National Institute for Health and Care Excellence

Final

Intrapartum care

[N] Evidence reviews for position of the baby during cord clamping

NICE guideline NG235

Evidence reviews underpinning a research recommendation in the NICE guideline

September 2023

Final

These evidence reviews were developed by NICE

Disclaimer

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

Local commissioners and/or providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

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Position of the baby during cord clamping

Review question

What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

Introduction

After birth, the umbilical cord connecting the baby to the placenta is cut. Until recently the cord was clamped and cut immediately after birth. However, in the last twenty years the benefits of delayed cord clamping for term babies (usually waiting for at least 1 minute after birth) has been recognised, and delayed cord clamping has become normal practice. This delay allows for blood to pass from the placenta to the baby (known as placental transfusion) and aids cardiovascular transition from fetal to postnatal life. Based on the belief that gravity may affect the volume of placental transfusion, babies may be held at or below vaginal level until the cord is clamped. However, this can be difficult as many women wish to have skin-to-skin contact with their baby as soon as it is born to facilitate bonding which may result in low compliance with delayed cord clamping. It is not known if raising the baby to the level of the mother's abdomen or chest prior to cord clamping reduces the volume of placental transfusion leading to adverse outcomes for the baby.

The aim of this review is to assess whether there is a difference in outcomes for babies held at or below vaginal level or at the mother's abdominal or chest level during delayed cord clamping.

Summary of the protocol

See Table 1 for a summary of the Population, Intervention, Comparison and Outcome (PICO) characteristics of this review.

Table 1: Summary of the protocol (PICO table)

Population	• Women in labour who are pregnant with a single baby, who go into labour at term (37 to 42 weeks of pregnancy)
Intervention	• Before clamping the umbilical cord, the baby is held at a higher level in relation to the uterus, for example: ○ mother's abdomen level ○ mother's chest level
Comparison	• Before clamping the umbilical cord, the baby is held: ○ at vaginal level ○ below vaginal level ○ any of the above interventions
Outcome	**Critical:** • Jaundice requiring phototherapy or exchange transfusion • Infant haemoglobin concentration (24 hours after birth and 3- 6 months after birth) • Apgar score <7 at 5 minutes **Important:** • Women's experience of labour and birth • Skin-to-skin contact (uninterrupted, for example minimum 30 mins in the first hour) • Breastfeeding (as defined by the study) • Neonatal admission

For further details see the review protocol in appendix A.

Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in appendix A and the methods document (supplementary document 1).

Declarations of interest were recorded according to NICE's conflicts of interest policy.

Effectiveness evidence

Included studies

Three randomised control trials (RCTs) were included for this review (Jain 2020, Mansaray 2015, Vain 2014).

The included studies are summarised in Table 2.

Two different comparisons were identified for optimum position for the baby during delayed cord clamping; 2 studies compared placing the baby at the mother's abdomen versus holding the baby below the vaginal level (Jain 2020, Mansaray 2015), and 1 study compared placing the baby at the mother's abdomen or chest versus holding the baby at the vaginal level (Vain 2014).

This review also considered cohort studies (prospective and retrospective) as the included RCTs did not report data on all critical and important outcomes, however no eligible studies were found.

See the literature search strategy in appendix B and study selection flow chart in appendix C.

Excluded studies

Studies not included in this review are listed, and reasons for their exclusion are provided in appendix J.

Summary of included studies

Summaries of the studies that were included in this review are presented in Table 2.

Table 2: Summary of included studies.

Study	Population	Intervention	Comparison	Outcomes
Jain 2020 Randomised control trial India	N=248 women who had a vaginal birth at term Singleton pregnancies BMI and management of the third stage not reported	Babies were placed on the mother's abdomen Cord was clamped at 90 seconds	Babies were held 20 cm below the vaginal level Cord was clamped at 90 seconds	• Jaundice requiring phototherapy • Infant haemoglobin at 3-4 months • Fall in haemoglobin from birth to 3-4 months • Exclusive breastfeeding at 3-4 months • NICU admission
Mansaray 2015 Randomised control trial US	N=101 women who had a vaginal birth at term Singleton pregnancies BMI and management of the third stage not reported	Babies were placed on the mother's abdomen Cord was clamped at 60-75 seconds	Babies were held at least 10 cm below the vaginal level Cord was clamped at 60-75 seconds	• Jaundice requiring phototherapy • Jaundice requiring transfusion • Apgar score at 5 min • NICU admission
Vain 2014 Randomised control trial Argentina	N=546 women who had an uncomplicated vaginal birth at term Singleton pregnancies BMI and management of the third stage not reported	Babies were placed on the mother's abdomen or chest, dependent on the length of the umbilical cord Cord was clamped at 2 minutes	Babies were held at the vaginal level Cord was clamped at 2 minutes	• Bilirubin concentration at 36-48 hours • Apgar score at 5 minutes • NICU admission

BMI: body mass index; NICU: neonatal intensive care unit

See the full evidence tables in appendix D and the forest plots in appendix E.

Summary of the evidence

Two different comparisons were included in this review. The first compared placing the baby at the mother's abdomen level with holding the baby below the vaginal level and the second compared placing the baby at the mother's abdomen or chest level with holding the baby at the vaginal level.

The first comparison identified an important harm for the outcome of infant haemoglobin at 3-4 months, with a mean reduction in haemoglobin of 0.3 g/dL for babies placed at the abdominal level, compared to those held at vaginal level. For all other outcomes in this comparison there was either no evidence of an important difference or no important difference.

The second comparison showed either no evidence of an important difference or no important difference for all outcomes.

Typically, the comparisons where no difference between interventions was found included seriously imprecise findings, therefore they should not be taken as definitive evidence of no difference between the interventions.

Additionally, no evidence was identified on women's experience of labour and birth and skin-to-skin contact (usually defined as uninterrupted for a minimum of 30 minutes in the first hour after birth).

The quality of the evidence ranged from moderate to very low, with most concerns around blinding and the lack of a pre-specified protocol to determine bias in selected reporting.

See appendix F for full GRADE tables.

Economic evidence

Included studies

A systematic review of the economic literature was conducted but no economic studies were identified which were applicable to this review question.

Economic model

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation.

The committee's discussion and interpretation of the evidence

The outcomes that matter most

Babies are susceptible to jaundice in the first few days after birth due to the rapid transition from the intrauterine to the extrauterine pattern of heme catabolism. This leads to the circulation of unconjugated bilirubin that the neonatal liver may be unable to metabolise in time, resulting in neonatal jaundice. The risk of jaundice may therefore be increased in babies with delayed cord clamping who have a larger volume of placental transfusion and therefore an increased number of red blood cells. The committee therefore chose jaundice requiring phototherapy or exchange transfusion as critical outcomes to indicate the safety of different positions prior to cord clamping. Infant haemoglobin concentration 24 hours after birth and 3 to 6 months after birth were chosen as critical outcomes to assess the effects of different positions during cord clamping on placental transfusion and resulting haemoglobin levels at these time points. An Apgar score <7 at 5 minutes indicates that a baby has not transitioned well to life ex-utero and may need support and so this was also chosen as a critical outcome for this review.

The committee also chose important outcomes for this review. The committee agreed that it was important to find out about women's experience and whether holding the baby at or below vaginal level (and therefore not passing it to the mother or placing it on her abdomen) had an impact on this. The committee recognised the great importance of this outcome, however they were aware that the evidence was likely to be sparse, and unlikely to inform decision-making in a meaningful way, so they prioritised other outcomes as critical. The committee agreed that it was also important to look at outcomes that promote emotional attachment with the baby, such as skin-to-skin contact and breastfeeding, as again these can impact on the overall wellbeing of the baby, as well as being important for thermostasis and nutrition. The committee chose neonatal admission as an important outcome as, along with Apgar score, this would indicate whether there were any post-birth complications related to the different positions of the baby prior to cord clamping.

The quality of the evidence

The quality of the evidence ranged from moderate to very low, with most of the evidence being low to very low quality. Some of the evidence was downgraded for risk of bias due to the lack of an available prespecified protocol and imprecision around the estimate of effect. Due to the nature of the interventions, it was not possible to blind the study participants or midwives for all of the comparisons. Whilst this may have introduced some bias and most of the outcomes (with the exception of breastfeeding) are measured with appropriate standardised methods, the committee interpreted the evidence taking this limitation into account.

Benefits and harms

The committee discussed the evidence presented on the optimum position for the baby during delayed cord clamping. The committee's discussion initially focused on the outcome of infant haemoglobin at 3 to 4 months. The evidence showed that babies held at the mother's abdomen level had lower haemoglobin levels at 3 to 4 months (-0.3 g/dL) than those held below vaginal level. The committee agreed that despite not being a large difference in absolute terms, it was important to consider as babies have higher haemoglobin levels at birth, which then fall up until 6-8 weeks which is considered the nadir. The committee considered the 95% confidence interval reported for the fall in haemoglobin at 3 to 4 months (-0.58 to -0.02 g/dL) and discussed that for some babies this decrease could potentially move them into the pathological range, with the baby suffering from anaemia.

The committee then moved onto discussing the outcome of fall in haemoglobin between birth and 3 to 4 months. For this outcome there was no difference between the babies held below vaginal level or at the mother's abdomen level. The committee discussed that this might mean that the babies with the low haemoglobin at 3 to 4 months had a lower haemoglobin at birth, but as the haemoglobin levels at birth were not reported, it was not possible to verify this.

Overall, the committee came to the consensus agreement that the effects on haemoglobin were unclear, but the evidence suggested that holding the baby at abdominal level during delayed cord clamping might have an adverse effect on haemoglobin levels but that the effect was likely to be very small and may or may not be clinically significant.

The committee agreed that as there was no difference between the positions for any of the other reported outcomes it was not possible to recommend that either abdominal/chest or vaginal level be used in preference to the other during delayed cord clamping.

The committee also discussed whether the benefits of holding the baby below the vaginal level outweighed the benefits of immediate skin to skin contact between the mother and the baby. The committee came to an informal consensus that parents want to do what is most

beneficial for the baby, and that the benefits of immediate skin to skin contact may outweigh the small drop in haemoglobin but as none of the included studies had reported on this, they were unable to reach a definitive conclusion.

The committee discussed that the evidence had only looked at two main positions for the baby – abdominal/chest level and vaginal level or below – with the assumption that most women would be semi-recumbent. However, there were many other positions in which a woman could give birth including kneeling, squatting, standing, or sitting in a birthing pool. The committee considered the practical implications of holding the baby below the vaginal level straight after birth in these positions, and the fact that in women who were standing, raising the baby to chest level would be a greater height difference than in women who were semi-recumbent. The committee noted that after caesarean birth, women often wanted to see their baby immediately and so it was common practice to lift the baby to show the mother over the screen, before cord clamping, which was also at a greater height above the vaginal level. The committee also considered the practicalities of the vaginal level position for physiological management where the cord is clamped once it has stopped pulsing, so the baby would need to be held at the vaginal level for longer. The committee also added that holding the baby in set position after birth may result in the midwife or obstetrician not being able to address other care needs, and that in the case of a water birth this practice would not be feasible.

The committee were concerned about the low quality of the evidence for the outcome of infant haemoglobin at 3 to 4 months. There were concerns about the risk of bias for the outcome, the sample size, and the lack of data for the same outcome in the other included studies. The committee discussed the impact that holding the baby for longer would have on the outcome, and there were concerns that the included studies only considered the effect of position and not time. In their view, the time the baby is held and the position cannot be isolated, and timing might be more important as it may affect the blood volume more than the actual position of the baby. As a result, the committee agreed that there was not enough evidence to support holding the baby in a specific position, therefore they agreed not to make a definitive recommendation on this topic.

Based on the lack of evidence to guide advice on the optimal position of the baby, the committee agreed to make a research recommendation on the effect of holding the baby below vaginal level versus the mother's abdomen for a wider range of birthing positions including standing as well as during different modes of birth including caesarean and birth with forceps or ventouse as no evidence had been found on this.

Cost effectiveness and resource use

The committee did not think that there were resource implications arising from different birth positions and therefore agreed that cost effectiveness would be determined by clinical effectiveness. However, the lack of evidence meant that the committee did not advise one position or another for the baby prior to delayed cord clamping. As birth position does not impact resource use and because the recommendations do not change current practice there will be no resource implications.

Recommendations supported by this evidence review

This evidence review supports a research recommendation.

References – included studies

Effectiveness

Jain 2020

Jain, R., Jain, A., Devgan, V. et al. (2020) Effect of alternative positions of neonates prior to delayed cord clamping on placental transfusion: a randomized control trial. Journal of Maternal-Fetal and Neonatal Medicine 33(9): 1511-1516

Mansaray 2015

Mansaray A; Yetman R; Berens P (2015) Effect of Delayed Cord Clamping Above Versus Below the Perineum on Neonatal Hematocrit: A Randomized Controlled Trial. Breastfeeding medicine : the official journal of the Academy of Breastfeeding Medicine 10(10): 464-467

Vain 2014

Vain, Nestor E., Satragno, Daniela S., Gorenstein, Adriana N. et al. (2014) Effect of gravity on volume of placental transfusion: a multicentre, randomised, non-inferiority trial. Lancet (London, England) 384(9939): 235-40

Appendices

Appendix A Review protocols

Review protocol for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

Table 3: Review protocol

Field	Content
PROSPERO registration number	CRD42022307380
Review title	Optimum position for the baby during delayed cord clamping
Review question	What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?
Objective	To update the recommendations in CG190 (2014) for the optimum position of the baby during cord clamping. The guideline does not currently make any recommendations on where the baby should be held during delayed cord clamping. Surveillance has identified new evidence which suggests that volume of placental transfusion is similar in babies held by the mother compared to being held at vagina level for 2 minutes. Feedback suggests that both practices are used, however, holding the baby at vagina level was difficult and may result in low compliance of delayed cord clamping.
Searches	The following databases will be searched: • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • Embase • MEDLINE • International Health Technology Assessment database Searches will be restricted by: • No date limitations • English language only

Field	Content
	• Human studies only Other searches: • Inclusion lists of systematic reviews The full search strategies for MEDLINE database will be published in the final review. For each search, the principal database search strategy is quality assured by a second information scientist using an adaptation of the PRESS 2015 Guideline Evidence-Based Checklist.
Condition or domain being studied	Labour and birth
Population	Women in labour who are pregnant with a single baby, who go into labour at term (37 to 42 weeks of pregnancy)
Intervention	Before clamping the umbilical cord, the baby is held at a higher level in relation to the uterus, for example: • mother's abdomen level • mother's chest level
Comparator	Before clamping the umbilical cord, the baby is held: • at vaginal level • below vaginal level • any of the above interventions
Types of study to be included	Include published full-text papers: • Systematic reviews of RCTs • Parallel RCTs (individual or cluster) If RCTs do not report data on all critical and important outcomes: cohort studies (prospective and retrospective) Conference abstracts will not be included because these do not typically have sufficient information to allow full critical appraisal.

Field	Content
Other exclusion criteria	Population: • Women in preterm labour • Preterm births • Women with an intrauterine fetal death Studies: • Studies reporting that the cord was clamped earlier than 1 minute from the birth of the baby If any study or systematic review includes <1/3 of women with the above characteristics, it will be considered for inclusion but, if included, the evidence will be downgraded for indirectness.
Context	This guideline will partly update the following: Intrapartum care for healthy women and babies (CG190)
Primary outcomes (critical outcomes)	**Critical outcomes:** • Jaundice requiring phototherapy or exchange transfusion • Infant haemoglobin concentration (24 hours after birth and 3- 6 months after birth) • Apgar score < 7 at 5 minutes
Secondary outcomes (important outcomes)	**Important outcomes:** • Women's experience of labour and birth • Skin-to-skin contact (uninterrupted, for example minimum 30 mins in the first hour) • Breastfeeding (as defined by the study) • Neonatal admission (includes neonatal intensive care unit [NICU] and special care baby unit [SCBU])
Data extraction (selection and coding)	All references identified by the searches and from other sources will be uploaded into EPPI and de-duplicated. Titles and abstracts of the retrieved citations will be screened to identify studies that potentially meet the inclusion criteria outlined in the review protocol. Dual sifting will be performed on at least 10% of records; 90% agreement is required. Disagreements will be resolved via discussion between the two reviewers, and consultation with senior staff if necessary.

Field	Content
	Full versions of the selected studies will be obtained for assessment. Studies that fail to meet the inclusion criteria once the full version has been checked will be excluded at this stage. Each study excluded after checking the full version will be listed, along with the reason for its exclusion. A standardised form will be used to extract data from studies. The following data will be extracted: study details (reference, country where study was carried out, type and dates), participant characteristics, inclusion and exclusion criteria, details of the interventions if relevant, setting and follow-up, relevant outcome data and source of funding. One reviewer will extract relevant data into a standardised form, and this will be quality assessed by a senior reviewer.
Risk of bias (quality) assessment	Quality assessment of individual studies will be performed using the following checklists: • ROBIS tool for systematic reviews • Cochrane RoB tool v.2 for RCTs • Cochrane RoB tool v.2 for randomized cluster trials • Cochrane ROBINS-I tool for non-randomised (clinical) controlled trials and cohort studies The quality assessment will be performed by one reviewer and this will be quality assessed by a senior reviewer.
Strategy for data synthesis	Quantitative findings will be formally summarised in the review. Where multiple studies report on the same outcome for the same comparison, meta-analyses will be conducted using Cochrane Review Manager software. A fixed effect meta-analysis will be conducted and data will be presented as risk ratios if possible or odds ratios when required (for example, if only available in this form in included studies) for dichotomous outcomes, and mean differences or standardised mean differences for continuous outcomes. Heterogeneity in the effect estimates of the individual studies will be assessed using the I2 statistic. Alongside visual inspection of the point estimates and confidence intervals, I2 values of greater than 50% and 80% will be considered as significant and very significant heterogeneity, respectively. Heterogeneity will be explored as appropriate using sensitivity analyses and pre-specified subgroup analyses. If heterogeneity cannot be explained through subgroup analysis then a random effects model will be used for meta-analysis, or the data will not be pooled. The confidence in the findings across all available evidence will be evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group: http://www.gradeworkinggroup.org/ Minimally important differences:

Field	Content
	• Serious intervention-related adverse effects: statistical significance • Validated scales/continuous outcomes: published MIDs where available • All other outcomes & where published MIDs are not available: 0.8 and 1.25 for all relative dichotomous outcomes; +/- 0.5x control group SD for continuous outcomes

Analysis of subgroups	Evidence will be stratified by:
	
	• Active versus physiological management
	• Multi-fetal pregnancies
	• Women who had a caesarean birth
	• BMI thresholds on booking:
	  ○ underweight range: <18.5 kg/m^2
	  ○ healthy weight range: 18.5 to 24.9 kg/m^2
	  ○ overweight range: 25 to 29.99 kg/m^2
	  ○ obesity 1 range: 30 to 34.99 kg/m^2
	  ○ obesity 2 range: 35 to 39.99 kg/m^2
	
	Stratifications will be dealt with in a hierarchy (this is, first by active versus physiological management, multi-fetal pregnancies, women who had a caesarean birth, BMI thresholds on booking)
	
	Evidence will be subgrouped by the following only in the event that there is significant heterogeneity in outcomes:
	• Timing
	  ○ 1 to 5 minutes
	  ○ >5 minutes
	• Age of woman (<35 vs >/= 35)
	• Ethnicity
	  ○ White
	  ○ Asian/Asian British
	  ○ Black/African/Caribbean/Black British
	  ○ Mixed/Multiple ethnic groups

Field	Content	
	○ Other ethnic group • Women with disability vs not • Country where the study was conducted: high income countries versus low and middle income countries (as defined by the OECD) Where evidence is stratified or subgrouped the committee will consider on a case by case basis if separate recommendations should be made for distinct groups. Separate recommendations may be made where there is evidence of a differential effect of interventions in distinct groups. If there is a lack of evidence in one group, the committee will consider, based on their experience, whether it is reasonable to extrapolate and assume the interventions will have similar effects in that group compared with others.	
Type and method of review	☒	Intervention
	☐	Diagnostic
	☐	Prognostic
	☐	Qualitative
	☐	Epidemiologic
	☐	Service Delivery
	☐	Other (please specify)
Language	English	
Country	England	
Anticipated or actual start date	28/01/2022	
Anticipated completion date	22/03/2023	
Named contact	5a. Named contact Guideline Development Team National Guideline Alliance (NGA)	

Field	Content
	5b. Named contact e-mail IPCupdate@nice.org.uk 5c. Organisational affiliation of the review Guideline Development Team NGA, Centre for Guidelines, National Institute for Health and Care Excellence (NICE)
Review team members	From the Guideline Development Team NGA: • Senior Systematic Reviewer • Systematic Reviewer
Funding sources/sponsor	This systematic review is being completed by the Guideline Development Team NGA, Centre for Guidelines, which is part of the National Institute for Health and Care Excellence (NICE).
Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: https://www.nice.org.uk/guidance/cg190
Other registration details	None
URL for published protocol	https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=307380
Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: notifying registered stakeholders of publication publicising the guideline through NICE's newsletter and alerts issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE.

Field	Content
Keywords	Cord clamping, baby position
Details of existing review of same topic by same authors	Not applicable
Additional information	None
Details of final publication	www.nice.org.uk

CDSR: Cochrane Database of Systematic Reviews; CENTRAL: Cochrane Central Register of Controlled Trials; GRADE: Grading of Recommendations Assessment, Development and Evaluation; HTA: Health Technology Assessment; MID: minimally important difference; NGA: National Guideline Alliance; NHS: National health service; NICE: National Institute for Health and Care Excellence; OECD: Organisation for Economic Co-operation and Development; PRESS: peer review of electronic search strategies; RCT: randomised controlled trial; RoB: risk of bias; ROBINS-I: Risk Of Bias In Non-randomised Studies - of Interventions; ROBIS: Risk of bias in systematic reviews; SD: standard deviation.

Appendix B Literature search strategies

Literature search strategies for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

Database: Medline – OVID interface

Date of last search: 07/12/2022

#	Searches
1	UMBILICAL CORD/
2	(umbilical adj3 cord?).ti,ab.
3	(cord? adj5 (clamp* or cut*)).ti,ab.
4	or/1-3
5	PATIENT POSITIONING/
6	position*.ti,ab.
7	held.ti,ab.
8	hold*.ti,ab.
9	placed.ti,ab.
10	placing.ti,ab.
11	((abdomen* or chest* or vagina* or uterus* or uterine) adj3 (level* or height* or higher or above or lower or below)).ti,ab.
12	or/5-11
13	4 and 12
14	limit 13 to english language
15	LETTER/
16	EDITORIAL/
17	NEWS/
18	exp HISTORICAL ARTICLE/
19	ANECDOTES AS TOPIC/
20	COMMENT/
21	CASE REPORT/
22	(letter or comment*).ti.
23	or/15-22
24	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
25	23 not 24
26	ANIMALS/ not HUMANS/
27	exp ANIMALS, LABORATORY/
28	exp ANIMAL EXPERIMENTATION/
29	exp MODELS, ANIMAL/
30	exp RODENTIA/
31	(rat or rats or mouse or mice).ti.
32	or/25-31
33	14 not 32
34	META-ANALYSIS/
35	META-ANALYSIS AS TOPIC/
36	(meta analy* or metanaly* or metaanaly*).ti,ab.
37	((systematic* or evidence*) adj2 (review* or overview*)).ti,ab.
38	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
39	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
40	(search* adj4 literature).ab.
41	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
42	cochrane.jw.
43	or/34-42
44	randomized controlled trial.pt.
45	controlled clinical trial.pt.
46	pragmatic clinical trial.pt.
47	randomi#ed.ab.
48	placebo.ab.
49	randomly.ab.
50	CLINICAL TRIALS AS TOPIC/
51	trial.ti.

#	Searches
52	or/44-51
53	COHORT STUDIES/
54	FOLLOW-UP STUDIES/
55	LONGITUDINAL STUDIES/
56	PROSPECTIVE STUDIES/
57	RETROSPECTIVE STUDIES/
58	((cohort* or follow-up or follow?up or longitudinal* or prospective* or retrospective*) adj1 (stud* or research or analys*)).tw.
59	(incidence? adj (stud* or research or analys*)).tw.
60	(longitudinal* adj1 (survey* or evaluat*)).tw.
61	(prospective* adj method*).tw.
62	(retrospective* adj design*).tw.
63	or/53-62
64	33 and 43
65	33 and 52
66	33 and 63
67	64 or 65 or 66

Database: Embase – OVID interface

Date of last search: 07/12/2022

#	Searches
1	UMBILICAL CORD/
2	(umbilical adj3 cord?).ti,ab.
3	(cord? adj5 (clamp* or cut*)).ti,ab.
4	or/1-3
5	PATIENT POSITIONING/
6	BODY POSITION/
7	position*.ti,ab.
8	held.ti,ab.
9	hold*.ti,ab.
10	placed.ti,ab.
11	placing.ti,ab.
12	((abdomen* or chest* or vagina* or uterus* or uterine) adj3 (level* or height* or higher or above or lower or below)).ti,ab.
13	or/5-12
14	4 and 13
15	limit 14 to english language
16	letter.pt. or LETTER/
17	note.pt.
18	editorial.pt.
19	CASE REPORT/ or CASE STUDY/
20	(letter or comment*).ti.
21	or/16-20
22	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
23	21 not 22
24	ANIMAL/ not HUMAN/
25	NONHUMAN/
26	exp ANIMAL EXPERIMENT/
27	exp EXPERIMENTAL ANIMAL/
28	ANIMAL MODEL/
29	exp RODENT/
30	(rat or rats or mouse or mice).ti.
31	or/23-30
32	15 not 31
33	SYSTEMATIC REVIEW/
34	META-ANALYSIS/
35	(meta analy* or metanaly* or metaanaly*).ti,ab.
36	((systematic or evidence) adj2 (review* or overview*)).ti,ab.
37	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
38	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
39	(search* adj4 literature).ab.
40	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
41	((pool* or combined) adj2 (data or trials or studies or results)).ab.
42	cochrane.jw.
43	or/33-42

#	Searches
44	random*.ti,ab.
45	factorial*.ti,ab.
46	(crossover* or cross over*).ti,ab.
47	((doubl* or singl*) adj blind*).ti,ab.
48	(assign* or allocat* or volunteer* or placebo*).ti,ab.
49	CROSSOVER PROCEDURE/
50	SINGLE BLIND PROCEDURE/
51	RANDOMIZED CONTROLLED TRIAL/
52	DOUBLE BLIND PROCEDURE/
53	or/44-52
54	COHORT ANALYSIS/
55	FOLLOW UP/
56	LONGITUDINAL STUDY/
57	PROSPECTIVE STUDY/
58	RETROSPECTIVE STUDIES/
59	((cohort* or follow-up or follow?up or longitudinal* or prospective* or retrospective*) adj1 (stud* or research or analys*)).tw.
60	(incidence? adj (stud* or research or analys*)).tw.
61	(longitudinal* adj1 (survey* or evaluat*)).tw.
62	(prospective* adj method*).tw.
63	(retrospective* adj design*).tw.
64	or/54-63
65	32 and 43
66	32 and 53
67	32 and 64
68	65 or 66 or 67

Databases: Cochrane Central Register of Controlled Trials; Cochrane Database of Systematic Reviews – Wiley interface

Date of last search: 07/12/2022

#	Searches
#1	MeSH descriptor: [Umbilical Cord] this term only
#2	(umbilical near/3 cord*):ti,ab
#3	(cord* near/5 (clamp* or cut*)):ti,ab
#4	#1 or #2 or #3
#5	MeSH descriptor: [Patient Positioning] this term only
#6	position*:ti,ab
#7	held:ti,ab
#8	hold*:ti,ab
#9	placed:ti,ab
#10	placing:ti,ab
#11	((abdomen* or chest* or vagina* or uterus* or uterine) near/3 (level* or height* or higher or above or lower or below)):ti,ab
#12	#5 or #6 or #7 or #8 or #9 or #10 or #11
#13	#4 and #12

Database: International Health Technology Assessment

Date of last search: 07/12/2022

#	Searches
	All: ("umbilical cord" or "cord clamp" or "cord clamping" or "cord cut" or "cord cutting")

Health Economics Search Strategies

Database: Medline – OVID interface

Date of last search: 07/12/2022

#	Searches
1	UMBILICAL CORD/
2	(umbilical adj3 cord?).ti,ab.
3	(cord? adj5 (clamp* or cut*)).ti,ab.
4	or/1-3
5	PATIENT POSITIONING/
6	position*.ti,ab.
7	held.ti,ab.
8	hold*.ti,ab.
9	placed.ti,ab.
10	placing.ti,ab.
11	((abdomen* or chest* or vagina* or uterus* or uterine) adj3 (level* or height* or higher or above or lower or below)).ti,ab.
12	or/5-11
13	4 and 12
14	limit 13 to english language
15	LETTER/
16	EDITORIAL/
17	NEWS/
18	exp HISTORICAL ARTICLE/
19	ANECDOTES AS TOPIC/
20	COMMENT/
21	CASE REPORT/
22	(letter or comment*).ti.
23	or/15-22
24	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
25	23 not 24
26	ANIMALS/ not HUMANS/
27	exp ANIMALS, LABORATORY/
28	exp ANIMAL EXPERIMENTATION/
29	exp MODELS, ANIMAL/
30	exp RODENTIA/
31	(rat or rats or mouse or mice).ti.
32	or/25-31
33	14 not 32
34	ECONOMICS/
35	VALUE OF LIFE/
36	exp "COSTS AND COST ANALYSIS"/
37	exp ECONOMICS, HOSPITAL/
38	exp ECONOMICS, MEDICAL/
39	exp RESOURCE ALLOCATION/
40	ECONOMICS, NURSING/
41	ECONOMICS, PHARMACEUTICAL/
42	exp "FEES AND CHARGES"/
43	exp BUDGETS/
44	budget*.ti,ab.
45	cost*.ti,ab.
46	(economic* or pharmaco?economic*).ti,ab.
47	(price* or pricing*).ti,ab.
48	(financ* or fee or fees or expenditure* or saving*).ti,ab.
49	(value adj2 (money or monetary)).ti,ab.
50	resourc* allocat*.ti,ab.
51	(fund or funds or funding* or funded).ti,ab.
52	(ration or rations or rationing* or rationed).ti,ab.
53	ec.fs.
54	or/34-53
55	33 and 54

Database: Embase – OVID interface

Date of last search: 07/12/2022

#	Searches
1	UMBILICAL CORD/
2	(umbilical adj3 cord?).ti,ab.
3	(cord? adj5 (clamp* or cut*)).ti,ab.
4	or/1-3
5	PATIENT POSITIONING/
6	BODY POSITION/

#	Searches
7	position*.ti,ab.
8	held.ti,ab.
9	hold*.ti,ab.
10	placed.ti,ab.
11	placing.ti,ab.
12	((abdomen* or chest* or vagina* or uterus* or uterine) adj3 (level* or height* or higher or above or lower or below)).ti,ab.
13	or/5-12
14	4 and 13
15	limit 14 to english language
16	letter.pt. or LETTER/
17	note.pt.
18	editorial.pt.
19	CASE REPORT/ or CASE STUDY/
20	(letter or comment*).ti.
21	or/16-20
22	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
23	21 not 22
24	ANIMAL/ not HUMAN/
25	NONHUMAN/
26	exp ANIMAL EXPERIMENT/
27	exp EXPERIMENTAL ANIMAL/
28	ANIMAL MODEL/
29	exp RODENT/
30	(rat or rats or mouse or mice).ti.
31	or/23-30
32	15 not 31
33	HEALTH ECONOMICS/
34	exp ECONOMIC EVALUATION/
35	exp HEALTH CARE COST/
36	exp FEE/
37	BUDGET/
38	FUNDING/
39	RESOURCE ALLOCATION/
40	budget*.ti,ab.
41	cost*.ti,ab.
42	(economic* or pharmaco?economic*).ti,ab.
43	(price* or pricing*).ti,ab.
44	(financ* or fee or fees or expenditure* or saving*).ti,ab.
45	(value adj2 (money or monetary)).ti,ab.
46	resourc* allocat*.ti,ab.
47	(fund or funds or funding* or funded).ti,ab.
48	(ration or rations or rationing* or rationed).ti,ab.
49	or/33-48
50	32 and 49

Database: Cochrane Central Register of Controlled Trials – Wiley interface

Date of last search: 07/12/2022

#	Searches
#1	MeSH descriptor: [Umbilical Cord] this term only
#2	(umbilical near/3 cord*):ti,ab
#3	(cord* near/5 (clamp* or cut*)):ti,ab
#4	#1 or #2 or #3
#5	MeSH descriptor: [Patient Positioning] this term only
#6	position*:ti,ab
#7	held:ti,ab
#8	hold*:ti,ab
#9	placed:ti,ab
#10	placing:ti,ab
#11	((abdomen* or chest* or vagina* or uterus* or uterine) near/3 (level* or height* or higher or above or lower or below)):ti,ab
#12	#5 or #6 or #7 or #8 or #9 or #10 or #11
#13	#4 and #12
#14	MeSH descriptor: [Economics] this term only
#15	MeSH descriptor: [Value of Life] this term only
#16	MeSH descriptor: [Costs and Cost Analysis] explode all trees

#	Searches
#17	MeSH descriptor: [Economics, Hospital] explode all trees
#18	MeSH descriptor: [Economics, Medical] explode all trees
#19	MeSH descriptor: [Resource Allocation] explode all trees
#20	MeSH descriptor: [Economics, Nursing] this term only
#21	MeSH descriptor: [Economics, Pharmaceutical] this term only
#22	MeSH descriptor: [Fees and Charges] explode all trees
#23	MeSH descriptor: [Budgets] explode all trees
#24	budget*:ti,ab
#25	cost*:ti,ab
#26	(economic* or pharmaco?economic*):ti,ab
#27	(price* or pricing*):ti,ab
#28	(financ* or fee or fees or expenditure* or saving*):ti,ab
#29	(value near/2 (money or monetary)):ti,ab
#30	resourc* allocat*:ti,ab
#31	(fund or funds or funding* or funded):ti,ab
#32	(ration or rations or rationing* or rationed):ti,ab
#33	#14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32
#34	#13 and #33

Database: International Health Technology Assessment

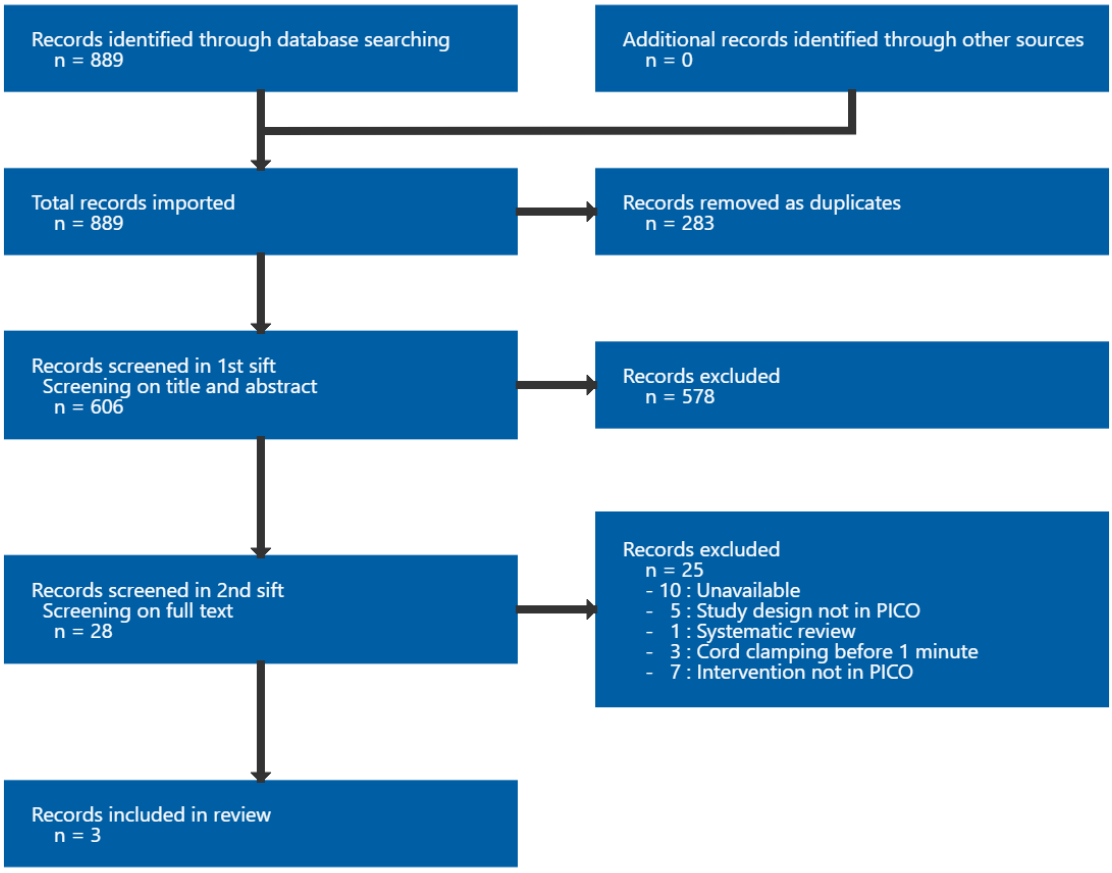
Date of last search: 07/12/2022

#	Searches
	All: ("umbilical cord" or "cord clamp" or "cord clamping" or "cord cut" or "cord cutting")

Appendix C Effectiveness evidence study selection

Study selection for: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

Figure 1: Study selection flow chart



Appendix D Evidence tables

Evidence tables for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

Jain, 2020

Bibliographic Reference	Jain, R.; Jain, A.; Devgan, V.; Sekhar, J.; Effect of alternative positions of neonates prior to delayed cord clamping on placental transfusion: a randomized control trial; Journal of Maternal-Fetal and Neonatal Medicine; 2020; vol. 33 (no. 9); 1511-1516

Study details

Country/ies where study was carried out	India
Study type	Randomised controlled trial (RCT)
Study dates	Not reported
Inclusion criteria	• term pregnancy • uncomplicated antenatal period • informed written consent
Exclusion criteria	• Women with medical complications including eclampsia, heart disease, anaemia (Hb <10 g/dl), hypothyroidism, antepartum haemorrhage, abnormal antenatal ultrasound, multiple pregnancies, and Rh-negative blood group
Patient characteristics	<u>Maternal age - mean ± standard deviation</u> • Abdominal Level group: 23.9 ± 3.4 • Below vaginal Level group: 23.3 ± 3.5 <u>Gestational age - median (Inter Quartile Range)</u> • Abdominal Level group: 39 (2) • Below vaginal Level group: 38 (3)

	Primiparous - number - (%) Abdominal Level group: 52 (53.6) Below vaginal Level group: 59 (57.8)
Intervention(s)/control	• Abdominal Level (above level of introitus): newborns were placed on the mother's abdomen for 90 seconds. The cord was clamped at 90 seconds. • Below vaginal Level (below level of introitus): newborns were held at 20cm below the introitus for 90 seconds. The cord was clamped at 90 seconds.
Duration of follow-up	• 3 - 4 months
Sources of funding	• Not reported

Sample size	Randomised N= 248
	
	• Abdominal Level group: 124 (excluded n= 1 maternal medical disease)
	• Below vaginal Level group: 124 (excluded n= required resuscitation)
	
	Received intervention
	
	• Abdominal Level group: 123
	  ○ Excluded n= 3 (1 withdrew consent)
	  ○ Errors in processing blood samples n= 7
	  ○ Lost to follow up n= 16
	• Below vaginal Level group: 123
	  ○ Excluded n= 1 (major congenital abnormality)
	  ○ Errors in processing blood samples n= 5
	  ○ Lost to follow up n= 15
	
	Included in analysis
	
	• Abdominal Level group: 97
	• Below vaginal Level group 102

Other information	2 unaccounted for exclusions in AL group

Outcomes

Outcome	**AL group, , N = 97**	**BL group, , N = 102**
Jaundice requiring phototherapy Lower values are better No of events	n = 3	n = 2
Infant haemoglobin at 3-4 months Higher values are better Mean (SD)	12 (0.9)	12.3 (1.1)
Fall in haemoglobin from birth Lower values are better Mean (SD)	4.2 (0.9)	4 (0.9)
Exclusive breastfeeding at 3-4 months No of events	n = 89	n = 95
Neonatal admission Lower values are better No of events	n = 0	n = 2

Critical appraisal

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Allocation was computer generated and concealed in opaque envelopes and opened just prior to delivery. No baseline imbalances to suggest problems with randomisation.)*

Section	Question	Answer
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Some concerns *(Participants and people delivering the intervention were aware of their assigned intervention. Analysis was by per protocol as loss to follow up was excluded. Reasons for loss to follow up are unclear and is possible that it is because of non-adherence to assigned intervention.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(Outcome data available for most participants, there was loss to follow up but it was balanced between groups so unlikely that missingness in the outcome depended on its true values)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Method of outcome measurement was not inappropriate, blinding of the investigator was not possible and is likely that this could have affected some of the outcome measurements. The laboratory technicians that processed blood sample for haemoglobin outcomes were not aware of the assigned intervention. Breastfeeding data was collected at follow up appointment, NICU admission is an objective measure data was collected in the hospital)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(A pre-specified protocol was not available to determine bias in selected reporting.)*
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation between outcomes.

Mansaray, 2015

Bibliographic Reference	Mansaray A; Yetman R; Berens P; Effect of Delayed Cord Clamping Above Versus Below the Perineum on Neonatal Hematocrit: A Randomized Controlled Trial.; Breastfeeding medicine : the official journal of the Academy of Breastfeeding Medicine; 2015; vol. 10 (no. 10)

Study details

Country/ies where study was carried out	US
Study type	Randomised controlled trial (RCT)
Study dates	March 2012 - October 2013
Inclusion criteria	• Singleton intrauterine pregnancy • ≥ 37 weeks gestation • Anticipated vaginal birth
Exclusion criteria	• Hypertension • Diabetes mellitus • Renal disease • Medically managed seizure disorders • Pre-eclampsia • Intrauterine growth restriction • Chromosomal/anatomical abnormalities • Placental abruption.
Patient characteristics	Maternal age - years - mean ± standard deviation • Group A: 26.3 ±1.86 • Group B: 26.5 ±2.01 Gestational age - weeks - mean ± standard deviation • Group A: 39.0 ±0.38 • Group B: 39.4 ±0.39
Intervention(s)/control	Group A: babies were placed on the mother's abdomen Group B: babies were held below the perineum (at least 10 cm) In both groups the cord was clamped at 60-75 seconds

Duration of follow-up	Not reported
Sources of funding	Not reported
Sample size	Randomized N= 101 • Group A: 53 o Excluded: 26 o Caesarean birth n= 7 o Meconium n=4 o Nurse failure to collect blood sample n= 4 o Physician failure to delay clamping n= 2 o Tight nuchal n=3 o Operative delivery n= 2 o Bradycardia n= 1 o Sample clotted n= 2 o Intra-amniotic infection n=1 • Group B: 48 o Excluded: 22 o Caesarean birth n= 7 o Meconium n= 5 o Nurse failure to collect blood sample n= 2 o Physician failure to delay clamping n= 2 o Tight nuchal n= 1 o Operative delivery n= 2 o Bradycardia n= 2 o Sample clotted n= 1 o Intra-amniotic infection n= 0 Included in analysis

	• Group A: 27 • Group B: 26
Other information	Breastfeeding rates at discharge were low at an average of 27.8% with a monthly low rate of 19% and high rate of 40%. The study cohort would not have been expected to have different initiation rates.

Outcomes

Outcome	Group A, , N = 27	Group B, , N = 26
Jaundice requiring phototherapy Lower values are better No of events	n = 3	n = 1
Jaundice requiring transfusion Lower values are better No of events	n = 0	n = 0
Apgar score <7 at 1 min Higher values are better Mean (SD)	8.5 (0.24)	8.3 (0.22)
Apgar score <7 at 5 min Higher values are better Mean (SD)	9 (0.07)	9 (0)
NICU admission Lower values are better No of events	n = 3	n = 2

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Allocation was randomly generated via an online program research randomiser. No baseline imbalances to suggest problems with randomisation.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(Blinding of midwives and women was not possible, but no evidence that assignment to intervention affected implementation. No evidence that ITT protocol not followed.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	*Low* *(Outcome data available for all participants. 48 participants were removed post randomisation. Reasons for removal were specified and exclusions were balanced across groups)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Method of outcome measurement was not inappropriate, blinding of the medical staff (outcome assessors) was not possible but it is not deemed to have affected outcome measurement. The staff collecting the newborn haemoglobin and haematocrit samples were blinded to group assignment. Jaundice requiring photo therapy or transfusion was obtained by a review chart after discharge, Apgar score and NICU admission are standardised measures)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(A pre-specified protocol was not available to determine bias in selected reporting.)*
Overall bias and Directness	Risk of bias judgement	Some concerns
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation between outcomes.

Vain, 2014

Bibliographic Reference	Vain, Nestor E.; Satragno, Daniela S.; Gorenstein, Adriana N.; Gordillo, Juan E.; Berazategui, Juan P.; Alda, M. Guadalupe; Prudent, Luis M.; Effect of gravity on volume of placental transfusion: a multicentre, randomised, non-inferiority trial; Lancet (London, England); 2014; vol. 384 (no. 9939); 235-40

Study details

Country/ies where study was carried out	Argentina
Study type	Randomised controlled trial (RCT)
Study dates	August 18th, 2011 - August 31st 2012
Inclusion criteria	• >37 weeks gestation • Uncomplicated vaginal birth
Exclusion criteria	• Placenta praevia • Postpartum haemorrhage • Multiple gestation • Intrauterine growth restriction • Major congenital malformations diagnosed before delivery • Maternal diseases (eg, eclampsia, Rh incompatibility, congestive heart failure) • Request by the parents for cord blood banking • Need for resuscitation of newborn • Short umbilical cord or tight nuchal cord that prevented the the newborn being placed according to randomisation were initially randomised were not included in the analyses
Patient characteristics	<u>Maternal age - mean – standard deviation</u> • Introitus group: 27 (6.8) • Abdomen group: 26.9 (6.9)

	Gestational age - mean - standard deviation • Introitus group: 39.1 (0.9) • Abdomen group: 39.1 (0.9) Parity - mean – standard deviation • Introitus group: 1.3 (1.6) • Abdomen group: 1.4 (1.7)
Intervention(s)/control	Introitus group: newborns were held by the investigator at the vaginal level Abdomen group: newborns were placed on the mother's abdomen or chest, dependent on the length of the umbilical cord In both groups the cord was clamped at 2 minutes All newborn babies were weighed immediately after birth at the level of the vagina
Duration of follow-up	Not reported
Sources of funding	Not industry funded

Sample size	Randomised N= 546
	
	• Introitus group n= 274
	  ○ 77 not eligible for primary analysis
	  ○ 42 caesarean section or forceps
	  ○ 19 short umbilical cord or nuchal cord
	  ○ 7 need for resuscitation
	  ○ 6 team became unavailable
	  ○ 2 weight scale malfunctioned
	  ○ 1 parent withdrew consent
	
	• Abdomen group n= 272

	○ 78 not eligible for primary analysis ○ 41 caesarean section or forceps ○ 16 short umbilical cord or nuchal cord ○ 10 need for resuscitation ○ 7 team became unavailable ○ 2 weight scale malfunctioned ○ 2 parents withdrew consent • Introitus group n= 197 included in analysis • Abdomen group n= 194 included in analysis

Outcomes

Outcome	Introitus group, , N = 197	Abdomen group , , N = 194
Bilirubin concentration Mean (SD)	8.4 (3)	8.7 (3)
Apgar score <7 at 5 min higher values are better Mean (SD)	9.5 (0.5)	9.4 (0.5)
NICU admission Lower values are better No of events	n = 1	n = 1

Critical appraisal

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Randomised in a 1:1 ratio with computer-generated allocation sequence in block sizes of four to eight (created by a statistician who was not involved again in the trial until statistical analysis of the results). Allocation was concealed by sequentially numbered sealed opaque envelopes. There were no differences between groups at baseline.)*
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Some concerns *(Participants and people delivering the intervention were aware of their assigned intervention. Analysis was by per protocol as participants were excluded after randomisation. Reasons for ineligibility were: caesarean or forceps birth; short umbilical cord or nuchal cord; need for resuscitation; team became unavailable; weight scale malfunctioned and parents withdrew consent.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Some concerns *(Outcome data was not available for most participants, there was loss to follow up but it was balanced between groups so unlikely that missingness in the outcome depended on its true values)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Blinding of the outcome assessors (nurses and obstetricians) was not possible but it is not deemed to have affected outcome measurement.) Method of outcome measurement was not inappropriate. Bilirubin concentration obtained by blood sample, Apgar score and NICU admission are standardised measures)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low *(Outcomes reported as in the specified protocol. Unlikely to have been selected.)*
Overall bias and Directness	Risk of bias judgement	High
Overall bias and Directness	Overall Directness	Directly applicable
Overall bias and Directness	Risk of bias variation across outcomes	No variation between outcomes.

Appendix E Forest plots

Forest plots for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

This section includes forest plots only for outcomes that are meta-analysed. Outcomes from single studies are not presented here; the quality assessment for such outcomes is provided in the GRADE profiles in appendix F.

Comparison 1. Placing the baby at the mother's abdomen versus holding the baby below the vaginal level

Figure 2: Jaundice requiring phototherapy

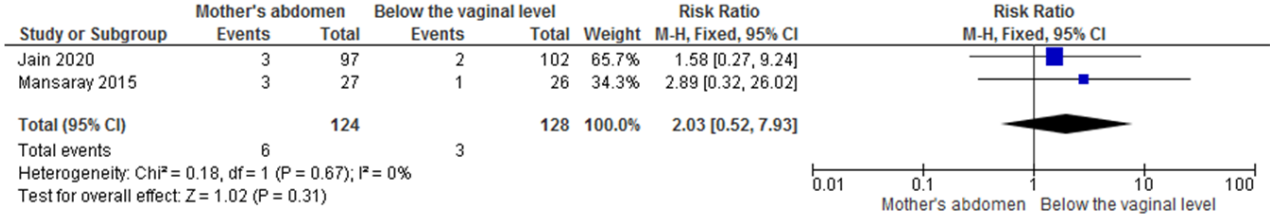
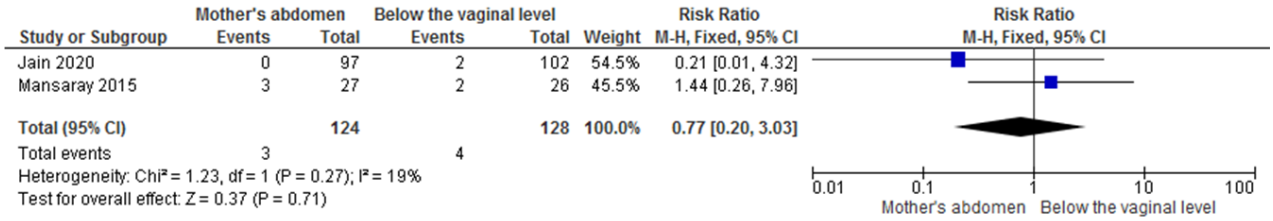


Figure 3: NICU admission



Appendix F GRADE tables

GRADE tables for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

Table 4: Evidence profile for comparison 1: Placing the baby at the mother's abdomen versus holding the baby below the vaginal level

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Mother's abdomen level	Below vaginal level	Relative (95% CI)	Absolute		
Jaundice requiring phototherapy												
2 (Jain 2020, Mansaray 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	6/124 (4.8%)	3/128 (2.3%)	RR 2.03 (0.52 to 7.93)	24 more per 1000 (from 11 fewer to 162 more)	VERY LOW	CRITICAL
Jaundice requiring transfusion												
1 (Mansaray 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	0/27 (0%)	0/26 (0%)	RD 0.00 (-0.07 to 0.07)	0 per 1000 (from 70 fewer to 70 more)	VERY LOW	CRITICAL
Infant Haemoglobin at 3-4 months (Better indicated by higher values)												
1 (Jain 2020)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[4]	none	97	102	-	MD 0.3 lower (0.58 to 0.02 lower)	LOW	CRITICAL
Fall in Haemoglobin from birth to 3-4 months (Better indicated by lower values)												
1 (Jain 2020)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[5]	none	97	102	-	MD 0.2 higher (0.05 lower to 0.45 higher)	LOW	CRITICAL
Apgar score at 5 minutes (Better indicated by higher values)												
1 (Mansaray 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	27	26	-	MD 0 higher (0.03 lower to 0.03 higher)	MODERATE	CRITICAL
Exclusive breastfeeding at 3-4 months												
1 (Jain 2020)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	89/97 (91.8%)	95/102 (93.1%)	RR 0.99 (0.91 to 1.07)	9 fewer per 1000 (from 84 fewer to 65 more)	MODERATE	IMPORTANT
NICU admission												
2 (Jain 2020, Mansaray 2015)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	3/124 (2.4%)	4/128 (3.1%)	RR 0.77 (0.20 to 3.03)	7 fewer per 1000 (from 25 fewer to 63 more)	VERY LOW	IMPORTANT

[1] Serious risk of bias in the evidence contributing to the outcomes as per RoB 2
[2] 95% CI crosses 2 MIDs
[3] Sample size <200
[4] 95% CI crosses 1 MID (0.5x control group SD for 'outcome Infant haemoglobin at 3-4 months' = 0.55)

[5] 95% CI crosses 1 MID (0.5x control group SD for 'outcome Fall in infant haemoglobin from 3-4 months' = 0.45)

Table 5: Evidence profile for comparison 2: Placing the baby on the mothers' abdomen or chest versus holding the baby at the vaginal level

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Mother's abdomen or chest	Vaginal level	Relative (95% CI)	Absolute		
Bilirubin concentration at 36-48 hours (Better indicated by lower values)												
1 (Vain 2014)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	194	197	-	MD 0.3 higher (0.29 lower to 0.89 higher)	MODERATE	CRITICAL
Apgar score at 5 minutes (Better indicated by lower values)												
1 (Vain 2014)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	194	197	-	MD 0.1 lower (0.2 lower to 0 higher)	MODERATE	CRITICAL
NICU admission												
1 (Vain 2014)	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	1/197 (0.51%)	1/194 (0.52%)	RR 0.98 (0.06 to 15.63)	0 fewer per 1000 (from 5 fewer to 75 more)	VERY LOW	IMPORTANT

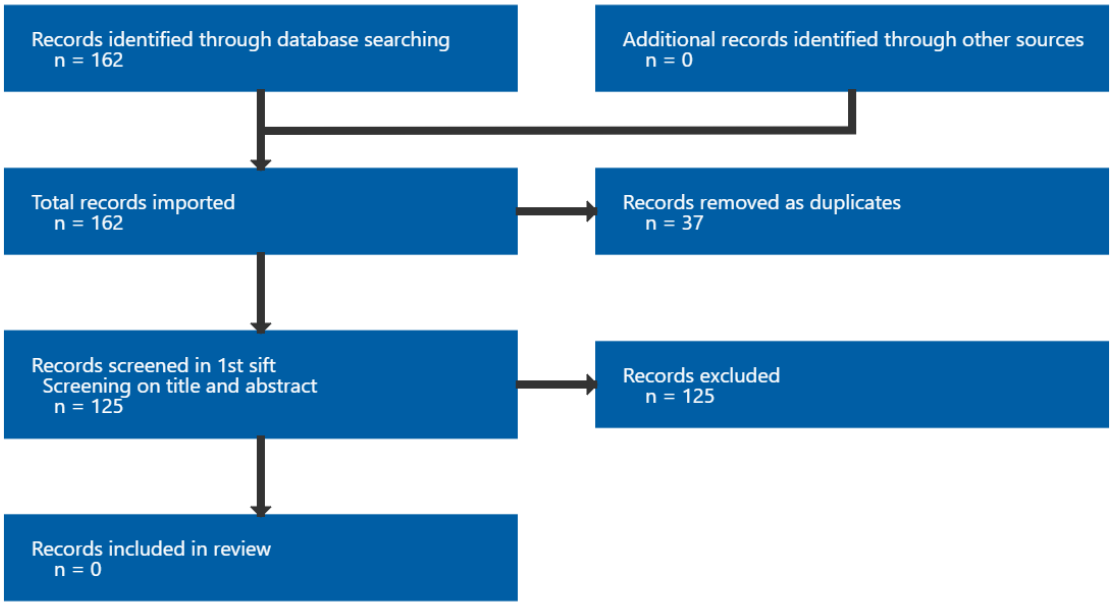
[1] Serious risk of bias in the evidence contributing to the outcomes as per RoB 2
[2] 95% CI crosses 2 MIDs

Appendix G Economic evidence study selection

Study selection for: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

No economic evidence was identified which was applicable to this review question.

Figure 4: Study selection flow chart



Appendix H Economic evidence tables

Economic evidence tables for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

No evidence was identified which was applicable to this review question.

Appendix I Economic model

Economic model for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

No economic analysis was conducted for this review question.

Appendix J Excluded studies

Excluded studies for review question: What is the optimum position for the baby during delayed cord clamping (including after instrumental and caesarean birth)?

Excluded effectiveness studies

Study	Reason
Airey, Rebecca J.; Farrar, Diane; Duley, Lelia (2010) Alternative positions for the baby at birth before clamping the umbilical cord. The Cochrane database of systematic reviews: cd007555	- Systematic review Empty review References list checked for eligible studies
Bjorland, P.A., Ersdal, H.L., Eilevstjonn, J. et al. (2021) Changes in heart rate from 5 s to 5 min after birth in vaginally delivered term newborns with delayed cord clamping. Archives of Disease in Childhood: Fetal and Neonatal Edition 106(3): f311-f315	- Intervention not in PICO Does not compare position of delayed cord clamping
Boere, I, Roest, A A W, Wallace, E et al. (2015) Umbilical blood flow patterns directly after birth before delayed cord clamping. Archives of disease in childhood. Fetal and neonatal edition 100(2): f121-5	- Intervention not in PICO Does not compare position of delayed cord clamping
COLOZZI AE (1954) Clamping of the umbilical cord; its effect on the placental transfusion. The New England journal of medicine 250(15): 629-632	- Cord clamping before 1 minute
Cottrell, B H and Shannahan, M K (1987) A comparison of fetal outcome in birth chair and delivery table births. Research in nursing & health 10(4): 239-43	- Intervention not in PICO compared delivery-table and birthing chair - Cord clamping before 1 minute cord was clamped at less than 1 minute in both groups
Ctri (2017) a clinical trial on the effects of the umbilical cord being cut after squeezing cord blood towards the baby, on the mother and newborns beyond 34 weeks. https://trialsearch.who.int/Trial2.aspx?TrialID=CTRI/2017/10/009970	- Trial register/protocol
Ctri (2013) Effect of alternative positions of the baby at birth before clamping the umbilical cord on placental transfusion and short term outcome of the baby. https://trialsearch.who.int/Trial2.aspx?TrialID=CTRI/2013/06/003726	- Trial register/protocol
Ctri (2020) Umbilical cord blood transfusio by raising the cord at birth, to improve blood content and health of the newborn babies. https://trialsearch.who.int/Trial2.aspx?TrialID=CTRI/2020/09/027856	- Trial register/protocol
Ctri (2021) A STUDY ON THE EFFECT OF GRAVITY ON BLOOD INVESTIGATIONS OF THE BABY REFLECTED BY DIFFERENT POSITIONING OF BABY BEFORE DELAYED CORD CLAMPING. https://trialsearch.who.int/Trial2.aspx?TrialID=CTRI/2021/06/034422	- Trial register/protocol
Duley, L. (2012) Delayed cord clamping. International Journal of Gynecology and Obstetrics 119(suppl3): 186	- Study design not in PICO Conference abstract
Grisaru, D., Deutsch, V., Pick, M. et al. (1999) Placing the newborn on the maternal abdomen after delivery increases the volume and CD34 cell content in the umbilical cord blood collected: an old	- Cord clamping before 1 minute Cord was clamped at 30 seconds in both groups

Study	Reason
maneuver with new applications. American journal of obstetrics and gynecology 180(5): 1240-3	
Isrctn (2010) Comparison of two techniques for collecting umbilical cord blood: on the mother (upper level) versus on the delivery table (bottom level). https://trialsearch.who.int/Trial2.aspx?TrialID=ISRCTN65689096	- Trial register/protocol
Law, Graham R, Cattle, Brian, Farrar, Diane et al. (2013) Placental blood transfusion in newborn babies reaches a plateau after 140 s: Further analysis of longitudinal survey of weight change. SAGE open medicine 1: 2050312113503321	- Intervention not in PICO Did not compare position of delayed cord clamping
Mercer, Judith S. and Erickson-Owens, Debra A. (2012) Rethinking placental transfusion and cord clamping issues. The Journal of perinatal & neonatal nursing 26(3): 202-9	- Study design not in PICO Narrative review
Nct (2016) Cord Clamping Level Above or Below Mother's Perineum. https://clinicaltrials.gov/show/NCT02659605	- Trial register/protocol
Nct (2008) Effect of Infant Placement on Iron Stores in Infancy: A Pilot Study. https://clinicaltrials.gov/show/NCT00675337	- Trial register/protocol
Nct (2013) Placental Transfusion in Term Infants: A Pilot Study. https://clinicaltrials.gov/show/NCT01924572	- Trial register/protocol
Nct (2011) Placental Transfusion and Cord Clamping. https://clinicaltrials.gov/show/NCT01497353	- Trial register/protocol
Nct (2011) Position at Birth,Placental Transfusion Volume and Cord Clamping. https://clinicaltrials.gov/show/NCT01497340	- Trial register/protocol
Ninan, K., Liyanage, S., Ali, R. et al. (2020) What do clinical practice guidelines suggest for deferred cord clamping for preterm and term infants and how evidence-based are they? A systematic review. Journal of Obstetrics and Gynaecology Canada 42(5): 686	- Study design not in PICO Conference abstract
Okulu, E, Haskologlu, S, Guloglu, D et al. (2022) Effects of Umbilical Cord Management Strategies on Stem Cell Transfusion, Delivery Room Adaptation, and Cerebral Oxygenation in Term and Late Preterm Infants. Frontiers in pediatrics 10	- Intervention not in PICO Does not compare position of the woman
Ridhimaa, Jain; Ashish, Jain; Veena, Devgan (2014) Effect of Alternative Positions of Newborn (Relative To Placenta), Prior To Recommended Delayed Cord Clamping on Placental Transfusion. A Randomized Control Trial. Pediatric academic societies annual meeting; 2014 july 17 - 18; vienna, austria	- Study design not in PICO Conference abstract
Satragno, D., Vain, N., Gordillo, J. et al. (2018) Postpartum maternal administration of oxytocin and volume of placental transfusion, an RCT. American Journal of Obstetrics and Gynecology 218(1supplement1): 26	- Study design not in PICO Conference abstract
Tekin, M, Gokdemir, M, Toprak, E et al. (2022) The haemodynamic effects of umbilical cord milking in term infants: a randomised controlled trial. Singapore medical journal	- Intervention not in PICO Does not compare position of the woman
Yoshimitsu, N, Douchi, T, Yamasaki, H et al. (1999) Differences in umbilical cord serum lipid levels with mode of delivery. British journal of obstetrics and gynaecology 106(2): 144-7	- Intervention not in PICO compared umbilical cord serum lipid levels during vaginal delivery versus elective caesarean section.

Excluded economic studies

No economic evidence was identified for this review.

Appendix K Research recommendations – full details

Research recommendations for review question: What is the optimum position for the baby during delayed cord clamping in relation to the mother's uterus?

K.1.1 Research recommendation

What is the optimum position for the baby during delayed cord clamping in relation to the mother's uterus?

K.1.2 Why this is important

Delayed cord clamping allows blood to pass from the placenta to the baby but there are few data on where the baby should be held in relation to the mother's position and timing of delayed cord clamping. It is important to assess the benefits or harms as it may have implications for both mother and baby.

K.1.3 Rationale for research recommendation

Table 6: Research recommendation rationale

Importance to 'patients' or the population	Little is known about the benefits or risks associated with delayed cord clamping in relation to the mother's position and timing of delayed cord clamping. This is important as it may affect mother-baby bonding and the amount of blood that is passed from the placenta to the baby.
Relevance to NICE guidance	The committee were unable to make clear recommendations on where the baby should be held during delayed cord clamping because evidence was not sufficient and was not assessed in the context of mother's position and timing of cord clamping.
Relevance to the NHS	Clear recommendations in this area may reduce the likelihood of morbidity, which has implications for NHS resources.
National priorities	Medium
Current evidence base	Minimal long-term data
Equality considerations	None known

K.1.4 Modified PICO table

Table 7: Research recommendation modified PICO table

Population	• Women in labour who are pregnant with a single baby, who go into labour at term (37 to 42 weeks of pregnancy)
Intervention	• Before clamping the umbilical cord, the baby is held at a higher level in relation to the uterus, for example: ○ mother's abdomen level ○ mother's chest level ○ higher than chest

Comparator	• Before clamping the umbilical cord, the baby is held: ○ at vaginal level ○ below vaginal level ○ any of the above interventions
Stratified analyses	• Timing of delayed cord clamping ○ 1 to 5 minutes ○ >5 minutes • Mode of birth ○ Caesarean birth ○ Vaginal birth • Position during vaginal birth ○ Upright position (kneeling, on all fours, squatting, standing, sitting upright) ○ Recumbent position (lying on back, lying on side, semi-recumbent)
Outcome	**Critical:** • Jaundice requiring phototherapy or exchange transfusion • Infant haemoglobin concentration (24 hours after birth and 3- 6 months after birth) • Apgar score < 7 at 5 minutes • Need for blood transfusion **Important:** • Women's experience of labour and birth • Skin-to-skin contact (uninterrupted, for example minimum 30 mins in the first hour) • Breastfeeding (as defined by the study) • Neonatal admission • Long-term developmental delay
Study design	Randomised controlled trial
Timeframe	Short term – follow-up for 6 months after birth
Additional information	None