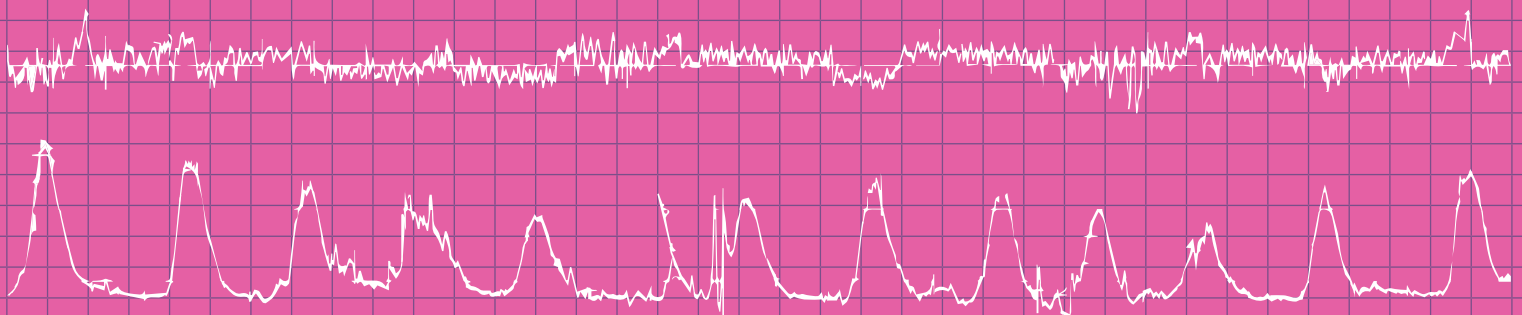
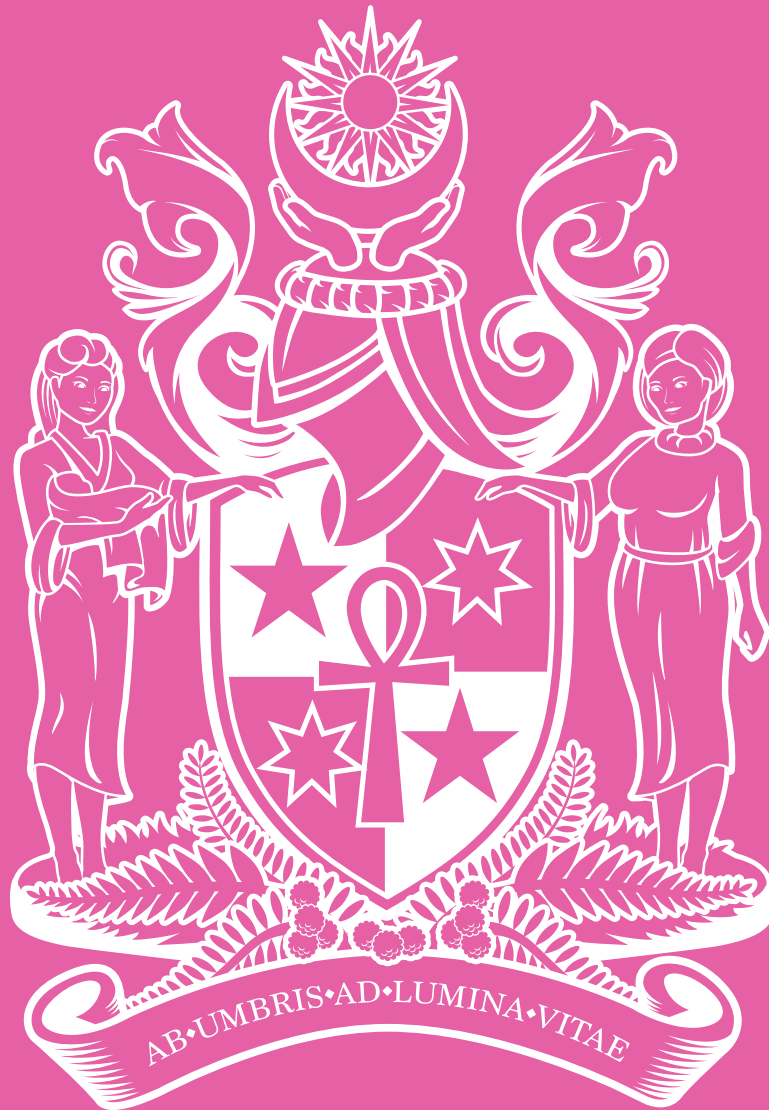


Intrapartum Fetal Surveillance

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

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**The Royal Australian
and New Zealand
College of Obstetricians
and Gynaecologists**

Excellence in Women's Health

Intrapartum Fetal Surveillance

Clinical Guideline – Fourth Edition 2019

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Foreword

This is the fourth edition of the Intrapartum Fetal Surveillance Clinical Guideline to be published by the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). This guideline has been revised in light of the evolving evidence supporting the use of various fetal surveillance techniques. It updates what has become a widely utilised and highly regarded resource for those providing intrapartum care for women and their fetuses and also those developing locally relevant institutional policies.

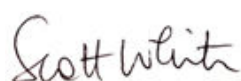
The evidence is clear that a standardised approach to the assessment, description, and management of fetal heart rate abnormalities results in improved outcomes for women and their babies. This is particularly important in light of the increasing complexity of contemporary pregnancies. This Guideline is intended to stand beside and complement the now well-established and successful Fetal Surveillance Education Program (FSEP) which has delivered quality training in intrapartum fetal surveillance since 2004. Further information on the Fetal Surveillance Education Program can be found at www.fsep.ranzcog.edu.au.

It was not the intent of this revision to extensively change the format of the previous editions but, rather, to update the Guideline to maintain currency with the published literature. Much of the recent research in intrapartum fetal surveillance has focused on technological advances such as computerised CTG assessment and fetal ST-segment analysis which have been evaluated as potential improvements over traditional visual CTG interpretation by clinicians. Although the evidence does not support widespread adoption of these techniques currently, it is changes such as these, as well as others focusing on parameters other than the fetal heart rate, that may in the future provide optimisation of detection of intrapartum fetal compromise whilst avoiding the increase in obstetric intervention that has been the trade-off of traditional CTG.

In developing this and the previous editions of this Guideline, it has been the hope of RANZCOG that it assists the wide and varied body of clinicians who have roles in the care of women in labour to provide optimal outcomes for these women and their babies.

RANZCOG is grateful for the contributions of key stakeholders in the refinement of this Guideline to ensure it meets the needs of those with an interest in intrapartum care.

Although all care has been taken in the development of this Guideline to take into account the varying circumstances of individual health care institutions such that it is generalisable to the broad Australian and New Zealand community, attention must still be paid in its application to the individual characteristics of the woman, her fetus, and the specific location in which care is provided.



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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 monitoring⁶ (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 1-6⁷⁻⁹ 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 key stakeholders were invited to participate in multidisciplinary discussion of the revised Guideline (Second edition) prior to publication. Such external consultation facilitated dialogue to ensure the Guideline was relevant to the needs of clinicians and consumers throughout Australia and New Zealand.

Revision of the Guideline: 2010–2014

In 2010, recognising that this Guideline had not been reviewed for four years, RANZCOG convened a new multidisciplinary Fetal Surveillance Guideline Review Working Party. The Working Party was brought together to consider new published evidence in the field of fetal surveillance in labour, and to recommend any required changes to the second edition of the Guideline.

RANZCOG commissioned the Royal Women's Hospital Clinical Practice Improvement Unit (Melbourne, Australia) to undertake a literature search and critical appraisal of publications addressing the topic of intrapartum fetal surveillance, published between September 2004 and March 2012. The outcome of this search was that 28 new citations were considered by the Guideline Review Working Party for this third edition IFS Clinical Guideline. An additional literature search specific for emergency treatment of uterine hyperstimulation carried out by the Evidence Synthesis Program, Monash Applied Research, Monash University yielded one relevant article for consideration.

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.

Clinical Need for this Guideline

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}

However, the interpretation of the available evidence is more complex. Firstly, it is widely acknowledged that the accumulated evidence of RCTs, when subjected to meta-analysis, still does not have sufficient participant numbers to validly assess effects on a rare outcome such as intrapartum event-related cerebral palsy.¹⁴ It is therefore quite possible that continuous CTG does confer important benefits on neonatal outcomes but that the potential benefits or risks have not been quantifiable by the trials undertaken to date. However, there is other evidence, both from RCTs and cohort studies, using surrogate end points that would support the routine use of continuous CTG.^{15, 16} Secondly, it is now widely appreciated that the visual interpretation of continuously generated signals from the fetal heart, however derived, is subject to shortcomings in interpretation. Review of cases with poor outcomes repeatedly demonstrate that abnormal CTGs were misinterpreted and the resulting management inappropriate.^{17, 18} This likely arises, at least in part, because health care professionals have not been supported by comprehensive ongoing education and credentialing programs. Attempts to remove the "human error" component to such cases by computer-assisted CTG interpretation has not been shown to reduce the rate of adverse perinatal outcomes associated with unrecognised abnormalities of the fetal heart rate pattern¹⁹ and cannot replace quality training programs for all clinicians undertaking intrapartum fetal surveillance.

It is therefore not surprising that the apparent inconsistencies in the currently available evidence and apparent inadequacies of professional training in the use of intrapartum fetal surveillance have resulted

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 Recommendations²¹

Recommendation Category		Description
Evidence-based recommendation	A	Body of evidence can be trusted to guide practice
	B	Body of evidence can be trusted to guide practice in most situations
	C	Body of evidence provides some support for recommendation(s) but care should be taken in its application
	D	The body of evidence is weak and the recommendation(s) must be applied with caution
Consensus-based recommendation		Consensus-based recommendations based on expert opinion where the available evidence was inadequate or could not be applied in the Australian and NZ healthcare context
Good Practice Note		Practical advice and information based on expert opinion to aid in the implementation of the Guideline

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.

Antenatal and Intrapartum Risk Factors that Increase Risk of Fetal Compromise

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} and others were derived by consensus of the Working Party.

Although in isolation some of the risk factors may be considered minor, there is often a continuum of disease and the cumulative effects of multiple risk factors may be additive or synergistic.

**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 PIGF) ^{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 $\geq 38^{\circ}\text{C}$ 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 contractions in ten minutes, without fetal heart rate abnormalities)
- uterine hypertonus (contractions lasting more than two minutes in duration or contractions occurring within 60 seconds of each other, without 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.

Conditions where an intrapartum cardiotocography is not indicated when the condition occurs in isolation, but if multiple conditions are present, intrapartum cardiotocography should be considered

Antenatal Risk Factors	Intrapartum Risk Factors
<ul style="list-style-type: none"> - pregnancy gestation 41.0 – 41.6 weeks' gestation 23, 32-34 - gestational hypertension 42 - gestational diabetes mellitus without complicating factors - obesity (BMI 30-40) - maternal age ≥ 40 and < 42 years - AFI 5-8cm (or MVP 2-3cm) 43 	<ul style="list-style-type: none"> - maternal pyrexia $\geq 37.8^{\circ}\text{C}$ and $< 38^{\circ}\text{C}$ 40

Communication with, and Information for, Pregnant Women

Two papers demonstrate the importance of providing information to women in labour. The first describes the results of a questionnaire that was sent to women 8–9 months after they gave birth in Victoria, Australia. 44 Not having an active say in decisions was associated with a six-fold increase in dissatisfaction among nulliparous women and a 1.5-fold increase among multiparous women. When adjusted for parity, insufficient information was highly related to dissatisfaction with intrapartum care. In a second qualitative study where 20 women were interviewed about their second stage of labour, these women wanted more informational support, especially in alleviating unvoiced fears about their child's health. 45

Women are encouraged to involve themselves in making informed decisions together with their obstetrician, general practitioner or midwife about intrapartum fetal surveillance, based on accurate information and consideration of their particular risk factors, if any. RANZCOG has developed an updated patient information pamphlet to complement this Guideline, which can be obtained from RANZCOG and is outlined in Appendix D.

Women should have the same level of general care and support, regardless of their decision about intrapartum fetal surveillance.

Recommendation 1	Grade and Supporting References
During pregnancy, women should be offered information on intrapartum fetal surveillance by those responsible for provision of maternity care.	C 44-46 (Level IV)

Communication and Information Between Clinicians

Intrapartum fetal surveillance and its interpretation is a complex task which requires:

- a sound understanding of fetal physiological responses to hypoxia as well as the normal events of labour and birth;
- good pattern recognition skills; and
- the ability to integrate this knowledge with each clinical situation.

Case reviews have indicated that adverse perinatal outcomes are more likely to occur where there is lack of clear communication between clinicians caring for the individual woman and failure to use clear and consistent terminology. ^{13, 47} A comprehensive education and credentialing program can best address these issues, enabling suitable competency assessment of health professionals to identify and minimise system errors, which contribute to poor fetal surveillance practices. ⁵

A systematic review of 20 studies published by Pehson and colleagues in 2011 reported several studies demonstrating an increase in knowledge and skills in fetal surveillance in all staff following multidisciplinary training. ⁴⁸ There was also a significant reduction in suboptimal intrapartum care observed after the introduction of mandatory educational interventions to improve CTG skills to all staff. ⁴⁹ CTG assessment is improved with the use of e-learning packages. ⁵⁰

Recommendation 2	Grade and Supporting References
Health professionals who provide intrapartum care have a responsibility to ensure that they undertake that care with an understanding of the relevant maternal and fetal pathophysiology and understand the available fetal surveillance options.	B 48 (Level I)

Intrapartum Fetal Surveillance

There is universal acceptance that the fetus is at risk of hypoxic injury during labour. ⁵¹ It is expected that the detection of intrapartum fetal compromise enables appropriate and timely intervention, thereby reducing the incidence of adverse outcomes. ¹⁸

Recommendation 3	Grade and Supporting References
Fetal surveillance in labour, whether by intermittent auscultation or by continuous electronic fetal monitoring, should be discussed with and recommended to all women.	C 18-46 (Level III-3)

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 series⁵⁴ have suggested that the use of an admission CTG improves the prediction of important adverse perinatal outcomes including neonatal acidaemia, neonatal encephalopathy⁵⁴, long-term neurological impairment⁵⁵ and death.⁵²

In contrast to these cohort studies, a meta-analysis of the randomised controlled trials (RCTs) of admission CTG in low risk labours⁵⁶ 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 RCT⁵⁷ 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 trial⁶², 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
<p>Limitations in the randomised controlled trial evidence make it difficult to depend on that evidence to guide practice in the Australian and New Zealand context regarding the use of admission CTG in women.</p> <p>Admission CTG increases the rate of continuous cardiotocography use which may increase the rate of caesarean section but may identify a small number of previously unidentified at risk fetuses.</p> <p>Attending clinicians and their institutions should decide whether or not to recommend admission CTG according to individual women's circumstances and decisions.</p>	<p>A 56 (Level I)</p>
Good Practice Note	Grade and Supporting References
<p>Women should receive 1:1 intrapartum midwifery care. Cardiotocography should not be used as a substitute for adequate intrapartum midwifery staffing.</p>	<p>C 63 (Level III-3)</p>
Good Practice Note	Grade and Supporting References
<p>It is important to identify the potentially unrecognised "at risk" fetus.</p> <p>Cardiotocography may be beneficial for women with risk factors for fetal compromise that on their own do not meet the criteria for recommending continuous cardiotocography (e.g. maternal age 40-41, BMI 35-39, gestational hypertension etc.) but do so where more than one such risk factor is present, as multiple factors are more likely to have a synergistic impact on fetal risk.</p>	<p>Good Practice Note 64 (Consensus-based)</p>

Modality of intrapartum fetal monitoring in the absence of recognised risk factors

A systematic review of RCTs of intermittent auscultation (IA) versus continuous CTG in low risk women revealed a significant reduction in neonatal seizures (RR 0.50) with a non-significant increase in the caesarean section rate (RR 1.95).⁶⁵ It is only when women with recognised risk factors are included that the increase in caesarean section rate with continuous CTG becomes statistically significant and this is regardless of whether fetal blood sampling in labour was deployed or not.⁶⁵

Many centres or clinicians will recommend IA rather than continuous CTG for women without risk factors, given a likely increase in the caesarean section rate and the probability of only a small fetal benefit. Other centres or clinicians will recommend continuous CTG for women without risk factors for one or more of the following reasons:

- 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
<p>Intermittent auscultation is an appropriate method of intrapartum fetal monitoring in women without recognised risk factors.</p> <p>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.</p>	<p>B 65 (Level I)</p>
Good Practice Note	Grade and Supporting References
<p>Regardless of the method of intrapartum monitoring, it is essential that an accurate record of fetal wellbeing is obtained. Fetal and maternal heart rates should be differentiated whatever the mode of monitoring used, ideally with monitors capable of simultaneously recording maternal and fetal heart rates.</p>	<p>Good Practice Note (Consensus-based)</p>

Method of auscultation

Intermittent auscultation (IA) is defined as the auscultation of the fetal heart using a hand-held Doppler at regular intervals and for a pre-defined duration during labour. There is evidence that use of a Pinard stethoscope is not as accurate as a hand held Doppler in the detection of fetal heart rate abnormalities. ^{66, 67}

In relation to the frequency of auscultation, there have been no clinical studies comparing different frequencies to guide practice. The Dublin study ¹⁵ used auscultation at 15 minute intervals and some authorities have accepted this frequency as appropriate without further evidence. Based upon this trial, the RCOG/NICE and FIGO guidelines recommend 15 minute intervals of intermittent auscultation. ^{6, 68} However, it has been highlighted that there is no high level evidence to support this recommendation ⁶⁹ and the observational evidence of experts is that every 30 minutes is adequate. This frequency of monitoring is widespread established standard practice in Australia, New Zealand and many overseas countries. ^{12, 66, 67}

Accordingly, it is recommended that IA should be undertaken and documented:

- Every 15-30 minutes in the active phase of the first stage of labour
- With each contraction or at least every five minutes in the active second stage of labour.

Recommendation 6	Grade and Supporting References
<p>When using intermittent auscultation, it should be performed according to a standardised protocol:</p> <ul style="list-style-type: none"> - Intermittent auscultation must be performed with a technique that can accurately measure the fetal heart rate in the individual woman. - Each auscultation episode should commence toward the end of a contraction and be continued for at least 30-60 seconds after the contraction has finished. - Auscultation in labour should be undertaken and documented: Every 15-30 minutes in the active phase of the first stage of labour. With each contraction or at least every five minutes in the active second stage of labour. 	<p>B 66 (Level III) Consensus-based Recommendation</p> <p>Consensus-based Recommendation</p>

Intrapartum Fetal Surveillance in the Presence of, or with the Emergence of, Fetal and/or Maternal Risk Factors

A number of antenatal and intrapartum risk factors have been shown to be associated with the development of neonatal encephalopathy, cerebral palsy or perinatal death (see section on risk factors). In the presence of any of these risk factors, continuous electronic fetal monitoring should be recommended. 23, 25, 26, 41, 65, 70-72

Recommendation 7	Grade and Supporting References
<p>Continuous CTG should be recommended when either risk factors for fetal compromise have been detected antenatally, are detected at the onset of labour or develop during labour.</p> <p>Each institution should adopt a standardised method of CTG evaluation and description.</p>	<p>B 65 (Level I)</p> <p>C 73, 74 (Level IV)</p>

Good Practice Notes	Grade and Supporting References
<p>Interruptions to Fetal Heart Rate Monitoring</p> <p>Personal Care Where continuous electronic fetal monitoring is required, and if the electronic fetal monitoring to date is considered to be normal, monitoring may be interrupted for short periods of up to 15 minutes to allow personal care (e.g. shower, toilet). Such interruptions should be infrequent and not occur immediately after any intervention that might be expected to alter the fetal heart rate (e.g. amniotomy, epidural insertion or top-up etc.).</p> <p>When fetal compromise is suspected or the CTG is abnormal, it should not be discontinued without senior clinical review.</p> <p>Women's wellbeing is considered and their wishes are respected in relation to monitoring. Disturbances to the woman are also minimised e.g. monitoring volume low, upright positions/mobility, and use of water for pain relief.</p> <p>Procedures Consideration should be given to instituting electronic fetal monitoring prior to the use of regional analgesia to establish baseline fetal heart rate characteristics. Interruptions to fetal monitoring during procedures should be minimised given the potential for fetal vulnerability during these times.</p> <p>Transfers The fetal heart rate should be monitored by intermittent auscultation during unavoidable interruptions, at times of potential fetal vulnerability, with re-commencement of continuous CTG when feasible. Interruptions to fetal monitoring should be minimised during transfer to the operating theatre and prior to delivery of the fetus, especially in the context of suspected fetal compromise.</p>	<p>Good Practice Note (Consensus-based)</p> <p>Good Practice Note (Consensus-based)</p> <p>Good Practice Note (Consensus-based)</p>

Management of Fetal Heart Rate Patterns Considered Suggestive of Fetal Compromise

Fetal compromise in labour may be due to a variety of pathologies including placental insufficiency, uterine hyperstimulation, maternal hypotension, cord compression, placental abruption, uterine rupture, and fetal sepsis. Identification and management of reversible abnormalities may prevent unnecessary intervention. In particular, when uterine hypertonus is associated with abnormal fetal heart rate patterns, acute tocolysis has, in some studies, been shown to be useful.^{75, 76} However, if significant abnormalities persist, further evaluation or delivery is indicated.^{70, 77, 78} In particular, it should be kept in mind that not all fetal heart rate abnormalities are due to fetal hypoxia/acidosis and that other causes, such as uterine rupture and fetal sepsis, may warrant expedited delivery even in the context of normal fetal acid-base status.

Recommendation 8	Grade and Supporting References
<p>In clinical situations where the fetal heart rate pattern is considered abnormal, immediate management should include:</p> <ul style="list-style-type: none"> - Identification of any reversible cause of the abnormality and initiation of appropriate action (e.g. maternal repositioning, correction of maternal hypotension, rehydration with intravenous fluid, cessation of oxytocin and/or tocolysis for excessive uterine activity) and initiation or maintenance of continuous CTG. - Consideration of further fetal evaluation or delivery if a significant abnormality persists. - Escalation of care if necessary to a more experienced practitioner. 	<p>A 65 (Level I)</p> <p>79, 80 Consensus-based Recommendation</p>
Good Practice Notes	Grade and Supporting References
<p>Each institution should adopt a standardised method of CTG evaluation and description.</p> <p>Each institution should have standardised clinical protocols for the response to abnormal intrapartum fetal heart rate patterns.</p> <p>The CTG should be assessed using the individual fetus as its own benchmark with changes in fetal heart rate characteristics noted over time.</p> <p>The normal CTG is associated with a low probability of fetal compromise and has the following features:</p> <ul style="list-style-type: none"> - Baseline rate 110-160 bpm. - Baseline variability of 6-25 bpm. - Accelerations 15bpm for 15 seconds. - No decelerations. <p>All other CTGs are by this definition abnormal and require further evaluation taking into account the full clinical picture.</p> <p>The following features are unlikely to be associated with fetal compromise when occurring in isolation:</p> <ul style="list-style-type: none"> - Baseline rate 100-109 bpm. - Reduced or reducing baseline variability 3-5bpm. - Absence of accelerations. - Early decelerations. - Variable decelerations without complicating features. <p>The following features may be associated with significant fetal compromise and require further action, such as described in Recommendation 8:</p> <ul style="list-style-type: none"> - Baseline fetal tachycardia >160 bpm. - Rising baseline fetal heart rate (including where it remains within normal range). - Complicated variable decelerations. - Late decelerations. - Prolonged decelerations (a fall in the baseline fetal heart rate for more than 90 seconds and up to 5 minutes). <p>The following features are likely to be associated with significant fetal compromise and require immediate management, which may include urgent delivery:</p> <ul style="list-style-type: none"> - Bradycardia (a fall in the baseline fetal heart rate for more than 5 minutes). - Absent baseline variability <3bpm. - Sinusoidal pattern. - Complicated variable decelerations with reduced or absent baseline variability. - Late decelerations with reduced or absent baseline variability. <p>See Appendix B for Definitions.</p>	<p>Good Practice Notes (Consensus-based)</p>

Excessive Uterine Activity and Uterine Hyperstimulation

Excessive uterine activity is defined as:

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

OR

- contractions lasting longer than two minutes in duration or contractions occurring within 60 seconds of each other, without fetal heart rate abnormalities (uterine hypertonus).

Uterine hyperstimulation is defined as:

- Excessive uterine activity, (either tachysystole or uterine hypertonus) with fetal heart rate abnormalities.

Uterine hyperstimulation may occur as tachysystole or uterine hypertonus, which may lead to fetal heart rate changes. Tachysystole is commonly associated with induction of labour, particularly following prostaglandin administration⁸¹⁻⁸⁴ or augmentation of labour with oxytocin infusion.^{81, 85} It can also occur in spontaneous labour^{86, 87} and may occur in association with placental abruption⁸⁶ or intrauterine infection.^{86, 88} As tachysystole or uterine hypertonus may progress to uterine hyperstimulation, it is important that continuous electronic fetal monitoring is undertaken where they are observed.

During excessive uterine activity, uterine blood flow and fetal oxygenation are altered. Over time, uterine hyperstimulation can negatively impact on fetal status and neonatal outcomes. In a study involving 1,433 women, increased uterine activity during the first and second stage of labour was significantly associated with an increased incidence of lower umbilical artery pH, suggesting a risk of progressive deterioration of fetal status where there is hyperstimulation.⁸⁹

Maternal risks of uterine hyperstimulation include uterine rupture in both scarred and unscarred uteri with tachysystole (with or without evidence of fetal compromise); and rare complications such as amniotic fluid embolism are increased in the setting of uterine hyperstimulation.⁹⁰ There may be further maternal risks associated with urgent caesarean section in the setting of hyperstimulation.

Evidence was examined with respect to whether tocolytic therapy is effective in the management of uterine hyperstimulation and, if so, which tocolytic agent should be administered for treatment of uterine hyperstimulation.

Tocolytics of interest included: intravenous or subcutaneous terbutaline (250 micrograms), sublingual GTN spray (400 micrograms) or intravenous salbutamol (100 micrograms) as these are available for use in Australia. It should be noted that in New Zealand, terbutaline is only available as an inhaled preparation but GTN and salbutamol are the same as in Australia.

One randomised controlled trial on the effect of terbutaline on suspected fetal compromise was carried out on 20 women who showed evidence of ominous fetal heart rate patterns with fetal scalp pH values of <7.25.⁹¹ It showed that treatment with terbutaline significantly improved the acid-base status of the fetus ($P < 0.01$) with no significant fetal or maternal morbidity occurring in the treatment group.⁹¹ A more recent Cochrane review of trials of acute tocolysis for uterine tachysystole and/or suspected intrapartum fetal compromise found that there was insufficient evidence to determine the benefits or adverse effects of such therapy.⁹²

Further high-quality trials on the effectiveness of all the tocolytic agents used in Australia and New Zealand are required.

Recommendation 9	Grade and Supporting References
<p>Excessive uterine activity in the absence of fetal heart rate abnormalities</p> <p>In the presence of excessive uterine activity (defined as either):</p> <ul style="list-style-type: none"> - tachysystole (more than five active labour contractions in ten minutes, without fetal heart rate abnormalities); or - uterine hypertonus (contractions lasting more than two minutes in duration or contractions occurring within 60 seconds of each other, without fetal heart rate abnormalities). <p>appropriate management should include:</p> <ul style="list-style-type: none"> - continuous cardiotocography; - consideration of reducing or ceasing oxytocin infusion; - maternity staff remaining with the woman until normal uterine activity is observed; and - consideration of tocolysis. 	<p>A 56 (Level I)</p>
Recommendation 10	Grade and Supporting References
<p>Uterine hyperstimulation is defined as tachysystole or uterine hypertonus in the presence of fetal heart rate abnormalities. Appropriate management of uterine hyperstimulation should include:</p> <ul style="list-style-type: none"> - continuous cardiotocography; - reducing or ceasing oxytocin infusion; - maternity staff remaining with the woman until normal uterine activity is observed; - consideration of tocolysis; and - consideration of urgent delivery. <p>Maternity care providers should be familiar with and have a protocol for acute tocolysis (relevant to the level of service) in the event that uterine hyperstimulation occurs.</p> <p>Tocolytic regimens available may include:</p> <ul style="list-style-type: none"> - salbutamol, 100 micrograms intravenously; - terbutaline, 250 micrograms intravenously or subcutaneously (Grade C); or - GTN spray, 400 micrograms sublingually. 	<p>Consensus-based Recommendation</p> <p>C 63 (Level III-3)</p>
Good Practice Note	Grade and Supporting References
<p>Excessive uterine activity in the absence of evidence of fetal compromise is not in itself an indication for tocolysis.</p>	<p>Good Practice Notes (Consensus-based)</p>

Fetal Blood Sampling

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 measurement⁹³ 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 group⁹⁴ 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

Fetal Blood Sampling

Recommendation 11	Grade and Supporting References
Units employing electronic fetal monitoring are strongly encouraged to have access to fetal blood sampling facilities to assist in the management of labours where the fetus is demonstrating equivocal CTG changes.	Consensus-based Recommendation
Recommendation 12	Grade and Supporting References
If fetal blood sampling is indicated, the use of either scalp lactate or pH measurement is reasonable. Lactate will provide an easier and more affordable adjunct to electronic fetal monitoring for most units.	A 94 (Level I)
Good Practice Note	Grade and Supporting References
Thresholds for lactate may vary between institutions and equipment. Institutions should have local protocols for lactate thresholds.	Good Practice Note (Consensus-based)

In situations where FBS is contraindicated or not possible, decisions regarding delivery should take into account the severity of the fetal heart rate abnormality and the clinical situation.^{13, 96, 97}

Recommendation 13	Grade and Supporting References
<p>Delivery should be expedited where:</p> <ul style="list-style-type: none"> - There is clear evidence of serious fetal compromise, either according to the fetal heart rate pattern or other clinical concerns such as suspected placental abruption or maternal / fetal sepsis. In such a context FBS should not be undertaken as it delays the delivery which is indicated regardless of the result. - CTG abnormalities are of a degree requiring further assessment, but FBS is contraindicated, clinically inappropriate or unavailable. - The decision to delivery interval may be prolonged by virtue of location, clinical staff availability, patient factors or access to clinical services. 	<p>Consensus-based Recommendation</p>
Good Practice Note	Grade and Supporting References
<p>If fetal blood sampling is undertaken, it is recommended that the woman be in the left-lateral position or lithotomy with a wedge in place to avoid or supine hypotension.</p> <p>Contraindications to FBS include:</p> <ul style="list-style-type: none"> - Evidence of serious, sustained fetal compromise. - Risk of fetal bleeding disorders (e.g. fetal thrombocytopenia, haemophilia). - Non-vertex presentation. - Maternal infection* (e.g. HIV, hepatitis B, hepatitis C, active primary herpes and suspected fetal sepsis). *Group B Streptococcus carrier status does not preclude FBS. 	<p>Good Practice Note (Consensus-based)</p>
Good Practice Note	Grade and Supporting References
<p>Fetal blood sampling is not generally recommended in pregnancies at less than 34 weeks of gestation because delivery may be inappropriately delayed in a premature "at risk" fetus that may sustain damage earlier than would be expected in a term fetus.</p>	<p>Good Practice Note (Consensus-based)</p>
Good Practice Note	Grade and Supporting References
<p>If a fetus is in breech presentation during labour and is exhibiting signs of fetal compromise that are not readily remediable, it would be more appropriate to deliver the fetus by caesarean section than to undertake fetal blood sampling.</p>	<p>Good Practice Note (Consensus-based)</p>

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 or contraindicated and caesarean section is relatively contraindicated.

Recommendation 16	Grade and Supporting References
<p>Amnioinfusion is not recommended for routine treatment of variable decelerations in labour.</p> <p>However, in a small number of cases where fetal blood sampling is not possible or contraindicated and caesarean section is relatively contraindicated, amnioinfusion may confer a small benefit.</p>	<p>B 118-120 (Level I)</p>

Maintaining Standards in Intrapartum Fetal Surveillance

Standardisation

Reports on strategies to reduce medical errors have highlighted the need to simplify systems and standardise procedures. ^{121, 122} With respect to undertaking CTG monitoring, there is no evidence that any particular paper speed is preferable ¹²³, but it is recognised that the paper speed selected should be familiar to all users. The Guideline Review Working Party endorses the RCOG/NICE recommendation for standard CTG settings. ^{6,124}

Recommendation 17	Grade and Supporting References
<p>Settings on CTG machines should be standardised to enable a consistent approach to teaching and interpretation of CTG traces, particularly as many health professionals move between different institutions in Australia and New Zealand.</p>	<p>Consensus-based Recommendation</p>

Recommendation 18	Grade and Supporting References
Until there is clear evidence that interpretation based on one paper speed is superior to the others, it is recommended that the paper speed of 1 cm per minute be adopted universally.	Consensus-based recommendation
Good Practice Notes	Grade and Supporting References
<ul style="list-style-type: none"> - Date and time settings on CTG machines should be validated whenever used. - CTGs should be labelled with the mother's name, hospital number, date and time of commencement and include the maternal observations. - Any intrapartum events that may affect the fetal heart rate (e.g. vaginal examination, obtaining a fetal blood sample (FBS), insertion/top-up of an epidural) should be noted contemporaneously including date, time and signature. - For women receiving continuous CTG, the trace should be reviewed at least every 15-30 minutes and any abnormalities acted upon. It should be regularly recorded, either by written or electronic entry, in the medical record that the CTG has been reviewed. - Consideration should be given to a policy of a second clinician independently assessing the CTG periodically. - Health professionals should be aware that machines from different manufacturers use different vertical axis scales and this can change the perception of fetal heart rate variability. 	Good Practice Notes (Consensus-based)

Implementation

Education

Hospitals and health services should ensure that the health professionals providing intrapartum care have access to regular training in intrapartum fetal surveillance. Training should occur in a multidisciplinary forum to optimise communication between professional groups.

The Guideline Review Working Party has assessed grading and classification systems for fetal heart rate interpretation. Without an adequate appreciation of the underlying pathophysiology such systems may mislead the user. If used, the inclusion of grading/ classification systems in education programs should be in addition to, rather than instead of, an understanding of fundamental physiology.

It is acknowledged that this Guideline must be complemented by a comprehensive and ongoing education and assessment program for health professionals. The Guideline Review Working Party is aware of a number of such programs currently available in Australia and New Zealand, including FSEP. Further information about the FSEP and other education resources is available through RANZCOG (www.fsep.ranzcog.edu.au). The Guideline Review Working Party believes that institutions providing birthing services have a responsibility to ensure that the relevant health professionals are appropriately skilled in fetal surveillance and maintain those skills.

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}

Recommendation 20	Grade and Supporting References
<p>Paired umbilical cord blood gas or lactate analysis should be taken at delivery either routinely or where any of the following are present:</p> <ul style="list-style-type: none"> - Apgar score < 4 at 1 minute. - Apgar score < 7 at 5 minutes. - Fetal scalp sampling performed in labour. - Operative delivery undertaken for fetal compromise. <p>When paired umbilical cord blood gas or lactate analysis is taken at delivery as part of a clinical audit regimen, this process should not interfere with management of the third stage of labour.</p>	<p>C 125-126 (Level III-3)</p>
Recommendation 21	Grade and Supporting References
<p>All health professionals involved in providing antenatal and intrapartum care should participate in regular multi-disciplinary clinical audits focusing on maternal and perinatal outcomes in relation to intrapartum fetal monitoring.</p>	<p>Good Practice Note (Consensus-based)</p>
Good Practice Note	Grade and Supporting References
<p>The following practices assist with clinical audit and education:</p> <ul style="list-style-type: none"> - Regular CTG review meetings. - Review of the use of FBS where available. 	<p>Good Practice Note (Consensus-based)</p>
Good Practice Note	Grade and Supporting References
<p>CTG traces should be stored in a manner that enables ready access for multidisciplinary clinical audit and clinical education.</p>	<p>Good Practice Note (Consensus-based)</p>

Maintenance of competence

Health professionals with responsibility for performing and interpreting continuous CTG should receive regular training and assessment. The RANZCOG FSEP assessment tool (www.fsep.ranzcog.edu.au/products/assessment-tool.html) is now recognised as a valid and reliable assessment of fetal surveillance knowledge and associated cognitive skills and should be a component of any overall competency assessment program.

Local implementation

It is anticipated that this Guideline will provide the foundation for hospital policies and procedures, which should take into account the constraints of local practitioners and resources. The implementation of this Guideline should be undertaken as part of the quality improvement program for each hospital. Hospitals should review existing service provision against this Guideline. The review should identify necessary resources required to implement the recommendations in this Guideline.

Considerations for Indigenous and Culturally and Linguistically Diverse populations

The importance of clear communication with the woman and her birth partner about fetal surveillance in labour were discussed earlier in this Guideline. All health care providers responsible for providing intrapartum care should ensure they are sensitive to cultural factors and that they deliver information in a suitable format that each patient is able to understand. The indications for fetal monitoring in labour apply to all women, regardless of culture and language.

Evaluation

RANZCOG is committed to the ongoing evaluation of this Guideline and encourages all health professionals to provide feedback on the feedback sheet which can be accessed via the RANZCOG website (www.ranzcog.edu.au) or a hard copy obtained from College House, Melbourne Australia.

Strategy for Dissemination and Implementation

This Guideline will be made available in an electronic version on the RANZCOG website. Limited numbers of printed copies are available on request from RANZCOG.

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.

Term	Definition
Baseline fetal Heart Rate	The mean level of the fetal heart rate when this is stable, excluding accelerations and decelerations and contractions. It is typically determined over a time period of 5 or 10 minutes and expressed in bpm. Preterm fetuses tend to have values towards the upper end of this range. A progressive rise in the baseline is important as well as the absolute values.
Normal Baseline	FHR 110-160 bpm
Baseline Bradycardia	<110 bpm
Baseline Tachycardia	>160 bpm
Baseline variability:	The minor fluctuations around the baseline FHR. It is assessed by estimating the difference in beats per minute between the highest peak and lowest trough of fluctuation in one minute segments of the trace between contractions.
Normal baseline variability:	6 – 25 bpm at the baseline fetal heart rate
Reduced baseline variability	3 – 5 bpm
Absent baseline variability	<3 bpm
Increased baseline variability	> 25 bpm
Sinusoidal:	A regular oscillation of the baseline FHR resembling a sine wave. This smooth, undulating pattern is persistent, has a relatively fixed period of 2 –5 cycles per minute and an amplitude of 5 –15 bpm above and below the baseline. Baseline variability is absent and there are no accelerations.
Accelerations	Transient increases in FHR of 15 bpm or more above the baseline and lasting 15 seconds at the baseline. Accelerations in the preterm fetus may be of lesser amplitude and shorter duration. The significance of no accelerations on an otherwise normal CTG is unclear.
Decelerations	Transient decreases of the FHR below the baseline lasting at least 15 seconds, conforming to one of the patterns below:
Early decelerations	Uniform, repetitive decrease of FHR with slow onset early in the contraction and slow return to baseline by the end of the contraction.
Variable decelerations	Repetitive or intermittent decreasing of FHR with rapid onset and recovery. Time relationships with contraction cycle may be variable but most commonly occur simultaneously with contractions.
Complicated variable decelerations	The following additional features increase the likelihood of fetal hypoxia: <ul style="list-style-type: none"> - Rising baseline rate or fetal tachycardia. - Reducing baseline variability. - Slow return to baseline FHR after the end of the contraction. - Large amplitude (by 60 bpm or to 60 bpm) and/or long duration (60 seconds). - Presence of smooth post deceleration overshoots (temporary smooth increase in FHR above baseline).
Prolonged decelerations	A fall in the baseline fetal heart rate for more than 90 seconds and up to 5 minutes
Bradycardia	A fall in the baseline fetal heart rate for more than 5 minutes
Late decelerations	Uniform, repetitive decreasing of FHR with, usually, slow onset mid to end of the contraction and nadir more than 20 seconds after the peak of the contraction and ending after the contraction. In the presence of a non-accelerative trace with baseline variability <5 bpm, the definition would include decelerations of <15 bpm.

Appendix C Abbreviations

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
95%CI	95% Confidence Interval

Appendix D Patient Information



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Monitoring the Baby's Heart Rate in Labour

For centuries, birth attendants have listened to the baby's heartbeat during pregnancy and labour. In the 19th century, a small trumpet-shaped stethoscope was invented that made it possible to listen to the baby's heartbeat during pregnancy with greater accuracy. This device, named after its inventor Dr Pinard, is still used in many areas of the world.

During labour, the doctor or midwife can listen to the baby's heartbeat at regular intervals ('intermittent auscultation'). In the early stages of labour, this may be carried out every 15 to 30 minutes. In the later stages of labour, when the mother has started to push, intermittent auscultation is performed more frequently, perhaps every five minutes or after every contraction. Intermittent auscultation is an appropriate method of monitoring the baby's heartbeat for women without risk factors.

It is possible to create a continuous record of the unborn baby's heartbeat using Doppler ultrasound. The woman wears two plastic discs containing sensors on her abdomen, held by a belt around her waist. One sensor picks up the baby's heartbeat and the other detects contractions. The continuous, combined recording of the baby's heartbeat and contractions is called the 'cardiotocograph' (CTG).

The use of CTG in labour

The aim of CTG monitoring in labour is to record the baby's heartbeat pattern to assess wellbeing.

During a contraction, there is normally some reduction in blood flow through the placenta, resulting in less oxygen reaching the baby. In a normal, healthy pregnancy, the baby copes well with this natural 'stress' of labour. Some slowing of the baby's heartbeat may occur during a contraction, but the heart rate should recover quickly.

If a baby is not coping well with labour, the slowing of the baby's heartbeat may be more pronounced and may continue after the contraction is finished. These warning signs, along with other changes in the baby's heart rate pattern, are more readily detected by CTG than by intermittent auscultation. The doctor and/or midwife must interpret the CTG and decide whether the baby is coping with labour. If the baby is not coping with the stress of labour, they may recommend simple measures such as slowing down the contractions or changing the mother's position.

Sometimes though, hastening the birth by caesarean section, forceps or vacuum assistance is required, depending on the stage of labour, and the condition of the woman and the baby.

Fetal Scalp Electrode

Sometimes, it may not be possible to get a continuous and reliable recording of the baby's heartbeat in labour by using the external device placed on the abdomen. In this situation, the baby's heartbeat may be measured more accurately using a fetal scalp electrode (called a clip).

This is a tiny device that is attached to the baby's scalp directly by vaginal examination. The fetal scalp electrode is very safe for the mother and baby, but applying the scalp electrode requires the waters to be broken and the cervix to be several centimetres dilated. Use of the scalp electrode is usually avoided if there is any risk of a pre-existing maternal infection (such as hepatitis B) passing from the mother to the baby during birth.



Should my baby be monitored by intermittent auscultation or continuous CTG in labour?

Intermittent auscultation is the recommended method to monitor a baby in labour when there are no risk factors, since the benefit of continuous CTG is likely to be small.

Continuous CTG is recommended when maternal or fetal risk factors for labour complications are present. These include maternal risk factors such as high blood pressure or vaginal bleeding, fetal risk factors such as growth problems or prematurity, and factors to do with the labour itself, such as induction of labour or the use of epidural pain relief.

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Monitoring the Baby's Heart Rate in Labour



Are there any disadvantages of CTG?

Any method of listening to the baby's heartbeat, even intermittent auscultation, presents some inconvenience to the woman.

Intermittent monitoring may temporarily restrict the woman's movement or position in order to obtain a signal from the baby's heart. The doctor/midwife may need to listen to the baby's heartbeat at the very time when a woman is least able to move - namely, at the end of a uterine contraction.

Continuous CTG monitoring is more restrictive than intermittent monitoring because the woman remains connected to the machine throughout labour. The device may need to be removed and re-applied if the woman wishes to have a shower or to use the toilet. Mobility can be improved with use of a wireless 'telemetry' device that avoids the need for connecting leads to a machine.



Does the CTG increase caesarean sections?

It is controversial whether routine continuous CTG monitoring increases caesarean sections because of 'false alarms' caused by the baby's heart rate pattern. The risk of caesarean section may be reduced by the use of a blood sample from the baby's scalp to confirm the baby's condition (the 'scalp lactate' or 'scalp pH'), rather than relying on the CTG alone.

Studies looking at the routine use of CTG in all women in labour have not been big enough to prove that it does prevent serious, but rare, complications for the baby. In low risk situations, the benefit of continuous CTG is likely to be small.

The admission CTG

Some centres will perform a CTG when the woman first arrives in labour, and then discontinue the CTG if the heartbeat is normal and there are no current risk factors. This is a 'compromise' position between continuous CTG and intermittent auscultation for low risk women. Like continuous CTG, studies have not been large enough to determine whether the 'routine' use of the admission CTG at the start of labour reduces the incidence of adverse outcomes.

It is important to remember that even though a woman and her unborn baby may have been perfectly well throughout pregnancy, new risk factors may appear during labour. These include a maternal fever, prolonged labour, bleeding, or an abnormal fetal heart rate on intermittent auscultation.

Any of these situations, and others, may lead to a recommendation for continuous CTG monitoring in labour. Maternity carers should always explain the reason for CTG monitoring if performed, and respect the woman's wishes and preferences for her care in labour.

For further detailed clinical practice recommendations on fetal surveillance, please see Intrapartum Fetal Surveillance Clinical Guidelines - Third Edition

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