum fetal surveillance, supported by standardised continuing professional development in the application and interpretation of fetal monitoring. It is hoped that this Guideline assists in these processes and is complemented by structured education programs such as the FSEP.

Thus, this Guideline was produced in order to provide a foundation on which clinicians providing intrapartum care in Australia and New Zealand should base their practice.

This Guideline has been developed using the best available published evidence. Where insufficient high-level evidence was available, recommendations have been developed based on expert opinion and consensus. This Guideline is written as a general guide, subject to the clinician's expert judgement in any particular clinical situation.

Guideline Objectives

The specific aim of this Guideline is, in combination with continuing education and training of maternity care staff, to reduce adverse perinatal outcomes related to inappropriate or inadequate performance and / or interpretation of intrapartum fetal surveillance. This will be achieved by encouraging best practice in:

- Decisions relating to the use and interpretation of intermittent auscultation (IA) or continuous CTG;
- Appropriate antenatal and perinatal risk identification and management for each pregnant woman;
- Decisions relating to the use of admission CTG; and
- Management of suspected fetal compromise both antepartum and intrapartum.

Target Audience for the Guideline

This Guideline is intended for use by health care professionals providing intrapartum care to pregnant women in labour in Australia and New Zealand. Health care professionals providing intrapartum care may include: obstetricians (specialist or general practitioner), midwives, obstetric physicians, and trainees.

This Guideline also provides useful information for pregnant women and their partners, health policy makers, health regulators, and those responsible for quality and safety of healthcare.

Scope of the Guideline

This Guideline provides recommendations on decisions relating to the use and interpretation of intrapartum fetal surveillance in pregnant women in labour. The Guideline includes recommendations on the management of suspected fetal compromise in both the latent and active phases of labour.

This guideline does not provide recommendations for fetal surveillance during the antenatal period.

Funding Source for the Update of this Guideline

The update of this Guideline was funded by the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG).

Revision of this Guideline

To maintain currency this Guideline will be reviewed for consideration of an update in 2022.

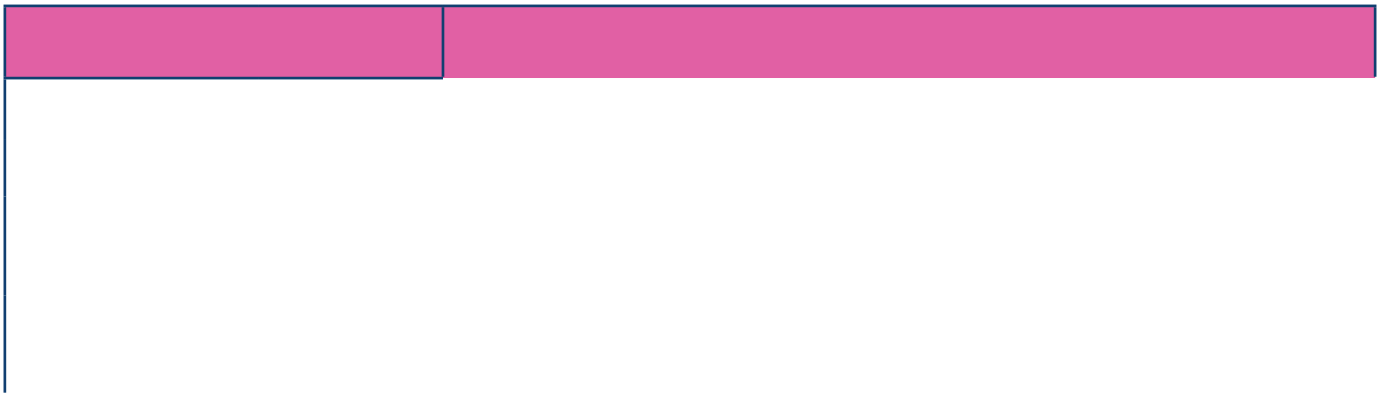
Evidence and Recommendations

Developing Recommendations

This section lists all the recommendations presented in this Guideline together with their grade and level of evidence on which they are based. Further details on the supporting evidence can be found in the relevant section of this Guideline. Each recommendation is given an overall grade based on National Health and Medical Research Council (NHMRC) Levels of Evidence and Grades for Recommendations for Developers of Guidelines. [21]

Where no robust evidence was available but there was sufficient consensus within the Fetal Surveillance Guideline Review Working Party, consensus-based recommendations were developed, and agreed to by the entire committee and are identifiable as such. Good Practice Notes are highlighted throughout this Guideline and provide practical guidance to facilitate implementation. These were also developed through consensus of the entire Working Party.

Grading of Recommendations [21]



Developing Recommendations

Where the words "use", "recommended" or "should" appear in recommendations in this Guideline, this Working Party judged that the benefits of the recommended approach clearly exceeded the harms, and that the evidence supporting the recommendation was trusted to guide practice.

Where the words "consider", "might" or "could" appear in recommendations in this Guideline, either the quality of evidence was insufficient to make a strong recommendation, or the available studies demonstrated little clear advantage of one approach over another, or the balance of benefits to harm was unclear.

Where the words "not recommended" appear in recommendations in this Guideline, there was either a lack of appropriate evidence, or the harms outweighed the benefits.

The likelihood of poor fetal outcomes is increased by well-recognised antenatal and intrapartum risk factors. However, there are few population-based studies on risk factors associated with poor outcomes.

This Working Party identified a number of risk factors listed below. Some were taken from previous editions of this Guideline, some were risk factors listed in other international intrapartum fetal surveillance guidelines [6, 22]

Antenatal and intrapartum factors that increase risk of fetal compromise. Intrapartum cardiotocography is recommended

Antenatal Risk Factors

- abnormal antenatal CTG
- abnormal Doppler umbilical artery velocimetry
- suspected or confirmed intrauterine growth restriction
- oligohydramnios (MVP < 2cm or AFI < 5cm) or polyhydramnios (MVP > 8cm or AFI > 20cm or as defined by local referral guidelines)
- prolonged pregnancy ≥ 42 weeks [23]
- multiple pregnancy [24]
- breech presentation [25, 26]
- antepartum haemorrhage
- prolonged rupture of membranes (≥ 24 hours) [25]
- known fetal abnormality which requires monitoring
- uterine scar (e.g. previous caesarean section)
- essential hypertension or pre-eclampsia
- diabetes where medication is indicated [27] or poorly controlled, or with fetal macrosomia
- other current or previous obstetric or medical conditions which constitute a significant risk of fetal compromise (e.g. cholestasis, isoimmunisation, substance abuse)
- fetal movements altered unless there has been demonstrated wellbeing and return to normal fetal movements [28, 29]
- morbid obesity (BMI ≥ 40) [30, 31]
- maternal age ≥ 42 [32-34]
- abnormalities of maternal serum screening associated with an increased risk of poor perinatal outcomes (e.g. low PAPP-A <0.4MoM or low PlGF) [35, 36]
- abnormal placental cord insertion [37]
- abnormal cerebroplacental ratio [38, 39]

Intrapartum Risk Factors

- induction of labour with prostaglandin / oxytocin
- abnormal auscultation or CTG
- oxytocin augmentation
- regional anaesthesia (e.g. epidural* or spinal)
- abnormal vaginal bleeding in labour
- maternal pyrexia ≥ 38°C [40]
- meconium or blood stained liquor [41]
- absent liquor following amniotomy
- prolonged first stage as defined by referral guidelines
- prolonged second stage as defined by referral guidelines
- pre-term labour less than 37 completed weeks
- tachysystole (more than five active labour con tractions in ten minutes, without fetal heart rate abnormalities)
- uterine hypertonus (contractions lasting more than two minutes in duration or contractions ocurring within 60 seconds of each other, with out fetal heart rate abnormalities)
- uterine hyperstimulation (either tachysystole or uterine hypertonus with fetal heart rate abnormalities).

*Following a decision to insert an epidural block, a CTG should be commenced to establish baseline features prior to the block's insertion.

Communication with, and Information for, Pregnant Women

There is universal acceptance that the fetus is at risk of hypoxic injury during labour. [51] It is expected that the

Intrapartum Fetal Surveillance in the Absence of Recognised Risk Factors

Admission CTG

The admission CTG is a commonly used screening test, which aims to identify, on admission to the delivery unit, the fetus at increased risk of intrapartum hypoxia. A number of cohort studies [52,53] and case control series [54] have suggested that the use of an admission CTG improves the prediction of important adverse perinatal outcomes including neonatal acidaemia, neonatal encephalopathy [54], long-term neurological impairment [55] and death. [52]

In contrast to these cohort studies, a meta-analysis of the randomised controlled trials (RCTs) of admission CTG in low risk labours [56] failed to show an immediate benefit to the neonate. The review found a 20% increase in the caesarean section rate in the admission CTG group.

A subsequent RCT [57] compared admission CTG to intermittent auscultation in 3034 women. It showed that women randomised to admission CTG were more likely to go on to have continuous intrapartum CTG monitoring but that the rates of caesarean section and adverse neonatal outcomes were not different from those allocated to intermittent auscultation.

While many centres or clinicians will objectively follow the recommendations of Devane et al., 2017 and not recommend admission CTGs for women without identified risk factors, others will continue to recommend admission CTGs for such women for one or more of the following reasons:

- Multiple authors have highlighted that the RCTs have not been of sufficient size to demonstrate statistically significant differences in the incidence of important but infrequent neonatal outcomes such as hypoxic ischaemic encephalopathy (HIE) [14, 58-60] and it remains possible that the admission CTG confers a fetal benefit in a very small number of labours. [61] Importantly, in the Dublin trial [62], the largest trial reported to date, which therefore dominates the meta-analysis, [56] early amniotomy was performed and continuous CTG undertaken if meconium-stained amniotic fluid was observed. In Australia and New Zealand, early amniotomy is less commonly practised, and therefore less women with meconium stained amniotic fluid, an important intrapartum risk factor for fetal hypoxia, will be recognised early in labour. Thus, the possible benefits of admission CTG in Australian practice may be greater than would have been detectable in the Dublin trial.
- Other regional variations reduce the relevance of the RCT meta-analysis to the Australian and New Zealand context. For example, the RCTs were conducted in hospitals with a tradition of one-to-one midwife-patient ratios in labour and immediate access to operative intervention should that become necessary. It is unfortunate reality that there are centres in Australia and New Zealand where staffing ratios are suboptimal and / or access to an operating theatre limited by the need to call in theatre staff from home and / or competition with emergency general surgery.
- Many women in Australia are accepting of an increase in the caesarean section rate even if the fetal benefit is very small. [61]

Recommendation 4	Grade and Supporting References
[illegible]	

- The RCTs have not been of sufficient size (inadequately powered) to address infrequent but clinically important neonatal outcomes such as hypoxic ischaemic encephalopathy (HIE), cerebral palsy or perinatal death.
- In the largest trial [15] which dominates the meta-analysis, early amniotomy was performed and continuous CTG undertaken if meconium-stained amniotic fluid was observed. In Australia and New Zealand early amniotomy is less commonly practised and therefore fewer women with meconium stained amniotic fluid (an important intrapartum risk factor for fetal hypoxia) will be recognised early in labour. Thus, the possible benefits of admission CTG in Australian and New Zealand practice may be greater than would have been detectable in the 1985 trial of McDonald et al.
- As previously discussed with regard to admission CTG and midwife staffing ratios, other regional variations reduce the relevance of the RCT meta-analysis to the Australian and New Zealand context (see Admission CTG section above).

Recommendation 5	Grade and Supporting References
Intermittent auscultation is an appropriate method of intrapartum fetal monitoring in women without recognised risk factors. Weighing the probable increase in operative birth against a possible fetal benefit in a very small number of labours, the use of cardiotocography in women without recognised risk factors for fetal compromise should be individualised after discussion with the woman.	B 65 (Level I)

Recommendation 6	Grade and Supporting References

Excessive uterine activity is defined as:

- more than five active labour contractions in ten minutes, without fetal heart rate abnormalities (tachysystole)

Recommendation 9	Grade and Supporting References
Excessive uterine activity in the absence of fetal heart rate abansT 0	k 0 0 5952.91 00' 2631. k 0le of fpreal heart e

A systematic review of RCTs of intermittent auscultation (IA) versus continuous CTG in both low- and high-risk women reveals a significant increase in the caesarean section rate, whether fetal blood sampling (FBS) was deployed in labour (RR 1.50; 95%CI 1.10-2.06) or not (RR 1.96; 1.24-2.09). [65] It is therefore possible that the availability of FBS in labour will lessen the increase in the caesarean rate that comes as a consequence of using continuous CTG. However, in Australia and New Zealand many women birth in hospitals where undertaking FBS may delay a necessary delivery and thereby worsen outcomes. For example, in some hospitals the decision to delivery interval for an emergency caesarean section may generally be considerably longer than in those hospitals from which the RCT literature is derived. In these circumstances, FBS may compound the delay. Therefore, while FBS facilities are desirable, (particularly in larger units that have ready access to operative delivery if required) it is not practical for all hospitals to provide FBS.

In the past, some hospitals interested in providing FBS were unable to because of the costs of maintaining the necessary hardware. More recently, the introduction and validation of scalp lactate measurement [93] has provided an affordable alternative. Indeed, in a systematic review comparing FBS for pH measurement with FBS for lactate, there were significantly less failed procedures in the lactate measurement group [94] suggesting that lactate measurement is easier to perform – requiring less sample volume – and so more likely to be appropriately utilised. If FBS is performed, the scalp pH or lactate result should be interpreted taking into account any previous measurement, the rate of progress in labour and other clinical circumstances. Furthermore, lactate measurements may vary according to the analysis hardware used and this can influence the threshold values employed. [95]

Other Techniques for Intrapartum Fetal Surveillance

Computer-assisted CTG interpretation, fetal ECG/ST segment analysis, fetal pulse oximetry, scalp electrodes and intrauterine pressure catheters

A number of techniques for intrapartum fetal surveillance other than electronic fetal monitoring were considered at this Guideline review including:

- fetal ECG / ST segment analysis [98-106];
- fetal pulse oximetry [107];
- Computer-assisted CTG interpretation [108-110];
- Short-term variability assessment [111]; and
- intrauterine pressure catheters.[112-114]

None of the published RCTs demonstrated a benefit over electronic fetal monitoring by CTG. At this time, the use of fetal ECG / ST segment analysis, fetal pulse oximetry, computer-assisted CTG interpretation, short-term variability assessment, or intrauterine pressure catheters is not recommended in routine intrapartum fetal surveillance. However, where uterine activity is not readily palpable, e.g. morbid obesity, the use of an intrauterine pressure catheter may confer a better assessment of uterine activity and the subsequent assessment of fetal well-being.

In 2013, a Cochrane Review was published examining internal versus external tocodynamometry during induced or augmented labour.[114] This review included both studies which were originally considered by the Guideline Review Working Party when formulating the recommendation on intrauterine pressure catheters, [112, 113] and also included another trial of 239 women.[115] Importantly, there were no changes to any of the outcomes of interest compared with this Working Party's original review of evidence on intrauterine pressure catheters earlier in 2012. The only additional information provided in the 2013 review was that where infection was not reported in the 2010 Bakker Review, the 2013 Bakker Cochrane Review does look at infection rates and finds that there is no increased risk for infection reported when an intrauterine catheter was used. [114]

Cardiotocography devices which monitor fetal heart rate by fetal ECG and uterine contractions by electromyography, both obtained from maternal abdominal surface electrodes, have recently been developed. These devices are of benefit when a traditional ultrasound and abdominal surface pressure transducers are ineffective and can be considered as alternatives to fetal scalp electrodes and intrauterine pressure transducers. [116, 117]

Recommendation 14	Grade and Supporting References
There is insufficient evidence to recommend fetal ECG / ST segment analysis, fetal pulse oximetry, computerised CTG assessment, or short-term variability measurement for routine use in intrapartum fetal surveillance.	A 98-107, 112-114 (Level I)
Recommendation 15	**Grade and Supporting References**
If there is difficulty auscultating the fetal heart or obtaining an adequate fetal heart rate tracing at any time in labour, the fetal heart rate should be monitored using a scalp electrode or external fetal ECG-derived monitor.	Consensus-based Recommendation

Amnioinfusion

Amnioinfusion has been used to dilute thick meconium, for treatment of abnormal fetal heart rate patterns and prophylactically or therapeutically in cases of oligohydramnios resulting from rupture of membranes. Of the Level I systematic reviews considered regarding amnioinfusion, [118-120] there was insufficient evidence to recommend amnioinfusion for any indication in the Australian and New Zealand healthcare setting. However, amnioinfusion may confer a small benefit in a small number of cases where fetal blood sampling is not possible

Recommendation 19	Grade and Supporting References
Institutions should ensure that their staff have access to and are supported to use suitable educational resources, such as the FSEP and its suite of educational resources.	Consensus-based Recommendation

Clinical audit and practice review

Health professionals with responsibility for the intrapartum care of women should review their current practice in line with this Guideline. This Guideline is likely to improve clinical practice and outcomes where it becomes a foundation of routine clinical care. Institutions and health professionals are encouraged to develop and undertake regular audits of guideline implementation and regular reviews of clinical practice. It is believed that such audits and reviews are best undertaken in a multidisciplinary environment.

Aspects of care and guideline implementation that are suitable for audit include:

- Women receiving continuous CTG (including those with and without indications for such monitoring).
- Women with indications for continuous CTG who did not receive it.
- Delivery interventions arising from clinical interpretations of the CTG.
- Poor perinatal outcomes.
- Fetal scalp samplings / umbilical cord blood gas analysis.
- Maternal satisfaction with labour care.

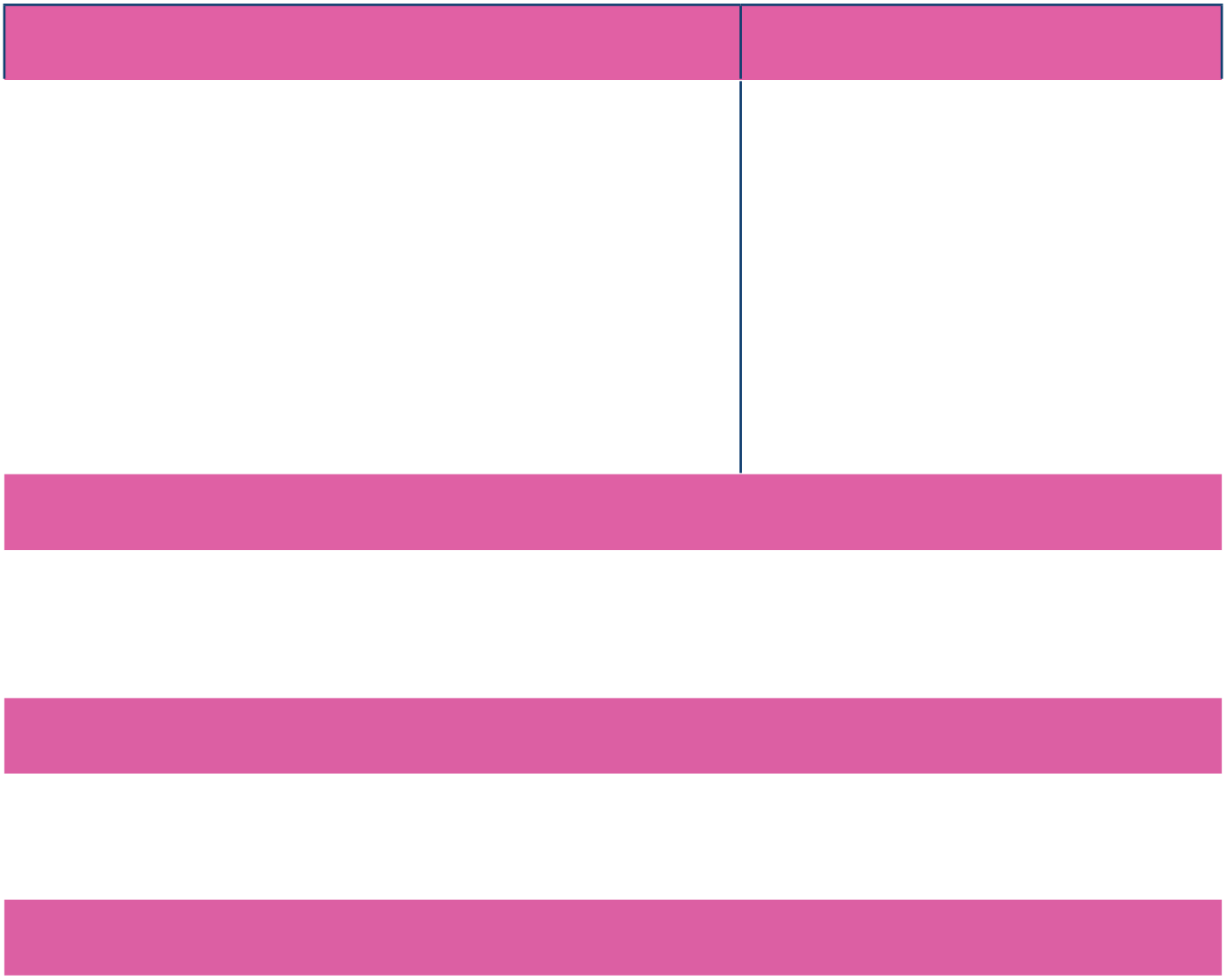
In addition to formal audits, it is recommended that health professionals participate in regular practice review meetings such as CTG reviews and reviews of intrapartum interventions triggered by fetal surveillance.

Local evaluation of the use of fetal surveillance should address:

- Education of health professionals and skill maintenance.
- On-going competency assessment of health professionals.
- Provision of relevant information for women.
- Availability of monitoring equipment including FBS.
- Timely access to operative delivery.

Paired umbilical cord blood gas analysis

There has been some debate on whether umbilical cord blood gas analysis should be performed in some, or all, deliveries. A retrospective observational study of all deliveries greater than or equal to 20 weeks' gestation at a Western Australian tertiary obstetric unit between January 2003 and December 2006 aimed to evaluate the impact on perinatal outcomes of introducing universal umbilical cord blood gas analysis at delivery. Paired umbilical arterial and venous blood samples were collected at all deliveries for blood gas and lactate analysis. This study showed that the introduction of universal umbilical cord blood gas analysis into a unit was associated with a reduction in the incidence of fetal acidaemia and the incidence of lactic acidaemia at birth, as well as neonatal nursery admissions. These perinatal outcomes were independent of obstetric intervention rates. The blood gas results proved to be a useful clinical audit tool in providing targeted education for staff providing intrapartum care. Expansion of this protocol into secondary units and internationally has showed similar benefits in reduction of lactic acidaemia. [125, 126]



Appendix A Overview of the Guideline Development Process

Steps in updating this Guideline

The reviewers carried out the following steps in developing this IFS Clinical Guideline (Fourth Edition):

- Developed a search strategy and searched the literature.
- Assessed the eligibility of studies for inclusion.
- Critically appraised the included studies.
- Summarised the relevant data into evidence tables and evidence summaries.
- Assessed the full body of evidence and formulated recommendations according to NHMRC grading criteria via an evidence statement form.

Assessing the eligibility of studies

During the initial search citations were screened and selected using the following inclusion and exclusion criteria.

Table 1: Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Limited from January 2013 – January 2019	Investigations other than search
Intrapartum	Reference to Antenatal only
Management	Antenatal diagnosis
Treatment	Non-human
Other options	Non-fetal
Human	Not intrapartum
	Care / management of neonate
	Non-English

This search identified 198 articles, of which 62 were of relevance to this Guideline. These were critically appraised to assess suitability to inform this Guideline.

Potential conflicts of interest were managed as per RANZCOG policy.

Classification and assessment of evidence

Studies identified for inclusion in this fourth edition were classified according to the NHMRC designation of "levels of evidence". [21]

Appendix B Definitions

When does monitoring commence, if indicated? What is admission?

Women with an indication for continuous CTG, monitoring should commence as soon as possible after the establishment of active labour.

Established (active) labour

Regular painful contractions (contractions occurring every 5 minutes and persisting for 30 minutes or more) which may be associated with a show, ruptured membranes or cervical changes (full effacement, 4 or more cm dilatation). [127, 128]

Early labour

Regular painful contractions (5 minutely contractions persisting over 30 minutes) which may be associated with a show, intact membranes or some cervical changes that fall short of full effacement, and or < 4 cm dilatation). [127, 128]

When women telephone for advice who are potentially in labour, ascertainment of fetal well-being should be assessed by the presence of normal fetal activity. Where a woman has an indication for continuous CTG (e.g. with risk factors), she should be encouraged to present for assessment of fetal well-being following the onset of regular contractions.

Electronic Fetal Monitoring with CTG

The use of electronic fetal heart rate monitoring for the evaluation of fetal wellbeing in labour.[1] Cardiotocography (CTG) is one form of electronic fetal monitoring.

bpm	Beats per minute
BMI	Body Mass Index
CTG	Cardiotocograph(y)
ECG	Electrocardiogram
EFM	Electronic Fetal Monitoring
FBS	Fetal Blood Sampling
FHR	Fetal Heart Rate
HIE	Hypoxic Ischaemic Encephalopathy
IA	Intermittent Auscultation
MoM	Multiples of the median
PAPP-A	Pregnancy-associated Plasma Protein A
RCT	Randomised controlled trial
RR	Relative Risk
VE	Vaginal examination

Appendix D Patient Information

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