

*National Collaborating Centre for  
Women's and Children's Health*

# Caesarean section

**Clinical Guideline**

April 2004

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# Caesarean section

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# Guideline Development Group membership and acknowledgements

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## Stakeholder organisations

Action on Pre-Eclampsia (APEC)  
Alliance Pharmaceuticals Ltd  
Association for Improvements in Maternity Services (AIMS)  
Association of Baby Charities  
Association of British Health-Care Industries  
Association of Radical Midwives  
AstraZeneca UK Ltd  
British Association of Perinatal Medicine  
British Maternal and Fetal Medicine Society  
British Medical Association  
British National Formulary (BNF)

## Caesarean section

British Psychological Society  
Buckinghamshire Hospital's Trust  
Carmarthenshire NHS Trust  
Chelsea and Westminster Hospital Maternity Dept  
Cochrane Pregnancy & Childbirth Group  
County Durham and Darlington Acute Hospitals NHS Trust  
Contact a Family  
Department of Health  
Dudley Group of Hospitals NHS Trust  
English National Forum of LSA Midwifery Officers  
Evidence based Midwifery Network  
Faculty of Public Health  
Faculty of Public Health Medicine  
Ferring Pharmaceuticals Limited  
Fibroid Network Charity  
General Medical Council  
Group B Strep Support  
Infection control Nurses Association of the British Isles  
National Association of Theatre Nurse  
National Childbirth Trust  
National Council for Disabled People, Black, Minority and Ethnic Community  
National Public Health Service  
Neoventa Medical  
NHS Information Authority, (PHSMI Programme)  
NHS Quality Improvement Scotland  
North Tees and Hartlepool NHS Trust  
Nottingham City Hospital  
Obstetric Anaesthetists Association  
Oxford Radcliffe Hospitals NHS Trust  
RCM Consultant Midwives Forum  
Royal College of Anaesthetists  
Royal College of General Practitioners  
Royal College of General Practitioners Wales  
Royal College of Midwives  
Royal College of Nursing  
Royal College of Obstetricians and Gynaecologists  
Royal College of Paediatrics and Child Health  
Royal College of Psychiatrists  
Royal Pharmaceutical Society of Great Britain  
Scottish Intercollegiate Guidelines Networks (SIGN)  
Sheffield Teaching Hospitals NHS Trust  
The Royal Society of Medicine  
Tissue Viability Nurses Association  
Twins and Multiple births Association (TAMBA)  
UK Coalition of People Living with HIV and AIDS  
UK Pain Society  
VBAC Information and Support  
Welsh Assembly Government (formerly National Assembly for Wales)

# Abbreviations

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APH	ante partum haemorrhage
CEMD	Confidential Enquiry into Maternal Deaths
CI	confidence interval
CS	caesarean section
CSR	caesarean section rate
CTG	cardiotocograph
DGH	district general hospital (non-teaching hospital)
DIC	disseminated intravascular coagulopathy
EFM	electronic fetal monitoring
ECV	external cephalic version
EL	evidence level
FBS	fetal blood sampling
FHR	fetal heart rate
FTP	“failure to progress” (in labour)
GDG	Guideline Development Group
HDU	high dependency unit
HIV	human immunodeficiency virus
HTA	Health Technology Assessment
ITU	Intensive therapy unit
LSHTM	London School of Hygiene and Tropical Medicine
MTCT	mother-to-child-transmission
NCC-WCH	National Collaborating Centre for Women’s and Children’s Health
NCEPOD	National Confidential Enquiry into Perioperative Deaths
NICE	National Institute for Clinical Excellence
NICU	neonatal intensive care unit
NNT	number needed to treat
NSCSA	National Sentinel Caesarean Section Audit <sup>4</sup>
OR	odds ratio
RCA	Royal College of Anaesthetists
RDS	Respiratory Distress Syndrome
RCM	Royal College of Midwives
RCOG	Royal College of Obstetricians and Gynaecologists
RCT	randomised controlled trial
RR	risk ratio
SCBU	special care baby unit
SMD	standard mean deviation
SROM	spontaneous rupture of membranes
TOL	trial of labour
TTN	transient tachypnoea of the newborn
VBAC	vaginal birth after caesarean section



# Glossary of terms

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<b>Absolute risk</b>	Measures the probability of an event or outcome occurring (e.g. an adverse reaction to the drug being tested) in the group of people under study. Studies that compare two or more groups of patients may report results in terms of the <b>Absolute Risk Reduction</b> .
<b>Absolute risk reduction (ARR)</b>	The ARR is the difference in the risk of an event occurring between two groups of patients in a study – for example if 6% of patients die after receiving a new experimental drug and 10% of patients die after having the old drug treatment then the ARR is $10 - 6\% = 4\%$ . Thus by using the new drug instead of the old drug 4% of patients can be prevented from dying. Here the ARR measures the risk reduction associated with a new treatment. See also <b>Absolute risk</b> .
<b>Allied health professionals</b>	Healthcare professionals, other than doctors, midwives and nurse/midwife, directly involved in the provision of healthcare. Includes several groups such as physiotherapists, occupational therapists, dieticians, etc. (Formerly known as professions allied to medicine or PAMs.)
<b>Applicability</b>	The extent to which the results of a study or review can be applied to the target population for a clinical guideline.
<b>Appraisal of evidence</b>	Formal assessment of the quality of research evidence and its relevance to the clinical question or guideline under consideration, according to predetermined criteria.
<b>Best available evidence</b>	The strongest research evidence available to support a particular guideline recommendation.
<b>Bias</b>	Influences on a study that can lead to invalid conclusions about a treatment or intervention. Bias in research can make a treatment look better or worse than it really is. Bias can even make it look as if the treatment works when it actually doesn't. Bias can occur by chance or as a result of <b>systematic</b> errors in the design and execution of a study. Bias can occur at different stages in the research process, e.g. in the collection, analysis, interpretation, publication or review of research data. For examples see Selection bias, Performance bias, Information bias, Confounding, Publication bias.
<b>Blinding or masking</b>	The practice of keeping the investigators or subjects of a study ignorant of the group to which a subject has been assigned. For example, a clinical trial in which the participating patients or their doctors are unaware of whether they (the patients) are taking the experimental drug or a placebo (dummy treatment). The purpose of 'blinding' or 'masking' is to protect against <b>bias</b> . See also <b>Double blind study</b> , <b>Single blind study</b> , <b>Triple blind study</b> .
<b>Case-control study</b>	A study that starts with the identification of a group of individuals sharing the same characteristics (e.g. people with a particular disease) and a suitable comparison (control) group (e.g. people without the disease). All subjects are then assessed with respect to things that happened to them in the past, e.g. things that might be related to getting the disease under investigation. Such studies are also called <b>retrospective</b> as they look back in time from the outcome to the possible causes.
<b>Case series</b>	Description of several cases of a given disease, usually covering the course of the disease and the response to treatment. There is no comparison ( <b>control</b> ) group of patients.

<b>Causal relationship</b>	Describes the relationship between two <b>variables</b> whenever it can be established that one causes the other. For example there is a causal relationship between a treatment and a disease if it can be shown that the treatment changes the course or outcome of the disease. Usually <b>randomised controlled trials</b> are needed to ascertain causality. Proving cause and effect is much more difficult than just showing an association between two variables. For example, if it happened that everyone who had eaten a particular food became sick, and everyone who avoided that food remained well, then the food would clearly be associated with the sickness. However, even if leftovers were found to be contaminated, it could not be proved that the food caused the sickness – unless all other possible causes (e.g. environmental factors) had been ruled out.
<b>Clinical audit</b>	A systematic process for setting and monitoring standards of clinical care. Whereas ‘guidelines’ define what the best clinical practice should be, ‘audit’ investigates whether best practice is being carried out. Clinical audit can be described as a cycle or spiral. Within the cycle there are stages that follow a systematic process of establishing best practice, measuring care against specific criteria, taking action to improve care, and monitoring to sustain improvement. The spiral suggests that as the process continues, each cycle aspires to a higher level of quality.
<b>Clinical effectiveness</b>	The extent to which a specific treatment or intervention, when used under usual or everyday conditions, has a beneficial effect on the course or outcome of disease compared to no treatment or other routine care. (Clinical trials that assess effectiveness are sometimes called management trials.) Clinical ‘effectiveness’ is not the same as efficacy.
<b>Clinical governance</b>	A framework through which NHS organisations are accountable for both continuously improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish.
<b>Clinical impact</b>	The effect that a guideline recommendation is likely to have on a treatment, or treatment outcomes, of the target population.
<b>Clinical question</b>	This term is sometimes used in guideline development work to refer to the questions about treatment and care that are formulated in order to guide the search for research evidence. When a clinical question is formulated in a precise way, it is called a focused question.
<b>Clinician</b>	A health care professional providing patient care, e.g. doctor, nurse/midwife, physiotherapist.
<b>Cochrane Collaboration</b>	An international organisation in which people find, appraise and review specific types of studies called randomised controlled trials. The Cochrane Database of Systematic Reviews contains regularly updated reviews on a variety of health issues and is available electronically as part of the Cochrane Library.
<b>Cochrane Library</b>	The Cochrane Library consists of a regularly updated collection of evidence-based medicine databases including the Cochrane Database of Systematic Reviews (reviews of randomised controlled trials prepared by the Cochrane Collaboration). The Cochrane Library is available on CD-ROM and the Internet.
<b>Cohort study</b>	An observational study that takes a group (cohort) of patients and follows their progress over time in order to measure outcomes such as disease or mortality rates and make comparisons according to the treatments or interventions that patients received. Thus within the study group, subgroups of patients are identified (from information collected about patients) and these groups are compared with respect to outcome, e.g. comparing mortality between one group that received a specific treatment

and one group which did not (or between two groups that received different levels of treatment). Cohorts can be assembled in the present and followed into the future (a 'concurrent' or 'prospective' cohort study) or identified from past records and followed forward from that time up to the present (a 'historical' or 'retrospective' cohort study). Because patients are not randomly allocated to subgroups, these subgroups may be quite different in their characteristics and some adjustment must be made when analysing the results to ensure that the comparison between groups is as fair as possible.

<b>Co-morbidity</b>	Co-existence of a disease or diseases in the people being studied in addition to the health problem that is the subject of the study.
<b>Confidence interval</b>	A way of expressing certainty about the findings from a study or group of studies, using statistical techniques. A confidence interval describes a range of possible effects (of a treatment or intervention) that are consistent with the results of a study or group of studies. A wide confidence interval indicates a lack of certainty or precision about the true size of the clinical effect and is seen in studies with too few patients. Where confidence intervals are narrow they indicate more precise estimates of effects and a larger sample of patients studied. It is usual to interpret a '95%' confidence interval as the range of effects within which we are 95% confident that the true effect lies.
<b>Confounder or confounding factor</b>	Something that influences a study and can contribute to misleading findings if it is not understood or appropriately dealt with. For example, if a group of people exercising regularly and a group of people who do not exercise have an important age difference then any difference found in outcomes about heart disease could well be due to one group being older than the other rather than due to the exercising. Age is the confounding factor here and the effect of exercising on heart disease cannot be assessed without adjusting for age differences in some way.
<b>Consensus methods</b>	A variety of techniques that aim to reach an agreement on a particular issue. Formal consensus methods include Delphi and nominal group techniques, and consensus development conferences. In the development of clinical guidelines, consensus methods may be used where there is a lack of strong research evidence on a particular topic.
<b>Consensus statement</b>	A statement of the advised course of action in relation to a particular clinical topic, based on the collective views of a body of experts.
<b>Considered judgement</b>	The application of the collective knowledge of a guideline development group to a body of evidence, to assess its applicability to the target population and the strength of any recommendation that it would support. Consistency The extent to which the conclusions of a collection of studies used to support a guideline recommendation are in agreement with each other.
<b>Control group</b>	A group of patients recruited into a study that receives no treatment, a treatment of known effect, or a placebo (dummy treatment) - in order to provide a comparison for a group receiving an experimental treatment, such as a new drug.
<b>Cost benefit analysis</b>	A type of economic evaluation where both costs and benefits of health care treatment are measured in the same monetary units. If benefits exceed costs, the evaluation would recommend providing the treatment.
<b>Cost effectiveness</b>	A type of economic evaluation that assesses the additional costs and benefits of doing something different. In cost effectiveness analysis, the costs and benefits of different treatments are compared. When a new treatment is compared with current care, its additional costs divided by its additional benefits is called the cost effectiveness ratio. Benefits are

	measured in natural units, for example, cost per additional heart attack prevented.
<b>Cost utility analysis</b>	A special form of cost effectiveness analysis where benefit is measured in quality adjusted life years. A treatment is assessed in terms of its ability to extend or improve the quality of life.
<b>Cross-sectional study</b>	The observation of a defined set of people at a single point in time or time period – a snapshot. (This type of study contrasts with a longitudinal study which follows a set of people over a period of time.)
<b>Declaration of interest</b>	A process by which members of a working group or committee ‘declare’ any personal or professional involvement with a company (or related to a technology) that might affect their objectivity e.g. if their position or department is funded by a pharmaceutical company.
<b>Double blind study</b>	A study in which neither the subject (patient) nor the observer (investigator/clinician) is aware of which treatment or intervention the subject is receiving. The purpose of blinding is to protect against bias.
<b>Economic evaluation</b>	Comparative analysis of alternative courses of action in terms of both their costs and consequences.
<b>Efficacy</b>	The extent to which a specific treatment or intervention, under ideally controlled conditions (e.g. in a laboratory), has a beneficial effect on the course or outcome of disease compared to no treatment or other routine care.
<b>Elective</b>	Name for clinical procedures that are regarded as advantageous to the patient but not urgent.
<b>Epidemiology</b>	Study of diseases within a population, covering the causes and means of prevention
<b>Evidence based</b>	The process of systematically finding, appraising, and using research findings as the basis for clinical decisions.
<b>Evidence-based clinical practice</b>	Evidence-based clinical practice involves making decisions about the care of individual patients based on the best research evidence available rather than basing decisions on personal opinions or common practice (which may not always be evidence based). Evidence-based clinical practice therefore involves integrating individual clinical expertise and patient preferences with the best available evidence from research
<b>Evidence table</b>	A table summarising the results of a collection of studies which, taken together, represent the evidence supporting a particular recommendation or series of recommendations in a guideline.
<b>External validity</b>	The degree to which the results of a study hold true in non-study situations, e.g. in routine clinical practice. May also be referred to as the generalisability of study results to non-study patients or populations.
<b>Extrapolation</b>	The application of research evidence based on studies of a specific population to another population with similar characteristics.
<b>Forest plot</b>	A graphical display of results from individual studies on a common scale, allowing visual comparison of results and examination of the degree of heterogeneity between studies.
<b>Generalisability</b>	The extent to which the results of a study hold true for a population of patients beyond those who participated in the research. See also <b>External validity</b> .
<b>Gold standard</b>	A method, procedure or measurement that is widely accepted as being the best available.
<b>Good practice point</b>	Recommended good practice based on the expert experience of the

	<p>guideline development group (and possibly incorporating the expertise of a wider reference group). A guideline development group may produce a 'Good practice point' (rather than an evidence based recommendation) on an important topic when there is a lack of research evidence.</p>
<b>Grade of recommendation</b>	<p>A code (e.g. A,B,C,D) linked to a guideline recommendation, indicating the strength of the evidence supporting that recommendation.</p>
<b>Grey literature</b>	<p>Reports that are unpublished or have limited distribution, and are not included in bibliographic retrieval systems.</p>
<b>Guideline</b>	<p>A systematically developed tool which describes aspects of a patient's condition and the care to be given. A good guideline makes recommendations about treatment and care, based on the best research available, rather than opinion. It is used to assist clinician and patient decision-making about appropriate health care for specific clinical conditions.</p>
<b>Guideline recommendation</b>	<p>Course of action advised by the guideline development group on the basis of their assessment of the supporting evidence.</p>
<b>Health economics</b>	<p>A field of conventional economics which examines the benefits of health care interventions (e.g. medicines) compared with their financial costs.</p>
<b>Health technology</b>	<p>Health technologies include medicines, medical devices such as artificial hip joints, diagnostic techniques, surgical procedures, health promotion activities (e.g. the role of diet versus medicines in disease management) and other therapeutic interventions.</p>
<b>Health Technology Appraisal (HTA)</b>	<p>A health technology appraisal, as undertaken by NICE, is the process of determining the clinical and cost effectiveness of a health technology. NICE health technology appraisals are designed to provide patients, health professionals and managers with an authoritative source of advice on new and existing health technologies.</p>
<b>Heterogeneity</b>	<p>Or lack of homogeneity. The term is used in <b>meta-analyses</b> and <b>systematic reviews</b> when the results or estimates of effects of treatment from separate studies seem to be very different – in terms of the size of treatment effects or even to the extent that some indicate beneficial and others suggest adverse treatment effects. Such results may occur as a result of differences between studies in terms of the patient populations, outcome measures, definition of <b>variables</b> or duration of follow-up.</p>
<b>Hierarchy of evidence</b>	<p>An established hierarchy of study types, based on the degree of certainty that can be attributed to the conclusions that can be drawn from a well conducted study. Well-conducted randomised controlled trials (RCTs) are at the top of this hierarchy. (Several large statistically significant RCTs which are in agreement represent stronger evidence than say one small RCT.) Well-conducted studies of patients' views and experiences would appear at a lower level in the hierarchy of evidence.</p>
<b>Homogeneity</b>	<p>This means that the results of studies included in a systematic review or meta analysis are similar and there is no evidence of heterogeneity. Results are usually regarded as homogeneous when differences between studies could reasonably be expected to occur by chance. See also <b>Consistency</b>.</p>
<b>Information bias</b>	<p>Pertinent to all types of study and can be caused by inadequate questionnaires (e.g. difficult or biased questions), observer or interviewer errors (e.g. lack of blinding), response errors (e.g. lack of blinding if patients are aware of the treatment they receive) and measurement error (e.g. a faulty machine).</p>
<b>Intention to treat analysis</b>	<p>An analysis of a clinical trial where patients are analysed according to the group to which they were initially randomly allocated, regardless of</p>

	<p>whether or not they had dropped out, fully complied with the treatment, or crossed over and received the alternative treatment. Intention-to-treat analyses are favoured in assessments of clinical effectiveness as they mirror the non-compliance and treatment changes that are likely to occur when the treatment is used in practice.</p>
<b>Internal validity</b>	Refers to the integrity of the study design.
<b>Intervention</b>	Healthcare action intended to benefit the patient, e.g. drug treatment, surgical procedure, psychological therapy, etc.
<b>Level of evidence</b>	A code (e.g. 1a, 1b) linked to an individual study, indicating where it fits into the hierarchy of evidence and how well it has adhered to recognised research principles.
<b>Literature review</b>	A process of collecting, reading and assessing the quality of published (and unpublished) articles on a given topic.
<b>Meta analysis</b>	Results from a collection of independent studies (investigating the same treatment) are pooled, using statistical techniques to synthesise their findings into a single estimate of a treatment effect. Where studies are not compatible e.g. because of differences in the study populations or in the outcomes measured, it may be inappropriate or even misleading to statistically pool results in this way. See also <b>Systematic review</b> and <b>Heterogeneity</b> .
<b>Methodological quality</b>	The extent to which a study has conformed to recognised good practice in the design and execution of its research methods.
<b>Multicentre study</b>	A study where subjects were selected from different locations or populations, e.g. a co-operative study between different hospitals; an international collaboration involving patients from more than one country.
<b>Non-experimental study</b>	A study based on subjects selected on the basis of their availability, with no attempt having been made to avoid problems of bias.
<b>Number needed to treat (NNT)</b>	This measures the impact of a treatment or intervention. It states how many patients need to be treated with the treatment in question in order to prevent an event which would otherwise occur. E.g. if the NNT = 4, then 4 patients would have to be treated to prevent one bad outcome. The closer the NNT is to 1, the better the treatment is. Analogous to the NNT is the Number Needed to Harm (NNH), which is the number of patients that would need to receive a treatment to cause one additional adverse event. e.g. if the NNH = 4, then 4 patients would have to be treated for one bad outcome to occur.
<b>Objective measure</b>	A measurement that follows a standardised procedure which is less open to subjective interpretation by potentially biased observers and study participants.
<b>Observational study</b>	In research about diseases or treatments, this refers to a study in which nature is allowed to take its course. Changes or differences in one characteristic (e.g. whether or not people received a specific treatment or intervention) are studied in relation to changes or differences in other(s) (e.g. whether or not they died), without the intervention of the investigator. There is a greater risk of selection bias than in experimental studies.
<b>Odds ratio</b>	Odds are a way of representing probability, especially familiar for betting. In recent years odds ratios have become widely used in reports of clinical studies. They provide an estimate (usually with a confidence interval) for the effect of a treatment. Odds are used to convey the idea of 'risk' and an odds ratio of 1 between two treatment groups would imply that the risks of an adverse outcome were the same in each group. For rare events the odds ratio and the relative risk (which uses actual risks and not odds) will be very similar. See also <b>Relative risk</b> , <b>Risk ratio</b> .

<b>Outcome</b>	The end result of care and treatment and/ or rehabilitation. In other words, the change in health, functional ability, symptoms or situation of a person, which can be used to measure the effectiveness of care/ treatment/ rehabilitation. Researchers should decide what outcomes to measure before a study begins; outcomes are then assessed at the end of the study.
<b>Peer review</b>	Review of a study, service or recommendations by those with similar interests and expertise to the people who produced the study findings or recommendations. Peer reviewers can include professional and/ or patient/ carer representatives.
<b>Planned CS</b>	A CS that is scheduled before the onset of labour for a specific clinical indication
<b>Prognostic factor</b>	Patient or disease characteristics, e.g. age or co-morbidity, which influence the course of the disease under study. In a randomised trial to compare two treatments, chance imbalances in variables (prognostic factors) that influence patient outcome are possible, especially if the size of the study is fairly small. In terms of analysis these prognostic factors become confounding factors.
<b>Prospective study</b>	A study in which people are entered into the research and then followed up over a period of time with future events recorded as they happen. This contrasts with studies that are retrospective.
<b>P value</b>	If a study is done to compare two treatments then the P value is the probability of obtaining the results of that study, or something more extreme, if there really was no difference between treatments. (The assumption that there really is no difference between treatments is called the 'null hypothesis'.) Suppose the p-value was $p = 0.03$ . What this means is that if there really was no difference between treatments then there would only be a 3% chance of getting the kind of results obtained. Since this chance seems quite low we should question the validity of the assumption that there really is no difference between treatments. We would conclude that there probably is a difference between treatments. By convention, where the value of p is below 0.05 (i.e. less than 5%) the result is seen as statistically significant. Where the value of p is 0.001 or less, the result is seen as highly significant. p values just tell us whether an effect can be regarded as statistically significant or not. In no way do they relate to how big the effect might be, for which we need the confidence interval.
<b>Qualitative research</b>	Qualitative research is used to explore and understand people's beliefs, experiences, attitudes, behaviour and interactions. It generates non-numerical data, e.g. a patient's description of their pain rather than a measure of pain. Qualitative research techniques such as focus groups and in depth interviews have been used in one-off projects commissioned by guideline development groups to find out more about the views and experiences of patients and carers.
<b>Quantitative research</b>	Research that generates numerical data or data that can be converted into numbers, for example clinical trials.
<b>Random allocation or Randomisation</b>	A method that uses the play of chance to assign participants to comparison groups in a research study, for example, by using a random numbers table or a computer-generated random sequence. Random allocation implies that each individual (or each unit in the case of cluster randomisation) being entered into a study has the same chance of receiving each of the possible interventions.
<b>Randomised controlled trial</b>	A study to test a specific drug or other treatment in which people are randomly assigned to two (or more) groups: one (the experimental group) receiving the treatment that is being tested, and the other (the comparison or control group) receiving an alternative treatment, a placebo (dummy

	<p>treatment) or no treatment. The two groups are followed up to compare differences in outcomes to see how effective the experimental treatment was. (Through randomisation, the groups should be similar in all aspects apart from the treatment they receive during the study.)</p>
<b>Relative risk</b>	<p>A summary measure which represents the ratio of the risk of a given event or outcome (e.g. an adverse reaction to the drug being tested) in one group of subjects compared to another group. When the 'risk' of the event is the same in the two groups the relative risk is 1. In a study comparing two treatments, a relative risk of 2 would indicate that patients receiving one of the treatments had twice the risk of an undesirable outcome than those receiving the other treatment. Relative risk is sometimes used as a synonym for risk ratio.</p>
<b>Reliability</b>	<p>Reliability refers to a method of measurement that consistently gives the same results. For example someone who has a high score on one occasion tends to have a high score if measured on another occasion very soon afterwards. With physical assessments it is possible for different clinicians to make independent assessments in quick succession – and if their assessments tend to agree then the method of assessment is said to be reliable.</p>
<b>Retrospective study</b>	<p>A retrospective study deals with the present/ past and does not involve studying future events. This contrasts with studies that are prospective. Review Summary of the main points and trends in the research literature on a specified topic. A review is considered non-systematic unless an extensive literature search has been carried out to ensure that all aspects of the topic are covered and an objective appraisal made of the quality of the studies.</p>
<b>Risk ratio</b>	<p>Ratio of the risk of an undesirable event or outcome occurring in a group of patients receiving experimental treatment compared with a comparison (control) group. The term relative risk is sometimes used as a synonym of risk ratio.</p>
<b>Sample</b>	<p>A part of the study's target population from which the subjects of the study will be recruited. If subjects are drawn in an unbiased way from a particular population, the results can be generalised from the sample to the population as a whole. Sampling refers to the way participants are selected for inclusion in a study.</p>
<b>Selection bias</b>	<p>Selection bias has occurred if:</p> <ul style="list-style-type: none"><li>a) the characteristics of the sample differ from those of the wider population from which the sample has been drawn OR</li><li>b) there are systematic differences between comparison groups of patients in a study in terms of prognosis or responsiveness to treatment.</li></ul>
<b>Selection criteria</b>	<p>Explicit standards used by guideline development groups to decide which studies should be included and excluded from consideration as potential sources of evidence.</p>
<b>Semi-structured interview</b>	<p>Structured interviews involve asking people pre-set questions. A semi-structured interview allows more flexibility than a structured interview. The interviewer asks a number of open-ended questions, following up areas of interest in response to the information given by the respondent.</p>
<b>Statistical power</b>	<p>The ability of a study to demonstrate an association or causal relationship between two <i>variables</i>, given that an association exists. For example, 80% power in a clinical trial means that the study has a 80% chance of ending up with a p value of less than 5% in a statistical test (i.e. a statistically significant treatment effect) if there really was an important difference (e.g. 10% versus 5% mortality) between treatments. If the statistical power of a study is low, the study results will be</p>



questionable (the study might have been too small to detect any differences). By convention, 80% is an acceptable level of power. See also p value.

**Structured interview**

A research technique where the interviewer controls the interview by adhering strictly to a questionnaire or interview schedule with pre-set questions.

**Study population**

People who have been identified as the subjects of a study.

**Survey**

A study in which information is systematically collected from people (usually from a sample within a defined population).

**Systematic review**

A review in which evidence from scientific studies has been identified, appraised and synthesised in a methodical way according to predetermined criteria. May or may not include a meta-analysis.

**Target population**

The people to whom guideline recommendations are intended to apply. Recommendations may be less valid if applied to a population with different characteristics from the participants in the research study – e.g. in terms of age, disease state, social background.

**Validity**

Assessment of how well a tool or instrument measures what it is intended to measure.

# 1. Introduction

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## 1.1 Aim of the guideline

Caesarean section (CS) is the end point of a number of care pathways hence it is not possible to cover all the clinical decisions and pathways which may lead to a CS in one guideline. This evidence based guideline has been developed to help ensure consistency of quality of care experienced by women having CS. It provides evidence based information for health care professionals and women about:

- the risks and benefits of CS
- certain specific indications for CS
- effective management strategies which avoid CS
- anaesthetic and surgical aspects of care
- interventions to reduce morbidity from CS and
- aspects of organisation and environment which affect CS rates.

This guideline draws together and builds on work from other relevant NICE guidelines (such as Antenatal Care, Electronic Fetal Monitoring and Induction of Labour<sup>1-3</sup>), the findings of the NSCSA<sup>4</sup> and the Children's National Service Frameworks (England and Wales). The NSF is in development and will produce standards for service configuration, with emphasis on how care is delivered and by whom, including issues of ensuring equity of access to care for disadvantaged women and women's views about service provision. (For more information, see [www.doh.gov.uk/nsf/children.htm](http://www.doh.gov.uk/nsf/children.htm) for England and [www.wales.nhs.uk/sites/page.cfm?orgid=334&pid=934](http://www.wales.nhs.uk/sites/page.cfm?orgid=334&pid=934) for Wales).

In England, CS rates have increased from 9% of deliveries in 1980 to 21% in 2001 therefore about 120,000 caesarean sections are performed annually in England and Wales. A similar increase in CS rates has been seen in many developed countries.<sup>4</sup>

Evaluation of factors associated with the increase in CS rates has been carried out in several countries.<sup>5-11</sup> These studies have demonstrated that some of the difference in CS rates observed can be explained by changes in the demographic characteristics of the childbearing population. For example where women are delaying childbirth and having fewer children the average age of women giving birth and the proportion having their first pregnancy has increased.<sup>4</sup>

CS rates increase with maternal age [see evidence table] and this association persists after adjustment for other factors<sup>4</sup> [evidence level 3]. The overall CS rate for women in their first pregnancy is increased (24%). For women who have had a baby before but who have not had a CS, the rate of CS is reduced (10%) and for women who have had a baby before but who have had at least one previous CS the CS rate is markedly increased (67%).<sup>4</sup> The CS rate also varies in the UK according to ethnic group with higher CS rates reported in women who are black African or black Caribbean. This association persists after adjustment for other demographic or clinical differences<sup>12</sup> [evidence level 3]. However these factors only explain part of the variation observed between regions and maternity units.<sup>4</sup>

Although CS rates have increased over the last ten to fifteen years, the four major clinical determinants of the CS rate have not changed.<sup>4</sup> These remain fetal compromise (22%), "failure to progress" in labour (20%), repeat CS (14%) and breech (11%). The fifth most common reason given for performing a CS has changed and is now reported to be "maternal request" (7%).<sup>4</sup>

Variation in clinical practice contributes to variation in CS rate. For example, the use of continuous electronic fetal monitoring in labour is associated with increases in CS rates but not with a reduction in perinatal mortality rate. A national clinical standard recommends that fetal

blood sampling is undertaken to assess whether there is fetal compromise in labour prior to the decision to perform a CS. Concordance with this standard was assessed in the NSCSA which demonstrated that maternity services meeting the standard had lower CS rates. If this standard was met throughout maternity services it is likely the CS rate would be reduced by 1%.<sup>2-4</sup>

A clinical unit's CS rate is also affected by organisational factors (such as being a tertiary referral centre or the presence of a neonatal intensive care unit). A review of Canadian hospitals with low CS rates suggested that achievement and attainment of a low CS rate was associated with a range of factors including attitudinal factors (such as pride in a low CS rate, a 'culture' of birth as a normal physiological process, a commitment to one-to-one supportive care in labour), organisation of care (such as strong leadership, effective multidisciplinary teams, timely access to skilled professionals), clinicians application of knowledge and information (such as a strong commitment to evidence based practice and programmes to ensure continuous quality improvement).<sup>11</sup>

### 1.2 Areas outside the remit of the guideline

Caesarean section is the end of a number of care pathways; hence, it is not possible to cover all the clinical decisions and pathways which may lead to a CS in one guideline. It is outside the remit to give advice about the risks and benefits of CS within the management of specific clinical conditions such as pre-eclampsia or gestational diabetes. The guideline does not address the needs of pregnant women or babies with rare conditions, or with complex conditions (such as monozygotic twins) or unusual conditions (such as maternal congenital heart disease). The guideline does not address how care is delivered or whom should deliver the care.

### 1.3 For whom is the guideline intended?

This guideline is of relevance to those who work in or use the National Health Service in England and Wales:

- primary, community and secondary healthcare professionals who are involved in the care of women during pregnancy, birth and in the postnatal period who may need or have had a CS
- those with responsibilities for commissioning and planning health services such as Primary Care Trust commissioners (UK), Welsh Assembly Government officers
- public health and trust managers
- pregnant women, their families, birth supporters and other carers.

### 1.4 Who has developed the guideline?

The guideline was developed by a multi-professional and lay working group (the Guideline Development Group; GDG) convened by the National Collaborating Centre for Women's and Children's Health (NCC-WCH). Membership included:

- two consumer representatives
- two obstetricians
- two midwives
- a neonatologist
- an anaesthetist;
- a member of Confidential Enquiry into Maternal and Child Health in the United Kingdom
- a general practitioner

Staff from the NCC-WCH provided methodological support for the guideline development process, undertook systematic searches, retrieval and appraisal of the evidence and wrote successive drafts of the document.

In accordance with guidance from the National Institute for Clinical Excellence (NICE), all GDG members' interests were recorded on a standard declaration form that covered consultancies, fee-paid work, share-holdings, fellowships, and support from the healthcare industry.<sup>13</sup>

## 1.5 Guideline methodology

The guideline was commissioned by NICE and developed in accordance with the guideline development process outlined in *The Guideline Development Process – Information for National Collaborating Centres and Guideline Development Groups*.<sup>13</sup>

### Literature search strategy

The aim of the literature review was to identify and synthesise relevant evidence within the published literature, in order to answer specific clinical questions. Searches were performed using generic and specially developed filters, relevant medical subject heading terms and free-text terms. Details of all literature searches are available on application to the NCC-WCH.

The National Guidelines Clearinghouse database, the Turning Research into Practice database, and the Organising Medical Networked Information service on the Internet were searched for guidelines produced by other development groups. The reference lists in these guidelines were checked against our searches to identify any missing evidence.

Searches were carried out for each topic of interest. The Cochrane Library (up to Issue 4, 2003) was searched to identify systematic reviews (with or without meta-analyses) of randomised controlled (clinical) trials (RCTs) and individual RCTs. The electronic databases MEDLINE (Ovid version for the period January 1966 to January 2004), EMBASE (Ovid version for the period between 1988 to January 2004), the Cumulative Index to Nursing and Allied Health Literature, the British Nursing Index and PsychInfo were also searched, as was the Database of Abstracts and Reviews of Effectiveness.

There was no systematic attempt to search the 'grey literature' (conferences, abstracts, theses and unpublished trials). A preliminary scrutiny of titles and abstracts was undertaken and full papers were obtained if the research question addressed the Guideline Development Group's question relevant to the topic. Following a further review of the full version of the study, articles that did not address the Group's question were excluded. Studies that did not report relevant outcomes were also excluded. Submitted evidence from stakeholders was included where the evidence was relevant to the Group's clinical question and was of equivalent or better quality than the research identified in the literature searches.

The economic evidence presented in this guideline is not a systematic review of all the economic evidence around CS, but a review of evidence relating to specific aspects of CS. In addition to the databases listed above, the Health Economic Evaluations Database and the NHS Economic Evaluations Database were searched for relevant economic studies.

The search strategies were designed to find any economic study related to CS. Relevant references in the bibliographies of reviewed papers were also identified. Abstracts and database reviews of papers found were reviewed by the health economists and were excluded if they appeared not to contain any cost data relevant to the UK setting or did not relate to the precise topic or question being considered. Studies were included if they focused on the appropriate clinical question and were generalisable to the England and Wales setting. The review of the evidence included cost-effectiveness studies, cost-consequence studies (cost of present and future costs only) and high quality systematic reviews of the evidence (see below).

### Clinical effectiveness

For all subject areas, evidence from the study designs least subject to bias was included. Where possible, the highest levels of evidence were used, but all papers were reviewed using established guides.<sup>14–20</sup> Published systematic reviews or meta-analyses were used where available. For subject areas where neither was available, other appropriate experimental or observational studies were sought.

Identified articles were assessed methodologically and the best available evidence was used to form and support the recommendations. The highest level of evidence was selected for each clinical question. The retrieved evidence was graded according to the evidence-level structure shown in Table 1.1.

**Table 1.1** Levels of evidence

Level	Evidence
1a	Systematic review or meta-analysis of randomised controlled trials
1b	At least one randomised controlled trial
2a	At least one well-designed controlled study without randomisation
2b	At least one well-designed quasi-experimental study, such as a cohort study
3	Well-designed non-experimental descriptive studies, such as comparative studies, correlation studies, case-control studies, and case series
4	Expert committee reports, or opinions and/or clinical experience of respected authorities

The clinical question dictated the highest level of evidence that could be sought. For issues of therapy or treatment the highest possible level of evidence was a meta-analysis of RCTs or an individual RCT.

For issues of prognosis, a cohort study was the best possible level of evidence. This equates to a grade B recommendation (see below). However, this should not be interpreted as an inferior grade of recommendation because it represents the highest level of evidence attainable for that type of clinical question.

For diagnostic tests, test evaluation studies examining the performance of the test were used if the efficacy of the test was required, but where an evaluation of the effectiveness of the test in the management and outcome was required, evidence from RCTs or cohort studies was sought. For questions about women’s beliefs, attitudes and experiences of childbirth and CS, qualitative research was reviewed.

All retrieved articles were appraised methodologically using established guides. Where appropriate, if a systematic review, meta-analysis or RCT existed in relation to a topic, studies of a weaker design were excluded.

The evidence was synthesised using qualitative methods. These involved summarising the content of identified papers in the form of evidence tables and agreeing brief statements that accurately reflected the relevant evidence. Quantitative synthesis (meta-analysis) was performed where appropriate. Meta-analyses based on dichotomous outcomes are presented as relative risks with 95% confidence intervals.

For the purposes of this guideline, data are presented as absolute risks, relative risks or odds ratios where relevant (i.e. in RCTs and cohort studies). Where the data are statistically significant they are also presented as numbers needed to treat (for beneficial outcomes) or numbers need to harm (for adverse effects of treatment) if relevant.

**Health economics**

The purpose of including economic evidence in a clinical guideline is to allow recommendations to be made not just on the clinical effectiveness of different forms of care, but also on their cost effectiveness. The aim is to produce guidance that uses scarce health service resources efficiently, that is providing the best possible care within resource constraints.

There is economic literature that has considered the economic costs and consequences of different modes of birth. The economic evidence is focused around the cost of CS compared to vaginal birth. The economic evidence presented in this guideline is not a systematic review of all the economic evidence around CS. Specific topics were considered where it was thought that economic evidence would help them to inform decision making.

Topics for economic analysis were selected on the following basis by the guideline development group:

- Does the proposed topic have major resource implications?
- Is there a change of policy involved?
- Are there sufficient data of adequate quality to allow useful review or modelling?
- Is there a lack of consensus amongst clinicians?
- Is there a particular area with a large amount of uncertainty?

Where the above answers are “yes”, this indicated that further economic analysis including modelling was more likely to be useful.

A simple economic model was developed for each of the specific topic areas for which the economic evidence was reviewed, in order to present the guideline development group with a coherent picture of the costs and consequences of the decisions based on the clinical and economic evidence. The health economist undertook the literature review in these specific areas and obtained cost data considered to be the closest to current UK opportunity cost (the value of the resources used, rather than the price or charge). The criteria for assessing the economic papers was based on that developed by Drummond et al (1997)<sup>21</sup> and the format of the abstract follows that of the NHS Economic Evaluation Database (NHS EED) managed by the NHS Centre for Reviews and Dissemination (<http://nhscrd.york.ac.uk/>).

Health economics evidence was available for the following areas:

- external cephalic version for breech presentation at term,
- CS in the management of women with breech presentation,
- HIV/AIDS,
- herpes simplex virus
- vaginal birth after CS
- maternal request for CS
- use of antibiotics at CS
- intrathecal diamorphine.

The economic evidence is based not only on the economic literature, but is also consistent with the clinical effectiveness evidence presented in the guideline.

### Forming and grading recommendations

The Guideline Development Group was presented with the summaries (text and evidence tables) of the best available research evidence to answer each clinical question. Recommendations were based on, and explicitly linked to, the evidence that supported them. Where possible, the Group worked on an informal consensus basis. Formal consensus methods (the nominal group technique) were employed when required (e.g. grading recommendations and agreeing audit criteria).

The strength of evidence corresponding to each level of recommendation is shown in Table 1.2. The grading of recommendations follows that outlined in the Health Technology Assessment ‘How to develop cost conscious guidelines’.<sup>22</sup>

Summary results are presented in the guideline text. More detailed results and other data are presented in the relevant evidence tables.

### External review

The guideline has been developed in accordance with the NICE guideline development process. This has included the opportunity for registered stakeholders to comment on the scope of the guideline, the first draft of the full and summary guidelines and the second draft of all versions of the guideline. In addition the drafts were reviewed by an independent Guideline Review Panel and the Patient Involvement Unit established by NICE. The summary of recommendations was reviewed the NICE Executive.

**Table 1.2** Grading of recommendations

Grade	Strength of evidence
A	Based directly based on level 1 evidence
B	Based directly on level 2 evidence or extrapolated from level 1 evidence
C	Based directly on level 3 evidence or extrapolated from level 1 or level 2 evidence
D	Based directly on level 4 evidence or extrapolated from level 1, level 2 or level 3 evidence
GPP	Good practice point based on the view of the Guideline Development Group
NICE TA	Recommendation taken from a NICE Technology Appraisal

The comments made by the stakeholders, peer reviewers, the Guideline Review Panel and NICE were collated and presented anonymously for consideration by the Guideline Development Group. All comments were considered systematically by the Guideline Development Group and the resulting actions and responses were recorded.

# 2. Summary of recommendations and practice algorithm

## 2.1 Summary of recommendations

### Chapter 3 Woman centred care

#### 3.1 Provision of information

Pregnant women should be offered evidence-based information and support to enable them to make informed decisions about childbirth. Addressing women's views and concerns should be recognised as being integral to the decision making process.

C

Pregnant women should be given evidence-based information about CS during the antenatal period, because about 1 in 5 women will have a CS. This should include information about CS, such as:

GPP

- indications for CS (such as presumed fetal compromise, 'failure to progress' in labour, breech presentation)
- what the procedure involves
- associated risks and benefits
- implications for future pregnancies and birth after CS.

Communication and information should be provided in a form that is accessible to pregnant women, taking into account the information and cultural needs of minority communities and women whose first language is not English or who cannot read, together with the needs of women with disabilities or learning difficulties.

GPP

#### 3.2 Consent for CS

Consent for CS should be requested after providing pregnant women with evidence-based information and in a manner that respects the woman's dignity, privacy, views and culture whilst taking into consideration the clinical situation.

C

A competent pregnant woman is entitled to refuse the offer of treatment such as CS, even when the treatment would clearly benefit her or her baby's health. Refusal of treatment needs to be one of the patient's options.

D

When considering a CS there should be discussion on the benefits and risks of CS compared with vaginal birth specific to the woman and her pregnancy.

GPP

When the decision is made to perform a CS, a record should be made of all the factors that influence the decision, and which of these is the most influential.

GPP

#### 3.3 Classification of urgency

The urgency of CS should be documented using the following standardised scheme in order to aid clear communication between healthcare professionals about the urgency of a CS:

C

1. immediate threat to the life of the woman or fetus
2. maternal or fetal compromise which is not immediately life-threatening
3. no maternal or fetal compromise but needs early delivery
4. delivery timed to suit woman or staff.



**Chapter 4 Planned CS**

*4.1 Breech presentation*

Women who have an uncomplicated singleton breech pregnancy at 36 weeks gestation should be offered external cephalic version. Exceptions include women in labour and women with a uterine scar or abnormality, fetal compromise, ruptured membranes, vaginal bleeding or medical conditions.

A

Pregnant women with a singleton breech presentation at term, for whom external cephalic version is contraindicated or has been unsuccessful, should be offered CS as it reduces perinatal mortality and neonatal morbidity.

A

*4.2 Multiple pregnancy*

In otherwise uncomplicated twin pregnancies at term where the presentation of the first twin is cephalic, perinatal morbidity and mortality is increased for the second twin. However, the effect of planned CS in improving outcome for the second twin remains uncertain and therefore CS should not routinely be offered outside a research context.

C

In twin pregnancies where the first twin is not cephalic the effect of CS in improving outcome is uncertain but current practice is to offer a planned CS.

GPP

Planned CS for uncomplicated twin pregnancy should not be carried out before 38 weeks because this increases the risk of respiratory problems in these babies.

B

*4.3 Preterm birth*

Preterm birth is associated with higher neonatal morbidity and mortality. However, the effect of planned CS in improving these outcomes remains uncertain and therefore CS should not routinely be offered outside a research context.

C

*4.4 Small for gestational age*

The risk of neonatal morbidity and mortality is higher with ‘small for gestational age’ babies. However, the effect of planned CS in improving this outcome remains uncertain and therefore CS should not routinely be offered outside a research context.

C

*4.5 Placenta praevia*

Women with a placenta that partly or completely covers the internal cervical os (grade 3 or 4 placenta praevia) should be offered CS.

D

*4.6 Predicting CS for cephalopelvic disproportion in labour*

Pelvimetry is not useful in predicting “failure to progress” in labour and should not be used in decision making about mode of birth.

A

Shoe size, maternal height and estimations of fetal size (ultrasound or clinical examination) do not accurately predict cephalopelvic disproportion and should not be used to predict “failure to progress” during labour.

B

*4.7 Mother-to-child transmission of maternal infections*

HIV-positive women who are pregnant should be offered a planned CS because it reduces the risk of mother-to-child transmission of HIV.

A

Mother-to-child transmission of hepatitis B can be reduced if the baby receives immunoglobulin and vaccination. In these situations pregnant women with hepatitis B should not be offered a planned CS because there is insufficient evidence that this reduces mother-to-child transmission of hepatitis B virus.

B

Women who are infected with hepatitis C should not be offered planned CS because this does not reduce mother-to-child transmission of the virus.

C

Pregnant women who are co-infected with hepatitis C virus and HIV should be offered a planned CS as this reduces the mother-to-child-transmission of both hepatitis C virus and HIV.

C

Women with primary genital herpes simplex virus (HSV) infection occurring in the third trimester of pregnancy should be offered planned CS because it decreases the risk of neonatal HSV infection.

C

Pregnant women with a recurrence of HSV at birth should be informed that there is uncertainty about the effect of planned CS in reducing the risk of neonatal HSV infection. Therefore, CS should not routinely be offered outside a research context.

C

#### 4.8 Maternal request

Maternal request is not on its own an indication for CS and specific reasons for the request should be explored, discussed and recorded.

GPP

When a woman requests a CS in the absence of an identifiable reason, the overall benefits and risks of CS compared with vaginal birth should be discussed and recorded.

GPP

When a woman requests a CS because she has a fear of childbirth, she should be offered counselling (such as cognitive behavioural therapy) to help her to address her fears in a supportive manner, because this results in reduced fear of pain in labour and shorter labour.

A

An individual clinician has the right to decline a request for CS in the absence of an identifiable reason. However the woman's decision should be respected and she should be offered referral for a second opinion.

GPP

### Chapter 5 Factors affecting likelihood of CS during intrapartum care

#### 5.1 Place of birth

During their discussions about options for birth, healthy pregnant women with anticipated uncomplicated pregnancies should be informed that delivering at home reduces the likelihood of CS.

B

During their discussions about options for birth, healthy pregnant women with anticipated uncomplicated pregnancies should be informed that planned childbirth in a 'midwifery led unit' does not reduce the likelihood of CS.

A

#### 5.2 Factors reducing the likelihood of CS

Women should be informed that continuous support during labour from women with or without training reduces the likelihood of CS.

A

Women with an uncomplicated pregnancy should be offered induction of labour beyond 41 weeks because this reduces the risk of perinatal mortality and the likelihood of CS.

A

A partogram with a 4-hour action line should be used to monitor progress of labour of women in spontaneous labour with an uncomplicated singleton pregnancy at term, because it reduces the likelihood of CS.

A

Consultant obstetricians should be involved in the decision making for CS, because this reduces the likelihood of CS.

C

Electronic fetal monitoring is associated with an increased likelihood of CS. When CS is contemplated because of an abnormal fetal heart rate pattern, in cases of suspected fetal acidosis, fetal blood sampling should be offered if it is technically possible and there are no contraindications.

B

#### 5.3 No influence on likelihood of CS

Women should be informed that the following interventions during intrapartum care have not been shown to influence the likelihood of CS, although they may affect other outcomes that are outside the scope of this guideline:

A

- walking in labour
- non-supine position during the second stage of labour
- immersion in water during labour
- epidural analgesia during labour
- the use of raspberry leaf.

Women should be informed that the effects on the likelihood of CS of complementary therapies used during labour (such as acupuncture, aromatherapy, hypnosis, herbal products, nutritional supplements, homeopathic medicines, and Chinese medicines) have not been properly evaluated and further research is needed before such interventions can be recommended.

D

#### 5.4 'Failure to progress' (FTP) in labour and CS

The following aspects of intrapartum care have not been shown to influence the likelihood of CS for "failure to progress" and should not be offered for this reason, although they may affect other outcomes which are outside the scope of this guideline:

A

- Active management of labour
- Early amniotomy.

#### 5.5 Eating during labour

Women should be informed that eating a low-residue diet during labour (toast, crackers, low-fat cheese) results in larger gastric volumes, but the effect on the risk of aspiration if anaesthesia is required is uncertain.

A

Women should be informed that having isotonic drinks during labour prevents ketosis without a concomitant increase in gastric volume.

A

### Chapter 6 Procedural aspects of CS

#### 6.1 Timing of planned CS

The risk of respiratory morbidity is increased in babies born by CS before labour, but this risk decreases significantly after 39 weeks. Therefore planned CS should not routinely be carried out before 39 weeks.

B

#### 6.2 Decision to delivery interval for emergency CS

Delivery at emergency CS for maternal or fetal compromise should be accomplished as quickly as possible, taking into account that rapid delivery has the potential to do harm. A decision to delivery interval of less than 30 minutes is not in itself critical in influencing baby outcome, but has been accepted an audit standard for response to emergencies within maternity services.

C

#### 6.3 Preoperative testing and preparation for CS

Pregnant women should be offered a haemoglobin assessment before CS to identify those who have anaemia. Although blood loss of more than 1000ml is infrequent after CS (it occurs in 4 to 8% of CS) it is a potentially serious complication.

C

Pregnant women having CS for ante partum haemorrhage, abruption, uterine rupture and placenta praevia are at increased risk of blood loss greater than 1000 ml and should have the CS carried out at a maternity unit with on-site blood transfusion services.

C

Pregnant women who are healthy and who have otherwise uncomplicated pregnancies should not routinely be offered the following tests before CS:

C

- grouping and saving of serum
- cross-matching of blood
- a clotting screen

preoperative ultrasound for localisation of placenta, because this does not improve CS morbidity outcomes (such as blood loss of more than 1000 ml, injury of the infant, injury to the cord or to other adjacent structures).

Women having CS with regional anaesthesia require an indwelling urinary catheter to prevent over-distension of the bladder, because the anaesthetic block interferes with normal bladder function.

GPP

#### 6.4 Anaesthesia for CS

Pregnant women having a CS should be given information on different types of post-CS analgesia so that analgesia best suited to their needs can be offered.

GPP

Women who are having a CS should be offered regional anaesthesia because it is safer and results in less maternal and neonatal morbidity than general anaesthesia. This includes women who have a diagnosis of placenta praevia.

A

Women who are having induction of regional anaesthesia for CS should be cared for in theatre because this does not increase patient anxiety.

B

Women who are having a CS under regional anaesthesia should be offered intravenous ephedrine or phenylephrine, and volume pre-loading with crystalloid or colloid to reduce the risk of hypotension occurring during CS.

A

Each maternity unit should have a drill for failed intubation during obstetric anaesthesia.

D

To reduce the risk of aspiration pneumonitis women should be offered antacids and drugs (such as H<sub>2</sub> receptor antagonists or proton pump inhibitors) to reduce gastric volumes and acidity before CS.

B

Women having a CS should be offered anti-emetics (either pharmacological or acupressure) to reduce nausea and vomiting during CS.

A

General anaesthesia for emergency CS should include preoxygenation, cricoid pressure and rapid sequence induction to reduce the risk of aspiration.

GPP

Intravenous ephedrine or phenylephrine should be used in the management of hypotension during CS.

A

The operating table for CS should have a lateral tilt of 15 degrees, because this reduces maternal hypotension.

A

#### 6.5 Surgical techniques for CS

Healthcare professionals should wear double gloves when performing or assisting at CS on women who have tested positive for HIV, to reduce the risk of HIV infection of healthcare professionals during surgery.

A

General recommendations for safe surgical practice should be followed at CS to reduce the risk of HIV infection of staff.

C

CS should be performed using a transverse abdominal incision because this is associated with less postoperative pain and an improved cosmetic effect compared with a midline incision.

B

The transverse incision of choice should be the Joel Cohen incision (straight skin incision, 3 cm above the symphysis pubis; subsequent tissue layers are opened bluntly and if necessary extended with scissors and not a knife), because it is associated with shorter operating times and reduced postoperative febrile morbidity.

A

The use of separate surgical knives to incise the skin and the deeper tissues at CS is not recommended because it does not decrease wound infection.

B

When there is a well formed lower uterine segment, blunt rather than sharp extension of the uterine incision should be used because it reduces blood loss, incidence of postpartum haemorrhage and the need for transfusion at CS.

A

Women who are having a CS birth should be informed that the risk of fetal lacerations at CS is about 2%.

C

Forceps should only be used at CS if there is difficulty delivering the baby's head. The effect on neonatal morbidity of the routine use of forceps at CS remains uncertain.

C

Oxytocin 5 iu by slow intravenous injection should be used at CS to encourage contraction of the uterus and to decrease blood loss.

C

At CS, the placenta should be removed using controlled cord traction and not manual removal as this reduces the risk of endometritis.

A

Intraperitoneal repair of the uterus at CS should be undertaken. Exteriorisation of the uterus is not recommended because it is associated with more pain and does not improve operative outcomes such as haemorrhage and infection.

A

The effectiveness and safety of single layer closure of the uterine incision is uncertain. Except within a research context, the uterine incision should be sutured with two layers.

B

Neither the visceral nor the parietal peritoneum should be sutured at CS because this reduces operating time, the need for postoperative analgesia and improves maternal satisfaction.

A

In the rare circumstances that a midline abdominal incision is used at CS, mass closure with slowly absorbable continuous sutures should be used because this results in fewer incisional hernias and less dehiscence than layered closure.

B

Routine closure of the subcutaneous tissue space should not be used, unless the woman has more than 2 cm subcutaneous fat, because it does not reduce the incidence of wound infection.

A

Superficial wound drains should not be used at CS because they do not decrease the incidence of wound infection or wound haematoma.

A

Obstetricians should be aware that the effects of different suture materials or methods of skin closure at CS are not certain.

C

Umbilical artery pH should be performed after all CS for suspected fetal compromise, to allow review of fetal wellbeing and guide ongoing care of the baby.

B

Women having a CS should be offered prophylactic antibiotics, such as a single dose of first generation cephalosporin or ampicillin, to reduce the risk of postoperative infections (such as endometritis, urinary tract and wound infection) which occurs in about 8% of women who have had a CS.

A

Women having a CS should be offered thromboprophylaxis because they are at increased risk of venous thromboembolism. The choice of method of prophylaxis (for example, graduated stockings, hydration, early mobilisation, low molecular weight heparin) should take into account risk of thromboembolic disease and follow existing guidelines.

D

Women's preferences for the birth, such as music playing in theatre, lowering the screen to see baby born, or silence so that the mother's voice is the first the baby hears, should be accommodated where possible.

GPP

## Chapter 7 Care of the baby born by CS

### 7.1 Presence of paediatrician at CS

An appropriately trained practitioner skilled in the resuscitation of the newborn should be present at CS performed under general anaesthesia or where there is evidence of fetal compromise.

C

### 7.4 Thermal care for babies born by CS

Babies born by CS are more likely to have a lower temperature, and thermal care should be in accordance with good practice for thermal care of the newborn baby.

GPP

### 7.5 Maternal contact (skin to skin)

Early skin-to-skin contact between the woman and her baby should be encouraged and facilitated because it improves maternal perceptions of their infant, mothering skills, maternal behaviour, breastfeeding outcomes and reduces infant crying.

A

### 7.6 Breastfeeding

Women who have had a CS should be offered additional support to help them to start breastfeeding as soon possible after the birth of their baby. This is because women who have had a CS are less likely to start breastfeeding in the first few hours after the birth, but, when breastfeeding is established, they are as likely to continue as women who have a vaginal birth.

A

## Chapter 8 Care of the woman after CS

Health professionals caring for women after CS should be aware that, although it is rare for women to need intensive care following childbirth, this occurs more frequently after CS (about 9 per 1000).

B

After CS women should be observed on a one-to-one basis by a properly trained member of staff until they have regained airway control and cardiorespiratory stability and are able to communicate.

D

After recovery from anaesthesia, observations (respiratory rate, heart rate, blood pressure, pain and sedation) should be continued every half hour for two hours, and hourly thereafter provided that the observations are stable or satisfactory. If these observations are not stable, more frequent observations and medical review are recommended.

GPP

For women who have had intrathecal opioids, there should be a minimum hourly observation of respiratory rate, sedation and pain scores for at least 12 hours for diamorphine and 24 hours for morphine.

GPP

For women who have had epidural opioids and patient-controlled analgesia with opioids, there should be routine hourly monitoring of respiratory rate, sedation and pain scores throughout treatment and for at least 2 hours after discontinuation of treatment.

GPP

### 8.2 Pain management after CS

Women should be offered diamorphine (0.3–0.4 mg intrathecally) for intra- and postoperative analgesia because it reduces the need for supplemental analgesia after a CS. Epidural diamorphine (2.5–5.0 mg) is a suitable alternative.

A

Patient-controlled analgesia using opioid analgesics should be offered after CS because it improves pain relief.

GPP

Providing there is no contraindication, nonsteroidal anti-inflammatory drugs should be offered post-CS as an adjunct to other analgesics, because they reduce the need for opioids.

A

### 8.3 Early eating and drinking after CS

Women who are recovering well after CS and who do not have complications can eat and drink when they feel hungry or thirsty.

A

### 8.4 Urinary catheter removal after CS

Removal of the urinary bladder catheter should be carried out once a woman is mobile after a regional anaesthetic and not sooner than 12 hours after the last epidural 'top up' dose.

D

### 8.5 Respiratory physiotherapy after CS

Routine respiratory physiotherapy does not need to be offered to women after a CS under general anaesthesia, because it does not improve respiratory outcomes such as coughing, phlegm, body temperature, chest palpation and auscultatory changes.

A

### 8.6 De-briefing for women after CS

Women who have had a CS should be offered the opportunity to discuss with their health care providers the reasons for the CS and implications for the child or future pregnancies.

GPP

*8.7 Length of hospital stay and readmission to hospital*

Length of hospital stay is likely to be longer after a CS (an average of 3–4 days) than after a vaginal birth (average 1–2 days). However, women who are recovering well, are afebrile and do not have complications following CS should be offered early discharge (after 24 hours) from hospital and follow up at home, because this is not associated with more infant or maternal readmissions.

A

**Chapter 9 Recovery following CS**

In addition to general postnatal care, women who have had a CS should be provided with:

GPP

- specific care related to recovery after CS
- care related to management of other complications during pregnancy or childbirth.

Women who have a CS should be prescribed and encouraged to take regular analgesia for postoperative pain, using:

D

- for severe pain, co-codamol with added ibuprofen
- for moderate pain, co-codamol
- for mild pain, paracetamol.

CS wound care should include:

D

- removing the dressing 24 hours after the CS
- specific monitoring for fever
- assessing the wound for signs of infection (such as increasing pain, redness or discharge), separation or dehiscence
- encouraging the woman to wear loose, comfortable clothes and cotton underwear
- gently cleaning and drying the wound daily
- if needed, planning the removal of sutures or clips.

Healthcare professionals caring for women who have had a CS and who have urinary symptoms should consider the possible diagnosis of:

D

- urinary tract infection
- stress incontinence (occurs in about 4% of women after CS)
- urinary tract injury (occurs in about 1 per 1000 CS).

Healthcare professionals caring for women who have had a CS and who have irregular vaginal bleeding should consider that this is more likely to be due to endometritis than retained products of conception.

D

Women who have had a CS are at increased risk of thromboembolic disease (both deep vein thrombosis and pulmonary embolism), so healthcare professionals need to pay particular attention to women who have chest symptoms (such as cough or shortness of breath) or leg symptoms (such as painful swollen calf).

D

Women who have had a CS should resume activities such as driving a vehicle, carrying heavy items, formal exercise and sexual intercourse once they have fully recovered from the CS (including any physical restrictions or distracting effect due to pain).

GPP

Healthcare professionals caring for women who have had a CS should inform women that after a CS they are not at increased risk of difficulties with breastfeeding, depression, post-traumatic stress symptoms, dyspareunia and faecal incontinence.

D

**Chapter 10 Pregnancy and childbirth after CS**

The risks and benefits of vaginal birth after CS compared with repeat CS are uncertain. Therefore the decision about mode of birth after a previous CS should take into consideration:

GPP

- maternal preferences and priorities

- a general discussion of the overall risks and benefits of CS
- risk of uterine rupture
- risk of perinatal mortality and morbidity.

GPP

Pregnant women who have a previous CS and who want to have a vaginal birth should be supported in this decision. They should be informed that:

B

- uterine rupture is a very rare complication, but is increased in women having a planned vaginal birth (35 per 10,000 women compared with 12 per 10,000 women having planned repeat CS)
- the risk of an intrapartum infant death is small for women who have planned vaginal birth (about 10 per 10,000); however, this is higher than for planned repeat CS (about 1 per 10,000)
- the effect of planned vaginal birth or planned repeat CS on cerebral palsy is uncertain.

Women who have had a previous CS should be offered:

GPP

- electronic fetal monitoring during labour
- care during labour in a unit where there is immediate access to CS and on-site blood transfusion services.

Women who have had a previous CS can be offered induction of labour, but both women and healthcare professionals should be aware that the likelihood of uterine rupture in these circumstances is increased to:

B

- 80 per 10,000 when labour is induced with non-prostaglandin agents
- 240 per 10,000 when labour is induced using prostaglandins.

During induction of labour, women who have had a previous CS should be monitored closely, with access to electronic fetal monitoring and with immediate access to CS, because they are at increased risk of uterine rupture.

GPP

Pregnant women with both previous CS and a previous vaginal birth should be informed that they have an increased likelihood of a vaginal birth than women who have had a previous CS but no previous vaginal birth.

B

## 2.2 Future research recommendations

RCTs are needed of planned CS compared with planned vaginal delivery and should include evaluation of the short- and long-term health effects (benefits and harms) of CS. To facilitate pooling of results in meta-analysis these should be consistently measured and reported across trials.

Further evaluation is needed to determine the impact of demographic and clinical factors (such as ethnic group, increase in body mass index) and attitudinal factors on CS rates.

Further research is needed to determine the effect of CS compared with vaginal birth for women with:

- preterm breech
- a breech presentation that is diagnosed in the second stage of labour.

RCTs are needed to evaluate the benefits and risks to mothers and babies of CS for delivery of twin and triplet pregnancies.

RCTs are needed to evaluate the impact of CS on the benefits and risks to mothers and babies born preterm.

RCT evidence is needed to determine the effect of planned CS on neonatal mortality and morbidity for 'small for gestational age' babies.

RCTs are needed to evaluate the effect on MTCT and maternal health of planned CS in pregnant women on highly active antiretroviral therapy (such as HAART) or who have low viral loads.

RCTs are needed to evaluate the effect of planned CS in addition to immunoglobulin and vaccination on MTCT of hepatitis B.



RCT's are needed to determine whether planned CS should be offered to prevent MTCT of HSV to women with recurrence of HSV at birth and in women in whom the primary HSV infection occurs in the first trimester of pregnancy.

Qualitative and quantitative research should be carried out to look at the reasons that lead to pregnant women's request for CS.

The effect of counselling and other interventions such as second opinion and provision of support on the likelihood of CS for women who express a preference for CS need further evaluation.

RCTs comparing planned birth in a 'stand alone' birthing centre to birth in conventional maternity facilities or midwifery-led units.

Qualitative research is needed to explore women's opinions on place of birth and the impact of place of birth on their birth experiences.

Further RCTs are needed to determine the effect of 'delayed admission in labour' on the likelihood of CS.

RCT evidence is needed to determine the impact of partograms based on different curves of labour on CS rates and morbidity outcomes.

RCT evidence is required to evaluate the effect of parenteral analgesia (intramuscular and intravenous morphine based analgesia) used during childbirth on the likelihood of CS.

RCTs are needed to establish the safety and efficacy of complementary therapies used during labour.

More RCTs are required to determine the effect of oxytocin augmentation as single interventions or as part of a package of interventions (such as "active management of labour") on the likelihood of CS and other outcomes including women's satisfaction with care.

Further research on the short and longer term health impacts of CS during the second stage compared to operative vaginal delivery are needed.

RCTs that evaluate the effects of eating during labour compared with restricting intakes on labour outcomes are needed. Cohort or case-control studies on the risk factors for aspiration and other morbidities for women having CS are needed.

RCTs are required to determine the effectiveness of adhesive drapes at CS in reducing blood spillage and cross infection and improving safety for staff in the operating room.

RCTs are needed to evaluate the effectiveness of incisions made with diathermy compared with surgical knife in terms of operating time, wound infection, wound tensile strength, cosmetic appearance and women's satisfaction with the experience.

RCTs are needed to determine the effect of delayed cord clamping on neonatal outcomes including transient tachypnoea of the newborn and risk of maternal fetal transfusion in rhesus negative women for term and preterm births.

RCTs are required to determine the effectiveness of mass closure compared to layered closure of the abdominal wall incision at CS particularly for transverse abdominal incisions.

Research is required to assess the effect of the various surgical techniques for CS on future surgery such as repeat CS and the incidence of complications during future surgery such as hysterectomy and urogynaecological procedures.

More RCTs are needed to determine the effect of wound drainage of postoperative morbidity especially in women more at risk of this outcome such as obese women.

More RCTs are needed to determine the effect of staples compared with subcuticular sutures for skin closure at CS on postoperative pain, cosmetic appearance and removal of sutures and staples.

RCTs are needed to determine the effect of the timing of administering antibiotics in relation to cord clamping on neonatal outcomes.

More evaluation of interventions such as seeing baby born via a lowered screen; music playing in theatre; silence in theatre so mother's voice is the first baby hears and lowering the lights in theatre during CS are needed.

Further evaluation of the long and short term risks and benefits of CS compared with vaginal birth for babies is required.

Research is required to establish the thermal care requirements for babies born by CS.

Further research is needed to determine the effect of wound infiltration with local anaesthetic at CS on the need for post-CS analgesia .

Research is needed to establish the effect of non-respiratory physiotherapy for women following CS on post-CS recovery.

More RCT evidence is required to determine the effect of midwifery led debriefing following CS.

Further evaluation of the long and short term risks and benefits of CS compared to vaginal birth.

RCT are needed to evaluate the effects on maternal and infant health of VBAC or elective repeat CS for women who have had a previous CS.

## 2.3 Algorithm

# Caesarean section

Pregnant women should be given evidence-based information on caesarean section (CS), as 1 in 5 will have a including indications, what the procedure involves, risks and benefits of CS and implications for future pregnancies.

## Offer planned CS to women with:

- ✓ A term singleton breech (if external cephalic version is contraindicated or has failed)
- ✓ A twin pregnancy with first twin breech
- ✓ HIV
- ✓ Both HIV and hepatitis C
- ✓ *Primary* genital herpes in the third trimester
- ✓ Grade 3 and 4 placenta praevia

## Do not routinely offer planned CS to women with:

- ✗ Twin pregnancy (first twin is cephalic at term)
- ✗ Preterm birth
- ✗ A 'small for gestational age' baby
- ✗ Hepatitis B virus
- ✗ Hepatitis C virus
- ✗ *Recurrent* genital herpes at term

## Maternal request for CS:

- Is not on its own an indication for CS
- Explore and discuss specific reasons
- Discuss benefits and risks of CS
- Offer counselling if fear of childbirth
- The clinician can decline a request for CS, but should offer referral for a second opinion

## Planning place of birth

Inform healthy pregnant women with anticipated uncomplicated pregnancies that:

- Home birth reduces CS
- Birth in a 'midwifery-led unit' does not affect CS

## Reducing CS rates

- ✓ Offer external cephalic version if breech at 36 weeks
- ✓ Facilitate continuous support during labour
- ✓ Offer induction of labour beyond 41 weeks
- ✓ Use a partogram with a 4-hour action line in labour
- ✓ Involve consultant obstetricians in CS decision
- ✓ Do fetal blood sampling before CS for abnormal cardiotocograph in labour
- ✓ Support women who choose vaginal birth after caesarean section (VBAC)

## No influence on likelihood of CS

- Walking in labour
- Non-supine position during the second stage of labour
- Immersion in water during labour
- Epidural analgesia during labour
- Active management of labour or early amniotomy to augment the progress of labour
- Raspberry leaves during labour

*These may affect other outcomes that are outside the scope of this guideline.*

## Summary of the effects of CS compared with vaginal birth for women and their babies

Increased with CS	No difference after CS	Reduced with CS
<ul style="list-style-type: none"> <li>• Abdominal pain</li> <li>• Bladder injury</li> <li>• Ureteric injury</li> <li>• Need for further surgery</li> <li>• Hysterectomy</li> <li>• ITU/ HDU admission</li> <li>• Thromboembolic disease</li> <li>• Length of hospital stay</li> <li>• Readmission to hospital</li> <li>• Placenta praevia</li> <li>• Uterine rupture</li> <li>• Maternal death</li> <li>• Antepartum stillbirth in future pregnancies</li> <li>• Not having more children</li> <li>• Neonatal respiratory morbidity</li> </ul>	<ul style="list-style-type: none"> <li>• Haemorrhage</li> <li>• Infection</li> <li>• Genital tract injury</li> <li>• Faecal incontinence</li> <li>• Back pain</li> <li>• Dyspareunia</li> <li>• Postnatal depression</li> <li>• Neonatal mortality (excluding breech)</li> <li>• Intracranial haemorrhage</li> <li>• Brachial plexus injuries</li> <li>• Cerebral palsy</li> </ul>	<ul style="list-style-type: none"> <li>• Perineal pain</li> <li>• Urinary incontinence</li> <li>• Uterovaginal prolapse</li> </ul>
<p>This table shows the direction of the effects of CS on risks and benefits but not the size of the effects. The risks do not apply to all women in all circumstances. Details of the absolute and relative risks and benefits are available in the full guideline.</p>		

## Pregnancy and childbirth following CS

The decision about mode of birth should consider maternal preferences and priorities, general discussion of the overall risks and benefits of CS (specific risks and benefits uncertain), risk of uterine rupture and perinatal mortality and morbidity.

Women who want VBAC should be supported and:

- be informed that uterine rupture is very rare but is increased with VBAC (about 1 per 10,000 repeat CS and 50 per 10,000 VBAC)
- be informed intrapartum infant death is rare (about 10 per 10,000 the same as the risk for women in their first pregnancy), but increased compared with planned repeat CS (about 1 per 10,000)
- be offered electronic fetal monitoring during labour
- should labour in a unit where there is immediate access to CS and on-site blood transfusion
- if having induction of labour should be aware of the increased risk of uterine rupture (80 per 10,000 if non-prostaglandins are used, 240 per 10,000 if prostaglandins are used)
- be informed that women with both previous CS and a previous vaginal birth are more likely to give birth vaginally

CS is the end point of a number of care pathways. This algorithm includes the common reasons for CS, but this list is not exhaustive. CS may be required for complex or rare conditions that are outside the scope of this guideline.

## Making the decision for CS

- ✓ Communication and information should be provided in a form that is accessible
- ✓ Consent for CS should be requested after providing pregnant women with evidence-based information
- ✓ A competent pregnant woman is entitled to refuse the offer of treatment such as CS, even when the treatment would clearly benefit her or her baby's health

**Timing of planned CS:** CS should be carried out after 39 weeks of gestation to decrease the risk of respiratory morbidity.

**Emergency CS:** In cases of suspected or confirmed acute fetal compromise, delivery should be accomplished as soon as possible. The accepted standard is within 30 minutes.

### Document the urgency of CS using:

- 1) Immediate threat to the life of the woman or fetus
- 2) Maternal or fetal compromise which is not immediately life-threatening
- 3) No maternal or fetal compromise but needs early delivery
- 4) Delivery timed to suit woman or staff

## Procedural aspects of CS

### Preoperative assessment

- ✓ Check haemoglobin
- ✓ Prescribe antibiotics (one dose of first-generation cephalosporin or ampicillin)
- ✓ Assess risk for thromboembolic disease (offer graduated stockings, hydration, early mobilisation and low molecular weight heparin)
- ✓ Site an indwelling bladder catheter

For healthy women with an uncomplicated pregnancy don't offer:

- ✗ Grouping and saving of serum
- ✗ Cross matching of blood
- ✗ Clotting screen
- ✗ Preoperative ultrasound to localise the placenta

### Anaesthetic care

- ✓ Discuss post-CS analgesia options
- ✓ Offer antacids and H<sub>2</sub> receptor analogues
- ✓ Offer antiemetics
- ✓ Offer regional anaesthesia
- ✓ Reduce risk of hypotension using:
  - intravenous ephedrine or phenylephrine infusion
  - volume pre-loading with crystalloid or colloid
  - lateral tilt of 15 degrees
- ✓ General anaesthesia for emergency CS should include preoxygenation and rapid sequence induction to reduce the risk of aspiration

*Maternity units should have a drill for failed intubation*

### Surgical techniques

(For pregnancies at term, where there is a lower uterine segment. These may need modification in situations such as repeat CS, placenta praevia)

#### Do

- ✓ Wear double gloves for CS for women who are HIV-positive
- ✓ Use a transverse lower abdominal incision (Joel Cohen incision)
- ✓ Use blunt extension of the uterine incision
- ✓ Give oxytocin (5iu) by slow intravenous injection
- ✓ Use controlled cord traction for removal of the placenta
- ✓ Close the uterine incision with two suture layers
- ✓ Check umbilical artery pH if CS performed for fetal compromise
- ✓ Consider women's preferences for birth (such as music playing in theatre)
- ✓ Facilitate early skin-to-skin contact for mother and baby

#### Don't

- Close subcutaneous space (unless > 2 cm fat)
- Use superficial wound drains
- Use separate surgical knives for skin and deeper tissues
- Use routinely use forceps to deliver babies head
- Suture either the visceral or the parietal peritoneum
- Exteriorise the uterus
- Manually remove the placenta

The effects of different suture material or methods of skin closure are uncertain

A practitioner skilled in the resuscitation of the newborn should be present at CS with a general anaesthetic or with presumed fetal compromise

### Postoperative monitoring

- ✓ Recovery area – one-to-one observations until the woman has airway control, cardiorespiratory stability and can communicate
- ✓ In the ward – half-hourly observations (respiratory rate, heart rate, blood pressure, pain and sedation) for 2 hours, then hourly if stable
- ✓ Intrathecal opioids – hourly observation of respiratory rate, sedation and pain scores for 12 hours for diamorphine and 24 hours for morphine
- ✓ For epidural opioids and patient-controlled analgesia with opioids – hourly monitoring during the CS, plus 2 hours after discontinuation

### Care of the woman and her baby after CS

- ✓ Provide additional support to help women to start breastfeeding as soon as possible
- ✓ Offer diamorphine (0.3–0.4 mg intrathecally) or epidural diamorphine (2.5–5 mg) to reduce the need for supplemental analgesia
- ✓ Offer non-steroidal anti-inflammatory analgesics to reduce the need for opioid analgesics
- ✓ Women who are feeling well and have no complications can eat or drink when they feel hungry or thirsty
- ✓ After regional anaesthesia remove catheter when woman is mobile (> 12 hours after top-up)
- ✓ Remove wound dressing after 24 hours, keep wound clean and dry
- ✓ Discuss the reasons for the CS and implications before discharge from hospital
- ✓ Offer earlier discharge (after 24 hours) to women who are recovering, afebrile and have no complications

### Recovery following CS

- Offer postnatal care, plus specific post-CS care, and management of pregnancy complications
- Prescribe regular analgesia
- Monitor wound healing
- Inform women they can resume activities (such as driving, exercise) when pain not distracting or restricting

Consider CS complications:

- Endometritis if excessive vaginal bleeding
- Thromboembolism if cough or swollen calf
- Urinary tract infection if urinary symptoms
- Urinary tract trauma (fistula) if leaking urine

This algorithm should, where necessary be interpreted with reference to the full guideline

# 3. Woman-centred care

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## 3.1 Provision of information

In 1993, the Expert Maternity Group from the Department of Health (DH) released the Changing Childbirth report which made explicit the right of women to be involved in decisions regarding all aspects of their care during pregnancy and childbirth.<sup>23</sup> One of the priorities of the report is to enable women to make informed decisions about their care.<sup>24</sup> To make these decisions women require access to evidence-based information so that they can take part in discussions with caregivers about these decisions.

In a survey, pregnant women were asked their views about childbirth. This included questions about the information they wanted or had received. About 40% of women reported that they had sufficient information on the risks and benefits of CS, however almost 50% reported that they would have liked more information on reasons for CS, what to expect and the risks and benefits of CS<sup>4</sup> [evidence level 3]. Information from RCTs on antenatal education suggest that the provision of information is often seen as inadequate by women<sup>25</sup> [evidence level 3]. About 1 in 5 pregnant women will be delivered by CS<sup>4</sup> [evidence level 3] therefore when planning the birth of their baby women need information on both vaginal birth and CS. For women who experience a fear of childbirth, it is possible that building up confidence during pregnancy in her ability to give birth has the potential to influence her choices for the birth of her baby and the interventions she receives during birth.<sup>26</sup>

### Information leaflets

An RCT assessed the impact of evidence-based leaflets to promote informed decision making among pregnant women.<sup>27</sup> The leaflets were designed to be used in a conscious and controlled way (i.e. not left in a rack at an antenatal clinic or GP office) and the information provided was based on results of systematic reviews of the best available evidence and they were peer-reviewed. No differences were detected in the proportion of women who reported that they had exercised informed choice or among those who reported an 'active' decision making role during antenatal care between the women that received these leaflets and those that did not. However, satisfaction with the amount of information received was higher among women who had received the leaflets [evidence level 1b]. Qualitative assessment within the RCT of the use of the leaflets found that their potential as decision aids was reduced due to competing demands within the clinical environment.<sup>28</sup> Time pressures limited discussion and the hierarchical nature of the relationship between healthcare professionals and patients determined which 'choices' were available. This meant that women complied with their carer's choice rather than making an informed decision [evidence level 3].

### Antenatal education

A systematic review based on six RCTs (n = 1443) assessed the effects of antenatal education on knowledge acquisition, anxiety, sense of control, pain, support, breastfeeding, infant care abilities, and psychological and social adjustment.<sup>29</sup> The largest RCT (n = 1275) examined an educational intervention to increase vaginal birth after CS. The other five RCTs (combined n = 168, range RCT n = 10 – 67) included more general educational interventions; however the methodological quality of these RCTs is uncertain as they do not report randomisation procedures, allocation concealment or accrual/loss of participants. None of the RCTs included labour and birth outcomes, anxiety, breastfeeding success, or general social support. The effects on knowledge acquisition and infant care competencies were measured but interpretation is difficult because of the size and methodological quality of the RCTs<sup>29</sup> [evidence level 1b].

**RECOMMENDATIONS**

Pregnant women should be offered evidence-based information and support to enable them to make informed decisions about childbirth. Addressing women’s views and concerns should be recognised as being integral to the decision making process.

C

Pregnant women should be given evidence-based information about CS during the antenatal period, because about 1 in 5 women will have a CS. This should include information about CS, such as:

GPP

- indications for CS (such as presumed fetal compromise, ‘failure to progress’ in labour, breech presentation)
- what the procedure involves
- associated risks and benefits
- implications for future pregnancies and birth after CS.

Communication and information should be provided in a form that is accessible to pregnant women taking into account the information and cultural needs of minority communities and women whose first language is not English or who cannot read, together with the needs of women with disabilities or learning difficulties.

GPP

**3.2 Consent for CS**

Provision of information is central to the consent process, this should include information about the patients condition, possible investigations and treatment options; the risks or benefits of these options, including the risk of doing nothing.<sup>30-32</sup> [evidence level 4] Information should be given in a way that patients can understand.<sup>32,33</sup> [evidence level 4] The amount of information provided will vary between patients according to the nature of the condition, the complexity of the treatment, the associated risk of the procedure, the patient’s own wishes and individual needs. For the process of seeking consent to be meaningful, refusal of treatment needs to be one of the patient’s options. Competent adults are entitled to refuse treatment even when the treatment would clearly benefit their health. Therefore a competent pregnant woman may refuse CS, even if this would be detrimental to herself or the fetus.<sup>30</sup> [evidence level 4] Ethical guidance for obtaining consent, points of law and model documentation are available in the above guidance.<sup>30-32,34</sup> [evidence level 4]

**Summarising the risks and benefits of CS**

Information summarising the estimated risk and benefits of planned CS compared to planned vaginal birth CS is given in Table 3a,b. Where possible these estimates are derived from intention to treat analysis of RCTs comparing planned CS to planned vaginal birth (3 systematic reviews<sup>35-37</sup> of 9 RCTs.<sup>38-45,48</sup> RCTs on CS for placental abruption<sup>46</sup> and women with HIV<sup>47</sup> are not included). All the RCTs include some measure of maternal morbidity although the measures used vary between studies. To estimate overall impact of CS on maternal health (such as any “ill effect” from CS) composite measures of morbidity are needed. However the same patient may have more than one morbidity (such as hysterectomy, and blood transfusion, PPH admission to ITU), so these measures should be derived from data on individual women rather than summation of event rates in trials to avoid spurious results. Individual patient data was available in 7 RCTs.<sup>38-42,45,48</sup> Using a random effects model to account for clinical heterogeneity of the populations in the studies no difference is detected in composite morbidity measure between women having planned CS or planned vaginal birth (random effects model: pooled RR 1.93 95% CI 0.91, 4.07). If the trials are not assumed to be heterogeneous and a fixed effects model is used, the pooled RR suggest an increase in “any” morbidity in the CS group (fixed effects model pooled RR 1.58 95% CI 1.09 to 2.29)

Even though a vaginal birth is planned, a CS may become necessary for other reasons. The planned vaginal birth group includes women who had either vaginal birth or ‘emergency’ CS. Likewise the planned CS group includes women who had a vaginal birth or emergency CS.

Data from observational studies is also considered because the RCT data is limited to specific

obstetric populations. However, care needs to be taken in interpretation of data from observational studies as there is usually more than one explanation for any associations seen, and it is often not possible to disentangle the effect of CS from the reasons for CS.

This table gives an overview of the likely risks and benefits of CS compared to vaginal birth. There may be good reason why these estimates are not applicable to individual women and in using these estimates in specific clinical situations other factors (such as co-morbidity) which may influence these estimates of risk or benefit need to be taken into account.

**Table 3.1a** Summary effect on women’s health of CS compared with vaginal birth

Effects around the time of birth	Absolute risk (%)		Relative Risk (95% CI) CS compared with vaginal birth	Evidence level
	CS	Vaginal birth		
<b>Reduced after a planned CS</b>				
Perineal pain	2	5	0.3 (0.2, 0.6)	1b
<b>Increased after a planned CS</b>				
Abdominal pain	9	5	1.9 (1.3, 2.8)	1b
Bladder injury <sup>a</sup>	0.1	0.003	36.6 (10.4, 128.4)	3
Ureteric injury <sup>a</sup>	0.03	0.001	25.2 (2.6, 243.5)	3
Need for further surgery such as laparotomy or dilatation and curettage <sup>a</sup>	0.5	0.03	17.5 (9.4, 32.1)	2b
Hysterectomy <sup>a,b</sup>	0.8	0.01	95.5 (67.7, 136.9)	2b
	0.7	0.02	44.0 (22.5, 85.8)	2b
Admission to Intensive Care Unit <sup>a</sup>	0.9	0.1	9.0 (7.2, 11.2)	3
Thromboembolic disease <sup>b</sup>	Overall risk 0.04–0.16		3.8 (2.0, 4.9)	2b
Longer length of hospital stay <sup>c</sup>	3–4 days	1–2 days		1b
Readmission to hospital <sup>a</sup>	5.3	2.2	2.5 (1.1, 5.4)	2b
Maternal death <sup>a</sup>	82.3 per million	16.9 per million	4.9 (3.0, 8.0)	3
<b>Not different</b>				
Haemorrhage <sup>d</sup> (blood loss in excess of 1000mls)	0.5	0.7	0.8 (0.4, 4.4)	1a
Infection <sup>d</sup> (wound infection or endometritis)	6.4	4.9	1.3 (1.0, 1.7)	1a
Genital tract injury (extension of uterine incision, cervical laceration)	0.6	0.8	1.2 (0.4, 3.4)	1a
<b>Long term effects</b>				
<b>Reduced after a planned CS</b>				
Urinary incontinence (at 3 months after birth)	4.5	7.3	0.6 (0.4, 0.9)	1b
Utero-vaginal prolapse <sup>a</sup>	Overall prevalence 5		0.6 (0.5, 0.9)	3
<b>Not different (at 3 months after birth)</b>				
Faecal incontinence	0.8	1.5	0.5 (0.2, 1.6)	1b
Back pain	11.3	12.2	0.9 (0.7, 1.2)	1b
Post natal depression	10.1	10.8	0.9 (0.7, 1.2)	1b
Dyspareunia	17.0	18.7	0.9 (0.7, 1.1)	1b
<b>Implications for future pregnancies</b>				
<b>Increased after CS</b>				
Having no more children <sup>a</sup>	42	29	1.5 (1.1, 2.0)	2b
Placenta praevia in a future pregnancy <sup>b</sup>	0.7	0.5	1.4 (1.1, 1.6)	2b
	0.8	0.5	1.6 (1.3, 2.0)	2b
	0.4	0.2	1.3 (1.0, 1.7)	2b
Uterine rupture in a future pregnancy <sup>a</sup>	0.4	0.01	42.2 (31.1, 57.2)	2b
Antepartum Stillbirth in a future pregnancy <sup>a</sup>	0.4	0.2	1.6 (1.2, 2.3)	2b

<sup>a</sup> The data for these outcomes are from observational studies and reflect the absolute and relative risks for women who actually had either a vaginal birth or CS. Care needs to be taken in interpretation of this data as there is usually more than one explanation for the associations seen and it is not possible to disentangle the effect of CS from reasons for CS.

<sup>b</sup> The 3 sets of numbers for placenta praevia are based on data from 3 separate observational studies

<sup>c</sup> The data provided are averages for length of hospital stay

<sup>d</sup> In these RCTs antibiotics and oxytocics were used as prophylaxis against infection and haemorrhage at CS

**Table 3.1b** Summary effect on baby’s health of CS compared with planned vaginal birth

	Absolute risk (%) CS	Absolute risk (%) Vaginal birth	Relative Risk (95% CI) CS compared with vaginal birth	Evidence level
<b>Increased after a planned CS</b>				
Respiratory morbidity	3.5	0.5	6.8 (5.2, 8.9)	3
<b>Not different</b>				
Neonatal mortality (excluding breech)	0.1	0.1	1.1 (0.1, 8.4)	2b
Intracranial haemorrhage <sup>e</sup>	0.04	0.03	1.4 (0.8, 2.6)	2b
	0.008	0.01	0.6 (0.1, 2.5)	2b
Brachial plexus injuries	Overall risk 0.05		0.5 (0.1,1.9)	3
Cerebral palsy	Overall risk 0.2			3

The 2 sets of numbers for Intracranial haemorrhage are based on data from 2 separate observational studies

### Tubal ligation at CS

It is estimated tubal ligation overall has a failure rate of 1 in 200 lifetime risk.<sup>49</sup> We did not identify any studies that describes the failure rate of tubal ligation at CS. Other guidelines recommend that tubal ligation should have been requested before or during pregnancy and agreed at least one week prior to the procedure. This advice is based on expert opinion.<sup>49</sup> [evidence level 4]

### RECOMMENDATIONS

Consent for CS should be requested after providing pregnant women with evidence-based information and in a manner that respects the woman’s dignity, privacy, views and culture whilst taking into consideration the clinical situation.



A competent pregnant woman is entitled to refuse the offer of treatment such as CS, even when the treatment would clearly benefit her or her baby’s health. Refusal of treatment needs to be one of the patient’s options.



When considering a CS there should be discussion on the benefits and risks of CS compared with vaginal birth specific to the woman and her pregnancy.



When the decision is made to perform a CS, a record should be made of all the factors that influence the decision, and which of these is the most influential.



### RESEARCH RECOMMENDATIONS:

RCTs are needed of planned CS compared with planned vaginal delivery and should include evaluation of the short and long term health effects (benefits and harms) of CS. To facilitate pooling of results in meta-analysis these should be consistently measured and reported across trials.

Further evaluation is needed to determine the impact of demographic and clinical factors (such as ethnic group, increase in body mass index) and attitudinal factors on CS rates.

### Cost of CS

A systematic review of economic studies of CS and alternative modes of birth identified 49 studies containing primary costs and resource use data.<sup>50</sup> The review reported overall costs of birth from a range of sources; studies reporting primary economic data, data from one urban teaching hospital in the UK, and a survey of European maternity units of varying size. The range of costs reported for all types of birth was wide. The range for spontaneous vertex birth was £341–£886 (£629–1,350 including postnatal stay). The cost of instrumental birth was reported as £606–£968 (£242–1,794), and for CS £1,004–£1,486 (£1,238–£3,551). These values are similar to the NHS reference cost data for 1999 (the data submitted to the Department of Health by NHS providers) which includes postnatal stay. The review includes some studies of poor quality (as they met minimum standards for economic evaluation) and some studies that did not



report resource use separately from costs, reducing the usefulness of the findings. The limitation of reporting the costs only for comparison is that it is assumed that women who have CS are similar to those who have vaginal birth, whereas there may be differences.<sup>51</sup> Not taking into account these differences may lead to overestimating the cost of CS.

Individual studies may provide more meaningful data, including more detail about how the data were collected. A UK study examined routine cost data from one UK health region and applied these costs to activity data collected as part of two observational studies on one NHS unit.<sup>52</sup> A detailed 'bottom-up' costing study was undertaken. Data were reported on mean costs, with the 10th and 90th centile. The mean cost of all vaginal birth (spontaneous and instrumental) was £363 (£189–£773). Spontaneous vaginal birth costs were lower (£170) and instrumental higher (£644 for forceps. Ventouse, £485 for breech birth, 1989 prices). The mean cost of CS was around £1,100. The 90th centile costs reported for both planned and emergency CS did not exceed £1,600. The authors also examined the costs from published studies and found these to be systematically higher than UK values.

A costing study undertaken as part of a decision analysis of offering ECV presented data on the costs of planned and emergency CS, using the dataset collected for an earlier study<sup>52</sup> and validated by a regional finance directorate (a 'top down' costing approach). Costs were reported at 1997 values.<sup>53</sup> Different values were reported depending on the grade of staff attending the birth but these values did not change the costs by anything more than a £40. The baseline spontaneous vaginal birth cost was estimated to be around £450. Assisted vaginal birth cost an additional £425 (£875 in total), emergency CS cost an additional £1,955. Emergency CS would be more if it followed an attempt at assisted vaginal birth. The study reported that the cost of planned CS as £2,400 (no vaginal birth costs).

Cost analyses also need to take account of the longer term costs of alternative modes of birth. A systematic review identified 19 studies that reported data on postnatal length of stay, but these only focus on the first week of the postnatal period.<sup>50</sup> For CS, the data ranged from 1.8 days in the USA in 1991, to 8.3 days in 1994–95 in Australia. The data clustered around 4–5 days. For vaginal birth, the shortest postnatal stay was 1.2 days in the USA in 1994, and 5.1 days in Australia in 1994–95. In the UK in 1994–95, 89% of women were discharged within three days following spontaneous vaginal birth and 12% in the same period following CS. Nine studies reported a cost or charge for postnatal stay by mode of birth.

A UK based study examined the overall costs of care two months postpartum by alternative modes of birth.<sup>54</sup> The study reported mean total costs of £1698 (95% CI £1,674–1,721 for spontaneous vaginal birth, £2,262 (£2,304–2,320) for instrumental birth, and £3,200 (£3,148–£3,253) for CS. These results were statistically significantly different. The confidence intervals did not cross and were narrow compared with the costs reported in previous studies. This value is closest to what could be described as social costs of modes of birth, taking into account wider costs of community care and social care as well as immediate hospital costs. Higher costs were associated with higher morbidity in the instrumental and CS groups in the two month postpartum period.

Cost data on their own provide few insights since they do not take account of the effectiveness of each mode of birth. However, these more inclusive costs of care are closer to the opportunity cost of birth and can be used as the cost values in the assessment of the overall cost effectiveness (taking into account the benefits and harm of each mode of birth). For singleton cephalic fetus at term, with no other complications, the benefits and risks of CS are uncertain. Since there is no added benefit from CS, and it is a more resource intensive intervention, it is straightforward to conclude that vaginal birth is the more cost-effective form of birth.

However, for specific maternal or fetal conditions, CS may have health benefits that will influence cost effectiveness.

### 3.3 Classification of urgency

CS has traditionally been divided into either elective or emergency procedures. The emergency category is broad, as it may include procedures done within minutes to save the life of a woman

or baby as well as those in which woman and baby are well but where early delivery is needed, (for example, a woman with a planned elective CS who is admitted in labour). A clear classification of the perceived degree of urgency of the CS can facilitate communication and reduce misunderstanding between health care professionals. The NCEPOD classification system recommended the categorisation of operations into four grades of urgency.<sup>55</sup> This categorisation scheme has been piloted and evaluated.<sup>4,56</sup> Although new to most maternity units, there was consistent use of the new scheme when compared with the binary categories and indication for CS. The categorisation also independently predicted baby outcome<sup>4</sup> The categories are:

1. Immediate threat to the life of the woman or fetus
2. Maternal or fetal compromise which was not immediately life-threatening
3. No maternal or fetal compromise but needs early delivery
4. Delivery timed to suit woman or staff

Grade 1 (immediate threat to the life of the woman or fetus) includes CS for acute severe bradycardia, cord prolapse, uterine rupture, fetal blood sampling pH less than 7.2. Grade 2 (maternal or fetal compromise which was not immediately life-threatening), there is 'urgency' to deliver the baby in order to prevent further deterioration of either the mother or baby's condition (e.g. antepartum haemorrhage, 'failure to progress' in labour with maternal or fetal compromise). Grade 3 (no maternal or fetal compromise but needs early delivery) includes CS carried out where there is **no** maternal or fetal compromise but early delivery is necessary (e.g. a woman booked for elective CS who is admitted with pre-labour SROM or 'failure to progress' with no maternal or fetal compromise). Grade 4 (delivery timed to suit woman or staff) includes all CS carried out 'electively' at a planned time to suit the mother and clinicians.

### RECOMMENDATIONS

The urgency of CS should be documented using the following standardised scheme in order to aid clear communication between healthcare professionals about the urgency of a CS:

- 1 immediate threat to the life of the woman or fetus
- 2 maternal or fetal compromise which is not immediately life-threatening
- 3 no maternal or fetal compromise but needs early delivery
- 4 delivery timed to suit woman or staff.

C

# 4. Planned CS

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This chapter considers the evidence related to decisions about planned mode of birth. Other aspects of management of specific conditions or complications of pregnancy are not included because they are outside the scope of the guideline.

## 4.1 Breech presentation at term

About 4% of all singleton pregnancies are breech presentation. The proportion of breech presentation fetuses decreases with increasing gestation: 3% of term infants, 9% for those born at 33–36 weeks of gestation, 18% of those born at 28–32 weeks and 30% of those born at less than 28 weeks<sup>4</sup>. Breech presentation, is associated with cerebral palsy and handicap, due principally to the association with preterm birth and congenital malformations.<sup>57,58</sup>

Breech presentation is the primary indication for 10% of all CS. Overall 88% of pregnancies with breech presentation in England and Wales are delivered by CS (56% elective and 44% emergency CS). However CS rates vary with gestational age, at term 91% women with a breech presentation had a CS, while at less than 28 weeks the CS rate was less than 40%.<sup>4</sup> [evidence level 3]

### External cephalic version

Interventions to promote cephalic version of babies in the breech position include external cephalic version (ECV), moxibustion and postural management. The research basis for these interventions is included in the guideline on antenatal care of healthy pregnant women.<sup>1</sup>

External cephalic version involves applying pressure to the mother's abdomen to turn the fetus in either a forward or backward somersault to achieve a vertex presentation. Recognised complications of ECV attributable to the procedure (and incidence) include:

- fetal heart rate abnormalities: the commonest is transient bradycardia (1.1% to 16%)<sup>59–62</sup>
- placental abruption (0.4% to 1%)<sup>59,61</sup>
- painless vaginal bleeding (1.1%)<sup>61</sup>
- admission for induction of labour (3%).<sup>62</sup>

Two systematic reviews examined the effect of ECV at term and before term. Performing ECV at term reduced the number of non-cephalic births by 60% when compared with no ECV (6 RCTs, n = 612 women, RR 0.42, 95% CI 0.35, 0.50).<sup>63</sup> [evidence level 1a] A reduction in caesarean section is also observed in the ECV group when compared with no ECV (6 RCTs, n = 612, RR 0.52, 95% CI 0.39, 0.71). ECV before 37 weeks gestation does not reduce non-vertex births at term (RR 1.02, 95% CI 0.89–1.17).<sup>64</sup> [evidence level 1a]

Success rates following ECV in primiparous women range from 35% to 57% and from 52% to 84% in multiparous women<sup>59–62,65</sup> [evidence level 2b]. Interventions to improve the success rates of ECV include the routine or selective use of tocolysis, the use of regional analgesia and the use of vibroacoustic stimulation.<sup>68</sup> None of the RCTs has used newer tocolytics and the effectiveness of these is uncertain<sup>66</sup> [evidence level 1a]. Further guidance on ECV maybe found in the RCOG green-top guideline on the management of breech presentation.<sup>67</sup>

In the NSCSA external cephalic version was offered to 33% of women having a CS for breech presentation at term, this was the same irrespective of the woman's parity. ECV was provided by consultants, specialist registrars or staff grade obstetricians.<sup>4</sup> [evidence level 4] If ECV was offered to all women at term, assuming a 50% success rate then it is likely this would reduce the overall CS rate by 1%.

### Cost effectiveness of ECV

Six cost-effectiveness studies were identified that considered the role of ECV in decreasing the rate of CS, two in the United Kingdom and four in the USA.

The UK studies reported the cost of ECV.<sup>53</sup> The first was a cost study that reported an expected cost of £1,452 for ECV versus £1,828 for not having ECV, an expected saving of around £380.<sup>53</sup> The results were insensitive (i.e. did not alter the result) to changes in the cost of an ECV. The cost of CS would need to fall by £8,576 (a fall of 56%, again, a highly unlikely scenario) for the non-ECV option to be the less costly option. However, the sensitivity analysis showed that the ECV success rate would only have to fall by around 5% for the ECV option to be the less favourable option. Therefore the cost analysis cannot categorically determine which option is least costly overall. The second UK study (much smaller) found that the cost of birth with a successful ECV was £2,230 and £2,595 for an unsuccessful ECV, a cost saving of around £360 per birth.<sup>68</sup>

Four American studies have been published. One used a decision analytic modelling technique to determine the overall costs of four management options for breeches at term: ECV with planned vaginal birth, ECV with CS, selected vaginal birth and planned CS.<sup>69</sup> The decision model used hospital charges (not costs) for vaginal birth of US\$6000 and US\$10,000 for CS (a wider ratio than the reported UK cost data). The expected CS rate was 25.4% ( $\pm$  5.4) for ECV plus planned vaginal birth; 31.9% ( $\pm$  6.6) for ECV plus planned vaginal birth; 62.6% ( $\pm$  5.9) for selected vaginal birth and 88.6% ( $\pm$  3.4) for planned CS. The model estimated the expected cost for each pathway (the cost of vaginal birth and CS for each option arm) and found that ECV with planned vaginal birth was the least costly option, due to the lower proportion of CS for this group (US\$8071) and planned CS to be the most costly (US\$9544). Whether these reported costs were statistically different is not reported. The validity of the range of probabilities used in the decision analysis were subsequently questioned.<sup>70</sup>

A study in the same year considered the costs of failed and successful ECV separately and reported a cost of US\$8042 for women with failed ECV and US\$5059 for women with successful ECV.<sup>71</sup> However, the effectiveness data on which this study was based was a cohort study and not an RCT.

An American study also presented data to show that successful ECV would yield savings over unsuccessful ECV.<sup>72</sup> The most recent US study was a much larger study of 695 women.<sup>73</sup> This was a decision-analytic model to calculate the potential cost savings from ECV (in terms of reduced CS rates). The authors assumed that ECV would be successful in 44% of cases, of which 67% would proceed to vaginal birth and 33% to a CS. They further assumed that ECV would be unsuccessful in 56% of cases, of which only 7% would proceed to a successful vaginal birth. Given these assumptions, the model calculated a savings (in US hospital charges) of around \$650 per birth. Savings from every ECV attempted (even if not successful) versus ECV not attempted were around US\$3000 per birth (these are greater due to higher reported rates of CS for women not attempting ECV).

Therefore in conclusion ECV yields cost savings in comparison with CS. There is no UK-based economic evaluation comparing ECV with vaginal breech birth.

### Term breech pregnancy and CS

A systematic review identified 3 RCTs ( $n = 2396$ ) that evaluated the effect of mode of birth for term breech pregnancies.<sup>36,43,44,48</sup> [evidence level 1a] The majority of the information about the effect of planned CS in the review comes from one international multi-centre RCT which is of good methodological quality ( $n = 2088$  women, 121 centres in 26 countries).<sup>48</sup> [evidence level 1b]

Offering planned CS reduced perinatal or neonatal death (excluding fatal anomalies) or serious neonatal morbidity (RR 0.33, 95% CI 0.19–0.56).<sup>36</sup> The risk of perinatal/neonatal mortality or serious morbidity was 1.6% in the planned CS group and 5.0% in the planned vaginal birth group. The absolute risk reduction in perinatal/neonatal mortality or serious neonatal morbidity was 3.4%, therefore for every 29 CS for term breech pregnancy one baby will avoid death or serious morbidity.<sup>36</sup> [evidence level 1a] These findings are consistent with findings from cohort studies<sup>74,75</sup>

The findings of the RCT and the systematic review are the subject of continued debate. Therefore more details about this RCT are outlined here. The RCT included a number of maternity units in the UK. About 40% of women recruited to the trial were in labour at time of randomisation. The women in labour were not further divided into stages of labour so there is no information on how many were in the second stage of labour. However advanced labour was not listed as an exclusion criterion. The RCT protocol provided guidance on management of labour. This included intermittent fetal heart monitoring (every 15 minutes in the first stage and every 5 minutes in the second stage), adequate progress in labour was defined as 0.5 cm dilatation per hour and descent of the breech to the pelvic floor within 2 hours of full cervical dilatation. Delivery of the breech could be spontaneous or assisted; the after coming head could be controlled using the Mauriceau–Smellie–Veit manoeuvre or forceps. The position of the woman for the second stage of labour was not stipulated by the protocol nor was this information collected during the trial.<sup>48</sup> [evidence level 1b]

Sub group analysis within this RCT has been undertaken to evaluate if the effect on perinatal mortality or morbidity could be explained by specific factors.<sup>48</sup> These effects remain consistent and are therefore not explained by differences in:

- operator experience
- prolonged labour
- induction of labour with oxytocin or prostaglandins
- augmentation of labour
- type of breech presentation (footling or uncertain)
- the use of epidural analgesia.

Women who were in labour were included in the RCT (therefore the findings of the trial are generalisable to women in labour), however the effect of CS on neonatal outcomes is not reported separately for this group. It is possible that the benefits and risks of caesarean section particularly during the second stage are different. Therefore further research that specifically addressed this issue was sought, however no studies evaluating the effect of CS for undiagnosed breech compared to expectant management were identified. An RCT to address this issue would require randomisation of at least 4230 women with undiagnosed breech pregnancy to either CS or vaginal birth in order to detect at least a 40% difference in neonatal morbidity.

The effects of planned CS for term breech on maternal health are less clear. The RCTs included in the systematic review assessed the impact of CS on maternal health using a variety of measures and combining the results across studies is not always possible. Where the estimates could be combined, no difference is detected in the measures of maternal morbidity (such as blood loss, blood transfusion, infection) between planned CS and planned vaginal birth.<sup>36</sup> Estimates of composite measures of morbidity have previously been reported<sup>36</sup> however these pooled estimates are not included in the guideline because it is unclear whether these estimates are based on person or event data. It is possible that the same woman may have more than one morbidity (for example a woman who needs additional surgery is more likely to need a blood transfusion or admission to ITU) so that composite morbidity measures based on summation of event rates rather than number of women affected can lead to spurious results.<sup>48</sup> [evidence level 1b] Data for individual women was reported in one RCT, it did not detect any difference in composite maternal morbidity between women in the planned CS group or women in the planned vaginal birth group (RR1.24, 95% CI 0.79–1.95).<sup>48</sup> [evidence level 1b] The specific estimates of the effect of planned CS on maternal health are outlined in Table 3.1

### Preterm breech

Breech presentation, is associated with cerebral palsy and handicap, due principally to the association with preterm birth and congenital malformations.<sup>57,58</sup> The proportion of breech presentation fetuses decreases with increasing gestation: 9% for those born at 33–36 weeks of gestation, 18% of those born at 28–32 weeks and 30% of those born at less than 28 weeks.<sup>4,76</sup>

Overall 88% of pregnancies with breech presentation were delivered by CS. However CS rates varied by gestational age, 87% for babies born at 33–36 weeks, 81% of those born at 28–32 weeks, and 39% for babies born at less than 28 weeks.<sup>4</sup> [evidence level 3]

The results of the term breech trial RCT are relevant for term breech pregnancies, extrapolation

to preterm breech babies is inappropriate. In the CESDI Project 27/28 report, survival rates were lower for babies who were breech (84.5%) when compared to babies who were cephalic presentation (89.4%). Survival for breech presentation was significantly greater in those delivered by CS (86.5%) than those delivered vaginally (77.4%).<sup>76</sup> [evidence level 3]

### RECOMMENDATIONS

Women who have an uncomplicated singleton breech pregnancy at 36 weeks gestation should be offered external cephalic version. Exceptions include women in labour and women with a uterine scar or abnormality, fetal compromise, ruptured membranes, vaginal bleeding or medical conditions.

A

Pregnant women with a singleton breech presentation at term, for whom external cephalic version is contraindicated or has been unsuccessful, should be offered CS because it reduces perinatal mortality and neonatal morbidity.

A

### RESEARCH RECOMMENDATION

Further research is needed to determine the effect of Caesarean section compared with vaginal birth for women with:

- preterm breech
- a breech presentation that is diagnosed in the second stage of labour.

## 4.2 Multiple pregnancy

About 15 per 1000 pregnancies are multiple gestations; the majority of these are twin pregnancies (twins 14.4 per 1000, triplets 4 per 10,000).<sup>4</sup> There have been increases in the rates of multiple pregnancy in the last ten years that are attributed to the use of ovulation induction in fertility treatments.<sup>77,78</sup> Perinatal mortality and morbidity such as cerebral palsy are higher among multiple births than singleton births (stillbirths: multiple: 2%. singleton: 0.5%; neonatal deaths multiple: 2.5. singleton 0.3%; RR cerebral palsy twins 4.63 (3.32–6.46).<sup>79,80</sup> [evidence level 3] Some of the observed increase is explained by the association of multiple pregnancy with preterm birth.<sup>4,80</sup> Other factors which have been associated with poorer outcome in twin pregnancy include low birth weight, discordant growth between twins, monochorionic twins and being a second born twin.<sup>81–85</sup> The management of complications (such as discordant growth, monochorionic twins) and other obstetric complications in pregnancy (such as pre-eclampsia) will influence the mode of delivery decisions, however these are outside the scope of this guideline and are therefore not discussed further in this section.

Multiple pregnancy is the primary indication for 1% of caesarean sections.<sup>4</sup> Overall 59% of twin pregnancies were delivered by CS. (37% elective and 63% emergency CS). CS for delivery of the second twin following vaginal birth of the first baby was carried out in 3.5% of twins (n = 75). CS rates vary by gestational age, at term 60% women with a twin pregnancy had a CS, while at less than 28 weeks the CS rate was less than 29%.<sup>4</sup> [evidence level 3] Where CS was planned for multiple pregnancy, breech presentation of the first twin was the most commonly reported indication (14%), together with previous CS (7%) and maternal request (9%). Of the emergency caesarean sections, fetal distress was the most influential factor in 29% and “failure to progress” in 12%. Almost all triplet pregnancies (92%) were delivered by CS.<sup>4</sup> [evidence level 3]

A systematic review that included 1 RCT (n = 60) compared CS for a second twin with a non vertex presentation to vaginal birth.<sup>37</sup> [evidence level 1b] The methodological quality of this trial is uncertain because ‘randomisation was according to a protocol that was changed randomly by a non-involved person, without prior notice, on a time basis’.<sup>45</sup> No difference was detected in any of the baby outcome measures, however the study is too small to accurately estimate the effect on outcomes such as neonatal birth trauma and perinatal death The study reported no difference in the average length of hospital stay (8 days compared to 5 days) and no difference in need for blood transfusion (RR 1.5 95% CI 0.27, 8.28). Women in the planned CS group had increased risk of puerperal pyrexia compared to women in the planned vaginal birth group (RR 3.67 95% CI 1.15, 11.69).<sup>45</sup> [evidence level 1b]

A large number of observational studies using population based registers have been published. However the majority of these studies are analysed by actual mode of delivery rather than intended mode of delivery, the reports provide insufficient data on neonatal outcome for women who had planned CS<sup>85,86</sup> and in the analysis paired tests have not been used to take into account that the outcome within twin pairs maybe related.<sup>87,88</sup> One systematic review included only studies where the intended mode of delivery could be identified. The review included 3 retrospective cohort studies<sup>89-91</sup> and the RCT discussed above.<sup>45</sup> The results from these studies were consistent and did not detect differences in neonatal morbidity such as low 5-minute Apgar score, birth trauma, neurological complications, hyperbilirubinaemia, hypoglycaemia, transient tachypnoea or secondary apnoea. The studies are too small to evaluate perinatal mortality.

Triplet and higher order multiple births are rare. They most frequently are the result of ovulation induction for treatment of fertility problems.<sup>78</sup> Triplets are almost always born preterm and some of the poorer outcomes such as cerebral palsy seen in these infants are due to preterm birth. These and other complicating factors may influence the mode of delivery decisions. Almost all triplet pregnancies (92%) were delivered by CS.<sup>4</sup> [evidence level 3] We identified 3 small retrospective case control studies which compared baby outcomes according to mode of birth for triplet pregnancies (119 sets of triplets in total). The babies born vaginally tended to have better outcomes such as higher Apgar scores than those delivered by CS. However these studies are analysed by actual mode of delivery rather than intended mode of delivery and do not use analysis to take into account that the outcome within triplets will be related.<sup>92-94</sup> [evidence level 2b]

Women who have multiple pregnancies have an increased risk of maternal mortality and morbidity. CEMD estimates maternal mortality is increased with multiple pregnancy (20.3 per 100 000 twin pregnancies; 215 per 100 000 triplet pregnancies, compared with 11.2 per 100 000 for singleton pregnancies).<sup>95</sup> [evidence level 3] The effect of mode of delivery on this outcome is uncertain.

### Timing of planned CS for twin pregnancy

Planned CS of twins between 36–37 weeks and 6 days is associated with increased risk of respiratory disorders (TTN or RDS) in one or both of the twins compared to CS between 38 and 40 weeks (RR 5.94, 95% CI 0.78 to 45.01).<sup>96</sup> [evidence level 2b] Multiple pregnancy is an established risk factor for preterm birth. About 29% of twin pregnancies are likely go into spontaneous labour before 37 weeks however CS in labour is associated with a reduced risk of respiratory disorders.<sup>4</sup> We did not identify any studies that had evaluated the optimal timing for CS in higher order multiple births.

### RECOMMENDATIONS

In otherwise uncomplicated twin pregnancies at term where the presentation of the first twin is cephalic, perinatal morbidity and mortality is increased for the second twin. However, the effect of planned CS in improving outcome for the second twin remains uncertain and therefore CS should not routinely be offered outside a research context.

C

In twin pregnancies where the first twin is not cephalic the effect of CS in improving outcome is uncertain, but current practice is to offer a planned CS.

GPP

Planned CS for uncomplicated twin pregnancy should not be carried out before 38 weeks because this increases the risk of respiratory problems in these babies

B

### RESEARCH RECOMMENDATION

RCTs are needed to evaluate the benefits and risks to mothers and babies of CS for delivery of twin and triplet pregnancies.

## 4.3 Preterm birth and CS

Preterm birth is the most common cause of neonatal mortality (47% of neonatal deaths are due to immaturity).<sup>76</sup> Babies born preterm are also at increased risk of morbidity (such as cerebral

palsy) however the impact of mode of delivery on outcomes is uncertain.<sup>97,98</sup> Preterm birth may result from spontaneous preterm labour or because delivery is thought to be beneficial to the mother's (such as severe pre-eclampsia or HELLP) or baby's health (for example presumed fetal compromise). Other obstetric complications (such as multiple pregnancies and breech presentation) are associated with preterm birth and will influence the mode of delivery decisions, however detailed discussion of the appropriate management of all these situations is outside the scope of this guideline. Changing the mode of birth for preterm infants to CS has been proposed as a means of reducing the morbidity and mortality<sup>40</sup> [evidence level 3] however when the infant is very small delivery can be difficult at CS<sup>76</sup> In addition upper segment caesarean section (classical) may be needed in about 10% of babies born at 27–28 weeks which may have a significant impact on future pregnancies of these women.<sup>76</sup>

A systematic review of elective CS versus expectant management for birth of the small baby identified six RCTs (n = 122).<sup>35</sup> [evidence level 1a] Three RCTs included only breech presentation and three included only cephalic presentations. All trials were discontinued before reaching their projected sample size because of difficulties in recruitment or difficulties in weight estimation where trial entry criteria were based on birthweight.<sup>41</sup> [evidence level 1b] About 1 in 6 of the babies allocated to CS were born vaginally, and vice versa. The findings of the review are inconclusive because there were too few events to give sufficiently precise estimates of effect that would be clinically useful.

A large number of observational studies evaluating mode of birth of preterm infants on mortality and morbidity (such as cerebral palsy) have been published. However the impact of mode of delivery on neonatal outcome remains uncertain.<sup>76,97,99–102</sup> [evidence level 3]

### RECOMMENDATION

Preterm birth is associated with higher neonatal morbidity and mortality. However, the effect of planned CS in improving these outcomes remains uncertain and therefore CS should not routinely be offered outside a research context.



### RESEARCH RECOMMENDATION

RCTs are needed to evaluate the impact of CS on the benefits and risks to mothers and babies born preterm.

## 4.4 Small for gestational age

Small for gestational age (SGA) refers to a fetus that has failed to achieve a specific biometric measurement (for example abdominal circumference) or estimated weight threshold by a specific gestational age. The commonly used threshold is the tenth centile. About half of these babies are constitutionally small, others are fetuses that are not achieving their growth potential (fetal growth restriction, FGR). SGA fetuses are at greater risk of stillbirth, birth hypoxia, neonatal complications and impaired neurodevelopment. However, most term SGA infants do not have significant morbidity or mortality.<sup>103</sup> It is beyond the scope of this guideline to consider the investigation and management of small for gestational age infants other than the effect of CS on neonatal outcome, however this topic is covered by another guideline.<sup>103</sup>

No RCTs were identified that directly reported on baby outcomes for planned CS versus planned vaginal birth for SGA babies. One RCT has compared delayed versus immediate delivery after diagnosis of fetal growth restriction. This trial reported that delayed delivery resulted in fewer CS (OR 2.7, 95% CI 1.6 to 4.5).<sup>104</sup> [evidence level 1b] Observational data has suggested that SGA babies exposed to labour are more at risk of neonatal death than those not exposed to labour (RR 1.79, 95% CI 1.54 to 1.86).<sup>105</sup> [evidence level 3] CS may reduce the need for neonatal resuscitation (OR 0.2, 95% CI 0.08 to 0.66).<sup>106</sup> [evidence level 3]

The effect of CS on cerebral palsy in low birth weight babies is not certain. CS is not associated with a difference in rates of cerebral palsy.<sup>107,108</sup> [evidence level 3] Currently available guidelines do not recommend a mode of birth for SGA babies.<sup>103</sup> [evidence level 4]



### RECOMMENDATION

The risk of neonatal morbidity and mortality is higher with ‘small for gestational age’ babies. However, the effect of planned CS in improving this outcome remains uncertain and therefore CS should not routinely be offered outside a research context.

C

### RESEARCH RECOMMENDATION

RCT evidence is needed to determine the effect of planned CS on neonatal mortality and morbidity for ‘small for gestational age’ babies.

## 4.5 Placenta praevia

Placenta praevia is the primary indication for about 3% of all CS (2.2% not actively bleeding and 0.9% actively bleeding).<sup>4</sup> The majority of low lying placenta detected at 20 weeks will resolve. If the placenta extends over the os a repeat USS should offered at 36 weeks.<sup>1</sup> Placenta praevia may also present with painless bleeding. CS is usually necessary when the placenta covers the internal os at 36 weeks (grade 3 or 4 placenta praevia). Women having a CS for placenta praevia are at increased risk of blood loss of greater than 1000 ml compared to CS for other indications (RR 3.97, 95% CI 3.24 to 4.85).<sup>4</sup> In the last triennial report from the Confidential Enquiry into Maternal Deaths in the UK, four deaths occurred in women with placenta praevia, three as a result of haemorrhage.<sup>95</sup> Hence, they should have the CS carried out by an experienced operator with a consultant readily available and at a maternity unit with on-site blood transfusion services.

### RECOMMENDATION

Women with a placenta that partly or completely covers the internal cervical os (grade 3 or 4 placenta praevia) should be offered CS.

D

## 4.6 Predicting CS for cephalopelvic disproportion in labour

Pelvimetry (clinical or X-ray) has been used to predict the need for CS in pregnant women. A systematic review of 4 RCTs (n = 895) assessed the effects of x ray pelvimetry on mode of birth. Two RCTs included women with a previous CS. The women on whom pelvimetry was performed were more likely to be delivered by CS (Peto OR 2.17, 95% CI 1.63 to 2.88); There were no differences in neonatal outcomes (asphyxia, admission to neonatal unit, scar dehiscence).<sup>109</sup> [evidence level 1a] Guidelines have recommended that pelvimetry is not used except in rare circumstances such as if the woman has had a previous fracture of the pelvis.<sup>110</sup>

Other tests to predict failure to progress (FTP) have included shoe size, maternal height and size of fetus. Observational studies have not demonstrated their value in predicting FTP in labour.<sup>111,112</sup>[evidence level 3]

### RECOMMENDATIONS

Pelvimetry is not useful in predicting “failure to progress” in labour and should not be used in decision making about mode of birth.

A

Shoe size, maternal height and estimations of fetal size (ultrasound or clinical examination) do not accurately predict cephalopelvic disproportion and should not be used to predict “failure to progress” during labour.

B

## 4.7 Mother-to-child transmission of maternal infections

This section addresses CS as an intervention to reduce mother-to-child transmission (MTCT) of viral infections (such as HIV), other interventions also impact on the risk of the MTCT of viral infections (such as anti-retrovirals for HIV) but these topics are outside the scope of this guideline.

## HIV

Since 1999 it has been recommended that pregnant women are offered antenatal screening for HIV (human immunodeficiency virus) because there are effective interventions to reduce MTCT.<sup>1</sup> A system of clear referral paths should be established in maternity units so that women who are diagnosed with HIV can be managed and treated by appropriate specialist teams.<sup>1</sup> The prevalence of HIV infection in pregnant women in London in 2002 was 0.38%, compared 0.06% elsewhere in England.<sup>113</sup> [evidence level 3] In the absence of intervention, mother-to-child transmission (MTCT) is reported to occur in 25.5% of deliveries and was reduced to 8% with antiretroviral treatment with zidovudine.<sup>114</sup> [evidence level 1b] The combination of interventions (antiretroviral therapy, caesarean section, and avoidance of breastfeeding) can further reduce the risk of transmission to 1%.<sup>115</sup> In the UK, MTCT rates were 19.6% (95% CI 8.0% to 32%) in 1993 and declined to 2.2% (95% CI 0% to 7.8%) in 1998.<sup>116</sup>

A systematic review of interventions to reduce MTCT of HIV includes an international multi-centre RCT of planned CS at 38 weeks compared to planned vaginal birth. This shows a significant reduction in the MTCT of HIV with planned CS (RR 0.17, 95% CI 0.05 to 0.55).<sup>117,118</sup> [evidence level 1b] Similar proportions of women were on antiretroviral treatment between the groups, and none of the women breastfed their infants. Secondary non-ITT analysis by actual mode of birth revealed a 70% reduction in infection of the infant with HIV with elective CS (OR 0.3, 95% CI 0.1 to 0.8) but no reduction with emergency CS (OR 1.0, 95% CI 0.3 to 3.7).<sup>47</sup> [evidence level 1b] These findings are supported by observational studies with MTCT of less than 1% in women taking zidovudine who were delivered by CS (a five-fold reduction) and in women on antenatal anti-retroviral treatment, who have low viral loads (less than 400 copies/ml).<sup>115</sup> [evidence level 2b]

The management of HIV has rapidly advanced and new treatments are now available (such as HAART (Highly active antiretroviral therapy using three or more antiretroviral drugs)). These regimes are more effective in reducing viral load especially in women who have advanced disease than single agents such as zidovudine.<sup>113,119</sup> This is important because high viral loads are associated with an increased risk of vertical transmission. However, there is no threshold below which lack of transmission can be assured. The effect of CS for women taking HAART who have low viral loads has not been evaluated and therefore is not known. Current guidelines therefore recommend that women are offered CS.<sup>113,120</sup> [evidence level 2b]

In the RCT comparing planned CS to planned vaginal birth there were no serious complications in either group.<sup>47</sup> [evidence level 1b] However infective morbidity after CS may have more serious implications for women with HIV. The evidence from cohort and cross sectional studies data is inconclusive. Some studies report increased morbidity after CS in HIV-positive women compared to women who don't have HIV (OR 3.7 for major complications, 95% CI 1.4 to 9.6 and OR 1.3 for minor complications, 95% CI 0.3 to 4.9)<sup>121-122</sup> [evidence level 2b]. However it has been suggested this may relate to CD4 counts as HIV positive women with normal CD4 counts did not differ from HIV-negative women.<sup>123</sup> [evidence level 2b] Other studies have not detected a difference in incidence of morbidity nor in severity of morbidity.<sup>122,124</sup> [evidence level 2b]

### Cost effectiveness of CS In the prevention of vertical HIV transmission

We identified four economic studies that addressed this question, one of which was a UK based study. This study estimated that offering CS to HIV-positive women represented a cost of £27,836 per case of neonatal HIV case averted. The study pre-dated the European Collaborative study on mode of birth and HIV transmission and the authors concluded that there was some uncertainty around the cost-effectiveness of CS where the take-up of zidovudine therapy was high. The study did not include the long-term health and social care costs of the transmission of HIV from mother to infant.<sup>125</sup>

A later study undertaken in the USA used effectiveness data from the European collaborative study on modes of birth and HIV transmission. If future medical costs were included, elective CS was found to be both more effective and less costly than vaginal birth (a total saving of US\$3,900 less per birth for CS). This result did not change over a wide range of assumptions explored by the authors, making the results applicable to many scenarios.<sup>126</sup>

Another US study considered US data only and the lifetime costs (and life years saved) of preventing mother-to-child-transmission for women receiving zidovudine and concurrent

antiretroviral therapy and women who were not. The study found a cost saving for HIV-positive women delivering without antiretroviral therapy. However, for women receiving therapy, the data showed that CS was cost-effective but no longer cost saving. They estimated CS would cost US\$17 per life year saved based on the projection of a life of an adult of 85.8 years and the life expectancy of a child born with HIV infection of 9.4 years.<sup>127</sup>

In another USA study CS was found to be a cost-effective and clinically effective option for the prevention of vertical transmission of HIV when no other therapy is offered.<sup>126</sup> The study undertaken in 2001 considered the lifetime costs and savings (in terms of perinatal transmission avoided) of a CS for HIV-positive women who were receiving zidovudine therapy, compared with standard care (the method of birth consistent with 'obstetric indications' regardless of HIV status). The authors estimated a cost saving of US\$37,284 per case of perinatal HIV infection prevented when CS was planned. Threshold analysis indicated that CS was not cost-saving if perinatal transmission rates were decreased by 43.3% for all methods, the cost of uncomplicated vaginal birth was less than US\$556, the cost of uncomplicated CS was less than US\$5907, and the discounted lifetime costs for paediatric HIV infection was less than US\$49,000.<sup>128</sup> These thresholds (for CS to no longer be the preferred option) are unlikely to be crossed in the UK context given the costs of CS in the UK.

The authors conclude that elective CS in HIV-infected women receiving zidovudine is one treatment strategy for the prevention of perinatal HIV transmission, which can be cost-saving. However, if other strategies, such as the use of combination anti-retroviral therapy and/or measurement of viral load, result in at least a 50% reduction of the baseline perinatal HIV transmission rates, elective CS will no longer be cost-saving.<sup>128</sup>

### RECOMMENDATION

HIV-positive women who are pregnant should be offered a planned CS as it reduces the risk of mother-to-child transmission of HIV.

A

### RESEARCH RECOMMENDATION

RCTs are needed to evaluate the effect on MTCT and maternal health of planned CS in pregnant women on highly active antiretroviral therapy (such as HAART) /or who have low viral loads.

### Hepatitis B virus

Serological screening for hepatitis B should be offered to all pregnant women.<sup>1</sup> The prevalence of hepatitis B surface antigen (HBsAg) in pregnant women in the UK has been found to range from 0.5 to 1%<sup>129,130</sup> [evidence level 3]. The wide range in prevalence rates is most likely due to wide variation in prevalence among different ethnic groups.<sup>131</sup> [evidence level 3]

Hepatitis B immunoglobulin and hepatitis B vaccine reduce mother-to-child transmission (MTCT). The vaccine and immunoglobulin are given to the infant at birth followed by either a one month and six month dose or at 5 weekly intervals.<sup>132,133</sup> [evidence level 1b]

Most MTCT occurs at birth or postnatally. Transmission at birth may be due to microperfusion of maternal blood into the infant's circulation during placental separation or by the infant swallowing maternal blood, amniotic fluid or vaginal secretions at vaginal birth.<sup>134</sup> It has been suggested that CS could further reduce MTCT however no RCTs have addressed this issue. One cohort study was identified (n = 447 infants). The methodology of this study is not clearly reported and the generalisability of the findings are not clear.<sup>135</sup> [evidence level 2a]

### RECOMMENDATION

Mother-to-child transmission of hepatitis B can be reduced if the baby receives immunoglobulin and vaccination. In these situations pregnant women with hepatitis B should not be offered a planned CS as there is insufficient evidence that this reduces mother-to-child transmission of hepatitis B virus.

B

### RESEARCH RECOMMENDATION

RCTs are needed to evaluate the effect of planned CS in addition to immunoglobulin and vaccination on MTCT of hepatitis B.

### Hepatitis C virus

Women are not routinely offered screening for hepatitis C infection in the UK.<sup>1</sup> The prevalence of hepatitis C virus (HCV) in women of child-bearing age is not known as large scale serological studies have not been done. It is however estimated that 1–2% of women of child-bearing age in the US are positive for antibody to HCV<sup>136</sup> An estimate for EU countries is 0.9% (0.1–3%).<sup>136</sup>

Mother-to-child transmission (MTCT) of HCV was first described in the early 1990s and is now widely recognized. The risk of MTCT of HCV is usually low at 3–5% but higher rates of 10–20% are observed among HIV co-infected women.<sup>136</sup> [evidence level 3] A cohort study involving 441 mother-child pairs from the UK and Ireland of which 5% were known to be HIV-positive, estimated overall MTCT risk at 6.7% (95% CI 4.1 to 10.2). Women co-infected with HIV and HCV had a 3.8 times higher risk of transmitting HCV to their infants than HIV-negative women.<sup>137</sup> [evidence level 2b]

The effect of mode of birth on the risk of MTCT of HCV has not been evaluated in RCTs. We identified a pooled retrospective analysis of prospectively collected data on 1474 HCV infected women from 36 centres in eight European countries.<sup>138</sup> [evidence level 3] For women with hepatitis C infection, there was no difference in risk of vertical transmission by mode of birth (OR 1.19, 95% CI 0.64 to 2.20). This lack of association persisted with adjustment for breastfeeding status, geographic region and maternal age at birth (OR 1.26, 95% CI 0.68–2.34), (OR 1.29, 95% CI 0.69 to 2.42) and (OR 1.17, 95% CI 0.59 to 2.31).<sup>138</sup> [evidence level 3]

Within this study subgroup analysis of women co-infected with HIV (n = 503, 35.4%), reported that the risk of vertical transmission for HCV was reduced by 60% with CS (OR 0.43, 95% CI 0.23 to 0.80). Of the HIV co-infected women, 14 (7.3%) were classified as clinical stage C, the remainder of the women are described as being asymptomatic. There is no mention of whether any of the women were on anti-retroviral therapy. 13 (2.6%) of the HIV co-infected women breastfed their infants.<sup>138</sup> [evidence level 3]

### RECOMMENDATIONS

Women who are infected with hepatitis C should not be offered planned CS because this does not reduce mother-to-child transmission of the virus.

C

Pregnant women who are co-infected with hepatitis C virus and HIV should be offered planned CS because this reduces the mother-to-child-transmission of both hepatitis C virus and HIV.

C

### Genital herpes simplex virus

Genital herpes simplex virus (HSV) infection is an ulcerative sexually transmitted infection which can recur and is associated with considerable physical and psychological morbidity. Genital ulcers may cause pain but can be asymptomatic (for example cervical lesions). Between 1972 and 2001, there was a 9-fold increase in the incidence of genital HSV diagnosed in women in the UK.<sup>139</sup> [evidence level 3] Currently HSV-2 antibody prevalence in England and Wales is 3% in men and 5% in women.<sup>140</sup> [evidence level 3]

Neonatal HSV can cause severe systemic disease and is associated with a high mortality rate. Active surveillance in the UK suggests that neonatal HSV infection occurs in 1.65 per 100,000 live births.<sup>141</sup> [evidence level 3] Neonatal HSV may result from contact of the newborn with the birth canal of an infected mother.

### Primary HSV infection and MTCT of HSV

The accepted practice of offering CS to women with HSV infection is based on three case series. The first study included 101 pregnant women with HSV (both primary and recurrent disease). This study found the risk of neonatal herpes to be highest for women who acquired primary infection during the third trimester (3 cases of neonatal infection out of 9 cases of exposure).<sup>142</sup> [evidence level 3] Subsequently a study evaluating screening for HSV identified 94 women who acquired HSV during pregnancy but with no MTCT to the infants. There were an additional 9 women who acquired genital HSV near the onset of labour and in this group, 4 of the 9 infants developed neonatal HSV infection.<sup>143</sup> [evidence level 3] A study of 15,923 asymptomatic women

in early labour reported isolating HSV from 56 women of whom 18 (35%) had a primary infection. Neonatal HSV developed in 6 infants (33%).<sup>144</sup> [evidence level 3] None of the studies are large enough to address the effect of mode of birth on MTCT.

Despite limited evidence the high mortality associated with neonatal herpes means there is consensus about current practice to offer CS for primary infection.<sup>145,146</sup>

### **Recurrent HSV infection and history of HSV infection and MTCT**

Observational data suggests that the risk of neonatal infection with recurrent HSV is lower than with primary HSV infection (8% with recurrent infection and 33% with primary HSV infection).<sup>147,148</sup> [evidence level 3] In the Netherlands there has not been a policy of CS for women with recurrent HSV since 1987, and this practice has not resulted in an associated increase in HSV neonatal infections.<sup>149</sup> [evidence level 3]

Recurrent HSV may not cause symptomatic lesions, for example with cervical ulceration. A study of 15923 asymptomatic women in early labour reported isolating HSV from 34 women, neonatal HSV developed in 1 of the infants (3%).<sup>144</sup> [evidence level 3] To prevent MTCT of HSV in asymptomatic women antenatal screening using HSV cultures was proposed, but this test also did not predict infants risk at birth.<sup>150</sup> [evidence level 3]

Three RCTs evaluate using oral acyclovir from 36 weeks to prevent recurrence of HSV at the time of birth. These found a reduction in CS for HSV, however do not report the effect of acyclovir on MTCT.<sup>151–153</sup> [evidence level 1b]

A survey of obstetricians in the UK found there was no consensus of opinion or practice for recurrent disease or a history of disease.<sup>146</sup> [evidence level 3]

### **Cost effectiveness of CS to prevent MTCT of HSV**

Three American studies have considered the factors that promote or inhibit the cost-effectiveness of various strategies to prevent MTCT of HSV.<sup>154–156</sup> Two studies by the same author have examined the additional efficacy, risks, and costs of CS for three groups of women: those presenting with primary HSV; women with a history of HSV; and women with no clinical HSV or history of HSV. The first study was a decision analytic model using data from a review of 19 studies.<sup>154</sup> Marginal (additional) costs and benefits over and above standard delivery were calculated.

Adopting a programme of offering routine CS for women with a history of HSV, 9 neonatal cases would be averted per million births at an estimated cost of US\$2.5 million per case of neonatal HSV averted. For women with primary HSV, 18 neonatal cases prevented per million with estimated cost saving of US\$38,000 per case of neonatal HSV averted.<sup>154</sup> However more data on transmission rates and the efficacy of CS are required to make these estimates robust.<sup>154</sup>

A later study<sup>155</sup> modelled the cost-effectiveness of four strategies to prevent MTCT of HSV in women with at least one previous episode of HSV. CS only, acyclovir prophylaxis in late pregnancy with vaginal birth, acyclovir prophylaxis in late pregnancy with screening and follow-up, and a 'do nothing' option. The incremental cost per case prevented compared with 'do nothing' was highest for CS with 2.8 cases prevented at an additional cost of US\$1.3 million, and lowest for acyclovir prophylaxis with screening and follow-up of neonates (an additional cost of US\$400,300). This suggests that acyclovir therapy with follow-up was a more cost-effective strategy than CS alone.

The third paper examined whether acyclovir suppression was a more cost-effective option compared to offering CS only to women with a history of HSV.<sup>156</sup> The analysis showed that CS rate was the most sensitive variable (since it represents a high proportion of the total costs). The authors concluded that acyclovir suppression was a cost-effective alternative to CS for women with a history of genital herpes in agreement with analysis of the authors of the previous two papers. However, given the lack of data around the estimates of costs, the small sample size (46 women presenting with HSV or with a history of HSV) and the setting of the study, the findings are of limited value to this guideline.

In conclusion CS is the preferred (the most cost-effective and cost-saving) option in women presenting with primary HSV late in pregnancy. Acyclovir prophylaxis may be a more cost-effective option for women with recurrent HSV.

**RECOMMENDATIONS**

Women with primary genital herpes simplex virus (HSV) infection occurring in the third trimester of pregnancy should be offered planned CS because it decreases the risk of neonatal HSV infection.

C

Pregnant women with a recurrence of HSV at birth should be informed that there is uncertainty about the effect of planned CS in reducing the risk of neonatal HSV infection. Therefore, CS should not routinely be offered outside a research context.

C

**RESEARCH RECOMMENDATION**

RCT's are needed to determine whether planned CS should be offered to prevent MTCT of HSV to women with recurrence of HSV at birth and in women in whom the primary HSV infection occurs in the first trimester of pregnancy.

**4.8 Maternal request for CS****Rates of maternal request for CS**

We identified 19 observational studies that report rates of maternal request for CS. Twelve of these are included in a systematic review (n = 13285)<sup>157</sup> and 7 studies have been published since the review.<sup>4,157-162</sup> The largest of these studies were a survey of women attending antenatal clinics in Sweden (n = 3061)<sup>160</sup> and a survey of women's views of childbirth carried out within the NSCSA (n = 2475).<sup>4</sup>

The rates of preference for CS expressed by the women that were surveyed during pregnancy in UK, Australia and Sweden range from 6% - 8%.<sup>4,157,158,160</sup> [evidence level 3]

Within these studies there was a consistent relationship between women's preference for CS and either previous CS, previous negative birth experience, a complication in the current pregnancy or a fear of giving birth.<sup>4,157,160</sup> The main reason given for preference for CS was that it was perceived to be safest for the baby. The main reason given by those who expressed a preference for vaginal birth was the experience of a natural event. One study<sup>157</sup> concluded that maternal request for CS seems to be a marker for previously negative birth experiences and should prompt enquiries to address any issues or concerns.<sup>157</sup> [evidence level 3]

**Fear of childbirth**

It is estimated that about 6%–10% of pregnant women experience fear of childbirth.<sup>163,164</sup> [evidence level 3] Fears concerning childbirth such as pain, obstetric injury, emergency CS, health care staff and the effects on family life have been reported to be more common among primiparous compared to multiparous women, and among those who had not attended antenatal classes.<sup>165</sup> [evidence level 3] Fear of health care workers was reported to be more common among women who either had problems in the current pregnancy or those who were planning an elective CS.<sup>165</sup> [evidence level 3] Manifestations of this fear included stress symptoms influencing everyday life, nightmares, a wish to have CS and a wish to avoid the current pregnancy and childbirth.<sup>165</sup> [evidence level 3]

Fear of childbirth has been measured using different scoring systems.<sup>167</sup> One case–control study found that women who requested elective CS due to fear of child birth were more likely to have also experienced a spontaneous miscarriage (OR 1.73, 95% CI 1.05 to 2.85), a longer time between pregnancies (OR 1.44, 95% CI 1.19 to 1.75), a longer duration of second stage of labour and a previous assisted vaginal birth (OR 4.50, 95% CI 2.18 to 9.31) or emergency CS (OR 26.91, 95% CI 11.86 to 61.07).<sup>166</sup> [evidence level 3] Previous infertility, induction of labour, epidural analgesia, duration or intervention in the third stage of labour in a previous pregnancy were not found to be associated with fear of childbirth in this study.<sup>166</sup>

Another study reported that women who had emergency CS had higher scores for fear of childbirth during pregnancy compared to those who had vaginal births.<sup>167</sup> However a prospective study carried out in the U.K. did not find an association between fear of child birth and emergency CS (OR 1.00, 95% CI 0.98 to 1.01).<sup>26</sup> [evidence level 3]

One RCT randomised women referred to an antenatal clinic for fear of child birth to receive either cognitive behavioural therapy or usual care. No difference was detected in the proportion of women who chose to deliver by CS (OR 0.82, 95% CI 0.50 to 1.36), however fewer women in the intervention group who had vaginal births reported fear of pain in labour and had shorter labours.<sup>168</sup> [evidence level 1b]

### Responding to requests for CS

Obstetricians estimate that they agree to perform a CS for about half of the requests they receive.<sup>4</sup> [evidence level 3] A woman's request for CS is the 'start of a continuing dialogue and process' during which a negotiated plan of care can be developed which enables women to continue to feel in control with the support of her health care providers.<sup>169</sup> [evidence level 4] When a woman requests a CS the first response should be to determine the reason for the request and the factors that are contributing to the request. This can then be followed by the provision of information comparing the risks and benefits of planned CS and vaginal birth. (refer to Table 3a)

FIGO's Committee for the Ethical Aspects of Human Reproduction states that it is unethical to perform a CS without a medical reason because of inadequate evidence to support a net benefit.<sup>170</sup> An obstetrician who feels that in good conscience they cannot carry out a CS at the request of a woman and no identifiable clinical reason should refer her for a second opinion. This is good practice and is kindly care even if not acquiescence. Importantly it means that dialogue is maintained between the woman and her obstetrician.<sup>34,169</sup> [evidence level 4]

### Cost of maternal request for CS

An economic model showing the consequences of changing the rate of maternal request for CS in England and Wales is presented in Appendix B. This shows that encouraging women who request a CS to choose planned trial of labour instead leads to a crude cost saving cost of around £1257 per birth.

Comparing two extreme scenarios a 1% reduction in the rate of maternal requests agreed to could result in cost savings £374,000 per year. However at the other extreme if all requests for CS were refused, this could lead to savings of about £10 million per year in England and Wales (refer to Appendix B).

## RECOMMENDATIONS

Maternal request is not on its own an indication for CS and specific reasons for the request should be explored, discussed and recorded.

GPP

When a woman requests a CS in the absence of an identifiable reason, the overall benefits and risks of CS compared with vaginal birth should be discussed and recorded.

GPP

When a woman requests a CS because she has a fear of childbirth, she should be offered counseling (such as cognitive behavioural therapy) to help her to address her fears in a supportive manner, because this results in reduced fear of pain in labour and shorter labour.

A

An individual clinician has the right to decline a request for CS in the absence of an identifiable reason. However the woman's decision should be respected and she should be offered referral for a second opinion.

GPP

## RESEARCH RECOMMENDATIONS

Qualitative and quantitative research should be carried out to look at the reasons that lead to pregnant women's request for CS.

The effect of counselling and other interventions such as second opinion and provision of support on the likelihood of CS for women who express a preference for CS need further evaluation.

# 5. Factors affecting likelihood of CS during intrapartum care

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## 5.1 Place of birth

### Planned home birth

One systematic review that includes one small RCT comparing planned home birth to planned hospital birth was identified (n = 11). The RCT included operative delivery but not specifically CS. No difference was reported for any of the outcomes measured however this was a small RCT and has limited power to detect a difference.<sup>171</sup> [evidence level 1b]

A systematic review of observational studies evaluating the safety planned home births (in countries with good health resources) versus planned hospital births identified six cohort studies (n = 24,092)<sup>172</sup> [evidence level 2b] Outcome measures included perinatal and maternal mortality, Apgar scores and incidence of maternal lacerations. The review also reported other outcomes including CS rates. No difference was detected in perinatal mortality in any of the individual studies, nor in the pooled data. In the home birth group, both low 5 minute Apgar and maternal lacerations were less frequent in all studies. The odds of CS were lower in the planned home birth group in five studies (reported crude OR of CS in studies: 0.04; 0.09; 0.31; 0.05; 0.27). No maternal deaths occurred but the studies are underpowered to evaluate this outcome.<sup>172</sup> [evidence level 2a]

A subsequent cohort study in Canada (n = 2176) reported on CS rates and maternal and perinatal morbidity between 3 groups, women who had a planned home birth, women who were attended by a physician in hospital and women who were attended by a midwife in hospital. They reported that less women in the home birth group had a CS, compared to women in the physician-attended hospital group (adjusted OR 0.3, 0.22 to 0.43) and compared to the midwife attended hospital group (adjusted OR 0.66, 0.44 to 0.99). Odds ratios were adjusted for maternal age, lone parent status, income quintile, substance use and parity. No difference was detected between the groups for maternal or perinatal morbidity.<sup>173</sup> [evidence level 2a]

A large prospective case controlled UK study of 5971 planned home births and 4724 planned hospital births reported that planning a home birth halved the chance of having a CS (unadjusted OR 0.49, 95% CI 0.39 to 0.62).<sup>174</sup> [evidence level 2b]

### RECOMMENDATION

During their discussions about options for birth, healthy pregnant women with anticipated uncomplicated pregnancies should be informed that delivering at home reduces the likelihood of CS.

B

### 'Midwifery-led unit' or 'birthing centre'

Current convention in the UK is that the term "midwifery-led units" refers to units that are near to or adjacent to a hospital maternity facility and that "birthing centres" are stand alone units. However this convention is not standardised in the literature. The centres are intended for "low risk" women. The care is midwife led with minimal medical intervention, sometimes described in the literature as 'home like'. Case series have reported reduced CS or operative delivery in 'midwifery-led units' or 'birthing centres'.<sup>175-180</sup> [evidence level 4]



A systematic review that included six RCTs (n = 8677) compared clinical outcomes between women delivering in a midwife led unit or in a hospital.<sup>181</sup> [evidence level 1a] The RCTs were conducted in Stockholm<sup>182</sup>, Australia<sup>183</sup>, United Kingdom<sup>184-186</sup> and Canada.<sup>187</sup> The centre in each of the RCTs was situated close to the conventional labour ward within the same hospital setting. The RCTs all describe the environment as 'home like' and that the care was aimed at women retaining control and choice with minimal medical intervention. Three of the studies do not describe the study environment any further.<sup>182,183,185</sup> Three of the studies describe the furnishings in detail (for example "furnished to appear like a normal household bedroom")<sup>184,186,187</sup> and one RCT also mentions specifically interventions that were avoided such as enemas, perineal shaving, intravenous infusion and electronic fetal monitoring.<sup>187</sup> [evidence level 1b]

All RCTs (n = 8646) reported on CS rates, a further 39 outcomes are also reported. No difference was detected in CS rates between 'midwifery-led unit' and conventional birth settings (RR 0.85, 0.72 to 1.00). The review has a 90% power to detect a difference of at least 2% in CS rates if such a difference exists. No difference in instrumental vaginal deliveries was detected (OR 0.87, 0.74 to 1.01). Birth in a 'midwife-led unit'/'birthing centre' was associated with lower rates of intrapartum analgesia (OR 0.82, 0.72 to 0.93); less augmented labour (OR 0.72, 0.64 to 0.81); and less women 'less than completely satisfied with care' (OR 0.62, 0.55 to 0.70).<sup>181</sup> [evidence level 1a]

A further UK RCT (n = 2578) comparing care 'midwifery-led unit' or in a conventional labour ward did not evaluate mode of delivery but assessed maternal satisfaction using a postal questionnaire. No difference was detected in rates of satisfaction between the groups. Women who had their babies in the 'midwifery-led unit'/'birthing centre' saw fewer medical staff, were more likely to report having had a choice as to moving around during childbirth and alternative positions for birth and more likely to have made their own decisions regarding analgesia.<sup>188</sup> [evidence level 1b]

We did not identify any RCTs that compared birthing centres which are stand alone to conventional maternity facilities. However we did identify a case series following women admitted for labour and delivery at 84 'free standing' birthing centres in the United States (n = 11, 814). The overall rate of CS was 4.4%. The rate of transfer to other maternity facilities before birth was 11.9%. Other morbidity outcomes reported include 5-minute Apgar of less than 7 occurred in less than 0.5% of births.<sup>178</sup> [evidence level 4]

An Australian postnatal survey of women's views about their birth experience (n = 395) reports that women who had given birth at home or at a 'midwifery-led unit' were more likely to feel that the birth place affected the bonding process and less likely to see birth as a medical condition compared to women who gave birth in a conventional labour ward. Women who gave birth at home were older, more educated, more likely to be multiparous and better informed about childbirth compared to the women who gave birth in the 'midwife-led unit' or in the conventional labour ward. Adjusting for these differences, place of birth correlated with women's satisfaction with health care providers.<sup>189</sup> [evidence level 3]

### RECOMMENDATION

During their discussions about options for birth, healthy pregnant women with anticipated uncomplicated pregnancies should be informed that planned childbirth in a 'midwifery led unit' does not reduce the likelihood of CS.

A

### RESEARCH RECOMMENDATIONS

RCTs comparing planned birth in a stand alone birthing centre to birth in conventional maternity facilities or midwifery led units.

Qualitative research is needed to explore women's opinions on place of birth and the impact of place of birth on their birth experiences.

### Delayed admission to labour ward

A systematic review included one RCT (n = 209) compared a labour assessment program in a separate unit within the hospital and delayed admission to labour ward until labour is in the active phase, with direct admission to the labour ward.<sup>190,191</sup> The RCT did not detect a difference

in CS rates between the two groups (OR 0.70, 95% CI 0.27 to 1.79). At least two thousand women would be needed in each group to detect a 3% difference in CS therefore this RCT is underpowered to detect this difference in CS rates. There were differences in other outcomes such as length of time spent in the labour ward, analgesia requirements, oxytocic use and maternal satisfaction, measured using sense of control (see evidence table). [evidence level 1b]

An observational study (n = 3220) reported a reduced likelihood of CS with increased cervical dilatation at the time of presentation in labour. The CS rates for nulliparous women presenting at 0–3cm was 10% compared with 4% for those presenting at 4–10 cm (p = 0.001). This was consistent for nulliparous and parous women.<sup>192</sup> [evidence level 2b]

### RESEARCH RECOMMENDATIONS

Further RCTs are needed to determine the effect of ‘delayed admission in labour’ on the likelihood of CS.

## 5.2 Factors reducing the likelihood of CS

### One-to-one support

One-to-one support in labour had been evaluated in recently published systematic review;<sup>193</sup> this current review replaces the previous review on this subject by the same authors.<sup>194</sup> [evidence level 1a]. The first review included 14 RCTs (n = 5000), the new review includes 15 RCTs (n = 12,791) the newly included study is a multi centre RCT (n = 6915 women) conducted in Canada and the US (13 centres). The trial evaluated the effectiveness of continuous labour support by a specially trained nurse/midwives to usual care. Each hospital in the RCT had a CS rate of at least 15%. The main outcome measure was CS rate. The study did not detect a difference in CS rate between the two groups. The use of continuous electronic fetal monitoring higher in the usual care group (79%) compared to those in the continuous support group (75%, p < 0.001). All comparisons of women’s likes and dislikes, and their future preference for amount of nursing support, favoured the continuous labour support group.<sup>195</sup> [evidence level 1a]

The new systematic review (15 RCTs, n = 12,791 women) evaluates the effects of one-to-one support on women and their babies. In addition the new review also considers whether the effects of continuous support are influenced by routine practices and policies in the birth environment that may affect a woman’s autonomy, freedom of movement and ability to cope with labour; whether the caregiver is a member of staff and whether the continuous support begins early or late in labour.<sup>193</sup> [evidence level 1a] The RCTs in the review included support persons that varied in terms of their experience, qualifications and relationship to the women in childbirth. In eight RCTs the support was provided by a member of hospital staff. The remaining 7 RCTs included women from the community (“doulas”), with or without prior training, a childbirth educator, or a close female relative. Half of the RCTs were conducted in developed countries, where hospital policy permitted women to be accompanied by their husband/partners or other family members during labour. The remaining RCTs were conducted in developing countries in settings in which only the support person allocated by the study was allowed to accompany the woman during labour. No RCT evaluated the effects of husbands or partners as providers of support.

The results of the review reported that women who had continuous one-to-one support during labour were less likely to have a CS (15 trials, n = 12,791, RR 0.90, 95% CI 0.82 to 0.99). The effects of continuous support on CS appeared to be stronger in settings which did not permit the presence of additional support people (chi squared = 4.46, p < 0.05) and when epidural was not routinely available (chi squared 4.97, p < 0.05). The routine use of EFM did not affect the impact of one-to-one support on CS rates. The reduction in CS was influenced by who was giving the support and the reduction was only seen in the RCTs where the support was not provided by members of staff (RR 0.74, 95% CI 0.61 to 0.9). The difference between different sub-groups of non medical providers of support was not statistically significant. The impact of timing of onset of continuous support was of borderline statistical significance (chi squared = 5.93, p = 0.05) favouring support that began before active labour. Thirty other outcomes were considered in the review, but are not reported here.<sup>193</sup> [evidence level 1a]

## RECOMMENDATION

Women should be informed that continuous support during labour from women with or without training reduces the likelihood of CS.

A

### Pregnancy after 41 weeks

A systematic review of 26 RCTs compared induction of labour with expectant management after 41 weeks. Offering routine induction after 41 weeks reduced perinatal death (19 RCTs,  $n = 7925$ . Peto OR 0.20, 95% CI 0.06 to 0.70) and the rate of CS (9 RCT,  $n = 5954$  Peto OR 0.87, 95% CI 0.77 to 0.99).<sup>196</sup> [evidence level 1a]

It is estimated that by 41 weeks 74% of women have given birth, this increases to 82% by 42 weeks. The risk of stillbirth increases from 1 per 3000 ongoing pregnancies at 37 weeks to 3 per 3000 ongoing pregnancies at 42 weeks to 6 per 3000 with ongoing pregnancies at 43 weeks. A similar increase in neonatal mortality is also reported.<sup>197</sup> [evidence level 2a]

## RECOMMENDATION

Women with an uncomplicated pregnancy should be offered induction of labour beyond 41 weeks because this reduces the risk of perinatal mortality and the likelihood of CS.

A

### Partogram

Progress in labour can be assessed using the clinical parameters of descent of the presenting part and dilatation of the cervix. No study has evaluated tests based on maternal and fetal outcomes. The partogram is derived from a curve describing normal labour (Friedman's curve). The original Friedman's curve was developed using observational data from 100 American primigravid women at term in spontaneous labour (included 98 singleton cephalic, 1 breech presentation and 1 multiple pregnancy). Twenty two percent of the women received caudal anaesthesia and 10 percent received oxytocin augmentation. Cervical dilatation was determined using rectal examination predominantly at 10, 30 or 60 minute intervals. Curves of dilatation versus time were produced and resulted in a sigmoid curve of progress of labour with average progress during the active phase of 1.1cm per hour and average length of labour of 12 hours for nulliparous women and 6 hours for multiparous women.<sup>198</sup> [evidence level 3] More recent observational studies from the USA ( $n = 2511$ ) measured the length of labour in women who had not received oxytocin or epidurals and report average length of labour for nulliparous women to be 19.4 hours and 13.7 hours for multiparous women. This is longer than the originally described normal labour curve.<sup>199</sup> [evidence level 3]

On a partogram cervical dilatation and descent of the presenting part are plotted graphically against time. The partogram was initially proposed as a screening tool for use in poorly resourced countries to identify women who needed referral to hospital. The partogram includes two lines, an alert line and an action line. The alert line is set at a rate of 1cm per hour (derived from Friedman's curve). The action line is drawn 4 hours to the right of the alert line. If the progress of labour crossed the action line women were referred to hospital for either augmentation of labour or CS.<sup>200,201</sup> [evidence level 3]

Three RCTs have evaluated the use of partograms in the management of labour. The first RCT compared using a partogram with a four hour action line to not using a partogram in the management of labour. This was a cluster randomised trial where the unit of randomisation was a maternity hospital. Four pairs of hospitals participated. Each hospital had a practice of active management of labour including oxytocin use. The effect of the partogram was analysed in a before and after design which compared labour outcome data on 10,049 women who delivered before implementation of the partogram (4 hour action line) with data on 9130 women who delivered after implementation. This RCT did not report CS rates but did report rates of spontaneous vaginal birth. The number of spontaneous cephalic births were increased after implementation of the partogram (83% vs. 86.3%,  $p < 0.001$ ). There was a decrease in the proportion of women with labours of more than 18 hours (551 versus 249,  $p < 0.001$ ), labours augmented by oxytocin ( $p < 0.041$ ) and the number of intrapartum stillbirths (0.5% vs. 0.31%,  $p < 0.024$ ). There was no change in the

overall duration of labour or other neonatal indices. Similar patterns were noted for multiparous and primiparous women.<sup>202</sup> [evidence level 1b]

The second RCT (n = 928 women) compared partogram's with different action lines (either 2, 3 or 4 hours to the right of the alert line set at 1 cm per hour). The primary outcomes were CS rate and maternal satisfaction. CS rate was lowest when labour was managed using a partogram with a 4 hour action line. Women in the 2 hour arm were most satisfied with their labour experience. No difference was found in the secondary outcomes of neonatal and maternal morbidity.<sup>203</sup> [evidence level 1b]

The third RCT conducted in South Africa (n = 694) compared management using a single alert line partogram offering oxytocin if the alert line was crossed (with 2 hour vaginal examinations) to management using a 4 hour action line. CS was a primary outcome. Women in the intervention group were less likely to have a CS (RR 0.68, 95% CL 0.50 to 0.93)<sup>204</sup> [evidence level 1b]

Meta-analysis of the 2 RCTs that included comparison of the two hour action line with a four hour action line partogram showed no difference in CS rate between the use of 2 or 4 hour action lines (RR 0.93, 95% CI 0.48 to 1.78).<sup>203,204</sup> [evidence level 1b] The use of a 4 hour partogram reduces the number of vaginal examinations that women would undergo during labour.

### RECOMMENDATION

A partogram with a 4-hour action line should be used to monitor progress of labour of women in spontaneous labour with an uncomplicated singleton pregnancy at term, because it reduces the likelihood of CS.



### RESEARCH RECOMMENDATION

RCT evidence is needed to determine the impact of partograms based on different curves of labour on CS rates and morbidity outcomes.

### Decision making for emergency CS

Second opinion has been proposed as an intervention to decrease CS rates. Second opinion refers to a doctor needing the agreement of another usually more senior second opinion before a decision for CS can be made. A large multi centred RCT in five South American countries has recently been completed however the results have not been reported.

Using the NSCSA data the proportion of CS cases with consultant involvement varied between maternity units, although in the majority of CS, the consultant was the most senior obstetrician involved in the decision (see table).

In maternity unit where consultant obstetricians were frequently involved either in the decision for CS or present in theatre for emergency CS the crude and adjusted CS rates (having taken into account case mix differences) were lower (see Tables 5.1 and 5.2).

**Table 5.1** Proportion of CS with consultant involvement in maternity units

	Median (%)	IQR (%)
<b>Consultant present in theatre</b>		
All CS	12.6	7.6–18.5
Emergency CS	8.7	5.8–13.3
Emergency CS out of hours (1800–0700)	4.8	2.1–8.8
<b>Consultant involved on decision making to perform CS</b>		
All CS	76.4	63.0–89.2
Emergency CS	75.0	57.2–87.5
Emergency CS out of hours (1800–0700)	72.4	52.0–87.5

**Table 5.2** Relationship between proportion of CS where there was consultant involvement and CS rates

	Crude CS rate		Adjusted CS rate	
	Spearman's rank correlation coefficient	P value	Spearman's rank correlation coefficient	P value
<b>Consultant present in theatre</b>				
All CS	-0.01	0.85	-0.05	0.48
Emergency CS	-0.12	0.06	-0.14	0.04
Emergency CS out of hours (1800 – 0700)	-0.12	0.07	-0.14	0.04
<b>Consultant involved in decision making to perform CS</b>				
All CS	-0.19	<0.01	-0.19	<0.01
Emergency CS	-0.18	<0.01	-0.17	0.01
Emergency CS out of hours (1800 – 0700)	-0.19	<0.01	-0.17	0.01

**RECOMMENDATION**

Consultant obstetricians should be involved in the decision making for CS, because this reduces the likelihood of CS.

C

**Electronic fetal monitoring and fetal blood sampling**

Systematic reviews of 9 RCTs (conducted between 1976–1993, n = 18,561 women) have compared the use of electronic fetal monitoring (EFM) during labour to intermittent auscultation. No difference is detected in perinatal mortality (RR 0.89, 95% CI 0.60 to 1.33). The use of EFM during intrapartum care results in increased CS rates (RR 1.4, 95% CI 1.23 to 1.61). This increase is less marked if fetal blood sampling (FBS) is used (RR 1.27, 95% CI 1.08 to 1.51 for EFM with FBS, compared with RR 1.41, 95% CI 1.23 to 1.61 for EFM without FBS).<sup>205,206</sup> It is therefore recommended that where delivery is contemplated because of an abnormal fetal heart rate pattern, in cases of suspected fetal acidosis, FBS should be undertaken in the absence of technical difficulties or any contraindications. Contraindications to FBS include maternal infection (such as HIV, hepatitis viruses or herpes simplex virus); fetal bleeding disorders such as haemophilia and prematurity (less than 34 weeks). Where there is clear evidence of acute fetal compromise, e.g. prolonged decelerations (longer than 3 minutes), FBS should not be undertaken and the baby should be delivered urgently.<sup>2</sup>

The NSCSA measured practice against this audit standard for CS.<sup>4</sup> Overall an abnormal CTG was noted in 69% of singleton cephalic pregnancies delivered by CS for presumed fetal compromise. If the CTG was noted to be severely abnormal or cervical dilatation was less than 4cm these cases were not included (50%). Overall practice concurred with the audit standard in 44% of cases. However there was marked variation in practice. Five percent of maternity units met the standard in all cases (100%), in 9% the standard was not reached for any case. Units and regions which used FBS more frequently before CS had lower CS rates. Overall, cases in which this recommendation was not met contributed 4.6% to the overall CS rate or about 1% of all births.<sup>4</sup>

**RECOMMENDATION**

Electronic fetal monitoring is associated with an increased likelihood of CS. When CS is contemplated because of an abnormal fetal heart rate pattern, in cases of suspected fetal acidosis, fetal blood sampling should be offered if it is technically possible and there are no contraindications.

B

**5.3 No influence on likelihood of CS**

The following interventions during intrapartum care have not been shown to influence the likelihood of CS. These interventions may have other effects (beneficial or harmful) which are outside the scope of this guideline and are not considered here.

### Walking in labour

Two RCTs have evaluated the effect of walking in labour to usual care, one conducted in the UK (n = 68)<sup>207</sup> [evidence level 1b] and the other conducted in the USA (n = 1067)<sup>208</sup> [evidence level 1b]. No difference was detected in the CS rates between women who walked around during labour and those who did not (RR 0.71, 95% CI 0.43 to 1.20). Most of the weight of the pooled RR in the meta-analysis comes from the larger RCT. Therefore it is not surprising that the US RCT did not detect a difference in CS rates between groups (RR 0.73, 95% CI 0.43 to 1.24). The study has 80% power to detect a difference of at least 4% in CS rate, therefore if walking in labour has an impact on CS rates it is likely to be less than 4%. The RCT did not detect a difference in other outcomes including length of the first stage of labour and need for analgesia. The results were similar for parous and multiparous women.<sup>208</sup> [evidence level 1b]

### Position in the second stage of labour

A systematic review<sup>209</sup> of 18 RCTs evaluated the effect of different positions for the second stage of labour. No difference was detected between any upright or lateral position during second stage on CS rates compared to supine or lithotomy positions (12 RCTs; n = 2250; RR 0.87, 95% CI 0.52 to 1.45). Use of any upright or lateral position, compared with supine or lithotomy positions, was associated with the following: reduced duration of second stage of labour (12 RCTs. Weighted mean difference: 5.4 minutes, 95% CI 3.9, 6.9 minutes); a reduction in assisted deliveries (17 RCTs. OR 0.82, 95% CI 0.69 to 0.98); a reduction in episiotomies (11 RCTs: OR 0.73, 95% CI 0.64 to 0.84); an increase in second degree perineal tears (10 RCTs: OR 1.30, 95% CI 1.09 to 1.54); increased estimated risk of blood loss greater than 500 ml (10 RCTs: OR 1.76, 95% CI 1.34 to 3.32); reduced reporting of severe pain during second stage of labour (1 RCT: OR 0.59, 95% CI 0.41 to 0.83) and fewer abnormal fetal heart rate patterns (1 RCT: OR 0.31, 95% CI 0.11 to 0.91).<sup>209</sup> [evidence level 1a]

### Immersion in water in labour

Water births and the use of immersion in water during labour comprise 0.6% of births in the UK.<sup>210</sup> [evidence level 3] A systematic review<sup>211</sup> [evidence level 1a] that included three RCTs (n = 988) compared immersion in water during labour (no births occurred in the water) to conventional care. Another RCT (n = 1237) on this topic has been published since this review.<sup>212</sup> [evidence level 1b] The CS rate in the intervention arm of these RCTs ranged from 1.8% - 8.9%, in the control group it ranged from 0%–7.9%. A new meta-analysis of the findings from these 4 RCTs (n = 2225) did not detect a difference in CS rates between the two groups (RR 1.31, 95% CI 0.89 to 1.93) [evidence level 1a]. Overall these studies have a 90% power to detect a difference of at least 4% in CS rates between the two groups therefore if water birth has an effect on CS rate it is likely to be less than 4%.

One of the above RCTs interviewed a subset of women about their use and satisfaction with care in labour. Women most liked the presence of a support person and immersion in water.<sup>213</sup>

A national cohort study using regional UK survey data compared the perinatal mortality and morbidity of 4032 births either in water (or following labours in water) to births not in water. They report no difference in perinatal mortality (RR 0.9, 99% CI 1.2 to 3.6). There were two cases of water aspiration which required admission to NICU.<sup>214</sup> [evidence level 3] A prospective observational study in Switzerland of 7508 births of which 2014 were water births showed no increased risk for women or their babies. The study reported: lower episiotomy rates, higher rates of intact perineum, lower blood loss and lower use of pain killers in women who had a waterbirth.<sup>215</sup>[evidence level 3]

A number of position papers have provided guidelines for water births in the absence of adequate evidence, and have suggested the continued reporting of adverse events.<sup>216,217</sup>[evidence level 4]

### Analgesia during labour

There has been an increase in the use of epidural analgesia in labour and there has been concern that this may have contributed to an increase in CS. Observational data provides conflicting results.<sup>218–227</sup> [evidence level 3]

Two systematic reviews have included RCTs of women in spontaneous labour who requested analgesia and were randomised to receive either epidural analgesia or usual analgesia (such as intravenous or intramuscular pethidine). The first review of 10 RCTs (n = 2369) did not detect a difference in CS rates between the two groups. (OR 1.5, 95% CI 0.81 to 2.76).<sup>228</sup> [evidence level 1a]. A subsequent review includes 11 RCTs (n = 3157, it includes 6 RCTs from the previous review, 2 new RCTs<sup>229,230</sup> and 2 RCTs not included in the first review<sup>231-234</sup>). It also did not detect a difference in CS rates (OR 1.30, 95% CI 0.93 to 1.83).<sup>235</sup> [evidence level 1a]

We did not identify any RCTs that had compared parenteral analgesia (intravenous or intramuscular opiate derived analgesia) to placebo or complementary therapies on mode of birth and risk of CS.

### Raspberry leaf during labour

An RCT (n = 192) was conducted that looked at the use of raspberry leaf, given in tablet form during labour. No difference was detected in length of labour or mode of birth, including emergency CS<sup>236</sup> [evidence level 1b]. Earlier descriptive studies of raspberry leaf used in labour excluded women who had a CS from their analysis.<sup>237</sup> [evidence level 3]

### RECOMMENDATION

Women should be informed that the following interventions during intrapartum care have not been shown to influence the likelihood of CS, although they may affect other outcomes that are outside the scope of this guideline:

- Walking in labour
- Non-supine position during the second stage of labour
- Immersion in water during labour
- Epidural analgesia during labour
- the use of raspberry leaves.

A

### RESEARCH RECOMMENDATIONS

RCT evidence is required to evaluate the effect of parenteral analgesia (intramuscular and intravenous morphine based analgesia) used during childbirth on the likelihood of CS.

### Complementary therapies during labour

Complementary therapies used during pregnancy include acupuncture, aromatherapy, hypnosis, Chinese medicines, herbal products and nutritional supplements, homeopathic medicines and raspberry leaf (discussed previously). We have only considered their use during labour in this guideline. The antenatal use of complementary therapies is included in the NICE Antenatal Care Guideline.<sup>1</sup>

We identified a systematic review of complementary therapies for pain management in labour which includes seven RCTs (n = 366) using different modalities of pain management<sup>238</sup> [evidence level 1a]. CS rates were considered as secondary outcomes in two of the included studies: one RCT using acupuncture (n = 90), one aromatherapy RCT (n = 22), neither showed any difference in CS rates however the trials were underpowered to evaluate this outcome. Two RCTs (n = 125) have compared the use of hypnosis to usual analgesia. CS was not reported. However women in the hypnosis group were more likely to have a spontaneous vaginal birth (RR 1.38, 95% CI 1.13 to 2.47).<sup>238</sup> [evidence level 1b]

A large survey (n = 8058) of women views on the effect of using aromatherapy during labour. Effect was measured using a Likert scale. About half of the women reported aromatherapy was helpful, a minority (14%) found it unhelpful.<sup>239</sup> [evidence level 4]

The suggested benefits of Chinese medicines in labour include prevention of nausea and vomiting, heartburn and fatigue. We did not identify any RCTs on their use in labour. We identified a cohort study on the use of Chinese medicines during pregnancy which reported no effect on mode of birth.<sup>240</sup> [evidence level 2b]

Surveys from the USA and Australia suggest that there is widespread use of herbal products and

nutritional supplements during pregnancy, 12% of women in Australia<sup>241</sup> [evidence level 4] and 7% in the USA.<sup>242</sup> [evidence level 3] A UK survey of midwives estimated that 34% of midwives offer some form of complementary medicine to women during pregnancy or childbirth.<sup>243</sup> [evidence level 4] The majority of this use is antenatal with only certain herbal products used during labour or to induce labour. We did not identify any RCTs on the use of herbs during labour but a number of expert opinion papers offer advice and suggested guidelines for their use. Using information from midwives surveys they recommend caution with the use of blue cohosh (due to reports of dizziness, fainting, nausea and meconium stained liquor as well as case reports of neonatal heart failure); black cohosh and castor oil to induce labour.<sup>244</sup> [evidence level 4] There have not been reported complications with either evening primrose oil or raspberry leaf.<sup>245,246</sup> [evidence level 4]

### RECOMMENDATION

Women should be informed that the effects on the likelihood of CS of complementary therapies used during labour (such as acupuncture, aromatherapy, hypnosis, herbal products, nutritional supplements, homeopathic medicines, and Chinese medicines) have not been properly evaluated and further research is needed before such interventions can be recommended.

D

### RESEARCH RECOMMENDATION

RCTs are needed to establish the safety and efficacy of complementary therapies used during labour.

## 5.4 ‘Failure to progress’ in labour and CS

In the NSCSA, “failure to progress” in labour (FTP) was the primary indication for CS in 35% (n = 4896) of women with term cephalic pregnancies and no uterine scar. For 17% (n = 811) of these women cervical dilatation at the time of CS was less than 4 cm. While 74% of these women had their labour augmented (65% were given oxytocin and amniotomy, 7% amniotomy only, 2% oxytocin only), 24% (n = 193) had no augmentation of labour before CS. The majority (98%) of women with cervical dilatation of at least 4 cm at the time of CS had either amniotomy or oxytocin or both. Twenty-five percent (n = 1231) of CS for FTP were done at a cervical dilatation of 10 cm, 28% (n = 345) of these women did not have oxytocin before CS. These cases in which labour augmentation with oxytocin was not used contributed 3.2% to the overall CS rate.<sup>4</sup> [evidence level 3]

We searched for research that evaluated the impact of packages of interventions such as active management of labour and interventions such as routine amniotomy or oxytocin infusion used together or alone are included.

### Active management of labour

Active management of labour refers to a labour ward protocol that includes routine amniotomy and early augmentation with oxytocin as well as strict criteria for the diagnosis of labour, abnormal progress in labour and fetal compromise. It also includes the continual presence of a midwife or support person during labour and peer review of assisted deliveries. Observational studies by the initiators of active management reported lower CS rates, reduction in the number of women having prolonged labour, better neonatal outcomes and improved maternal satisfaction.<sup>247</sup> Subsequent observational studies did not replicate these findings.<sup>248,249</sup> It has remained an area of controversy.<sup>250</sup> [evidence level 3]

A systematic review of 10 RCTs (n = 5111) evaluated the effects of a package intervention of early augmentation of labour with amniotomy and oxytocin in nulliparous women compared to usual care (‘care at the discretion of the individual doctor/midwife attending the woman in labour’). Overall there was no reduction in the likelihood of CS with early amniotomy and early oxytocin infusion (OR 0.9, 95% CI 0.7 to 1.1). Subgroup analysis of the therapy RCTs (recruited women in whom a delay in progress was diagnosed) (3 RCT, n = 109) and prevention RCTs (7 RCTs, n = 5002)



were undertaken. No difference in CS rate was apparent in these subgroups. However the therapy subgroup is too small and is therefore underpowered to evaluate this outcome.<sup>251</sup> [evidence level 1a] None of the RCTs had maternal satisfaction as an outcome measure.<sup>251</sup> [evidence level 1a]

A recently published RCT from South Africa (n = 694) compared using a single line partogram, two-hourly vaginal examinations and use of oxytocin if the partogram line was crossed in nulliparous women to usual management (4 hour vaginal examinations) . CS rates in the intervention group were lower (RR 0.68 95% CI 0.50, 0.93) Analysis is by intention to treat but it was noted that there were a high proportion of protocol violations in both groups (about 30%)<sup>204</sup> [evidence level 1b]. It was not possible to include this RCT with the earlier RCTs as the descriptions of management of labour were not consistent.

### Oxytocin

Most RCTs identified incorporate the use of oxytocin into active management of labour. However we identified one RCT (n = 60) that looked at the effect of oxytocin without other components of active management of labour in women in whom there was a delay in labour progress. Women whose cervical dilatation was less than 0.5 cm per hour were randomised to one of three groups: group one – oxytocin was deferred for 8 hours; group two – low-dose oxytocin infusion (2mu/minute) or group three – high-dose oxytocin (7mu/minute). The CS rates between the three groups were not statistically different (45%, 35% and 26% respectively  $\chi^2$  1.6346 2df). There were no differences between the groups in terms of neonatal outcomes.<sup>252</sup> [evidence level 1b] This RCT is underpowered to assess these outcomes.

Observational data from the original active birth management study suggested benefit of the early use of high dose oxytocin infusions.<sup>247</sup> [evidence level 3] Subsequent observational studies that looked at the use of oxytocin alone in labour suggested that it decreased the CS rates<sup>253</sup> and did not result in increased neonatal morbidity.<sup>254,255</sup> [evidence level 3]

### Amniotomy

A systematic review of nine RCTs looked at the impact of early routine amniotomy.<sup>256</sup> CS rate was reported in 8 of the included RCTs (n = 4008). No difference in CS rates was found between early routine amniotomy and no routine amniotomy (OR 1.26, 95% CI 0.96 to 1.66). Amniotomy was associated with a reduction in labour duration of between 60 and 120 minutes, reduction in the likelihood of 5 minute Apgar of less than 7 (OR 0.54, 95% CI .0.30 to 0.96) and a decrease in the use of oxytocin (OR 0.79, 95% CI 0.67 to 0.92). Groups were similar with respect to other neonatal indicators.<sup>256</sup> [evidence level 1a]

### Operative delivery in the second stage

Four percent (n = 1203) of all CS were performed for failure to progress in the second stage of labour (in women without a previous CS who had a term singleton cephalic infant). In the majority 55% (n = 661) no other method of delivery had been attempted before CS. In 35% (n = 427) of these occurrences, CS followed a failed attempt at ventouse, in 7% (n = 81) both ventouse and forceps had been attempted prior to CS and in 2% (n = 27) CS followed a failed attempt at forceps delivery. Overall in the UK while CS rates have increased, operative vaginal delivery rates have remained relatively constant (about 10–11%).<sup>4,257</sup> [evidence level 3] However there has been a marked reduction in the use of forceps and an increase in the use of ventouse since the early nineties.<sup>4,257</sup> [evidence level 3] Within RCTs the use of ventouse is associated with an increase in failure to achieve a vaginal delivery but it is not associated with a concomitant increase in CS rates.<sup>258</sup> [evidence level 1a]<sup>259</sup>

A cohort study has compared the maternal and neonatal outcomes following either instrumental vaginal delivery or CS in the second stage of labour (n = 393 women, 184 had a vaginal delivery, 209 CS).<sup>260</sup> [evidence level 2a] Major haemorrhage (blood loss > 1000 ml) was more common after CS than vaginal delivery (adjusted OR 2.82, 95% CI 1.1 to 7.62). Length of hospital stay was increased with CS. No difference was detected in wound infection, blood transfusion, need for opiate analgesia or rates of breastfeeding. Odds ratios were adjusted for maternal body mass index, pre-eclampsia, maternal diabetes, duration of second stage, station and position of the presenting part, demographic differences and experience of the operator.<sup>260</sup> [evidence level 2a]

A further study following up the same women after 3 years reported half had achieved a further pregnancy after 3 years. There was no difference the proportion of women who had difficulty conceiving but there was an increase in involuntary infertility of more than 1 year. Of women who choose not to have more children there was no difference in the proportion that stated they “could not go through childbirth again”. Of women who had a further pregnancy those who had had a previous instrumental vaginal birth were more likely to aim for and achieve a vaginal birth again (adjusted OR 15.55, 95% CI 5.25 to 46.04; adjusted OR 9.50, 95% CI 3.48 to 25.97)<sup>261</sup> Qualitative research of women views on the impact of operative delivery in the second stage of labour (n = 27) describe that women felt unprepared for operative delivery and that antenatal education had not adequately prepared them for this event.<sup>262</sup>

### RECOMMENDATION

The following aspects of intrapartum care have not been shown to influence the likelihood of CS for “failure to progress” and should not be offered for this reason, although they may affect other outcomes which are outside the scope of this guideline:

- Active management of labour
- Early amniotomy

A

### RESEARCH RECOMMENDATION

More RCTs are required to determine the effect of oxytocin augmentation as single interventions or as part of a package of interventions (such as “active management of labour”) on the likelihood of CS and other outcomes including women’s satisfaction with care.

Further research on the short and longer term health impacts of CS during the second stage compared to operative vaginal delivery are needed.

### Female genital mutilation

Female genital mutilation is defined by WHO as, ‘all procedures that involve partial or total removal of the female external genitalia or other injury to the female genital organs whether for cultural, religious or other non-therapeutic reasons’. An estimated 10,000 to 20,000 girls in the UK are thought to have undergone genital mutilation.<sup>263</sup> [evidence level 3]

The association between female genital mutilation and intrapartum complications has been systematically reviewed by the WHO<sup>264</sup>. Possible complications include obstructed labour, fetal distress and increased perinatal mortality however the evidence for these are contradictory.<sup>264–266</sup> [evidence level 3] <sup>267</sup> [evidence level 2a] No RCTs or observational studies have addressed the effect on health outcomes of CS in the management of female genital mutilation. It is outside the scope of this guideline to address the antenatal or intrapartum management of female genital mutilation.

## 5.5 Eating during labour

The practice of encouraging women to eat and drink during labour in order to maintain their strength for the second stage changed following publication of a case series (n = 66) of aspiration pneumonitis. In this paper Mendelson suggested that mortality due to aspiration pneumonitis could be reduced if women did not eat and drink during labour.<sup>268,269</sup> [evidence level 3] This work continues to influence practice both in the UK and elsewhere. In the UK less than 5% (12/268) maternity hospitals have a policy of unrestricted intake during labour,<sup>270</sup> this is also usual practice in many other countries.<sup>271,272</sup> [evidence level 3] An exception to this is the Netherlands where a survey reported that the majority of obstetricians and midwives had an unrestrictive policy on fluid and food intake. The Netherlands do not have a higher mortality rate due to aspiration pneumonitis than other countries.<sup>273</sup> [evidence level 3] A UK survey of women’s views about eating in labour reported that 31% of women said that would have liked to have eaten during labour.<sup>274</sup> [evidence level 3] Many historical overviews, comments, surveys or non-systematic literature reviews have been written discussing the benefits and harms of eating during labour.<sup>275–277</sup> [evidence level 3]

One RCT (n = 94) compared offering a low residue diet of toast cereal, crackers and low fat cheese during labour to offering a range of drinks to women during labour (water, tea, coffee, cocoa). Women included in the trial were in spontaneous labour, at term with singleton cephalic presentation and who did not request parenteral opioids (because opioids can delay gastric emptying). Outcome measures used were women's metabolic profile, volume of gastric contents as well as labour outcomes such as length of labour, use of oxytocin and mode of birth.<sup>274</sup> [evidence level 1b] Women who had a low residue diet were less likely to have ketosis and had higher plasma glucose at the end of labour than women in the drinks only group. Gastric contents were significantly higher in those eating a low residue diet and these women were more likely to vomit at birth, vomit higher volumes and vomit more solid material. Higher gastric volumes could be of importance if unexpected general anaesthesia was needed. No differences were detected in labour outcomes between the two groups but the study is underpowered to evaluate these outcomes.<sup>278</sup> [evidence level 1b] This issue is currently being evaluated in another RCT.<sup>279</sup>

A further RCT (n = 60) compared drinking an isotonic drink to drinking water only during labour. Metabolic indices and gastric volumes were measured. Isotonic drinks reduced ketosis but did not increase gastric volume. There was no change in labour outcomes but the study was underpowered to assess these outcomes.<sup>280</sup> [evidence level 1b]

### RECOMMENDATION

Women should be informed that eating a low-residue diet during labour (toast, crackers, low-fat cheese) results in larger gastric volumes, but the effect on the risk of aspiration if anaesthesia is required is uncertain.

A

Women should be informed that having isotonic drinks during labour prevents ketosis without a concomitant increase in gastric volume.

A

### RESEARCH RECOMMENDATION

RCTs that evaluate the effects of eating during labour compared with restricting intake on labour outcomes are needed. Cohort or case control studies on the risk factors for aspiration and other morbidities for women having CS are needed.

# 6. Procedural aspects of CS

## 6.1 Timing of planned CS

Babies born preterm are at increased risk of respiratory distress syndrome. One UK survey (n = 179,701) of babies born at 34 weeks gestation or more reported 0.08% (149 babies) had respiratory distress requiring surfactant therapy. Of these babies, 24% (n = 36) were born at or after 37 weeks but 88% (n = 32) of these babies were born by planned CS.<sup>281</sup> [evidence level 3]

Babies born by elective CS at term (37–42 weeks of gestation) are at risk of respiratory distress syndrome and this decreases with increasing gestational age.<sup>282</sup> A large prospective UK survey looked at all cases of respiratory distress syndrome (RDS) or transient tachypnoea of the newborn (TTN) at term requiring NICU. This study found a decrease in respiratory morbidity from 39 weeks onwards (from 42.3 per 1000 at 38 weeks to 17.8 per 1000 at 39 weeks – OR 8.2 and 3.5 respectively). Respiratory morbidity among neonates born by CS before the onset of labour across the different gestational ages was an increased.<sup>282</sup> [evidence level 3] Figure 6.1 shows respiratory morbidity per 1000 for CS before labour.<sup>282</sup> [evidence level 3]

From the NSCSA data it is estimated that about 10% of women went into spontaneous labour between 39–39 weeks. The average planned CS rate is also about 10%. Therefore about 1% of women booked for a planned CS after 39 weeks would be expected to go into labour before this time. For an average hospital with 3000 births this would prevent 1 case of TTN or RDS per year and would increase unscheduled CS rate by 10%.

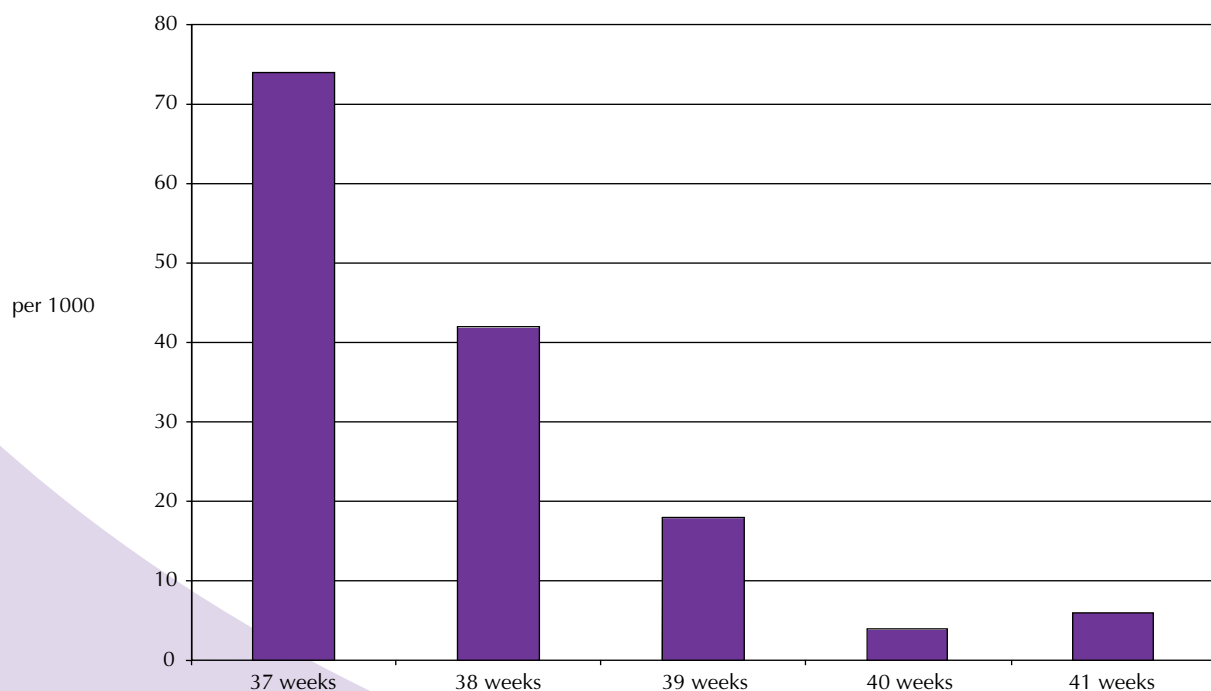
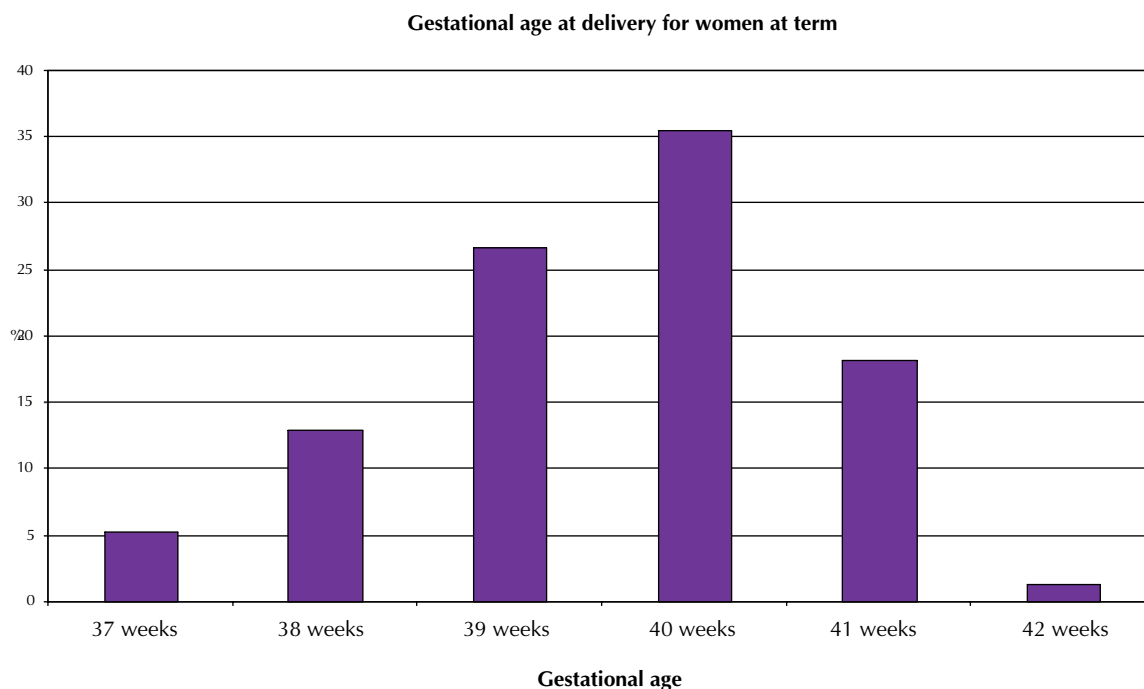


Figure 6.1 Respiratory morbidity per 1000 for CS before labour<sup>282</sup> [evidence level 3].



**Figure 6.2** Distribution of gestational age at birth in England and Wales<sup>4</sup>

**RECOMMENDATION**

The risk of respiratory morbidity is increased in babies born by CS before labour, but this risk decreases significantly after 39 weeks. Therefore planned CS should not routinely be carried out before 39 weeks.



**6.2 Decision-to-delivery interval for emergency CS**

Guidelines on electronic fetal monitoring recommend that where acute fetal compromise is suspected or confirmed, delivery should occur as soon as possible, ideally within 30 minutes, taking into account fetal heart rate and maternal factors.<sup>2</sup> The ability of hospitals to meet this standard was assessed in the NSCSA.<sup>4</sup> [evidence level 3]

There is limited research to underpin this standard.<sup>283–286</sup> [evidence level 3] and 30 minutes is a somewhat arbitrary cut-off. In the U.S, the recommendation is that delivery should be expedited within 20–30 minutes.<sup>287</sup> [evidence level 4] It has been suggested that rapid delivery may be dangerous in itself for the fetus.<sup>288</sup> [evidence level 3] However, the most compromised babies are most predisposed to a poorer outcome and are also often delivered with the least delay and this needs to be taken into account when assessing the effects of a rapid delivery.<sup>289</sup> Rapid delivery may also increase the risk of maternal mortality, as a result of factors such as general anaesthesia.<sup>95</sup> [evidence level 3]

The association between decision to delivery interval and, baby and maternal outcomes was examined using data from NSCSA.<sup>290</sup> [evidence level 3] Of the babies born by emergency caesarean, 3.4% (n = 586) had a five-minute Apgar score of less than 7 and 1.0% (n = 175) had a five-minute Apgar score of less than 4. Compared with babies delivered within 15 minutes, the adjusted odds ratio for five-minute Apgar scores of less than 7 were not different for babies delivered between 16 and 75 minutes. Babies delivered after 75 minutes, however, had higher odds of five-minute Apgar scores of less than 7 (OR 1.7, 95% CI 1.2 to 2.4). Similar trends were seen for five-minute Apgar scores of less than 4 and stillbirth, but these did not reach statistical significance.

We repeated this analysis with cases delivered within 30 minutes as the reference group. We found no significant difference in the odds of a poor outcome for babies delivered in less than 30 minutes compared with those delivered between 31 and 75 minutes (OR 1.1, 95% CI 0.9 to 1.4 for five-minute Apgar score of less than 7). Babies delivered after 75 minutes, however, had an 80% increased odds of a five-minute Apgar score of less than 7 (OR 1.8, 95% CI 1.3 to 2.4).

Women who were delivered with short (< 30 minutes) or long (> 75 minutes) decision to delivery intervals were more likely to require special care. Women who were delivered after 75 minutes had a 50% increase in adjusted odds of requiring special care after delivery compared with women delivered within 15 minutes (OR 1.5, 95% CI 1.2 to 1.8). We found no difference between the odds of this outcome between a delivery interval of 15 minutes and intervals up to 75 minutes. Women who were delivered after 75 minutes had a 60% increase in odds of requirement for special care compared with women delivered within 30 minutes (OR 1.6, 95% CI 1.4 to 1.9). We found no difference in maternal outcome in women delivered between 31 and 75 minutes (OR 1.1, 95% CI 0.9 to 1.2).

These findings are consistent with previous studies.<sup>283–286</sup> In univariate analysis shorter decision to delivery intervals are associated with poorer baby outcomes. After adjusting for other clinical factors, however, decision to delivery intervals of less than 30 minutes did not improve or worsen maternal or baby outcomes. Outcomes do not change for decision to delivery intervals of up to 75 minutes. For all emergency caesareans, however, delays in delivery of more than 75 minutes are associated with poorer outcomes; this effect is greater with prior maternal or fetal compromise.<sup>290</sup> [evidence level 3] Maternity services need to ensure that they can respond rapidly to obstetric emergencies and expedite delivery within a limited time frame. Monitoring decision to delivery intervals remains important in evaluating quality of maternity care and a reference time frame is needed. The 30-minute decision to delivery interval should remain as the benchmark for service provision for caesarean sections of grade 1 and grade 2 urgency. The 75 minute decision to delivery interval should be added as a clinically important audit standard, and all deliveries by emergency caesarean should occur within this time.

### RECOMMENDATION

Delivery at emergency CS for maternal or fetal compromise should be accomplished as quickly as possible, taking into account that rapid delivery has the potential to do harm. A decision-to-delivery interval of less than 30 minutes is not in itself critical in influencing baby outcome, but remains an audit standard for response to emergencies within maternity services.



## 6.3 Preoperative testing and preparation for CS

### Full blood count and haemoglobin

Recommendations for antenatal screening include measuring haemoglobin (Hb) at booking and repeating this at 28 weeks of gestation to screen for anaemia.<sup>1</sup> Pregnancy increases maternal iron requirements and antenatal screening enables women who have anaemia to receive appropriate treatment before birth. Women who are anaemic at the time of birth are likely to be less able to tolerate blood loss.<sup>95</sup> [evidence level 3]

Overall it is estimated that about 1.3% of all women giving birth have blood loss in excess of 1000 ml,<sup>291</sup> while 0.7% have blood loss in excess of 1500 ml however measurements of blood loss at birth are reliant on visual estimations and are usually underestimations.<sup>292</sup> In the NSCSA 32% of women who had CS had an estimated blood loss between 500–1000 ml, while for 4% it was in excess of 1000 ml. Haemorrhage remains an important cause of maternal mortality.<sup>95</sup> [evidence level 3]

Two pragmatic RCTs comparing planned CS to planned vaginal birth report blood loss as an outcome measure.<sup>44,48</sup> (n = 2281) No difference in blood loss greater than 1000 ml or 1500 ml between the two groups was detected (0.5% planned CS; 0.7% planned vaginal birth group, pooled RR 0.80, 95% CI 0.29 to 2.18. For blood loss greater than 1500 ml, pooled RR 1.32, 95% CI 0.39

to 4.42). [evidence level 1a] Non intention to treat analysis (by actual rather than intended mode of delivery) indicate that blood loss greater than 1000 ml occurred in 2.7% of women who had CS and 1.6% of women who had vaginal birth. Blood loss greater than 1500 ml occurred in 2% of women who had CS compared to none of the women who had vaginal birth.<sup>44</sup> [evidence level 2]

A large UK cohort study<sup>291</sup> reported that compared to women who had spontaneous vaginal deliveries, the risk of blood loss in excess of 1000ml was greater among women who had either planned CS (RR 3.94, 99% CI 2.52 to 6.17), CS in labour (RR 8.84, 99% CI 6.74 to 11.6) or assisted vaginal birth (RR 2.39, 95% CI 1.64 to 3.48). Compared with women who had planned CS, risk of blood loss in excess of 1000 ml was higher among women who had CS in labour (RR 2.24, 95% CI 1.43 to 3.53) [evidence level 2b]. However these relative risks do not take into account any other factors that may also affect blood loss, for example the reasons for performing CS in labour such as placental abruption or ante partum haemorrhage.

No studies have evaluated the effect of preoperative Hb or full blood count (FBC) on management or maternal health outcomes. Guidelines for preoperative testing in general surgery have been developed.<sup>293</sup> [evidence level 3] The guideline divides surgical procedures into four grades; minor, intermediate, major, major+, neurosurgery and cardiovascular surgery. CS would be classed as major surgery. Patients are then classified according to American Society of Anaesthesia (ASA) grades. In most instances women having CS are ASA grade 1, that is a normal healthy patient without any co - morbidity. The recommendations in the guideline are based on case series, indirect evidence and consensus methodology. The guideline recommends full blood count before major surgery in healthy adults aged 16–40 years.

### Availability of blood and group and saving of serum

Blood transfusion may be necessary in cases of severe obstetric haemorrhage and is a surrogate marker for heavy blood loss. Six RCTs report on the need for blood transfusion as an outcome measure<sup>40,42–45,48</sup> (n = 2469). 1.4% of women in the planned CS group compared to 1.8% in the planned vaginal birth group required blood transfusion. No difference was detected in this outcome measure between the two groups (pooled RR 0.86, 95% CI 0.48 to 1.53). [evidence level 1a] Non intention to treat analysis (by actual rather than intended mode of delivery), indicate the rate of blood transfusion for women who had CS was 9–10% compared to 0–2% for women who had a vaginal birth.<sup>43,44</sup> One cohort study reported on peripartum blood transfusion by mode of birth.<sup>294</sup> The overall incidence of blood transfusion following birth was 0.99%. Compared to women who had spontaneous vaginal birth, the relative risk of blood transfusion for women who had CS was 5.6 (95% CI 2.9 to 10.8) and for women who had assisted vaginal birth it was increased (RR 15.5, 95% CI 8.3 to 29.0). [evidence level 2b]

National data on CS for the United Kingdom shows women who had CS for antepartum haemorrhage, placenta praevia or uterine rupture accounted for 21% of occurrences of blood loss greater than 1000 ml.<sup>4</sup> [evidence level 3] Women with a prior diagnosis of placenta praevia, abruption, uterine rupture or APH are at increased risk of blood loss of more than 1000 ml (RR 5.31, 95% CI 4.67 to 6.04) compared with women without these conditions. Other predictive factors for haemorrhage during CS include pre-eclampsia, obesity, amnionitis and prolonged active phase of labour.<sup>295,296</sup> [evidence level 3]

Haemorrhage is still an important cause of maternal mortality and it is recommended that all obstetric units should have a protocol for the management of obstetric haemorrhage and that women at high risk of haemorrhage should be delivered at a unit with a blood bank on site.<sup>95</sup> [evidence level 3] The majority (95%) of maternity units in England and Wales report having on-site cross matching facilities at all times with 3% of maternity units cross matching facilities during the day only and the remainder keeping O-negative blood on labour ward at all times.<sup>4</sup> [evidence level 3] There is also a wide range of blood ordering practices.<sup>297</sup> [evidence level 3] Blood transfusion service guidelines do not address preoperative cross matching, rather provide recommendations for safer blood transfusion practices.<sup>298</sup> [evidence level 4]

We did not identify any studies that looked at whether all women having CS should have group and save taken preoperatively. Women who are at high risk of having a blood loss of greater than 1000 ml at CS should be delivered at a site with blood transfusion services. Studies set in circumstances where there are no blood transfusion services suggest that availability of blood is of importance in reducing the morbidity associated with haemorrhage.<sup>299</sup> [evidence level 3]

### Other blood tests

We did not identify any evidence on the value of clotting screen or other blood tests prior to CS. Extrapolation from the preoperative testing guideline for major surgery mentioned previously would not recommend clotting screen or other tests such as urea and electrolytes prior to CS.<sup>293</sup> [evidence level 3]

### Routine ultrasound before CS

Preoperative ultrasound has been proposed for placental localisation, presentation and as a method of predicting the integrity of a previous CS scar. A cohort study looked at whether routine preoperative ultrasound at CS impacted on CS outcomes. The study performed preoperative ultrasound scans on 124 women and compared them with matched controls, retrospectively. The outcomes they considered were incidence of incision through the placenta, blood loss of more than 1000 ml, difficult birth; injury of the infant, injury to the cord or to other adjacent structures. No difference in these outcomes was detected between the two groups.<sup>300</sup> [evidence level 2b]

It has been reported that about a quarter (28%) of transverse uterine scars can be seen on ultrasound, vertical uterine scars cannot be visualised on ultrasound.<sup>301</sup> [evidence level 2b] The clinical usefulness of this is not clear.<sup>302</sup> [evidence level 2a].<sup>303</sup> [evidence level 1b]

Ultrasound has been used for the antenatal diagnosis of placenta accreta however the predictive value of this remains uncertain.<sup>304,305</sup> [evidence level 3]

### Urinary catheter use at CS

A UK survey of obstetricians reports that for CS with epidural anaesthesia the majority (82%) use an indwelling urethral catheter for both the procedure and postoperatively, a minority would use an indwelling catheter for either the duration of the procedure only (10.6%) or an in-out catheter (7.3%). This was similar for both emergency or planned CS, and for CS with general anaesthesia.<sup>306</sup> [evidence level 3]

An RCT (n = 50) of women undergoing elective caesarean section under epidural analgesia who were randomised prospectively to be catheterised with an 'in-out' or an indwelling urethral catheter removed the after the CS. Of the women who had catheterisation for the time of surgery alone 44% subsequently required re-catheterisation, whereas all women with indwelling catheters voided spontaneously on their removal. The frequency of significant bacteruria was the same in both groups.<sup>307</sup> [evidence level 1b]

Another RCT from Iran (n = 270) included women having a CS with general or regional anaesthesia. Women were randomised into two groups: group I were not catheterised but were encouraged to void urine immediately prior to the CS; group II had indwelling catheters removed the day after the CS. Outcomes measured were discomfort at first voiding post-CS, time of ambulation, time of hospital stay and need for re-catheterisation. Of women who were not catheterised 4% required catheterisation postoperatively. There was no difference in ambulation time and women who did not have an indwelling catheter had a slightly shorter hospital stay (17 hours).<sup>308</sup> [evidence level 1b]

### Preoperative shaving

No RCTs have compared pre-CS shaving of the abdomen to no shaving. A systematic review included 2 RCTs (n = 539) to assess the effects of routine perineal shaving on admission in labour on maternal and neonatal outcomes. In the earlier trial, 389 women were alternately allocated to receive either skin preparation and perineal shaving (control) or clipping of vulval hair only (experimental). In the second trial, which included 150 participants, perineal shaving was compared with the cutting of long hairs for procedures only. The primary outcome for both trials was maternal febrile morbidity. No differences were found (combined OR 1.26, 95% CI 0.75 to 2.12). In the smaller trial, fewer women who had not been shaved had gram negative bacterial colonisation compared with women who had been shaved (OR 0.43, 95% CI 0.20 to 0.92).<sup>309</sup> [evidence level 1a]

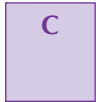


**RECOMMENDATIONS**

Pregnant women should be offered a haemoglobin assessment before CS to identify those who have anaemia. Although blood loss of more than 1000 ml is infrequent after CS (it occurs in 4 to 8% of CS) it is a potentially serious complication.



Pregnant women having CS for ante partum haemorrhage, abruption, uterine rupture and placenta praevia are at increased risk of blood loss of more than 1000 ml and should have the CS carried out at a maternity unit with on-site blood transfusion services.



Pregnant women who are healthy and who have otherwise uncomplicated pregnancies should not routinely be offered the following tests before CS:



- grouping and saving of serum
- cross-matching of blood
- a clotting screen
- preoperative ultrasound for localisation of placenta, because this does not improve CS morbidity outcomes (such as blood loss of more than 1000 ml, injury of the infant, injury to the cord or to other adjacent structures).

Women having CS with regional anaesthesia require an indwelling urinary catheter to prevent overdistension of the bladder because the anaesthetic block interferes with normal bladder function.



**6.4 Anaesthesia for CS**

**Planning post-CS analgesia**

The different options for post-CS analgesia should be discussed with the woman before her CS using available obstetric anaesthesia and analgesia patient information booklets<sup>310</sup> so that the individual analgesic needs of each woman can be met.<sup>310</sup> [evidence level 3] Post-CS pain relief should be prescribed prior to discharge from the anaesthetic recovery area to a general ward.<sup>311</sup> [evidence level 3]

**General versus regional anaesthesia for CS**

The NSCSA reported that 77% of emergency and 91% of elective CS are performed using regional anaesthesia.<sup>4</sup> [evidence level 3] Of the CS that were reported to be grade 1 urgency (immediate threat to the life of the woman or fetus), 41% were performed using general anaesthesia, 54% had regional anaesthesia and 3% had general anaesthesia following regional anaesthesia. A UK survey of anaesthetic techniques for CS reported an overall failure rate of epidural anaesthesia of 7.1%, for combined spinal epidural's it was 2% and for single shot spinal anaesthetic 1.9%. Failure of regional anaesthesia accounted for 10% of general anaesthetic cases for CS.<sup>312</sup> [evidence level 3]

Three RCTs have compared the impact of general versus regional anaesthesia for CS on maternal and neonatal morbidity. One RCT (n = 341) randomised women into three groups: general anaesthesia, epidural anaesthesia or spinal anaesthetic. The maternal and neonatal outcomes were reported separately.<sup>313,314</sup> [evidence level 1b] General anaesthesia resulted in increased blood loss, lower postoperative haematocrit and higher proportion of women with postoperative haematocrit of less than 30%. There was no difference in neonatal cord blood gas analysis, Apgar and a Neurologic Adaptive Capacity Score (4 hours after birth).<sup>314</sup> [evidence level 1b] The second RCT (n = 47) randomised women to have either general or epidural anaesthesia, the trial measured neonatal outcomes only. No difference was detected in the incidence of low Apgar scores and umbilical artery gas analysis.<sup>315</sup> [evidence level 1b] The third RCT (n = 104) randomised women having elective repeat CS to either general anaesthesia or spinal anaesthesia. The RCT measured short term neonatal outcomes only. This RCT is poorer quality because it has 20% loss to follow-up. Of the 84 infants followed up no difference was detected in neonatal outcomes between the two groups.<sup>316</sup> [evidence level 1b] All the RCTs are underpowered to look at neonatal outcomes.

A large observational study from the US (n = 3940) reported that infants born by CS with general anaesthesia are more likely to have an Apgar less than 7 and to need resuscitation compared to those born by CS with regional anaesthesia (1-minute Apgar less than 7: RR 3.13, 95% CI 2.5 to 3.88. 5-minute Apgar less than 7: RR 3.6, 95% CI 1.81 to 7.00. Need for resuscitation RR 2.02, 95% CI 1.39 to 2.9).<sup>317</sup> [evidence level 3]

Two RCTs compared regional and general anaesthetic for specific clinical conditions; severe pre-eclampsia and placenta praevia. One RCT (n = 80) compared general, epidural or combined spinal epidural anaesthetic for CS in women with severe pre-eclampsia. They found no significant difference in maternal (BP or urine output) or fetal complications (umbilical artery pH, Apgar score) between the three groups.<sup>318</sup> [evidence level 1b] The second RCT (n = 25) randomised women having CS for placenta praevia to receive either general or epidural anaesthesia. Women who received general anaesthesia had lower postoperative haematocrit (28.1% versus 32.5%) and were more likely to need blood transfusion (42% versus 15%; RR 2.71, 95% CI 0.64 to 11.4). There was no difference in neonatal outcomes.<sup>319</sup> [evidence level 1b] Two large scale retrospective surveys comparing regional to general anaesthesia for CS for placenta praevia showed that general anaesthesia was an independent predictor for increased blood loss, decreased postoperative haemoglobin and increased need for blood transfusion. One of the surveys was conducted in the USA (514 women)<sup>320</sup> [evidence level 3] and one in the UK (350 women).<sup>321</sup> [evidence level 3]

A UK-based retrospective survey of 137 women reported that the mean time for surgical readiness for regional anaesthesia 27.6 minutes (range 13–55 minutes) compared with 15.4 minutes (range 2–44 minutes) for general anaesthesia,  $p < 0.01$ . Time for surgical readiness is defined as time between leaving the delivery room to skin incision.<sup>322</sup> [evidence level 3]

### Monitoring during anaesthesia for CS

For CS under regional block the following monitoring is recommended; continuous pulse oximetry, non-invasive blood pressure capable of one minute cycles (preferably with printout) and continuous ECG are required during induction, maintenance and recovery. The fetal heart rate should be recorded during the initiation of regional block and until the abdominal skin preparation is begun in emergency CS.<sup>323</sup> [evidence level 4]

During general anaesthesia, the woman should be monitored in accordance with the recommendations of the Association of Anaesthetists of Great Britain and Ireland (AAGBI) guidelines for obstetric anaesthesia services. The recommendations include continual assessment of the patient's physiological state, depth of anaesthesia and function of equipment. Monitoring devices supplement clinical observations.<sup>324</sup> [evidence level 4]

No economic studies comparing the cost effectiveness of general and regional anaesthesia for CS were identified. However we identified one economic study from America using a effectiveness data from a case note review comparing spinal and epidural anaesthesia for non-emergency CS. Spinal anaesthesia took up less operating time, required less intraoperative analgesia, and led to fewer complications than epidural. The only dimension which was not different between spinal anaesthesia and epidural was in the need for postoperative analgesia. Therefore spinal anaesthesia was associated with lower cost than epidural anaesthesia (postoperative analgesia was not included in the costs). A full cost-effectiveness analysis was not undertaken.<sup>325</sup>

### Place of induction of anaesthesia

There are no RCTs looking at the use of anaesthetic rooms in obstetric anaesthesia. One RCT (n = 100) patients having minor or intermediate operative procedures who were randomised to induction of anaesthesia in an anaesthetic room versus in theatre. The outcomes included patient anxiety assessed using physical parameters (such as heart rate) and questionnaire. There was no difference detected between the two groups.<sup>326</sup> [evidence level 1b]

A survey of 115 women having an elective CS under regional anaesthesia in the UK reported that stress scores were higher in theatre. Women reported this to be due to anxiety about pain and the well being of themselves and their babies and not from the environment.<sup>327</sup> [evidence level 3] Anaesthetic rooms for induction of anaesthesia have been used in the United Kingdom for many years and are currently more commonly used than theatre for induction (4% of UK hospitals induce anaesthesia in theatre).<sup>328</sup> [evidence level 3]

### Converting epidural analgesia to anaesthesia for CS

There were no studies that addressed the issue of place of top-up. A survey of current UK practice is being conducted.<sup>329</sup> Key issues in relation to the place of topping up of epidural or spinal are monitoring and safety. Two RCTs have compared different drugs to convert epidural analgesia for labour to epidural anaesthesia for CS. One RCT (n = 90) compared 3 groups. Group 1: bupivacaine 0.5% alone, group 2: bupivacaine 0.5% with lignocaine 2% and adrenalin and group 3: lignocaine 2% with adrenalin. The outcome was time to adequate block (loss of cold sensation to T4). No difference was detected between the groups but group 3 had 6 adverse events (3 high blocks and 3 patients requiring general anaesthesia).<sup>330</sup> [evidence level 1b] Another RCT (n = 84) compared epidural conversion with or without alkalinising agents (bicarbonate v saline). Outcome assessed was time to adequate surgical block. Time to adequate block was less in the alkalinised group (mean difference 4.5 minutes)<sup>331</sup> [evidence level 1b].

### Procedures to avoid hypotension

Current practice in the UK includes the use of lateral tilt and intravenous ephedrine infusion to prevent and manage hypotension. Pre-loading and leg binders are not commonly used.<sup>312</sup> [evidence level 3]

Lateral tilt of the operating table at CS is used to decrease compression of the inferior vena cava by a gravid uterus and resultant hypotension.<sup>332</sup> [evidence level 3] Lateral tilt is standard practice in UK units for CS.<sup>312</sup> [evidence level 3] A systematic review that includes 3 RCTs (n = 293) has evaluated the effect of lateral tilt at CS on Apgar scores or umbilical artery pH measurements. All of the RCTs were methodologically poor with inadequate allocation concealment and poorly reported randomisation methods. All of the RCTs were conducted in the 1970s. Meta analysis was limited as different outcomes were measured. There were no differences in low Apgar scores (Peto OR 0.53, 95% CI 0.25 to 1.16) or umbilical artery pH measurements (weighted mean difference 0.03, 95% CI 0.01 to 0.04) when lateral tilt was used.<sup>333</sup> [evidence level 1a]

We identified one RCT published after the most recent update of the review. In this RCT fetal heart rate patterns, uterine activity, umbilical artery, acid base status, newborn evaluation and maternal parameters were compared between left lateral tilt and no tilt at emergency CS. No difference was found when lateral tilt was used.<sup>334</sup> [evidence level 1b]

A 15° wedge under the women's right hip is sometimes used instead of lateral tilt at CS. Two RCTs (n = 100) considered the effect of lateral tilt versus a 15° wedge on aortocaval compression as measured by incidence of hypotension after spinal anaesthetic for CS. No difference was detected between the methods.<sup>335,336</sup> [evidence level 1b]

A systematic review that included 20 RCTs evaluating techniques for preventing hypotension during spinal anaesthesia for CS reported that the following interventions reduce the incidence of hypotension under spinal anaesthesia for CS: pre load with crystalloid 20 ml/kg vs. control (1 RCT, n = 140; RR 0.78, 95% CI 0.6 to 1.0); pre emptive colloid vs. crystalloid (4 RCTs, n = 126; RR 0.54, 95% CI 0.37 to 0.78); ephedrine vs. control (3 RCTs, n = 146; RR 0.70, 95% CI 0.57 to 0.85); lower limb compression vs. control (5 RCTs, 181 women, RR 0.75, 95% CI 0.59 to 0.94). No difference in maternal or neonatal side effects were reported, however the RCTs were not large enough to evaluate these. A further 26 were excluded from this review the main reason given for these exclusions was that the spinal technique was uncontrolled<sup>337</sup> [evidence level 1a].

Subsequent to the review two RCTs have been published that evaluate the use of elastic stockings for prevention of hypotension (n = 20)<sup>338</sup> [evidence level 1b] and elastic stockings plus a sequential compression device (n = 100).<sup>339</sup> [evidence level 1b] Neither RCT detected a difference in the incidence of hypotension with the use of elastic stockings alone or together with a compression device. The RCTs used different outcome measure to the RCTs included in the systematic review and therefore could not be added to the meta-analysis.

The use of bolus phenylephrine is a suggested alternative to ephedrine in maintaining maternal arterial blood pressure during regional anaesthesia. This was evaluated in an RCT (n = 38) which reported maternal blood pressure was similar in both groups.<sup>340</sup> [evidence level 1b] A further RCT (n = 50) looked at the use of prophylactic epidural ephedrine to decrease the incidence of

hypotension. They did not detect a difference in the incidence of hypotension between the groups.<sup>341</sup> [evidence level 1b]

### Procedures to manage hypotension

Despite methods to prevent hypotension it does still occur. A systematic review of 7 RCTs (n = 292) compare the use of ephedrine to phenylephrine for the management of hypotension during spinal anaesthesia for CS. The review did not detect a difference between the two vasopressors for the management of hypotension (RR 1.00, 95% CI 0.96 to 1.06). Maternal bradycardia was more common with phenylephrine (RR 4.79, 95% CI 1.47 to 15.6) and neonates born to women given phenylephrine less likely to be acidotic (RR 0.78, 95% CI 0.16 to 3.92)<sup>342</sup> [evidence level 1a].

A further RCT published since the review (n = 30) also compared intravenous ephedrine infusion with bolus ephedrine if hypotension developed. They reported a reduced incidence of hypotension when ephedrine infusion was used and less nausea and vomiting. There was no difference in neonatal heart rate or blood pressure.<sup>343</sup> [evidence level 1b] Current guidelines advise that maternity departments should have guidelines for management of hypotension.<sup>323</sup> [evidence level 4]

### Failed intubation

Failed intubation remains a cause of maternal death.<sup>95</sup> A survey of cases of failed tracheal intubation for the six year period 1993 to 1998 reports 36 cases of failed intubation in 8790 obstetric anaesthetics (incidence 1/249).<sup>344</sup> This incidence was constant for the six year period. In the majority of cases there had been no preoperative assessment of the patient for intubation risk. There is no single test that on its own has a high predictive value for difficult intubation. Use of two or more abnormal airway findings are needed for prediction of difficult intubation and in this situation regional anaesthesia should be considered although that is no guarantee that intubation will not be needed.<sup>345</sup> [evidence level 4]

A number of opinion-based papers have proposed the use of laryngeal masks in cases of failed intubation with CS.<sup>346,347</sup> [evidence level 4] We identified a case series of 1067 women undergoing elective CS which used laryngeal masks instead of endotracheal intubation. They reported that an effective airway was obtained in 99% of women at the first attempt, 7% required intubation during the CS and there were no episodes of hypoxia, aspiration, regurgitation or laryngospasm.<sup>348</sup> [evidence level 3]

National anaesthetic obstetric guidelines recommend that each unit has their own drill for failed intubation<sup>323</sup> such as described in recent literature.<sup>349-351</sup> This together with predictive tools and innovative training tools such as anaesthetic emergency simulators<sup>352</sup> should reduce mortality associated with failed intubation. [evidence level 4]

### Use of antacids before CS

Antacid prophylaxis forms part of routine practice at most units in the UK. NSCSA reports that 99% of UK units routinely use antacids and drugs to reduce the gastric volume and acidity for elective CS and 98% for emergency CS. Ninety eight percent use histamine H<sub>2</sub> receptor blockers (ranitidine or cimetidine), 2% proton pump inhibitors (omeprazole) and 99% a non-particulate antacid such as sodium citrate.<sup>4</sup> [evidence level 3] Ranitidine currently costs £0.64 and omeprazole £2.04 per dose to reduce acidity of gastric contents.<sup>353</sup>

The risk of developing acid aspiration syndrome is increased when the volume aspirated into the lungs exceeds 25 ml and has an acidic pH (less than 2.5).<sup>354</sup> [evidence level 3] No studies have used maternal aspiration pneumonitis as an outcome measure as this is rare and would require large numbers of women to be included. Antacids are used to decrease the acidity of gastric contents. An RCT (n = 32) comparing sodium citrate with no antacid reported reduced acidity and no difference in gastric volume.<sup>355</sup> [evidence level 1a] A study of 20 women undergoing CS reported that women who received cimetidine preoperatively had an average pH of 5.05 compared to pH 2.97 in women who did not receive antacid. There was no difference in gastric volume measured by intraoperative aspiration of stomach contents.<sup>356</sup> [evidence level 2b]

An RCT (n = 595) compared ranitidine with sodium citrate to sodium citrate alone. Women who had acidic gastric contents (pH < 3.5) or a gastric volume > 25ml were defined as “at risk of aspiration”. The “risk of aspiration” was reduced in the group who had ranitidine and sodium citrate compared to sodium citrate alone (5.6% vs. 0.3%, p < 0.05)<sup>357</sup> [evidence level 1b]. Another RCT (n = 541) compared omeprazole to placebo on the same “risk of aspiration” outcome. They reported a reduction in the women “at risk of aspiration” (4.3% v 1.4% OR 3.08 95% CI 1.02,9.29)<sup>358</sup> [evidence level 1b]. A further 3 RCTs have compared ranitidine to omeprazole. Omeprazole results in a higher mean pH than ranitidine, however cost issues make ranitidine with sodium citrate a more cost effective option.<sup>359–361</sup> [evidence level 1b]

**Use of antiemetics**

Nausea and vomiting commonly occur during CS due to aortocaval compression and resultant hypotension (see section on procedures to avoid hypotension during CS).

Routine practice in UK maternity units includes using an antacid and metoclopramide (a phenothiazine like antiemetic).<sup>4</sup> [evidence level 3] An early RCT (n = 58) women undergoing elective CS with general anaesthetic compared using metoclopramide to no treatment. The RCT did not detect a difference in gastric volume between the groups.<sup>362</sup> [evidence level 1b] Later RCTs in women having CS with spinal anaesthesia show reduced incidence of nausea and vomiting in women who were given metoclopramide before induction of anaesthesia (14% vs. 81%).<sup>363</sup> [evidence level 1b]

We identified five RCTs comparing different anti emetics to placebo: propofol,<sup>364</sup> granisetron, droperidol and metoclopramide,<sup>365</sup> ondansetron and droperidol,<sup>366</sup> metoclopramide and ondansetron,<sup>367</sup> ondansetron.<sup>368</sup> Meta analysis of these RCTs showed compared to placebo, any anti-emetic reduced nausea and vomiting. [evidence level 1b] Ondansetron appears to be more effective than metoclopramide in reducing nausea (2 RCTs. RR 0.54, 95% CI 0.33 to 0.87). No difference was detected between ondansetron and droperidol in reducing nausea(2 RCTs. RR 1.0, 95% CI 0.44 to 2.27). However considering cost and safety in prescribing the cost of metoclopramide £0.28 per 10mg parenteral dose.<sup>353</sup> Metoclopramide is not known to be harmful but its use should be limited to situation where there is known benefit. 5HT<sub>3</sub> antagonists (ondansetron) is £12.89 per 8 mg parenteral dose, it is advised to avoid use during pregnancy and breastfeeding.<sup>353</sup> Therefore metoclopramide should be offered if a pharmacological anti-emetic is used during CS.

One RCT (n = 75) compared acupressure with placebo and metoclopramide for the prevention of nausea and vomiting during CS. Compared to placebo either acupressure or metoclopramide reduced nausea. No difference was detected between acupressure and metoclopramide (RR 1.5, 95% CI 0.5, 4.7)<sup>369</sup> [evidence level 1b]

**Use of pre-oxygenation, rapid sequence induction and cricoid pressure**

Standard UK practice for emergency CS includes pre oxygenation, rapid-sequence induction and cricoid pressure for CS under general anaesthetic.<sup>312</sup> [evidence level 3] We did not identify any RCT that compared use of these interventions to non use. A number of discussion papers were identified<sup>370–372</sup> which included results of experimental work but no outcomes based studies. [evidence level 4]

**RECOMMENDATION**

Pregnant women having a CS should be given information on different types of post-CS analgesia so that analgesia best suited to their needs can be offered.



Women who are having a CS should be offered regional anaesthesia because it is safer and results in less maternal and neonatal morbidity than general anaesthesia. This includes women who have a diagnosis of placenta praevia.



Women who are having induction of regional anaesthesia for CS should be cared for in theatre because this does not increase patient anxiety.



Women who are having a CS under regional anaesthesia should be offered intravenous ephedrine or phenylephrine, and volume pre-loading with crystalloid or colloid to reduce the risk of hypotension occurring during CS.



Each maternity unit should have a drill for failed intubation during obstetric anaesthesia.

D

To reduce the risk of aspiration pneumonitis women should be offered antacids and drugs (such as H<sub>2</sub> receptor antagonists or proton pump inhibitors) to reduce gastric volumes and acidity before CS.

B

Women having a CS should be offered anti emetics (either pharmacological or acupressure) to reduce nausea and vomiting during CS.

A

General anaesthesia for emergency CS should include preoxygenation, cricoid pressure and rapid sequence induction to reduce the risk of aspiration.

GPP

Intravenous ephedrine or phenylephrine should be used in the management of hypotension during CS.

A

The operating table for CS should have a lateral tilt of 15°, because this reduces maternal hypotension

A

## 6.5 Surgical techniques for CS

A national survey of surgical techniques used during CS in the UK reports a wide range of surgical techniques being used in practice.<sup>306</sup> [evidence level 3] This section presents the evidence on surgical techniques for lower segment CS in uncomplicated first procedures. Discussion of surgical techniques for specific clinical situations such as CS for preterm birth (classic uterine incision) or CS in women with previous CS (bladder adhesions) are outside the scope of this guideline.

### Methods to prevent HIV transmission in theatre

Prevention of transmission of HIV from a woman undergoing CS who is known to be HIV-positive to staff carrying out the CS has been evaluated using a mathematical model<sup>373</sup> and current UK HIV data<sup>374</sup> the estimated cumulative probability of occupationally acquired HIV infection is less than 1%. This is calculated at a skin puncture rate of 0.025 per procedure. However this estimate does not take into account the more common mode of contact with contaminated blood in obstetrics which is face contamination. One paper estimated the incidence of face shield contamination during CS as 50%. The incidence of cases of definite occupational acquisition of HIV in the United Kingdom has been small (1 in 319 percutaneous exposures and 1 in 3000 mucocutaneous exposures).<sup>375</sup> [evidence level 3]

The use of surgical pass trays and double gloving have been tested in RCTs to determine whether their use decreases the risk of glove perforation and hence risk of infection. The use of surgical pass trays was considered in an RCT (n = 192 CS, 444 pairs of gloves) that did not detect any difference in the number of glove perforations (19% vs. 16.1% of gloves perforated, RR 1.2, 95% CI 0.8 to 1.8).<sup>376</sup> [evidence level 1b]

A systematic review of wearing double gloves to reduce surgical cross infection included 18 RCTs that looked a glove perforation as an indirect measure of surgical infection. The results of the review showed that double latex gloving reduces the number of perforations to the innermost glove (OR 3.72, 95% CI 2.82, 4.91).<sup>377</sup> [evidence level 1a]

In addition to the above evidence there are recommendations for safer surgical practices in general which include post exposure prophylaxis<sup>378</sup> [evidence level 4]

### RECOMMENDATIONS

Healthcare professionals should wear double gloves when performing or assisting at CS on women who have tested positive for HIV, to reduce the risk of HIV infection of healthcare professionals during surgery.

A

General recommendations for safe surgical practice should be followed at CS to reduce the risk of HIV infection of staff.

C

### Use of adhesive drapes

We identified two RCTs on the use of adhesive drapes. Both studies addressed the impact of the use of adhesive drapes only on the incidence of postoperative wound infection. Other issues such as staff safety in the operating theatre related to spillage of blood were not addressed in these RCTs. One study described the use of adhesive drapes at CS as an isolated intervention and found the incidence of post-CS wound infection to be unchanged by their use.<sup>379</sup> [evidence level 1b] The other RCT described the use of adhesive drapes together with repeat disinfection of the skin before skin closure. This RCT did not find any decrease in the incidence of wound infection with the use of adhesive drapes.<sup>380</sup> [evidence level 1b] Neither RCT commented on the HIV status of the women that were included in the studies.

### RESEARCH RECOMMENDATION

RCTs are required to determine the effectiveness of adhesive drapes at CS in reducing blood spillage and cross infection and improving safety for staff in the operating room.

### Abdominal-wall incision

Vertical incisions for CS are uncommon in the UK (less than 1% of skin incisions are vertical) and have been replaced by transverse incisions.<sup>306</sup> [evidence level 3] No RCTs have compared midline to transverse incisions for CS. A meta analysis of general surgical RCTs has compared midline, oblique and transverse incisions for their effect on postoperative pain, wound infection rates, incisional hernias and wound dehiscence.<sup>381</sup> Seven RCTs included postoperative pain as an outcome measure. Two RCTs (n = 209) compared midline and transverse incisions and found that the group with transverse incisions had lower pain scores and required less pethidine for analgesia (p < 0.001). Ten RCTs (n = 3586) reported on the incidence of wound infection and found no difference between the different types of incisions. Wound dehiscence and incisional hernias were reported in 9 RCTs (n = 2551) and there was no difference detected for these outcomes.<sup>381</sup> [evidence level 1a]

A case-control study of 48 cases of fascial dehiscence after CS described risk factors for dehiscence using stepwise logistic regression and did not find transverse incisions to have a lower risk of dehiscence than vertical incisions.<sup>382</sup> [evidence level 3]

An observational study (n = 89) reported on women's perceptions of the cosmetic outcome of scar formation after either percutaneous or subcuticular sutures for CS. They found that the factor that impacted most on women's perception of scar appearance was whether the scar was midline or transverse with transverse being more favoured.<sup>383</sup> [evidence level 2b]

Pfannenstiel, Maylard and Joel Cohen all described transverse abdominal wall incisions used for CS. The Pfannenstiel incision consists of a curved skin incision, two fingers breadths above the symphysis pubis, transverse incision of the sheath, rectus muscles are separated bluntly and the parietal peritoneum is incised is the midline. Maylard incision is similar but the rectus muscles are cut transversely with a knife. The Joel Cohen incision is a straight skin incision 3 cm above the pubic symphysis, then subsequent layers are opened bluntly and if necessary extended with scissors and not a knife.<sup>384</sup>

Four RCTs have compared different transverse incisions for CS. Two RCTs compared Pfannenstiel incision with the Joel Cohen incision. Both RCT's reported that the Joel Cohen incision is associated with shorter operating time (SMD -0.29 minutes, 95% CI -0.54 and -0.04<sup>385</sup>; SMD -0.87 minutes, 95% CI -1.28 and -0.46).<sup>386</sup> Both RCTs also reported reduced postoperative febrile morbidity with the Joel Cohen incision (Pooled RR 0.35, 95% CI 0.19 to 0.64).<sup>385,386</sup> [evidence level 1b] Two RCTs compared Pfannenstiel with Maylard incisions and showed no difference in terms of operative and postoperative morbidity.<sup>387,388</sup> [evidence level 1b]

### RECOMMENDATIONS

CS should be performed using a transverse abdominal incision because this is associated with less postoperative pain and an improved cosmetic effect compared to a midline incision.

**B**

The transverse incision of choice should be the Joel Cohen incision (straight skin incision, 3 cm above the symphysis pubis; subsequent tissue layers are opened bluntly and if necessary extended with scissors and not a knife), because it is associated with shorter operating times and reduced postoperative febrile morbidity.

A

### Instruments for skin incision

No RCTs have addressed which instruments should be used for skin incision at CS. An RCT that included patients undergoing elective general surgical compared 'one versus two scalpels' technique (first scalpel for the skin and the second scalpel for deeper tissue) (n = 277). This RCT did not detect any difference in wound infection.<sup>389</sup> [evidence level 1b] No other outcomes were reported. An experimental study showed that scalpels remained sterile after skin incision supporting the view that there was no need to discard the skin scalpel to prevent wound infection.<sup>390</sup> [evidence level 3]

Two general surgical RCTs comparing abdominal entry using a scalpel with electrocautery did not detect any difference in any wound outcomes such as infection and strength. However the time required for the incision and incisional blood loss was less with electrocautery.<sup>391,392</sup> [evidence level 1b]

Another RCT compared incision using a surgical knife with diathermy at cholecystectomy (n = 200).<sup>393</sup> The results from this RCT showed that postoperative pain at 4, 8, 12, 16 and 24 hours and the need for morphine analgesia was less in the diathermy group. [evidence level 1b] This RCT did not assess the impact of diathermy on time to surgically open the abdomen.

### RECOMMENDATION

The use of separate surgical knives to incise the skin and the deeper tissues at CS is not recommended because it does not decrease wound infection.

B

### RESEARCH RECOMMENDATION

RCTs are needed to evaluate the effectiveness of incisions made with diathermy compared with surgical knife in terms of operating time, wound infection, wound tensile strength, cosmetic appearance and women's satisfaction with the experience.

### Extension of the uterine incision

In the UK 53% of clinicians use blunt dissection to extend the uterine incision and 47% use sharp dissection.<sup>306</sup> [evidence level 3] Two RCTs have compared sharp versus blunt extension of the uterine incision at CS.<sup>394,395</sup> [evidence level 1b]

One RCT (n = 945) reports that sharp extension is associated with greater estimated blood loss (886 ml versus 843 ml, p = 0.001); greater change in haematocrit (6.1% vs. 5.5%, p = 0.003); incidence in postpartum haemorrhage (13% vs. 9%, RR 1.23, 95% CI 1.03 to 1.46) and need for transfusion (2% vs. 0.4%, RR 1.65, 95% CI 1.25 to 2.21).<sup>394</sup> [evidence level 1b]

The other RCT (n = 286) found no difference between sharp and blunt extension for the outcomes of unintended extension, postoperative endometritis, duration of surgery or estimated blood loss.<sup>395</sup> [evidence level 1b] This RCT was however underpowered to detect a difference in these outcomes. It was not possible to meta analyse the data from these two RCTs because the outcomes are measured and reported differently in the trials.

Stapling devices can be used during incision of the uterus to decrease the blood loss from the cut edges of the uterine wall. They are not commonly used in the United Kingdom. A systematic review that included four RCTs (n = 526 women)<sup>396</sup> reported no difference in the total operating time between the groups which used a stapling device and those that did not (weighted mean difference: 1.17 minutes, 95% CI -3.57 minutes to 1.22 minutes). However stapling devices increased the time to deliver the baby (weighted mean difference 0.85 minutes, 95% CI 0.48 minutes to 1.23 minutes). Blood loss was less with the use of staples (weighted mean difference 41.22 ml, 95% CI -50.63 ml to -31.8 ml). There was no difference for other perinatal outcomes. These RCTs were funded by the manufacturers of surgical staples. [evidence level 1a]



### RECOMMENDATION

When there is a well formed lower uterine segment, blunt rather than sharp extension of the uterine incision should be used as it reduces blood loss, incidence of postpartum haemorrhage and the need for transfusion at CS.

A

### Fetal laceration

The RCTs comparing sharp to blunt extension of the uterine incision do not report on incidence of trauma to the neonate, however three descriptive studies report on the incidence of fetal lacerations at CS. One study was from the UK<sup>397</sup> [evidence level 3] and two of the studies were from the US (115).<sup>398</sup> [evidence level 3] The UK study reports an incidence of fetal lacerations of 1.5% which is similar to the US studies (1.9% and 0.74% respectively). The UK study reported that the incidence of lacerations was independent of type of CS (emergency or elective), fetal presentation cervical dilatation and operator grade. One US study reported that the incidence of lacerations increased to 6% with a non-cephalic presentation.<sup>399</sup> [evidence level 3]

### RECOMMENDATION

Women who are having a CS birth should be informed the risk fetal lacerations at CS is about 2%

C

### Use of forceps

The use of forceps at CS has been suggested as a method of easing delivery of the fetal head, particularly for preterm infants or when the lower segment of the uterus is poorly formed.<sup>400</sup> [evidence level 3]

A small RCT (n = 44) of women undergoing elective repeat CS were randomised to vacuum, forceps or manual delivery of the fetal head.<sup>401</sup> [evidence level 1b] There was no difference detected between the groups in the incidence of extension of the uterine scar, maternal blood loss or neonatal outcomes (including neonatal injuries). However women in the vacuum group reported less pain. The trial is however underpowered to evaluate these outcomes. [evidence level 1b]

### RECOMMENDATION

Forceps should only be used at CS if there is difficulty delivering the babies head. The effect on neonatal morbidity of the routine use of forceps at CS remains uncertain.

C

### Cord clamping

Suggested benefits of delayed cord clamping include decreased neonatal anaemia; better systemic and pulmonary perfusion; and better breastfeeding outcomes. Possible harms are polycythaemia, hyperviscosity, hyperbilirubinaemia, transient tachypnoea of the newborn and risk of maternal fetal transfusion in rhesus negative women.<sup>402</sup>

One RCT based in the UK randomised women having a vaginal birth to either early or delayed cord clamping (n = 554). There was no difference detected in the duration of cord adherence, neonatal or maternal outcomes.<sup>403</sup> [evidence level 1b]

Two RCTs have compared the likelihood of infant anaemia between delayed and early cord clamping in preterm neonates delivered by CS. The trials use different outcome measures.<sup>404,405</sup> [evidence level 1b] One of the RCTs, from Germany (n = 40)<sup>404</sup> reports that delayed cord clamping of 45 seconds results in a reduced need for packed cell transfusions during the first six weeks of life (RR 3.33, 95% CI 1.07 to 10.03). The second RCT from Australia (n = 46)<sup>405</sup> found no difference in infant haematocrit between the two groups. Both RCT's found delayed cord clamping to be feasible at CS. Both RCTs were underpowered for the outcomes measured.

### RESEARCH RECOMMENDATION

RCTs are needed to determine the effect of delayed cord clamping on neonatal outcomes including transient tachypnoea of the newborn and risk of maternal fetal transfusion in rhesus negative women for term and preterm births.

### Use of uterotonics

The licensed dose of oxytocin for CS is 5 iu by slow intravenous injection.<sup>353</sup> Oxytocin is used to ensure uterine contraction, minimise delay in delivering the placenta, reduce intra operative blood loss and prevent postpartum haemorrhage. A survey of UK lead obstetric anaesthetists<sup>406</sup> (n = 179) reports that 87% gave 10 units at CS, half of them administered this by rapid bolus injection.<sup>406</sup> [evidence level 3] The risks of Syntocinon® (oxytocin), especially given by rapid injection, have been highlighted.<sup>95</sup> Oxytocin has a direct relaxant effect on vascular smooth muscle. Under normal circumstances there is a reflex tachycardia and increased cardiac output that accompanies the transient decrease in blood pressure. The hypovolaemic woman may not respond in the normal way and in some circumstances profound hypotension may occur with resultant compromise of cardiac function.<sup>95</sup>

Five RCTs have compared the use of different uterotonics at CS. Uterotonics used in these RCTs include- oxytocin, oxytocin with ergometrine, misoprostol and prostaglandin F<sub>2α</sub>. No placebo controlled RCTs were identified. The use of ergometrine at uncomplicated CS is not common practice in the UK and therefore the RCT that included ergometrine is not discussed further.<sup>406</sup> [evidence level 3]

One RCT (n = 40) compared oxytocin administered as an intravenous bolus of 5 iu compared with intramyometrial injection of 20 iu. This is not a licensed dose or route of administration. The intramyometrial injection was associated with more hypotension (mean decrease in systolic blood pressure one minute after oxytocin was 8.4mmHg in the intravenous group and 14.6mmHg in the intramyometrial group, p < 0.001).<sup>407</sup> [evidence level 1b]

Another RCT (n = 321) compared different oxytocin infusion concentrations (20 iu/l versus 160 iu/l). The results showed that the lower concentration group had more need for additional uterotonics (39% vs. 19%, p < 0.001). There was no difference in the incidence of hypotension between the two groups.<sup>408</sup> [evidence level 1b]

One small RCT (n = 40) compared oxytocin to misoprostol orally and found no difference between the two uterotonics.<sup>409</sup> Misoprostol has not been found to be as effective as oxytocin for preventing postpartum haemorrhage after vaginal birth in large multicentred RCTs.<sup>410</sup> [evidence level 1b]

Another RCT (n = 60) compared prophylactic administration of intravenous oxytocin and intramyometrial prostaglandin and detected no difference in mean estimated blood loss between the two uterotonics.<sup>411</sup> [evidence level 1b]

Oxytocin (Syntocinon) has a short half life (4–10 minutes). Carbetocin is an oxytocin derivative which has a longer half life of 40 minutes.<sup>412</sup> Two published RCTs (n = 694 + n = 40) have compared 100 microgrammes carbetocin with an 8-hour oxytocin infusion.<sup>413,414</sup> The oxytocin regimen is not that recommended within this guideline. Only 1 RCT (n = 57) measured estimated blood loss and there was no difference detected between the groups.<sup>413</sup> [evidence level 1b] The other RCT reported surrogate measures such as need for additional oxytocic.<sup>414</sup> The RCTs were funded by the companies that produce carbetocin. Carbetocin is licensed in the UK but is yet to be launched. The basic NHS price is expected to be in the region of £12–15 per vial (information supplied by manufacturers) this compares to oxytocin which costs about £1.40 for a 5-iu or 10-iu vial.<sup>353</sup>

Excessive haemorrhage or uterine atony can occur at CS despite the use of prophylactic uterotonics. Haemorrhage is an important cause of maternal mortality. However it is outside the scope of this guideline to address the management of obstetric haemorrhage.

### RECOMMENDATION

Oxytocin 5 iu by slow intravenous injection should be used at CS to encourage contraction of the uterus and to decrease blood loss.

C

### Method of placental removal

Nine RCTs have studied the effect of method of placental removal. Three of these are included in a systematic review.<sup>415</sup> Eight of the RCTs considered blood loss and endometritis<sup>416,417</sup> and one RCT

only looked at fetomaternal haemorrhage<sup>418</sup>. Feto-maternal transfusion does not appear increased by manual removal of the placenta (RR 0.37, 95% CI 0.13 to 1.07).<sup>418</sup> [evidence level 1b]

The methods of placental removal described in each of the RCTs are manual removal of the placenta compared to controlled cord traction or spontaneous separation of the placenta. In current UK practice, the controlled cord traction is used more frequently (73%) compared to manual removal of the placenta (25%).<sup>306</sup> [evidence level 3]

A meta-analysis of five of the RCT that reported data for endometritis was undertaken. The meta analysis showed an increased incidence of endometritis with manual removal of the placenta compared to spontaneous separation (RR 1.54, 95% CI 1.23 to 1.92) [evidence level 1a]. The definition of endometritis was similar across the different RCTs (temperature of greater than 38° C, tender uterus, raised leucocyte count and offensive lochia). In four of the six RCTs all women received prophylactic antibiotics. In one RCT no antibiotics were given<sup>417</sup> [evidence level 1b] and in the other RCT there was variable use of antibiotics.<sup>419</sup> [evidence level 1b] All of these RCTs used routine administration of intra operative uterotonics.<sup>417,419-422</sup> [evidence level 1b]

Three RCTs reported blood loss as an outcome measure.<sup>416,417,421</sup> Meta analysis of these RCTs showed no difference between manual removal and spontaneous separation of the placenta (SMD 0.62ml, 95% CI -1.17ml to 2.4 ml) [evidence level 1b].

Three RCTs reported on the effect of changing gloves after manual removal of the placenta and found no difference in the likelihood of post-CS endometritis (RR 1.1, 95% CI 0.75 to 1.47,<sup>423</sup>; RR of 1.0, 95% CI 0.79 to 1.3,<sup>422</sup> and RR 1.2, 95% CI 0.5 to 2.8)<sup>419</sup> [evidence level 1b].

### RECOMMENDATION

At CS, the placenta should be removed using controlled cord traction and not manual removal as this reduces the risk of endometritis.

A

### Exteriorisation of the uterus

A survey of current surgical practice in the UK reports that 69% of surgeons rarely exteriorise the uterus for repair at CS, 18% 'sometimes do so' and 13% usually exteriorise the uterus.<sup>306</sup> [evidence level 3] Four RCTs compare exteriorisation to intraperitoneal repair, two of the RCTs are included in a systematic review,<sup>424</sup> the other two RCTs were published after the systematic review.<sup>425,426</sup> All four RCTs report on blood loss and wound infection however this is measured differently across the trials (such as total units of blood transfused in each group, mean change in haematocrit per group, peri-operative change in haemoglobin and mean drop in haemoglobin between the two groups) Three RCTs detected no difference in blood loss between the groups.<sup>427,428,425</sup> [evidence level 1b] The fourth RCT detected a reduction in haemoglobin drop if the uterus is exteriorised (SMD 0.2 g/dl 95% CI 0.03 g/dl to 0.51 g/dl) however there was no difference in blood transfusion rates or surgeon's estimates of blood loss.<sup>426</sup> [evidence level 1b]

Two RCTs reported on the proportion of women in each group that had blood transfusion. The meta analysis of this outcome showed no difference in rate of blood transfusion between the two groups (RR 1.17, 95% CI 0.43 to 3.19).<sup>425,426</sup> [evidence level 1b]

Three RCTs reported on wound infection. The meta-analysis showed no difference in wound infection between the two groups (RR 0.48 95% CI 0.18 to 1.29).<sup>425-427</sup> [evidence level 1b]

One RCT assessed nausea, vomiting, sensation of tugging and pain scores at the end of the procedure and found no difference between the two groups. All of the women had CS under regional anaesthesia. However two women in the exteriorised group had their epidural converted to general anaesthetic due to pain.<sup>426</sup> [evidence level 1b] The other RCT reported intra operative nausea, vomiting and intra operative pain and found no difference in these outcomes between the groups. Daily pain scores were measured from day 1 to day 5 postoperatively. Pain scores were higher in the exteriorisation group on day 3. A postal questionnaire was used to assess pain scores and satisfaction with the CS experience at six weeks. No difference was found in mean satisfaction scores or persistent pain.<sup>425</sup> [evidence level 1b]

**RECOMMENDATION**

Intraperitoneal repair of the uterus at CS should be undertaken. Exteriorisation of the uterus is not recommended because it is associated with more pain and does not improve operative outcomes such as haemorrhage and infection.

A

**One- vs. two-layer closure of uterus**

One-layer closure of the uterus at CS has been suggested as a means of decreasing operating time with no associated or subsequent increase in morbidity. Current practice in the UK reports that 96% of surgeons use a double layer closure and 3% a single layer.<sup>306</sup> [evidence level 3]

A systematic review compares single versus two-layer suturing for closing the uterine incision at CS.<sup>429</sup> [evidence level 1a] Two RCTs were included in the review (n = 1006). These RCTs measured different outcomes. One RCT (n = 906) analysed operating time and number of haemostatic sutures.<sup>430</sup> [evidence level 1b] The results showed a shorter mean operating time of 5.6 minutes (43.8 versus 47.5 minutes, p = 0.0003) and fewer haemostatic sutures in the one layer closure group.

In the second RCT all the women had hystero-graphy to determine integrity of the uterine scar 3 months after the CS in the first half of the menstrual cycle.<sup>431</sup> [evidence level 1b] In the control group (two-layer closure) 82% of cases had either a major or minor scar deformity and in the intervention group (one layer closure) scar deformity was lower (26%). The method of randomisation in this RCT is unclear and the clinical significance of the hystero-graphy findings as an outcome measure is uncertain.

The two RCTs have been published after the systematic review. Both assessed operating time as an outcome measure. One RCT (n = 188) found no difference in operating time<sup>432</sup> [evidence level 1b] and the other RCT (n = 200) found a decrease in operating time with single layer closure of the uterus, the absolute difference was 12 minutes.<sup>433</sup> [evidence level 1b]

These four RCTs used slightly different methods of single layer closure, two RCTs describing the use of continuous unlocked suture of the uterus, one RCT used continuous locked sutures while another RCT used interrupted sutures. The two later RCTs both used vicryl suture material, one of the earlier RCTs used chromic catgut and one RCT did not describe what suture material was used. None of the RCTs directly compared locked versus unlocked sutures.

Concern about the use of single layer closure of the uterus and scar rupture in future pregnancies have been raised by a cohort study (n = 2142) that reported an increase likelihood of uterine rupture in women who had had a single layer closure of the uterus (OR 3.95, 95% CI 1.35 to 11.49).<sup>434</sup> [evidence level 2b] Follow up of the women recruited in one of these RCTs has also been reported.<sup>435</sup> Of 164 subsequent births, 19 women had elective repeat CS and 145 experienced labour. Length of labour, mode of birth, incidence of uterine scar dehiscence and other labour outcomes were not significantly different between those women who had had previous one or two layer closure.<sup>435</sup> [evidence level 2a] Closure of the uterus is currently being studied in a large UK RCT (CAESAR).<sup>436</sup>

**RECOMMENDATION**

The effectiveness and safety of single layer closure of the uterine incision is uncertain. Except within a research context the uterine incision should be sutured with two layers.

B

**Closure of the peritoneum**

Closure of the peritoneum (visceral and parietal) has formed part of standard surgical practice and aimed to restore anatomy, reapproximate the tissues and reduce infection by forming an anatomical barrier. Current UK practice reports that 66% of surgeons do not close the parietal peritoneum while 34% do close the parietal peritoneum.<sup>306</sup> [evidence level 3]

A systematic review comparing non-closure with closure of the peritoneum at CS includes four RCTs (n = 1194).<sup>437</sup> [evidence level 1a] Two RCTs compared closure to non-closure of both visceral and parietal peritoneum,<sup>438,439</sup> one RCT compared closure to non-closure of the visceral

peritoneum only<sup>440</sup> and one RCT compared closure with non-closure of the parietal peritoneum only.<sup>441</sup> Overall, non-closure of the peritoneum saved operating time (weighted mean difference of 6.12 minutes, 95% CI –8.00 to –4.27) with no significant differences detected in postoperative morbidity, analgesic requirements or length of hospital stay [evidence level 1a].

Since the review 7 RCTs comparing closure of both visceral and parietal peritoneum with non-closure of peritoneum have been published.<sup>441–447</sup> [evidence level 1b] Four RCTs (n = 845 women) considered a wide range of morbidity measures as well as operating times.<sup>442–445</sup> All consistently found operating times to be less with non-closure of the peritoneum. Three RCTs found no difference in morbidity measures between the closure and non-closure groups.<sup>442,444,445</sup> One RCT suggested fewer postoperative complications.<sup>443</sup> Three RCTs assess the effect on postoperative pain.<sup>441,446,447</sup> [evidence level 1b] All three trials report no difference in postoperative pain (assessed using a visual analogue scoring (VAS)),<sup>441,446,447</sup> decreased use of analgesia after 24 hours with non-closure<sup>441</sup> and increased maternal satisfaction.<sup>447</sup> None of the RCTs reported long term outcomes related to healing and scarring or implications for future surgery.

### RECOMMENDATION

Neither the visceral nor parietal peritoneum should be sutured at CS as this reduces operating time, the need for postoperative analgesia and improves maternal satisfaction.

A

### Closure of the abdominal wall

We did not identify any RCTs that looked at closure of rectus sheath at CS. A meta-analysis (15 RCTs) has evaluated methods of abdominal-wall closure for midline incisions in general surgical patients (n = 6566). The main outcome measures were incidence of hernias, wound dehiscence, wound infection, wound pain and suture sinus formation. Incisional hernias were less common with continuous slowly absorbable sutures compared with continuous rapidly absorbable suture or non absorbable suture. Wound pain and sinus formation was more common with non absorbable sutures.<sup>448</sup> [evidence level 1a]

A meta-analysis of RCTs comparing mass versus layered closure of midline incisions in general surgical patients found less incisional hernias and dehiscence to be less common with mass closures.<sup>449</sup> [evidence level 1a] Midline incisions are not commonly used for CS, however there is no direct evidence on this issue so for midline incisions at CS we have extrapolated the research evidence from general surgical trials. Further research is needed on this topic for transverse abdominal incisions.

### RECOMMENDATION

In the rare circumstances that a midline abdominal incision is used at CS, mass closure with slowly absorbable continuous sutures should be used because this results in fewer incisional hernias and less dehiscence than layered closure.

B

### RESEARCH RECOMMENDATIONS

RCTs are required to determine the effectiveness of mass closure compared to layered closure of the abdominal wall incision at CS particularly for transverse abdominal incisions.

Research is required to assess the effect of the various surgical techniques for CS on future surgery such as repeat CS and the incidence of complications during future surgery such as hysterectomy and urogynaecological procedures.

### Closure of subcutaneous tissue

Current practice in the UK for closure of the subcutaneous layer varies between obstetricians: 42% never close it; 21% always close; 8% only close if the layer is thin; 28% close if the layer is thick.<sup>306</sup> [evidence level 3]

Four RCTs have compared suturing of the subcutaneous tissue with no suturing at CS. Two RCTs randomised all women undergoing CS to suture or non-suture of the subcutaneous tissue space. One RCT found no difference in terms of wound infection or risk of wound separation.<sup>450</sup>

[evidence level 1b] The other RCT reported suturing to be protective against wound separation (0.36, 95% CI 0.14 to 0.91) however the method of randomisation and hence the quality of the RCT is not clear.<sup>451</sup> [evidence level 1b]

Two further RCTs<sup>452,453</sup> (n = 76, n = 91) randomised women with at least 2 cm subcutaneous fat. Meta analysis of these RCTs showed that closure of the subcutaneous space decreased the incidence of wound complications (RR 0.42, 95% CI 0.22 to 0.81). [evidence level 1a]

### RECOMMENDATION

Routine closure of the subcutaneous tissue space should not be used, unless the woman has more than 2 cm subcutaneous fat, because it does not reduce the incidence of wound infection.

A

### Use of superficial wound drains

Five RCTs (n = 1211) have compared the routine use of superficial wound drains in CS to their selective use.<sup>452,454–457</sup> [evidence level 1b] Each RCT measured slightly different parameters for the outcomes of infection and blood loss. There was no significant difference in wound infection, formation of haematoma, duration of hospital stay or need for analgesia between the groups.

One small RCT (n = 76) included women with more than 2cm of subcutaneous fat randomised into three groups. Group 1 had suture closure of subcutaneous tissue, group 2 had a subcutaneous closed suction drain and group 3 the control group had neither.<sup>452</sup> Use of a subcutaneous drain was associated with reduced incidence of wound complications compared with controls (RR 10.2, 95% CI 1.4 to 72.9) and reduced incidence of wound infection or separation (RR 7.4, 1.0, 54.8). This is a small trial and these findings could be due to chance.<sup>452</sup> [evidence level 1b]

We did not identify any evidence on the routine use of subrectus drains at CS.

### RECOMMENDATION

Superficial wound drain should not be used at CS because they do not decrease the incidence of wound infection or wound haematoma.

A

### RESEARCH RECOMMENDATION

More RCTs are needed to determine the effect of wound drainage of postoperative morbidity especially in women more at risk of this outcome such as obese women.

### Closure of the skin

A systematic review that includes one RCT (n = 66) compares subcuticular polyglycolic suture with staples for closure of a Pfannenstiel skin incision.<sup>458,459</sup> [evidence level 1b] They found that women with wounds closed using staples had more postoperative pain and the cosmetic effect was seen as less favourable by women. Staples took less time than subcuticular sutures (47 seconds versus 605 seconds, p < 0.001).

A nonrandomised controlled study compared percutaneous with intracutaneous (subcuticular) sutures and reported women's perceptions of the cosmetic appearance of scar formation after CS. They found that there was no difference between percutaneous and intracutaneous (subcuticular) sutures and that the factor that impacted most on women's perception of scar appearance was whether the scar was midline or transverse and the transverse scar was preferable.<sup>383</sup> [evidence level 2a]

We did not identify any studies that looked at removal of staples or sutures or wound suture pain.

### RECOMMENDATION

Obstetricians should be aware that the effects of different suture materials or methods of skin closure at CS are not certain.

C

## RESEARCH RECOMMENDATION

More RCTs are needed to determine the effect of staples compared to subcuticular sutures for skin closure at CS on postoperative pain, cosmetic appearance and removal of sutures and staples.

### Umbilical artery pH measurement

Umbilical artery pH, neonatal Apgar and neonatal encephalopathy are the most reliable short term markers of poor longer term outcome such as neurodevelopment disability, cerebral palsy and perinatal death.<sup>2</sup> Guidelines on electronic fetal monitoring recommend that umbilical artery pH is assessed following emergency CS<sup>2</sup> and paired umbilical artery and vein measurements are taken. [evidence level 4] This information can be used to review fetal wellbeing and to guide on-going care. It is can also be used for risk management and audit purposes.

## RECOMMENDATION

Umbilical artery pH should be performed after all CS for suspected fetal compromise to allow review of fetal wellbeing and guide ongoing care of the baby.

**B**

### Use of antibiotics

Infectious complications after birth are an important cause of maternal morbidity and can prolong length of hospital stay.<sup>460</sup> These include wound infection, postpartum endometritis and urinary tract infection.

Six RCTs (n = 2566) that compare planned CS to planned vaginal birth report on infection as a maternal morbidity outcome measure.<sup>38–40,43,44,48</sup> The incidence of infection was 6.4% for women in the planned CS group compared with 4.9% in the planned vaginal birth group. In the largest RCT the protocol suggested prophylactic antibiotics should be used at CS<sup>48</sup>. There was no information on the use of antibiotics in the other RCTs. No difference was detected in rate of infection between the two groups (pooled RR 1.29 95% CI 0.97, 1.72). [evidence level 1a]

Five RCTs comparing planned CS with planned vaginal birth reported on maternal puerperal pyrexia.<sup>39–42,45</sup> This was defined in one of the RCTs as temperature above 38°C.<sup>42</sup> Pyrexia can occur after any operative procedure and a low grade fever following a CS may not necessarily be a marker of infection. The pooled relative risk of puerperal pyrexia for women in the planned CS group was 1.96 (95% CI 1.36 to 2.84). [evidence level 1a]

Two cohort studies conducted in Israel<sup>461</sup> (n = 75,947) and the USA<sup>462</sup> (n = 33,251) examined the risk of infection according to mode of birth. In one study, the risk of infection was higher among women who had CS (7.9%) compared to those who had vaginal birth (1.8%) (RR 4.51 95% CI 4.00 to 5.09).<sup>462</sup> [evidence level 2b] The majority of infections were endometritis; wound infection among women who had CS. In the other cohort,<sup>461</sup> the incidence of postpartum endometritis among women who had CS was 2.6% compared to 0.2% among those who had vaginal births (RR 14.97, 95% CI 11.96 to 18.74);<sup>461</sup> [evidence level 2b] The incidence of wound infection following CS in this study was 4.0%.<sup>461</sup> The rates of wound infection were higher among women with gestational diabetes and those who had had previous CS.

In the UK 85% of surgeons usually administer prophylactic antibiotics, 12% do so if other factors are present and 3% rarely use them.<sup>306</sup> [evidence level 3]

One systematic review evaluates the use of antibiotic prophylaxis at CS on infectious complications.<sup>463</sup> This review included 81 RCTs (n = 11,957) of which 12 RCTs included women having elective CS (n = 2037), 23 RCTs included women having non-elective CS (n = 2132), 48 RCTs included women having either elective or non elective CS (n = 6788). In most trials antibiotic prophylaxis was administered intravenously after clamping of the umbilical cord. Overall the use of prophylactic antibiotics with CS results in a reduction in the incidence of episodes of fever (RR 0.45, 95% CI 0.39 to 0.52), endometritis (RR 0.39, 95% CI 0.34 to 0.43), wound infection (RR 0.41, 95% CI 0.35 to 0.48), urinary tract infection (RR 0.54, 95% CI 0.46 to 0.64) and serious infection (RR 0.42, CI 0.28 to 0.65). [evidence level 1a]

Maternal side effects were not consistently collected across the RCTs. There were 3 possible episodes in the placebo group and 16 in the antibiotic group, such as phlebitis or rash at the

intravenous infusion site. No serious drug reactions were reported. The effect on breast feeding and thrush in newborns being breastfed was not reported in any of the RCTs included in the systematic review.

Another systematic review<sup>464</sup> investigated the effectiveness of different antibiotic regimens. Fifty one RCTs were included. There is no advantage in using a multiple dose regimen compared with a single dose (OR 0.92, 95% CI 0.70 to 1.23). There was no difference in the efficacy of ampicillin compared with first generation cephalosporins (OR 1.27, CI 0.84 to 1.93), nor was there any difference between first generation compared with second or third generation cephalosporins (OR 1.21, 95% CI 0.97 to 1.51). [evidence level 1a]

Other methods to reduce infectious morbidity at CS have been investigated including RCTs on the use of intra abdominal lavage with saline,<sup>465</sup> intrauterine lavage with antibiotics,<sup>466</sup> preoperative skin preparation<sup>467</sup> and vaginal preparation with povidone iodine<sup>468</sup> none of which showed a difference in infectious morbidity [evidence level 1b]. Pelvic irrigation with antibiotic solution<sup>467</sup> and the use of intravaginal metronidazole<sup>469</sup> did show some difference in infectious morbidity but the numbers were small. [evidence level 1b] We did not find any RCTs looking at the postoperative prophylactic use of antibiotics after CS.

### Economic considerations for the use prophylactic antibiotics at CS

Where two antibiotics have the same efficacy, the less expensive antibiotic should be offered since there is no justification for the use of more expensive regimens. There is some economic evidence that a single dose of antibiotic is as effective as two- and three-dose regimens<sup>470</sup> and since the efficacy is the same, the lower cost regimen should be offered.

An economic evaluation study undertaken in the United Kingdom in the late 1980s suggested that there might be significant savings from the use of prophylactic antibiotics.<sup>471</sup> This evaluation was based on a model that used post-CS wound infection rates of 8.4% and 50–70% reduction in odds of wound infection with the use of prophylactic antibiotics. Using these assumptions in an economic model, the estimated additional average cost of hospital postnatal care for women with wound infection (compared with women who had had CS and no wound infection) was £716. Introducing routine prophylaxis with antibiotics would reduce average costs of postnatal care by between £1,300 and £3,900 per 100 CS, depending on the cost of the antibiotic used and its effectiveness. This analysis supports the use of prophylactic antibiotics after CS since this strategy dominates a no antibiotic strategy (due to lower cost, greater effectiveness).

A cost-effectiveness analysis of the cost per post-CS infection averted has not been undertaken in a United Kingdom setting.

### RECOMMENDATION

Women having a CS should be offered prophylactic antibiotics, such as a single dose of first generation cephalosporin or ampicillin, to reduce the risk of postoperative infections (such as endometritis, urinary tract and wound infection), which occurs in about 8% of women who have had a CS.

A

### RESEARCH RECOMMENDATION

RCTs are needed to determine the effect of the timing of administering antibiotics in relation to cord clamping on neonatal outcomes.

### Thromboprophylaxis for CS

Pregnancy is a risk factor for thromboembolic disease. The reported incidence of pulmonary thromboembolism is 6 per 10,000 maternities, this varies according to risk factors such as maternal age, obesity, smoking.<sup>472</sup> Pulmonary embolism is the leading direct cause of maternal death in the UK (estimate mortality rate of 1.45 per 100, 000 maternities.<sup>95</sup>

Thromboembolic disease is rare and is reported as an outcome measure in only one RCT of planned CS compared with planned vaginal birth, however within this trial there were no events in either group.<sup>48</sup>



A population-based cohort evaluated the risk of thromboembolism by mode of birth (n = 1,003,489) (1987–1995).<sup>473</sup> The risk of pulmonary embolism was increased for women who had CS compared with those who had vaginal birth (unadjusted RR 3.8 95% CI 2.0–4.9). [evidence level 2b] Within this cohort it is not known how many women in this study would have received thromboprophylaxis.

A systematic review of thromboprophylaxis during pregnancy and the early postnatal period was identified.<sup>474</sup> [evidence level 1a] The review included eight RCTs (n = 649) of which only four studies address the issue of thromboprophylaxis for CS (n = 350). The interventions evaluated in these trials include hydroxyethyl starch, heparin and placebo. Thromboembolic events are relatively rare so that although no differences were detected between the intervention and control groups this is probably because the trials are too small to evaluate these outcomes. There is a large RCT of thromboprophylaxis after CS in progress.<sup>475</sup> [evidence level 1b]

Currently available publications to guide practice on this issue recommend thromboprophylaxis for CS based on assessment of risk (such as emergency versus elective CS, maternal age over 35 years, weight greater than 80 kg, medical complication). Recommended thromboprophylaxis includes hydration, early mobilisation, graduated elastic compression stockings and low-molecular-weight heparin.<sup>476</sup> [evidence level 4] Data from the NSCSA shows that in current practice, thromboprophylaxis is used in 89% of emergency CS and 87% of elective CS.

## RECOMMENDATION

Women having a CS should be offered thromboprophylaxis as they are at increased risk of venous thromboembolism. The choice of method of prophylaxis (for example, graduated stockings, hydration, early mobilisation, low-molecular-weight heparin) should take into account risk of thromboembolic disease and follow existing guidelines.

D

### Need for further surgery (including hysterectomy)

Surgery immediately following birth can include manual removal of placenta, uterine curettage, and laparotomy (with or without hysterectomy). In the UK, the reported rate of peripartum hysterectomy is 6–7 per 10,000 deliveries.<sup>477,478</sup> In other well resourced countries the incidence (excluding elective hysterectomy) range from 4–15 per 10000.<sup>479–484</sup> These rates vary according to parity, number of previous CS and other conditions e.g. placenta praevia. In one UK survey about 2% of women required further surgery.<sup>485</sup>

The need for dilatation and curettage was reported in one RCT (n = 2082) that compared planned CS with planned vaginal birth. Dilatation and curettage was reduced in the planned CS group (0.3%) compared to the planned vaginal birth group (0.4%. RR 0.75, 95% CI 0.17 to 3.34)<sup>48</sup> [evidence level 1b]. Hysterectomy was reported in two RCTs.<sup>44,48</sup> In one RCT there were no events in either group.<sup>48</sup> In the other RCT<sup>44</sup> (n = 208), 1.1% of women in the planned CS group and none of the women in the planned vaginal birth group were reported to have this outcome.

One Australian cohort study (n = 29488) evaluated need for further surgery following childbirth.<sup>486</sup> The return to theatre rate for women who had a CS was 0.5% compared to 0.03% of women who had vaginal birth (unadjusted RR 17.53, 95% CI 9.37 to 32.1). [evidence level 2a] The main reason for further surgery in both groups was severe obstetric haemorrhage. 80% of women who had further surgery for haemorrhage following CS required a laparotomy compared to 27% of women who required surgery after vaginal birth for severe haemorrhage. The majority (73%) of women who had a vaginal birth with severe haemorrhage requiring surgery had uterine curettage.

Two cohort studies<sup>482,484</sup> conducted in the USA have compared rates of hysterectomy for women according to mode of birth. The rate of peripartum hysterectomy was higher among women who had CS (0.7–0.8%) compared with 0.01–0.02% among women who had vaginal birth (unadjusted RR 95.5 95% CI 67.7, 136.9;<sup>482</sup> unadjusted RR 43.97 95% CI 22.52 to 85.85).<sup>484</sup> The RR adjusted for placenta praevia was reported to be 10.8 (95% CI 7.6 to 15.4).<sup>482</sup> [evidence level 2a] In one of these studies, 19% cases of peripartum hysterectomy were in women who were in their first pregnancy. Data on rates of peripartum hysterectomy following primary CS were not reported in either of these studies.

### Maternal satisfaction during CS

A number of practices have been suggested to improve women's satisfaction with CS birth. These include seeing baby born via a lowered screen; music playing in theatre; silence at moment of birth in theatre so mother's voice is the first baby hears and lowering the lights at the moment of birth. We did not identify any RCT that evaluated the effectiveness of these changes in practice. Although no papers discuss the use of music during CS one experimental study (n = 65) describes the use of medical resonant music therapy as preoperative preparation for CS compared with women who received sedatives. The experimental group receiving music therapy had lower cortisol levels and noted better sleep and less need for analgesics postoperatively.<sup>487</sup> [evidence level 2b]

Case reports<sup>488</sup> [evidence level 3] and case series<sup>489</sup> [evidence level 3] report positive maternal attitudes towards music during labour in terms of pain relief and satisfaction. A non systematic review of literature on the efficacy of music therapy for premature infants suggest that music is associated with reduced length of hospital stay, improved weight gain and oxygen saturation level.<sup>490</sup> [evidence level 3]

A number of studies relate to hearing 'mother's voice' were identified. One (n = 10 babies) experiment showed that neonates were 'more likely to work' to produce their mother's voice than other female voices<sup>491</sup> [evidence level 3] and another experimental study (40 neonates) found that neonates responded more to their mothers voice than other female voices even when there was no post natal experience of the mothers voice.<sup>492</sup> [evidence level 3]

No other published evidence was found on other changes in practice to improve woman's satisfaction of CS birth. Personal communication from consumer groups suggest that this is an area that warrants further research due to woman's perceptions of the benefit of these practices.<sup>493</sup>

### RECOMMENDATION

Women's preferences for the birth, such as music playing in theatre, lowering the screen to see baby born, or silence so that the mother's voice is the first baby hears, should be accommodated where possible.

GPP

### RESEARCH RECOMMENDATION

More evaluation of interventions such as seeing baby born via a lowered screen; music playing in theatre; silence in theatre so mother's voice is the first baby hears and lowering the lights in theatre during CS are needed.

# 7. Care of the baby born by CS

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The perinatal mortality rate in England and Wales is 7.9 per 1000 total births.<sup>79</sup> The effect of CS on baby outcome is not a simple reciprocal relationship.<sup>494,495</sup> Perinatal mortality rate can decline in the presence of a low and stable CS rate or remain stable while the CS rate increases.<sup>494,496</sup> [evidence level 4] A cohort study (n = 11,702) reported neonatal mortality. No difference was detected in neonatal mortality between vaginal birth and CS however the study is underpowered to evaluate this outcome (RR 1.09, 95% CI 0.14 to 8.38).<sup>497</sup> [evidence level 2b]

## 7.1 Presence of paediatrician at CS

One cohort study reported of infants delivered by CS (using regional anaesthesia) were more likely to have a 1 minute Apgar of less than 4, (6.3%) compared with infants delivered vaginally (1.3%). RR 3.04 95% CI 1.80,5.13).<sup>497</sup> [evidence level 2b] Two descriptive studies list CS as one of the situations that require a paediatrician to be present at birth.<sup>498,499</sup> [evidence level 3] A series of 460 deliveries showed that there was higher incidence of neonatal resuscitation with elective CS deliveries compared to vaginal births. Similar results were found in two other studies as well.<sup>500,501</sup> Of the 59 emergency CS, 24 were for fetal distress of which 12 needed resuscitation. There is no difference in the need for resuscitation between babies with cephalic presentation born by CS (1.8%) and vaginal birth (2.7%) with no evidence of fetal distress.<sup>502</sup> [evidence level 3]

A large observational study from the USA (n = 3940) reported that infants born by CS with general anaesthesia are at an increased risk of having 1- and 5-minute Apgar scores of less than 7 when compared with those born by CS with regional anaesthesia (1-minute Apgar less than 7 RR 3.13, 95% CI 2.5 to 3.88. 5-minute Apgar RR 3.6, 95% CI 1.81 to 7.00) and the need for resuscitation (RR 2.02, 95% CI 1.39 to 2.9)<sup>317</sup> [evidence level 3]. These findings are consistent with those in the NSCSA.<sup>290</sup>

### RECOMMENDATION

An appropriately trained practitioner skilled in the resuscitation of the newborn should be present at CS performed under general anaesthesia or where there is evidence of fetal compromise.

C

## 7.2 Neonatal encephalopathy and cerebral palsy

There are a number of causes of cerebral palsy and probably only about 10% are related to intra partum events.<sup>503</sup> The majority of neurological pathologies causing cerebral palsy occur as a result of multi factorial and mostly unpreventable reasons during either fetal development or the neonatal period.<sup>504,503</sup> It is therefore not surprising that ecological studies do not show an association between high CS rates and low cerebral palsy rates.<sup>505</sup> [evidence level 3] The impact of CS on cerebral palsy was assessed in a systematic review. The review identified 10 studies none of which found a difference in the rates of cerebral palsy, abnormal neurological development between children born by CS or vaginal birth. The studies were in groups at “high risk” of these outcomes (such as preterm birth, breech).<sup>505</sup> [evidence level 3]

Another cohort study considers the effect of CS on severe neurological morbidity including cerebral palsy.<sup>100</sup> There was an increased risk of severe neurological morbidity in those delivered

by CS (unadjusted RR 1.81, 95% CI 1.56 to 2.11). [evidence level 2b] A case–control study compared 164 babies with neonatal encephalopathy compared with 400 babies that did not have neonatal encephalopathy (controls). Babies that had neonatal encephalopathy were more likely to have had instrumental vaginal delivery (OR 2.34, 95% CI 1.16 to 4.70), emergency CS (OR 2.17, 95% CI 1.01 to 4.64) and less likely to have had elective CS (OR 0.17, 95% CI 0.05 to 0.56).<sup>506</sup> [evidence level 3]

#### RESEARCH RECOMMENDATION

Further evaluation of the long and short term risks and benefits of CS compared with vaginal birth for babies is required.

### 7.3 Birth injuries

The benefits of CS for specific groups such as term breech, or preterm birth are discussed in Chapter 4. The evidence on the comparative risk of birth injuries in term singleton cephalic infants is limited to one large audit of birth records looking at mode of birth and intracranial injury<sup>507</sup> and one case–control study looking at brachial plexus injuries.<sup>508</sup>

In the audit, 583,340 live born singleton infants born to nulliparous women, weighing between 2500 g and 4000 g over a two year period were studied. Breech presentations were excluded. Neonates were grouped according to mode of birth. The incidence of intracranial haemorrhages was 0.01% in the ‘CS during labour’ group compared to 0.05% in the ‘spontaneous’ vaginal birth group (OR 2.1, 95% CI 1.6 to 2.7). It was 0.04% in the ‘CS before labour’ group (OR 0.7, 95% CI 0.4 to 1.3).<sup>507</sup> [evidence level 3]

The case–control study compared all modes of birth including assisted vaginal deliveries<sup>508</sup> for risk of brachial plexus injury in 106 cases of Erb’s palsy and 382 controls. No difference between CS and vaginal birth could be found for brachial plexus injuries once controlled for birth weight and presentation (OR 0.5, 95% CI 0.1 to 1.9). [evidence level 3]

### 7.4 Thermal care for babies born by CS

Descriptive studies report that babies born by CS have lower body temperatures<sup>509,510</sup> [evidence level 3]. Standard care includes a warm environment for the newborn. We did not identify any studies that address the specific requirements for thermal care for babies born by CS. One RCT showed that fathers can effectively achieve heat conservation in healthy newborn infants.<sup>511</sup> [evidence level 1b] Skin-to-skin contact for women and their newborn babies is addressed in Section 7.3.

#### RECOMMENDATION

Babies born by CS are more likely to have a lower temperature, and thermal care should be in accordance with good practice for thermal care of the newborn baby.

GPP

#### RESEARCH RECOMMENDATION

Research is required to establish the thermal care requirements for babies born by CS.

### 7.5 Maternal contact (skin to skin)

A systematic review was identified that looked at early skin-to-skin contact for women and their healthy babies.<sup>512</sup> Sixteen RCTs and one quasi-randomised trial were included (n = 806). Two of these RCTs included women having CS. The methodological quality of 12 of the included RCTs was poor. Overall, early skin-to-skin contact was associated with higher rates and longer duration of breastfeeding (OR 2.15, 95% CI 1.10 to 4.22. WMD 41.99, 95% CI 13.97 to 70.0)

reduced infant crying (OR 21.89, 95% CI 5.2 to 92.3) and higher score summary score of maternal affection. There were no apparent negative effects. One RCT included only women having CS and used three different instruments to evaluate the impact of early contact (within 12 hours of birth) on maternal perceptions of their infant, mothering skills and maternal behaviour. They found significant differences between the groups that had early versus late or limited (after 12 hours) contact and found early skin-to-skin contact to be of benefit. However, these differences were less marked one month after birth.<sup>513</sup> [evidence level 1b]

#### RECOMMENDATION

Early skin-to-skin contact between the woman and her baby should be encouraged and facilitated because it improves maternal perceptions of their infant, mothering skills, maternal behaviour, breastfeeding outcomes, and reduces infant crying.

A

## 7.6 Breastfeeding

At least 70% of women express a preference for a birth that would give them the best start to breastfeeding.<sup>4</sup> The RCTs that compare planned vaginal birth with planned CS include only women with small, preterm or term breech babies. Three RCTs<sup>40,42,514</sup> measure uptake of breastfeeding either as rates of breastfeeding at discharge from hospital or as “any attempt at breastfeeding”.<sup>40,42,514</sup> Overall, no difference was detected between the two groups (Pooled RR 0.94, 95% CI 0.89 to 1.00). [evidence level 1a].

One RCT<sup>514</sup> also surveyed women at three months to ask if breastfeeding had been initiated at any time and if they were currently breastfeeding. At three months no difference in breastfeeding rates was detected between the groups. (Planned CS group 68%, planned vaginal birth group 70% RR 0.98, 95% CI 0.92 to 1.05). [evidence level 1b]

In the non intention to treat analysis, 73–77% of women who had a vaginal birth and 65–67% of those who had CS, had breastfed at three months after birth.<sup>514</sup>

Six relevant population studies were identified.<sup>515–520</sup> These included diverse populations from several countries including one from the UK.<sup>515</sup> In this latter study (n = 202), breastfeeding rates were 76% among those who delivered vaginally and 39% among those who had a CS. [evidence level 2a] Rates of breastfeeding vary markedly between countries from around 30% in Hong Kong<sup>518</sup> to more than 90% in Scandinavia.<sup>519,520</sup> [evidence level 2a] In all studies rates of initiation of breastfeeding were higher in women who had had a vaginal birth compared to those having a CS. Two of the studies<sup>517,519</sup> followed women up for 3 months, and one<sup>519</sup> followed women up for 6 months. There was no difference in breastfeeding rates according to mode of birth at either 3 or 6 months. [evidence level 2a]

#### RECOMMENDATIONS

Women who have had a CS should be offered additional support to help them to start breastfeeding as soon possible after the birth of their baby. This is because women who have had a CS are less likely to start breastfeeding in the first few hours after the birth, but, when breastfeeding is established, they are as likely to continue as women who have a vaginal birth.

A

# 8. Care of the woman after CS

Common complications and the estimated frequency with which they occur are shown in Table 3.a.

## HDU/ITU admission

Maternal mortality is rare. In the UK it is 11.4/100,000 maternities,<sup>95</sup> [evidence level 3] the direct maternal mortality rate from all causes is 1/20,000 maternities. The mortality rate for women who have vaginal deliveries is 16.9/million compared to 82.3 per million for women who have CS (RR 4.9, 95% CI 2.96 to 7.97).<sup>95</sup> However it was not possible to determine the proportion of the increased risk that is attributable to antecedent conditions or the procedure itself. The incidence of severe morbidity for women giving birth has been reported to be 12 per 1000 deliveries.<sup>292</sup> A small proportion of women (0.1–0.9%) develop complications of pregnancy that require admission to an Intensive Therapy Unit (ITU)<sup>521</sup>. HDU/ITU admission was not reported as an outcome in any of the RCTs.

In the NSCSA, 10% of women who had CS required special care postoperatively within a high dependency unit, 3.5% of these women were transferred to an intensive care unit.<sup>4</sup> [evidence level 3]

Table 8.1 shows the proportion of women who had CS and required admission to an intensive care unit according to the reason for the CS.

We identified one case control study that examined risk factors associated with intensive care unit admission during hospital stay for childbirth among women in U.S.A between 1984 and 1997 (n = 2046).<sup>522</sup> The overall rate of admission to ICU was 0.13%. The odds of admission to ICU was significantly higher for women who had CS compared with those who had vaginal birth, after adjustment for socio demographic factors (age and ethnicity) and type of hospital (OR 9.0, 95% CI 7.24 to 11.16). [evidence level 3] However it is not possible to disentangle the effect of CS from the reasons for CS when interpreting these results. A UK study that evaluated the risk of severe obstetric morbidity has not been included here because the comparison groups are between women who had emergency CS to women who had either elective CS or vaginal births.<sup>292</sup> [evidence level 3]

## RECOMMENDATION

Health professionals caring for women after CS should be aware that, although it is rare for women to need intensive care following childbirth this occurs more frequently after CS (about 9 per 1000).

**B**

**Table 8.1** Admission to intensive care unit (ICU) according to reason for CS (n = 29,349)

Reason for CS	Admission to ICU (%)	OR (95% CI)
Breech	0.2	1.00
Placenta praevia, actively bleeding	2.5	16.6 (5.3 to 52.2)
Placenta praevia, not actively bleeding	1.1	7.0 (2.2 to 22.1)
Placental abruption	1.1	7.2 (1.7 to 30.4)
Pre-eclampsia/eclampsia/HELLP	1.9	12.4 (4.3 to 35.5)
Maternal medical disease	2.7	17.8 (6.4 to 49.2)
Uterine rupture	6.4	43.3 (9.9 to 189.5)

## 8.1 Routine monitoring after CS

There were 3 deaths in the last CEMD triennium report in which poor postoperative care was a contributing factor. The importance of monitoring the patient adequately postoperatively was emphasised.<sup>95</sup> [evidence level 3] Earlier triennial reports recommended electronic monitoring of oxygen saturation levels.<sup>523</sup> [evidence level 3] UK obstetric anaesthesia guidelines suggest that the postoperative care of a CS patient should be in accordance with the care of any postoperative patient as laid out in guidelines for postanesthetic recovery.<sup>311</sup> [evidence level 4]

After CS, women should be observed on a one-to-one basis by an anaesthetist, recovery nurse, midwife or other properly trained member of staff until they have regained airway control and cardiorespiratory stability and are able to communicate. All recovery rooms must be staffed to a level which allows this to be routine practice. Women must be kept under clinical observation at all times and all measurements must be recorded. The introduction of automatic recording systems is encouraged. The frequency of recordings will depend on the stage of recovery and clinical condition of the patient. As a minimum non-invasive blood pressure, heart rate and rhythm, respiratory rate and continuous pulse oximetry every 5 minutes for the first 30 minutes in recovery ('recovery' refers to any area where the patient is cared for immediately postoperatively and is not limited to a specific recovery room. The following information should be recorded:

- level of consciousness
- haemoglobin saturation and oxygen administration
- blood pressure
- respiratory frequency
- heart rate and rhythm
- pain intensity e.g. verbal rating scale
- intravenous infusions
- drugs administered.

Other parameters depending on circumstances e.g. temperature, urinary output, central venous pressure, end tidal CO<sub>2</sub>, surgical drainage.

For all women, the name, hospital number, time of admission, time of discharge and destination should be recorded in a central register.

Women with epidural or intrathecal analgesia will need additional observations including pain and sedation scores, respiratory rate and mobility which should be laid out in individual hospital protocol. This recording will normally be continued after discharge from the recovery area. It is generally accepted that after discharge from the recovery area to the ward, observations (respiratory rate, heart rate, blood pressure, pain and sedation) should be continued every half hour for two hours and hourly thereafter provided that the observations are stable or satisfactory. If these observations are not stable, more frequent observations and medical review are recommended.

For women who have had intrathecal opioids, there should be a minimum hourly observation of respiratory rate, sedation and pain scores for at least 12 hours for diamorphine and 24 hours for morphine. For epidural opioids and opioid PCA, there should be routine hourly monitoring of the latter throughout the duration of the treatment plus a further period of at least 2 hours after discontinuation.

An ECG, nerve stimulator, thermometer and capnograph should be readily available as well as facilities for resuscitation and emergencies. Women should only be discharged from the recovery area once they have been assessed by a trained recovery staff member and should be taken to the postoperative ward with all of their case notes. In addition no patient should be returned to a general ward unless control of emesis and postoperative pain is satisfactory. After the first 30 minutes postoperatively if the patient is stable then observations are carried out and documented half hourly, 2 hourly and then 4 hourly.<sup>324,524</sup> [evidence level 4]

### RECOMMENDATIONS

After CS, women should be observed on a one-to-one basis by a properly trained member of staff until they have regained airway control and cardiorespiratory stability and are able to communicate.

D

After recovery from anaesthesia observations (respiratory rate, heart rate, blood pressure, pain and sedation) should be continued every half hour for two hours and hourly thereafter provided that the observations are stable or satisfactory. If these observations are not stable, more frequent observations and medical review are recommended.

GPP

For women who have had intrathecal opioids, there should be a minimum hourly observation of respiratory rate, sedation and pain scores for at least 12 hours for diamorphine and 24 hours for morphine.

GPP

For women who have had epidural opioids or patient controlled analgesia with opioids, there should be routine hourly monitoring of respiratory rate, sedation and pain scores throughout treatment and for at least 2 hours after discontinuation of treatment.

GPP

## 8.2 Pain management after CS

In the UK, intrathecal analgesia, patient controlled analgesia, local anaesthetic wound infiltration and nonsteroidal anti-inflammatory agents are commonly used for analgesia post-CS.

### Intrathecal analgesia

Key issues related to intrathecal analgesia post-CS are which drug and dose to use as most side effects (particularly with morphine) are dose related.<sup>525</sup> [evidence level 3] Morphine was commonly used until diamorphine was shown to be a useful alternative.<sup>526</sup> [evidence level 1b] One RCT comparing intrathecal morphine with normal saline (n = 60) reported that the group given intrathecal morphine had less pain as measured by visual analogue scale (VAS) at 4 and 24 hours postoperative (p < 0.05) and morphine consumption was lower (p < 0.01).<sup>527</sup> [evidence level 1b]

The documented side effects of intrathecal morphine include itching, nausea and vomiting. Alternative intrathecal opioids have been used more frequently because they have fewer reported side effects. One RCT (n = 40) comparing intrathecal diamorphine with intrathecal morphine reported no difference in VAS for pain or overall PCA morphine use. However VAS for itching and drowsiness were higher in the morphine group.<sup>528</sup> [evidence level 1b]

Two RCTs have evaluated using intrathecal diamorphine in order to reduce the use of other analgesics. One RCT (n = 40) randomised women to either 0.3 mg of intrathecal diamorphine or normal saline (all women then had patient controlled analgesia via a morphine pump). Outcomes used were time to request for first analgesia and total morphine used. Both time to first analgesia (218 minutes versus 136.3 minutes, p < 0.05) and total morphine used were less in the group that received intrathecal diamorphine.<sup>529</sup> [evidence level 1b] The second RCT (n = 40) used 0.3 mg of intrathecal diamorphine post spinal anaesthesia for CS. The women then used morphine PCA. The median amount of PCA morphine used over 24 hours was less in the group that received the intrathecal diamorphine (5 mg versus 45 mg, p < 0.05) and the time to request for first morphine dose was less (340 minutes versus 80 minutes, p = 0.0006).<sup>530</sup> [evidence level 1b]

One RCT (n = 80) of women undergoing elective CS with spinal anaesthesia randomised to receive one of four doses of intrathecal diamorphine for post-CS analgesia (0.125 mg, 0.25 mg, 0.375 mg, or saline). The optimal intrathecal dose of diamorphine for intrathecal post-CS analgesia is reported to be between 0.25 mg and 0.375 mg. Nausea and pruritus increased as dose increased.<sup>531</sup> [evidence level 1b] Higher doses than this have also been suggested because the minimum dose of intrathecal diamorphine required to prevent intraoperative supplementation of spinal anaesthesia for CS is 0.4 mg.<sup>532</sup>

Epidural diamorphine 2.5 mg to 5 mg is an alternative to intrathecal diamorphine as a significant proportion of emergency CS (34%) are carried out using epidural anaesthesia.<sup>312</sup> [evidence level 3] This has been evaluated in 2 RCTs. One RCT (n = 50) showed no difference in the duration and quality of analgesia between intrathecal or epidural diamorphine. There was no difference in the incidence of pruritis between the two groups but there was a higher incidence of nausea



and vomiting in the epidural group (24% vs. 4%,  $p < 0.05$ ).<sup>533</sup> [evidence level 1b] The other RCT ( $n = 53$ ) comparing epidural with intrathecal diamorphine reported that time to first request for morphine and side effects were similar between the two groups but VAS pain scores and additional morphine consumption was higher in the intrathecal group ( $p = 0.03$  and  $p = 0.03$  respectively).<sup>534</sup> [evidence level 1b]

Another RCT compared intramuscular administration of diamorphine and four epidural regimens for the administration of diamorphine. Time to next analgesia was shorter in the intramuscular group when compared to any of the epidural groups (3.53 hours vs. 5.7,  $p = 0.007$ ).<sup>535</sup> [evidence level 1b]

A small American cost-effectiveness study was identified that evaluated the addition of intrathecal morphine to a regimen of oral analgesia. The effectiveness data was gathered retrospectively for 55 patients. The comparator was patient controlled analgesia. There was no synthesis of costs and benefits. The authors reported that the mean intrathecal morphine cost US\$15 (1997 prices) compared with US\$35 for patient controlled analgesia. Nursing time was also significantly reduced for intrathecal analgesia patients. Since there were no reported differences in pain control or side-effects, the study concluded that the addition of intrathecal morphine was a less expensive and less time consuming and therefore the more cost-effective option.<sup>536</sup>

### Patient-controlled analgesia

Patient-controlled analgesia (PCA) is either epidural patient-controlled analgesia (EPCA) or via an infusion pump device. In the UK EPCA is not common practice post-CS and hence is not considered here

We did not identify any RCTs that evaluate the effectiveness of PCA compared to other forms of analgesia after CS. We identified two RCTs that compared different drugs for PCA after CS using a pump device. One RCT ( $n = 77$ ) compared morphine alone to morphine combined with alfentanil for PCA. The group with alfentanil and morphine scored higher on a written questionnaire in terms of speed of onset of effectiveness of analgesia but there were no differences in terms of grading for duration of analgesia or overall satisfaction.<sup>537</sup> [evidence level 1b] The other RCT compared morphine to fentanyl and found no difference in patient satisfaction or provision of effective analgesia over 37 hours.<sup>538</sup> [evidence level 1b]

### Wound infiltration with local anaesthetic

Three RCTs evaluated the use of wound infiltration and nerve blocks for post-CS analgesia specifically. One RCT ( $n = 45$ ) used 20 mls of 0.1% bupivacaine infiltrated into the CS wound. They randomised the women into three groups: one group had general anaesthetic and wound infiltration; one group regional anaesthetic and wound infiltration and one group general anaesthetic only. They reported that the two groups that had wound infiltration did not use any pethidine in the first 6 hours postoperatively compared to the group with no infiltration in which all the women needed at least one dose of pethidine within the first 6 hours.<sup>539</sup> [evidence level 1b]

Another RCT ( $n = 62$ ) compared the effectiveness of bilateral ilioinguinal nerve block and wound infiltration with 0.5% bupivacaine for postoperative analgesia after CS. Mean VAS scores and mean papaveretum (morphine derivative) requirements were compared at 4, 8, 12, 16, 20 and 24 hours post-CS. Mean VAS scores for the ilioinguinal block group were reduced compared to control at 4, 8, 12, 20 and 24 hours and papaveretum requirements were less at 4, 8, 12 and 20 hours. Mean VAS scores for the wound infiltration group were reduced compared with the control group at 4 and 12 hours and papaveretum requirements less at 4, 8 and 12 hours ( $p < 0.05$ ).<sup>540</sup> [evidence level 1b]

A review of 26 RCTs, ( $n = 1211$ ) evaluating the effectiveness of wound infiltration with local anaesthetic in a range of general surgical abdominal operations. Outcome measures were pain scores, supplementary analgesics and time to first analgesic requirements. Overall the study did not find any effect of local anaesthetic wound infiltration for postoperative pain.<sup>541</sup> [evidence level 1a]

### Non-steroidal anti-inflammatory analgesia

Non-steroidal anti-inflammatory drugs (NSAIDs) are used together with other modalities of pain relief after CS mainly to reduce the need for morphine based analgesics. We considered evidence on NSAID preparations available in the UK.

Two RCTs looked at the analgesic sparing effect of rectal NSAIDs suppository (diclofenac) administered immediately post-CS. In one RCT (n = 50) there was no difference in the VAS scores but the time to request for first analgesia was prolonged with rectal NSAID from 13 hours 45 minutes in the placebo group to 18 hours 58 minutes in the study group ( $p < 0.03$ ).<sup>542</sup> [evidence level 1b] The other RCT (n = 45) used the amount of PCEA as an outcome measure as well as VAS scores of pain. Women who received the rectal NSAID used less PCEA local anaesthetic solution (52.8 ml) compared to the control group (74 ml). There was no difference in VAS pain scores.<sup>543</sup> [evidence level 1b]

Another RCT (n = 50) administered the NSAID (75 mg diclofenac) intramuscularly to women who were using morphine based PCA post-CS. The women who had the NSAID consumed less morphine via the PCA than the control group (mean at 18 hours post-CS was 61.4 mg compared with 91.4 mg).<sup>544</sup> [evidence level 1b]

### Complications following regional anaesthesia

In England and Wales 77% of emergency and 91% of elective CS are performed with regional anaesthetic (spinal or epidural).<sup>4</sup> [evidence level 3] Information on anaesthetic complications in the UK is not routinely collected other than serious complications resulting in mortality.<sup>95</sup> A prospective multi disciplinary audit in the UK reported that epidural analgesia contributes to a neurological complication in 1/13,007 women.<sup>545</sup> [evidence level 3] The National Obstetric Anaesthetic Database reported incidence of headache ranged from 1.1% to 1.9% between all anaesthetic techniques and increased to 11% for women receiving multiple regional anaesthetics.<sup>546</sup> [evidence level 3] Unpublished data from a UK audit of 517,455 deliveries including 135,546 epidurals for analgesia and anaesthesia described complications rates associated with regional anaesthesia. 1/5000 (0.02%) epidural catheters are sited in the epidural vein; 1/3000 (0.034%) are sited in the intrathecal space; total spinal block occurs in 1/20,000 (0.005%) epidurals and 1/4000 (0.025%) subdural bleeds occur.<sup>547</sup> [evidence level 3]

An audit of epidural related complications from Australia reports rates of complications for regional anaesthesia as follows: need for re insertion of epidural catheter 4.7%; hypotension after epidural for CS 28%; inadequate block 1.7%; conversion to general anaesthetic 0.5%. Serious complications are relatively rare: unexpected high block 0.07%; high block requiring intubation 0.02% respiratory depression 0.06% and local anaesthetic toxicity 0.04%.<sup>548</sup> [evidence level 3]

### RECOMMENDATIONS

Women should be offered diamorphine (0.3–0.4 mg intrathecally) for intra- and postoperative analgesia because it reduces the need for supplemental analgesia after a CS. Epidural diamorphine (2.5–5 mg) is a suitable alternative.

A

Patient controlled analgesia using opioid analgesics should be offered after CS as it improves pain relief.

GPP

Providing there is no contraindication, nonsteroidal anti-inflammatory drugs should be offered post-CS as an adjunct to other analgesics, because they reduce the need for opioids.

A

### RESEARCH RECOMMENDATION

Further research is needed to determine the effect of wound infiltration with local anaesthetic at CS on the need for post-CS analgesia.

### 8.3 Early eating and drinking after CS

A systematic review compared early with delayed oral fluids and food after CS and included 6 RCTs. Three RCTs were limited to CS with regional anaesthesia; the other 3 RCTs included both regional and general anaesthesia. The intervention groups varied (either allowing immediate access to fluids and food within 6–8 hours if the woman was hungry or thirsty). The comparison groups delayed oral intake for a minimum of 12 hours to 24 hours, or to the presence of bowel sounds and graduated intake. Early eating and drinking was associated with reduced time to return of bowel sounds (1 RCT,  $n = 118$ ; weighted mean difference of  $-4.3$  hours, 95% CI  $-6.78$  hours to  $-1.82$  hours) and reduced postoperative hospital stay (2 RCTs,  $n = 220$ ). There was no difference between the intervention and control groups with respect to nausea, vomiting, abdominal distension, time to bowel action, paralytic ileus and number of analgesic doses.<sup>549</sup> [evidence level 1a]

#### RECOMMENDATION

Women who are recovering well and who do not have complications after CS can eat and drink when they feel hungry or thirsty.

A

### 8.4 Urinary catheter removal after CS

Urinary bladder catheters are commonly used during CS to prevent damage to the bladder during surgery. The effect of urinary bladder catheterisation at CS on has been described in a prospective survey ( $n = 8402$ ) as a risk factor for postpartum urinary retention.<sup>550</sup> [evidence level 3] Evidence to determine timing of removal of the urinary catheter and the value of routine indwelling catheterisation is currently under review.<sup>551</sup> We identified two RCTs on this topic. One RCT compared immediate catheter removal to removal of an indwelling catheter the next day in women who had a CS under general anaesthetic ( $n = 107$ ). They report no difference in incidence of urinary tract infection (RR 1.64, 95% CI 0.80 to 3.34) but more instances of urinary retention with intermittent catheterisation (39% vs. 0%).<sup>552</sup> [evidence level 1b] A small RCT compared urinary retention after CS with a general anaesthetic to urinary retention after CS with an epidural anaesthetic and found no difference.<sup>553</sup> [evidence level 1b]

Another RCT ( $n = 78$ ) compared removal of the urinary bladder catheter immediately post-operatively with removal the next day in women undergoing gynaecological (pelvic) surgery, 29 who had CS. They found no difference in the incidence of urinary tract infection, urinary retention or fever but the method of randomisation is unclear and data given in the paper is incomplete.<sup>554</sup> [evidence level]

#### RECOMMENDATION

Removal of the urinary bladder catheter should be carried out once a woman is mobile after a regional anaesthetic and not sooner than 12 hours after the last epidural 'top up' dose.

D

### 8.5 Respiratory physiotherapy after CS

One RCT ( $n = 120$ ) has evaluated the effect of respiratory physiotherapy after CS under general anaesthesia. The RCT did not detect a difference between the intervention group who had post-CS respiratory physiotherapy and the control group for coughing, phlegm, body temperature, chest palpation and auscultation.<sup>555</sup> [evidence level 1b]

#### RECOMMENDATION

Routine respiratory physiotherapy does not need to be offered to women after a CS under general anaesthesia, because it does not improve respiratory outcomes such as coughing, phlegm, body temperature, chest palpation and auscultatory changes.

A

**RESEARCH RECOMMENDATION**

Research is needed to establish the effect of non-respiratory physiotherapy for women following CS on post-CS recovery.

**8.6 Debriefing for women after CS**

A longitudinal study, based in Australia suggests that a high level of obstetric intervention during childbirth, such as emergency CS is associated with the development of acute traumatic symptoms in women postnatally.<sup>556</sup> [evidence level 3] Midwife led debriefing has been proposed to be of value in reducing the incidence of depression and anxiety after birth. A systematic review (11 RCTs) evaluating the effect of psychological debriefing on the prevention of post traumatic stress disorder (PTSD) in the general population reported that single session individual debriefing did not affect the incidence of PTSD at 3 to 5 months (6 RCT, n = 387, OR 1.22, 95% CI 0.60 to 2.46). and increased the likelihood of long term PTSD (after one year 2 RCTs, n = 238, OR 2.04, 95% CI 0.92 to 4.53).<sup>557</sup> [evidence level 1a] Only two of the included studies were in an obstetric setting.<sup>558,559</sup> Of these two trials, one was UK based (n = 129) and included primigravid women who had a normal vaginal birth. Women who received midwife debriefing were less likely to have high anxiety and depression scores after birth than women who did not (anxiety score OR 13.5, 95% CI 0.41 to 56.9; depression OR 8.5, 95% CI 2.8 to 30.9).<sup>559</sup> [evidence level 1b] The second RCT was from Australia (n = 1041) looked at the effect of midwife-led debriefing on maternal depression after operative childbirth. No difference was detected in depression scores (OR 1.24, 95% CI 0.87 to 1.77) or in the proportion of women who reported that depression had been a problem at six months after the birth (OR 1.37, 95% CI 1.00, 1.86)<sup>558</sup> [evidence level 1b]

Subsequently a further two RCTs have been published. One RCT (n = 103) tested opportunity to debrief at an initial postnatal interview (less than 72 hours postpartum) and 4–6 weeks postpartum to usual care. The RCT reported a high baseline prevalence of post-traumatic stress disorder (9.6% of women at 4 to 6 weeks postpartum). No difference was detected in the prevalence of symptom profile for PTSD immediately following debriefing or at 3 months. (RR 1.06, 95% CI 0.61 to 1.84). This is RCT is underpowered to detect a 2% difference in prevalence of symptoms of post-traumatic stress disorder.<sup>560</sup> [evidence level 1b] A recently published RCT (n = 1745) compared a midwife debriefing session within 72 hours of birth to usual care. No differences were detected between the groups for either stress disorders or depression (assessed EPDS and report of depressive illness).<sup>561</sup> [evidence level 1b]

**RECOMMENDATION**

Women who have had a CS should be offered the opportunity to discuss with their health care providers the reasons for the CS and implications for the child or future pregnancies.

GPP

**RESEARCH RECOMMENDATION**

More RCT evidence is required to determine the effect of midwifery-led debriefing following CS.

**8.7 Length of hospital stay and readmission to hospital**

Length of hospital stay after childbirth is declining, recent routine national statistics for England<sup>562</sup> suggest that women who have a spontaneous vaginal delivery spend on average 1 day in hospital, women who have an instrumental delivery spend 1 or 2 days in hospital and women who have a CS spend 3 or 4 days in hospital.

In one RCT<sup>48</sup> that compared planned CS with planned vaginal birth, the median length of hospital stay for women in the planned CS group was 4 days (5th centile 1.7 days, 95th centile 7.4 days). For women in the planned vaginal birth group it was 2.8 days (0.8, 6.9 days). The median length of stay reported in this RCT<sup>48</sup> is compatible with routine maternity statistics for the

U.K. In 3 RCTs<sup>38,39,42</sup> the length of hospital stay was reported as either greater or less than 10 days. On pooling these results, the relative risk of length of hospital stay greater than 10 days for women in the planned CS group was 1.27 (95% CI 0.35 to 4.65). [evidence level 1a]

### Readmission to hospital

Infection and bleeding constitute the main reasons for readmission to hospital following birth.<sup>563</sup> Two surveys of women in the postpartum period have estimated about 3% are readmitted to hospital for reasons related to their own health.<sup>563,564</sup>

Readmission to hospital was not included as an outcome measure in the RCTs of planned CS versus planned vaginal birth.

One prospective cohort study in Australia<sup>564</sup> examined rates of readmission to hospital within 8 weeks of birth. A higher proportion of women who had CS (5.3%) reported readmission to hospital compared to women who had vaginal birth (2.2%) (OR 2.46, 95% CI 1.11 to 5.43). [evidence level 2b] Similar findings were reported in a retrospective cohort study conducted in Washington USA<sup>565</sup> (n = 256,795). The age adjusted relative risk for rehospitalisation among women who had CS compared to those who had vaginal birth was increased (RR 1.8, 95% CI 1.6 to 1.9). [evidence level 2b]

Discharge from hospital after CS usually occurs on day 3.<sup>562</sup> [evidence level 3] A systematic review of early post natal discharge from hospital included eight RCTs but only two RCTs included women who had caesarean births, one of which is ongoing.<sup>566</sup> [evidence level 1a] The RCT (n = 61) randomised women having CS to either early hospital discharge and home follow up or usual hospital discharge (requires the woman to be ambulatory, voiding, tolerating a normal diet, passing flatus, normal uterine involution, afebrile for 24 hours, uncomplicated wound healing, removal of skin sutures or staples and an adequate blood count). Women in the intervention group were discharged when they met the same criteria other than afebrile for 24 hours and staple or suture removal. They report no difference in maternal or infant rehospitalisations, maternal affect or overall maternal functional status. Women in the early discharge group were more satisfied with care and had a 29% reduction in health care requests.<sup>567</sup> [evidence level 1b]

### RECOMMENDATION

Length of hospital stay is likely to be longer after a CS (an average of 3–4 days) than after a vaginal birth (average 1–2 days). However, women who are recovering well, are afebrile and do not have complications following CS should be offered early discharge (after 24 hours) from hospital and follow up at home, because this is not associated with more infant or maternal readmissions.

A

# 9. Recovery following CS

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Post natal advice for women who have had a CS includes general and specific advice. Specific advice includes advice on CS wound care, analgesia at home, when to resume normal activities such as driving, exercise and sexual intercourse and the provision of detailed information on possible risks associated with CS birth and possible complications. Information on the risk and benefits of CS should have been discussed prior to CS however they should be reiterated again. It is outside the scope of this guideline to consider general post natal advice. General advice has been developed and published as part of RCT(IMPACT study).<sup>568</sup> [evidence level 3]

## Pain

Antenatally about 60% women express a preference for a birth that is as pain free as possible and for a quick recovery.<sup>4</sup> Assessment of pain during the immediate postoperative period is not reported in any of the RCTs .One RCT (n = 1596) report on abdominal, perineal and back pain at three months after birth.<sup>514</sup> [evidence level 1b] Four cohort studies involving a total of 4749 women in Australia,<sup>564,569</sup> USA<sup>570</sup> and Scotland<sup>563</sup> reported on pain between 2 weeks to 18 months after birth.

Three months after delivery women who had planned CS were more likely to report pain in the abdomen (RR 1.76, 95% CI 1.24 to 2.50), and pain deep inside the abdomen (RR 1.89, 95% CI 1.29 to 2.79) than women who had planned vaginal birth at three months after birth. Not surprisingly perineal pain is reduced in women who have planned CS (RR 0.32, 95% CI 0.18 to 0.58).<sup>514</sup> [evidence level 1b] At three months after birth there is also no difference in reports of back pain (RR 0.93, 95% CI 0.71 to 1.22).<sup>514</sup> [evidence level 1b] Back pain is common, 22% to 50% of women surveyed report having back pain at either 8, 16 or 24 weeks after birth. Mode of birth has not been found to affect rates of back pain.<sup>563,564,569</sup> [evidence level 2b]

In cohort studies 60% of women who had a CS (either planned CS or CS in labour), reported having wound pain at 24 weeks after birth,<sup>563,564</sup> [evidence level 2b]

There is little direct evidence to guide prescribing practice of analgesia after discharge from hospital for women who have had a CS with no complications. Current guidelines on post-CS wound care suggest that for mild post-CS pain paracetamol (1000 mg four times daily) should be prescribed, for moderate pain co-codamol (1 to 2 tablets four times daily) and for severe pain co-codamol with added ibuprofen (500 mg twice daily).<sup>568</sup> [evidence level 3]

## Wound care

General CS wound care advice for women includes encouraging women to take prescribed analgesia, to complete antibiotics if prescribed, to wear loose comfortable clothes and cotton underwear, to bath or shower daily, to gently clean and dry the wound well (flannels or washcloths should be freshly laundered) and only apply dressings if advised by the doctor or midwife.<sup>568</sup> [evidence level 3]

## Infection

Evidence from cohort studies report an increased risk of postpartum endometritis among women who had CS compared to those who had spontaneous vaginal birth (RR 4.51, 95% CI 4.00 to 5.09).<sup>462</sup> [evidence level 2b] For this reason prophylactic antibiotics are prescribed during CS.<sup>463</sup> [evidence level 1a] Overall the impact of CS on risk of infection when antibiotics are used is less clear. No difference was detected in rates of infection between women randomised to have planned CS (6.4%) and planned vaginal birth (4.9%) (RR 1.29, 95% CI 0.97 to 1.72).<sup>48</sup> [evidence level 1a]

Midwives and doctors involved in post natal care of women who have had a CS should retain a high index of suspicion for wound infection, urinary tract infection and endometritis; they

should ask the woman about wellbeing and in particular any signs of fever; assess the wound for signs of infection, separation or dehiscence; discuss pain relief requirements and plan to remove sutures or clips when appropriate.<sup>568</sup> [evidence level 3]

### Urinary symptoms

Urinary symptoms in women who have had a CS are commonly due to urinary tract infection, but can be due to stress incontinence or rarely due to urinary tract injury.

Pregnancy and childbirth are established risk factors for urinary incontinence. Urinary incontinence is the involuntary loss of urine that becomes a social or hygienic problem.<sup>571</sup> [evidence level 4] Women who have had a CS may have urinary incontinence but the risk of incontinence following CS is reduced compared to women who have had a vaginal birth. (3 months following birth planned CS 4.5%, planned vaginal birth 7.3% (RR, 95% CI 0.62 0.41–0.93).<sup>514</sup> [evidence level 1b] Five cohorts also report an increased risk of urinary incontinence among women who have vaginal deliveries compared to those who have CS.<sup>572–576</sup> [evidence level 2b]. One cohort (n = 149) did not detect any difference in urinary incontinence at 9 weeks by mode of birth.<sup>577</sup> [evidence level 2b] Risk of incontinence increases following pregnancy (10% in the nulliparous women, 16% after CS and 21% after vaginal birth)<sup>574</sup> [evidence level 2b]

The estimated incidence of bladder injury in women delivered by CS is 0.1% and 0.003% in women delivered vaginally (RR 36.59, 95% CI 10.43 to 128.38) Ureteric injury occurred in 0.03% of women who had CS and in 0.001% women who had vaginal birth (RR 25.22, 95% CI 2.63 to 243.50).<sup>578</sup> [evidence level 3] In other studies the frequency is reported to range between 16 per million to 1%.<sup>579,578,580,581</sup> Risk factors include repeat CS and peripartum hysterectomy.<sup>580,582,583</sup> [evidence level 3] Two RCTs include bladder/bowel/ureteric injury as an outcome measure.<sup>44,48</sup> There were no events in either group in one RCT,<sup>48</sup> while in the other 1 of the 93 women in the planned CS group, and none of the 115 women in the planned vaginal birth group suffered this morbidity measure.<sup>44</sup> [evidence level 1b]

### Faecal incontinence

Faecal or anal incontinence has been defined as the involuntary leakage of solid or liquid faeces or gas.<sup>584</sup> One RCT (n = 1596) asked women about symptoms of incontinence of faeces and flatus three months following birth. No difference was detected between the groups. (incontinence of faeces 0.8% planned CS 1.5% planned vaginal birth group RR 0.54, 95% CI 0.18 to 1.62. Incontinence of flatus 10.7% planned CS, 9.7% planned vaginal birth RR 1.10, 95% CI 0.79 to 1.54).<sup>514</sup> [evidence level 1b] Non-intention-to-treat analysis was also not different.

Four cohort studies evaluated faecal or anal incontinence according to mode of birth. In two of these studies<sup>584,585</sup> no difference was detected in the prevalence of faecal incontinence among women who had CS and those who had vaginal birth. In the other two studies<sup>586,587</sup> none of the women who had CS were reported to have faecal incontinence. The prevalence of faecal incontinence among women who had vaginal deliveries in these studies ranged from 1% to 23%.

### Resuming activities

In one cohort study (n = 971) the extent to which bodily pain interfered with usual activities was measured 8 weeks after birth. Women who had CS were more likely to have bodily pain which interfered with usual activity.<sup>570</sup> [evidence level 2b] At six months pain limited physical activity among women who had either CS or assisted vaginal birth when compared with women who had spontaneous vaginal birth after birth. [evidence level 2b]

The Association of Chartered Physiotherapists in Women's Health (ACPWH) suggests that women who have had a CS should wait 8 to 10 weeks before commencing vigorous exercise. We did not identify any other guidance on exercise after a CS.<sup>588</sup> [evidence level 4]

The Driver and Vehicle Licensing Agency (DVLA) in their guide for medical practitioners as to current medical standards of fitness to drive do not specifically provide guidance on driving after CS. They provide a general statement on driving after any surgery that suggests that drivers wishing to drive after surgery 'should establish with their own doctors when it is safe to do so'.

They add that decisions regarding return to driving should consider recovery from the surgical procedure itself, recovery from the anaesthesia, distracting effect from the pain of the surgery and any resultant physical restrictions. [evidence level 4]

### Sexual intercourse

A study of women in their first pregnancy reported the prepregnancy prevalence of sexual problems to be 38%. Sexual morbidity increased in the first three months after birth to 83%, declining to 64% at 6 months after birth.<sup>589</sup> [evidence level 2b]

Sexual function after birth has been assessed in one RCT<sup>514</sup> and 4 cohort studies. The measures used to assess this included resumption of sexual activity after birth<sup>514,590</sup> and dyspareunia following birth.<sup>514,589,591</sup> One RCT evaluated sexual function at 3 months after birth and did not detect any difference between the two groups in the proportion of women who reported (i) not having sex since the birth (RR 1.12, 95% CI 0.89 to 1.42) or (ii) having pain during sex on the most recent occasion (RR 1.03, 95% CI 0.91 to 1.16).<sup>514</sup> [evidence level 1b]

One cohort study (n = 971) included women in their first pregnancy. No difference was detected between women who had CS and those who had vaginal birth (assisted or unassisted).<sup>570</sup> [evidence level 2b] A smaller study from the USA (n = 66) did not detect any difference in dyspareunia at 2–8 weeks postpartum between women who had CS and those who had vaginal birth.<sup>591</sup> [evidence level 2b] The third study reported that one month after birth women who had CS were more likely to have resumed intercourse than women who delivered vaginally.<sup>590</sup> [evidence level 2b] The fourth study reported that dyspareunia was associated with vaginal deliveries and previous experience of dyspareunia in the first 3 months after birth. At six months there was no difference detected in rates of dyspareunia according to mode of birth<sup>589</sup> [evidence level 2b]

### Breastfeeding

Rates of initiation of breastfeeding are higher among women who had vaginal birth compared with those who had CS, however, by three to six months after birth there is no difference in breast feeding rates between the two groups.<sup>514</sup> [evidence level 1b]

### Postnatal depression

The incidence of postnatal depression is estimated to be 13%.<sup>592,593</sup> Self report measures tend to yield higher estimates of postpartum depression than interview-based methods.<sup>593</sup> [evidence level 2b] Depression following childbirth has been assessed by various scales including the Edinburgh Postnatal Depression Scale (EPDS),<sup>592</sup> the Profile of Mood States (POMS),<sup>594</sup> the Beck Depression Inventory, the Zung Depression Scale and the Center for Epidemiological studies Depression scale.<sup>593</sup>

One RCT measured postnatal depression, at 6 weeks<sup>48</sup> (n = 2086) and 3 months<sup>514</sup> (n = 1596). Early postpartum depression occurred in 0.3% of women in the CS group and none in the planned vaginal birth group. It is therefore not possible to estimate a relative risk measure for this outcome. At 3 months no difference was detected in postnatal depression as defined by the Edinburgh Postnatal Depression scale (EPDS) between the groups (RR 0.93, 95% CI 0.70 to 1.24). [evidence level 1b]

Six observational studies have evaluated post natal depression and mode of birth. These studies were conducted in Scotland,<sup>563</sup> Australia,<sup>592,594,595</sup> USA<sup>596</sup> and Finland.<sup>597</sup> A variety of methods have been used to assess postnatal depression and the length of follow up varies between 2 weeks to 18 months. Two studies<sup>563,594</sup> report a higher prevalence of post natal depression among women who had a CS in the first two weeks after birth compared to those who had a vaginal birth. However, after 8 weeks postpartum, no difference was detected in the prevalence of postnatal depression between the two groups. [evidence level 2b]

### Post-traumatic stress disorder

None of the RCTs on planned mode of birth have evaluated the impact of this on post-traumatic stress disorder. Two cohort studies from Sweden examined the prevalence of post-traumatic stress



disorder between 1 month and 2 years postpartum. No difference was detected in the prevalence of post-traumatic stress disorder between women who had CS and vaginal birth. Compared with women who had vaginal birth, a higher proportion of women who had emergency CS (OR 6.3, 95% CI 2.0 to 20.2) and those who had assisted vaginal birth (OR 4.8, 95% CI 1.5 to 15.2) had post-traumatic stress disorder at 1–2 years after birth,<sup>598,599</sup> [evidence level 2b]

**Maternal satisfaction**

One RCT asked women at three months after birth about their likes and dislikes regarding the childbirth experience.<sup>514</sup> More women in the planned CS group indicated that they liked being able to schedule their birth (RR 1.99, 95% CI 1.66 to 2.40), liked that the childbirth experience was not very painful (RR 1.18, 95% CI 1.05 to 1.31) and felt reassured about their infant’s health (RR 1.13, 95% CI 1.06 to 1.20). However, fewer women in the planned CS group indicated that they ‘liked that birth was natural’ (RR 0.17, 95% CI 0.14 to 0.22), ‘liked actively participating in the birth’ (RR 0.37, 95% CI 0.31 to 0.44) and ‘liked that recovering from the childbirth experience was not difficult’ (RR 0.84, 95% CI 0.77 to 0.92). A similar proportion of women in both groups indicated that they ‘liked the method of birth that they had had’ or ‘felt reassured about their own health’. The proportion of women that reported that ‘there was nothing they liked about their childbirth experience’ was also similar in both groups. No difference was detected between the two groups with regards to either ‘ease in caring for their new infant’ or ‘adjusting to being a new mother’. Similar trends were seen for these outcomes in the non intention to treat analysis. [evidence level 1b]

One cross sectional study<sup>600</sup> surveyed women within a week of birth in Dublin, Ireland. The CS rate in this study was 10%. 91% of women who had vaginal birth compared with 33% of those who had CS reported that they would like a similar mode of birth for future pregnancies. [evidence level 3]

**Prolapse**

The prevalence of genital prolapse around the menopause has been estimated at 5%. In a case control study (n = 21,449) women attending menopause clinics were examined for uterine prolapse. Previous CS was associated with a 40% reduction in the risk of developing uterine prolapse (OR 0.6, 95% CI 0.5 to 0.8).<sup>601</sup> [evidence level 3] Another case control in the USA found that women who underwent surgery for uterovaginal prolapse were less likely to have had a CS.<sup>602</sup> [evidence level 3]

**RECOMMENDATIONS**

In addition to general postnatal care, women who have had a CS should be provided with:

- specific care related to recovery after CS
- care related to management of other complications during pregnancy or childbirth.

**GPP**

Women who have a CS should be prescribed and encouraged to take regular analgesia for postoperative pain, using:

- for severe pain, co-codamol with added ibuprofen
- for moderate pain, co-codamol
- for mild pain, paracetamol.

**D**

CS wound care should include:

- removing the dressing 24 hours after the CS
- specific monitoring for fever
- assessing the wound for signs of infection (such as increasing pain, redness or discharge), separation or dehiscence
- encouraging the woman to wear loose, comfortable clothes and cotton underwear
- gently cleaning and drying the wound daily
- if needed, planning the removal of sutures or clips.

**D**

Healthcare professionals caring for women who have had a CS and who have urinary symptoms should consider the possible diagnosis of:

- urinary tract infection
- stress incontinence (occurs in about 4% of women after CS)
- urinary tract injury (occurs in about 1 per 1000 CS).

D

Healthcare professionals caring for women who have had a CS and who have irregular vaginal bleeding should consider that this is more likely to be due to endometritis than retained products of conception.

D

Women who have had a CS are at increased risk of thromboembolic disease (both deep vein thrombosis and pulmonary embolism), so healthcare professionals need to pay particular attention to women who have chest symptoms (such as cough or shortness of breath) or leg symptoms (such as painful swollen calf).

D

Women who have had a CS should resume activities such as driving a vehicle, carrying heavy items, formal exercise and sexual intercourse once they have fully recovered from the CS (including any physical restrictions or distracting effect due to pain).

GPP

Healthcare professionals caring for women who have had a CS should inform women that after a CS they are not at increased risk of difficulties with breastfeeding, depression, post-traumatic stress symptoms, dyspareunia and faecal incontinence.

D

#### RESEARCH RECOMMENDATION

Further evaluation of the long and short term risks and benefits of CS compared to vaginal birth.

# 10. Pregnancy and childbirth after CS

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## 10.1 Implications of CS for future pregnancies

### Infertility

Infertility is defined as failure to conceive within 1–2 years of unprotected sexual intercourse. Most studies however have measured birth interval, reflecting future live birth rates and not rates of conception. These studies may not have been able to adjust for confounding factors such as use of contraception.

We found one systematic review<sup>603</sup> which included 8 cohort studies in Northern Europe and USA and one further cohort study<sup>164</sup> conducted in England which had addressed this question. Follow-up period in most studies ranged between 3.5 to 6 years, however one study had a follow up period between 1–19 years. Register information or interviews examined outcomes of at least one pregnancy, at least one live birth, all pregnancies, all live births, and fecundity. Almost all studies report that fewer women having a CS will subsequently have children/or will have less children, due to a combination of a lessened desire for, or an incapability of having children. There is a 46% increase in the risk of having no more children five years after primary CS (RR 1.46, 95% CI 1.07 to 1.99).<sup>164</sup> [evidence level 2b]

Sterilisation rates were higher after a CS in 3 studies. The increased risk ranged between 6% and 23%.<sup>604</sup> [evidence level 2b]

### Placenta praevia

We identified three recent cohort studies and an earlier systematic review. The incidence of placenta praevia in these studies ranges from 0.2%<sup>605</sup> to 0.5%<sup>606,607</sup> for women with a previous vaginal birth and 0.4%<sup>605</sup> to 0.8%<sup>607</sup> for women with a previous CS. These studies report a 30% to 60% increase in risk of placenta praevia in subsequent pregnancies for women who had had a previous CS compared to those who had had vaginal deliveries. Three case series<sup>608–610</sup> have reported on the incidence of placenta praevia and placenta accreta in women who have had previous CS. Overall the incidence of placenta accreta is estimated to be 1 in 2500 pregnancies, however there is no comparative data for the incidence in women who have not had previous CS.

The incidence of placenta praevia ranges from 0.2% to 0.5% for women with a previous vaginal birth and 0.4% to 0.8% for women with a previous CS. [evidence level 2b].

### Stillbirth

A large retrospective cohort study in Scotland (n = 120,633) investigated the association between previous CS and risk of stillbirth in subsequent pregnancies. The risk of antepartum stillbirth among women who had no previous CS was 2 per 1000 compared to 4 per 1000 among women who had a previous CS (hazard ratio 1.64, 95% CI 1.17 to 2.30). The risk of unexplained stillbirth associated with previous CS differed with gestational age, the excess risk was apparent from 34 weeks (hazard ratio 2.23, 95% CI 1.48 to 3.36).<sup>611</sup> [evidence level 2b]

## 10.2 Childbirth following CS

Nine percent of women giving birth in England and Wales have had a previous CS.<sup>4</sup> The CS rate was 67% for women who had had at least one previous CS. Repeat CS contributed 14% to the

overall CS rate. An increase in the percentage of women who have had a previous CS in a population will result in a disproportionate increase in the overall CS rate.

### VBAC rates

Vaginal birth after CS (VBAC) has been advocated as a means of reducing the CS rate, in the USA, a target VBAC rate of 40% and then more recently 37%<sup>612</sup> has been set. The VBAC rate in England and Wales was 33%.<sup>4</sup> VBAC with parity and birth history. Rates were highest in women who had one previous CS and at least one previous vaginal birth CS (51%). VBAC rates were lower in women who have not had a previous vaginal birth (1 previous CS and no vaginal birth VBAC 30%, 2 CS and no vaginal birth 4%) and in women who have had more than 1 CS (women who had two previous CS and a vaginal birth 8%).

A systematic review of observational studies evaluating indicators of success for VBAC identified 29 cohort studies. VBAC rates were higher in women who had previous vaginal birth, previous CS for breech. VBAC rates were lower in women who had previous CS for cephalopelvic disproportion, who had more than 1 previous CS or when oxytocin was used.<sup>613</sup> [evidence level 2b]

### Outcomes following VBAC

41 cohort studies. that compare maternal and baby outcomes for women with previous CS, according to planned mode of birth were identified. 35 of these studies were included in two systematic review articles.<sup>614,615</sup> Overall, the planned VBAC rate reported in these studies ranges from 21%<sup>616</sup> and 86%.<sup>617</sup> It was not always possible in the retrospective studies to determine the proportion of women who were offered but declined VBAC. In all of these studies, the selection criteria for either VBAC or elective repeat CS are unclear (e.g. women have self selected to have either VBAC or repeat elective CS). This could lead to systematic differences between the groups. The outcome measures of interest were uterine rupture, maternal morbidity and mortality, and perinatal morbidity and mortality.

### Uterine rupture and VBAC

Uterine rupture was defined as symptomatic rupture of the uterus, requiring surgical repair or extrusion of fetal parts.

Uterine rupture was evaluated in 39 studies. The incidence of uterine rupture ranges from 0/1000 to 28/1000 for women who underwent a planned vaginal birth and 0/1000 to 15/1000 for women who had elective repeat CS [evidence level 2b]. 28 studies report no difference in the relative risk of uterine rupture between planned vaginal birth and elective repeat CS. In six studies,<sup>607,618-621</sup> the risk for uterine rupture was higher with planned vaginal birth relative risks ranged from 1.88<sup>619</sup> to 24.11.<sup>620,618</sup> The relative risks from three larger well-conducted studies were also increased but the effect was smaller (RR 2.07, 95% CI 1.28 to 3.33,<sup>607</sup> RR 1.88, 95% CI 1.45 to 2.43,<sup>619</sup> and RR 3.87, 2.06 to 7.26).<sup>621</sup> In England and Wales (NSCSA), the relative risk of uterine rupture for women undergoing planned vaginal birth compared with women undergoing elective CS was 2.76 (95% CI 1.24 to 6.13) [evidence level 3]

These results are crude relative risks as there was not enough information reported to enable adjustment for other factors that may also be associated with uterine rupture such as maternal age and parity. Based on these results, the number of elective CS to prevent 1 uterine rupture ranged from 63<sup>620</sup> to 488<sup>607</sup> [evidence level 3].

One study reports a higher risk of uterine rupture for women who had induction of labour compared to those who had spontaneous onset of labour (RR 2.15, 95% CI 1.35 to 3.42). this increase was higher for women who received prostaglandins (RR 4.74, 95% CI 2.36 to 9.50). Further information about the risks and benefits of induction of labour can be found in the guideline on induction of labour.<sup>3</sup>

### Maternal morbidity and VBAC

The maternal morbidity measures were haemorrhage, need for hysterectomy, and infection.

Six cohort studies evaluated rates of haemorrhage between the elective CS and planned vaginal birth groups. Five of these detected no difference in haemorrhage more than 1000 ml,<sup>620,622-625</sup> and

one<sup>626</sup> reported that fewer women in the planned vaginal birth group had blood loss greater than 1000 ml.

Eight cohort studies evaluated rates of hysterectomy between the elective CS and planned vaginal birth. Six studies did not detect a difference between the two groups.<sup>618,624,626-629</sup> Two reported lower rates of hysterectomy for women in the planned vaginal birth group (RR 0.2, 95% CI 0.1 to 0.5<sup>630</sup>; RR 0.4, 95% CI 0.2 to 0.6).<sup>607</sup>

Five cohort studies evaluated rates of infection between the elective CS and planned vaginal birth. Three studies did not detect any difference between the two groups<sup>622,631,632</sup>. One study reported a higher rate of chorioamnionitis in the planned vaginal birth group (RR 3.0, 95% CI 1.9 to 4.9),<sup>626</sup> another study reported lower rates of infection in the planned vaginal birth group (RR 0.7, 95% CI 0.6 to 0.9).<sup>633</sup>

### Maternal mortality

Maternal mortality was included as an outcome measure in 18 studies. There was no maternal mortality reported among women who had an elective repeat CS. In three studies maternal deaths were reported in the planned vaginal birth group.<sup>607,629,634</sup> The maternal mortality rate among women who had a planned vaginal birth ranged from less than 1/10,000.<sup>607,634</sup> These latter 3 studies did not detect a difference in maternal mortality between the groups (RR 3.51, 95% CI 0.14 to 86.07),<sup>629</sup> (RR 1.95, 95% CI 0.08 to 47.80)<sup>607</sup> and (RR 1.09, 95% CI 0.04 to 26.75)<sup>634</sup> respectively. [evidence level 3]

### Perinatal mortality and VBAC

Perinatal mortality was included as an outcome measure in 26 studies. In 8 studies, there was no perinatal mortality. The incidence of perinatal mortality ranged from 0/1000 to 28/1000 for women having planned vaginal birth and 0 to 25 per 1000 for those having elective repeat CS. In 13 studies, there was no difference in the risk of perinatal mortality according to elective repeat CS or planned vaginal birth. In two studies,<sup>617,634</sup> the relative risk of perinatal mortality favours planned vaginal birth (RR 0.22, 95% CI 0.05 to 0.91;<sup>634</sup> RR 0.22, 95% CI 0.08 to 0.64).<sup>617</sup> In three others studies, the relative risk of perinatal mortality favours elective repeat CS (RR 2.14, 95% CI 1.04 to 4.34;<sup>607</sup> RR 11.62, 95% CI 1.56 to 86.56).<sup>635</sup> Perinatal mortality in the NSCSA also favoured elective repeat CS (RR 2.91, 95% CI 1.66 to 5.12). [evidence level 3]

The number of elective repeat CS to prevent 1 perinatal death ranged from 225<sup>4</sup> to 1001.<sup>607</sup> [evidence level 3]

### Perinatal morbidity and VBAC

Perinatal morbidity was measured using Apgar score, neonatal seizures, umbilical artery pH and transient tachypnoea of the newborn.

Two studies reported on umbilical artery pH as an outcome measure. In one study of 249 babies in Netherlands,<sup>622</sup> there was a significantly higher proportion of babies with umbilical artery pH less than 7.2 in the group that had planned vaginal birth compared to those delivered by elective CS (RR 3.87, 95% CI 1.46 to 10.24). [evidence level 3] In another study carried out in the USA involving 295 babies,<sup>636</sup> there was no difference in this outcome measure between the two groups. [evidence level 3]

Fifteen studies reported on 5-minute Apgar scores, the majority reported on proportion of babies with 5-minute Apgar score less than 7, however two studies used a cut off of 5<sup>616</sup> and 6.<sup>632</sup> In 10 of these studies, there was no difference in the proportion of babies with a 5-minute Apgar score less than 7 between the planned vaginal birth and elective CS groups. In three studies, there was a higher proportion of babies with 5 minute Apgar scores less than 7 in the planned vaginal birth group (RR 4.71, 95% CI 1.36 to 16.30),<sup>637</sup> RR 2.17, 95% CI 1.25 to 3.77),<sup>627</sup> RR 12.57, 95% CI 1.56 to 101.52).<sup>632</sup> [evidence level 3] Two studies reported on the incidence of neonatal seizures,<sup>620,638</sup> there was no difference in this outcome measure between the two groups. [evidence level 3]

Two studies<sup>620,639</sup> reported on incidence of transient tachypnoea of the newborn, there was no difference in this outcome between the groups. [evidence level 3]

### 10.3 Cost of VBAC compared with repeat CS

An early US study undertaken in 1981 suggested that if routine elective CS could be avoided this might represent a cost saving of around US\$5 million.<sup>640</sup> The key economic question is whether a policy VBAC leads to a higher enough proportion of successful vaginal deliveries for this policy to be adopted routinely. There are concerns that attempted planned vaginal birth that leads to emergency CS both increases the overall costs of birth since the costs are higher for emergency CS than planned repeat CS. If the VBAC rate is high, then a policy of a routine VBAC may reduce the number of unnecessary caesarean sections and reduce the overall cost of birth.

Five studies evaluating the cost-effectiveness of repeat CS versus VBAC were identified in the published literature. The first two studies produced overall cost estimates for VBAC and repeat CS. An Australian study examined the medical records of 198 women with previous CS<sup>641</sup> and reported that VBAC was less than half the cost of an emergency delivery following planned vaginal birth (A\$2,524 versus, A\$5,319), and emergency CS after TOL was more expensive than planned CS (A\$4,424). This difference in mean cost was mainly due to the cost of special care baby units which were, on average, almost three times higher for emergency CS following TOL than for VBAC (A\$914 versus A\$393). No statistical analysis was undertaken to explore the robustness of this cost data (how much variation there was in the data or the significance of the cost this difference). However, some of the additional expenditure associated with repeat CS may have been explained by the local policy of routine monitoring of infants in this group rather than costs associated with additional morbidity.

A US study undertaken in the same year examined hospital charges for 50 women who elected to have VBAC, 50 who elected to have a repeat CS and 50 women who had no history of CS in a previous birth.<sup>642</sup> The cost of planned vaginal birth appeared to be similar (although no confidence intervals were reported) regardless of the actual mode of birth (US\$5,820 for those who successfully delivered vaginally and US\$5,289 for the group who delivered by CS). However the cost of repeat CS was US\$6,785, a significantly higher cost than the TOL group ( $p < 0.0001$ ). Like the previous study, the cost of planned CS was lower than the costs of emergency CS after TOL.

These two studies considered the benefits to the mother or infant of TOL versus planned CS, and the analysis beyond a descriptive comparison of costs is limited. More recent studies have used modelling techniques to assess the costs alongside positive and adverse outcomes associated with different modes of birth after CS.

A US study used a decision analysis model to compare the costs of VBAC and elective repeat CS.<sup>643</sup> Data from 26,000 births were used in the model. The main outcome in the model was successful vaginal birth. The authors explored the costs of different modes of birth at various levels of success of VBAC. At a 70% success rate, the cost per successful birth was US\$2,611 for vaginal birth and US\$3,042 for planned CS, with a difference of US\$431. This difference in costs per successful birth was reduced to US\$280 at 60% successful VBAC and US\$127 at a rate of 50%. No statistical analysis of this difference was presented. However the inclusion of the cost of severe birth outcomes (uterine rupture leading to birth asphyxia and cerebral palsy) affected the relative cost effectiveness of the different modes of birth depending on rate of asphyxia and incidence of CP used in the model.

Another decision analytic model included specific adverse events (both maternal and neonatal) as well as the costs of managing those events.<sup>644</sup> The model considered the costs and consequences of TOL versus repeat CS for a hypothetical cohort of 100,000 women. It analysed the expected excess morbidity and mortality associated with repeat CS over and above either VBAC or emergency CS following TOL. On the cost side, the model estimated that a policy of repeat CS after previous CS would cost in excess of US\$179 million. In the synthesis of costs and benefits, the model estimated that the cost per averted neurological injury (cerebral palsy) was US\$4.8 million, and the same for the cost per neonatal death averted. The cost per maternal morbidity avoided was US\$32,500 and the cost per maternal death averted was more than US\$25 million.

Another US model has been published that considered the threshold cost values and threshold effectiveness values necessary for VBAC to be a cost-effective option.<sup>645</sup> Cost effectiveness was

defined as being under US\$50,000 per quality adjusted life year (QALY). The model was most sensitive to the probability of a successful VBAC. It estimated that planned CS would be the more cost effective option only if the VBAC rate was at least 65%.

The threshold analysis considered a hypothetical cohort of women. A small study using a real cohort of women in one US institution was undertaken to explore the validity of these findings.<sup>646</sup> The study compared two groups of women who were eligible for TOL after CS, one group of whom planned to have a CS (n = 65), the other planned to have TOL (n = 139). There was no mortality or serious morbidity in either group. The mean overall cost of care in the TOL group was US\$4411 compared with US\$6272 in the repeat CS group. Costs were only significantly different between successful VBAC and repeat CS and the study found only a small insignificant difference in costs between successful and failed VBAC groups. The authors concluded that TOL is more cost-effective above a threshold for VBAC following TOL of 18%, but it was not clear how they arrived at this threshold, except that the number of successful deliveries in their cohort is 35/204, which was around 17%. The small study did not indicate the costs of major adverse events since there were no maternal or neonatal deaths or major incidences of morbidity. The magnitude of the costs of even one of these events could have changed this result considerably.

The structure of the model developed in the threshold analysis study<sup>168</sup> was used to explore the cost effectiveness of TOL after CS in England and Wales using the data on VBAC rates and adverse outcomes associated with planned vaginal birth and planned CS presented in this guideline. Costs were calculated from published literature and from NHS reference cost values. Data on highest and lowest rates for each outcome were used in the model and different estimates of cost were also explored (Appendix A). The range of estimates in the literature for adverse outcomes was wide. Therefore the effect of using highest and lowest estimates in the model was explored, as well as the estimates published in the threshold analysis which fall some way between the highest and lowest values.<sup>168</sup> Based on the NSCSA data (VBAC rate of 64%), this model showed that TOL was the more cost effective option (based on cost per birth), with planned vaginal birth costing between £136 and £986 less per birth depending on the rates of adverse events included in the model. Using the data on the rate of adverse events presented in the original US model and using UK cost data, the difference in cost per live birth was £592.

A threshold analysis was also performed using the same model parameters. In the scenario favouring planned vaginal birth (that is, inputting minimum rates of adverse outcomes for VBAC and maximum values for planned CS), the success rate of VBAC had to be at least 19% for TOL to be as cost-effective as planned CS. In the scenario favouring planned CS, the successful VBAC rate had to reach at least 58%.for TOL to be as cost-effective. This is less than the estimated VBAC rate in England and Wales based on the NCSCA data. Further analyses using other cost data are reported in appendix A. It showed that the favourability of VBAC was sensitive to the values used for estimating the cost of birth by model. Using adverse event rates favouring planned CS and a higher cost of vaginal birth as reported in the NHS reference costs for 2001, VBAC was no longer the favourable option, making the findings less robust.

The structure of the model was published in the USA. It included the cost of birth and adverse events only and none of the longer term consequences of a poor birth outcome. We did not find any articles that reported the long term costs of infant morbidity such as birth asphyxia, even though the costs of these could be extremely high. In 2001 an English health authority awarded £2.8 million in damages for a child with brain damage following birth asphyxia to cover the cost of past and future care and lost earnings. If this were to be considered as part of the “cost” of birth asphyxia, then this could have a substantial impact on the relative cost-effectiveness of VBAC versus planned CS. However, since the evidence of the consequences of these alternatives is not robust, as described above, the economic model has focussed on the cost of birth and adverse maternal outcomes only. This represents only a partial economic analysis in this context. Other factors should be taken into account that are not included in the model.

### RECOMMENDATIONS

The risks and benefits of vaginal birth after CS compared with repeat CS are uncertain. Therefore the decision about mode of birth after a previous CS should take into consideration:

GPP

- maternal preferences and priorities
- a general discussion of the overall risks and benefits of CS
- risk of uterine rupture
- risk of perinatal mortality and morbidity.

GPP

Pregnant women who have a previous CS and who want to have a vaginal birth should be supported in this decision. They should be informed that:

B

- uterine rupture is a very rare complication, but is increased in women having a planned vaginal birth (35 per 10,000 women compared with 12 per 10,000 women having planned repeat CS)
- the risk of an intrapartum infant death is small for women who have planned vaginal birth (about 10 per 10,000); however, this is higher than for planned repeat CS (about 1 per 10,000)
- the effect of planned vaginal birth or planned repeat CS on cerebral palsy is uncertain.

Women who have had a previous CS should be offered:

GPP

- electronic fetal monitoring during labour
- care during labour in a unit where there is immediate access to CS and on-site blood transfusion services.

Women who have had a previous CS can be offered induction of labour, but both women and healthcare professionals should be aware that the likelihood of uterine rupture in these circumstances is increased to:

B

- 80 per 10,000 when labour is induced with non-prostaglandin agents
- 240 per 10,000 when labour is induced using prostaglandins.

During induction of labour, women who have had a previous CS should be monitored closely, with access to electronic fetal monitoring and with immediate access to CS, because they are at increased risk of uterine rupture.

GPP

Pregnant women with both previous CS and a previous vaginal birth should be informed that they have an increased likelihood of a vaginal birth than women who have had a previous CS but no previous vaginal birth.

B

#### RESEARCH RECOMMENDATION

RCT are needed to evaluate the effects on maternal and infant health of VBAC or elective repeat CS for women who have had a previous CS.



# 11. Auditable standards

**Table 11.1** Suggested audit criteria

Criterion	Exception	Definition of terms
<b>Making the decision</b>		
Percentage of women having CS that have a documented discussion on benefits and risks of CS compared with vaginal birth specific to the woman and her pregnancy.		
Percentage of women requesting a CS that have a documented discussion on the reasons for the request.		
<b>Carrying out the procedure</b>		
Percentage of CS carried out using a regional block		Regional block – spinal or epidural anaesthesia
Percentage of CS where the woman receives prophylactic antibiotics		
Percentage of CS where an appropriate method of thromboprophylaxis is used		
Percentage of CS where antacids are given prior to regional or general anaesthesia		
Percentage of CS where antiemetics are given prior to regional or general anaesthesia		
Percentage of planned CS carried out after 39 weeks.	Specific clinical indications	
<b>Reducing the likelihood of CS</b>		
Percentage of women who have an uncomplicated singleton breech pregnancy at 36 weeks' gestation that have a documented offer of external cephalic version.	Women in labour, women with a uterine scar or abnormality, fetal compromise, ruptured membranes, vaginal bleeding and medical conditions	
Hospitals should measure the overall CS rate as well as the percentage of CS performed for the four major determinants (presumed fetal compromise, failure to progress in labour, breech presentation, multiple pregnancy) and 'maternal request'.		
Percentage of women in labour that have continuous support during labour, provided by women with or without prior training, for example, doulas, childbirth educators or a female relative.		
Percentage of women with uncomplicated pregnancies beyond 41 weeks with documented offer of induction of labour		
Percentage of women in spontaneous labour with an uncomplicated singleton pregnancy at term monitored using a partogram with a 4-hour action line		Partogram – graphic representation of labour progress
Percentage of documented involvement of consultant obstetricians in the decision making for CS.	Women not having CS	
Percentage of CS for abnormal fetal heart rate pattern, suspected fetal acidosis, in which fetal blood sampling is undertaken	Severely abnormal fetal heart rate pattern Contraindications to fetal blood sampling	

# Appendix A

## Caesarean section. Understanding NICE guidance: information for pregnant women, their families and the public

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### About this information

This information describes the guidance that the National Institute for Clinical Excellence (called NICE for short) has issued to the NHS on managing and treating women who plan or who need to have a caesarean section. It is based on *Caesarean section* (NICE Clinical Guideline no. 13), which is a clinical guideline for doctors, midwives, nurses, counsellors and others working in the NHS in England and Wales. The information in this booklet has been written chiefly for pregnant women, and particularly for women whose doctors or midwives have mentioned the possibility of a caesarean section. It may also be useful for partners, family members and anyone with an interest in pregnancy or in healthcare in general.

### Clinical guidelines

Clinical guidelines are recommendations for good practice. The recommendations in NICE guidelines are prepared by groups of health professionals, lay representatives with personal experience or knowledge of the condition being discussed, and researchers. The groups look at the evidence available on the best way of treating or managing a condition and make recommendations based on this evidence.

There is more information about NICE and the way that the NICE guidelines are developed on the NICE website ([www.nice.org.uk](http://www.nice.org.uk)). You can download the booklet *The Guideline Development Process – An overview for stakeholders, the public and the NHS* from the website, or you can order a copy by phoning 0870 1555 455 (quote reference number N0472).

### What the recommendations cover

NICE clinical guidelines can look at different areas of diagnosis, treatment, care, self-help or a combination of these. The areas that a guideline covers depend on the topic. They are laid out in a document called the scope at the start of guideline development.

The recommendations in *Caesarean section*, which are also described here, cover:

- the information you can expect to receive from your doctor or midwife about caesarean section
- the most common reasons why you might need to have a caesarean section
- the benefits and risks of having a baby by a caesarean section compared with a vaginal birth
- what can be done to reduce the chances that you will need a caesarean section
- routine tests and treatments you should be offered if you have a caesarean section
- the care you can expect to receive before, during and after a caesarean section.

The recommendations here do not tell you about:

- the risks and benefits of caesarean section when it is used to deal with specific medical conditions that arise during pregnancy such as high blood pressure that happens for the first time during your pregnancy (pre-eclampsia)

- what will happen if you or your baby have a rare or complex condition such as a severe heart condition
- extra care you may need if you or your baby develop specific medical conditions in the course of your pregnancy or labour.

The information that follows tells you about the NICE guideline on caesarean section. If you want to find out more about caesarean section, or if you have questions about the specific treatments and options mentioned in this booklet, NHS Direct is a good starting point. Phone NHS Direct on 0845 46 47 or visit the website at [www.nhsdirect.nhs.uk](http://www.nhsdirect.nhs.uk).

### How guidelines are used in the NHS

In general, health professionals working in the NHS are expected to follow NICE's clinical guidelines. But there will be times when the recommendations won't be appropriate for someone because of a specific medical condition, their general health, their wishes, lack of resources or a combination of all of these things. If you think that the treatment or care you receive does not match the treatment or care described in the pages that follow, you should discuss your concerns with your midwife or doctor.

### If you want to read the other versions of this guideline

There are four versions of this guideline:

- this one
- the Quick Reference Guide, which is a summary of the main points in the NICE guideline; NICE has sent copies of the quick reference guide to doctors, midwives and other people working in the NHS
- the NICE guideline, *Caesarean section*, which includes all the recommendations
- the full guideline, which contains all the recommendations, and information about why they have been made.

All versions of the guideline are available from the NICE website ([www.nice.org.uk](http://www.nice.org.uk)). This version and the Quick Reference Guide are also available from the NHS Response Line – phone 0870 1555 455 and give the reference number(s) of the booklet(s) you want (N0479 for this version, N0480 for this version in English and Welsh and N0478 for the Quick Reference Guide). The full version is available for sale from the RCOG Online Bookshop ([www.rcogbookshop.com](http://www.rcogbookshop.com)) or by mail order. Telephone 020 7772 6275 for more information or to place your order.

## About caesarean section

Most women give birth through the vagina. Caesarean section is a surgical operation in which an obstetrician makes an opening in the mother's abdomen and womb and removes the baby through it. (An obstetrician is a doctor who has had specialist training in the care of women during pregnancy and childbirth.)

A caesarean may be planned in advance – for example, because the baby is positioned bottom first – or it may be done at short notice as an emergency if complications develop during your pregnancy or labour.

## What you can expect from your care

You have a right to be involved in and make decisions about your care and treatment. To be able to do this, you need to understand what is involved and what your choices are. Your care will be provided by an antenatal healthcare team, which may include midwives, your GP or an obstetrician, and they should take account of your views and concerns.

During your pregnancy your midwife or doctor should give you information about birth that is based on the best available research evidence. You should be offered this information in a form that suits you if you have extra needs – if, for example, you do not speak or read English or if you have a disability. It should include accurate information about caesarean section, including:

- common reasons for needing a caesarean section
- what the procedure involves
- the risks and benefits of caesarean section compared with vaginal birth
- how having a caesarean section might affect any future pregnancies
- how having a caesarean section might affect your chances of having a vaginal birth in future.

Your midwife or doctor should encourage you to ask questions if there is anything you do not understand, and discuss them with you.

## Consent for caesarean section

Your healthcare team should give you information about birth and caesarean section before they ask you to consent to the operation. They should do this in a way that respects your dignity, privacy, views and culture, while taking into account your medical circumstances. You have the right to decline a caesarean section even if this will harm you or your baby's health.

### Making decisions about how to have your baby

To enable you to make decisions about how to have your baby, your midwife or doctor should discuss with you the benefits and risks of a caesarean section compared with a vaginal birth specific for your situation. He or she should make a note of this discussion.

If you need a caesarean section, your healthcare team should explain to you why it is necessary and record their reasons for carrying it out.

Your healthcare team should record the level of urgency of any caesarean section. They will do this using the following standard categories:

1. Where there is an immediate threat to your life or the life of your baby
2. Where there is concern about your health or the health of your baby, but your lives are not in immediate danger
3. Where there is no immediate concern about your health or the health of your baby, but you need an early delivery because of an existing condition
4. Where delivery is timed to suit you or your healthcare team.

### If you request a caesarean section

Your doctor or midwife should explore and discuss your reasons with you and make a note of this; they will not automatically agree to arrange for a caesarean section if you ask for one. They should discuss the overall benefits and risks of caesarean section compared with a vaginal birth and make a note of this.

If you ask for a caesarean section because you have fears about giving birth, your midwife or doctor should offer you the chance to discuss your fears with a counsellor.

If your doctor doesn't think a caesarean section will benefit the health of you or your baby, he or she has the right to decline your request for one. However, they should offer to refer you to another doctor.

### Effects of caesarean section on a woman's health

The table on the next page shows the effects of caesarean section on a woman's health. These risks do not apply to all women or all circumstances. If you have a caesarean section because of a problem that develops during pregnancy or labour, the risks will be different. Your midwife or doctor should discuss this with you.

Some problems – such as needing admission to an intensive care unit – are more likely after a caesarean birth than after a vaginal birth. It is not clear whether this happens as a result of a caesarean section or because of the reasons for needing a caesarean section. Pain in the abdomen affects about 9 of every 100 women who have a caesarean section, but most of the other problems are very rare.

There is more detailed information on the effects of caesarean section on women's health in Appendix A below.

### Summary of the effects of caesarean section for women

More likely after caesarean section	No difference after caesarean section	Less likely after caesarean section
<ul style="list-style-type: none"><li>• Pain in the abdomen (tummy)</li><li>• Bladder injury</li><li>• Injury to the tube that connects the kidney and bladder (ureter)</li><li>• Needing further surgery</li><li>• Hysterectomy (removal of the womb)</li><li>• Admission to intensive care unit</li><li>• Developing a blood clot</li><li>• Longer hospital stay</li><li>• Returning to hospital afterwards</li><li>• Death of the mother</li><li>• Having no more children</li><li>• In a future pregnancy, the placenta covers the entrance to the womb (placenta praevia)</li><li>• Tearing of the womb in a future pregnancy</li><li>• In a future pregnancy, death of the baby before labour starts</li></ul>	<ul style="list-style-type: none"><li>• Losing more than 1 litre of blood (haemorrhage) before or after the birth</li><li>• Infection of the wound or lining of the womb</li><li>• Injuries to the womb or genital organs, such as tearing around the neck of the womb</li><li>• Bowel incontinence (no control of bowel actions)</li><li>• Postnatal depression</li><li>• Back pain</li><li>• Pain during sexual intercourse</li></ul>	<ul style="list-style-type: none"><li>• Pain in the area between the vagina and anus (the perineum)</li><li>• Bladder incontinence 3 months after the birth</li><li>• Sagging of the womb (prolapse) through the vaginal wall</li></ul>

#### *Other considerations*

Women usually spend longer in hospital after a caesarean section (on average, 3–4 days) than after a vaginal birth (on average, 1–2 days).

Women who have a caesarean section are less likely to start breastfeeding in the first hours after the birth, but if they do start they are just as likely to continue breastfeeding as those who have a vaginal delivery.

Women who have a caesarean section are more likely to have one again in the future, although there is not enough evidence to know why this is.

#### **Risks to your baby**

In general, caesarean section does not increase or decrease the risk of your baby having an injury to the nerves in the neck and arms, or bleeding inside the skull, having cerebral palsy or dying. These are very rare complications, and affect less than 20 in 10,000 babies.

The most common problem affecting babies born by caesarean section is breathing difficulties. About 35 of every 1000 babies born by caesarean section have breathing problems just after the birth, compared with 5 of every 1000 babies after a vaginal birth.

## Medical reasons for considering a caesarean section

### Medical reasons for planning a caesarean section

There are many reasons why you might be offered a caesarean section that is planned in advance. For example, you should be offered this if:

- your baby is positioned bottom first (known as the breech position) at the end of your pregnancy
- you have placenta praevia (a condition where the placenta is low lying in the womb and covers all or part of the womb entrance)
- you have certain viral infections, namely:
  - HIV
  - HIV together with hepatitis C virus
  - a first infection (but not a recurrence) of genital herpes in the last 3 months of your pregnancy.

### **If your baby is positioned bottom first**

Most babies move into a head-first position in the womb before they are born.

If you have had no problems with your pregnancy and your baby is still bottom first (known as the breech position) at 36 weeks, your midwife or doctor should offer you a procedure called external cephalic version (ECV). This means they gently try to move the baby round to head first by placing their hands on the mother's abdomen and pushing from the outside. ECV does not always work, but if the baby moves so that it is head first, it can usually be born vaginally in the normal way.

You should not be offered ECV if:

- your waters have broken
- you are in labour
- you have a scar on your womb, or if your womb is irregularly shaped
- the health of your baby is at risk
- you have any vaginal bleeding
- you have an existing medical condition.

If your baby is positioned bottom first at the end of your pregnancy and you are not able to have ECV, or it has not been successful, you should be offered a caesarean section. This reduces the risk of your baby dying or being injured during birth.

### **If you have a viral infection**

This guideline is only about caesarean section. If there are other treatments to reduce the chance of you passing on a viral infection to your baby, your doctor or midwife will talk to you about them.

If you have HIV, or HIV and hepatitis C virus, having a caesarean section will reduce the risk of passing on these infections to your baby.

You do not need a planned caesarean section if you have hepatitis C virus alone, because it will not reduce the risk of passing the virus to your baby.

If you have hepatitis B and you have agreed for your baby to have vaccination and immunoglobulin (an injection of antibodies) once it is born, you will not need a caesarean section because this will not reduce the risk of passing on the infections to your baby.

If you have a first-ever infection of genital herpes in the last 3 months of your pregnancy, you should be offered a caesarean section. But if you have a recurrence of genital herpes at the time of the birth you should not be offered a planned caesarean section, unless you have agreed to take part in a research programme. There is not enough evidence to tell us whether caesarean section cuts down the risk of passing the herpes virus on to your baby if you are having a recurrence at the time of birth.

### **If you are expecting twins**

If you are expecting twins, the risks to their health and lives at the time of birth are about four times greater than for singleton babies.

If the first twin is in the breech (bottom-first) position you should be offered a planned caesarean section. This is in line with current medical practice, although it is not certain that caesarean section will cut down the risks to the babies.

If your babies are due to be born, you are healthy and have not developed complications in the pregnancy, and the first twin is in the head-first position (the normal position for birth), you should not routinely be offered a planned caesarean section, unless you have agreed to take part in a research programme. It is not certain that planned caesarean section improves the health of the second twin in these circumstances.

If you are expecting twins and have had no problems with your pregnancy you should not have a caesarean section before the 38th week of your pregnancy. Having a caesarean section any earlier than this increases the chances of the babies having breathing problems when they are born.

### If your baby is small

Babies who are not growing well in the womb are known as 'small for gestational age' babies. They have a higher risk of dying or being ill around birth, but there is not enough evidence to tell us whether having a planned caesarean section makes any difference to this risk. In these cases you should not routinely be offered a planned caesarean section unless you have other complications or you have agreed to take part in a research programme.

### If your baby is premature

Babies born too early have a higher risk of death or complications. However, there is not enough research to tell us whether having a planned caesarean section makes any difference to these risks. In this situation you should not routinely be offered a planned caesarean section unless you have other complications or you have agreed to take part in a research programme.

## If you are planning a normal birth, what choices may affect your chance of needing a caesarean section?

### Tests to predict if you will need a caesarean section

You should not be offered X-rays of your pelvis, or vaginal examinations to measure the size of your pelvic bones, because they do not help to predict the course of your labour. For the same reason, your healthcare team do not need to take any account of your height, the size of your feet or the size of your baby in trying to predict the course of your labour.

### Where you have your baby

If you are healthy and there are no problems expected in your pregnancy, you should be aware that having your baby at home can reduce the chance of needing a caesarean section.

If you are healthy and have no problems in your pregnancy, having your baby in a 'midwifery-led unit' does not affect the chance of your having a caesarean section.

### Things that reduce your chance of needing a caesarean section

Some things are known to cut down the chances of needing a caesarean section. They may also affect other aspects of your labour or the birth that are not considered in this guideline.

- You should be aware that having another woman with you for support throughout your labour reduces the chance of having a caesarean section.
- If you are still pregnant after 41 weeks of pregnancy, you should be offered induction of labour (to have your labour started off). This is safer for the baby and reduces the chance that you will have a caesarean section (for information about induction of labour, see the NICE guideline *Induction of labour*).
- The use of a chart called a partogram to follow the progress of your labour also makes a caesarean section less likely. At 4-hourly intervals, your midwife or doctor will offer to do a vaginal examination to measure how far your cervix has opened up (dilated), and feel your abdomen to see how the baby is moving downwards. If the progress of your labour lags more than 4 hours behind the average they should discuss with you what your options are (including whether you can go ahead with a vaginal birth), and take action as appropriate.
- Having a consultant (senior) obstetrician involved in decision making about caesarean section reduces the chances that a woman will have a caesarean section.
- In some cases, the midwife or doctor will need to monitor the baby's heartbeat and contractions throughout labour, using electronic devices that are attached to the abdomen. This is called cardiotocography, or CTG for short. The trace may make your doctor or midwife suspect there is a problem, when in fact your baby is fine. If they suspect your baby is not coping well with labour, further action may be taken. This could include immediate caesarean section, but usually another test should be offered before the decision is made. The test is a 'fetal blood sample'. This is done by passing a small tube through a speculum (a metal instrument which is inserted into your vagina) to take the sample from a pinprick on

the baby's scalp. This sample will be tested to see if the baby is coping well with labour. Having this test may avoid an unnecessary caesarean section. (For more information about monitoring the baby's heartbeat see the NICE guideline *Electronic fetal monitoring*).

### Things that do not affect your chance of having a caesarean section

Some things make no difference to the chances of needing a caesarean section, although they may affect other aspects of your labour or the birth that are not considered in this guideline. These include:

- walking around while you are in labour
- not lying on your back in the second stage of labour
- being in water during your labour
- having epidural pain relief during labour
- taking raspberry leaves
- early breaking of the waters through amniotomy (this is done by placing a plastic hook into a woman's vagina in order to break the amniotic membranes around the baby and release the amniotic fluid)
- active management during labour (a type of care that includes one-to-one support from a midwife, early breaking of the waters, and the early use of the drug oxytocin to encourage the womb to contract).

There is no research that tells us whether using complementary therapies (such as acupuncture, aromatherapy, hypnosis, herbal products, nutritional supplements, homeopathic medicines or Chinese medicines) during labour cuts down the chance of having a caesarean section.

### Reasons for needing an emergency caesarean section

You may need an emergency caesarean section because:

- there is concern that your baby's health is compromised
- your labour is not progressing
- you have vaginal bleeding during pregnancy or labour
- you go into labour before the date of your planned caesarean section.

In some situations your baby may need to be delivered very quickly (within half an hour).

If you have an emergency caesarean section, you are at risk of vomiting during the operation. If this happens, fluid and food particles from your stomach may pass into your lungs (this is known as aspiration) and can cause potentially serious inflammation (known as aspiration pneumonitis). You should be aware that eating during labour may increase the amount of food and fluid in your stomach, and this may increase the risk of aspiration if you have an emergency caesarean section. Drinking drinks that have the same concentrations of salt and sugar as human body fluid (known as isotonic drinks) during labour gives you energy without giving you a full stomach.

### Having a caesarean section

If you have a planned caesarean section, this should not normally be done before the 39th week of pregnancy. This is because if your baby is born early, there is a chance it might have breathing problems soon after birth. These problems are less likely if the baby is born after 39 weeks.

#### Tests before a caesarean section

If you are having a caesarean section you should be offered a blood test to check whether you are anaemic.

Around 4–8 of every 100 women lose more than a litre of blood at the time of caesarean section. Some women have a high risk of this happening, if they have:



- heavy bleeding before labour (known as antepartum haemorrhage)
- placental abruption (where the placenta separates from the wall of the womb)
- placenta praevia (where the placenta is lying across the entrance to the womb)
- uterine rupture (a tear in the womb, often along the scar of a previous caesarean section).

If you have any of these problems, you may need a blood transfusion and you should have the caesarean section at a maternity unit with blood transfusion services.

If you have been healthy during your pregnancy, you do not need to have:

- screening tests for blood clotting
- grouping and saving of serum (this is when a sample of your blood is taken, the blood group is analysed and then the sample is saved in the hospital blood bank ready to be used to order a blood transfusion if you need one)
- an ultrasound scan before a caesarean section; it does not cut down your risk of heavy blood loss or the risk of injury to the baby.

### Anaesthetics for caesarean section

A caesarean section should usually be done using a regional anaesthetic, which numbs the lower part of the body and means you will be awake during the operation. This is safer for you and the baby than a general anaesthetic (where you are put to sleep). Spinal and epidural anaesthetics are types of regional anaesthetic. You may be given the anaesthetic in the operating theatre or in a separate room next to the theatre.

You should be given information about the different kinds of pain relief that you can use after the operation, so that you can be prescribed whatever best suits your needs. If you have a regional anaesthetic for your operation, you should also be offered diamorphine, given by an injection into your spine at the same time that the anaesthetic is given. This reduces the need for other pain relief afterwards.

You will need to have a bladder catheter inserted to empty your bladder because, with a regional anaesthetic, you will not be able to tell if your bladder is full and needs to be emptied.

If you are having a regional anaesthetic, you should also be offered a drug called ephedrine or phenylephrine, which will be given through a drip to reduce your risk of low blood pressure during the operation.

If you have an emergency caesarean section, your healthcare team should cut down the risk of vomiting and aspiration into the lungs by:

- offering you drugs or acupuncture (which involves wearing wrist bands that apply pressure to special points in your wrists) to try to prevent nausea and vomiting
- offering you antacids to reduce the acidity in your stomach and drugs to keep the amount of food in your stomach low, and reduce its acidity
- using standard emergency procedures such as giving you oxygen through a mask before a general anaesthetic, and the anaesthetist applying pressure with his or her hand at the front of your neck to block the airway and prevent particles going into your lungs.

Maternity units should follow accepted good practice when giving anaesthetics to women in labour. When a person is under general anaesthetic, a tube may need to be inserted through the mouth or nose to feed air and oxygen down to the lungs. Maternity units need to have a procedure in place for what to do when attempts to do this fail.

### The operation

You have more risk of a blood clot if you have a caesarean section, so you should be offered things during and after the operation to reduce the risk of this happening, such as elastic support stockings, help to walk around after the CS, or injections. Your doctor should assess your risks of blood clots when deciding which of these you need.

If you are awake during the operation, a screen will be placed across your abdomen so that you do not see the operation being done. You may be able to choose to have the screen lowered, so that you see the baby being born. You may also be able to have music playing, or have silence

in theatre so that your voice is the first the baby hears. If you are interested in any of these things, you should discuss them with your midwife or doctor.

During caesarean section, the operating table will be tilted sideways to an angle of at least 15°. This reduces your chance of getting low blood pressure and feeling sick during the operation, because it takes the weight of your womb off major blood vessels in your abdomen.

Whenever possible, the obstetrician will make a horizontal cut across your lower abdomen (just below the line of your pubic hair) to reach your womb. This opening along your 'bikini line' will cause you less pain afterwards and look better than an 'up and down' scar. Sometimes the baby's skin may be cut while the opening in the womb is being made. This happens to about 2 of every 100 babies.

You should be given the drug oxytocin by slow injection into a vein once your baby is born to encourage your womb to contract and cut down blood loss.

You should be offered antibiotics at the time of your caesarean section because they cut down the risk of getting an infection afterwards.

### *Checking your baby's health*

A trained practitioner who is skilled in resuscitating newborn babies should be present if your healthcare team think that your baby's health is at risk. If you have had a caesarean section because of suspected distress in the baby, your healthcare team should measure the pH balance (acidity) of the blood in the artery in the baby's umbilical cord. This will help them to confirm whether your baby was distressed.

Babies born by caesarean section are more likely to have a lower temperature than normal. Your healthcare team should follow accepted good practice for keeping babies warm (for example, having a higher temperature in the operating theatre, or wrapping the baby in blankets).

Your healthcare team should encourage you to have skin-to-skin contact with your baby as soon as possible. This tends to improve how women feel about their baby, their mothering skills and their chances of successfully breastfeeding. It also tends to reduce the amount a baby cries.

You can find more information on how your healthcare team will carry out the operation in Appendix B below.

### **After the operation**

Immediately after the operation you should be observed on a one-to-one basis by a properly trained member of staff until you are breathing normally and are able to talk and communicate clearly.

After you recover from the anaesthetic, the staff looking after you will check your breathing rate, heart rate, blood pressure and whether you are feeling pain or feeling sleepy every half hour for 2 hours, and then every hour. These observations will be done for a number of hours, depending on what type of anaesthetic you had during the operation. If you are not feeling well or if the observations are changing then a doctor will come and see you.

If you have had a caesarean section, you may have more difficulty starting to breastfeed your baby. Therefore, you should be offered extra support and help to do this. Once you have started breastfeeding, you are as likely as other women to be able to carry on.

Unless you have an infection that needs treatment, you do not need to continue to have antibiotics after your caesarean section.

You should be offered pain relief that you can control yourself with drugs such as morphine (called patient-controlled analgesia or 'PCA'). However, these can make you drowsy and nauseous, so you should also be offered non-steroidal anti-inflammatory drugs (NSAIDs), such as diclofenac, if they are suitable for you. Taking NSAIDs can cut down the amount of morphine-like painkillers (such as diamorphine) that you might need.

If you are recovering well and you have no problems after your caesarean section, you should be able to eat and drink if you are thirsty or hungry.

Your bladder catheter will be removed once you are able to walk and at least 12 hours after the last 'top-up' of your epidural.

Your wound dressing will be removed after 24 hours. Wound drains do not cut down infection or the risk of bruises, so they should not be used as a matter of routine in caesarean section. Wound drains do reduce the chances of infection for women who are very overweight, however, and should be offered to them.

If you have had a caesarean section, your healthcare team should give you the opportunity to discuss the reasons for it and any other related issues at an appropriate time. They should keep a record of the reasons for carrying out a caesarean section.

Current good practice for the care of your baby after a caesarean section should follow the accepted care for any newborn (see page XX).

### Going home

Women generally stay in hospital for 3–4 days after a caesarean section. But if you and your baby are well, and if you wish to go home early, you should be able to go home earlier than this (after 24 hours) and have follow-up care at home.

In addition to routine postnatal care, you will need advice about recovering after a caesarean section and possibly about other complications if you had these during pregnancy or childbirth.

When you go home, you should be given regular pain killers to take for as long as you need them. For severe pain you should be offered co-codamol and ibuprofen; for moderate pain, you should be offered co-codamol; and for mild pain, you should take paracetamol.

You should be given advice about how to look after your wound. Advice should cover wearing loose, comfortable clothes and cotton underwear, gently cleaning and drying the wound daily, and looking out for possible wound infection (such as more pain, redness or discharge) or fever.

You should tell your midwife or doctor if you have symptoms such as pain on passing urine, or leaking urine.

You should tell your midwife or doctor if your vaginal bleeding increases, or becomes painful. After caesarean section, this is less likely to be due to retaining part of the placenta, and more likely to be due to infection in the lining of the womb.

You should tell your midwife or doctor if you develop a cough or shortness of breath, or swelling and pain in your calf, so that they can make sure that these symptoms are not due to a blood clot.

After a caesarean section, you will not be able to do some activities straight away such as driving a car, carrying heavy things, exercise or having sex. You should only start these once you feel that you are able to do so and when they do not cause you pain. If you are unsure, you could discuss this with your midwife.

If you have a caesarean section, you are not more likely than other mothers to have any of the following: difficulty breastfeeding, postnatal depression, pain during sex or difficulty controlling your bowels.

### Having a baby when you have had a caesarean section before

If you have already had a caesarean section, it is not certain what the overall effect on your health is likely to be if you have another caesarean section rather than a vaginal birth. When you and your doctors are discussing whether to plan a caesarean section or a vaginal birth, your doctors should take account of:

- your preferences and priorities
- the overall risks and benefits of caesarean section

- the risk of tearing the wall of the womb (known as uterine rupture), along the scar from the previous caesarean section
- the risk to you and your baby's life and health around the time of birth.

If you want to have a vaginal birth, your healthcare team should support you in this decision. You do need to be aware that some rare but serious complications are increased with vaginal birth after a caesarean section. These possible complications include your scar tearing apart or the baby dying. For these reasons, during your labour, you should be offered electronic fetal heart rate monitoring, and be cared for in a maternity unit where a caesarean section can be done very quickly if needed, and where there are blood transfusion services. This is even more important if your labour is induced, because the risks of some complications, such as the scar tearing apart, are higher.

Studies have shown that pregnant women who have had both a previous caesarean section and a previous vaginal birth are more likely to have a vaginal birth than those who have had only a previous caesarean section.

## Where you can find more information

If you need further information about any aspect of having a caesarean section, or about the care that you are receiving, please ask your midwife, doctor or another member of your healthcare team. You can discuss this guideline with them if you wish, especially if you aren't sure about anything in this booklet. They will be able to explain things to you.

For further information about the National Institute for Clinical Excellence (NICE), the Clinical Guidelines Programme or other versions of this guideline (including the sources of evidence used to inform the recommendations for care), you can visit the NICE website at [www.nice.org.uk](http://www.nice.org.uk). At the NICE website you can also find information for the public about other maternity-related guidance:

- Antenatal care: routine antenatal care for healthy pregnant women (NICE Clinical Guideline 6)
- Pregnancy and childbirth: electronic fetal monitoring (NICE Clinical Guideline C)
- Pregnancy and childbirth: induction of labour (NICE Clinical Guideline D)
- Pregnancy – routine anti-D prophylaxis for rhesus negative women (NICE Technology Appraisal no. 41).

If this is your first pregnancy, your midwife or doctor should offer you a copy of *The Pregnancy Book*, which is published by the Departments of Health in England and Wales. This tells you about most aspects of pregnancy. You can get information on common problems during pregnancy from NHS Direct (telephone 0845 46 47; website [www.nhsdirect.nhs.uk](http://www.nhsdirect.nhs.uk)).

## Glossary

**Antenatal healthcare team** – the health professionals providing care during pregnancy, such as midwives, GP or an obstetrician (this will vary depending on the type of antenatal care you have chosen and where you plan to give birth).

**Complications** – extra health problems after an operation or arising from another condition or infection.

**Consultant obstetrician** – a senior doctor who has had specialist training and experience in the care of women during pregnancy and childbirth.

**Full term** – the 37th to 41st weeks of pregnancy; this is the full and normal duration of pregnancy.

**Induction of labour** – methods that are used to start labour. These include a membrane sweep, breaking the waters, using tablets inserted into a woman's vagina or a drip.

**Isotonic fluids** – drinks that have the same concentrations of salt and sugar as human body fluid.

**Midwifery-led unit** – a unit close to a labour ward that provides care led by midwives, with a minimum of medical interventions and in a home-like environment. Different phrases may be used to describe this type of unit. If you are not sure, ask your doctor or midwife.

**Obstetrician** – a doctor who has received specialised training and experience in the care of women during pregnancy and childbirth.

**Oxytocin** – a hormone naturally produced by the body which causes the womb to contract. A synthetic copy of this hormone is sometimes used during childbirth to increase or start contractions of the womb.

**Prolapse** – when the womb, bladder or bowel sags from its normal position and protrudes through the vaginal wall. It is more common after a vaginal birth than after a caesarean section because the muscles supporting the womb get stretched during a vaginal birth.

**Regional anaesthetic** – a type of anaesthetic that numbs the lower part of your body. The anaesthetic drugs are either given through an injection into the spine before the start of the operation, or run into your spine through a small tube (catheter). The catheter may have been put in place as part of the epidural used for pain relief during labour, or at the time of the operation.

**Speculum** – a metal instrument that is inserted into a woman's vagina so that examination of the cervix and vagina can be done. It is used in smear tests and most gynaecological examinations.

**'Top-up' epidural dose** – doses of anaesthetic drugs given via the epidural catheter to maintain the effects of the epidural

## Appendix A: Summary of the effects of caesarean section on women's health

This table shows the effects of a caesarean section on women's health. It shows the problems that are more or less likely after a caesarean section than a vaginal birth, but not the problems where there is no difference.

The figures in the table are the best estimate we have, but it is impossible to be precise about the effects, because different studies often give different results.

Most of the problems are rare. Some problems – such as needing admission to an intensive care unit – are more likely after a caesarean birth than after a vaginal birth. It is not clear whether this happens as a result of a caesarean section or because of the reasons for needing a CS. This is the case for the complications marked (a) in the table.

	How many women does this affect, out of every 10,000 women?	
	Caesarean section	Vaginal birth
<b>More likely after a caesarean section</b>		
Pain in the abdomen (tummy)	900	500
Bladder injury <sup>a</sup>	10	0.3
Injury to the tube that connects the kidney and bladder <sup>a</sup>	3	0.1
Needing further surgery <sup>a</sup>	50	3
Hysterectomy (removal of the womb) <sup>a</sup>	Up to 80	1 or 2
Admission to intensive care unit <sup>a</sup>	90	10
Developing a blood clot <sup>a</sup>	Between 4 and 16 overall (no detailed figures available)	
Longer hospital stay	3 to 4 days	1 to 2 days
Returning to hospital afterwards <sup>a</sup>	530	220
Death of the mother <sup>a</sup>	0.82	0.17
Having no more children <sup>a</sup>	4200	2900
In a future pregnancy, the placenta covers the entrance to the womb (placenta praevia)	40–70	20–50
Tearing of the womb in a future pregnancy <sup>a</sup>	40	1
In a future pregnancy, death of the baby in the womb before labour starts <sup>a</sup>	40	20
<b>Less likely after caesarean section</b>		
Pain in the area between the vagina and anus (the perineum)	200	500
Bladder incontinence 3 months after the birth	450	730
Sagging of the womb (prolapse) through the vaginal wall <sup>a</sup>	500 overall (no detailed figures available)	

<sup>a</sup> It is not clear whether the increased risk of these problems is a result of a caesarean section or because of the reasons for needing a CS.

Note: Very rarely, women develop a blood clot after having a baby. This happens to between 4 and 16 of every 10,000 women who have a baby, and the risk is nearly four times higher after a caesarean section than after a vaginal birth. Sagging of the womb through the wall of the vagina (called a prolapse) is uncommon – it affects about 500 of every 10,000 women who have a baby – and the risk is nearly twice as high after a vaginal birth than after a caesarean section.

## Appendix B: Surgical techniques for caesarean sections

Healthcare professionals should be encouraged to wear two pairs of surgical gloves (double gloves) when taking part in a caesarean section on women who are HIV positive, to reduce the risk of infecting healthcare professionals during the operation. They should follow general recommendations on safety in surgery to reduce the risk of HIV infection of staff.

To make the opening into your body cavity, the obstetrician should use a horizontal cut across the abdomen, 3 cm above your pubic bone (a type of cut known as a Joel Cohen incision). This takes less time than other kinds of cut and reduces the chance of you having a fever after the operation.

The obstetrician does not need to use separate surgical knives for opening the skin and the tissues inside as this does not decrease the risk of wound infection. The obstetrician should use their fingers, rather than operating scissors, to widen the opening in the womb when making the cut on the womb to take the baby out. This reduces bleeding during the caesarean section, the need for blood transfusion during the operation, and the risk of bleeding after the birth.

Forceps should only be used when there is difficulty in delivering the head of the baby at caesarean section.

The obstetrician should sew up your womb by keeping it inside your abdomen, rather than lifting it out. Lifting your womb out of your abdomen is likely to cause you more pain and does not cut down the risk of infection or excessive bleeding.

To reduce the risk of infection of the lining of your womb (endometritis), the obstetrician should remove your placenta by pulling steadily on the umbilical cord to bring it out of the womb. He or she should close up the opening in the wall of the womb with two layers of stitches.

The layer of tissue over the womb (peritoneum) does not need to be stitched and should be left to heal and close over naturally; you will need less pain relief as a result. Your obstetrician should usually only close up the space of tissue under your skin if you are very overweight, in order to reduce the risk of infection.

If you have had to have an 'up and down' cut, the obstetrician should use a single line of continuous stitches (rather than a series of single stitches) which are slowly absorbable (that is, they will dissolve after a few months) to close your abdominal wall. This reduces the risk of the wound becoming infected or splitting open, and the risk of developing a hernia (where deep tissues, such as the bowel, protrude through the wound).

# Appendix B

## The VBAC model

The VBAC model for this guideline had two purposes: The first was to assess whether planned vaginal birth was a more cost-effective alternative than planned repeat CS. Second, since the cost of failed TOL leading to emergency CS is higher than the cost of planned repeat CS, there is a success rate for TOL above which it is a more cost-effective option than planned CS. Below this threshold, planned CS is the more cost-effective option. The model considers what this threshold might be under different scenarios. These scenarios explore different rates of adverse events and different costs of birth by mode of birth.

An American model to assess the relative cost-effectiveness of planned vaginal birth versus planned repeat CS has been published which included data on the rates of adverse maternal outcomes.<sup>645</sup> The model presented in this guideline uses the same structure with the birth rates and maternal outcomes reported in this guideline.

The cost data were derived from a UK based study that reported bottom-up cost data at 1997 prices.<sup>53</sup> This is the most up to date UK data available from a detailed study. These costs were uplifted to 2001 values using the Hospital and Community Health Services Index (<http://www.doh.gov.uk/finman.htm>). NHS reference cost data were also inputted into the model. NHS reference costs are cost data from NHS providers for accounting purposes and can vary widely across centres. The NHS reference cost data were from 2001 (Table B.1).

The estimated costs of adverse events associated with delivery are reported in Table B.2. NHS reference costs were used in the absence of other published data, except for the cost of blood transfusion.<sup>648</sup>

**Table B.1.** Baseline cost estimates used in the model, 1997 prices<sup>53</sup> (uplifted to 2001 prices) using the Hospital and Community Health Services Index)

Model of birth	Bottom-up costs (£)	Top-down costs (£)
Successful TOL (VBAC)	447 (506)	943 (1,067)
Unsuccessful TOL (emergency CS)	2403 (2,720)	2974 (3,367)
Planned repeat CS	1995 (2,213)	2301 (2,605)

**Table B.2.** Baseline costs of adverse events in the model, with source of data and date

Adverse outcome	Unit cost (£)	Source
Uterine rupture	1778	Lower genital tract major procedures*
Haemorrhage with transfusion	635	Varney et al 2003 <sup>647</sup>
Infection (endometritis)	538	Non-surgical treatment of lower genital tract disorders*
Thrombosis	640	Non-surgical treatment of other gynaecological conditions*
Operative injury	5122	Lower genital tract complex major procedures*
Urinary incontinence	842	Non-surgical treatment of genital prolapse or incontinence*
Fecal incontinence	1148	General abdominal disorders with complications*

\* NHS Reference cost, 2001



**Table B.3.** Highest and lowest values of the rates of adverse events used in the model, from the studies reviewed in this guideline

Adverse event	Unsuccessful TOL (VBAC) (%)	Successful VBAC (%)	Planned repeat CS (%)
Uterine rupture	1.1–13.4	0.1–3.1	0.2–11.7
Haemorrhage with blood transfusion	7.0–20.4	0.5–9.3	0.3–10.0
Infection (endometritis)	1.9–18.5	1.0–6.2	1.2–8.8
Thrombosis	12.5 (1 paper only)	No data	No data
Hysterectomy	0.3–1.0	0.1–0.2	0.2–1.3
Operative injury	3.0 (one paper only)	0.1 (one paper only)	0.6 (one paper only)
Urinary incontinence	Same as original model 0.6	Same as original model 2.0	Same as original model 0.0
Fecal incontinence	Same as original model 1.3	Same as original model 1.8	Same as original model 0.0

Rates of adverse events used in the model are reported in Table B.3. The data derive from the published literature reported in Chapter 5. They show the highest and lowest estimates of adverse outcomes reported. Where estimates are not reported in Chapter 5, the estimates from the original US study are used since this is the model on which the VBAC model is based.<sup>168</sup>

### Analysis explored in the model

The costs per live birth by mode of delivery are presented in Table B.4. Additional sensitivity analyses using different cost estimates were explored. Since a wide range of estimates of adverse events were reported in the published literature, the results of the VBAC model are presented in two ways. First, the results are reported using data favouring planned VBAC (using the lowest estimates of adverse event rates for successful and unsuccessful TOL, and the highest estimates of adverse event rates for planned CS). Second, results are reported favouring planned CS (highest adverse event estimates for successful and unsuccessful TOL, lowest for planned CS). The true estimate of cost lies within this range.

The higher the success rate of TOL, the more cost effective this option is compared with planned CS. The threshold rate for successful TOL leading to VBAC (above which TOL is more cost-effective) was 19% in the scenario favouring planned VBAC and 58% in the scenario favouring planned CS. Since both of these thresholds are less than 64% reported in the NCSCA, VBAC is the more cost-effective option using these cost data.

NHS reference cost data from 2001 were also entered into the model to assess the impact of these cost-estimates on the relative cost-effectiveness of VBAC and planned repeat CS (Table B.5). In the scenario favouring VBAC, the threshold success rate for TOL at which it was as cost-effective as planned CS was 29%. This higher threshold using NHS reference cost data reflects the higher estimated cost of a successful vaginal delivery (£943) cost compared with the NHS

**Table B.4.** Results of the VBAC model using highest and lowest rates of adverse events, VBAC success rate of 64%, and baseline cost data for mode of delivery

	Scenario favouring planned vaginal birth <sup>a</sup> (£)	Scenario favouring planned repeat CS <sup>b</sup> (£)
Cost per live birth for planned VBAC	1,606	2,126
Cost per live birth for planned CS	2,593	2,263
Difference in cost per live birth	986	136

<sup>a</sup>lowest rate of adverse events for VBAC, highest for CS

<sup>b</sup> highest rate of adverse events for VBAC, lowest for CS

**Table B.5.** Results of the VBAC model using highest and lowest rates of adverse events, VBAC success rate of 64%, and NHS reference costs by mode of delivery, 2001

	<b>Scenario favouring planned vaginal birth</b> (£)	<b>Scenario favouring planned repeat CS</b> (£)
Cost per live birth for planned VBAC	1,977	2,497
Cost per live birth for planned CS	2,601	2,351
Difference in cost per live birth	703	-146 (planned repeat CS leads to savings)

reference cost for CS, and less of a difference in the cost estimates of planned CS and emergency CS after failed planned vaginal birth (£2,301 and £2,974 respectively in the NHS cost data). However, in the scenario favouring CS, the threshold success rate at which planned TOL was as cost-effective as planned repeat CS was 72%. This is higher than the 64% success rate reported in the NCSCA.

The relative cost-effectiveness of TOL versus planned repeat CS was influenced by the choice of cost parameters and adverse event rates used in the model. Using research based cost data, TOL was always the more cost-effective option. However, using NHS reference cost data, the relative cost-effectiveness depended on the rates of adverse events used in the model. Therefore, the superiority of TOL over planned CS after previous CS cannot be categorically determined using these data.

# Appendix C

## The cost of maternal request for caesarean section

The purpose of the economic model was to determine the cost consequence of maternal requests for CS to the NHS. A model was constructed to explore the impact on the cost of birth of changes in the rate of maternal requests for planned CS made by women, and on the rate of maternal requests that are accepted by obstetricians as a reason for planning a CS.

The annual cost of maternal request for CS in the absence of clinical indicators estimated from prevalence data are reported in the National Sentinel Caesarean Section Audit (NSCSA). Estimates of the cost of delivery by mode of birth are reported in chapter 4. This showed the cost consequences of different levels of maternal request that were asked for by women or agreed to by obstetricians. Table C.1 shows the data from the NSCSA used in the model. The number of live births in England and Wales in 2001 was reported as 595,000 (<http://www.statistics.gov.uk/pdfdir/birth1202.pdf>).

The model compared two scenarios: The first scenario reflected current practice in England and Wales, based on NSCSA data that showed that planned CS was requested in 5% of all births. It was also reported that 7% of all planned CS deliveries were due to maternal request only, that is, where no specific clinical or other reason for planned CS was given. From this, it was calculated that 29.4% of all maternal requests for CS were currently agreed to by obstetricians.<sup>a</sup>

The second scenario considered possible changes to the current scenario where different proportions of maternal requests were either made by women or agreed to by obstetricians. The model calculated the associated costs and savings of changing the rate of maternal requests

**Table C.1.** Baseline probabilities used in maternal request model (NSCSA data)

Model parameter	Proportion (%)	Number
The number of births in England and Wales in 2001	100	595,000
Births by CS – of all births	21	124,950
Planned CS birth – of all CS	37	46,232
Planned CS birth – of all births	7.77	
Planned CS delivered by scheduled CS – of all CS	96*	44,383
Planned CS delivered by emergency CS – of all CS	2*	925
Planned CS delivered by spontaneous vaginal delivery – of all CS	2*	925
Births by vaginal delivery of all births	79	470,050
Planned vaginal births – of all births	92.23	548,769
Births by vaginal delivery – of all planned vaginal births	86	471,941
Births by emergency CS – of all planned vaginal births	14	76,828
Maternal request - of all births	5	29,750
Maternal requests that are currently accepted for planned CS – of all CS	7	8,747
Maternal requests that are accepted – of all maternal requests	29.4	

\* These are consensus estimates as these data were not available from the NSCSA

<sup>a</sup> 21% of all 595,000 births are by CS, which is 124,950 women annually. Around 7% of all CS deliveries were undertaken by maternal request, 7% of 124,950 is 8747 births. In 5% of births women request a CS, which is 29,750 maternal requests per year. 8747 planned CS births by maternal request represents 29.4% of the 29750 maternal requests for CS annually.

**Table C.2.** Cost data used in the model and sensitivity analyses

	Baseline (£)	Sensitivity analysis 1 (£)	Sensitivity analysis 2 (£)
	Petrou et al 2002 <sup>120</sup>	Henderson et al 2001 <sup>116</sup>	James et al 2001 <sup>119</sup>
Vaginal delivery	1,698	629–1350	447
Emergency CS	3,200	1238–3551	1,955
Planned CS	3,200	1238–3551	2,403

leading to planned CS by comparing the baseline scenario (scenario 1) with a second scenario that varied the proportion of maternal requests made or the proportion of request agreed to (scenario 2). Scenario 1 showed the estimated cost of delivery where 7% of maternal requests are accepted by obstetricians for planned CS delivery. Scenario 2 reports the same costs where this 7% of maternal requests for CS are not agreed to by obstetricians. In scenario 2, therefore, these 7% of births are managed as planned vaginal deliveries.

Baseline cost data were applied to each delivery and the total cost and cost difference between scenario 1 and scenario 2 is reported.

UK based cost data from Petrou<sup>54</sup> were used in the baseline model. These costs included the costs of birth by different modes of delivery and two months postpartum care. Sensitivity analysis was undertaken to evaluate the effects of using different cost estimates in the model (Table C.2).

## Results

The total numbers of deliveries and cost for each scenario are reported in Table C.3, as well as the overall difference in cost between the two scenarios. The total cost for all births in the UK was almost £1.2 billion using the baseline cost data (Petrou et al).<sup>120</sup> Using these cost estimates in the first instance, the model estimated the cost consequence of changing from the current position of 7% of planned CS deliveries carried out due to maternal request, to a position where all these requests are refused and planned vaginal birth is offered (an increase of 8,747 planned vaginal deliveries). The model showed that this change in policy could result in a saving of around £11 million per annum, or £1,257 per planned CS delivery avoided. To put this into

**Table C.3.** Results of the economic model with baseline cost data, showing costs of birth where 7% of all maternal requests for planned CS are accepted (scenario 1) and refused (scenario 2)

Scenario 1 (maternal request agreed to)	Numbers of births	Baseline unit cost of delivery (£)	Total cost (£)
Vaginal delivery	470,975	1,698	799,714,922
Emergency CS	79,643	3,200	254,858,016
Non-emergency CS	44,382	3,200	142,023,168
Total	595,000		1,196,596,106
Scenario 2 (maternal request refused)			
Vaginal delivery	478,292	1,698	812,139,055
Emergency CS	80,723	3,200	258,313,114
Non-emergency CS	35,986	3,200	115,153,920
Total	595,000		1,185,606,089
Comparison of scenario 1 and scenario 2	Planned CS per births avoided	Actual CS births avoided	Cost saving per planned CS avoided
<b>Total cost saving</b>	8,747	8,572	1,257
£10,990,017			

\* Since it is assumed that a small proportion (2%) of planned CS births will lead to spontaneous vaginal birth

context, this is less than 0.1% of the estimated total cost of birth per annum in England and Wales.

Much of the cost saving was due to non-emergency CS delivery (planned CS leading to actual CS delivery) that decreased by 19% (from 44,382 to 35,986 deliveries per annum). Since the rate of planned vaginal birth is higher in scenario 2, the number of emergency CS resulting from planned vaginal birth (14% of all planned vaginal birth) is also higher. The cost of morbidity associated with emergency CS is considered in this cost estimates in the model, but the impact of quality of life of increased morbidity on maternal and child health is not taken into account, which is an important limitation of this analysis.

### Impact of changes in rates of maternal requests

A complete reduction of all CS by maternal request may not be realistic. A reduction in maternal requests that are accepted from the current 29.4% of all maternal requests made to obstetricians to, say, 20%, (5950 requests or 1% of all planned births) would represent a saving of over £3.5 million using baseline cost estimates. The reduction of maternal requests accepted by only 1% (to 28.4% of all request overall) would represent £374,000 cost savings.

The rate of CS by maternal request could also increase in the future, either due to the increase in overall maternal requests by women planning birth or because the number of maternal requests that are accepted by obstetricians increases. If, in a worst case scenario, all maternal requests were accepted, this would increase the number of planned CS deliveries by maternal request from 8747 currently to 29,750. The cost to the NHS would be £37.4 million more than accepting no maternal requests, which is £26.4 million more than the additional costs associated with accepting the current 7% of maternal requests.

If the rate of maternal requests made by women were to increase from 5% to 6% of all births with no change in the rate of maternal requests accepted by obstetricians, the number of planned CS births would increase to 10,496 (an increment of 1749 planned CS deliveries). The total cost of birth compared with no maternal requests accepted would be £13.3 million, which is £2.2 million more than the cost associated with the current 5% rate of maternal requests.

### Impact of changing the relative cost by mode of delivery

The estimated cost of maternal request can change depending on the cost value entered in the model. In the baseline model, taking into account two months postpartum care, the cost values for vaginal delivery were estimated to be half the cost of CS. Other studies that have focussed on perinatal hospital stay only have estimated the differences in cost between models of birth to be wider than this.

A review of cost studies is presented in Chapter 4 and the cost data used in the model are reported in Table B.2 as sensitivity analysis 1<sup>116</sup> (Table C.2) Using the highest and lowest cost estimates from this review of cost studies in the model makes a very large difference to the magnitude of the cost savings from reducing maternal requests accepted for planned CS. If the lowest vaginal birth costs reported in the review and highest CS cost estimate reported in the review are used, the additional cost for accepting 8,747 maternal requests for CS is around £21.2 million. This is the highest cost saving in the model derived from the published sources of literature on cost of delivery. Since the highest cost for vaginal birth in the review is higher than the lowest cost for CS, if these values were entered into the model, the model would show that increasing planned CS due to maternal request would lead to savings, which is not a realistic conclusion. Inputting recent UK values from James et al<sup>53</sup> (sensitivity analysis 2, Table B.2), the additional cost of accepting maternal requests for planned CS is around £14.8 million.

## Which cost value to choose?

The cost values that represent the closest estimate of 'opportunity cost' to the NHS should take into account the widest range of costs associated with the different modes of delivery. The study that included two months postpartum care in the baseline model is probably a reasonable estimate of the overall costs to the NHS. It is also a recent study, so the cost values reflect current practice in the NHS. Using these estimates, the cost savings from refusing maternal requests for planned CS were £10.9 million. Therefore the actual estimate of the cost of maternal request probably ranges from £10.9 to £14.8 million per annum.

## Interpretation of the results

The mean cost saving as a result of switching from planned CS to planned vaginal birth on the basis of maternal request only is reported here as £1,257 per birth. However, it is important to state that this is a crude estimate of health service savings since it does not take into account any additional costs that might be associated with planning a vaginal delivery against a woman's judgement or request. These might involve additional counselling or additional antenatal care in planning for the vaginal birth. Nor does it take into account additional non-health service costs to women or to statutory services as a result of a woman having a request for a planned CS delivery refused, or of the additional economic burden of increased emergency CS. Good data on what these additional non-health service costs and benefits might include were not identified in the published literature. However, the cost consequence of reducing maternal requests is in the order of magnitude of millions of pounds. This supports the view that there could be significant cost savings even if additional non-health service costs were taken into account and a policy to reduce maternal requests as a reason on its own for planned CS could release health services resources.

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**Other NICE guidelines produced by the National Collaborating Centre for Women's and Children's Health include:**

- The use of electronic fetal monitoring
- Induction of labour
- Fertility guideline: assessment and treatment for people with fertility problems

**Guidelines in production include:**

- Long-acting reversible contraceptives
- Intrapartum care
- Hysterectomy
- Incontinence

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A version of this guideline for pregnant women, their partners and the public, called Caesarean section. Understanding NICE guidance: information for pregnant women, their families and the public, is also available (reproduced as Appendix 1 in this version). It can be downloaded from the NICE website ([www.nice.org.uk](http://www.nice.org.uk)) or ordered from the NHS Response Line (0870 1555 455; quote reference number N0479 for an English version and N0480 for an English and Welsh version).

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