Cochrane Library

Cochrane Database of Systematic Reviews

Position in the second stage of labour for women without epidural anaesthesia (Review)

Gupta JK, Sood A, Hofmeyr GJ, Vogel JP

Gupta JK, Sood A, Hofmeyr GJ, Vogel JP.
Position in the second stage of labour for women without epidural anaesthesia.
Cochrane Database of Systematic Reviews 2017, Issue 5. Art. No.: CD002006.
DOI: 10.1002/14651858.CD002006.pub4.

www.cochranelibrary.com

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

WILEY

TABLE OF CONTENTS

HEADER 1
ABSTRACT 1
PLAIN LANGUAGE SUMMARY 2
SUMMARY OF FINDINGS 4
BACKGROUND 6
OBJECTIVES 7
METHODS 7
RESULTS 10
Figure 1. 11
Figure 2. 13
Figure 3. 17
Figure 4. 18
Figure 5. 19
Figure 6. 20
Figure 7. 21
Figure 8. 22
DISCUSSION 25
AUTHORS' CONCLUSIONS 26
ACKNOWLEDGEMENTS 26
REFERENCES 27
CHARACTERISTICS OF STUDIES 32
DATA AND ANALYSES 68
Analysis 1.1. Comparison 1 Any upright versus supine position, Outcome 1 Duration of second stage of labour (minutes). 70
Analysis 1.2. Comparison 1 Any upright versus supine position, Outcome 2 Pain. 71
Analysis 1.3. Comparison 1 Any upright versus supine position, Outcome 3 Use of any analgesia/anaesthesia during second stage of labour. 72
Analysis 1.4. Comparison 1 Any upright versus supine position, Outcome 4 Mode of birth: assisted birth. 72
Analysis 1.5. Comparison 1 Any upright versus supine position, Outcome 5 Mode of birth: caesarean section. 73
Analysis 1.6. Comparison 1 Any upright versus supine position, Outcome 6 Episiotomy. 73
Analysis 1.7. Comparison 1 Any upright versus supine position, Outcome 7 Second degree perineal tears. 74
Analysis 1.8. Comparison 1 Any upright versus supine position, Outcome 8 Third/fourth degree tears. 74
Analysis 1.9. Comparison 1 Any upright versus supine position, Outcome 9 Blood loss > 500 mL. 75
Analysis 1.10. Comparison 1 Any upright versus supine position, Outcome 10 Need for blood transfusion. 75
Analysis 1.11. Comparison 1 Any upright versus supine position, Outcome 11 Manual removal of placenta. 75
Analysis 1.12. Comparison 1 Any upright versus supine position, Outcome 12 Abnormal fetal heart rate patterns. 76
Analysis 1.13. Comparison 1 Any upright versus supine position, Outcome 13 Admission to neonatal intensive care unit. 76
Analysis 1.14. Comparison 1 Any upright versus supine position, Outcome 14 Perinatal death. 76
Analysis 1.15. Comparison 1 Any upright versus supine position, Outcome 15 Subgroup analysis: duration of second stage of labour (parity). 77
Analysis 2.1. Comparison 2 Birth stool or squat stool versus supine position, Outcome 1 Duration of second stage all women (minutes). 79
Analysis 2.2. Comparison 2 Birth stool or squat stool versus supine position, Outcome 2 Use of any analgesia/anaesthesia during second stage of labour. 79
Analysis 2.3. Comparison 2 Birth stool or squat stool versus supine position, Outcome 3 Mode of birth: assisted birth. 79
Analysis 2.4. Comparison 2 Birth stool or squat stool versus supine position, Outcome 4 Mode of birth: caesarean section. 80
Analysis 2.5. Comparison 2 Birth stool or squat stool versus supine position, Outcome 5 Episiotomy. 80
Analysis 2.6. Comparison 2 Birth stool or squat stool versus supine position, Outcome 6 Second degree perineal tears. 81
Analysis 2.7. Comparison 2 Birth stool or squat stool versus supine position, Outcome 7 Third/fourth degree tears. 81
Analysis 2.8. Comparison 2 Birth stool or squat stool versus supine position, Outcome 8 Blood loss > 500 mL. 81
Analysis 2.9. Comparison 2 Birth stool or squat stool versus supine position, Outcome 9 Need for blood transfusion. 82
Analysis 2.10. Comparison 2 Birth stool or squat stool versus supine position, Outcome 10 Manual removal of placenta. 82

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 2.11. Comparison 2 Birth stool or squat stool versus supine position, Outcome 11 Shoulder dystocia (not prespecified). 82
Analysis 2.12. Comparison 2 Birth stool or squat stool versus supine position, Outcome 12 Abnormal fetal heart rate patterns. 83
Analysis 2.13. Comparison 2 Birth stool or squat stool versus supine position, Outcome 13 Admission to neonatal intensive care unit. 83
Analysis 2.14. Comparison 2 Birth stool or squat stool versus supine position, Outcome 14 Perinatal death. 83
Analysis 3.1. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 1 Duration of second stage of labour (minutes). 84
Analysis 3.2. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 2 Mode of birth: assisted birth. 85
Analysis 3.3. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 3 Mode of birth: caesarean section. 85
Analysis 3.4. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 4 Episiotomy. 85
Analysis 3.5. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 5 Second degree perineal tears. 85
Analysis 3.6. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 6 Third/fourth degree tears. 86
Analysis 3.7. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 7 Blood loss > 500 mL. 86
Analysis 3.8. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 8 Perinatal death. 86
Analysis 3.9. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 9 Subgroup analysis: duration of second stage of labour (parity). 87
Analysis 4.1. Comparison 4 Birth chair versus supine/lithotomy, Outcome 1 Duration of second stage of labour (minutes). 88
Analysis 4.2. Comparison 4 Birth chair versus supine/lithotomy, Outcome 2 Any analgesia/anaesthesia during second stage of labour. 88
Analysis 4.3. Comparison 4 Birth chair versus supine/lithotomy, Outcome 3 Mode of birth: assisted delivery. 89
Analysis 4.4. Comparison 4 Birth chair versus supine/lithotomy, Outcome 4 Mode of birth: caesarean section. 89
Analysis 4.5. Comparison 4 Birth chair versus supine/lithotomy, Outcome 5 Episiotomy. 90
Analysis 4.6. Comparison 4 Birth chair versus supine/lithotomy, Outcome 6 Second degree perineal tears. 90
Analysis 4.7. Comparison 4 Birth chair versus supine/lithotomy, Outcome 7 Blood loss > 500 mL. 90
Analysis 4.8. Comparison 4 Birth chair versus supine/lithotomy, Outcome 8 Need for blood transfusion. 91
Analysis 4.9. Comparison 4 Birth chair versus supine/lithotomy, Outcome 9 Manual removal of placenta. 91
Analysis 4.10. Comparison 4 Birth chair versus supine/lithotomy, Outcome 10 Admission to neonatal intensive care unit. 91
Analysis 4.11. Comparison 4 Birth chair versus supine/lithotomy, Outcome 11 Subgroup analysis: duration of second stage of labour (parity). 91
Analysis 5.1. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 1 Duration of second stage of labour (minutes). 93
Analysis 5.2. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 2 Mode of birth: assisted birth. 93
Analysis 5.3. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 3 Mode of birth: caesarean section. 94
Analysis 5.4. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 4 Second degree perineal tears. 94
Analysis 5.5. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 5 Third/fourth degree tears. 94
Analysis 5.6. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 6 Blood loss > 500 mL. 95
Analysis 5.7. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 7 Admission to neonatal intensive care unit. 95
WHAT'S NEW 95
HISTORY 96
CONTRIBUTIONS OF AUTHORS 97
DECLARATIONS OF INTEREST 97
SOURCES OF SUPPORT 97
DIFFERENCES BETWEEN PROTOCOL AND REVIEW 97
INDEX TERMS 98

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

[Intervention Review]

Position in the second stage of labour for women without epidural anaesthesia

Janesh K Gupta[1], Akanksha Sood[2], G Justus Hofmeyr[3], Joshua P Vogel[4]

[1]Academic Department of Obstetrics and Gynaecology, University of Birmingham, Birmingham, UK. [2]Department of Obstetrics and Gynaecology, St Marys Hospital, CMFT, Manchester, UK. [3]Walter Sisulu University, University of the Witwatersrand, Eastern Cape Department of Health, East London, South Africa. [4]UNDP/UNFPA/UNICEF/WHO/World Bank Special Programme of Research, Development and Research Training in Human Reproduction (HRP), Department of Reproductive Health and Research, World Health Organization, Geneva, Switzerland

Contact address: Janesh K Gupta, Academic Department of Obstetrics and Gynaecology, University of Birmingham, Birmingham Women's Hospital, Edgbaston, Birmingham, B15 2TG, UK. j.k.gupta@bham.ac.uk.

Editorial group: Cochrane Pregnancy and Childbirth Group
Publication status and date: New search for studies and content updated (no change to conclusions), published in Issue 5, 2017.

Citation: Gupta JK, Sood A, Hofmeyr GJ, Vogel JP. Position in the second stage of labour for women without epidural anaesthesia. *Cochrane Database of Systematic Reviews* 2017, Issue 5. Art. No.: CD002006. DOI: 10.1002/14651858.CD002006.pub4.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ABSTRACT

Background

For centuries, there has been controversy around whether being upright (sitting, birthing stools, chairs, squatting, kneeling) or lying down (lateral (Sim's) position, semi-recumbent, lithotomy position, Trendelenburg's position) have advantages for women giving birth to their babies. This is an update of a review previously published in 2012, 2004 and 1999.

Objectives

To determine the possible benefits and risks of the use of different birth positions during the second stage of labour without epidural anaesthesia, on maternal, fetal, neonatal and caregiver outcomes.

Search methods

We searched Cochrane Pregnancy and Childbirth's Trials Register (30 November 2016) and reference lists of retrieved studies.

Selection criteria

Randomised, quasi-randomised or cluster-randomised controlled trials of any upright position assumed by pregnant women during the second stage of labour compared with supine or lithotomy positions. Secondary comparisons include comparison of different upright positions and the supine position. Trials in abstract form were included.

Data collection and analysis

Two review authors independently assessed trials for inclusion and assessed trial quality. At least two review authors extracted the data. Data were checked for accuracy. The quality of the evidence was assessed using the GRADE approach.

Main results

Results should be interpreted with caution because risk of bias of the included trials was variable. We included eleven new trials for this update; there are now 32 included studies, and one trial is ongoing. Thirty trials involving 9015 women contributed to the analysis. Comparisons include any upright position, birth or squat stool, birth cushion, and birth chair versus supine positions.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

In all women studied (primigravid and multigravid), when compared with supine positions, the upright position was associated with a reduction in duration of second stage in the upright group (MD -6.16 minutes, 95% CI -9.74 to -2.59 minutes; 19 trials; 5811 women; P = 0.0007; random-effects; I^2 = 91%; *very low-quality evidence*); however, this result should be interpreted with caution due to large differences in size and direction of effect in individual studies. Upright positions were also associated with no clear difference in the rates of caesarean section (RR 1.22, 95% CI 0.81 to 1.81; 16 trials; 5439 women; *low-quality evidence*), a reduction in assisted deliveries (RR 0.75, 95% CI 0.66 to 0.86; 21 trials; 6481 women; *moderate-quality evidence*), a reduction in episiotomies (average RR 0.75, 95% CI 0.61 to 0.92; 17 trials; 6148 women; random-effects; I^2 = 88%), a possible increase in second degree perineal tears (RR 1.20, 95% CI 1.00 to 1.44; 18 trials; 6715 women; I^2 = 43%; *low-quality evidence*), no clear difference in the number of third or fourth degree perineal tears (RR 0.72, 95% CI 0.32 to 1.65; 6 trials; 1840 women; *very low-quality evidence),* increased estimated blood loss greater than 500 mL (RR 1.48, 95% CI 1.10 to 1.98; 15 trials; 5615 women; I^2 = 33%; *moderate-quality evidence*), fewer abnormal fetal heart rate patterns (RR 0.46, 95% CI 0.22 to 0.93; 2 trials; 617 women), no clear difference in the number of babies admitted to neonatal intensive care (RR 0.79, 95% CI 0.51 to 1.21; 4 trials; 2565 infants; *low-quality evidence*). On sensitivity analysis excluding trials with high risk of bias, these findings were unchanged except that there was no longer a clear difference in duration of second stage of labour (MD -4.34, 95% CI -9.00 to 0.32; 21 trials; 2499 women; I^2 = 85%).

The main reasons for downgrading of GRADE assessment was that several studies had design limitations (inadequate randomisation and allocation concealment) with high heterogeneity and wide CIs.

Authors' conclusions

The findings of this review suggest several possible benefits for upright posture in women without epidural anaesthesia, such as a very small reduction in the duration of second stage of labour (mainly from the primigravid group), reduction in episiotomy rates and assisted deliveries. However, there is an increased risk blood loss greater than 500 mL and there may be an increased risk of second degree tears, though we cannot be certain of this. In view of the variable risk of bias of the trials reviewed, further trials using well-designed protocols are needed to ascertain the true benefits and risks of various birth positions.

PLAIN LANGUAGE SUMMARY

Women’s position for giving birth without epidural anaesthesia

What is the issue?

Women often give birth in upright positions like kneeling, standing or squatting. Some women give birth on their backs in what are known as ‘supine’ positions - including dorsal (the woman flat on her back), lateral (the woman lying on her side), semi-recumbent (where the woman is angled partly upright) or lithotomy (where the woman’s legs are held up in stirrups). Birth position can be influenced by many different factors including setting, mother's choice, caregiver preference, or medical intervention. This Cochrane review assessed the possible benefits and risks to the mother and baby, by giving birth in upright positions compared with supine positions and also looked at some individual upright positions for benefits and harms.

Why is this important?

Giving birth in the supine position may have been adopted to make it more convenient for midwives and obstetricians to assist the labour and birth. However, many women report that giving birth on their backs feels painful, uncomfortable and difficult. It is suggested that women in upright positions give birth more easily because the pelvis is able to expand as the baby moves down; gravity may also be helpful and the baby may benefit because the weight of the uterus will not be pressing down on the mother’s major blood vessels which supply oxygen and nutrition to the baby.

We looked at the upright positions such as: sitting (on an obstetric chair or stool); kneeling (either on all fours or kneeling up) and squatting (unaided or using a birth cushion or a squatting bar). We compared these with supine positions such as: dorsal; lateral; semi-recumbent and lithotomy. Our aim was to assess the effectiveness, benefits and possible disadvantages of the different positions for women without epidural, during the second stage of labour.

What evidence did we find?

We searched for evidence up to 30 November 2016. This review now includes data from 30 randomised controlled trials involving 9015 pregnant women who gave birth without epidural anaesthesia.

Overall, evidence was not of good quality. When women gave birth in an upright position, as compared with lying on their backs, the length of time they were pushing (second stage of labour) was reduced by around six minutes (19 trials, 5811 women; *very low-quality evidence*). Fewer women had an assisted delivery, for example with forceps (21 trials, 6481 women; *moderate-quality evidence*). The number of women having a caesarean section did not differ (16 trials, 5439 women; *low-quality evidence*). Fewer women had an episiotomy (a surgical cut to the perineum to enlarge the opening for the baby to pass through) although there was a tendency for more women to have perineal tears (*low-quality evidence*). There was no difference in number of women with serious perineal tears (6 trials, 1840 women; *very low-quality evidence*) between those giving birth upright or supine. Women were more likely to have a blood loss of 500 mL or more (15 trials, 5615 women; *moderate-quality evidence*) in the upright position but this may be associated with more accurate ways of measuring the

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

blood loss. Fewer babies had problems with fast or irregular heart beats that indicate distress (2 trials, 617 women) when women gave birth in an upright position although the number of admissions to the neonatal unit was no different (4 trials, 2565 infants; *low-quality evidence*).

What does this mean?

This review found that there could be benefits for women who choose to give birth in an upright position. The length of time they had to push may be reduced but the effect was very small and these women might lose more blood. The results should be interpreted with caution because of poorly conducted studies, variations between trials and in how the findings were analysed.

More research into the benefits and risks of different birthing positions would help us to say with greater certainty which birth position is best for most women and their babies. Overall, women should be encouraged to give birth in whatever position they find comfortable.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Any upright compared to supine position for the second stage of labour for women without epidural anaesthesia

Any upright compared to supine position for the second stage of labour for women without epidural anaesthesia

Patient or population: women in the second stage of labour without epidural anaesthesia
Setting: hospital settings in Iran, India, Brazil, Mexico, Hong Kong, Ireland, UK, New Zealand, Finland, Thailand, France, and Sweden
Intervention: any upright position
Comparison: supine position

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with supine position	Risk with Any upright				
Duration of second stage of labour			The mean duration of second stage of labour was 6.16 minutes shorter in the upright position (9.74 minutes shorter to 2.59 minutes shorter)	5811 (19 RCTs)	⊕⊖⊖⊖ VERY LOW [1 2 3]	Including multigravida and primigravida women
Mode of birth: assisted birth	Study population		RR 0.75 (0.66 to 0.86)	6481 (21 RCTs)	⊕⊕⊕⊖ MODERATE [1]	
	128 per 1000	96 per 1000 (84 to 110)				
Mode of birth: caesarean section	Study population		RR 1.22 (0.81 to 1.81)	5439 (16 RCTs)	⊕⊕⊖⊖ LOW [4 5]	
	14 per 1000	18 per 1000 (12 to 26)				
Trauma to the birth canal that required suturing: second degree perineal tears	Study population		average RR 1.20 (1.00 to 1.44)	6715 (18 RCTs)	⊕⊕⊖⊖ LOW [1 5]	
	127 per 1000	153 per 1000 (127 to 184)				
Trauma to the birth canal that required suturing: third/fourth degree tears	Study population		RR 0.72 (0.32 to 1.65)	1840 (6 RCTs)	⊕⊖⊖⊖ VERY LOW [6 7]	
	13 per 1000	9 per 1000				

Cochrane Library
Trusted evidence.
Informed decisions.
Better health.
Cochrane Database of Systematic Reviews

		(4 to 21)			
Blood loss > 500 mL	Study population		average RR 1.48 (1.10 to 1.98)	5615 (15 RCTs)	⊕⊕⊕⊖ MODERATE [8]
	44 per 1000	65 per 1000 (49 to 88)			
Admission to neonatal intensive care unit	Study population		RR 0.79 (0.51 to 1.21)	2565 (4 RCTs)	⊕⊕⊖⊖ LOW [5 9]
	36 per 1000	28 per 1000 (18 to 43)			

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

CI: Confidence interval; **RR:** Risk ratio; **OR:** Odds ratio;

GRADE Working Group grades of evidence
High quality: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[1] Six studies have serious design limitations (inadequate randomisation and allocation concealment) though contribute less than 40% weight to analysis, all other studies have design limitations. (Downgraded 1 level).
[2] High heterogeneity with variation in size and direction of effect. (Downgraded 2 levels).
[3] Asymmetrical funnel plot. Small studies contributing data. (Downgraded 1 level).
[4] Three studies have serious design limitations (inadequate randomisation and allocation concealment) though contribute less than 40% weight to analysis, all other studies have design limitations. (Downgraded 1 level).
[5] Wide confidence intervals crossing the line of no effect. (Downgraded 1 level).
[6] Three studies with serious design limitations contributing over 40% weight. (Downgraded 2 levels).
[7] Wide confidence intervals crossing the line of no effect and few events. (Downgraded 2 levels).
[8] Five studies have serious design limitations (inadequate randomisation and allocation concealment) though contribute less than 40% weight to analysis, all other studies have design limitations. (Downgraded 1 level).
[9] All studies had design limitations. (Downgraded 1 level).

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

BACKGROUND

Description of the condition

The position adopted naturally by women during birth has been described as early as 1882 (Engelmann 1882). Engelmann observed that women, not influenced by Western conventions, would try to avoid the dorsal position and would change position as and when they wished. Different upright positions could be achieved using posts, slung hammocks, furniture, holding on to ropes or knotted pieces of cloth, kneeling, crouching or squatting using bricks, stones, a pile of sand, or a birth stool (Balaskas 1992; Engelmann 1882; Jarcho 1934; Mead 1965; Simkin 2005). Today, most women in Western societies deliver in a dorsal, semi-recumbent or lithotomy position. It is claimed that the dorsal position enables the midwife or obstetrician to monitor the fetus better and thus to ensure a safe birth, but it may be more convenient and give better control for the caregiver.

The position assumed by women during birth is influenced by several complex factors. 'Instinctive' behaviour is difficult to identify because behaviour is strongly influenced by cultural norms. For societies in which most births take place within a medical facility, cultural norms have over the years been moulded by the expectations and demands of medical attendants, as well as restrictions imposed by medical procedures such as fetal monitoring, intravenous therapy, anaesthesia including regional anaesthesia, medical examinations and medical procedures. During the second stage of labour, practices such as perineal support and assistance of the birth during 'spontaneous' birth have restricted options for positions assumed by women. Options for instrumental birth are also limited.

The influence of medical personnel and institutions over the positions adopted by women during labour and birth has been viewed as inconsiderate of women's comfort and need to experience birth as a positive event. In view of indirect evidence that a positive, supportive labour environment promotes a sense of competence and personal achievement experienced by women during childbirth, and their subsequent confidence as mothers and risk of postnatal depression (Wolman 1993), serious attention should be given to medical practices which may undermine or humiliate women during labour.

Description of the intervention

The supine or semi-recumbent position for birth is widely used in contemporary obstetric practice. The parturient's position changed from an upright positions to a semi-recumbent position at the time of the introduction of the obstetric forceps by Hugh Chamberlen in 1670 (Atwood 1976). The main advantage cited is easy access of the caregiver to the woman's abdomen to monitor the fetal heart rate. Caregivers are comfortable with the dorsal position as it is the position in which they have usually been trained to conduct deliveries, including assisted vaginal deliveries, and is the conventional reference position for textbook descriptions of the mechanisms of vaginal birth.

The lithotomy position with the woman's legs fixed in stirrups is used in many institutions both for spontaneous and particularly for assisted vaginal deliveries (Dundes 1987). The use of stirrups may be combined with lateral pelvic tilting and a semi-recumbent posture with the mother sitting up at about 45 degrees, to reduce aortocaval compression.

The lateral recumbent position is also used for both spontaneous and assisted deliveries, with the advantage of avoiding uterine compression of the aorta, the inferior vena cava, or both.

Kneeling positions may also be assumed by women in the second stage of labour. These may vary from upright kneeling to an 'all fours' position with the pelvis and shoulders at the same level.

A supported standing position was promoted by Odent in Pithiviers, France in the 1980s, but to our knowledge, has not been evaluated systematically.

The McRoberts' position with hyperflexed thighs was introduced to overcome shoulder dystocia. It has been shown to increase the expulsive force in the second stage of labour (Buhimschi 2001).

Birth in a birthing chair has been studied, but most of these studies have involved small sample sizes (Dunn 1978). There are conflicting data on the possible advantages and disadvantages of using a birthing chair for birth.

The deep squat is very similar to the habitual resting position of the chimpanzee and perhaps all of us might have squatted at some stage of our lives if our custom did not train us to adopt other postures (Hewes 1957). The squatting position is often termed the most natural position and is often used by women if left alone to choose their own position for birth (Kurokawa 1985; Romond 1985). However, the major disadvantage of the squatting position is that Western women may not have the appropriate muscular fitness and stamina to remain squatting for a considerable length of time, and that it may increase perineal trauma. This may be particularly true of Western women who no longer squat to defecate. In one study in Leeds, UK, only 16% of women allocated to squatting managed to do so, despite antenatal exercises (Gupta 1989). In many parts of Asia, Africa and Americas, people customarily work and rest in this posture. Consequently, the advent of a supported squatting position during giving birth, either using a birthing cushion or stool, seems attractive (Simkin 2005).

Observational studies have suggested that upright postures may reduce the risk of postpartum de novo urinary incontinence (Serati 2016) and enhances fathers' experience of having been positively and actively engaged in the birth process (Johansson 2015).

How the intervention might work

There is controversy around whether being upright or lying down has advantages for women delivering their babies. Several physiological advantages have been hypothesised and measured for non-recumbent or upright labour: (i) the effects of gravity, (ii) lessened risk of aortocaval compression and improved acid-base outcomes in the newborns (Ang 1969; Humphrey 1974; Scott 1963), (iii) stronger and more efficient uterine contractions (Caldeyro-Barcia 1960; Méndez-Bauer 1975), (iv) improved alignment of the fetus for passage through the pelvis ('drive angle') (Gold 1950), and (v) radiological evidence of larger antero-posterior (Borell 1957b) and transverse (Russell 1969) pelvic outlet diameters, resulting in an increase in the total outlet area in the squatting (Gupta 1991; Lilford 1989; Russell 1982) and kneeling positions (Russell 1982).

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

We wanted to assess the maternal position in second stage of labour in women without epidural anaesthesia. There is a Cochrane Review in which epidural anaesthesia was assessed in the same population (Kemp 2013), but there is evidence that epidural anaesthesia can result in an increase in instrumental deliveries (Anim-Somuah 2011). We therefore wanted to assess the effects of posture alone on birth outcomes.

Why it is important to do this review

Given the uncertainty regarding the optimal birth position, our aim was to evaluate the available evidence about the effectiveness, benefits and possible disadvantages for the use of different positions during the second stage of labour in women without epidural anaesthesia. A separate Cochrane Review has addressed women with epidural anaesthesia (Kemp 2013).

OBJECTIVES

To determine the possible benefits and risks of the use of different birth positions during the second stage of labour without epidural anaesthesia, on maternal, fetal, neonatal and caregiver outcomes.

METHODS

Criteria for considering studies for this review

Types of studies

Any randomised controlled trial, including cluster-randomised trials, that:

1. used random or quasi-random allocation and appropriate follow-up;
2. compared positions listed in the Review's types of interventions.

Cross-over trials were not appropriate for the subject of this review and were not included. Trials in abstract form were included.

Types of participants

Pregnant women during the second stage of labour irrespective of choice of anaesthesia after randomisation.

Types of interventions

The main comparison was the use of any upright position during the second stage of labour compared with supine or lithotomy positions. Secondary comparisons included different upright positions and the supine position.

The various positions can be broadly categorised as being either neutral or upright (Atwood 1976). The neutral positions, in which a line connecting the centre of a woman's third and fifth vertebrae is more horizontal than vertical, which are generally used in modern Western obstetrics, are defined as supine positions:

1. lateral (Sim's) position;
2. dorsal (lying on back);
3. semi-recumbent (trunk tilted forwards up to 30^{o} to the horizontal);
4. lithotomy position; and
5. Trendelenburg's position (head lower than pelvis).

There are distinct upright positions (with gravity involved), namely:

1. sitting (obstetric chair/stool);
2. kneeling;
3. squatting (unaided or using squatting bars); and
4. squatting (aided with birth cushion).

Comparisons between any upright position during the second stage of labour compared with supine positions were eligible for inclusion.

Types of outcome measures

Primary outcomes

Maternal outcomes

1. Duration of second stage of labour

Secondary outcomes

Maternal outcomes

1. Pain.
2. Use of any analgesia or anaesthesia.
3. Mode of birth: assisted birth.
4. Mode of birth: caesarean section.
5. Trauma to the birth canal that required suturing: episiotomy.
6. Trauma to the birth canal that required suturing: second degree tear.
7. Trauma to the birth canal that required suturing: third or fourth degree tear.
8. Blood loss greater than 500 mL.
9. Need for blood transfusion (not pre-specified).
10. Manual removal of placenta (not pre-specified).
11. Shoulder dystocia (not pre-specified).
12. Urinary or faecal incontinence.

Fetal outcomes

1. Abnormal fetal heart rate patterns needing intervention.

Neonatal outcomes

1. Admission to neonatal intensive care unit.
2. Perinatal death.

Search methods for identification of studies

The following methods section of this review is based on a standard template used by Cochrane Pregnancy and Childbirth.

Electronic searches

We searched Cochrane Pregnancy and Childbirth's Trials Register by contacting their Information Specialist (30 November 2016).

The Register is a database containing over 22,000 reports of controlled trials in the field of pregnancy and childbirth. For full search methods used to populate Pregnancy and Childbirth's Trials Register including the detailed search strategies for CENTRAL, MEDLINE, Embase and CINAHL; the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service, please follow this link to the editorial information about the Cochrane Pregnancy and Childbirth in the Cochrane Library and select the '*Specialized Register*' section from the options on the left side of the screen.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Briefly, Cochrane Pregnancy and Childbirth's Trials Register is maintained by their Information Specialist and contains trials identified from:

1. monthly searches of the Cochrane Central Register of Controlled Trials (CENTRAL);
2. weekly searches of MEDLINE (Ovid);
3. weekly searches of Embase (Ovid);
4. monthly searches of CINAHL (EBSCO);
5. handsearches of 30 journals and the proceedings of major conferences;
6. weekly current awareness alerts for a further 44 journals plus monthly BioMed Central email alerts.

Search results were screened by two people and the full text of all relevant trial reports identified through the searching activities described above is reviewed. Based on the intervention described, each trial report is assigned a number that corresponds to a specific Pregnancy and Childbirth review topic (or topics), and is then added to the Register. The Information Specialist searches the Register for each review using this topic number rather than keywords. This results in a more specific search set which has been fully accounted for in the relevant review sections (Included studies; Excluded studies).

Searching other resources

We searched the reference lists of retrieved studies and contacted authors of published and unpublished trials for additional information when necessary.

We did not apply any language or date restrictions.

Data collection and analysis

For methods used in the previous version of this review, see Gupta 2012.

For this update, the following methods were used for assessing the 17 reports that were identified as a result of the updated search.

The following methods section of this review is based on a standard template used by Cochrane Pregnancy and Childbirth.

Selection of studies

Two review authors independently assessed for inclusion all the potential studies identified as a result of the search strategy. We resolved any disagreement through discussion or, if required, we consulted the third review author.

Data extraction and management

We designed a form to extract data. For eligible studies, two review authors extracted the data using the agreed form. We resolved discrepancies through discussion or, if required, we consulted the third review author. Data were entered into Review Manager software (RevMan 2014) and checked for accuracy.

When information regarding any of the above was unclear, we planned to contact authors of the original reports to provide further details.

Assessment of risk of bias in included studies

Two review authors independently assessed risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). Any disagreement was resolved by discussion or by involving a third assessor.

(1) Random sequence generation (checking for possible selection bias)

We described for each included study the method used to generate the allocation sequence in sufficient detail to enable assessment of whether it should produce comparable groups.

We assessed the method as:

- low risk of bias (any truly random process, e.g. random number table; computer random number generator);
- high risk of bias (any non-random process, e.g. odd or even date of birth; hospital or clinic record number); or
- unclear risk of bias.

(2) Allocation concealment (checking for possible selection bias)

We described for each included study the method used to conceal allocation to interventions prior to assignment and assessed whether intervention allocation could have been foreseen in advance of, or during recruitment, or changed after assignment.

We assessed the methods as:

- low risk of bias (e.g. telephone or central randomisation; consecutively numbered sealed opaque envelopes);
- high risk of bias (open random allocation; unsealed or non-opaque envelopes, alternation; date of birth); or
- unclear risk of bias.

(3.1) Blinding of participants and personnel (checking for possible performance bias)

We described for each included study the methods used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. We considered that studies were at low risk of bias if they were blinded, or if we judged that the lack of blinding unlikely to affect results. We assessed blinding separately for different outcomes or classes of outcomes.

We assessed the methods as:

- low, high or unclear risk of bias for participants; and
- low, high or unclear risk of bias for personnel.

(3.2) Blinding of outcome assessment (checking for possible detection bias)

We described for each included study the methods used, if any, to blind outcome assessors from knowledge of which intervention a participant received. We assessed blinding separately for different outcomes or classes of outcomes.

We assessed methods used to blind outcome assessment as:

- low, high or unclear risk of bias.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

(4) Incomplete outcome data (checking for possible attrition bias due to the amount, nature and handling of incomplete outcome data)

We described for each included study, and for each outcome or class of outcomes, the completeness of data including attrition and exclusions from the analysis. We stated whether attrition and exclusions were reported and the numbers included in the analysis at each stage (compared with the total randomised participants), reasons for attrition or exclusion where reported, and whether missing data were balanced across groups or were related to outcomes. Where sufficient information was reported, or could be supplied by the trial authors, we planned to re-include missing data in the analyses which we undertook.

We assessed methods as:

- low risk of bias (e.g. no missing outcome data; missing outcome data balanced across groups);
- high risk of bias (e.g. numbers or reasons for missing data imbalanced across groups; 'as treated' analysis done with substantial departure of intervention received from that assigned at randomisation); or
- unclear risk of bias.

(5) Selective reporting (checking for reporting bias)

We described for each included study how we investigated the possibility of selective outcome reporting bias and what we found.

We assessed the methods as:

- low risk of bias (where it is clear that all of the study's pre-specified outcomes and all expected outcomes of interest to the review have been reported);
- high risk of bias (where not all the study's pre-specified outcomes have been reported; one or more reported primary outcomes were not pre-specified; outcomes of interest are reported incompletely and so cannot be used; study fails to include results of a key outcome that would have been expected to have been reported); or
- unclear risk of bias.

(6) Other bias (checking for bias due to problems not covered by (1) to (5) above)

We described for each included study any important concerns we had about other possible sources of bias.

(7) Overall risk of bias

We made explicit judgements about whether studies were at high risk of bias, according to the criteria given in the *Handbook* (Higgins 2011). With reference to (1) to (6) above, we planned to assess the likely magnitude and direction of the bias and whether we considered it is likely to impact on the findings. In future updates, we will explore the impact of the level of bias through undertaking sensitivity analyses - *see* Sensitivity analysis.

Assessment of the quality of the evidence using the GRADE approach

For this update, the quality of the evidence was assessed using the GRADE approach as outlined in the GRADE handbook to assess the quality of the body of evidence relating to the following outcomes for the main comparison: any upright position versus supine position.

1. Duration of second stage of labour;
2. Mode of birth: assisted birth;
3. Mode of birth: caesarean section;
4. Trauma to the birth canal that required suturing: Second degree tear;
5. Trauma to the birth canal that required suturing: Third/fourth degree tear;
6. Blood loss greater than 500 mL; and
7. Admission to neonatal intensive care unit.

GRADEpro Guideline Development Tool was used to import data from Review Manager 5.3 (RevMan 2014) to create a 'Summary of findings' table. A summary of the intervention effect and a measure of quality for each of the above outcomes were produced using the GRADE approach. The GRADE approach uses five considerations (study limitations, consistency of effect, imprecision, indirectness and publication bias) to assess the quality of the body of evidence for each outcome. The evidence can be downgraded from 'high quality' by one level for serious (or by two levels for very serious) limitations, depending on assessments for risk of bias, indirectness of evidence, serious inconsistency, imprecision of effect estimates or potential publication bias.

Measures of treatment effect

Dichotomous data

For dichotomous data, we presented results as summary risk ratio with 95% confidence intervals.

Continuous data

We used the mean difference if outcomes were measured in the same way between trials. In future updates, if appropriate, we will use the standardised mean difference to combine trials that measure the same outcome, but use different methods.

Unit of analysis issues

Cluster-randomised trials

There were no cluster-randomised trials included in this review. In future updates, cluster-randomised trials will be included and analysed alongside individually randomised trials. We will adjust their sample sizes or standard errors using the methods described in the *Handbook* Section 16.3.4 or 16.3.6 using an estimate of the intracluster correlation co-efficient (ICC) derived from the trial (if possible), from a similar trial or from a study of a similar population. If we use ICCs from other sources, we will report this and conduct sensitivity analyses to investigate the effect of variation in the ICC. If we identify both cluster-randomised trials and individually-randomised trials, we plan to synthesise the relevant information. We will consider it reasonable to combine the results from both if there is little heterogeneity between the study designs and the interaction between the effect of intervention and the choice of randomisation unit is considered to be unlikely.

Cross-over trials

There were no cross-over trials identified in this review. Cross-over design trials are not appropriate for inclusion in this review, and will not be included in future updates.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Dealing with missing data

Levels of attrition were noted for included studies. In future updates, if more eligible studies are included, the impact of including studies with high levels of missing data in the overall assessment of treatment effect will be explored by using sensitivity analysis.

As far as possible analyses for all outcomes were conducted on an intention-to-treat basis, i.e. we attempted to include all participants randomised to each group in the analyses. The denominator for each outcome in each trial was the number randomised minus any participants whose outcomes were known to be missing.

Assessment of heterogeneity

We assessed statistical heterogeneity in each meta-analysis using the Tau^2, I^2 and Chi^2 statistics. We regarded heterogeneity as substantial if I^2 was greater than 30% and either Tau^2 was greater than zero, or there was a low P value (less than 0.10) in the Chi^2 test for heterogeneity. If we identified substantial heterogeneity (above 30%), we planned to explore it by pre-specified subgroup analysis. We considered whether an overall summary was meaningful, and if it was, we used random-effects analysis to produce it.

Assessment of reporting biases

Where we included 10 or more studies in the meta-analysis we investigated reporting biases (such as publication bias) using funnel plots. We assessed funnel plot asymmetry visually. If asymmetry was suggested by a visual assessment, we planned to perform exploratory analyses to investigate it.

Data synthesis

We carried out statistical analysis using the Review Manager software (RevMan 2014). We used fixed-effect meta-analysis for combining data where it was reasonable to assume that studies were estimating the same underlying treatment effect: i.e. where trials were examining the same intervention, and the trials' populations and methods were judged sufficiently similar.

If there was clinical heterogeneity sufficient to expect that the underlying treatment effects differed between trials, or if substantial statistical heterogeneity was detected, we used random-effects meta-analysis to produce an overall summary if an average treatment effect across trials was considered clinically meaningful. The random-effects summary will be treated as the average range of possible treatment effects and we will discuss the clinical implications of treatment effects differing between trials. If the average treatment effect is not clinically meaningful, we will not combine trials. If we used random-effects analyses, the results were presented as the average treatment effect with 95% confidence intervals, and the estimates of Tau^2 and I^2.

Subgroup analysis and investigation of heterogeneity

If we identified substantial heterogeneity, we investigated it using subgroup analyses and sensitivity analyses. We considered whether an overall summary was meaningful, and if it was, we used random-effects analysis to produce it.

We carried out the following subgroup analyses.

1. Parity (primigravidae versus multigravida women).

Subgroup analysis was restricted to the review's primary outcome where there was sufficient data to make subgroup analysis meaningful.

We assessed subgroup differences by interaction tests available within RevMan (RevMan 2014). We reported the results of subgroup analyses quoting the Chi^2 statistic and P value, and the interaction test I^2 value.

Sensitivity analysis

We carried out sensitivity analyses to explore the effect of trial quality assessed by concealment of allocation, high attrition rates, or both, with poor quality studies being excluded from the analyses in order to assess whether this makes any difference to the overall result. This sensitivity analysis was only carried out for the GRADE outcomes in the main comparison (upright versus supine), and the results are recorded under the relevant outcomes in comparison 1.

RESULTS

Description of studies

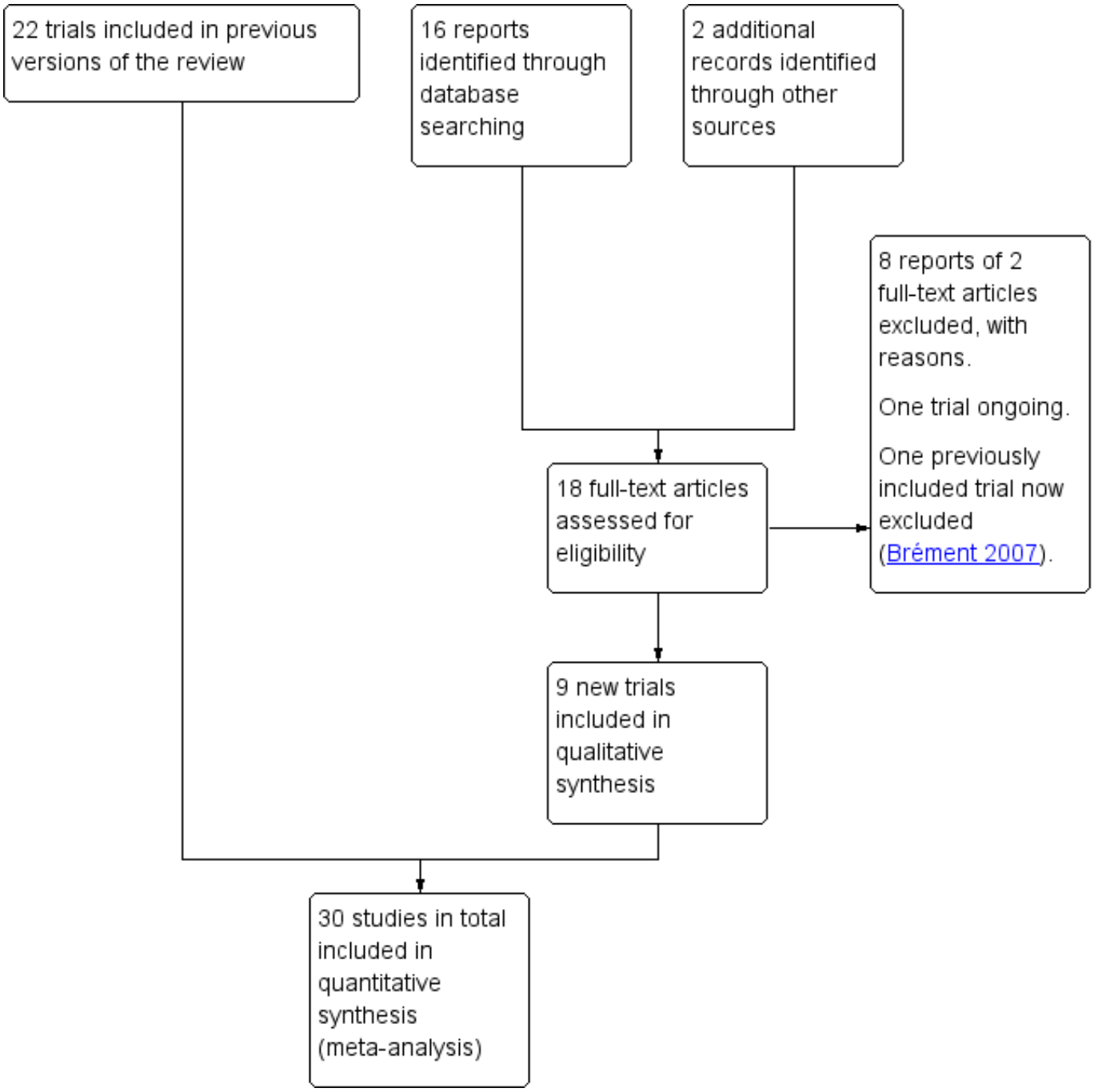
This updated review now has 32 trials, with review outcome data for 30 studies (9015 women), 17 excluded studies, and one ongoing study.

Results of the search

From the November 2016 search, 18 new reports of 12 trials were identified. Nine new trials were added with outcome data for 1735 women to the review (Amiri 2012; Azhari 2013; Calvo Aguilar 2013; Phumdoung 2010; Phumdoung 2013; Sekhavat 2009; Schirmer 2011; Zaibunnisa 2015; Zhang 2016) and two trials excluded (Corton 2012; Thies-Lagergren 2011). Two trials previously excluded due to none reporting of outcomes have been in included in this update (Liu 1986 and Schneider-Affeld 1982). One trial previously included has now been excluded as it was found to compare two recumbent positions (Brément 2007). One trial is ongoing (Hofmeyr 2015). See Figure 1.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 1. Study flow diagram.



Included studies

For more information, *see* Characteristics of included studies.

Methods

This review includes 32 randomised controlled trials, with outcome data from 30 trials.

Participants

Of trials contributing outcome data, fourteen studies reported on nulliparous women and five with multiparous women; 15 stated recruiting both parous and nulliparous women. Most trials included women at more than 36 weeks' gestation with no obstetric or medical complications. Exceptions were Crowley 1991, who included women at 34 weeks' gestation, and Hemminki 1986, who included women at 35 weeks' gestation.

Interventions and comparisons

All included studies reported on any upright position versus supine (Allahbadia 1992; Amiri 2012; Azhari 2013; Bhardwaj 1994; Bomfim-Hyppólito 1998; Calvo Aguilar 2013; Chan 1963; Crowley 1991; De Jong 1997; Gardosi 1989a; Gardosi 1989b; Gupta 1989; Hemminki 1986; Hillan 1984; Jahanfar 2004; Liddell 1985; Liu 1986; Martti-

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

la 1983; Nasir 2007; Phumdoung 2010; Phumdoung 2013; Racinet 1999; Radkey 1991; Schneider-Affeld 1982; Schirmer 2011; Sekhavat 2009; Stewart 1989; Suwanakam 1988; Turner 1986; Waldenström 1991; Zaibunnisa 2015; Zhang 2016).

We included 10 trials that compared women in supine position with those using a birthing or squat stool (Allahbadia 1992; De Jong 1997; Gardosi 1989a; Gardosi 1989b; Gupta 1989; Jahanfar 2004; Nasir 2007; Racinet 1999; Radkey 1991; Waldenström 1991). Three trials compared supine position with birth cushion (Bhardwaj 1994; Gardosi 1989a; Gardosi 1989b) and nine trials compared supine with birth chair (Bomfim-Hyppólito 1998; Crowley 1991; Hemminki 1986; Hillan 1984; Liddell 1985; Marttila 1983; Stewart 1989; Suwanakam 1988; Turner 1986).

Settings

Most studies were conducted in hospital settings. Studies were distributed from various parts of the world. Out of 30 studies with outcome data, seven were from the UK, nine from Asian sub continent, five from EU, four from America and the remaining three from Middle east, one from Cape Town and one from New Zealand. The two studies without outcome data did not specify the setting.

Outcomes

Outcomes reported by most studies were maternal use of analgesia or anaesthesia, duration of second stage of labour, mode of birth, perineal tears or episiotomy, and blood loss greater than 500 mL. Incidence of urinary and faecal incontinence was not reported in any trial.

Funding

Funding sources were not specifically reported in the included studies.

Excluded studies

We excluded 17 trials because:

- insufficient data were presented in abstract reports (4 trials: Ahmed 1985; Bonoan 1997; Caldeyro-Barcia 1985; Hegab 2002);
- not a randomised trial (Golay 1993);
- multiple number of exclusions from the analysis (37%) (Chen 1987);
- wrong population: women received an epidural prior to randomisation (2 trials: Downe 2004; Karraz 2003);
- wrong intervention: intervention not continued into the active phase of labour (Golara 2002); comparing upright positions (3 trials: Altman 2007; Corton 2012; Ragnar 2006); comparing recumbent/supine positions (3 trials: Brément 2007; Humphrey 1973; Johnstone 1987); two trials investigated a birth seat with any other position (Thies-Lagergren 2009; Thies-Lagergren 2011); because other positions were not classified, comparison of upright position versus the birth seat was not possible. (See Characteristics of excluded studies).

Ongoing studies

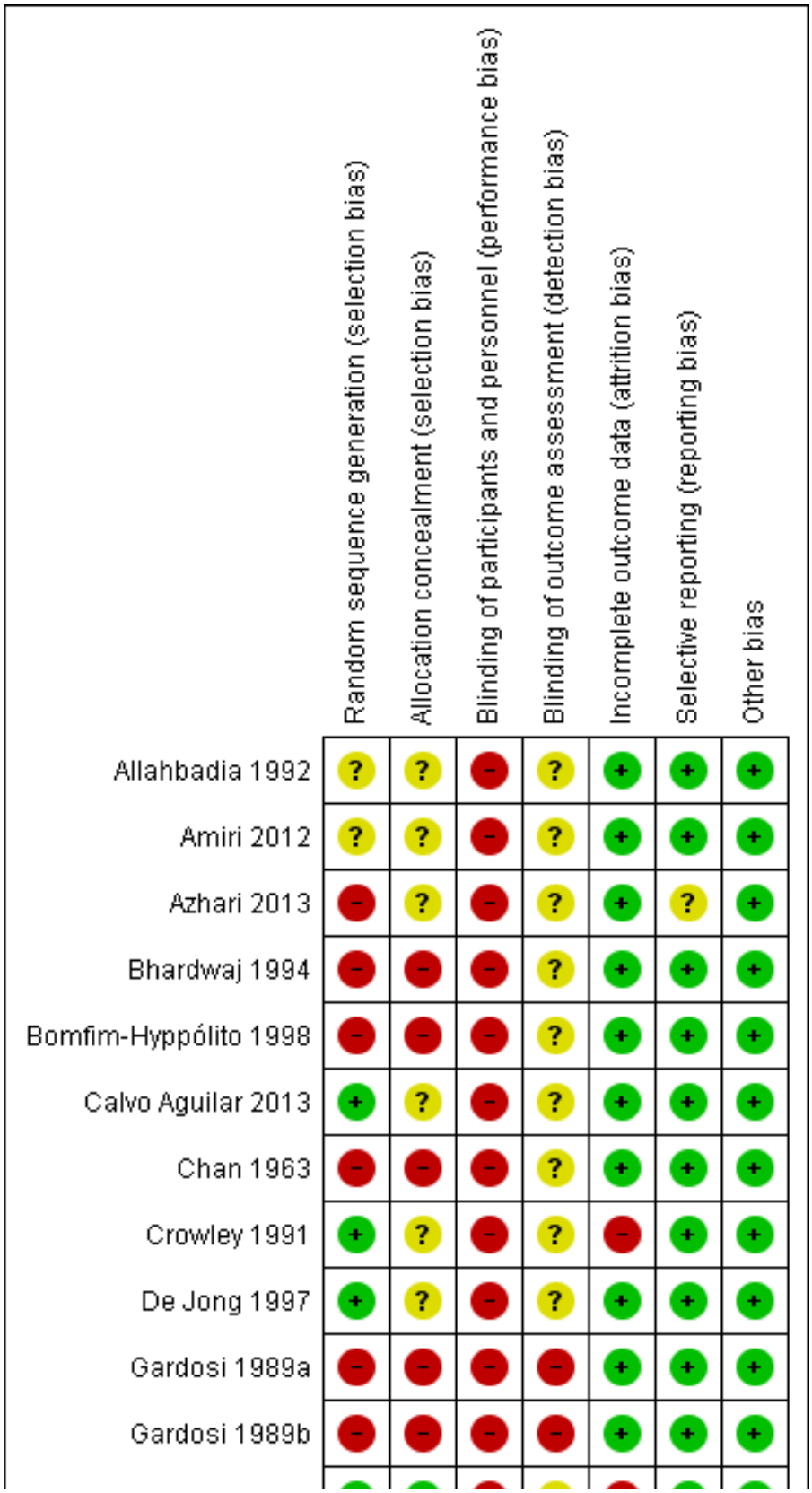
The Gentle Assisted Pushing (GAP) trial is ongoing (Hofmeyr 2015; Characteristics of ongoing studies).

Risk of bias in included studies

Overall, risk of bias in the included trials was variable. Blinding of participants, personnel and outcome assessors was either not performed or unclear in all trials (Figure 2).

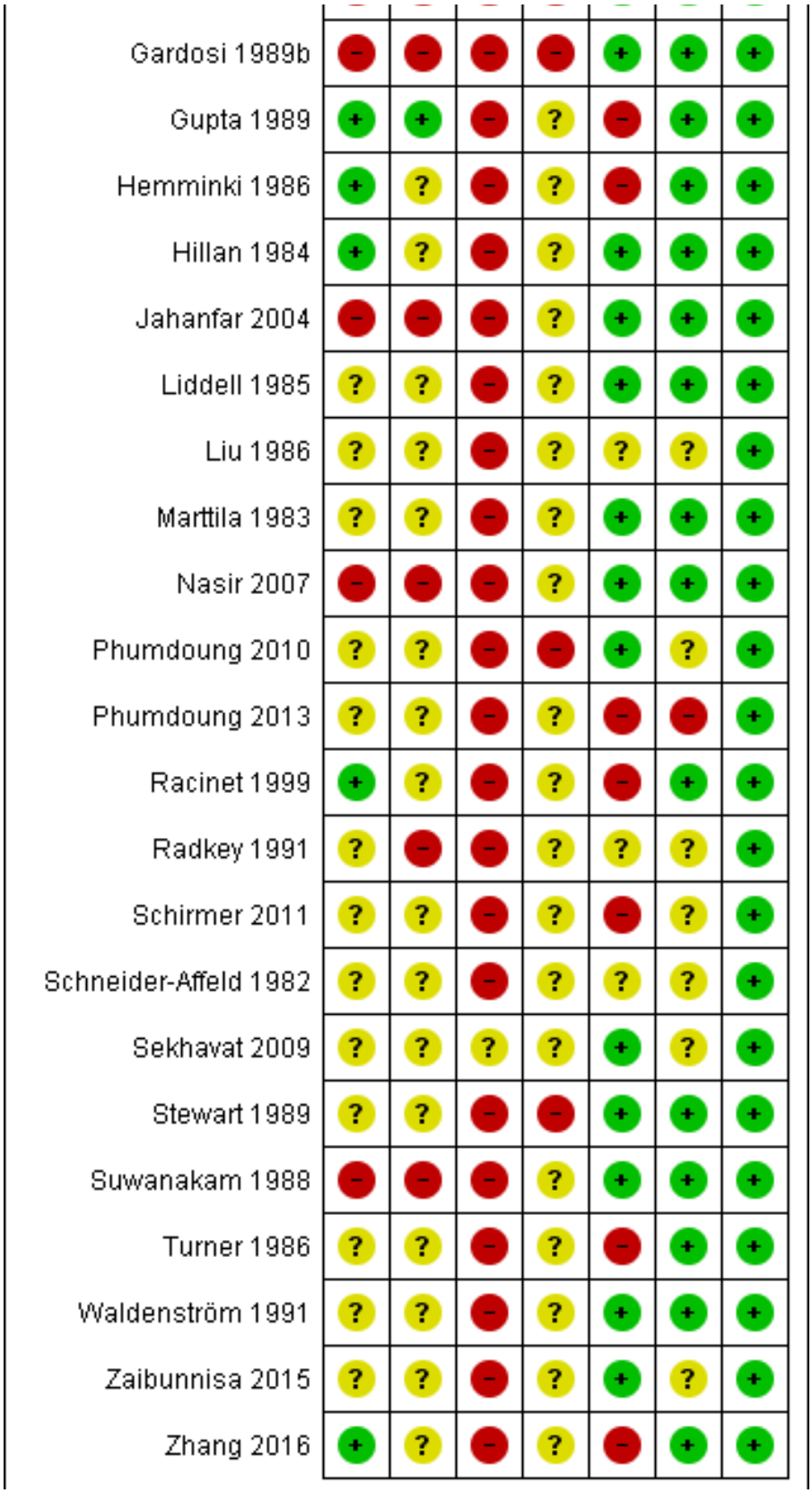
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.



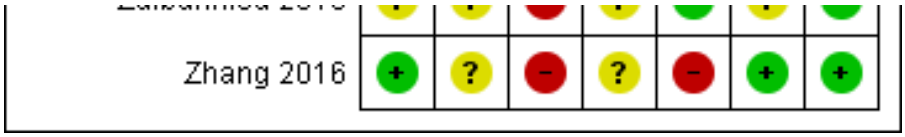
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 2. (Continued)



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 2. (Continued)



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Allocation

Random sequence generation was assessed at low risk of bias in eight trials, high risk in nine trials and unclear risk in 15 trials. Allocation concealment was classified as low risk in one trial, high risk in nine trials and unclear risk in 22 trials. Trials assessed as unclear risk of selection bias did not clearly describe randomisation or allocation methods. The nine trials that were at high risk of selection bias for randomisation and allocation issues (Bhardwaj 1994; Bomfim-Hyppólito 1998; Chan 1963; Gardosi 1989a; Gardosi 1989b; Jahanfar 2004; Nasir 2007; Suwanakam 1988) were quasi-randomised trials dependent on, for example, hospital admission, hospital number and height.

Blinding

Due to the nature of the intervention, it was not possible for women or carers to be blinded. Sekhavat 2009 did not provide adequate information to inform a judgement and was assessed as unclear risk of performance bias. In most studies it was unclear if an attempt was made to blind outcome assessors. Four studies reported that the attending midwife or research assistant, who were not blind to the allocation, assessed outcomes and were therefore assessed at high risk of detection bias (Gardosi 1989a; Gardosi 1989b; Phumdoung 2010; Stewart 1989).

Incomplete outcome data

Most trials reported complete outcome data (23 trials); while three trials were unclear risk of bias. Trials assessed at high risk of bias reported either post-randomisation exclusions (Crowley 1991; Gupta 1989; Schirmer 2011; Turner 1986), missing data (Hemminki 1986; Racinet 1999; Zhang 2016), or both (Phumdoung 2013).

Selective reporting

Of the 32 included trials, nine (one at high risk of bias, eight at unclear risk) demonstrated selective reporting; 23 trials reported all data. Phumdoung 2013 was assessed as high risk of bias for this domain due to reporting data for several outcomes for all women rather than by position in second stage.

Other potential sources of bias

No other sources of bias were identified for any trials.

Effects of interventions

See: **Summary of findings for the main comparison** Any upright compared to supine position for the second stage of labour for women without epidural anaesthesia

We found that in many analyses, data were inconsistent with varying levels of heterogeneity. We analysed data as presented in the studies, and therefore advise cautious interpretation of results. Random-effects meta-analysis was conducted as an overall summary when considered appropriate.

Comparison 1: Any upright position compared with supine position

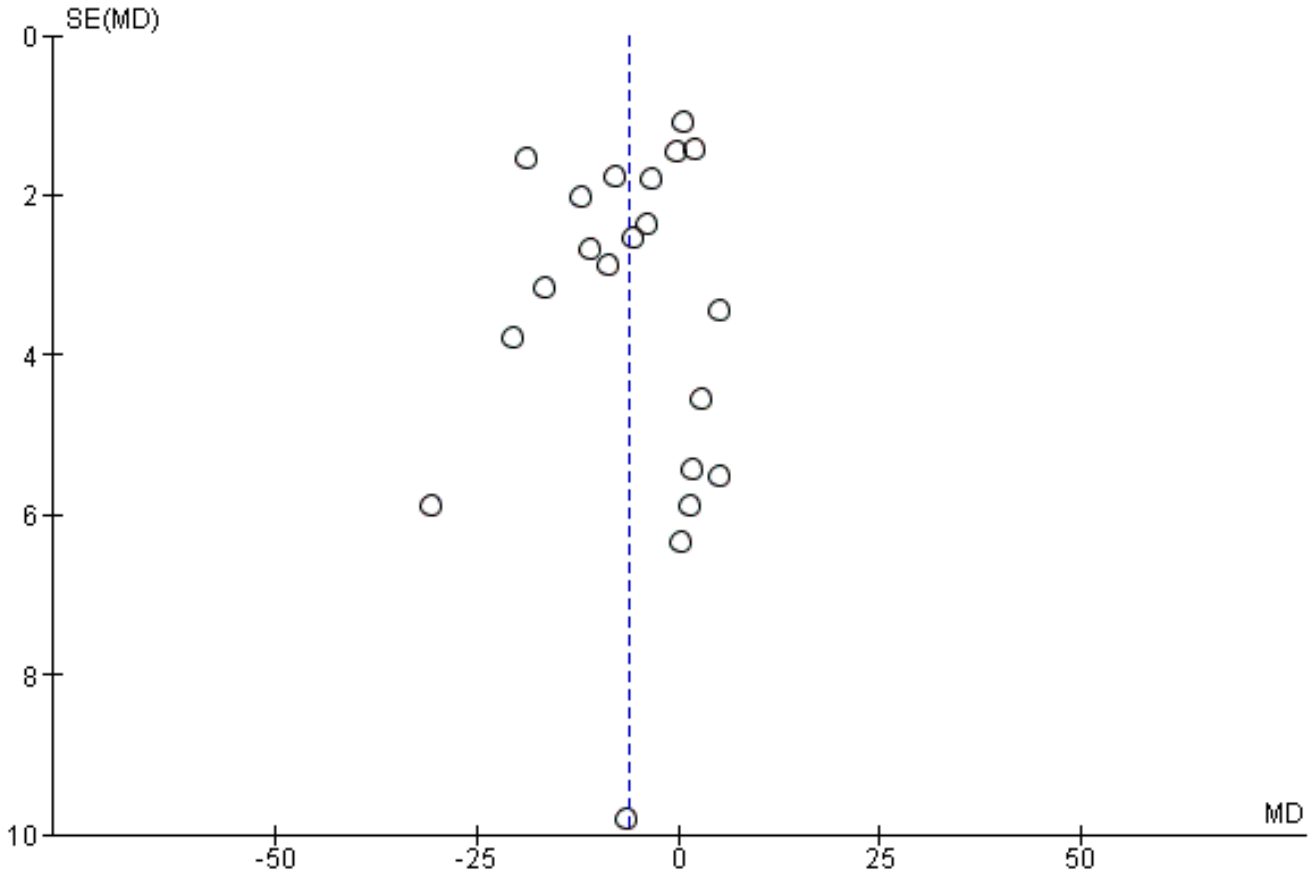
Primary outcome

Duration of second stage

For all women allocated to upright positions the duration of the second stage of labour was reduced by a mean of 6.16 minutes (95% CI -9.74 to -2.59 minutes; 19 trials; 5811 women; P = 0.0007; random-effects; I^2 = 91%; Tau^2 = 56.35; Analysis 1.1, Figure 3) (*very low-quality evidence*). Because 19 trials contributed data to this analysis we plotted results on a funnel plot; visual examination suggested asymmetry with more pronounced treatment effects in some of the smaller studies; asymmetry may indicate publication bias and results should therefore be interpreted cautiously (Figure 3). We acknowledge extreme variability in mean duration, difference and standard deviations of the contributing data; therefore, we cannot be certain of these results. It is possible that the studies contributing data measured the duration of second stage from different time points.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 3. Funnel plot of comparison: 1 Any upright versus supine position, outcome: 1.1 Duration of second stage of labour (minutes).



For primigravid women only, duration of the second stage of labour was reduced by a mean of 7.8 minutes (95% CI -12.68 to -2.92 minutes; 14 trials; 3826 women; I^2 = 89%; Analysis 1.15). However, we found high levels of heterogeneity among trials. There was no evidence of subgroup differences among primiparous, multiparous, and mixed parity groups (test for subgroup differences: Chi^2 = 3.41, df = 2, P = 0.18, I^2 = 41.3%).

We excluded nine trials (Bhardwaj 1994; Bomfim-Hyppólito 1998; Crowley 1991; Gardosi 1989a; Gardosi 1989b; Jahanfar 2004; Phumdoung 2013; Racinet 1999; Suwanakam 1988) from this analysis as part of a sensitivity analysis based on trial quality (assessed by concealment of allocation, high attrition rates, or both). Excluding these trials resulted in a trend toward reduction of the second stage by a mean of 4.34 minutes (MD -4.34, 95% CI -9.00 to 0.32; 21 trials; 2499 women; I^2 = 85%; Analysis 5.1) for women in upright positions, although the CIs crossed the line of no effect and high level heterogeneity was present.

Secondary outcomes

Pain

Four trials (Azhari 2013; Calvo Aguilar 2013; Phumdoung 2010; Phumdoung 2013) reported pain in the second stage of labour and postpartum (with higher scores indicating worse pain). Data from these studies contributed to subgroup reporting, such as distress, sensation, intensity in second stage, visual analogue scale scores (Analysis 1.2); however, data could not be pooled because studies used different ways to measure the same outcome. Overall, most trials (Azhari 2013; Phumdoung 2010; Phumdoung 2013) reported reduction in pain experienced by women in upright positions.

Use of any analgesia or anaesthesia

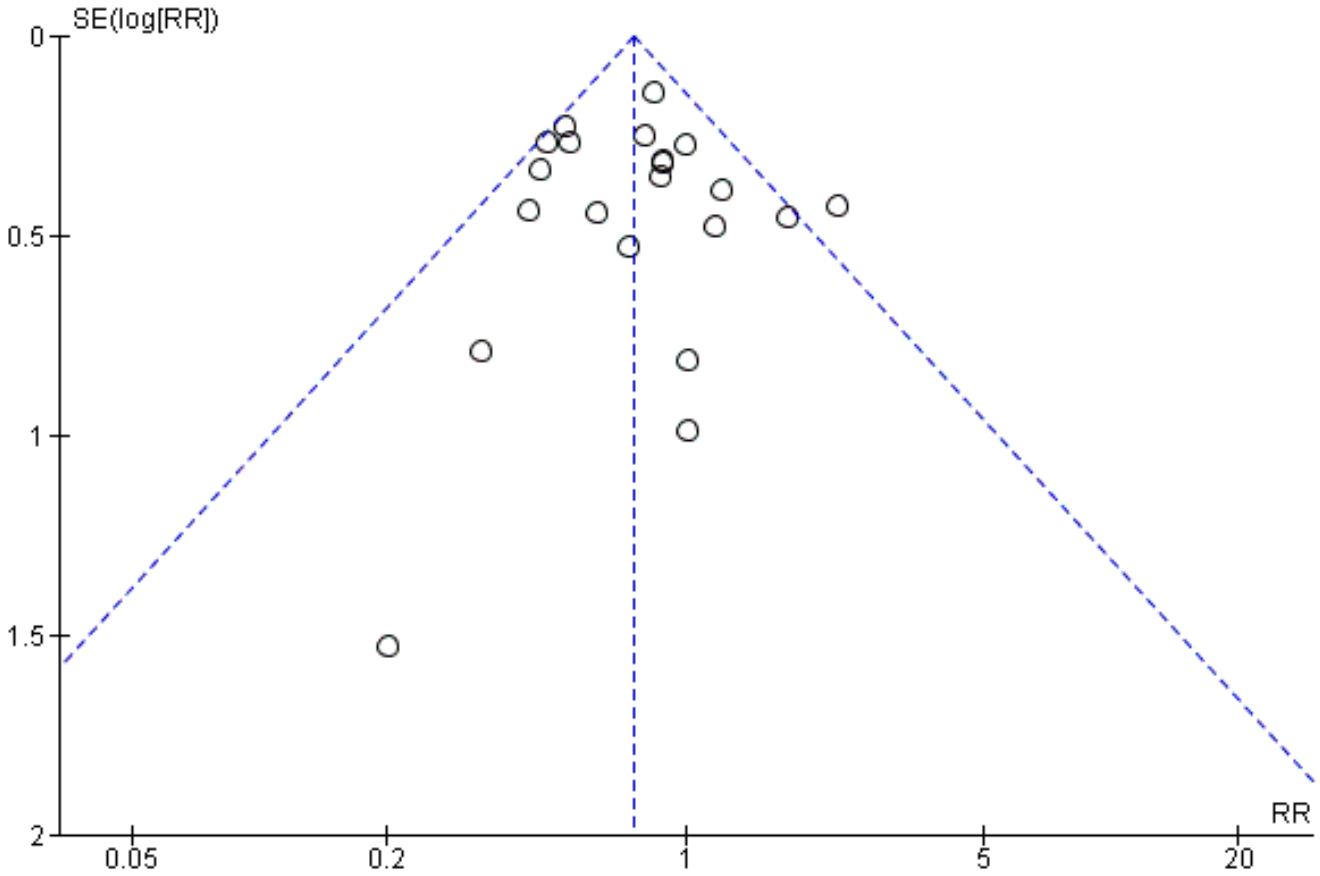
The upright position may lead to fewer women requiring analgesia or anaesthesia during the second stage of labour. However, the CIs crossed the line of no effect, so this result is not certain (RR 0.97, 95% CI 0.93 to 1.02; 7 trials; 3093 women; I^2 = 30%; Analysis 1.3). If there is an effect, it is likely to be very small.

Mode of birth: assisted birth

There was a reduction in assisted deliveries (RR 0.75, 95% CI 0.66 to 0.860; 21 trials; 6481 women; Analysis 1.4, Figure 4) (*moderate-quality evidence*). Because more than 10 trials contributed data to the analysis we constructed a funnel plot to look for any evidence of asymmetry which may suggest publication bias. Apart from one study there was no clear evidence of asymmetry from visual examination of the plot (Figure 4). A sensitivity analysis based on trial quality produced similar results for this outcome (RR 0.71, 95% CI 0.56 to 0.90; 21 trials; 2534 women; I^2 = 30%; Analysis 5.2).

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 4. Funnel plot of comparison: 1 Any upright versus supine position, outcome: 1.4 Mode of birth: assisted birth.

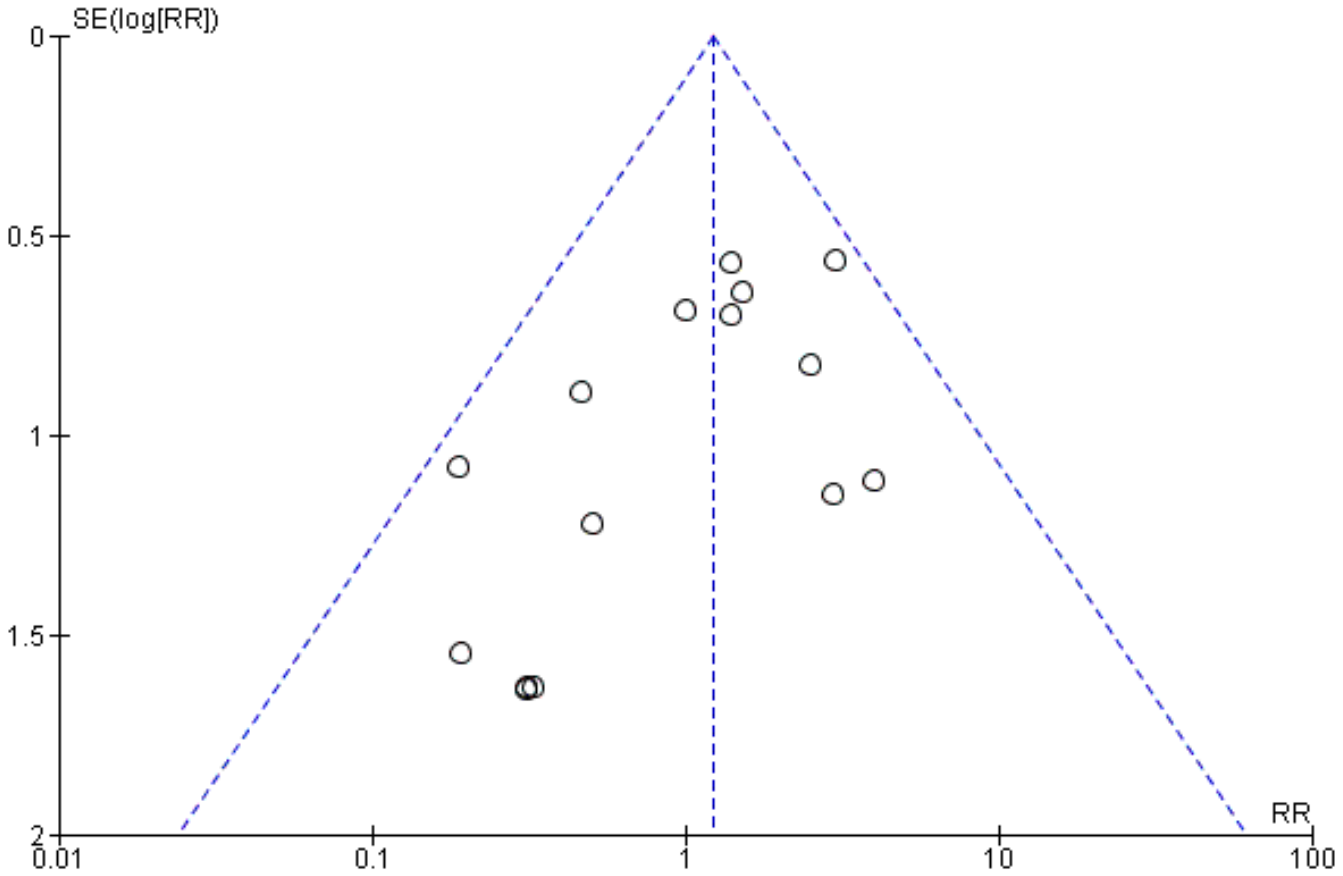


Mode of birth: caesarean section

There was no clear difference in rates of caesarean section (RR 1.22, 95% CI 0.81 to 1.81; 16 trials; 5439 women; Analysis 1.5, Figure 5) (*low-quality evidence*). There was no clear evidence of funnel plot asymmetry from visual examination.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 5. Funnel plot of comparison: 1 Any upright versus supine position, outcome: 1.5 Mode of birth: caesarean section.



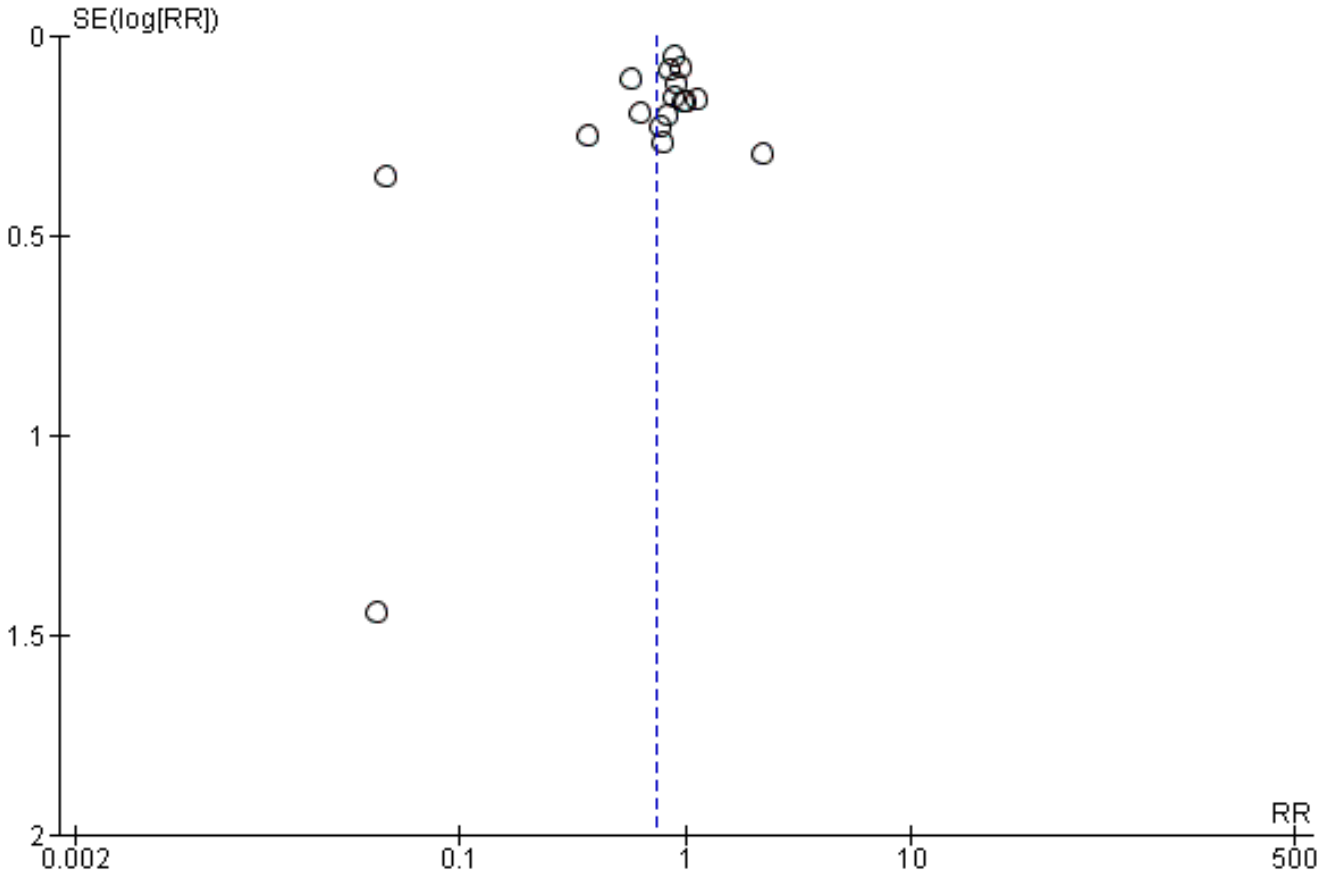
Removing low quality trials from this analysis produced similar results for this outcome, with wide CIs crossing the line of no effect (RR 1.47, 95% CI 0.88 to 2.46; 16 trials; 2544 women; Analysis 5.3).

Trauma to the birth canal that required suturing: episiotomy

Fewer episiotomies were performed for women randomised to upright position groups (average RR 0.75, 95% CI 0.61 to 0.92; 17 trials; 6148 women; random-effects, $I^2 = 88\%$; $Tau^2 = 0.13$; Analysis 1.6, Figure 6). There was some evidence of funnel plot asymmetry from visual examination, although it was difficult to assess if publication bias was present or not due to similar precision of many studies, and heterogeneity in the rates of outcomes between different trials. There was wide variation in episiotomy rates among the included studies, however, individual results from larger trials tended to favour reduction in episiotomy rates for upright positions. Episiotomy is heavily influenced by factors including policy, individual practice, and instrumental birth, therefore, results from this analysis should be interpreted with caution.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 6. Funnel plot of comparison: 1 Any upright versus supine position, outcome: 1.6 Episiotomy.

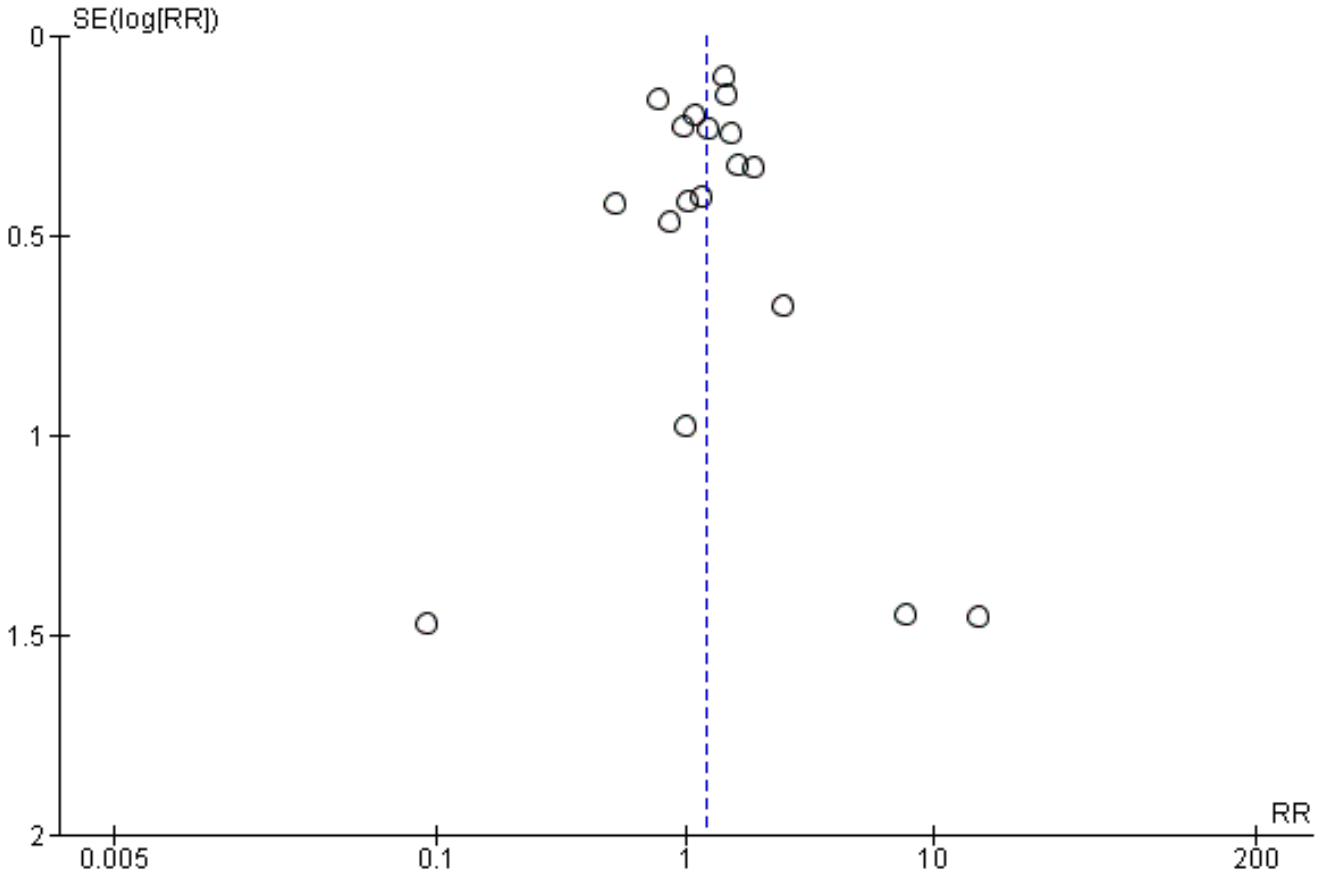


Trauma to the birth canal that required suturing: second degree perineal tear

Fewer episiotomies among women randomised to upright position groups was partly offset by a possible increase in second degree perineal tears, although the result touched the line of no effect (RR 1.20, 95% CI 1.00 to 1.44; 18 trials; 6715 women; random-effects, I^2 = 43%; Tau^2 = 0.05; Analysis 1.7, Figure 7) (*low-quality evidence*). There was no clear evidence of funnel plot asymmetry for this outcome from visual examination.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 7. Funnel plot of comparison: 1 Any upright versus supine position, outcome: 1.7 Second degree perineal tears.



The sensitivity analysis based on trial quality produced similar results, but the CIs no longer crossed the line of no effect (RR 1.35, 95% CI 1.10 to 1.67; 9 trials; 2977 women; fixed-effect; Analysis 5.4). Slightly more women in the upright position experienced second degree tear.

Trauma to the birth canal that required suturing: third or fourth degree tear

There was no clear difference in the number of third or fourth degree perineal tears between women in upright and supine positions (RR 0.72, 95% CI 0.32 to 1.65; 6 trials; 1840 women; Analysis 1.8) (*very low-quality evidence*).

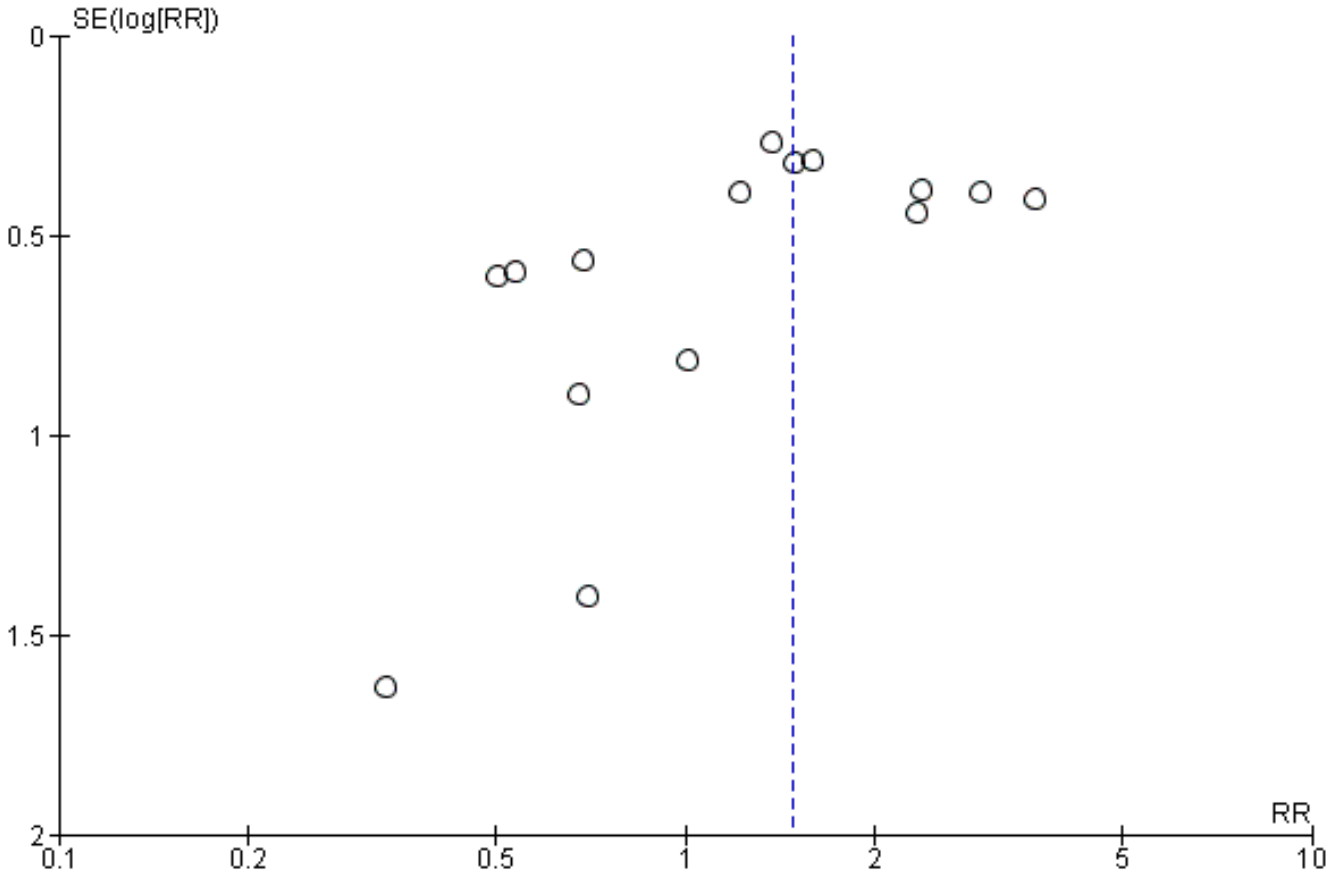
There was no clear difference among groups in the sensitivity analysis (RR 1.46, 95% CI 0.44 to 4.79; 6 trials; 872 women; Analysis 5.5).

Blood loss greater than 500 mL

Estimated blood loss greater than 500 mL was more common in women allocated to the upright position (RR 1.48, 95% CI 1.10 to 1.98; 15 trials; 5615 women; random-effects; I^2 = 33%; Tau^2 = 0.10; Analysis 1.9, Figure 8) (*moderate-quality evidence*). There appeared to be funnel plot asymmetry which may suggest possible publication bias; some of the smaller studies appear to have larger effect sizes.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Figure 8. Funnel plot of comparison: 1 Any upright versus supine position, outcome: 1.9 Blood loss > 500 mL.



There was no clear difference in blood loss between groups when low quality trials were excluded from the analysis (RR 1.59, 95% CI 0.90 to 2.80; 15 trials; 2186 women; random-effects; I^2 = 47%; Tau^2 = 0.24; Analysis 5.6).

Need for blood transfusion (not pre-specified)

There was no clear difference in numbers of blood transfusions for women in upright and supine positions (RR 1.66, 95% CI 0.70 to 3.94; 2 trials; 1747 women; Analysis 1.10).

Manual removal of placenta (not pre-specified)

There was no clear difference in numbers of manual removals for women in upright and supine positions (RR 1.15, 95% CI 0.64 to 2.08; 5 trials; 2020 women; I^2 = 38%; Tau^2 = 0.60; Analysis 1.11).

Shoulder dystocia (not pre-specified)

Shoulder dystocia was not reported in any of the included studies.

Urinary or faecal incontinence

The incidence of urinary or faecal incontinence was not reported in any of the included studies.

Abnormal fetal heart rate patterns needing intervention

Fewer abnormal fetal heart rate patterns were recorded for the upright position (RR 0.46, 95% CI 0.22 to 0.93; 2 trials; 617 women; Analysis 1.12).

Admission to neonatal intensive care unit

There was no clear difference in numbers of babies admitted to neonatal intensive care whose mothers gave birth in upright and supine positions (RR 0.79, 95% CI 0.51 to 1.21; 4 trials; 2565 infants; Analysis 1.13) (*low-quality evidence*).

A similar result was found in the sensitivity analysis after excluding low quality studies (RR 0.86, 95% CI 0.32 to 2.32; 4 trials; 449 infants; Analysis 5.7).

Perinatal death

There was no clear difference in the perinatal mortality rate between women in upright and supine positions (RR 0.79, 95% CI 0.51 to 1.21; 4 trials; 982 infants; Analysis 1.14).

Comparison 2: Birth stool or squatting stool compared with supine position

Primary outcome

Duration of second stage labour

The effect of the use of a birth or squatting stool on the duration of second stage of labour showed no difference to the supine position in the four trials reporting this outcome (MD -0.57, 95% CI -3.83 to 2.68; 4 trials; 613 women; random-effects, I^2 = 58%; Tau^2 = 5.81; Analysis 2.1).

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Secondary outcomes

Pain

Pain was not reported in any of the included studies.

Use of any analgesia or anaesthesia

Fewer women in the birth stool group may have used analgesia or anaesthesia compared with women in supine position. However, the CIs crossed the line of no effect (RR 0.90, 95% CI 0.76 to 1.06; 2 trials; 811 women; Analysis 2.2).

Mode of birth: assisted birth

Fewer women may require assisted births if they use a birth or squatting stool; the CIs just crossed the line of no effect (RR 0.77, 95% CI 0.58 to 1.01; 8 trials; 1824 women; Analysis 2.3).

Mode of birth: caesarean section

There was no clear difference in the rates of caesarean section between women using a birth or squatting stool and in a supine position (RR 0.76, 95% CI 0.37 to 1.55; 8 trials; 1824 women; Analysis 2.4).

Trauma to the birth canal that required suturing: episiotomy

Fewer episiotomies were performed in the birthing stool or squatting position (RR 0.82, 95% CI 0.72 to 0.92; 7 trials; 1930 women; Analysis 2.5).

Trauma to the birth canal that required suturing: second degree perineal tear

There was no clear difference in the second degree perineal tear rate between women randomised to birthing or squatting stool versus supine position (average RR 1.34, 95% CI 0.79 to 2.27; 7 trials; 1505 women; random-effects, $I^2 = 51\%$; $Tau^2 = 0.21$; Analysis 2.6).

Trauma to the birth canal that required suturing: third and fourth degree tear

There was no clear difference in the third and fourth degree tear rates (RR 0.49, 95% CI 0.16 to 1.48; 4 trials; 1061 women; Analysis 2.7) between women randomised to birthing or squatting stool versus supine position.

Blood loss greater than 500 mL

There was an increase in estimated blood loss greater than 500 mL in women who gave birth using birth or squat stools (RR 1.54, 95% CI 1.05 to 2.26; 7 trials; 1615 women; Analysis 2.8).

Need for blood transfusion (not pre-specified)

There was no difference in the need for blood transfusion between groups (RR 2.02, 95% CI 0.18 to 22.18; 1 trial; 517 women; Analysis 2.9).

Manual removal of placenta (not pre-specified)

There was no clear difference in the number of women who required manual removal of placenta (average RR 0.75, 95% CI 0.02 to 25.79; 2 trials; 493 women; $I^2 = 74\%$; $Tau^2 = 4.82$; Analysis 2.10) between women randomised to birthing or squatting stool versus supine position.

Shoulder dystocia (not pre-specified)

There was no clear difference in numbers of shoulder dystocias between women randomised between birthing or squatting stool versus supine position (RR 0.20, 95% CI 0.01 to 4.11; 1 trial; 200 women; Analysis 2.11).

Urinary or faecal incontinence

The incidence of urinary or faecal incontinence was not reported in any of the included studies.

Abnormal fetal heart rate patterns

Fewer abnormal fetal heart rate patterns were detected in the birth or squatting stools group but this difference was border line and based on data from one trial (RR 0.28, 95% CI 0.08 to 0.98; 1 trial; 517 women; Analysis 2.12).

Admission to neonatal intensive care unit

There was no clear difference in numbers of babies admitted to intensive care between birth stool or squatting stool compared with supine position (RR 0.86, 95% CI 0.32 to 2.30; 1 trial; 295 women; Analysis 2.13).

Perinatal death

There was no clear difference between birth stool or squatting stool and supine position groups in rates of perinatal mortality (RR 1.00, 95% CI 0.14 to 6.96; 1 trial; 200 women; Analysis 2.14).

Comparison 3: Birth cushion compared with supine position

Primary outcome

Duration of second stage labour

Women allocated to using birth cushions had shorter second stages of labour. Trials were assessed as low quality and high levels of heterogeneity were present (average MD -10.64, 95% CI -20.15 to -1.12; 3 trials; 1193 women; random-effects, $I^2 = 89\%$; $Tau^2 = 59.43$; Analysis 3.1). Results between subgroups (primigravid and multigravid women) were very similar (Analysis 3.9).

Secondary outcomes

Pain

Pain was not reported in any of the included studies.

Use of any analgesia or anaesthesia

Use of analgesia or anaesthesia was not reported in any of the included studies.

Mode of birth: assisted birth

There were fewer assisted deliveries among women using the birth cushion (RR 0.50, 95% CI 0.32 to 0.78; 2 trials; 1044 women; Analysis 3.2).

Mode of birth: caesarean section

There was no clear difference in the rates of caesarean section between women using the birth cushion and those in supine position (RR 0.19, 95% CI 0.01 to 3.97; 1 trial; 427 women; Analysis 3.3).

Trauma to the birth canal that required suturing: episiotomy

A similar rate of episiotomies was observed in both birth cushion and supine position groups (RR 0.99, 95% CI 0.71 to 1.36; 1 trial; 425 women; Analysis 3.4).

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Trauma to the birth canal that required suturing: second degree perineal tear

Fewer second degree perineal tears occurred in women using the birth cushion (RR 0.72, 95% CI 0.54 to 0.97; 2 trials; 1042 women; Analysis 3.5).

Trauma to the birth canal that required suturing: third and fourth degree tear

Similar rated of third and fourth degree tears were identified (RR 1.10, CI 0.16 to 7.75, 1 trial; 617 women; Analysis 3.6).

Blood loss greater than 500 mL

The rate of estimated blood loss greater than 500 mL was not clearly different between groups (RR 1.00, 95% CI 0.54 to 1.88; 2 trials; 1044 women; Analysis 3.7).

Need for blood transfusion (not pre-specified)

Need for blood transfusion was not reported in any of the included studies.

Manual removal of placenta (not pre-specified)

Manual removal of placenta was not reported in any of the included studies.

Shoulder dystocia (not pre-specified)

Shoulder dystocia was not reported in any of the included studies.

Urinary or faecal incontinence

Urinary or faecal incontinence was not reported in any of the included studies.

Abnormal fetal heart rate patterns needing intervention

Abnormal fetal heart rate patters was not reported in any of the included studies.

Admission to neonatal intensive care unit

Admission to neonatal intensive care was not reported in any of the included studies.

Perinatal death

There were no perinatal deaths in one trial that involved 427 women reporting this outcome (Gardosi 1989a; Analysis 3.8).

Comparison 4: Birth chair compared with supine position

Primary outcome

Duration of second stage

There was no clear difference between women using birthing chairs or supine positions in duration of the second stage of labour (average MD -2.63, 95% CI -7.03 to 1.77; 9 trials; 3090 women; I^2 = 77%; Tau^2 = 26.93; Analysis 4.1). Subgroup analysis of primigravid, multigravid and mixed parity women revealed no clear differences and high heterogeneity within groups (Analysis 4.11).

Secondary outcomes

Pain

Pain was not reported in any of the included studies.

Use of any analgesia or anaesthesia

Similar numbers of women in the birth chair and supine position groups had any analgesia or anaesthesia during the second stage of labour (RR 0.97, 95% CI 0.93 to 1.01; 4 trials; 2082 women; I^2 = 28%; Analysis 4.2).

Mode of birth: assisted birth

No clear differences were demonstrated for assisted birth (average RR 0.91, 95% CI 0.64 to 1.30; 8 trials; 2956 women; I^2 = 55%; Tau^2 = 0.12; Analysis 4.3).

Mode of birth: caesarean section

There was no clear difference in rates of caesarean section between women using the birth chair and those in supine position (RR 1.29, 95% CI 0.50 to 3.32; 4 trials; 2573 women; Analysis 4.4).

Trauma to the birth canal that required suturing: episiotomy

Due to high levels of heterogeneity, we applied a random-effects model to analyse rates of episiotomy. Rates were lower for women using the birth chair (average RR 0.82, 95% CI 0.68 to 0.99; 5 trials; 2620 women; random-effects, I^2 = 71%; Tau^2 = 0.03; Analysis 4.5).

Trauma to the birth canal that required suturing: second degree perineal tears

Rates of second degree perineal tears were increased in the birth chair group (RR 1.37, 95% CI 1.18 to 1.59; 5 trials; 2819 women; Analysis 4.6).

Trauma to the birth canal that required suturing: third or fourth degree tear

Third or fourth degree tear was not reported in any of the included studies.

Blood loss greater than 500 mL

Estimated blood loss greater than 500 mL did not differ between groups (average RR 1.57, 95% CI 0.83 to 2.98; 4 trials; 2573 women; random-effects, I^2 = 87%; Tau^2 = 0.35; Analysis 4.7).

Need for blood transfusion (not pre-specified)

No clear difference was found between groups for women requiring blood transfusion (RR 1.61, 95% CI 0.64 to 4.07; 1 trial; 1230 women; Analysis 4.8).

Manual removal of placenta (not pre-specified)

No clear difference was found between groups for women requiring manual removal of placenta (RR 1.69, 95% CI 0.79 to 3.63; 1 trial; 1229 women; Analysis 4.9).

Shoulder dystocia (not pre-specified)

Shoulder dystocia was not reported in any of the included studies.

Urinary or faecal incontinence

Urinary or faecal incontinence was not reported in any of the included studies.

Abnormal fetal heart rate patterns needing intervention.

Abnormal fetal heart rate was not reported in any of the included studies.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Admission to neonatal intensive care unit

Similar numbers of babies were admitted to neonatal intensive care unit (RR 0.80, 95% CI 0.46 to 1.38; 1 trial; 1230 women; Analysis 4.10).

Perinatal death

Perinatal death was not reported in any of the included studies.

Funnel plots

We constructed and analysed funnel plots to investigate publication bias for six analyses (Analysis 1.1; Analysis 1.4; Analysis 1.5; Analysis 1.6; Analysis 1.7; Analysis 1.9). Funnel plots Figure 4 (Analysis 1.4) and Figure 5 (Analysis 1.5) showed no asymmetry. However, four plots were asymmetrical and suggest publication bias: Figure 3 (Analysis 1.1); Figure 6 (Analysis 1.6); Figure 7 (Analysis 1.7); and Figure 8 (Analysis 1.9).

DISCUSSION

Summary of main results

Variability with risk of bias in trials, inconsistencies within trials, and heterogeneity of analyses, mean that results should be interpreted with caution. Furthermore, because blinding was not possible, negative or positive attitudes of caregivers to new techniques may have influenced the results. With upright postures, there was an overall reduction in duration of second stage of labour, largely contributed by the use of a birth cushion. No clear difference in duration of second stage was found with use of birth chair, birth stool or squatting stool. Fewer women had assisted delivery, for example using forceps, although using birth stools or birth chairs showed no effect. The number of women requiring caesarean section did not differ. Fewer women had episiotomies, those who did were mainly allocated to use of birthing stools or chairs, although there was a tendency for more women to have perineal tears in upright positions. There was no difference in numbers of women with serious perineal tears between those giving birth in upright or supine positions. Women were more likely to have blood losses of 500 mL or more in the upright position but this may be associated with more accurate ways of measuring blood loss. There was also a possibility of publication bias for blood loss (funnel plot asymmetry). Fewer babies had problems with fast or irregular heart rates that indicate distress in two trials (617 women) when women gave birth in an upright position although the number of admissions to the neonatal unit did not differ.

Overall completeness and applicability of evidence

The primary review outcome was reduction in duration of second stage labour, which has been demonstrated among women giving birth in the upright position. Most trials reported this outcome but the overall reduction in duration was small (less than 10 minutes) in the context of the whole duration of second stage labour. The largest reduction was achieved with the use of the birth cushion but these studies were conducted in the late 1980s. We are not aware if these cushions are commonly used in current obstetrics practice in other areas of the world; subsequent studies using these cushions have not been reported. The high heterogeneity for this outcome suggests that the included trials may have used different methods of measuring duration of second stage labour. It is also noteworthy that lack of blinding may have affected care provided for these women, for example rate of vaginal examinations and possible augmentation. Therefore, the overall applicability of the upright position to reduce the duration of second stage labour should be interpreted with caution.

There was no information in the included trials about compliance with allocation, and it is possible that in some trials women may have changed positions throughout second stage labour.

Most trials also reported on the review secondary outcome measures such as pain experienced (reduced), assisted deliveries (reduction), second degree tears (increased) and blood loss greater than 500 mL (increased) with the upright position. These measures can fit into the context of current practice, especially with regard to informing women of these risks during the counselling process.

Quality of the evidence

Overall, risk of bias in the included trials was variable. Blinding of participants, personnel and outcome assessors was either not performed or unclear in all trials (Figure 2).

Using GRADEpro software to assess evidence quality for selected important outcomes, we found moderate quality evidence for assisted birth (21 trials, 6481 women), and blood loss greater than 500 mL (15 trials, 5615 women). There were no outcomes graded as high quality; all other outcomes assessed were graded as either low (caesarean section; second degree perineal tears; admission to neonatal intensive care) or very low (duration of second stage of labour; third or fourth degree tears) quality (Summary of findings for the main comparison). The main reasons for downgrading GRADE assessment was that several studies had design limitations (inadequate randomisation and allocation concealment) with high heterogeneity and wide confidence intervals crossing the line of no effect.

Publication bias was assessed in funnel plots. Four analyses produced asymmetrical funnel plots (Figure 3 (Analysis 1.1); Figure 6 (Analysis 1.6); Figure 7 (Analysis 1.7); and Figure 8 (Analysis 1.9)) which could suggest that small studies had a large impact on the overall effect in the results and these analyses should be interpreted with caution.

Potential biases in the review process

The research question for this review was specific because another review of women with epidural anaesthesia had been undertaken (Kemp 2013). We attempted to identify all relevant studies and that all relevant data was obtained (non-English papers were translated and data extracted), and the methods used for searching, study selection, data collection and analysis were completed as per robust Cochrane methodology. We acknowledge that we may have missed some relevant trials because we did not search trials registers such as ClinicalTrials.gov or the WHO International Clinical Trials Registry Platform ((ICTRP), but we will search these registers in the next update.

Agreements and disagreements with other studies or reviews

There was reasonable agreement between our findings and those of a similar Cochrane Review that assessed women in different positions who had epidural anaesthesia (Kemp 2013).

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

AUTHORS' CONCLUSIONS

Implications for practice

The findings of this review suggest several possible benefits of upright posture for women without epidural anaesthesia, such as a small reduction in the duration of second stage of labour (mainly for primigravidae), reduction in episiotomy rates and assisted deliveries. However, there is an increased risk of blood loss greater than 500 mL, and there may be an increased risk of second degree tears, although this remains somewhat uncertain.

Implications for research

In view of the variable quality of the trials reviewed, further studies using well-designed protocols are needed. These should include a measure of the skill, confidence and attitudes of the midwives and obstetricians taking part in the trial. Attention must be paid to the way blood loss is measured, such as by haematocrit measurement before and after birth, and direct measurement of the blood loss.

ACKNOWLEDGEMENTS

Cheryl Nikodem was involved in the preparation of the original review (Gupta 1999). We thank Rebecca Smyth for her contribution to the review update (Gupta 2004). We are grateful to Manjeet Shehmar for helping to update the 2012 review (Gupta 2012).

As part of the pre-publication editorial process, this review has been commented on by two peers (an editor and referee who is external to the editorial team), a member of Cochrane Pregnancy and Childbirth's international panel of consumers and the Group's Statistical Adviser.

We thank Bita Mesgarpour for translating the following three trials Amiri 2012, Azhari 2013 and Sekhavat 2009.

The World Health Organization, Janesh Gupta, Akanksha Sood and G Justus Hofmeyr retain copyright and all other rights in their respective contributions to the manuscript of this Review as submitted for publication.

This project was supported by the National Institute for Health Research, via Cochrane Infrastructure funding to Cochrane Pregnancy and Childbirth. The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the Systematic Reviews Programme, NIHR, NHS or the Department of Health.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

REFERENCES

References to studies included in this review

Allahbadia 1992 *{published data only}*

Allahbadia GN, Vaidya PR. Squatting position for delivery. *Journal of the Indian Medical Association* 1993;**90**(1):13-6.

* Allahbadia GN, Vaidya PR. Why deliver in the supine position?. *Australian and New Zealand Journal of Obstetrics and Gynaecology* 1992;**32**(2):104-6.

Amiri 2012 *{published data only}*

Amiri L, Shirazi V, Rajabalipoor F. The effects of different positioning on the duration of the second stage of labor in primiparous women. *Journal of Zanjan University of Medical Sciences and Health Services* 2012;**20**(80):105-14.

Azhari 2013 *{published data only}*

Azhari S, Khalilian H, Tara F, Esmaeli H. Comparison the effect of sitting and kneeling positions during the second stage of labor on pain and duration of second stage of labor in nulliparous women. *Iranian Journal of Obstetrics, Gynecology and Infertility* 2013;**15**(38):7-16.

Bhardwaj 1994 *{published and unpublished data}*

* Bhardwaj N. Randomised controlled trial on modified squatting position of birthing. *International Journal of Gynecology & Obstetrics* 1994;**46**:118.

Bhardwaj N, Kukade JA, Patil S, Bhardwaj S. Randomised controlled trial on modified squatting position of delivery. *Indian Journal of Maternal and Child Health* 1995;**6**(2):33-9.

Bomfim-Hyppólito 1998 *{published data only}*

* Bomfim-Hyppólito S. Influence of the position of the mother at delivery over some maternal and neonatal outcomes. *International Journal of Gynecology & Obstetrics* 1998;**63**(Suppl 1):S67-73.

Bonfim-Hyppólito S. A comparative study of normal delivery assistance on vertical and horizontal position. International Conference on Maternal and Neonatal Health; 1997 November 3-5; Brazil. 1997.

Calvo Aguilar 2013 *{published data only}*

Calvo Aguilar O, Flores Romero AL, Morales Garcia VE. Comparison of obstetric and perinatal results of childbirth vertical position vs. childbirth supine position. *Ginecologia y Obstetricia de Mexico* 2013;**81**(1):1-10.

Chan 1963 *{published data only}*

Chan DPC. Positions during labour. *British Medical Journal* 1963;**1**:100-2.

Crowley 1991 *{published data only}*

Crowley P, Elbourne DR, Ashurst H, Garcia J, Murphy D, Duignan N. Delivery in an obstetric birth chair: a randomized controlled trial. *British Journal of Obstetrics and Gynaecology* 1991;**98**(7):667-74.

De Jong 1997 *{published data only}*

De Jong P. Randomised trial comparing the upright and supine positions for the second stage of labour. *British Journal of Obstetrics and Gynaecology* 1999;**106**(3):292.

De Jong PR, Johanson R, Baxen P, Adrians VD, Van der Westhuizen S, Jones P. St Monica's randomized controlled trial of upright vs dorsal position for the second stage of labour. 27th British Congress of Obstetrics and Gynaecology; 1995 July 4-7; Dublin, Ireland. 1995:493.

* De Jong PR, Johanson RB, Baxen P, Adrians VD, Van der Westhuisen S, Jones PW. Randomised trial comparing the upright and supine positions for the second stage of labour. *British Journal of Obstetrics and Gynaecology* 1997;**104**(5):567-71.

Eason E. Randomised trial comparing the upright and the supine positions for the second stage of labour. *British Journal of Obstetrics and Gynaecology* 1999;**106**(3):291-2.

Gardosi 1989a *{published data only}*

Gardosi J. Cushion birth: the modern application of ancient principles. 4th European Congress of Allied Specialists in Maternal and Neonatal Care; 1989; Bruges, Belgium. 1989.

Gardosi J. Randomised controlled trial of squatting in the second stage of labour. 9th Birth Conference; 1990; San Francisco, USA. 1990:74-5.

Gardosi J. Squatting in the second stage of labour. 12th European Congress of Perinatal Medicine; 1990 Lyon, France. 1990:224.

Gardosi J. The physiology of squatting during labour. *American Journal of Obstetrics and Gynecology* 1992;**166**:341.

* Gardosi J, Hutson N, Lynch CB. Randomised, controlled trial of squatting in the second stage of labour. *Lancet* 1989;**2**(8654):74-7.

Gardosi J, Hutson N, Lynch CB. Squatting in the second stage of labour: a randomised controlled trial. 4th European Congress of Allied Specialists in Maternal and Neonatal Care; 1989; Bruges, Belgium. 1989.

Gardosi J, Hutson N, Lynch CB. Squatting in the second stage of labour: a randomized controlled trial. *British Journal of Obstetrics and Gynaecology* 1989;**96**:1115.

Gardosi 1989b *{published data only}*

Gardosi J, Sylvester S, Lynch CB. Alternative positions in the second stage of labour: a randomized controlled trial. *British Journal of Obstetrics and Gynaecology* 1989;**96**(11):1290-6.

Gupta 1989 *{published data only}*

Gupta JK, Brayshaw EM, Lilford RJ. An experiment of squatting birth. *European Journal of Obstetrics, Gynecology, and Reproductive Biology* 1989;**30**(3):217-20.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hemminki 1986 *{published data only}*

Hemminki E, Virkkunen A, Makela A, Hannikainen J, Pulkkis E, Moilanen K, et al. A trial of delivery in a birth chair. *Journal of Obstetrics and Gynaecology* 1986;**6**(3):162-5.

Hillan 1984 *{published data only}*

* Hillan EM. The birthing chair trial. Research and the Midwife Conference; 1984; Manchester, UK. 1984:22-37.

Stewart P, Hillan E, Calder A. A randomised trial to evaluate the use of a birth chair for delivery. *Lancet* 1983;**1**(8337):1296-8.

Stewart P, Hillan E, Calder AA. A study of the benefits of maternal ambulation during labour and the use of a birth chair for delivery. 8th European Congress of Perinatal Medicine; 1982 September 7-10; Brussels, Belgum. 1982:113.

Jahanfar 2004 *{published data only}*

Amini L, Jahanfar S, Jamshidi R, Kashanian M. The effect of sitting position during labour on 3rd stage duration and postpartum haemorrhage. *Journal of Obstetrics and Gynaecology* 2011;**31**(Suppl 1):33-4.

Amini L, Jahanfar S, Kashanian M, Rahiniha F, Jamshidi R. Sitting position: a right way to reduce labour pain with shortening duration of labor. *Journal of Psychosomatic Obstetrics and Gynecology* 2010;**31**(Suppl 1):104.

* Jahanfar S, Amini L, Jamshidi R. Third and fourth stages of labour: sitting position. *British Journal of Midwifery* 2004;**12**(7):437-46.

Liddell 1985 *{published data only}*

Liddell HS, Fisher PR. The birthing chair in the second stage of labour. *Australian and New Zealand Journal of Obstetrics and Gynaecology* 1985;**25**(1):65-8.

Liu 1986 *{published data only}*

Liu YC. Effect of an upright position during childbirth. First Sigma Theta Tau, Alpha Tho Chapter National Research Conference. Living with change and choice in health; 1986; University of West Virginia, USA. 1986.

Marttila 1983 *{published data only}*

Marttila M, Kajanoja P, Ylikorkala O. Maternal half-sitting position in the second stage of labor. *Journal of Perinatal Medicine* 1983;**11**(6):286-9.

Nasir 2007 *{published data only}*

Nasir A, Korejo R, Noorani KJ. Child birth in squatting position. *Journal of the Pakistan Medical Association* 2007;**57**(1):19-22.

Phumdoung 2010 *{published data only}*

Phumdoung S, Morkruengsai S, Tachapattarakul S, Lawantrakul J, Junsuwan P. Effect of the Prince of Songkla University locked-upright position on the duration, pain and comfort of second-stage labor in primiparous women. *Pacific Rim International Journal of Nursing Research* 2010;**14**(2):112-21.

Phumdoung 2013 *{published data only}*

Phumdoung S, Manasurakarn B, Rattanasombat K, Mahattanan S, Maneechot K, Chanudom B, et al. Effect of the Prince of Songkla University birthing bed on duration, pain, and comfort level during second-stage labor in primiparous Thais. *Pacific Rim International Journal of Nursing Research* 2013;**17**(1):56-68.

Racinet 1999 *{published data only}*

Racinet C, Eymery P, Philibert L, Lucas C. Delivery in the squatting position. A randomized trial comparing the squatting position and the lithotomy position for the expulsion phrase [L'accouchement en position accroupie. Essai randomise comparant la position accroupie a la position classique en phase d' expulsion]. *Journal de Gynecologie, Obstetrique et Biologie de la Reproduction* 1999;**28**(3):263-70.

Radkey 1991 *{published data only}*

Radkey AL, Liston RM, Scott KE, Young C. Squatting: preventive medicine in childbirth?. Annual Meeting of the Society of Obstetricians and Gynaecologists of Canada; 1991;Toronto, Ontario, Canada. 1991:76.

Schirmer 2011 *{published data only}*

Schirmer J, Fustinoni SM, Basile ALO. Perineal outcomes on the left lateral versus vertical semi sitting birth positions: a randomized study [Resultado perineal nas posições de parto lateral esquerda versus vertical semi-sentada: estudorandomizado]. *Acta Paulista de Enfermagem* 2011;**24**(6):745-50.

Schneider-Affeld 1982 *{published data only}*

Schneider-Affeld F, Martin K. Delivery from a sitting position. *Journal of Perinatal Medicine* 1982;**2**(Suppl):70-1.

Sekhavat 2009 *{published data only}*

Sekhavat L, Dehghani-Firuzabadi R, Karimzadah-Mibodi M. Effect of maternal position on duration of second stage of labor and maternal and neonatal outcome in nulliparous women. *Journal of Gorgan University of Medical Sciences* 2009;**11**(2):33-7.

Stewart 1989 *{published data only}*

Stewart P, Spiby H. A randomized study of the sitting position for delivery using a newly designed obstetric chair. *British Journal of Obstetrics and Gynaecology* 1989;**96**(3):327-33.

Suwanakam 1988 *{published data only}*

Suwanakam S, Linasmita V, Phuapradit W, Pongruengphant P. The effects of sitting position on second stage of labor. *Journal of the Medical Association of Thailand* 1988;**71**(Suppl 1):72-5.

Turner 1986 *{published data only}*

Turner MJ, Romney ML, Webb JB, Gordon H. The birthing chair: an obstetric hazard?. *Journal of Obstetrics and Gynaecology* 1986;**6**(4):232-5.

Waldenström 1991 *{published data only}*

Waldenström U, Gottval K. Randomized trial of birthing stool or conventional semi-recumbent position for second-stage labor. *Jordemodern* 1994;**107**(7-8):261-5.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Waldenström U, Gottvall K. A randomised trial of the use of a birth stool in the second stage of labour. 22nd International Congress of Confederation of Midwives; 1991; Kobe, Japan. 1991:78.

* Waldenström U, Gottvall K. A randomized trial of birthing stool or conventional semirecumbent position for second-stage labor. *Birth* 1991;**18**(1):5-10.

Zaibunnisa 2015 *{published data only}*

Zaibunnisa, Ara F, Ara B, Kaker P, Aslam M. Child birth; comparison of complications between lithotomy position and squatting position during. *Professional Medical Journal* 2015;**22**(4):390-4.

Zhang 2016 *{published data only}*

Zhang HY, Shu R, Zhao NN, Lu YJ, Chen M, Li YX, et al. Comparing maternal and neonatal outcomes between hands-and-knees delivery position and supine position. *International Journal of Nursing Sciences* 2016;**3**(2):178-84.

References to studies excluded from this review

Ahmed 1985 *{published data only}*

Ahmed LT, Bouchetara K. The influence of maternal position on duration of labor. *Archives of Gynecology* 1985;**237 Suppl**:9.

Altman 2007 *{published data only}*

Altman D, Ragnar I, Ekstrom A, Tyden T, Olsson SE. Anal sphincter lacerations and upright delivery postures - a risk analysis from a randomized controlled trial. *International Urogynecology Journal* 2007;**18**(2):141-6.

Bonoan 1997 *{published data only}*

Bonoan MJ, Otayza M, Garcia G. Acceptability of an indiginous birthing position using a filipino-improvised birthing chair - a third world tertiary care center prospective trial. *Acta Obstetricia et Gynecologica Scandinavica* 1997;**76**(167):45.

Brément 2007 *{published data only}*

Brément S, Mossan S, Belery A, Racinet C. Delivery in lateral position. Randomized clinical trial comparing the maternal positions in lateral position and dorsal position for the second stage of labour [Accouchement en décubitus latéral. Essai clinique randomisé comparant les positions maternelles en décubitus latéral et en décubitus dorsal lors de la deuxième phase du travail]. *Gynécologie Obstétrique & Fertilité* 2007;**35**(7):637-44.

Caldeyro-Barcia 1985 *{published data only* **(unpublished sought but not used)}**

Caldeyro-Barcia R, Alonso JG, Sugo M, Barron R, Dellepiane M. Fetal outcome of humanised labor. Personal communication 1985.

Chen 1987 *{published data only}*

Chen SZ, Aisaka K, Mori H, Kigawa T. Effects of sitting position on uterine activity during labor. *Obstetrics and Gynecology* 1987;**69**(1):67-73.

Corton 2012 *{published data only}*

Corton MM, Lankford JC, Ames R, McIntire DD, Alexander JM, Leveno KJ. A randomized trial of birthing with and without stirrups. *American Journal of Obstetrics and Gynaecology* 2012;**207**(2):133.e1–133.e5.

Downe 2004 *{published data only}*

Downe S, Gerrett D, Renfrew MJ. A prospective randomised trial on the effect of position in the passive second stage of labour on birth outcome in nulliparous women using epidural analgesia. *Midwifery* 2004;**20**(2):157-68.

Golara 2002 *{published data only}*

Golara M, Plaat F Shennan AH. Upright versus recumbent position in the second stage of labour in women with combined spinal-epidural analgesia. *International Journal of Obstetric Anesthesia* 2002;**11**(1):19-22.

Plaat F, Golara M, Shennan A. Upright versus recumbent position with mobile extradurals in the early second stage of labour. *British Journal of Anaesthesia* 1996;**76**:102.

Golay 1993 *{published data only}*

Golay J, Vedam S, Sorger L. The squatting position for the second stage of labor: effects on labor and on maternal and fetal well-being. *Birth* 1993;**20**(2):73-8.

Hegab 2002 *{published data only}*

Hegab H, Nagati A, Abd-El Fatah H, Rizk A. Evaluation of the effect of four different maternal positions on the duration of the second stage in nulliparous women [abstract]. *Journal of Obstetrics and Gynaecology Research* 2002;**28**(1):64.

Humphrey 1973 *{published data only}*

Humphrey M, Hounslow D, Morgan S, Wood C. The influence of maternal posture at birth on the fetus. *Journal of Obstetrics and Gynaecology of the British Commonwealth* 1973;**80**(12):1075-80.

Humphrey MD, Chang A, Wood EC, Morgan S, Hounslow D. A decrease in fetal pH during the second stage of labour, when conducted in the dorsal position. *Journal of Obstetrics and Gynaecology of the British Commonwealth* 1974;**81**(8):600-2.

Johnstone 1987 *{published data only}*

Johnstone FD, Aboelmagd MS, Harouny AK. Maternal posture in second stage and fetal acid base status. *British Journal of Obstetrics and Gynaecology* 1987;**94**(8):753-7.

Karraz 2003 *{published data only}*

Karraz MA. Ambulatory epidural anesthesia and the duration of labor. *International Journal of Gynaecology and Obstetrics* 2003;**80**(2):117-22.

Ragnar 2006 *{published data only}*

Ragnar I, Altman D, Tyden T, Olsson SE. Comparison of the maternal experience and duration of labour in two upright delivery positions - a randomised controlled trial. *BJOG: an international journal of obstetrics and gynaecology* 2006;**113**(2):165-70.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Thies-Lagergren 2009 *{published data only}*

Thies-Lagergren L, Kvist LJ. Assessing the feasibility of a randomised controlled trial of birth on a birthing seat. *Evidence Based Midwifery* 2009;**7**(4):122-7.

Thies-Lagergren 2011 *{published data only}*

Thies-Lagergren L, Hildingsson I, Christensson K, Kvist LJ. Who decides the position for birth? A follow-up study of a randomised controlled trial. *Women and Birth* 2013;**26**(4):e99-104.

Thies-Lagergren L, Hildingsson I, Kvist L. Who decides the position for birth? - a follow up study of a randomized controlled trial. International Confederation of Midwives 30th Triennial Congress. Midwives: Improving Women's Health; 2014 June 1-4; Prague, Czech Republic. 2014:P032.

Thies-Lagergren L, Kvist LJ, Christensson K, Hildingsson I. Maternal outcomes in nulliparous women who gave vaginal birth on a birth seat or in any other position: results of a randomised controlled trial in Sweden. *Journal of Paediatrics and Child Health* 2011;**47**(Suppl 1):36-7.

Thies-Lagergren L, Kvist LJ, Christensson K, Hildingsson I. Striving for scientific stringency: a re-analysis of a randomised controlled trial considering first-time mothers' obstetric outcomes in relation to birth position. *BMC Pregnancy and Childbirth* 2012;**12**:135. [DOI: 10.1186/1471-2393-12-135]

Thies-Lagergren L, Kvist LJ, Sandin-Bojo AK, Christensson K, Hildingsson I. Augmentation of labour and fetal outcomes in relation to birth positions: A secondary analysis of an RCT evaluating birth seat births. *Journal of Paediatrics and Child Health* 2012;**48**(Suppl 1):101-2.

Thies-Lagergren L, Kvist LJ, Sandin-Bojo AK, Christensson K, Hildingsson I. Labour augmentation and fetal outcomes in relation to birth positions: A secondary analysis of an RCT evaluating birth seat births. *Midwifery* 2013;**29**(4):344-50.

Thies-Lagregren L, Kvist LJ, Christensson K, Hildingsson I. No reduction in instrumental vaginal births and no increased risk for adverse perineal outcome in nulliparous women giving birth on a birth seat: results of a Swedish randomised controlled trial. *BMC Pregnancy and Childbirth* 2011;**11**:22. [DOI: 10.1186/1471-2393-11-22]

References to ongoing studies

Hofmeyr 2015 *{published data only}*

Hofmeyr GJ, Singata M, Lawrie T, Vogel JP, Landoulsi S, Seuc AH, et al. A multicentre randomized controlled trial of gentle assisted pushing in the upright posture (GAP) or upright posture alone compared with routine practice to reduce prolonged second stage of labour (the Gentle Assisted Pushing study): study protocol. *Reproductive Health.* 2015;**12**(1):114.

Additional references

Ang 1969

Ang CK, Tan TH, Walters WAW, Wood C. Postural influence on maternal capillary oxygen and carbon dioxide tension. *British Medical Journal* 1969;**4**(5677):201-3.

Anim-Somuah 2011

Anim-Somuah M, Smyth RMD, Jones L. Epidural versus non-epidural or no analgesia in labour. *Cochrane Database of Systematic Reviews* 2011, Issue 12. [DOI: 10.1002/14651858.CD000331.pub3]

Atwood 1976

Atwood RJ. Parturitional posture and related birth behaviour. *Acta Obstetricia et Gynecologica Scandinavica. Supplement* 1976;**57**:1-25.

Balaskas 1992

Balaskas J. Active Birth: The New Approach to Giving Birth Naturally. Boston: Harvard Common Press, 1992.

Borell 1957b

Borell U, Fernström I. The movements at the sacro-iliac joints and their importance to changes in the pelvic dimensions during parturition. *Acta Obstetricia et Gynecologica Scandinavica* 1957;**36**(1):42-57.

Buhimschi 2001

Buhimschi CS, Buhimschi IA, Malinow A, Weiner CP. Use of McRoberts' position during delivery and increase in pushing efficiency. *Lancet* 2001;**358**(9280):470-1.

Caldeyro-Barcia 1960

Caldeyro-Barcia R, Noriega-Guerra L, Cibils LA, Alvarez H, Poseiro JJ, Pose SV, et al. Effect of position changes on the intensity and frequency of uterine contractions during labor. *American Journal of Obstetrics and Gynecology* 1960;**80**:284-90.

Dundes 1987

Dundes L. The evolution of maternal birthing position. *American Journal of Public Health* 1987;**77**(5):636–41.

Dunn 1978

Dunn PM. Posture in labour. *Lancet* 1978;**i**:496-7.

Engelmann 1882

Engelmann GJ. Labor Among Primitive Peoples. St. Louis: JH Chambers, 1882.

Gold 1950

Gold EM. "Pelvic drive" in obstetrics: an X-ray study of 100 cases. *American Journal of Obstetrics and Gynecology* 1950;**59**:890-6.

Gupta 1991

Gupta JK, Glanville JN, Johnson N, Lilford RJ, Dunham RJC, Watters JK. The effect of squatting on pelvic dimensions. *European Journal of Obstetrics, Gynecology, and Reproductive Biology* 1991;**42**(1):19-22.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hewes 1957

Hewes GW. The anthropology of posture. *Scientific American* 1957;**196**(2):123-32.

Higgins 2011

Higgins JPT, Green S, editors. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Humphrey 1974

Humphrey MD, Chang A, Wood EC, Morgan S, Humslow D. The decrease in fetal pH during the second stage of labour when conducted in the dorsal position. *Journal of Obstetrics and Gynaecology of the British Commonwealth* 1974;**81**(8):600-2.

Jarcho 1934

Jarcho J. Postures & Practices During Labor Among Primitive Peoples. New York: Paul Hoeber, 1934.

Johansson 2015

Johansson M, Thies-Lagergren L. Swedish fathers' experiences of childbirth in relation to maternal birth position: a mixed method study. *Women Birth* 2015;**28**(4):140-7.

Kemp 2013

Kemp E, Kingswood CJ, Kibuka M, Thornton JG. Position in the second stage of labour for women with epidural anaesthesia. *Cochrane Database of Systematic Reviews* 2013, Issue 1. [DOI: 10.1002/14651858.CD008070.pub2]

Kurokawa 1985

Kurokawa J, Zilkoski MW. Adapting hospital obstetrics to birth in the squatting position. *Birth* 1985;**12**(2):87-90.

Lilford 1989

Lilford RJ, Glanville JN, Gupta JK, Shrestha R, Johnson N. The action of squatting in the early postnatal period marginally increases pelvic dimensions. *British Journal of Obstetrics and Gynaecology* 1989;**96**(8):964-6.

Mead 1965

Mead M, Newton N. Cultural patterning of perinatal behavior. In: Richardson A, Guttmacher A editor(s). Childbearing: Its Social and Psychological Aspects. Baltimore: Williams and Wilkins, 1965.

Méndez-Bauer 1975

Méndez-Bauer C, Arroyo J, García Ramos C, Menéndez A, Lavilla M, Izquierdo F, et al. Effects of standing position on spontaneous uterine contractility and other aspects of labor. *Journal of Perinatal Medicine* 1975;**3**(2):89-100.

RevMan 2014 [Computer program]

The Nordic Cochrane Centre, The Cochrane Collaboration. Review Manager (RevMan). Version 5.3. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014.

Romond 1985

Romond JL, Baker IT. Squatting in childbirth. A new look at an old tradition. *Journal of Obstetric, Gynecologic, and Neonatal Nursing* 1985;**14**(5):406-11.

Russell 1969

Russell JGB. Moulding of the pelvic outlet. *Journal of Obstetrics and Gynaecology of the British Commonwealth* 1969;**76**(9):817-20.

Russell 1982

Russell JGB. The rationale of primitive delivery positions. *British Journal of Obstetrics and Gynaecology* 1982;**89**(9):712-5.

Scott 1963

Scott DB, Kerr MG. Inferior vena caval compression in late pregnancy. *Journal of Obstetrics and Gynaecology of the British Commonwealth* 1963;**70**:1044.

Serati 2016

Serati M, Di Dedda MC, Bogani G, Sorice P, Cromi A, Uccella S, et al. Position in the second stage of labour and de novo onset of post-partum urinary incontinence. *International Urogynecology Journal* 2016;**27**(2):281-6.

Simkin 2005

Simkin P, Ancheta R. The Labor Progress Handbook. Second Edition. Oxford: Blackwell Publishing, 2005.

Wolman 1993

Wolman WL, Chambers B, Hofmeyr GJ, Nikodem VC. Post-partum depression and companionship in the clinical birth environment: a randomised controlled study. *American Journal of Obstetrics and Gynecology* 1993;**168**(5):1388-93.

References to other published versions of this review

Gupta 1999

Gupta JK, Nikodem VC. Position for women during second stage of labour. *Cochrane Database of Systematic Reviews* 1999, Issue 3. [DOI: 10.1002/14651858.CD002006]

Gupta 2004

Gupta JK, Hofmeyr GJ, Smyth RMD. Position in the second stage of labour for women without epidural anaesthesia. *Cochrane Database of Systematic Reviews* 2004, Issue 1. [DOI: 10.1002/14651858.CD002006.pub2]

Gupta 2012

Gupta JK, Hofmeyr GJ, Shehmar M. Position in the second stage of labour for women without epidural anaesthesia. *Cochrane Database of Systematic Reviews* 2012, Issue 5. [DOI: 10.1002/14651858.CD002006.pub3]

Nikodem 1995a

Nikodem VC. Birthing chair vs recumbent position for 2nd stage of labour. [revised 03 October 1993] In: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP, Crowther C (eds.) Pregnancy and Childbirth Module. In: The Cochrane Pregnancy and Childbirth

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Database [database on disk and CDROM]. The Cochrane Collaboration; Issue 2, Oxford: Update Software; 1995.

Nikodem 1995b

Nikodem VC. Upright vs recumbent position during second stage of labour. [revised 06 May 1994] In: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP, Crowther C (eds.) Pregnancy and Childbirth Module. In: The Cochrane Pregnancy and Childbirth Database [database on disk and CDROM]. The Cochrane Collaboration; Issue 2, Oxford: Update Software; 1995.

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Allahbadia 1992

Methods	Randomised controlled trial. Women were "randomly selected" irrespective of their age, parity, height, weight or baby's weight.
Participants	200 women at Lokmanya Tilak Municipal General Hospital, Bombay, India. • 100 study participants: 42 primigravidae, 58 multigravida. • 100 control participants: 46 primigravidae, 54 multigravida. All women had full term (37 weeks completed) gestation; adequate pelvis; vertex presentation; no medical, surgical or obstetric complications.
Interventions	Study group: 100 women were kept ambulatory during the first stage of labour and were asked to squat on a birth cot during the second stage of labour. The last 20/42 primigravidae were subjected to prophylactic episiotomies. No support was given to the perineum at the time of birth. Control group: 100 women were kept in a supine position during the first and second stage of labour. All (46) primigravidae were subjected to prophylactic episiotomies. It is not stated whether support was given to the perineum at the time of birth. All women were in the supine position for the third stage of labour.
Outcomes	• Duration of first, second and third stage of labour. • Method of birth. • Complications to mother and infant.
Notes	The randomisation method was unclear. Not stated if support was given to the perineum at the time of birth in the control group. Intervention group included first stage ambulation and squatting during second stage; control group were supine in first and second stage.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Women were "randomly selected" but there was no description of the randomisation method.
Allocation concealment (selection bias)	Unclear risk	Not described in the trial report.
Blinding of participants and personnel (performance bias)	High risk	Participants and personnel aware of allocation.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Allahbadia 1992 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Amiri 2012

Methods	Randomised controlled trial.
Participants	Taleghani Hospital in Arak, Iran. Primiparous and singleton women with gestational age of 37 to 42 weeks. Inclusion criteria: primiparous and singleton Iranian women, gestational age of 37 to 42 weeks, spontaneous labour, cephalic presentation, birthweight > 2500 g and < 4000 g. Exclusion criteria: prolonged rupture (> 12 hours), medical-surgical disease in mother, fetal distress, accelerated or prolonged birth.
Interventions	Lithotomy position, N = 52 Control group 1: squatting position, N = 53. Control group 2: kneeling position, N = 55.
Outcomes	Times between full dilatation and effacement until the crowning stage, damage to the perineum, Apgar score.
Notes	Outcomes only reported for 50 women (lithotomy), 49 women (squatting) and 55 women (kneeling).

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Eligible women were randomised to three groups but there was no information regarding the generation of random sequence.
Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation/birth position.
Blinding of outcome assessment (detection bias)	Unclear risk	Not stated.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Amiri 2012 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) All outcomes	Low risk	All data entered.
Selective reporting (reporting bias)	Low risk	The study seems to adhere to the protocol IRCT201105113869N3.
Other bias	Low risk	None identified.

Azhari 2013

Methods	Randomised controlled trial.
Participants	Nulliparous women in Omolbanin Hospital, Mashhad (Iran), 2011 to 2012. Inclusion criteria: 42 weeks of pregnancy, single fetus, cephalic presentation, intact membranes, lack of infection of medical and midwifery, lack of fetal anomaly ultrasound proved by cervical dilation 3 to 5 cm. Exclusion criteria: women in the first stage or second stage of labour with fetal distress, fetal macrosomia and women, who because of his illness, were unable to get into certain positions.
Interventions	Intrvention - kneeling, N = 30. Control group 1 - sitting position, N = 30. Control group 2 - supine position, N = 30.
Outcomes	Pain intensity before and after intervention. Duration of second stage of labour.
Notes	For the analysis, we combined kneeling and sitting into an “any upright” group.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	They were selected by convenience sampling method.
Allocation concealment (selection bias)	Unclear risk	No information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided.
Incomplete outcome data (attrition bias)	Low risk	All data entered.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Azhari 2013 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Unclear risk	Protocol could not be located for comparison.
Other bias	Low risk	None identified.

Bhardwaj 1994

Methods	Quasi-randomised controlled trial. Women in labour were randomly allocated on admission in the labour ward to odd or even numbers, irrespective of their outpatient department number. Randomisation occurred before exclusion criteria were applied. Odd numbers = squatting and even numbers = lithotomy.
Participants	617 women, Latur, India. • 294 study participants: 136 primigravidae, 158 multigravida. • 323 control participants: 148 primigravidae, 175 multigravida. All women had full-term (> 36 weeks completed) gestation; vertex presentation. No medical, surgical or obstetric complications. Exclusion criteria: high-risk pregnancies; previous caesarean sections; epilepsy; hypertension; jaundice in pregnancy; malaria; heart disease; diabetes; rhesus factor negative; post maturity (> 40 weeks); other than vertex presentation; antepartum haemorrhage; severe anaemia; cephalopelvic disproportion; premature labour; late registration in labour; those who refused to squat.
Interventions	750 women were randomised before exclusion criteria were applied. These included women who were randomised to squat, but who declined to do so. 617 women took part in the study. • 293 women were randomised to squat on a 'birth cushion'. Women who spent 90% of the active bearing down phase on the birth cushion were analysed in the squatting group. Episiotomy was not done routinely in the squatting group. The groups were compared by the original (intention-to-treat) allocation, irrespective of the actual second stage positions. • 323 women were not informed about the "birth cushion" and delivered in the lithotomy position. All women were allowed to ambulate during the first stage of labour, although most preferred lying down.
Outcomes	• Lying down during first stage (no statistical difference). • Duration of second and third stage of labour. • Method of birth. • Blood loss estimated visually. • Complications to mother. • Complications to the infant. Statistical difference in fetal distress between groups (squatting 7/294 and 21/323 in the lithotomy group). • Weight of infant (no statistical difference).
Notes	Only abstract publication was available. Postpartum haemorrhage was not defined but assumed to be > 500 mL.

Risk of bias

Bias	Authors' judgement	Support for judgement

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Bhardwaj 1994 *(Continued)*

Random sequence generation (selection bias)	High risk	Inadequate - odd numbers squatting, even numbers lithotomy.
Allocation concealment (selection bias)	High risk	Inadequate.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Bomfim-Hyppólito 1998

Methods	Quasi-randomised controlled trial. Women were divided into sitting versus lying positions during labour according to their height. If their height ended in an even figure, they were assigned to the sitting position, if in an odd number to the lying position.
Participants	248 women who delivered at the Maternidade Escola Assis Chateaubriand of the Ceara Federal University. Included women with a singleton pregnancy at term with a vertex presentation. It excluded women who showed a preference for the other birthing position or who changed their minds during labour, those whose babies were less than 2500 g or heavier than 4000 g in weight and if the birth was any other than spontaneous vaginal. Also excluded seven patients who needed an episiotomy.
Interventions	127 participants randomised to vertical (sitting) position during birth defined as an inclination of the back support of the birth table at 60° with support for the feet and legs bent at 90°. 121 participants randomised to horizontal (lying) position during birth on an ordinary birthing table.
Outcomes	• Blood loss and changes in haemoglobin and haematocrit measured before birth, during labour and 24 hours after labour. • Duration of expulsion period according to the presence of cord around the neck and fetal position. • Incidence of vulvo-perineal lacerations. • Apgar scores at 1 and 5 minutes.
Notes	Women who delivered in the vertical position were slightly but significantly younger than those who delivered in the horizontal position.

Risk of bias

Bias	Authors' judgement	Support for judgement

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Bomfim-Hyppólito 1998 *(Continued)*

Random sequence generation (selection bias)	High risk	Dependent on height. If their height ended in an even figure, they were assigned to the sitting position, if in an odd number to the lying position.
Allocation concealment (selection bias)	High risk	Inadequate - predetermined allocation according to height.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No incomplete data.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Calvo Aguilar 2013

Methods	Randomised double blind study. Patients were assigned to the groups randomly using Windows excel program. Sealed envelopes were used. Set in Mexico.
Participants	Normal pregnancy, irrespective of parity, gestation age > 36 weeks, estimated fetal weight not > 3850 g, amniotic fluid volume > 4 cm, cervical dilatation > 4 cm Patients who underwent caesarean section or were not placed in the corresponding position were excluded.
Interventions	164 randomised. Study group, upright, N = 82 (outcomes for 77 reported; 4 had caesarean sections and 1 incomplete data). Control group, supine, N = 82 (outcomes for 78 reported; 4 had caesarean sections).
Outcomes	Blood loss, pain in the second stage of labour and immediate postpartum, duration of second stage of labour, perineal and vaginal tears, assisted birth, accomodation in position and perinatal outcome.
Notes	Women were able to mobilise in first stage, with random assignment during the second stage of labour. We used the author's definition of duration of second stage, rather than adding their second stage plus time to expulsion (although it likely underestimated second stage compared to other trials). Initially 164 patients were recruited, and 5 from group 1 and 4 from group 2 were eliminated (likely post-randomisation exclusion). Epidural status of enrolled women was not mentioned.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Calvo Aguilar 2013 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number tables were used.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel likely knew the allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	9 women were excluded (post-randomisation exclusion), however outcomes appear otherwise complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other forms of bias were identified.

Chan 1963

Methods	Quasi-randomised controlled trial. Alternate primigravidae were assigned to 1 of 2 groups during the first stage of labour. Women in group A were kept in the erect position during first stage of labour; women in group B were kept in bed in the lateral or dorsal position during first stage of labour. During second stage, women in group A (study group) were propped up to 45° to 60° in the birth bed. Women in group B (control) delivered in the dorsal position.
Participants	200 women, Hong Kong. • 100 study participants. • 100 control participants. Singleton and twin pregnancies were included (1 twin pregnancy in the study group), from 32 weeks' gestation.
Interventions	Study group: 100 women were kept ambulatory during the first stage of labour and were propped up to 45° to 60° in the bed during the second stage of labour. Control group: 100 women were kept in a supine or lateral position during the first of labour and in the dorsal position during the second stage of labour.
Outcomes	There were no statistically significant differences between groups regarding maternal age, gestation or complications during labour. • Use of analgesia or anaesthesia.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Chan 1963 *(Continued)*

- Duration of first and second stage of labour.
- Method of birth.
- Perinatal deaths.
- Manual removal of placenta.

Notes

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Quasi-randomisation "Alternate primigravidae, in whom elective caesarean section would not be done, were assigned at random to one of two groups, A and B".
Allocation concealment (selection bias)	High risk	Alternate participants.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	Nothing declared.

Crowley 1991

Methods	Randomised controlled trial. Randomisation by numbered sealed opaque envelopes just before second stage of labour.
Participants	1250 women participated, at Coombe Lying-in Hospital, Dublin between March 1984 and June 1985. There were 20 post randomisation withdrawals. 1230 women's results included. • 634 study participants. • 596 control participants. Only nulliparae. All women had reached 34 weeks' completed gestation. Singleton pregnancies. Vertex presentation. Induced and augmented women were allowed to participate. No epidural anaesthesia.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Crowley 1991 *(Continued)*

Interventions	Study group: 634 women were allocated at the beginning of second stage to deliver in the "E-Z birth chair" (413/634 did deliver in the chair). The height and angle of the chair were adjusted according to the preference of the midwife and the parturient. Control group: 596 women were allocated to deliver on the bed (576/596 did deliver on the bed). The women used any of the following positions: recumbent, semi-recumbent, dorsal, or left lateral.
Outcomes	There were no statistically significant differences between the groups for meconium-stained liquor, duration of first stage, birthweight and gestational age. • Maternal experience and satisfaction of second stage of labour. • Use of analgesia/anaesthesia. • Duration of second stage of labour. • Method of birth. • Trauma to the birth canal. • Postpartum haemorrhage. • Neonatal condition. • Apgar scores (no difference). • Admission to neonatal intensive care unit.
Notes	There were 20 post randomisation withdrawals of whom 7 had been allocated to the chair and 13 to the bed, and these women were not included in the analyses. Only 413/634 allocated to the chair, delivered in the chair and 576/596 allocated to the bed delivered in the bed. Analyses were done according to group allocation (intention-to-treat). The above short comings of the trial could have an effect on the results. A subgroup of women were interviewed (263 chair versus 289 bed).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Simple random allocation without balancing.
Allocation concealment (selection bias)	Unclear risk	Sealed opaque envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided.
Incomplete outcome data (attrition bias) All outcomes	High risk	There were 20 post-randomisation withdrawals, and these were unbalanced between groups.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

De Jong 1997

Methods	Randomised controlled trial. Randomisation was carried out in late first stage of labour by means of opaque sealed envelopes.
Participants	517 women, at St Monica's Nursing Home, Cape Town, South Africa. • 257 study participants: 107 primigravidae, 150 multigravida. • 260 control participants: 115 primigravidae, 145 multigravida. All women had full-term (37 weeks completed) gestation. Singleton pregnancies. No contra-indications for normal vaginal birth. Vertex presentation. No medical, surgical or obstetric complications. No epidural anaesthesia.
Interventions	Study group: 257 women were allocated to deliver in the upright position. 249/257 did maintain the position during second stage. The women used a 'step stool' covered with a foam mattress to deliver in a squatting position. They were kept in this position for the third stage of labour. Control group: 260 women delivered in a supine position on a delivery bed. All women were encouraged to walk, sit or recline during the first stage of labour.
Outcomes	There were no statistically significant differences between groups for maternal age, gravity, gestation, birthweight or Apgar scores. • Maternal experience and satisfaction of second stage of labour. • Pain. • Use of analgesia. • Duration of second stage of labour. • Method of birth. • Trauma to the birth canal. • Postpartum haemorrhage. • Abnormal fetal heart rate patterns.
Notes	Correction on state of perineum and vulva data were incorporated in this review (De Jong 1999).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random sequencing.
Allocation concealment (selection bias)	Unclear risk	Opaque sealed envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient not provided.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

De Jong 1997 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Gardosi 1989a

Methods	Quasi-randomised controlled trial. Randomisation was by adding the last digit of the women's hospital number to the date of admission. The groups were then allocated according to odd and even numbers.
Participants	427 primigravidae only, Milton Keynes, England. • 218 study participants. • 209 control participants. All women had full-term (37 weeks completed) gestation. Singleton pregnancies. No contraindications for normal vaginal birth. Vertex presentation. No medical, surgical or obstetric complications. Induced and spontaneous labours were included. No epidural anaesthesia.
Interventions	Study group: 218 women were allocated to the study group. Upright second stage positions were defined as squatting using a birth cushion (156/218), which was placed on the bed or floor. It was made of foam plastic, and had a 'u' shape and side handles and enabled women to adopt a modified squatting position during birth. Other upright positions used were kneeling (15/218) and sitting (8/218). 39 women, who were allocated to deliver in an upright position, used a semi-recumbent or lateral position during second stage. Control group: 209 women allocated to deliver in a conventional recumbent position, propped up to about 30 degrees from the horizontal, or on the side. 22 women spontaneously used an upright position, squatting (10/209), kneeling (6/209) or sitting (6/209) for birth. All women were free to walk about, sit up, or lie in the bed, during the first stage of labour. Episiotomy was not performed routinely.
Outcomes	There were no statistically significant differences between groups for maternal age, gestation, birthweight and Apgar scores. • Duration of second stage of labour. • Method of birth. • Trauma to the birth canal. • Postpartum haemorrhage. • Perinatal deaths: none.
Notes	Blood loss was estimated visually.

Risk of bias

Bias	Authors' judgement	Support for judgement

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Gardosi 1989a *(Continued)*

Random sequence generation (selection bias)	High risk	Addition of last digit of hospital number and the date of their admission and using quasi-randomisation.
Allocation concealment (selection bias)	High risk	Allocated according to whether the sum of their last digit of hospital number and the date of admission was an even or odd number.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Details of labour and its outcome were recorded by the midwife attending the birth. Therefore outcome assessor was not blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Gardosi 1989b

Methods	Quasi-randomised controlled trial. Randomisation was by adding the last digit of the woman's hospital number to the date of admission. The groups were then allocated according to odd and even numbers.
Participants	151 primigravidae only, Milton Keynes, England. • 73 study participants. • 78 control participants. All women had full-term (37 weeks completed) gestation. Maternal age between 16 years and 35 years. Singleton pregnancies. No contraindications for normal vaginal birth. Vertex presentation. No medical, surgical or obstetric complications. Induced and spontaneous labours were included. Had no epidural anaesthesia.
Interventions	Study group: 73 women were allocated to the study group. Upright second stage positions were defined as squatting, kneeling, sitting upright or standing. Control group: 78 women were allocated to deliver in a conventional recumbent position, propped up to about 30 degrees from the horizontal, or on the side. All women were free to walk about, sit up, or lie in the bed, during first stage of labour. Episiotomy was not done routinely.
Outcomes	There were no statistically significant differences between groups for: maternal age, gestation, Apgar scores or birthweight. • Duration of second stage of labour.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Gardosi 1989b *(Continued)*

- Method of birth.
- Trauma to the birth canal.
- Postpartum haemorrhage.

Notes	First-stage positions were not controlled. Blood loss was estimated visually.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Addition of last digit of hospital number and the date of their admission and being a quasi-randomised trial.
Allocation concealment (selection bias)	High risk	Allocated according to whether the sum of their last digit of hospital number and the date of admission was an even or odd number.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Details of labour, outcome and the state of the newborn were recorded by the midwife managing the birth.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Gupta 1989

Methods	Randomised controlled trial. Randomisation was by opaque sealed envelopes, determined by a random-number generator. Randomisation took place at 30 weeks' gestation.
Participants	114 women, St. James's University Hospital, Leeds, England. • 67 study participants. • 47 control participants. No further details of participants available. Women had full-term (37 weeks completed) gestation. Singleton pregnancies. Adequate pelvis. No contraindications for normal vaginal birth. Vertex presentation. No medical, surgical or obstetric complications.
Interventions	Study group: 67 women were allocated at 30 weeks of gestation to deliver in a squatting position.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Gupta 1989 *(Continued)*

	These women were asked to attend a special parent craft class, concentrating on special leg exercises. These women were given advice on the advantages of squatting during birth. Women were encouraged to adopt the squatting position when full cervical dilatation had been reached. Control group: 47 women were randomised to deliver in the conventional way.
Outcomes	• Duration of second stage of labour. • Method of birth. • Trauma to the birth canal. • Postpartum haemorrhage. • No statistically significant differences between groups' Apgar scores.
Notes	Additional data obtained from the author. Data in the published report not in useable format. Women were randomised at 30 weeks and received intensive advice on the benefits of the treatment. Data on duration of the second stage exclude the women who had caesarean sections or assisted deliveries.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number generator.
Allocation concealment (selection bias)	Low risk	Opaque sealed envelopes opened by a third party.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	High risk	Not analysed according to intention-to-treat.
Selective reporting (reporting bias)	Low risk	All outcomes reported according to actual position of birth.
Other bias	Low risk	No additional sources of bias identified

Hemminki 1986

Methods	Randomised controlled trial. Randomisation was by means of sealed envelopes in blocks of 10, stratified for gravidity. Women were randomised during the first stage of labour.
Participants	175 women, Kainuu Central Hospital, Kainuu, Finland. • 88 study participants. • 87 control participants.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hemminki 1986 *(Continued)*

	All women had reached 35 weeks completed gestation. Singleton pregnancies. No contra-indications for normal vaginal birth. Vertex presentation. No medical, surgical or obstetric complications.
Interventions	Study group: 88 women were randomised during the first stage of labour to use a birth chair. The mean cervical dilatation when transferred to the chair was 8.8 cm. The chair was made locally and was normally maintained with the back 60° to 70° from the horizontal. 12 women did not deliver in the chair. Control group: 87 women lay on their backs, propped up < 45° from the horizontal.
Outcomes	There were no statistically significant differences between groups for maternal age, gestation, gravidity, birthweight and Apgar scores. • Method of birth.
Notes	Data not in a usable format.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was in blocks of 10, stratified for gravidity.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	High risk	Missing data for mothers' preference in the next birth for both groups. In bed group, position in this birth missing for 16 women. These were not addressed.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Hillan 1984

Methods	Randomised controlled trial.
Participants	500 women, Glasgow, UK. • 250 study participants. • 250 control participants.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hillan 1984 *(Continued)*

	All women had singleton pregnancies, at 37 to 42 weeks' gestation, were of mixed parity (250 primigravidae, 250 multigravida), with a cephalic presentation, either in induced or spontaneous labour.
Interventions	Study group: 250 women were to be delivered in a 'Birth E-Z' birthing chair. During birth the chair was maintained with the back 15° to 20° from the vertical. Control group: 250 women were to be delivered in a bed in the dorsal recumbent position, but could be propped up to a maximum of 20° from the horizontal. All women could remain ambulant throughout the first stage of labour.
Outcomes	Duration of first stage of labour and active pushing, mode of birth, use of analgesia, blood loss, incidence of perineal damage.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was in blocks of 10, separately for primiparae and multipara.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. Allocation was by drawing a sealed envelope towards the end of the first stage of labour. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Information was collected from the patient records, and by questionnaires to midwives and mothers. Does not indicate whether outcome assessors were blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Jahanfar 2004

Methods	Quasi-randomised controlled trial. Consecutive random sampling method according to the last digit on their registration number. Those with an odd number to the experimental group, even numbers to the control group.
Participants	Multiparous women with singleton uncomplicated pregnancies gestation 38 to 42 weeks. Number in each group was 50.
Interventions	Sitting position in a chair versus lithotomy.
Outcomes	Length of second and third stage of labour, volume of blood loss during the third stage, first and fifth minutes Apgar scores.
Notes	

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Jahanfar 2004 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Sequence generation by registration number.
Allocation concealment (selection bias)	High risk	Able to predict experimental/control group.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Liddell 1985

Methods	Randomisation envelopes not opened until second stage of labour diagnosed. Motorised birthing chair used in study.
Participants	56 primigravid women, Auckland, New Zealand. • Control group: 21 women. • Study group: 27 women. All women had 38 to 42 week singleton pregnancies. Both induced and spontaneous labours.
Interventions	27 birthing chair; 21 supine.
Outcomes	Epidural: no difference. Significantly less pethidine or no analgesia was used for women on the birthing chair. Duration of first and second stage: no difference. Mode of birth: no difference. Episiotomies, tears, birthweight, fetal distress in second stage, Apgar scores: no difference, but 2 women had extensive second degree tears in the chair.
Notes	5 women were excluded from analysis because of caesarean section. 3 assigned to use the birthing chair chose not to, and were excluded. 24 out of 27 using birthing chair would use it again in next pregnancy. It gave support to back and relief from back pain.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Liddell 1985 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomly assigned sealed envelopes. Additional information not provided.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel aware of allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Liu 1986

Methods	Quasi-randomized trial
Participants	Setting not described 66 primigravidae women
Interventions	Group 1 – 30 degree upright with routine bearing down instructions during second stage Group 2 – 30 degree upright without routine bearing down instructions during second stage Group 3 – zero-degree recumbent position with bearing down instructions during second stage
Outcomes	The duration of labour is not reported separately for both groups, only the difference in mean time and p-values.
Notes	No data for review outcomes of interest could be extracted.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No information provided
Allocation concealment (selection bias)	Unclear risk	No information provided

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Liu 1986 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Unable to blind participants/personnel to this intervention
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information available to assess
Selective reporting (reporting bias)	Unclear risk	Insufficient information available to assess
Other bias	Low risk	No other sources of bias identified

Marttila 1983

Methods	Randomised trial, although randomisation method unclear. Randomisation at full dilatation.
Participants	100 women, 60 primiparous and 40 multiparous, Helsinki, Finland. 97 spontaneous labours. 3 augmented labours. 38 to 42 weeks' gestation. Singleton pregnancies.
Interventions	50 supine position on bed (control). 50 'half-sitting' (50°) in chair constructed from birth beds. First stage: supine in all except 8 ambulating women at 4 cm to 6 cm dilatation. Episiotomy in all except 2 multiparous women. No analgesia.
Outcomes	Age, parity, gestational age, length of first stage, birthweight: no difference. Mode of birth: all delivered vaginally. Vacuum extraction rate was significantly higher in the supine position. No difference in duration of second stage. Late decelerations were more common in the supine position.
Notes	86% of women delivering in the supine position would choose this method again and 96% of those in the half-sitting position.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Method not described.
Allocation concealment (selection bias)	Unclear risk	Random but not described.
Blinding of participants and personnel (performance bias)	High risk	Participants and personnel aware of allocation.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Marttila 1983 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Nasir 2007

Methods	Quasi-randomised controlled trial. Random selection of patients then alternatively divided into squatting or supine position in second stage.
Participants	200 patients from Department of Obstetrics and Gynaecology, Jinnah Postgraduate Medical Centre, Karachi. Gestation more than 37 weeks in active labour with cephalic presentation. Excluded patients with multiple gestation, malpresentation, previous scar, maternal fever and prenatal diagnosed fetal malformation.
Interventions	100 in squatting position. 100 in control supine in lithotomy.
Outcomes	• Episiotomy rate. • Extension of episiotomy. • Para-urethral tears. • Second and third degree perineal tears. • Shoulder dystocia. • Retained placenta - assumed to have required a manual removal of placenta. • Postpartum haemorrhage.
Notes	Outlet forceps for prolonged second stage due to inability to push.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Alternate group randomisation (quasi-randomisation).
Allocation concealment (selection bias)	High risk	Able to predict next intervention group.
Blinding of participants and personnel (performance bias)	High risk	Participants and personnel aware of allocation.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Nasir 2007 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Phumdoung 2010

Methods	4-arm randomised controlled trial.
Participants	320 primiparous women, labour unit of central hospital, Southern Thailand. Inclusion criteria: primiparous; married; aged 18 years to 35 years; receiving antenatal care for at least the second trimester; 38 to 42 weeks' gestation; fetal heart rate (120 to 160 beats per minute); estimated fetal weight of 2500 tp 4000 g; without any prolonged latent or active phases; and, without any known personal or fetal health complications.
Interventions	Intervention group: Group 2 PSU locked-upright position with knees-to-chest, N = 80. Group 3 PSU locked-upright lithotomy position, N = 80. Group 4 upright lithotomy position, N = 80. (Subjects in Groups 2, 3 and 4 had the head of the birth table raised 45° to 60°) Control group: Group 1- lithotomy position, N = 80.
Outcomes	Duration of second stage of labour, pain (sensation and distress) and comfort during second-stage labour among primiparous women. Type of birth (vaginal or caesarean section); whether the woman received oxytocin or any type of analgesic drug; and, whether any complications were sustained by the woman during second-stage labour.
Notes	In addition, participants in Groups 2 and 3 had their lumbar areas raised 30° to 40°, using a pillow. No information provided regarding use of epidural anaesthesia prior to enrolment. However, study reported that "subjects... reported moderate pain sensations, as well as mild distress from pain during second-stage labor". 100% of women in the control group (lithotomy) received an episiotomy; episiotomy was not used in Groups 2, 3 and 4. Birth weight was not reported by group but authors reported it was similar across groups.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Phumdoung 2010 *(Continued)*

	320 women had a normal birth, however use of instrumental vaginal birth was reported.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Participants were randomly allocated, method not described.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel knew the allocation.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcomes were assessed by research assistant, who was not blinded to allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	326 primiparous women were recruited, however only 320 participated in the study, since 6 "failed to experience normal labor". While absolute numbers are not provided, it seems that all outcomes were reported for all women in each group.
Selective reporting (reporting bias)	Unclear risk	Use of oxytocin and anaesthesia, as well as "any complications" were prespecified outcomes in methods section but not reported. However study reports "No significant differences were found among the four groups regarding demographic, obstetrical or infant data". A study protocol could not be located for comparison.
Other bias	Low risk	No additional biases identified.

Phumdoung 2013

Methods	Randomised controlled trial.
Participants	240 primiparous women in a hospital in southern Thailand. Inclusion criteria: primiparous; aged 17 to 35 years; 37 to 42 weeks' gestation; vertex presentation; expected fetal weight 2500 g to 4000 g; able to read and write Thai. Exclusion criteria: pregnant women who had: anaemia; hypertension; asthma; an infection; a bleeding disorder; a history or presence of psychological problems; fetal distress; and, a prolapsed cord.
Interventions	4 different types of beds/groups: Group 1- PSU birthing bed without a holding bar; N = 60. Group 2 - PSU birthing bed with a holding bar; N = 60. Group 3 - usual birthing bed with head elevated 45° to 60°; N = 60. Group 4 - usual birthing bed with head elevated 15°; N = 60.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Phumdoung 2013 *(Continued)*

Outcomes	• Duration of second stage of labour. • Difference in sensation of pain. • Differences in distress of pain. • Differences in comfort level.
Notes	Total 334 women were recruited - 240 included in final study - rest of the women had caesarean section/vacuum birth. For purposes of this review, Groups 1, 2 and 3 were combined (any upright position) and compared to Group 4 (supine).

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomisation done but method of sequence generation not described.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel knew the allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	High risk	It appears there was considerable post-randomisation exclusion of participants, 332 women were randomised. However, only 240 had outcome data reported (exclusions were 70 due to caesarean section and 22 due to vacuum birth).
Selective reporting (reporting bias)	High risk	Paper pre-specified outcomes on the use of oxytocin and analgesic medication, episiotomy, and degree of perineal tear. However, these were not reported by group, only overall, hence unable to assess for any differences.
Other bias	Low risk	No other bias.

Racinet 1999

Methods	Randomised method described as Zelen's design, envelopes, stratified for parity.
Participants	239 women, France. • 120 in the squat (study) position. • 119 in the lithotomy control group. Women at full cervical dilation able to assume squatting position of mixed parity. 120 study participants, gestation not stated in paper.
Interventions	Squatting versus lithotomy position for second stage bearing down.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Racinet 1999 *(Continued)*

Outcomes	Duration of second stage, cord arterial pH, Apgar scores, method of birth, perineal trauma, blood loss and women's perspectives.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Drawn into lots and randomised by Zelen's design.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel knew the allocation.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	High risk	Missing data in maternal satisfaction rates - response of 35 of 42 questionnaires.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Radkey 1991

Methods	Quasi-randomised controlled trial. Randomisation method described as Zelen's design. Randomisation at time of admission, with consent of patient after randomisation.
Participants	197 primiparous women, gestation not stated in paper. Halifax, Nova Scotia.
Interventions	Control group: managed 'normally' - position of inclination < 45°. Study group: upright/squatting.
Outcomes	• Duration of second stage. • Pushing time for second stage. • Mode of birth.
Notes	Numbers in different groups do not match. Unsure as to the reasons for the disparity making analysis difficult.

Risk of bias

Bias	Authors' judgement	Support for judgement

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Radkey 1991 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Zelen's design was used. Method used to generate the random sequence was not described.
Allocation concealment (selection bias)	High risk	Quasi-randomised trial, based on hospital admission
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not described.
Selective reporting (reporting bias)	Unclear risk	Not described.
Other bias	Low risk	No additional sources of bias were identified

Schirmer 2011

Methods	Randomised trial to investigate the left lateral position and the upright half sitting position in the expulsive period of the parturition, in regard to perineal outcomes in nulliparous women.
Participants	Hospital Geral de Itapecerica da Serra, São Paulo, Brazil. The sample size - 158 nulliparous parturients, randomly divided into the experimental group or the control group. The inclusion criteria employed in the samples were: nulliparous women admitted at the first gestation period and parturition, single fetus, live birth, fetus well-flexed in cephalic presentation, and absence of maternal and fetal disease. No exclusion criteria specified.
Interventions	Indicates allocation was blinded prior to randomisation during the dilatation period - "two identical and closed envelopes each containing the indication of the left lateral position or the upright half-sitting". 158 nulliparous parturients were allocated; experimental group (left lateral position), N = 81; control group (upright half-sitting), N = 77.
Outcomes	Vulvar oedema – classified by the presence or absence of a lump or increase in volume in the vulva region, during parturition and postpartum. Perineal result – the effects of parturition on the perineum and obstetric interventions done classified as: entire perineum; first and second-degree lacerations, episiotomy and position of perineal lacerations – categorised as: labial, paraurethral; vaginal, furcula and perineal body.
Notes	8 women withdrew; 6 had an obstetric indication for caesarean section, and 2 had dystocia. For these reasons, these women were replaced in the sample.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Schirmer 2011 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomly assigned sealed envelopes. Method of random sequence generation was not described.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	High risk	During allocation, 8 women withdrew from participation; 6 of these women had an obstetric indication for caesarean section, and 2 had dystocia. These women were replaced in the sample. Not clear how these women were selected, or whether allocation was known before or after women withdrew
Selective reporting (reporting bias)	Unclear risk	All outcomes reported. Unable to locate protocol for comparison.
Other bias	Low risk	No additional sources of bias identified

Schneider-Affeld 1982

Methods	Randomised trial of 64 women
Participants	women, not otherwise specified
Interventions	vertical vs horizontal birth position (not otherwise specified). While the report indicates 29 and 35 women were randomized, it is not clear which arm they were randomized to
Outcomes	Some data (including duration of labour) is reported separately for both groups, however: - data is ineligible - a stratification is used (EP, AP) of unknown meaning / significance - Mean of duration labour reported, but not standard deviation
Notes	No data for review outcomes of interest could be extracted

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No information provided

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Schneider-Affeld 1982 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	No information provided
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not possible to blind participants/personnel to this intervention
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient data available to make an assessment
Selective reporting (reporting bias)	Unclear risk	Insufficient data available to make an assessment
Other bias	Low risk	No other sources of bias identified

Sekhavat 2009

Methods	Parallel randomised controlled trial. Women individually randomised.
Participants	110 women, teaching hospital in Iran. • 55 women sitting • 55 women lithotomy Inclusion criteria: first pregnancy, full-term, singleton, the natural course of labour in the first stage, cephalic presentation with no contraindications to vaginal birth. Exclusion criteria: the first stage of labour with fetal distress, fixed fetal abnormalities by ultrasound, especially in the head, view posterior occipital stable, fetal macrosomia, women who were not able to get in a certain position due to their illness.
Interventions	55 women adopted sitting position in the second stage. 55 women in lithotomy in the second stage.
Outcomes	Duration of second stage of labour, perinea trauma and the first 5 minutes Apgar.
Notes	Translation and data extraction by Bita Mesgarpour.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	This clinical trial study was done on 110 term nulliparous women with normal conduct of labour in second stage, which divided randomly in sitting position, (N = 55) and lithotomy position (N = 55).
Allocation concealment (selection bias)	Unclear risk	No information provided.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Sekhavat 2009 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information provided.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All outcomes appear complete. Data reported for all women.
Selective reporting (reporting bias)	Unclear risk	Protocol of study was not available.
Other bias	Low risk	No evidence of other bias.

Stewart 1989

Methods	Randomised controlled trial. Randomisation took place as late as possible in the first stage of labour. Randomisation was performed by opening sealed envelopes, and women were allocated to deliver in a newly-designed birth chair or in an "edged'' dorsal position.
Participants	304 women, Sheffield, England. Participants recruited between May 1984 to March 1986. • 157 study participants: 61 primigravidae, 96 multigravida. • 147 control participants: 56 primigravidae, 91 multigravida. All women had full-term (37 weeks completed) gestation. Singleton pregnancies. No contra-indications for normal vaginal birth. Vertex presentation. No women who were augmented or who had epidural analgesia were included.
Interventions	All women were allowed to be ambulant during first stage of labour. Study group: 157 women were randomised to deliver in a special birth chair, kept at a recline of 15° to 20° from the upright. 22 women did not deliver in the chair but were analysed in the group. Control group: 147 women were randomised to deliver in a 'wedged' dorsal position.
Outcomes	A sub-sample of 92 women reported on comfort during birth. More women in the chair group reported that they were comfortable all of the time (23/52 control versus 5/40 study) and 51/52 control and 35/40 study would prefer to use the chair for their next birth. • Use of analgesia/anaesthesia. • Duration of first, second and third stage of labour. • Method of birth. • Trauma to the birth canal. • Postpartum haemorrhage. Birthweight: no statistically significant differences. Neonatal condition. Apgar scores < 7 at 1 minute. No statistically significant difference. Cord blood gas: no statistically significant difference.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Stewart 1989 *(Continued)*

Notes	Method of blood loss not described.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomisation by Zelen's design. Method of generating the random sequence was not described.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	High risk	"Data regarding the labour, birth and condition of the infant were collected, but it was not possible to blind those collecting this information to the experimental group allocation."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other biases identified.

Suwanakam 1988

Methods	Quasi-randomised controlled trial. Women were alternately divided into 2 groups as they came to the birth suite in spontaneous labour.
Participants	60 women, Sawan province, Thailand. 30 study participants and 30 control participants. All women were 'low risk' without any serious medical complication; primigravida; between 17 to 35 years whose heights were over 150 cm; their gestational ages were between 37 to 42 weeks. Throughout the first and second stage of labour, no intravenous fluid or any medications including oxytocin or analgesia.
Interventions	Study group (sitting position): 30 women at the start of the second stage of labour were asked to sit on a specially designed delivery table with the head part raised 45° from the horizontal. Control group: 30 women were in the supine dorsal position.
Outcomes	Characteristics of uterine contraction, duration of second stage of labour, type of birth, Apgar scores.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Alternate allocation.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Suwanakam 1988 *(Continued)*

Allocation concealment (selection bias)	High risk	Able to predict sequence.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Turner 1986

Methods	Randomised controlled trial. Women were randomly allocated by the opening of a sealed envelope before the onset of second stage of labour.
Participants	636 women were randomised. 97 were excluded from analyses. London, England. • 226 study participants: 111 primigravidae, 115 multigravida. • 313 control subjects: 140 primigravidae, 173 multigravida. All women had full-term (37 weeks completed) gestation. Singleton pregnancies. Induced and spontaneous labours were included. Women who had epidural anaesthesia were included.
Interventions	Study group: 318 women were randomly allocated to deliver in a 'Birth E-Z' chair. The birth was conducted with the chair tilted back to an angle of 40°. 92 women in the study group were excluded from the analyses as they did not deliver in the chair. Control group: 318 women were randomly allocated to deliver on the bed in the dorsal position, but were allowed to be propped up with a pillow. Five women were excluded from the analyses as they insisted on delivering in the chair.
Outcomes	• Duration of second stage of labour. • Method of birth. • Trauma to the birth canal. • Postpartum haemorrhage. • No perinatal deaths were recorded.
Notes	The authors excluded 92 women who were randomly allocated to use the chair, but delivered in the bed, from the analyses. Five women were excluded from the control group who insisted on using the chair for delivery. These exclusions could have affected the results and the data must be interpreted with care.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Turner 1986 *(Continued)*

	'Perineal tears' were included in review as second degree tears. It is not clear in the article if these include first degree tears.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Random opening of envelope. Method of randomisation not described.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	High risk	Data complete but there were post-randomisation exclusions.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Waldenström 1991

Methods	At the end of first stage of labour, the midwife would open a sealed envelope containing 1 of 2 instructions: study group = encourage birth sitting on the birthing stool or control group = encourage birth in a conventional semirecumbent position. The women were unaware that they were taking part in a trial, and were only told about the trial 2 hours after birth.
Participants	294 women, Uppsala, Sweden. • 148 study participants. • 146 control participants. Singleton and twin pregnancies were included of mixed parity; gestation not stated in paper. No contra-indications to normal vaginal birth. Vertex and breech presentations were included. Fetal distress was an exclusion criterion.
Interventions	Study group: 148 women were encouraged to give birth on a Dutch-designed birthing stool. The stool was moulded plastic in the shape of a horseshoe and 32 cm high. The women sat upright in a squatting position with their feet on the ground. 73/148 used the stool to give birth. Control group: 146 women were encouraged to give birth in a conventional semirecumbent position. 100/146 used the conventional position. Data were analysed according to group allocation.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Waldenström 1991 *(Continued)*

	Other positions used to give birth were all fours, lateral recumbent and standing.
Outcomes	Pain: women in the study group reported less pain on a 10-point scale (6.9 study vs 7.6 control) and a similar proportion of women in both groups experienced the birth position as not good (3% study versus 2% control). • Duration of second stage of labour. • Method of birth. • Trauma to the birth canal. • Postpartum haemorrhage. • Apgar scores (no statistically significant differences). • Admission to neonatal intensive care unit. More midwives reported the study working position as rather awkward (12.8% study versus 3% control). Fathers in the study group felt more supportive, involved and satisfied with their own contribution towards the second stage of labour than those in the control group.
Notes	Group allocations were not adhered to, which could have influenced the outcomes, although analyses were done according to intention-to-treat.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Unclear no description of how envelopes were selected.
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes. No further information provided.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias.

Zaibunnisa 2015

Methods	Randomised controlled trial.
Participants	Gynecology/Obstetrics Unit-II, Sandeman Provincial Teaching Hospital, Quetta, Pakistan. Participants recruited from 5 Oct 2011 to 05 April 2012.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Zaibunnisa 2015 *(Continued)*

	The inclusion criteria were - all patients including booked/unbooked with term pregnancy of gestation > 37 and < 40 weeks, presenting in active labour and with only cephalic presentation. The exclusion criteria were malpresentation, multiple gestation, antepartum haemorrhage, previous surgery (caesarean, myomectomy), and antenatally diagnosed fetal anomalies. The patients were randomly divided into 2 groups, Group A (squatting position) and Group B (lithotomy position) for study purpose.
Interventions	Group 1- 151 patients - lithotomy position. Group 2 - 151 patient - squatting position.
Outcomes	Perineal tears, periurethral tear, extended episiotomy, instrumental birth, caesarean section and primary postpartum haemorrhage.
Notes	Method of randomisation not stated. For this review, "episiotomy extension" was interpreted to mean episiotomy, however we did not include periurethral tears as part of perineal tears.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Random, not otherwise described.
Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data complete.
Selective reporting (reporting bias)	Unclear risk	All listed outcomes were reported, however we were unable to locate protocol for comparison.
Other bias	Low risk	No other bias found.

Zhang 2016

Methods	Prospective, 2-group randomised, controlled trial in 11 hospitals in China (5 maternal and child health hospitals and 7 general hospitals). Data were collected between May and December 2012. Equal numbers of 150 opaque and sealed envelopes containing randomisation assignments were randomly mixed, numbered, and placed in the office of the labour wards of each participating hospital. Each envelope also contained a data collection sheet. When a woman was admitted in active labour,

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Zhang 2016 *(Continued)*

	the midwife asked whether the patient is willing to participate and if so, drew an envelope in strict numerical succession.
Participants	The study participants included women who gave birth at 11 hospitals in China selected by convenience; these hospitals included 5 maternal and child health hospitals and 7 general hospitals. Inclusion criteria: • having a healthy, uncomplicated pregnancy without any medical diagnosis; • anticipating vaginal birth of a singleton fetus in cephalic presentation and longitudinal lie and spontaneous onset of labour at gestational weeks between (37 þ 0) and (41 þ 6); and • body mass index < 30; • understand Mandarin. Exclusion criteria: women with pregnancy complications, premature rupture of membranes, medical contraindications, physical limitations that do not allow the hands-and-knees position, and/or with fetus in the non-cephalic presentation or breech position and/or of less than 37 or over 42 weeks of gestation. Women with epidural anaesthesia were also excluded. Both nulliparous and multiparous women were eligible.
Interventions	Study group, hands knees position, N = 446. Control group, supine position, N = 440.
Outcomes	Primary outcome - episiotomy rate. Secondary outcomes • degree of perineum laceration; • rate of natural birth; • rate of shoulder dystocia; • postpartum bleeding; • neonatal Apgar score; • rate of neonatal asphyxia.
Notes	Per protocol analysis used - only women who completed protocol were included in analysis. A group of women (18/700 in experimental and 12/700 in control) did complete the protocol, where outcome data were not available. Reason for this discrepancy was not reported. Authors reported that "episiotomy was regarded as second-degree laceration", however this does not appear to be correct based on reported data. We have therefore used the data presented for second degree laceration and episiotomy rates. We have also taken neonatal asphyxia rates as those who needed neonatal intensive care.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Equal numbers of opaque and sealed envelopes containing randomisation assignments were randomly mixed, numbered, and placed in the office of the labor wards of each participating hospital."
Allocation concealment (selection bias)	Unclear risk	Randomisation using opaque sealed envelopes. No further information provided.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Zhang 2016 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants and personnel were aware of position.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided, however does mention that all outcome data came from electronic case notes.
Incomplete outcome data (attrition bias) All outcomes	High risk	It appears that a per-protocol analysis was used, with no intention-to-treat analysis conducted - a total of 480 (254 in experimental and 260 in control) randomised women "withdrew from the study because of lack of willingness to follow the allocated intervention". Outcome data for these women were not reported. In addition, a group of women (18/700 in experimental and 12/700 in control) did complete the protocol, but outcome data were not available. Reason for this was not reported.
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Low risk	No other bias found.

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Ahmed 1985	Excluded because insufficient data presented in abstract.
Altman 2007	This study compared 2 upright positions of kneeling and sitting.
Bonoan 1997	Excluded because insufficient data presented in abstract.
Brément 2007	This randomised trial compared 2 recumbent positions: Lateral versus dorsal. Both the rate of intact perineum and the blood loss were increased in the lateral recumbent group.
Caldeyro-Barcia 1985	Tried to contact trialists for details of their work. There was no contact made and therefore excluded from the analysis.
Chen 1987	Excluded because of multiple (37%) exclusions from the analysis.
Corton 2012	Excluded because comparison between delivery with stirrups and without stirrups.
Downe 2004	Excluded because all women received an epidural.
Golara 2002	Studied effect of ambulation versus recumbent position in only the passive phase of the second stage of labour, not during bearing down.
Golay 1993	Cohort study.
Hegab 2002	Insufficient data given in abstract.
Humphrey 1973	Compared 2 supine positions, i.e. lateral versus supine positions.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study	Reason for exclusion
Johnstone 1987	Compared 2 supine positions, i.e. lateral versus supine positions.
Karraz 2003	Excluded because all women received an epidural.
Ragnar 2006	This randomised controlled trial compared 2 upright positions in labour: kneeling versus sitting. An analysis for this could not be made according to our methodology.
Thies-Lagergren 2009	This study (assessing feasibility of RCT) compared the birth seat (BirthRite seat) with ANY other position. As the other positions were not classified, comparison of upright versus the birth seat was not possible.
Thies-Lagergren 2011	This study compared the birth seat (BirthRite seat) with ANY other position. As the other positions were not classified, comparison of upright versus the birth seat was not possible.

RCT: randomised controlled trial

Characteristics of ongoing studies *[ordered by study ID]*

Hofmeyr 2015

Trial name or title	The Gentle Assisted Pushing study (GAP). A multi-centre randomised controlled trial of gentle assisted pushing in the upright posture (GAP) or upright posture alone compared with routine practice to reduce prolonged second stage of labour.
Methods	Randomised, controlled, unblinded, clinical trial with 3 parallel arms across 4 hospital sites in South Africa.
Participants	Inclusion • Equal to or greater than 18 years old • Nulliparous women • Gestational age > 35 weeks • Singleton pregnancy • Vaginal birth anticipated • Cephalic fetal presentation • Baby's heartbeat detected Exclusion • No chronic medical conditions, including heart disease, epilepsy, hypertension, diabetes mellitus and renal disease • No obstetric complications, including hypertensive disorders of pregnancy, cephalo-pelvic disproportion, antepartum haemorrhage, intra-uterine growth restriction, fetal distress, intra-amniotic infection
Interventions	Intervention arm 1: Gentle Assisted Pushing. The woman will be assisted to assume an upright kneeling or squatting posture on the bed. The trained birth attendant will kneel behind her on the bed or stand behind her with the woman positioned at right angles to the length of the bed and back close to the side of the bed. The trained birth attendant will wrap her arms around the woman passing below her axillae, and place both open palms, overlapping, on the fundus of her uterus. Steady pressure in the long axis of the uterus will be applied only during contractions. The duration of pressure will be limited to 30 seconds with a minimum of 30 seconds rest before the next pressure. Intervention arm 2: upright crouching or kneeling position for second stage.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Hofmeyr 2015 *(Continued)*	Control: recumbent/supine posture only.
Outcomes	The primary outcome is defined as mean time (minutes) from randomisation to birth. Secondary outcomes include the following. Birth outcomes: - No spontaneous birth within 15 minutes of randomisation - Operative birth (vacuum, forceps or caesarean section) - Episiotomy or 2nd/3rd degree tears Neonatal outcomes: - Cord blood pH < 7.2 - 5-minute Apgar score < 7 - Neonatal injury - Neonatal encephalopathy - Admission to neonatal high care nursery for ≥ 24 hours - Neonatal death Mothers will also be asked to grade their discomfort experienced during the second stage of labour. All adverse events
Starting date	March 2015.
Contact information	Correspondence to vogeljo@who.int
Notes	Likely to finish June 2017.

DATA AND ANALYSES

Comparison 1. Any upright versus supine position

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Duration of second stage of labour (minutes)	19	5811	Mean Difference (IV, Random, 95% CI)	-6.16 [-9.74, -2.59]
2 Pain	4		Mean Difference (IV, Random, 95% CI)	Subtotals only
2.1 Pain - distress	1	320	Mean Difference (IV, Random, 95% CI)	-3.34 [-8.47, 1.79]
2.2 Pain - distress of pain	1	240	Mean Difference (IV, Random, 95% CI)	-17.6 [-25.43, -9.77]

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

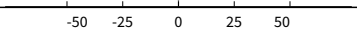
Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
2.3 Pain - sensation	1	320	Mean Difference (IV, Random, 95% CI)	-5.15 [-11.20, 0.90]
2.4 Pain - sensation of pain	1	240	Mean Difference (IV, Random, 95% CI)	-13.23 [-16.99, -9.47]
2.5 Pain intensity in second stage	1	90	Mean Difference (IV, Random, 95% CI)	-22.0 [-28.24, -15.76]
2.6 Pain in second stage of labour (VAS)	1	155	Mean Difference (IV, Random, 95% CI)	0.32 [-0.16, 0.80]
2.7 Pain in postpartum period (VAS)	1	155	Mean Difference (IV, Random, 95% CI)	-0.48 [-1.28, 0.32]
3 Use of any analgesia/anaesthesia during second stage of labour	7	3093	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.93, 1.02]
4 Mode of birth: assisted birth	21	6481	Risk Ratio (M-H, Fixed, 95% CI)	0.75 [0.66, 0.86]
5 Mode of birth: caesarean section	16	5439	Risk Ratio (M-H, Fixed, 95% CI)	1.22 [0.81, 1.81]
6 Episiotomy	17	6148	Risk Ratio (M-H, Random, 95% CI)	0.75 [0.61, 0.92]
7 Second degree perineal tears	18	6715	Risk Ratio (M-H, Random, 95% CI)	1.20 [1.00, 1.44]
8 Third/fourth degree tears	6	1840	Risk Ratio (M-H, Fixed, 95% CI)	0.72 [0.32, 1.65]
9 Blood loss > 500 mL	15	5615	Risk Ratio (M-H, Random, 95% CI)	1.48 [1.10, 1.98]
10 Need for blood transfusion	2	1747	Risk Ratio (M-H, Fixed, 95% CI)	1.66 [0.70, 3.94]
11 Manual removal of placenta	5	2020	Risk Ratio (M-H, Random, 95% CI)	0.92 [0.30, 2.82]
12 Abnormal fetal heart rate patterns	2	617	Risk Ratio (M-H, Fixed, 95% CI)	0.46 [0.22, 0.93]
13 Admission to neonatal intensive care unit	4	2565	Risk Ratio (M-H, Fixed, 95% CI)	0.79 [0.51, 1.21]
14 Perinatal death	4	982	Risk Ratio (M-H, Fixed, 95% CI)	0.75 [0.17, 3.31]
15 Subgroup analysis: duration of second stage of labour (parity)	19	5811	Mean Difference (IV, Random, 95% CI)	-5.89 [-8.85, -2.92]

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
15.1 Primigravidae only	14	3826	Mean Difference (IV, Random, 95% CI)	-7.80 [-12.68, -2.92]
15.2 Multigravidae only	5	1220	Mean Difference (IV, Random, 95% CI)	-4.03 [-9.09, 1.02]
15.3 Mixed parity	4	765	Mean Difference (IV, Random, 95% CI)	-2.03 [-5.74, 1.67]

Analysis 1.1. Comparison 1 Any upright versus supine position, Outcome 1 Duration of second stage of labour (minutes).

Study or subgroup	Upright N	Upright Mean(SD)	Supine N	Supine Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Amiri 2012	99	51.9 (26)	50	49 (26.3)		4.31%	2.83[-6.08,11.74]
Azhari 2013	60	44.5 (12.8)	30	65.1 (18.6)		4.7%	-20.57[-27.99,-13.15]
Bhardwaj 1994	294	26.3 (14.6)	323	45.1 (23.1)		5.66%	-18.87[-21.89,-15.85]
Bomfim-Hyppólito 1998	127	21.7 (13.9)	121	25.1 (14.4)		5.57%	-3.4[-6.93,0.13]
Calvo Aguilar 2013	77	26.4 (12.5)	78	35 (22)		5.14%	-8.67[-14.29,-3.05]
Crowley 1991	634	31.7 (19.2)	596	31.2 (18.8)		5.77%	0.5[-1.62,2.62]
Gardosi 1989a	218	39 (26)	209	50 (29)		5.23%	-11[-16.23,-5.77]
Gardosi 1989b	73	48.8 (34.8)	78	47.1 (31.8)		3.87%	1.7[-8.96,12.36]
Hillan 1984	250	19 (30)	250	23 (22)		5.37%	-4[-8.61,0.61]
Hillan 1984	250	86 (67)	250	81 (56)		3.82%	5[-5.82,15.82]
Jahanfar 2004	50	10.8 (9.9)	50	16.5 (15)		5.29%	-5.74[-10.71,-0.77]
Liddell 1985	27	52.5 (31.3)	21	59.1 (35.3)		2.19%	-6.6[-25.77,12.57]
Marttila 1983	50	20.1 (25)	50	19.9 (37.2)		3.44%	0.2[-12.22,12.62]
Marttila 1983	50	42.8 (33.9)	50	41.4 (24)		3.66%	1.4[-10.11,12.91]
Phumdoung 2010	240	27.5 (20.2)	80	44 (25.8)		5.01%	-16.54[-22.74,-10.34]
Phumdoung 2013	180	19.5 (11.5)	60	31.6 (14.2)		5.49%	-12.17[-16.14,-8.2]
Racinet 1999	120	14 (11.4)	119	14.4 (11.1)		5.68%	-0.33[-3.18,2.52]
Sekhavat 2009	55	34 (9.8)	55	42 (8.6)		5.59%	-8[-11.45,-4.55]
Stewart 1989	157	38.7 (30)	147	33.7 (30)		4.87%	5[-1.75,11.75]
Suwanakam 1988	30	31.4 (18.4)	30	62 (26.5)		3.65%	-30.6[-42.13,-19.07]
Waldenström 1991	73	53 (7.7)	50	51 (7.9)		5.69%	2[-0.81,4.81]
Total ***	**3114**		**2697**			**100%**	**-6.16[-9.74,-2.59]**
Heterogeneity: Tau²=56.35; Chi²=231.27, df=20(P<0.0001); I²=91.35%							
Test for overall effect: Z=3.38(P=0)							

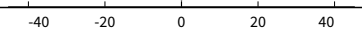


Favours upright — Favours supine

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 1.2. Comparison 1 Any upright versus supine position, Outcome 2 Pain.

Study or subgroup	Upright N	Upright Mean(SD)	Supine N	Supine Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.2.1 Pain - distress							
Phumdoung 2010	240	19.7 (19.7)	80	23.1 (20.5)		100%	-3.34[-8.47,1.79]
Subtotal ***	**240**		**80**			**100%**	**-3.34[-8.47,1.79]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.28(P=0.2)							
1.2.2 Pain - distress of pain							
Phumdoung 2013	180	63.2 (28.8)	60	80.8 (26.1)		100%	-17.6[-25.43,-9.77]
Subtotal ***	**180**		**60**			**100%**	**-17.6[-25.43,-9.77]**
Heterogeneity: Not applicable							
Test for overall effect: Z=4.41(P<0.0001)							
1.2.3 Pain - sensation							
Phumdoung 2010	240	42.2 (25.3)	80	47.3 (23.5)		100%	-5.15[-11.2,0.9]
Subtotal ***	**240**		**80**			**100%**	**-5.15[-11.2,0.9]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.67(P=0.1)							
1.2.4 Pain - sensation of pain							
Phumdoung 2013	180	81.4 (19.8)	60	94.7 (9.5)		100%	-13.23[-16.99,-9.47]
Subtotal ***	**180**		**60**			**100%**	**-13.23[-16.99,-9.47]**
Heterogeneity: Not applicable							
Test for overall effect: Z=6.9(P<0.0001)							
1.2.5 Pain intensity in second stage							
Azhari 2013	60	73.2 (14.8)	30	95.2 (13.9)		100%	-22[-28.24,-15.76]
Subtotal ***	**60**		**30**			**100%**	**-22[-28.24,-15.76]**
Heterogeneity: Not applicable							
Test for overall effect: Z=6.91(P<0.0001)							
1.2.6 Pain in second stage of labour (VAS)							
Calvo Aguilar 2013	77	8.7 (1.4)	78	8.4 (1.7)		100%	0.32[-0.16,0.8]
Subtotal ***	**77**		**78**			**100%**	**0.32[-0.16,0.8]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.31(P=0.19)							
1.2.7 Pain in postpartum period (VAS)							
Calvo Aguilar 2013	77	7.9 (2.5)	78	8.4 (2.5)		100%	-0.48[-1.28,0.32]
Subtotal ***	**77**		**78**			**100%**	**-0.48[-1.28,0.32]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.18(P=0.24)							



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 1.3. Comparison 1 Any upright versus supine position, Outcome 3 Use of any analgesia/anaesthesia during second stage of labour.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Chan 1963	45/100	33/100		3.17%	1.36[0.96,1.94]
Crowley 1991	514/634	495/596		48.95%	0.98[0.93,1.03]
De Jong 1997	76/257	88/260		8.39%	0.87[0.68,1.13]
Hillan 1984	171/250	179/250		17.17%	0.96[0.85,1.07]
Liddell 1985	21/27	21/21		2.31%	0.79[0.63,0.97]
Stewart 1989	135/157	127/147		12.58%	1[0.91,1.09]
Waldenström 1991	72/148	77/146		7.44%	0.92[0.74,1.16]
Total (95% CI)	**1573**	**1520**		**100%**	**0.97[0.93,1.02]**
Total events: 1034 (Upright), 1020 (Supine)					
Heterogeneity: Tau^2=0; Chi^2=8.59, df=6(P=0.2); I^2=30.17%					
Test for overall effect: Z=1.31(P=0.19)					

Favours upright — Favours supine

Analysis 1.4. Comparison 1 Any upright versus supine position, Outcome 4 Mode of birth: assisted birth.

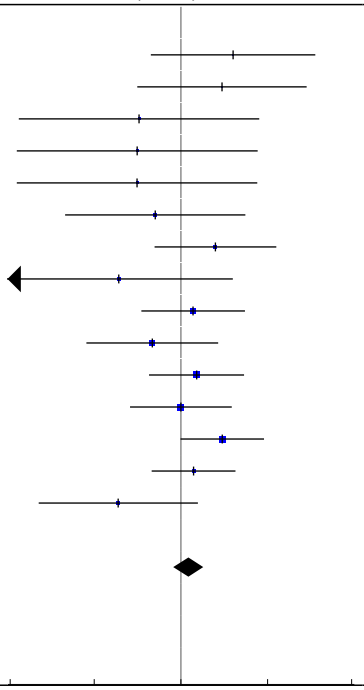
Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Allahbadia 1992	16/100	18/100		4.32%	0.89[0.48,1.64]
Bhardwaj 1994	7/294	18/323		4.12%	0.43[0.18,1.01]
Calvo Aguilar 2013	2/77	2/78		0.48%	1.01[0.15,7.01]
Chan 1963	21/100	21/100		5.05%	1[0.58,1.71]
Crowley 1991	80/634	89/596		22.04%	0.85[0.64,1.12]
De Jong 1997	3/257	3/260		0.72%	1.01[0.21,4.97]
Gardosi 1989a	19/218	34/209		8.34%	0.54[0.32,0.91]
Gardosi 1989b	7/73	12/78		2.79%	0.62[0.26,1.5]
Gupta 1989	10/67	6/47		1.69%	1.17[0.46,3]
Hemminki 1986	16/88	7/87		1.69%	2.26[0.98,5.22]
Hillan 1984	25/250	48/250		11.53%	0.52[0.33,0.82]
Liddell 1985	11/27	7/21		1.89%	1.22[0.57,2.61]
Marttila 1983	2/50	6/50		1.44%	0.33[0.07,1.57]
Nasir 2007	11/100	24/100		5.77%	0.46[0.24,0.88]
Racinet 1999	16/120	18/119		4.34%	0.88[0.47,1.64]
Radkey 1991	12/56	13/53		3.21%	0.87[0.44,1.74]
Stewart 1989	13/157	7/147		1.74%	1.74[0.71,4.24]
Suwanakam 1988	0/30	2/30		0.6%	0.2[0.01,4]
Turner 1986	22/226	38/313		7.66%	0.8[0.49,1.32]
Waldenström 1991	6/148	8/146		1.94%	0.74[0.26,2.08]
Zaibunnisa 2015	17/151	36/151		8.65%	0.47[0.28,0.8]
Total (95% CI)	**3223**	**3258**		**100%**	**0.75[0.66,0.86]**
Total events: 316 (Upright), 417 (Supine)					
Heterogeneity: Tau^2=0; Chi^2=28.11, df=20(P=0.11); I^2=28.86%					
Test for overall effect: Z=4.07(P<0.0001)					

Favours upright — Favours supine

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 1.5. Comparison 1 Any upright versus supine position, Outcome 5 Mode of birth: caesarean section.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Gardosi 1989b	0/73	0/78			Not estimable
Hillan 1984	4/250	1/250		2.37%	4[0.45,35.54]
Racinet 1999	3/120	1/119		2.38%	2.98[0.31,28.2]
Waldenström 1991	0/148	1/146		3.58%	0.33[0.01,8.01]
Crowley 1991	0/634	1/596		3.67%	0.31[0.01,7.68]
Stewart 1989	0/157	1/147		3.67%	0.31[0.01,7.6]
De Jong 1997	1/257	2/260		4.72%	0.51[0.05,5.54]
Allahbadia 1992	5/100	2/100		4.74%	2.5[0.5,12.59]
Gardosi 1989a	0/218	2/209		6.05%	0.19[0.01,3.97]
Turner 1986	4/226	4/313		7.96%	1.38[0.35,5.48]
Gupta 1989	2/67	3/47		8.37%	0.47[0.08,2.69]
Amiri 2012	9/99	3/50		9.46%	1.52[0.43,5.35]
Calvo Aguilar 2013	4/82	4/82		9.49%	1[0.26,3.86]
Zaibunnisa 2015	12/151	4/151		9.49%	3[0.99,9.09]
Chan 1963	7/100	5/100		11.86%	1.4[0.46,4.26]
Radkey 1991	1/56	5/53		12.19%	0.19[0.02,1.57]
Total (95% CI)	**2738**	**2701**		**100%**	**1.22[0.81,1.81]**
Total events: 52 (Upright), 39 (Supine)					
Heterogeneity: Tau^2=0; Chi^2=13.45, df=14(P=0.49); I^2=0%					
Test for overall effect: Z=0.96(P=0.34)					



Favours upright — Favours supine

Analysis 1.6. Comparison 1 Any upright versus supine position, Outcome 6 Episiotomy.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Amiri 2012	79/99	42/50		7.45%	0.95[0.81,1.11]
Crowley 1991	329/634	350/595		7.65%	0.88[0.8,0.98]
De Jong 1997	19/257	52/260		5.29%	0.37[0.23,0.61]
Gardosi 1989a	55/218	53/209		6.47%	0.99[0.72,1.38]
Gardosi 1989b	22/73	30/78		5.62%	0.78[0.5,1.23]
Gupta 1989	25/65	27/44		6.05%	0.63[0.43,0.92]
Hillan 1984	79/250	136/250		7.16%	0.58[0.47,0.72]
Liddell 1985	20/27	16/21		6.46%	0.97[0.7,1.35]
Nasir 2007	43/100	48/100		6.62%	0.9[0.66,1.21]
Racinet 1999	75/117	88/118		7.38%	0.86[0.72,1.02]
Schirmer 2011	27/77	13/81		4.71%	2.18[1.22,3.92]
Sekhavat 2009	34/55	30/55		6.52%	1.13[0.82,1.56]
Stewart 1989	36/157	40/146		6.03%	0.84[0.57,1.24]
Turner 1986	73/222	111/309		7.02%	0.92[0.72,1.16]
Waldenström 1991	21/148	26/145		5.07%	0.79[0.47,1.34]
Zaibunnisa 2015	0/151	11/151		0.48%	0.04[0,0.73]
Zhang 2016	8/446	166/440		4.03%	0.05[0.02,0.1]
Total (95% CI)	**3096**	**3052**		**100%**	**0.75[0.61,0.92]**
Total events: 945 (Upright), 1239 (Supine)					
Heterogeneity: Tau^2=0.13; Chi^2=137.32, df=16(P<0.0001); I^2=88.35%					

Favours upright — Favours supine

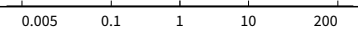
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Test for overall effect: Z=2.82(P=0)					

Favours upright — Favours supine

Analysis 1.7. Comparison 1 Any upright versus supine position, Outcome 7 Second degree perineal tears.

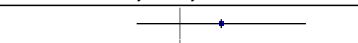
Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Allahbadia 1992	7/100	0/100		0.4%	15[0.87,259.16]
Amiri 2012	7/99	0/50		0.4%	7.65[0.45,131.3]
Bhardwaj 1994	8/294	17/323		3.77%	0.52[0.23,1.18]
Bomfim-Hyppólito 1998	7/121	3/127		1.68%	2.45[0.65,9.25]
Calvo Aguilar 2013	10/77	10/78		3.82%	1.01[0.45,2.3]
Crowley 1991	96/634	62/595		11.65%	1.45[1.08,1.96]
De Jong 1997	24/257	13/260		5.33%	1.87[0.97,3.59]
Gardosi 1989a	52/218	64/209		11.32%	0.78[0.57,1.07]
Gardosi 1989b	24/73	26/78		8.26%	0.99[0.63,1.55]
Gupta 1989	9/65	7/44		3.23%	0.87[0.35,2.16]
Hillan 1984	36/250	29/250		8.21%	1.24[0.79,1.96]
Jahanfar 2004	2/50	2/50		0.85%	1[0.15,6.82]
Nasir 2007	0/100	5/100		0.39%	0.09[0.01,1.62]
Racinet 1999	21/117	13/118		5.44%	1.63[0.86,3.1]
Schirmer 2011	11/77	10/81		3.98%	1.16[0.52,2.57]
Stewart 1989	41/157	35/146		9.53%	1.09[0.74,1.61]
Turner 1986	110/222	107/309		14.05%	1.43[1.17,1.75]
Zhang 2016	39/446	25/440		7.7%	1.54[0.95,2.5]
Total (95% CI)	**3357**	**3358**		**100%**	**1.2[1,1.44]**
Total events: 504 (Upright), 428 (Supine)					
Heterogeneity: Tau^2=0.05; Chi^2=29.73, df=17(P=0.03); I^2=42.82%					
Test for overall effect: Z=2(P=0.05)					



Favours upright — Favours supine

Analysis 1.8. Comparison 1 Any upright versus supine position, Outcome 8 Third/fourth degree tears.

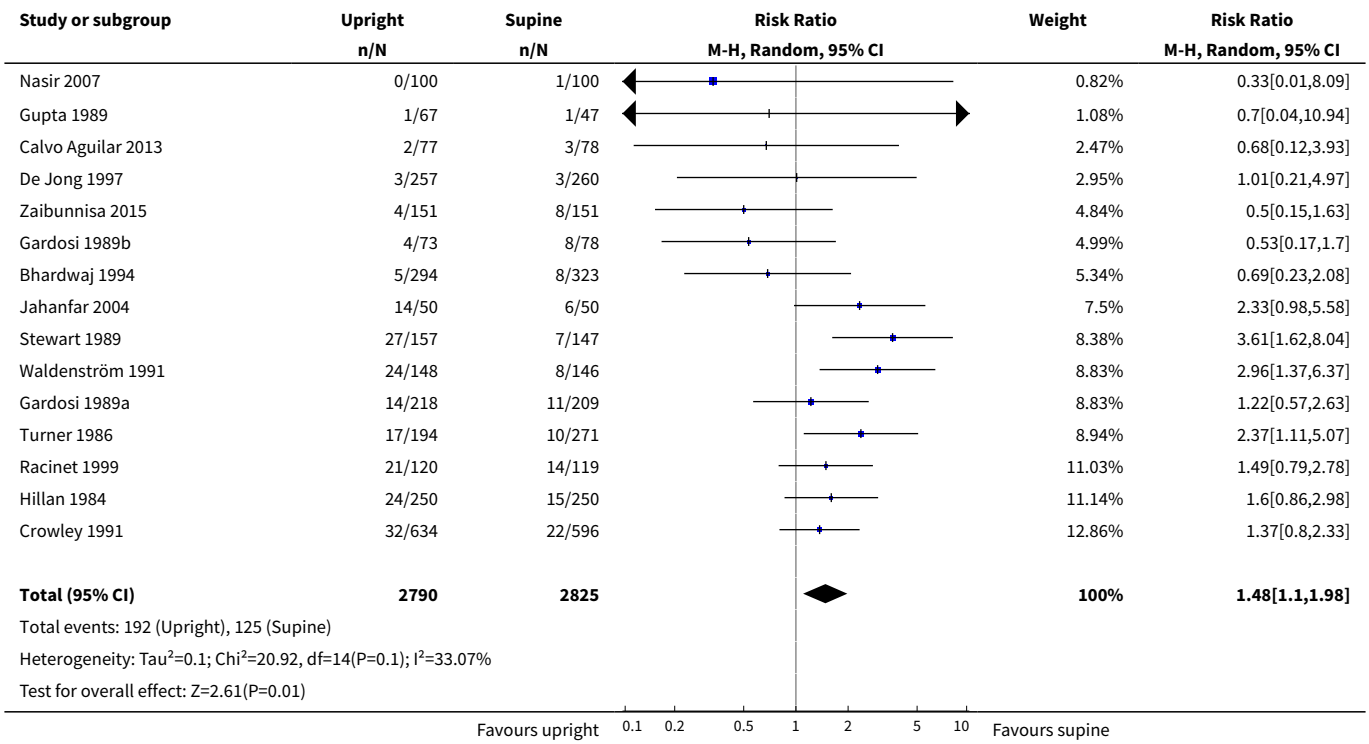
Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Allahbadia 1992	3/100	1/100		7.52%	3[0.32,28.35]
Bhardwaj 1994	2/294	2/323		14.33%	1.1[0.16,7.75]
Calvo Aguilar 2013	3/77	2/78		14.94%	1.52[0.26,8.84]
De Jong 1997	0/257	1/260		11.21%	0.34[0.01,8.24]
Gardosi 1989b	0/73	2/78		18.18%	0.21[0.01,4.37]
Nasir 2007	0/100	4/100		33.83%	0.11[0.01,2.04]
Total (95% CI)	**901**	**939**		**100%**	**0.72[0.32,1.65]**
Total events: 8 (Upright), 12 (Supine)					
Heterogeneity: Tau^2=0; Chi^2=4.84, df=5(P=0.44); I^2=0%					
Test for overall effect: Z=0.77(P=0.44)					



Favours upright — Favours supine

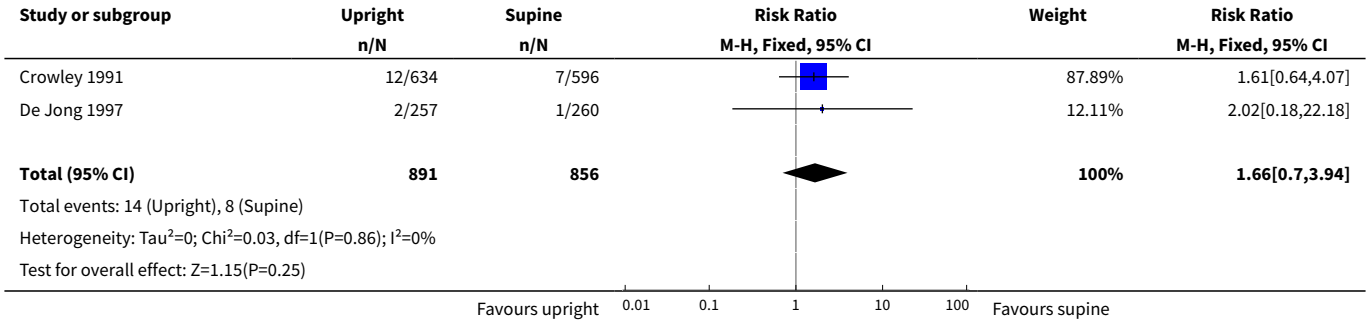
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 1.9. Comparison 1 Any upright versus supine position, Outcome 9 Blood loss > 500 mL.



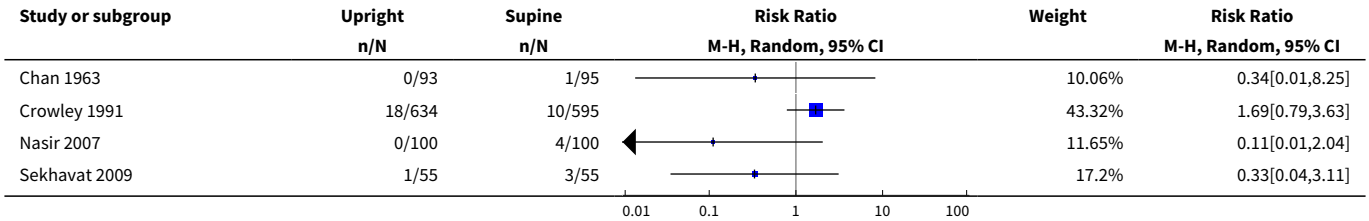
Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Nasir 2007	0/100	1/100		0.82%	0.33[0.01,8.09]
Gupta 1989	1/67	1/47		1.08%	0.7[0.04,10.94]
Calvo Aguilar 2013	2/77	3/78		2.47%	0.68[0.12,3.93]
De Jong 1997	3/257	3/260		2.95%	1.01[0.21,4.97]
Zaibunnisa 2015	4/151	8/151		4.84%	0.5[0.15,1.63]
Gardosi 1989b	4/73	8/78		4.99%	0.53[0.17,1.7]
Bhardwaj 1994	5/294	8/323		5.34%	0.69[0.23,2.08]
Jahanfar 2004	14/50	6/50		7.5%	2.33[0.98,5.58]
Stewart 1989	27/157	7/147		8.38%	3.61[1.62,8.04]
Waldenström 1991	24/148	8/146		8.83%	2.96[1.37,6.37]
Gardosi 1989a	14/218	11/209		8.83%	1.22[0.57,2.63]
Turner 1986	17/194	10/271		8.94%	2.37[1.11,5.07]
Racinet 1999	21/120	14/119		11.03%	1.49[0.79,2.78]
Hillan 1984	24/250	15/250		11.14%	1.6[0.86,2.98]
Crowley 1991	32/634	22/596		12.86%	1.37[0.8,2.33]
Total (95% CI)	**2790**	**2825**		**100%**	**1.48[1.1,1.98]**
Total events: 192 (Upright), 125 (Supine)					
Heterogeneity: Tau^2=0.1; Chi^2=20.92, df=14(P=0.1); I^2=33.07%					
Test for overall effect: Z=2.61(P=0.01)					

Analysis 1.10. Comparison 1 Any upright versus supine position, Outcome 10 Need for blood transfusion.



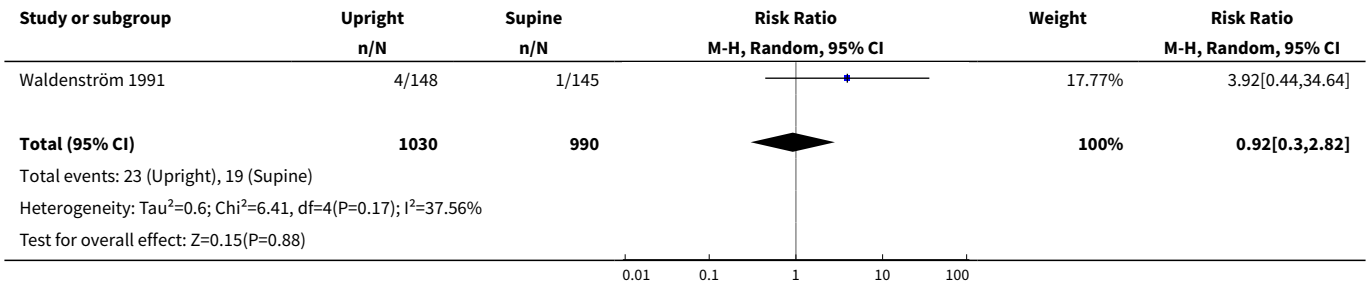
Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Crowley 1991	12/634	7/596		87.89%	1.61[0.64,4.07]
De Jong 1997	2/257	1/260		12.11%	2.02[0.18,22.18]
Total (95% CI)	**891**	**856**		**100%**	**1.66[0.7,3.94]**
Total events: 14 (Upright), 8 (Supine)					
Heterogeneity: Tau^2=0; Chi^2=0.03, df=1(P=0.86); I^2=0%					
Test for overall effect: Z=1.15(P=0.25)					

Analysis 1.11. Comparison 1 Any upright versus supine position, Outcome 11 Manual removal of placenta.

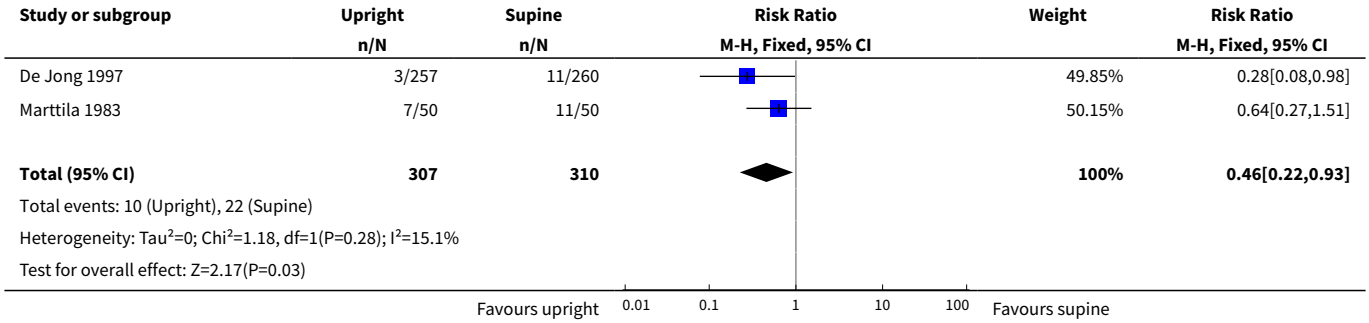


Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Chan 1963	0/93	1/95		10.06%	0.34[0.01,8.25]
Crowley 1991	18/634	10/595		43.32%	1.69[0.79,3.63]
Nasir 2007	0/100	4/100		11.65%	0.11[0.01,2.04]
Sekhavat 2009	1/55	3/55		17.2%	0.33[0.04,3.11]

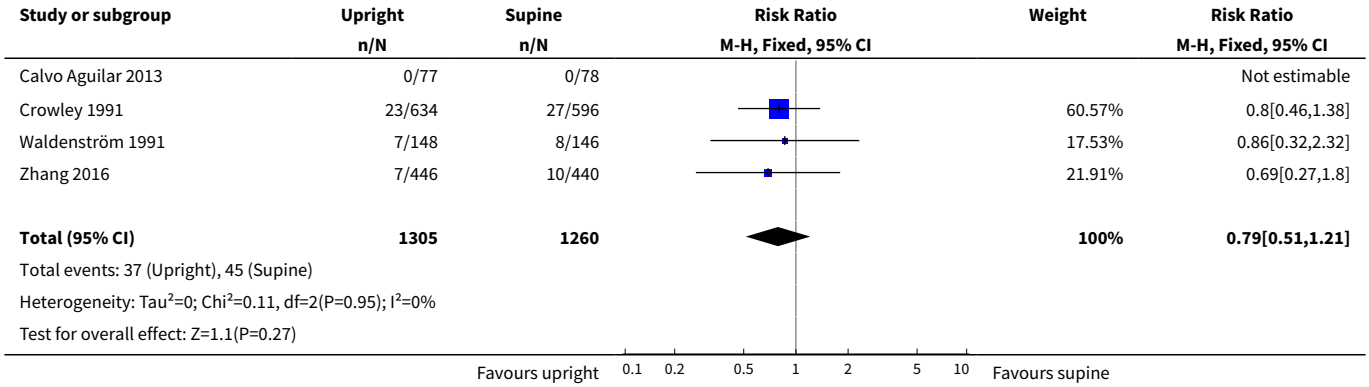
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



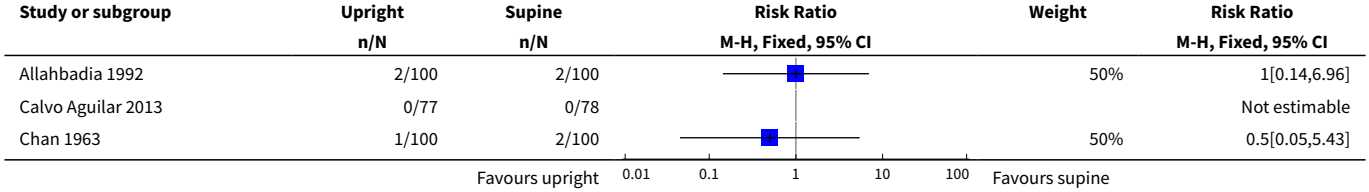
Analysis 1.12. Comparison 1 Any upright versus supine position, Outcome 12 Abnormal fetal heart rate patterns.



Analysis 1.13. Comparison 1 Any upright versus supine position, Outcome 13 Admission to neonatal intensive care unit.



Analysis 1.14. Comparison 1 Any upright versus supine position, Outcome 14 Perinatal death.



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Gardosi 1989a	0/218	0/209			Not estimable
Total (95% CI)	**495**	**487**		**100%**	**0.75[0.17,3.31]**
Total events: 3 (Upright), 4 (Supine)					
Heterogeneity: Tau²=0; Chi²=0.2, df=1(P=0.66); I²=0%					
Test for overall effect: Z=0.38(P=0.7)					

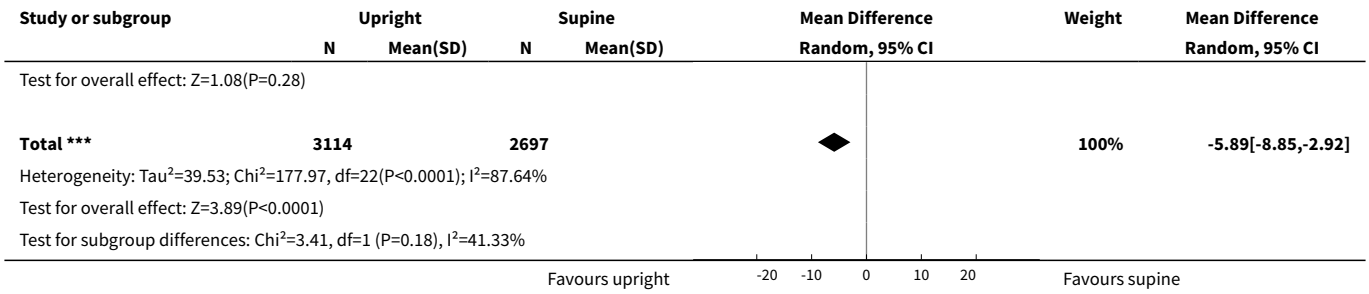
Favours upright 0.01 0.1 1 10 100 Favours supine

Analysis 1.15. Comparison 1 Any upright versus supine position, Outcome 15 Subgroup analysis: duration of second stage of labour (parity).

Study or subgroup	Upright N	Upright Mean(SD)	Supine N	Supine Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.15.1 Primigravidae only							
Amiri 2012	99	51.9 (26)	50	49 (26.3)		3.8%	2.83[-6.08,11.74]
Azhari 2013	60	44.5 (12.8)	30	65.1 (18.6)		4.25%	-20.57[-27.99,-13.15]
Bhardwaj 1994	136	42.7 (14.3)	148	57.7 (25.2)		5.05%	-15.03[-19.75,-10.31]
Crowley 1991	634	31.7 (19.2)	596	31.2 (18.8)		5.62%	0.5[-1.62,2.62]
Gardosi 1989a	218	39 (26)	209	50 (29)		4.91%	-11[-16.23,-5.77]
Gardosi 1989b	73	48.8 (34.8)	78	47.1 (31.8)		3.31%	1.7[-8.96,12.36]
Hillan 1984	250	86 (67)	250	81 (56)		3.27%	5[-5.82,15.82]
Liddell 1985	27	52.5 (31.3)	21	59.1 (35.3)		1.69%	-6.6[-25.77,12.57]
Marttila 1983	50	42.8 (33.9)	50	41.4 (24)		3.09%	1.4[-10.11,12.91]
Phumdoung 2010	240	27.5 (20.2)	80	44 (25.8)		4.62%	-16.54[-22.74,-10.34]
Phumdoung 2013	180	19.5 (11.5)	60	31.6 (14.2)		5.25%	-12.17[-16.14,-8.2]
Sekhavat 2009	55	34 (9.8)	55	42 (8.6)		5.37%	-8[-11.45,-4.55]
Stewart 1989	61	70.8 (43.3)	56	60.9 (46)		2.12%	9.9[-6.32,26.12]
Suwanakam 1988	30	31.4 (18.4)	30	62 (26.5)		3.09%	-30.6[-42.13,-19.07]
Subtotal ***	**2113**		**1713**			**55.45%**	**-7.8[-12.68,-2.92]**
Heterogeneity: Tau²=66.72; Chi²=122.55, df=13(P<0.0001); I²=89.39%							
Test for overall effect: Z=3.13(P=0)							
1.15.2 Multigravidae only							
Bhardwaj 1994	158	23.8 (13.3)	175	34.4 (25.5)		5.16%	-10.58[-14.89,-6.27]
Hillan 1984	250	19 (30)	250	23 (22)		5.08%	-4[-8.61,0.61]
Jahanfar 2004	50	10.8 (9.9)	50	16.5 (15)		4.98%	-5.74[-10.71,-0.77]
Marttila 1983	50	20.1 (25)	50	19.9 (37.2)		2.87%	0.2[-12.22,12.62]
Stewart 1989	96	18.8 (14)	91	16.9 (11.6)		5.32%	1.9[-1.78,5.58]
Subtotal ***	**604**		**616**			**23.41%**	**-4.03[-9.09,1.02]**
Heterogeneity: Tau²=24.58; Chi²=19.72, df=4(P=0); I²=79.72%							
Test for overall effect: Z=1.56(P=0.12)							
1.15.3 Mixed parity							
Bomfim-Hyppólito 1998	127	21.7 (13.9)	121	25.1 (14.4)		5.35%	-3.4[-6.93,0.13]
Calvo Aguilar 2013	77	26.4 (12.5)	78	35 (22)		4.79%	-8.67[-14.29,-3.05]
Racinet 1999	120	14 (11.4)	119	14.4 (11.1)		5.5%	-0.33[-3.18,2.52]
Waldenström 1991	73	53 (7.7)	50	51 (7.9)		5.5%	2[-0.81,4.81]
Subtotal ***	**397**		**368**			**21.15%**	**-2.03[-5.74,1.67]**
Heterogeneity: Tau²=10.74; Chi²=13.51, df=3(P=0); I²=77.8%							

Favours upright -20 -10 0 10 20 Favours supine

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



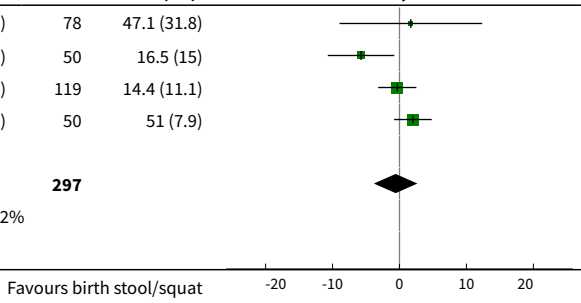
Comparison 2. Birth stool or squat stool versus supine position

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Duration of second stage all women (minutes)	4	613	Mean Difference (IV, Random, 95% CI)	-0.57 [-3.83, 2.68]
2 Use of any analgesia/anaesthesia during second stage of labour	2	811	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.76, 1.06]
3 Mode of birth: assisted birth	8	1824	Risk Ratio (M-H, Fixed, 95% CI)	0.77 [0.58, 1.01]
4 Mode of birth: caesarean section	8	1824	Risk Ratio (M-H, Fixed, 95% CI)	0.76 [0.37, 1.55]
5 Episiotomy	7	1930	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.72, 0.92]
6 Second degree perineal tears	7	1505	Risk Ratio (M-H, Random, 95% CI)	1.34 [0.79, 2.27]
7 Third/fourth degree tears	4	1061	Risk Ratio (M-H, Fixed, 95% CI)	0.49 [0.16, 1.48]
8 Blood loss > 500 mL	7	1615	Risk Ratio (M-H, Fixed, 95% CI)	1.54 [1.05, 2.26]
9 Need for blood transfusion	1	517	Risk Ratio (M-H, Fixed, 95% CI)	2.02 [0.18, 22.18]
10 Manual removal of placenta	2	493	Risk Ratio (M-H, Random, 95% CI)	0.75 [0.02, 25.79]
11 Shoulder dystocia (not prespecified)	1	200	Risk Ratio (M-H, Fixed, 95% CI)	0.2 [0.01, 4.11]
12 Abnormal fetal heart rate patterns	1	517	Risk Ratio (M-H, Fixed, 95% CI)	0.28 [0.08, 0.98]
13 Admission to neonatal intensive care unit	1	295	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.32, 2.30]
14 Perinatal death	1	200	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.14, 6.96]

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

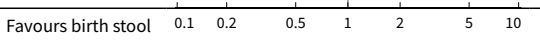
Analysis 2.1. Comparison 2 Birth stool or squat stool versus supine position, Outcome 1 Duration of second stage all women (minutes).

Study or subgroup	Birth/squat stool N	Birth/squat stool Mean(SD)	Supine N	Supine Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Gardosi 1989b	73	48.8 (34.8)	78	47.1 (31.8)		7.79%	1.7[-8.96,12.36]
Jahanfar 2004	50	10.8 (9.9)	50	16.5 (15)		22.5%	-5.74[-10.71,-0.77]
Racinet 1999	120	14 (11.4)	119	14.4 (11.1)		34.73%	-0.33[-3.18,2.52]
Waldenström 1991	73	53 (7.7)	50	51 (7.9)		34.98%	2[-0.81,4.81]
Total ***	**316**		**297**			**100%**	**-0.57[-3.83,2.68]**
Heterogeneity: Tau^2=5.81; Chi^2=7.22, df=3(P=0.07); I^2=58.42%							
Test for overall effect: Z=0.35(P=0.73)							



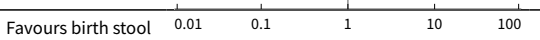
Analysis 2.2. Comparison 2 Birth stool or squat stool versus supine position, Outcome 2 Use of any analgesia/anaesthesia during second stage of labour.

Study or subgroup	Birth/ squat stool n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
De Jong 1997	76/257	88/260		53.02%	0.87[0.68,1.13]
Waldenström 1991	72/148	77/146		46.98%	0.92[0.74,1.16]
Total (95% CI)	**405**	**406**		**100%**	**0.9[0.76,1.06]**
Total events: 148 (Birth/squat stool), 165 (Supine)					
Heterogeneity: Tau^2=0; Chi^2=0.1, df=1(P=0.75); I^2=0%					
Test for overall effect: Z=1.25(P=0.21)					

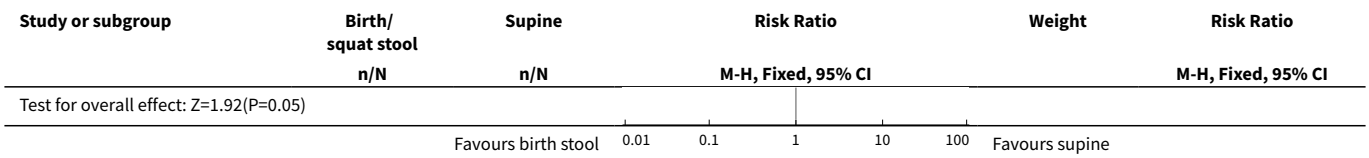


Analysis 2.3. Comparison 2 Birth stool or squat stool versus supine position, Outcome 3 Mode of birth: assisted birth.

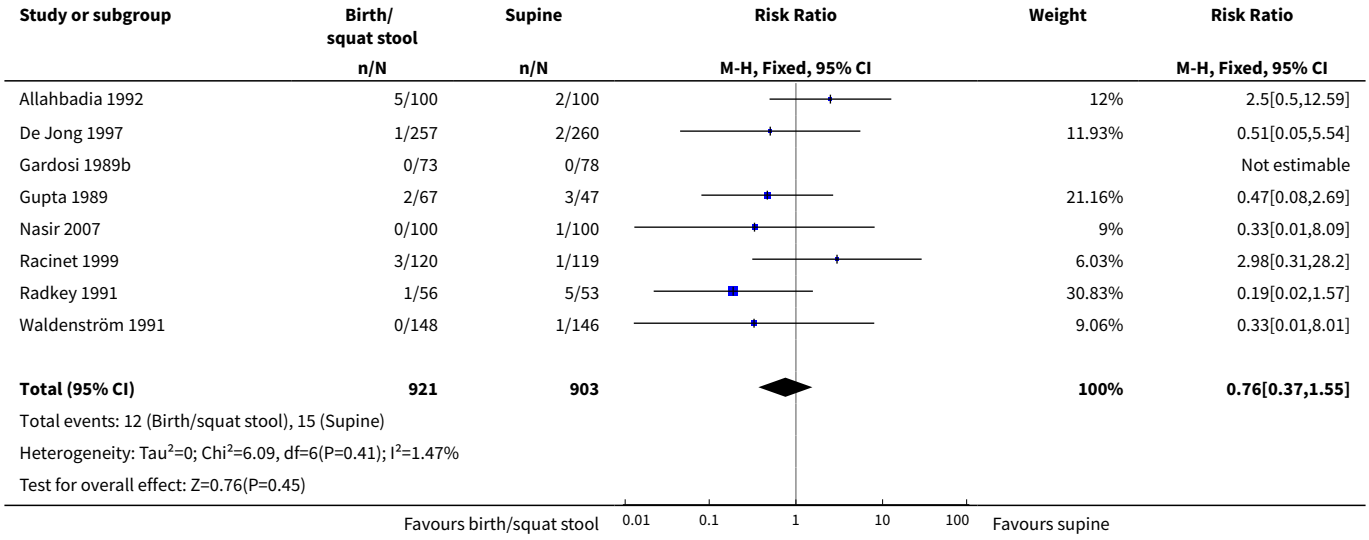
Study or subgroup	Birth/ squat stool n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Allahbadia 1992	16/100	18/100		17.45%	0.89[0.48,1.64]
De Jong 1997	3/257	3/260		2.89%	1.01[0.21,4.97]
Gardosi 1989b	7/73	12/78		11.25%	0.62[0.26,1.5]
Gupta 1989	10/67	6/47		6.84%	1.17[0.46,3]
Nasir 2007	11/100	24/100		23.27%	0.46[0.24,0.88]
Racinet 1999	16/120	18/119		17.53%	0.88[0.47,1.64]
Radkey 1991	12/56	13/53		12.95%	0.87[0.44,1.74]
Waldenström 1991	6/148	8/146		7.81%	0.74[0.26,2.08]
Total (95% CI)	**921**	**903**		**100%**	**0.77[0.58,1.01]**
Total events: 81 (Birth/squat stool), 102 (Supine)					
Heterogeneity: Tau^2=0; Chi^2=4.01, df=7(P=0.78); I^2=0%					



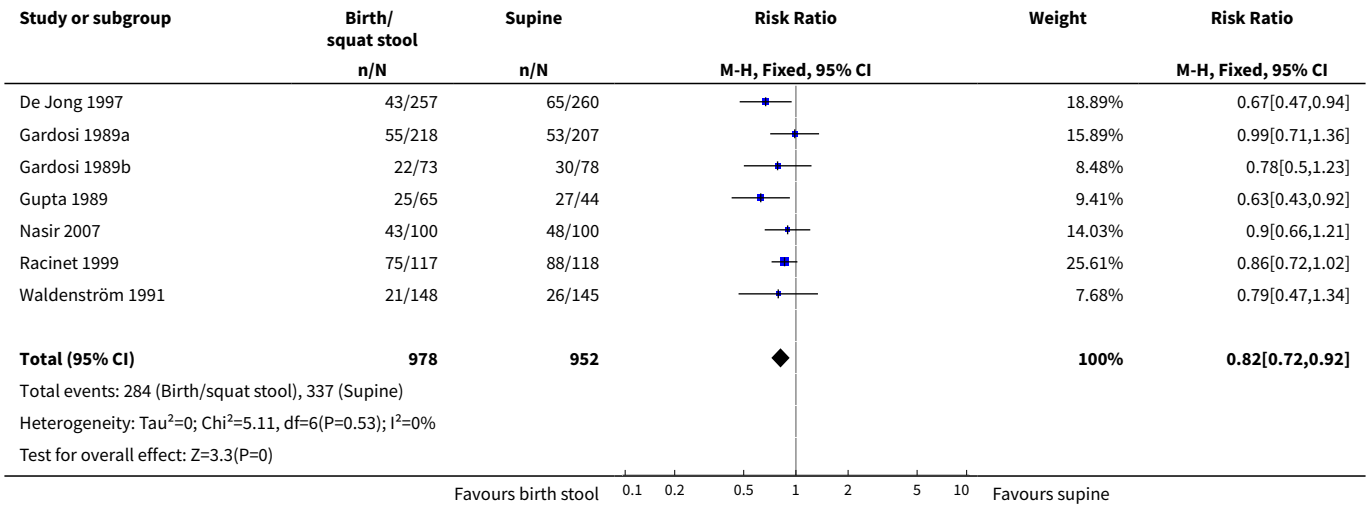
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



Analysis 2.4. Comparison 2 Birth stool or squat stool versus supine position, Outcome 4 Mode of birth: caesarean section.

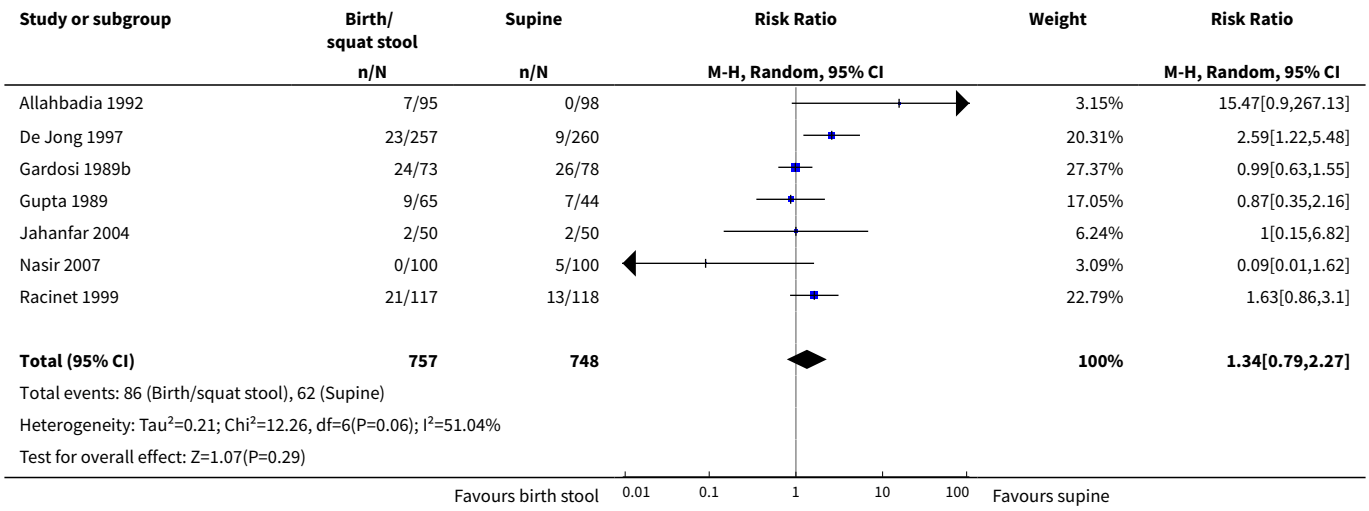


Analysis 2.5. Comparison 2 Birth stool or squat stool versus supine position, Outcome 5 Episiotomy.

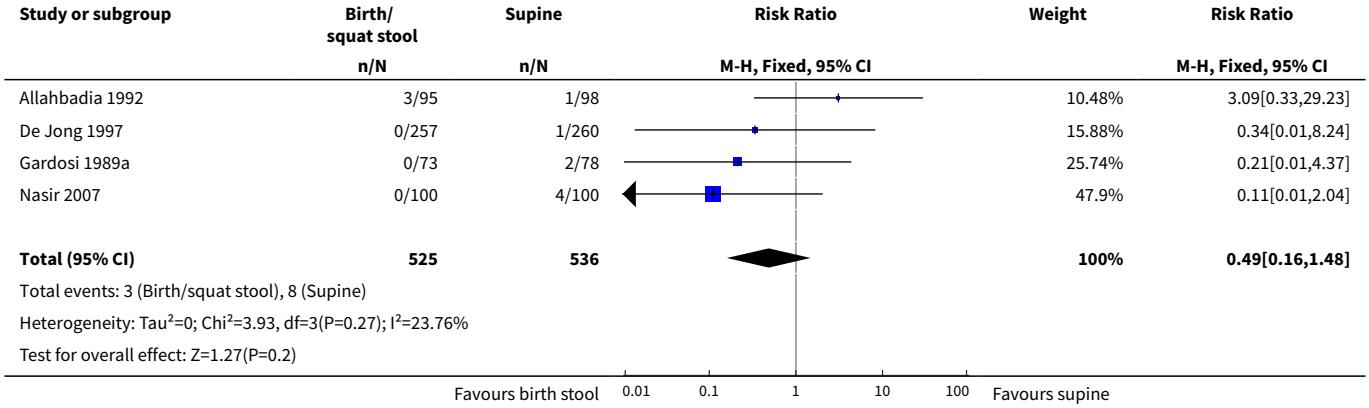


Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

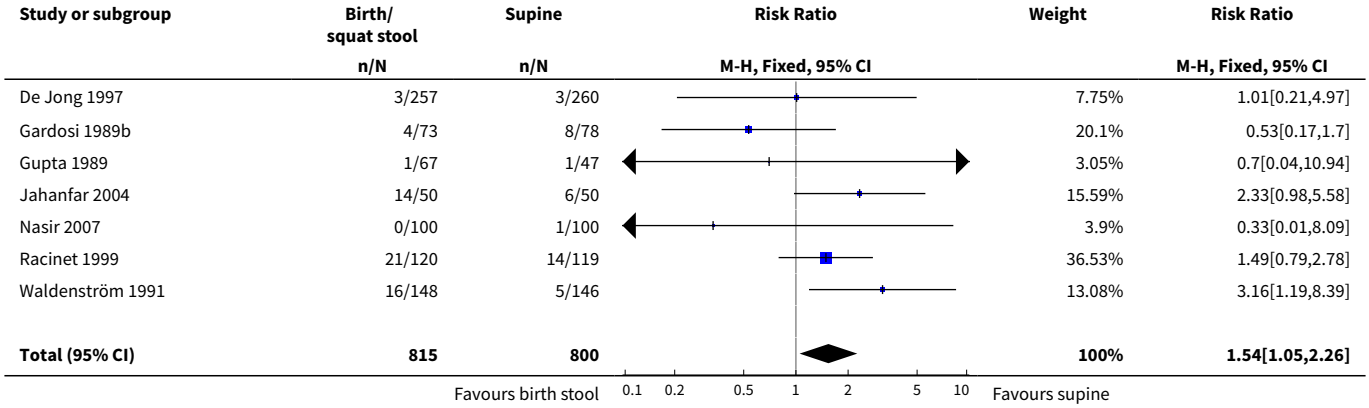
Analysis 2.6. Comparison 2 Birth stool or squat stool versus supine position, Outcome 6 Second degree perineal tears.



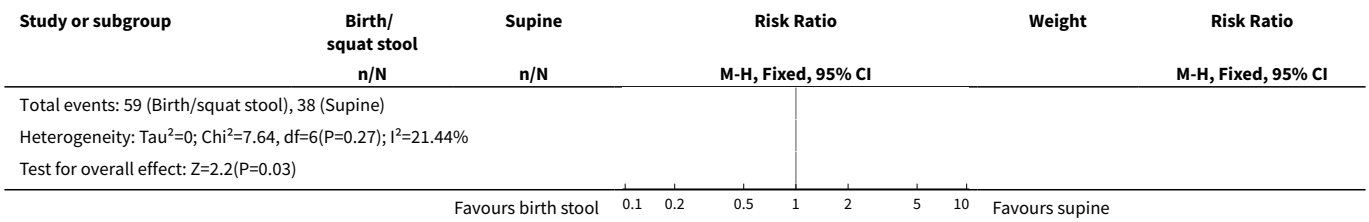
Analysis 2.7. Comparison 2 Birth stool or squat stool versus supine position, Outcome 7 Third/fourth degree tears.



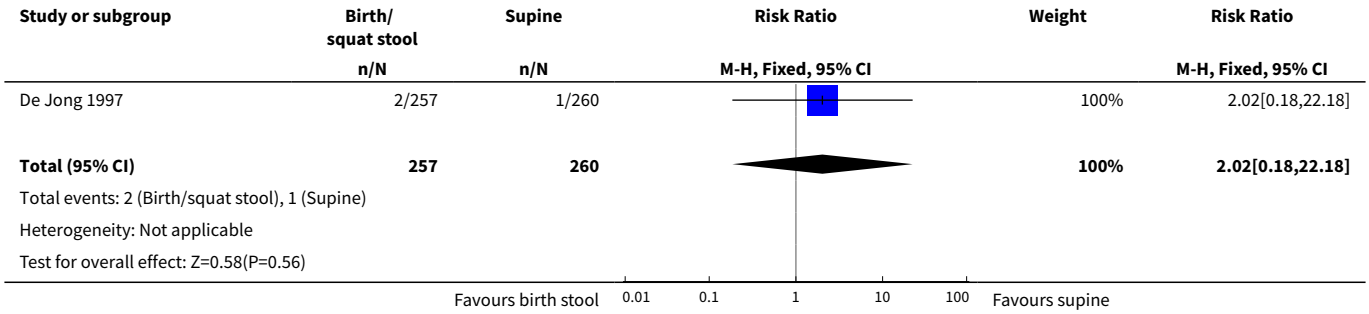
Analysis 2.8. Comparison 2 Birth stool or squat stool versus supine position, Outcome 8 Blood loss > 500 mL.



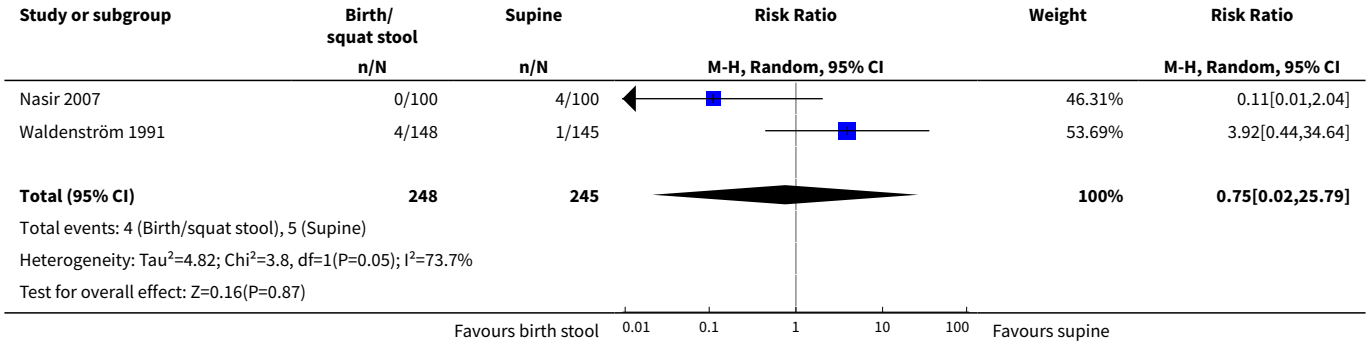
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



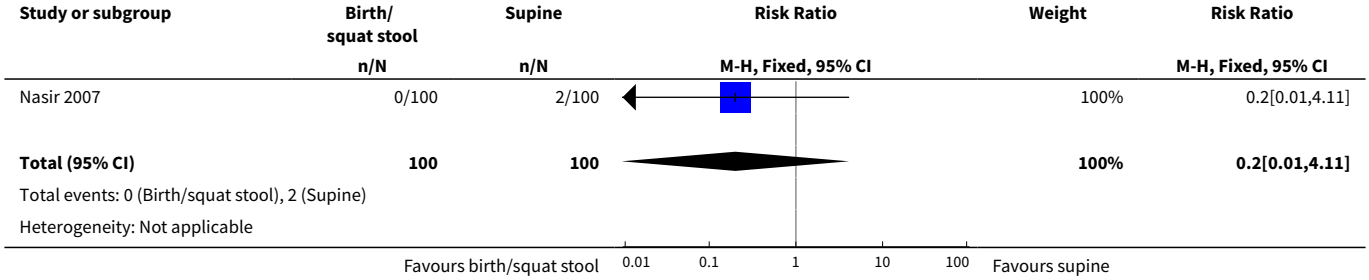
Analysis 2.9. Comparison 2 Birth stool or squat stool versus supine position, Outcome 9 Need for blood transfusion.



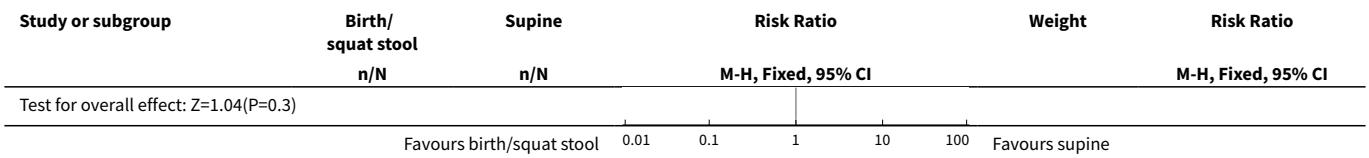
Analysis 2.10. Comparison 2 Birth stool or squat stool versus supine position, Outcome 10 Manual removal of placenta.



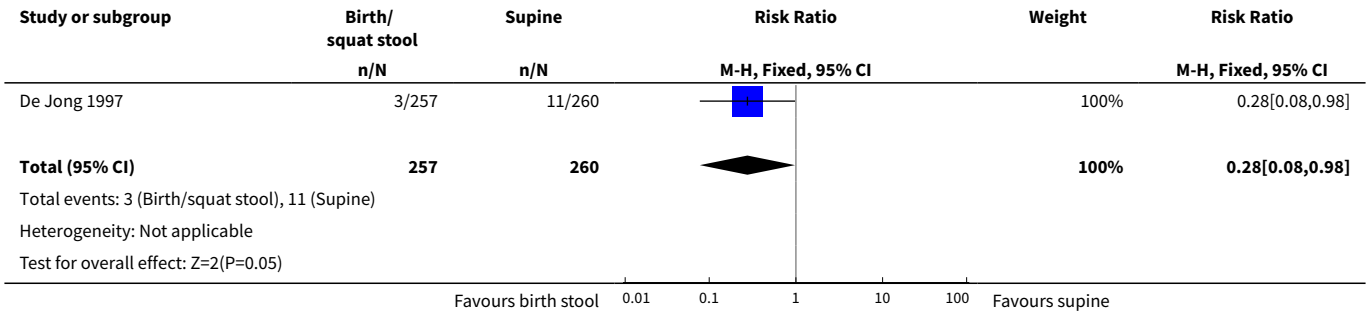
Analysis 2.11. Comparison 2 Birth stool or squat stool versus supine position, Outcome 11 Shoulder dystocia (not prespecified).



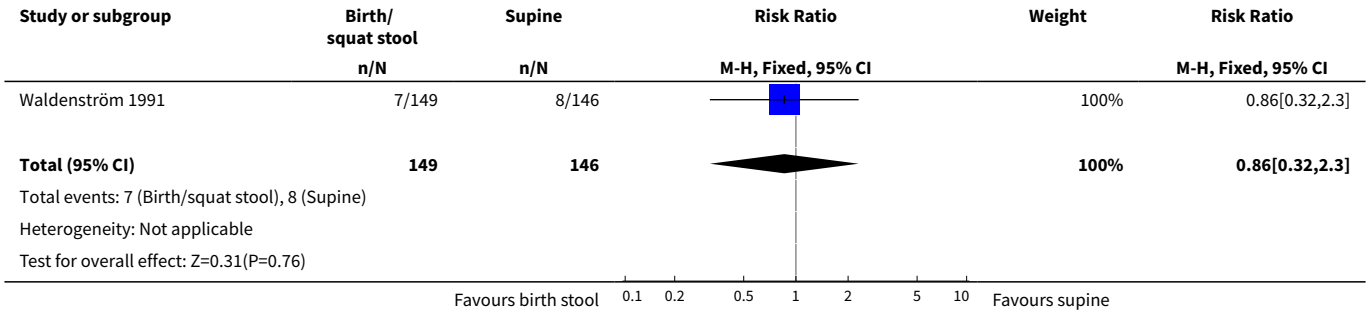
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



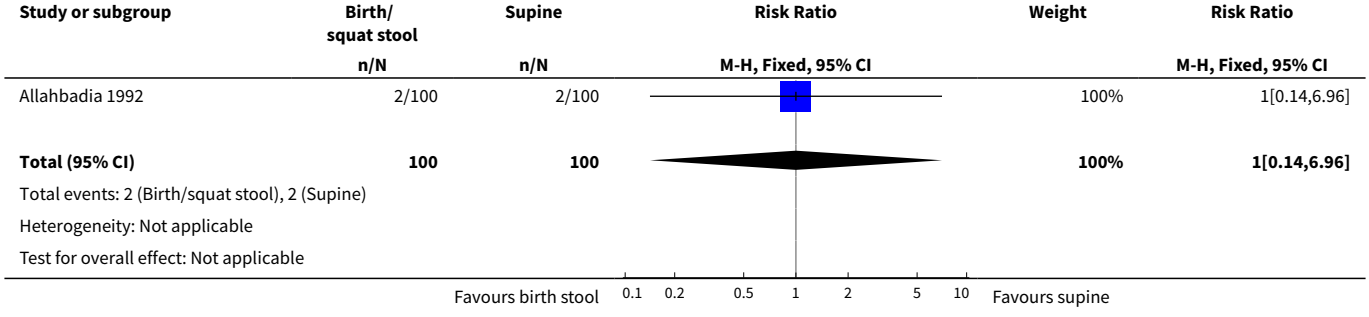
Analysis 2.12. Comparison 2 Birth stool or squat stool versus supine position, Outcome 12 Abnormal fetal heart rate patterns.



Analysis 2.13. Comparison 2 Birth stool or squat stool versus supine position, Outcome 13 Admission to neonatal intensive care unit.



Analysis 2.14. Comparison 2 Birth stool or squat stool versus supine position, Outcome 14 Perinatal death.



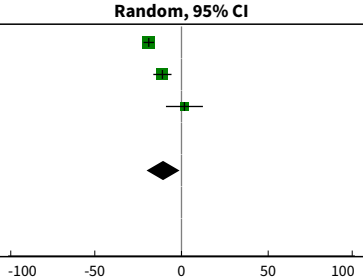
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Comparison 3. Birth cushion versus supine/lithotomy

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Duration of second stage of labour (minutes)	3	1193	Mean Difference (IV, Random, 95% CI)	-10.64 [-20.15, -1.12]
2 Mode of birth: assisted birth	2	1044	Risk Ratio (M-H, Fixed, 95% CI)	0.50 [0.32, 0.78]
3 Mode of birth: caesarean section	1	427	Risk Ratio (M-H, Fixed, 95% CI)	0.19 [0.01, 3.97]
4 Episiotomy	1	425	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.71, 1.36]
5 Second degree perineal tears	2	1042	Risk Ratio (M-H, Fixed, 95% CI)	0.72 [0.54, 0.97]
6 Third/fourth degree tears	1	617	Risk Ratio (M-H, Fixed, 95% CI)	1.10 [0.16, 7.75]
7 Blood loss > 500 mL	2	1044	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.54, 1.88]
8 Perinatal death	1	427	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
9 Subgroup analysis: duration of second stage of labour (parity)	3	1195	Mean Difference (IV, Random, 95% CI)	-10.38 [-15.04, -5.73]
9.1 Primigravidae only	3	862	Mean Difference (IV, Random, 95% CI)	-9.59 [-16.93, -2.25]
9.2 Multigravidae only	1	333	Mean Difference (IV, Random, 95% CI)	-10.58 [-14.89, -6.27]
9.3 Mixed parity	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

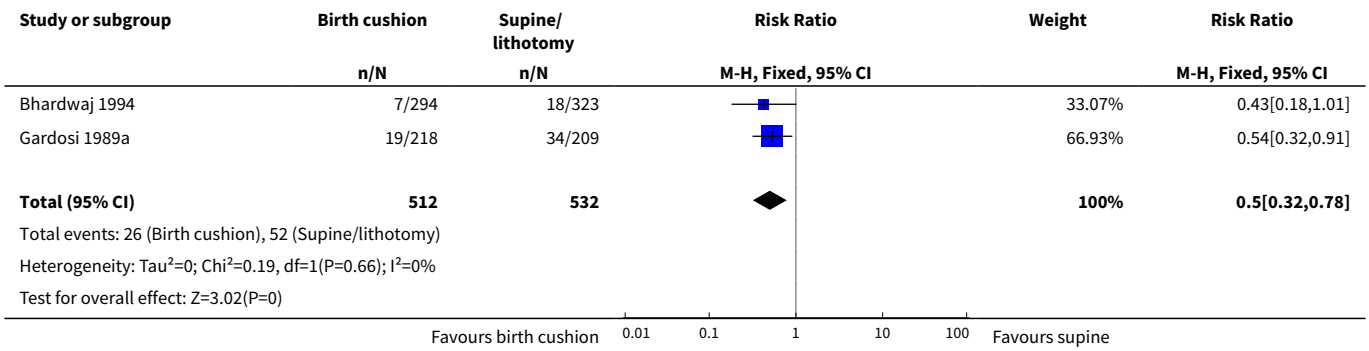
Analysis 3.1. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 1 Duration of second stage of labour (minutes).

Study or subgroup	Birth cushion N	Birth cushion Mean(SD)	Supine/lithotomy N	Supine/lithotomy Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Bhardwaj 1994	294	26.3 (14.6)	323	45.1 (23.1)		38.13%	-18.87[-21.89,-15.85]
Gardosi 1989a	218	39 (26)	207	50 (29)		35.39%	-11[-16.25,-5.75]
Gardosi 1989b	73	48.8 (34.8)	78	47.1 (31.8)		26.48%	1.7[-8.96,12.36]
Total ***	**585**		**608**			**100%**	**-10.64[-20.15,-1.12]**
Heterogeneity: Tau²=59.43; Chi²=17.55, df=2(P=0); I²=88.6%							
Test for overall effect: Z=2.19(P=0.03)							

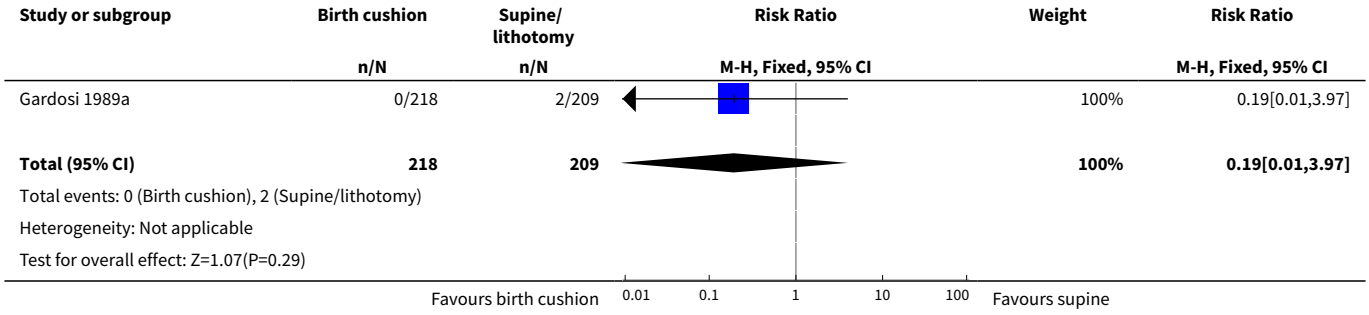


Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

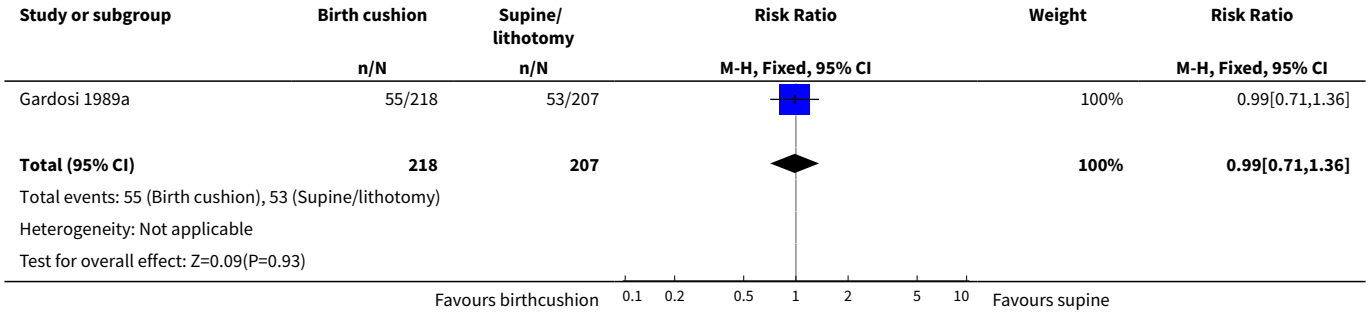
Analysis 3.2. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 2 Mode of birth: assisted birth.



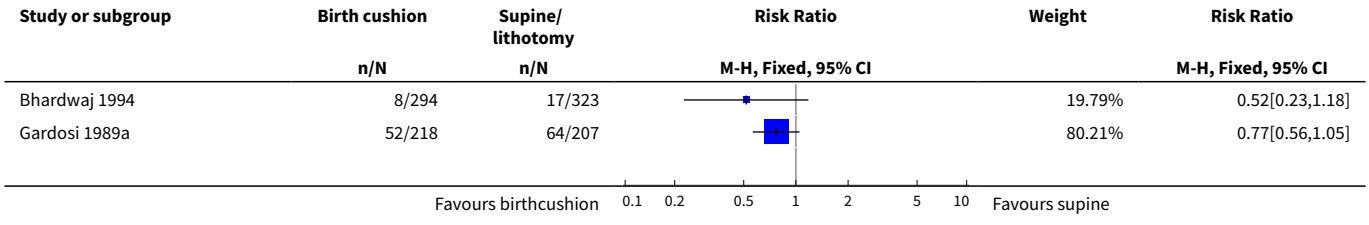
Analysis 3.3. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 3 Mode of birth: caesarean section.



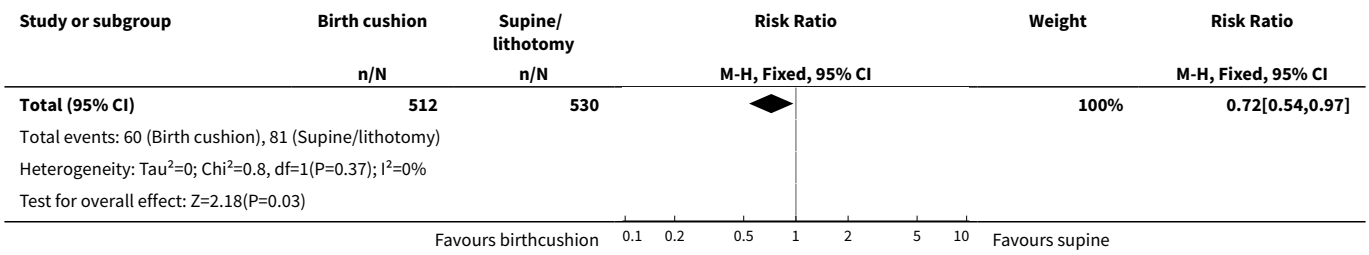
Analysis 3.4. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 4 Episiotomy.



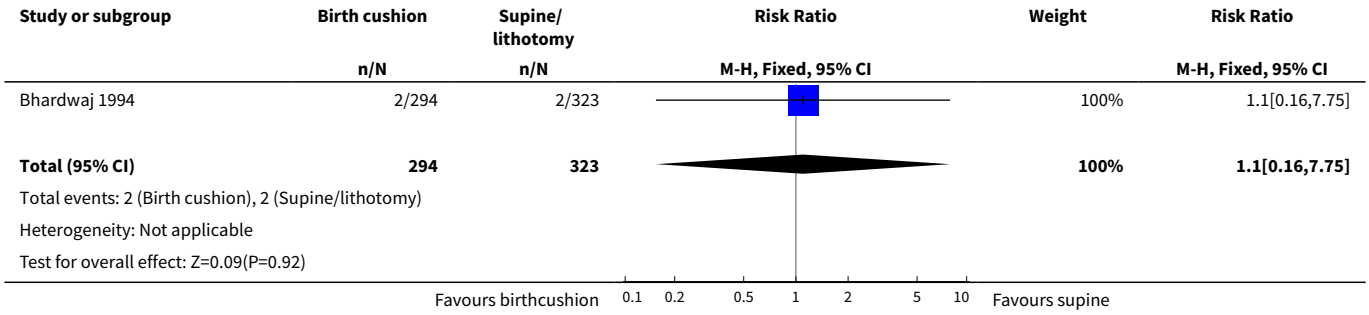
Analysis 3.5. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 5 Second degree perineal tears.



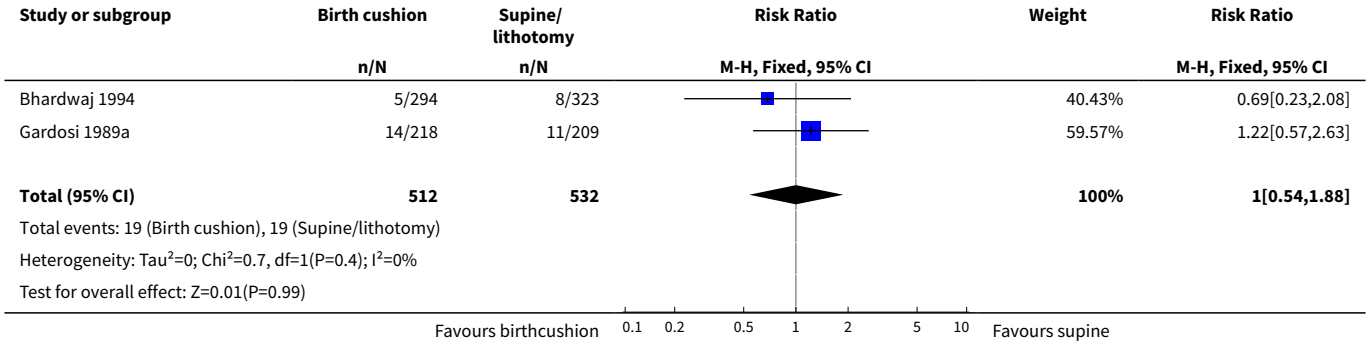
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



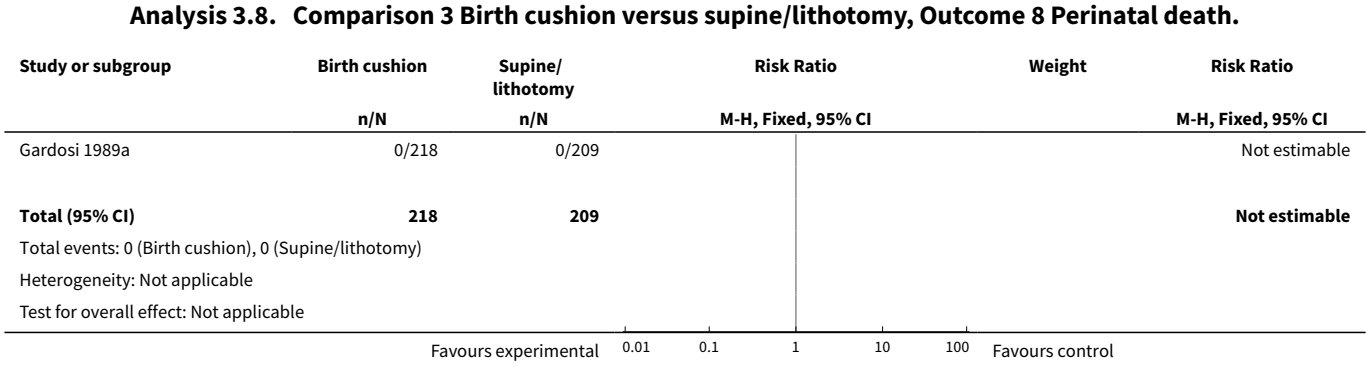
Analysis 3.6. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 6 Third/fourth degree tears.



Analysis 3.7. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 7 Blood loss > 500 mL.

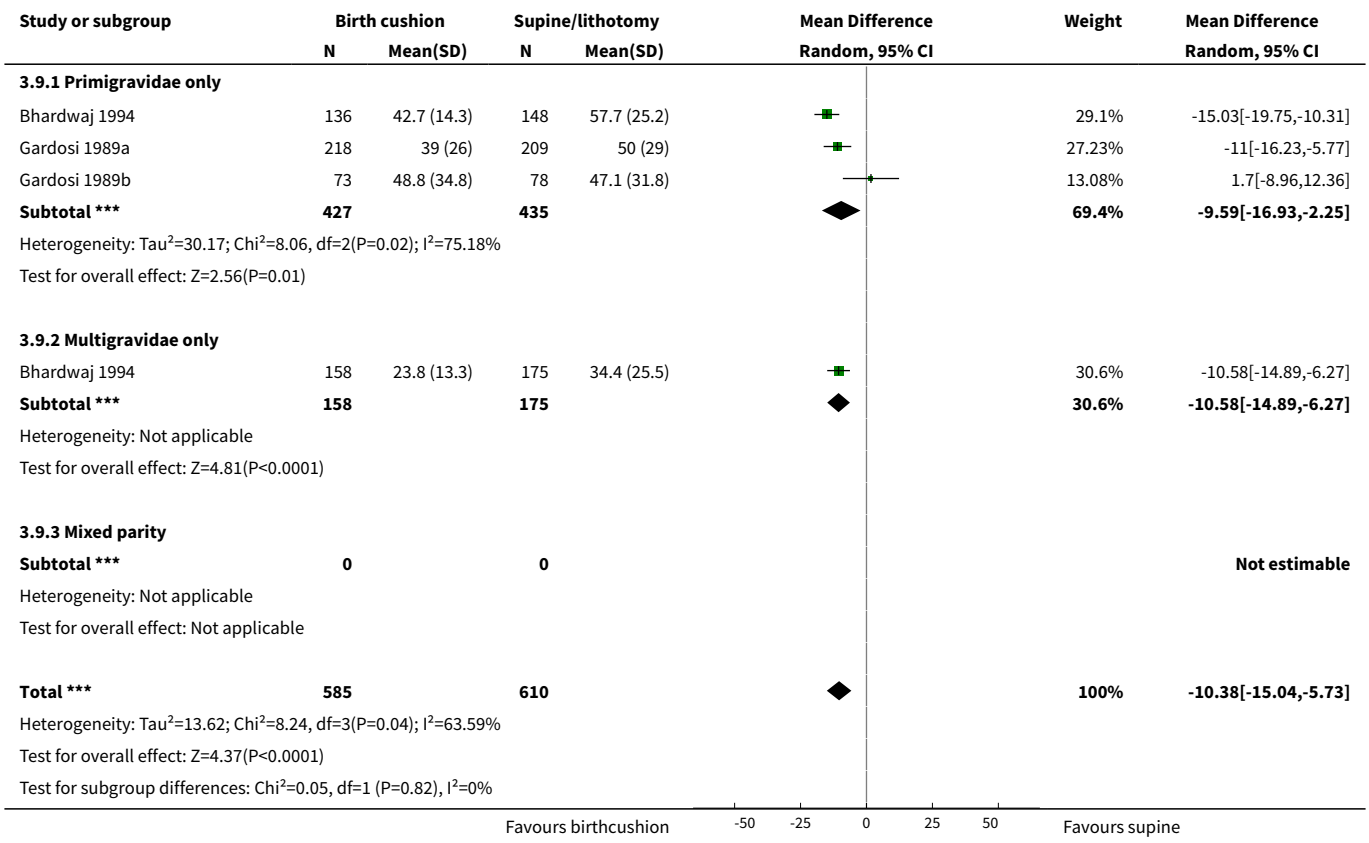


Analysis 3.8. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 8 Perinatal death.



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 3.9. Comparison 3 Birth cushion versus supine/lithotomy, Outcome 9 Subgroup analysis: duration of second stage of labour (parity).



Comparison 4. Birth chair versus supine/lithotomy

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Duration of second stage of labour (minutes)	7	3090	Mean Difference (IV, Random, 95% CI)	-2.63 [-7.03, 1.77]
2 Any analgesia/anaesthesia during second stage of labour	4	2082	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.93, 1.01]
3 Mode of birth: assisted delivery	8	2956	Risk Ratio (M-H, Random, 95% CI)	0.91 [0.64, 1.30]
4 Mode of birth: caesarean section	4	2573	Risk Ratio (M-H, Fixed, 95% CI)	1.29 [0.50, 3.32]
5 Episiotomy	5	2620	Risk Ratio (M-H, Random, 95% CI)	0.82 [0.68, 0.99]
6 Second degree perineal tears	5	2819	Risk Ratio (M-H, Fixed, 95% CI)	1.37 [1.18, 1.59]
7 Blood loss > 500 mL	4	2573	Risk Ratio (M-H, Random, 95% CI)	1.57 [0.83, 2.98]

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

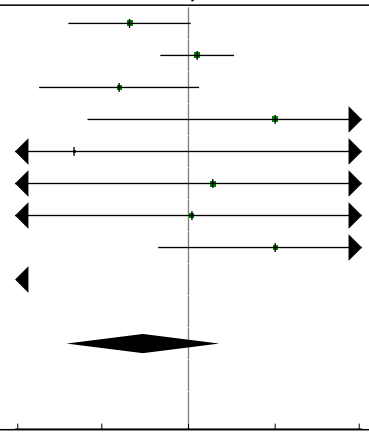
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
8 Need for blood transfusion	1	1230	Risk Ratio (M-H, Fixed, 95% CI)	1.61 [0.64, 4.07]
9 Manual removal of placenta	1	1229	Risk Ratio (M-H, Fixed, 95% CI)	1.69 [0.79, 3.63]
10 Admission to neonatal intensive care unit	1	1230	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.46, 1.38]
11 Subgroup analysis: duration of second stage of labour (parity)	7	3090	Mean Difference (IV, Random, 95% CI)	-2.18 [-6.09, 1.74]
11.1 Primigravidae	6	2055	Mean Difference (IV, Random, 95% CI)	-3.37 [-13.25, 6.51]
11.2 Multigravidae	3	787	Mean Difference (IV, Random, 95% CI)	-0.69 [-5.15, 3.78]
11.3 Mixed parity	1	248	Mean Difference (IV, Random, 95% CI)	-3.40 [-6.93, 0.13]

Analysis 4.1. Comparison 4 Birth chair versus supine/lithotomy, Outcome 1 Duration of second stage of labour (minutes).

Study or subgroup	Birth chair N	Birth chair Mean(SD)	Supine/lithotomy N	Supine/lithotomy Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Bomfim-Hyppólito 1998	127	21.7 (13.9)	121	25.1 (14.4)		16.72%	-3.4[-6.93,0.13]
Crowley 1991	634	31.7 (19.2)	596	31.2 (18.8)		17.94%	0.5[-1.62,2.62]
Hillan 1984	250	19 (30)	250	23 (22)		15.53%	-4[-8.61,0.61]
Hillan 1984	250	86 (67)	250	81 (56)		8.78%	5[-5.82,15.82]
Liddell 1985	27	52.5 (31.3)	21	59.1 (35.3)		4.11%	-6.6[-25.77,12.57]
Marttila 1983	50	42.8 (33.9)	50	41.4 (24)		8.21%	1.4[-10.11,12.91]
Marttila 1983	50	20.1 (25)	50	19.9 (37.2)		7.51%	0.2[-12.22,12.62]
Stewart 1989	157	38.7 (30)	147	33.7 (30)		13%	5[-1.75,11.75]
Suwanakam 1988	30	31.7 (18.4)	30	62 (26.5)		8.19%	-30.26[-41.79,-18.73]
Total * **	**1575**		**1515**			**100%**	**-2.63[-7.03,1.77]**

Heterogeneity: Tau²=26.93; Chi²=34.79, df=8(P<0.0001); I²=77.01%

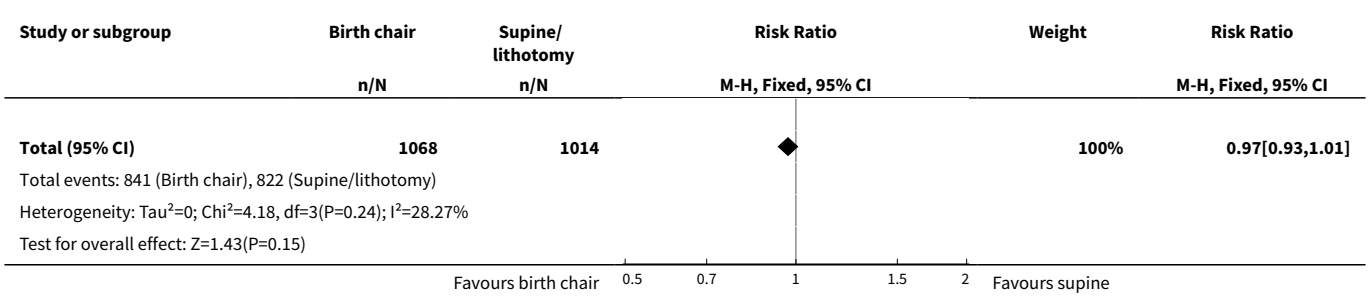
Test for overall effect: Z=1.17(P=0.24)



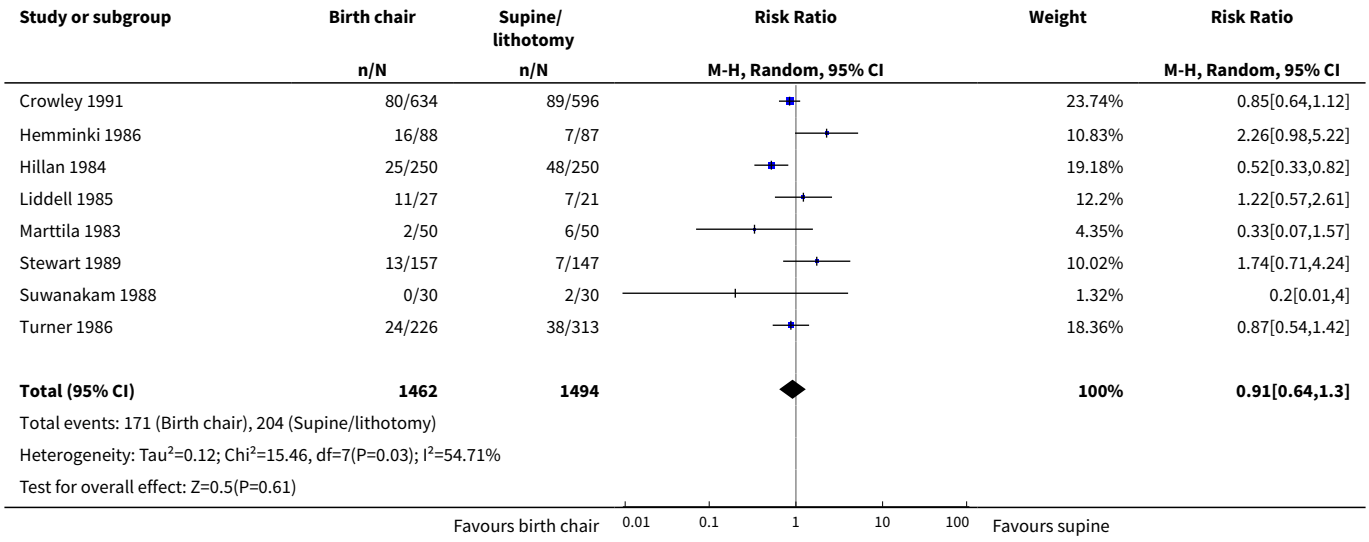
Analysis 4.2. Comparison 4 Birth chair versus supine/lithotomy, Outcome 2 Any analgesia/anaesthesia during second stage of labour.

Study or subgroup	Birth chair n/N	Supine/lithotomy n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Crowley 1991	514/634	495/596		60.42%	0.98[0.93,1.03]
Hillan 1984	171/250	179/250		21.19%	0.96[0.85,1.07]
Liddell 1985	21/27	21/21		2.85%	0.79[0.63,0.97]
Stewart 1989	135/157	127/147		15.53%	1[0.91,1.09]

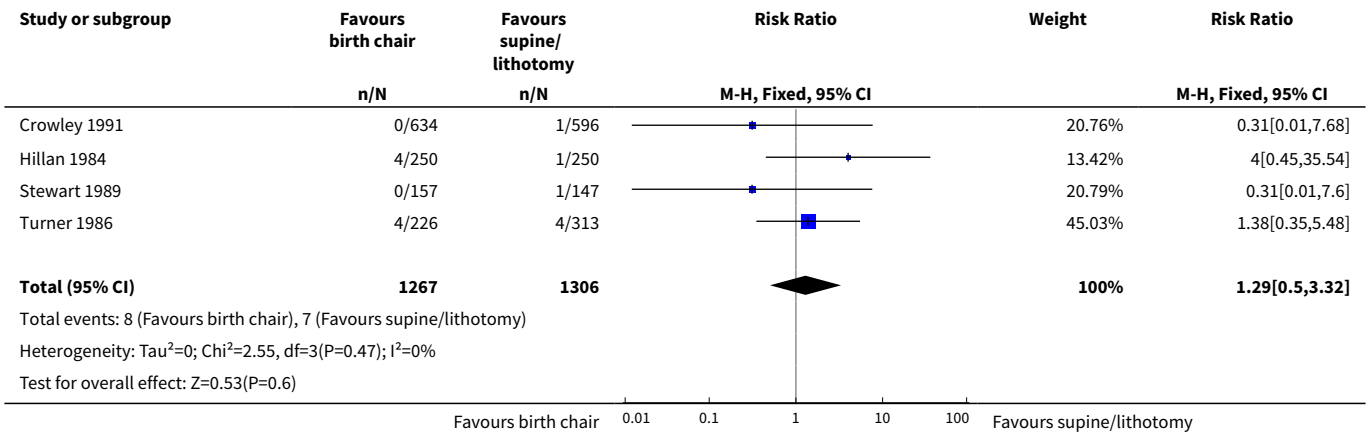
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



Analysis 4.3. Comparison 4 Birth chair versus supine/lithotomy, Outcome 3 Mode of birth: assisted delivery.



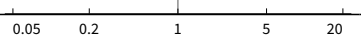
Analysis 4.4. Comparison 4 Birth chair versus supine/lithotomy, Outcome 4 Mode of birth: caesarean section.



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 4.5. Comparison 4 Birth chair versus supine/lithotomy, Outcome 5 Episiotomy.

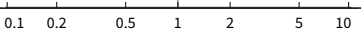
Study or subgroup	Birth chair n/N	Supine/ lithotomy n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Crowley 1991	329/634	350/596		28.3%	0.88[0.8,0.98]
Hillan 1984	79/250	136/250		21.98%	0.58[0.47,0.72]
Liddell 1985	20/27	16/21		15.96%	0.97[0.7,1.35]
Stewart 1989	36/157	40/146		13.27%	0.84[0.57,1.24]
Turner 1986	73/226	111/313		20.48%	0.91[0.72,1.16]
Total (95% CI)	**1294**	**1326**		**100%**	**0.82[0.68,0.99]**
Total events: 537 (Birth chair), 653 (Supine/lithotomy)					
Heterogeneity: Tau^2=0.03; Chi^2=13.69, df=4(P=0.01); I^2=70.78%					
Test for overall effect: Z=2.1(P=0.04)					



Favours birth chair — Favours supine

Analysis 4.6. Comparison 4 Birth chair versus supine/lithotomy, Outcome 6 Second degree perineal tears.

Study or subgroup	Birth chair n/N	Supine/ lithotomy n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Bomfim-Hyppólito 1998	7/121	3/127		1.32%	2.45[0.65,9.25]
Crowley 1991	96/634	62/595		28.83%	1.45[1.08,1.96]
Hillan 1984	36/250	29/250		13.07%	1.24[0.79,1.96]
Stewart 1989	41/157	35/146		16.35%	1.09[0.74,1.61]
Turner 1986	110/226	107/313		40.44%	1.42[1.16,1.75]
Total (95% CI)	**1388**	**1431**		**100%**	**1.37[1.18,1.59]**
Total events: 290 (Birth chair), 236 (Supine/lithotomy)					
Heterogeneity: Tau^2=0; Chi^2=2.52, df=4(P=0.64); I^2=0%					
Test for overall effect: Z=4.13(P<0.0001)					



Favours birth chair — Favours supine

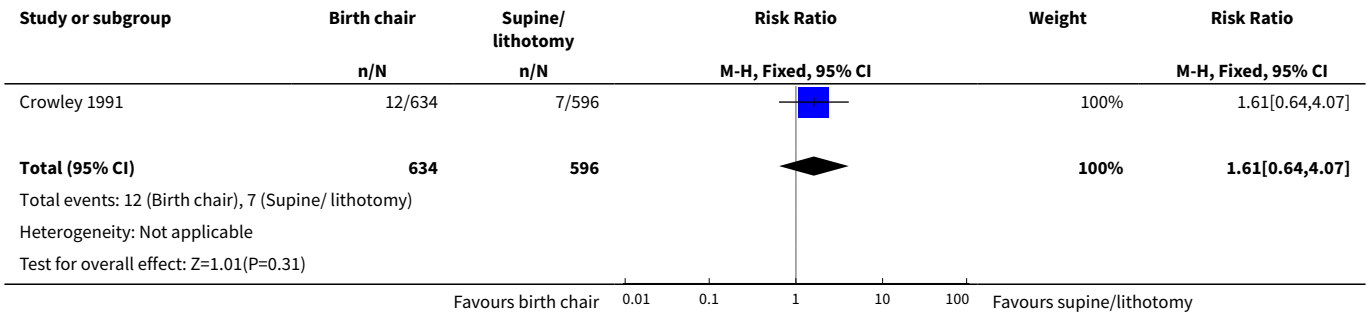
Analysis 4.7. Comparison 4 Birth chair versus supine/lithotomy, Outcome 7 Blood loss > 500 mL.

Study or subgroup	Birth chair n/N	Supine/ lithotomy n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Crowley 1991	32/634	22/596		25.22%	1.37[0.8,2.33]
Hillan 1984	24/250	15/250		23.7%	1.6[0.86,2.98]
Stewart 1989	27/157	7/147		20.65%	3.61[1.62,8.04]
Turner 1986	194/226	271/313		30.43%	0.99[0.93,1.06]
Total (95% CI)	**1267**	**1306**		**100%**	**1.57[0.83,2.98]**
Total events: 277 (Birth chair), 315 (Supine/lithotomy)					
Heterogeneity: Tau^2=0.35; Chi^2=23.1, df=3(P<0.0001); I^2=87.01%					
Test for overall effect: Z=1.39(P=0.16)					

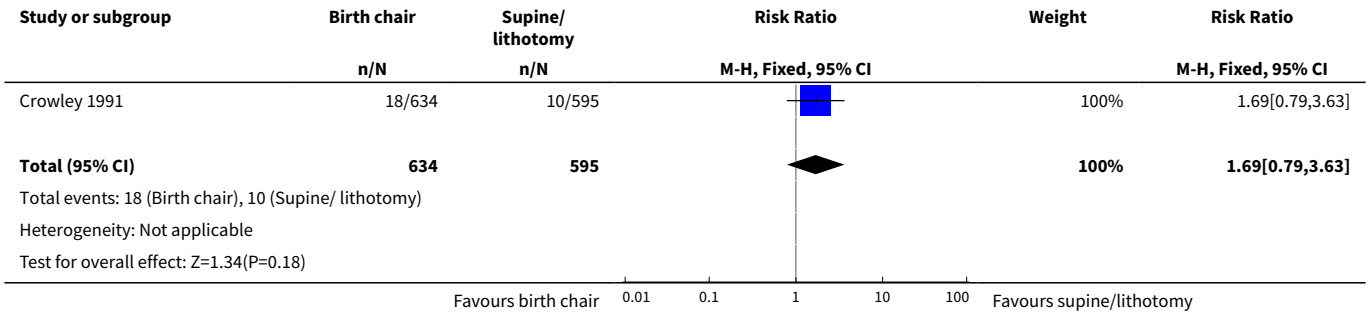
Favours birth chair — Favours supine

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

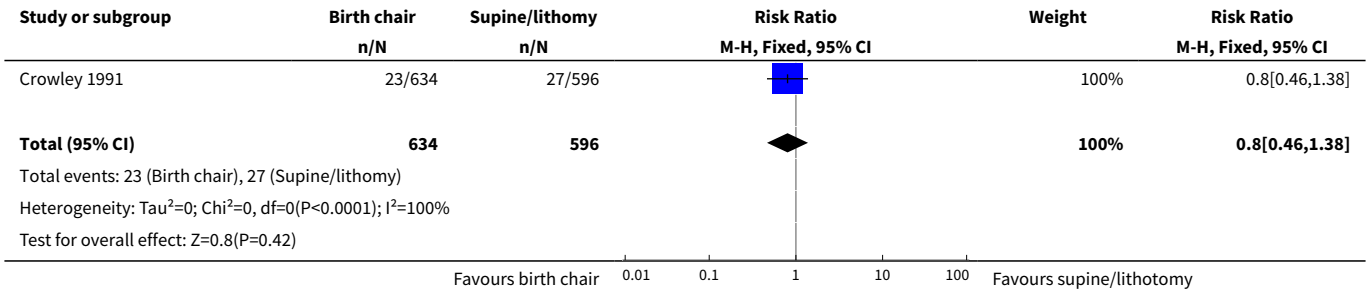
Analysis 4.8. Comparison 4 Birth chair versus supine/lithotomy, Outcome 8 Need for blood transfusion.



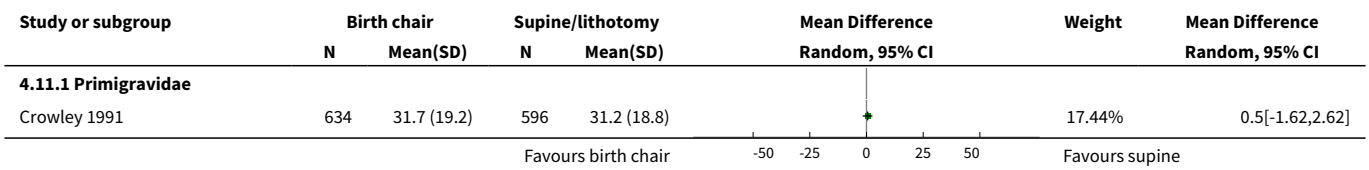
Analysis 4.9. Comparison 4 Birth chair versus supine/lithotomy, Outcome 9 Manual removal of placenta.



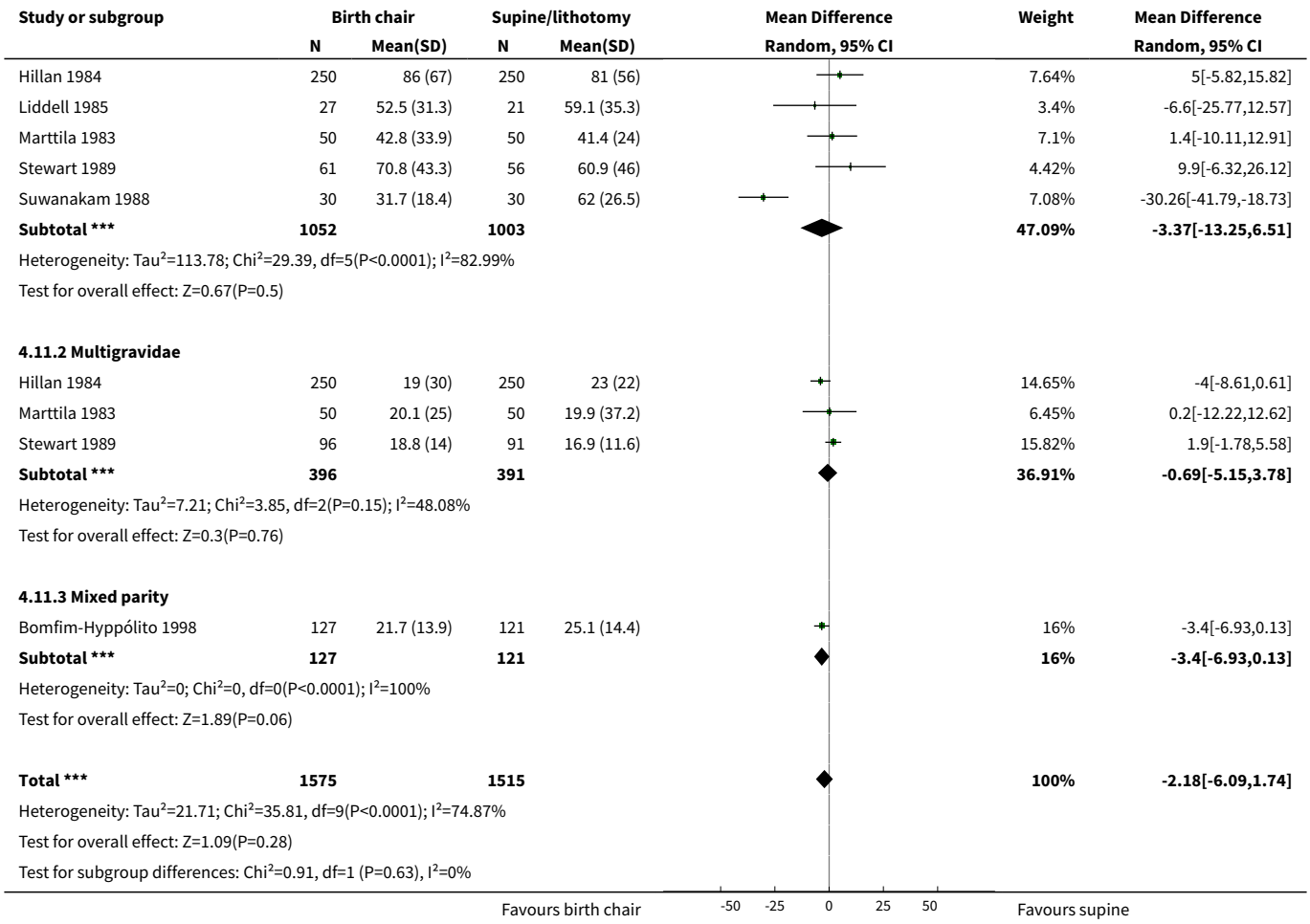
Analysis 4.10. Comparison 4 Birth chair versus supine/ lithotomy, Outcome 10 Admission to neonatal intensive care unit.



Analysis 4.11. Comparison 4 Birth chair versus supine/lithotomy, Outcome 11 Subgroup analysis: duration of second stage of labour (parity).



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



Comparison 5. Sensitivity analysis based on trial quality (Comparison 1)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Duration of second stage of labour (minutes)	10	2499	Mean Difference (IV, Random, 95% CI)	-4.34 [-7.00, 0.32]
2 Mode of birth: assisted birth	10	2534	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.56, 0.90]
3 Mode of birth: caesarean section	9	2544	Risk Ratio (M-H, Fixed, 95% CI)	1.47 [0.88, 2.46]
4 Second degree perineal tears	9	2977	Risk Ratio (M-H, Fixed, 95% CI)	1.35 [1.10, 1.67]
5 Third/fourth degree tears	3	872	Risk Ratio (M-H, Fixed, 95% CI)	1.46 [0.44, 4.79]
6 Blood loss > 500 mL	7	2186	Risk Ratio (M-H, Random, 95% CI)	1.59 [0.90, 2.80]
7 Admission to neonatal intensive care unit	2	449	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.32, 2.32]

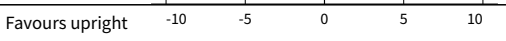
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 5.1. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 1 Duration of second stage of labour (minutes).

Study or subgroup	Upright N	Upright Mean(SD)	Supine N	Supine Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Amiri 2012	99	51.9 (26)	50	49 (26.3)		7.96%	2.83[-6.08,11.74]
Azhari 2013	60	44.5 (12.8)	30	65.1 (18.6)		8.74%	-20.57[-27.99,-13.15]
Calvo Aguilar 2013	77	26.4 (12.5)	78	35 (22)		9.65%	-8.67[-14.29,-3.05]
Hillan 1984	250	86 (67)	250	81 (56)		6.99%	5[-5.82,15.82]
Hillan 1984	250	19 (30)	250	23 (22)		10.11%	-4[-8.61,0.61]
Liddell 1985	27	52.5 (31.3)	21	59.1 (35.3)		3.87%	-6.6[-25.77,12.57]
Marttila 1983	50	20.1 (25)	50	19.9 (37.2)		6.24%	0.2[-12.22,12.62]
Marttila 1983	50	42.8 (33.9)	50	41.4 (24)		6.66%	1.4[-10.11,12.91]
Phumdoung 2010	240	27.5 (20.2)	80	44 (25.8)		9.36%	-16.54[-22.74,-10.34]
Sekhavat 2009	55	34 (9.8)	55	42 (8.6)		10.57%	-8[-11.45,-4.55]
Stewart 1989	157	38.7 (30)	147	33.7 (30)		9.08%	5[-1.75,11.75]
Waldenström 1991	73	53 (7.7)	50	51 (7.9)		10.78%	2[-0.81,4.81]
Total * **	**1388**		**1111**			**100%**	**-4.34[-9,0.32]**

Heterogeneity: Tau^2=50.35; Chi^2=73.25, df=11(P<0.0001); I^2=84.98%

Test for overall effect: Z=1.82(P=0.07)



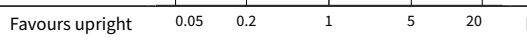
Analysis 5.2. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 2 Mode of birth: assisted birth.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Allahbadia 1992	16/100	18/100		12.57%	0.89[0.48,1.64]
Calvo Aguilar 2013	2/77	2/78		1.39%	1.01[0.15,7.01]
De Jong 1997	3/257	3/260		2.08%	1.01[0.21,4.97]
Gupta 1989	10/67	6/47		4.93%	1.17[0.46,3]
Hillan 1984	25/250	48/250		33.52%	0.52[0.33,0.82]
Liddell 1985	11/27	7/21		5.5%	1.22[0.57,2.61]
Marttila 1983	2/50	6/50		4.19%	0.33[0.07,1.57]
Stewart 1989	13/157	7/147		5.05%	1.74[0.71,4.24]
Waldenström 1991	6/148	8/146		5.63%	0.74[0.26,2.08]
Zaibunnisa 2015	17/151	36/151		25.14%	0.47[0.28,0.8]
Total (95% CI)	**1284**	**1250**		**100%**	**0.71[0.56,0.9]**

Total events: 105 (Upright), 141 (Supine)

Heterogeneity: Tau^2=0; Chi^2=12.78, df=9(P=0.17); I^2=29.59%

Test for overall effect: Z=2.86(P=0)



Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Analysis 5.3. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 3 Mode of birth: caesarean section.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Allahbadia 1992	5/100	2/100		8.49%	2.5[0.5,12.59]
Amiri 2012	9/99	3/50		16.92%	1.52[0.43,5.35]
Calvo Aguilar 2013	4/82	4/82		16.98%	1[0.26,3.86]
De Jong 1997	1/257	2/260		8.44%	0.51[0.05,5.54]
Gupta 1989	2/67	3/47		14.97%	0.47[0.08,2.69]
Hillan 1984	4/250	1/250		4.24%	4[0.45,35.54]
Stewart 1989	0/157	1/147		6.57%	0.31[0.01,7.6]
Waldenström 1991	0/148	1/146		6.41%	0.33[0.01,8.01]
Zaibunnisa 2015	12/151	4/151		16.98%	3[0.99,9.09]
Total (95% CI)	**1311**	**1233**		**100%**	**1.47[0.88,2.46]**
Total events: 37 (Upright), 21 (Supine)					
Heterogeneity: Tau²=0; Chi²=7.28, df=8(P=0.51); I²=0%					
Test for overall effect: Z=1.47(P=0.14)					

Favours upright — Favours supine

Analysis 5.4. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 4 Second degree perineal tears.

Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Allahbadia 1992	7/100	0/100		0.38%	15[0.87,259.16]
Amiri 2012	7/99	0/50		0.5%	7.65[0.45,131.3]
Calvo Aguilar 2013	10/77	10/78		7.5%	1.01[0.45,2.3]
De Jong 1997	24/257	13/260		9.75%	1.87[0.97,3.59]
Gupta 1989	9/65	7/44		6.3%	0.87[0.35,2.16]
Hillan 1984	36/250	29/250		21.88%	1.24[0.79,1.96]
Schirmer 2011	11/77	10/81		7.35%	1.16[0.52,2.57]
Stewart 1989	41/157	35/146		27.36%	1.09[0.74,1.61]
Zhang 2016	39/446	25/440		18.99%	1.54[0.95,2.5]
Total (95% CI)	**1528**	**1449**		**100%**	**1.35[1.1,1.67]**
Total events: 184 (Upright), 129 (Supine)					
Heterogeneity: Tau²=0; Chi²=8.23, df=8(P=0.41); I²=2.84%					
Test for overall effect: Z=2.84(P=0)					

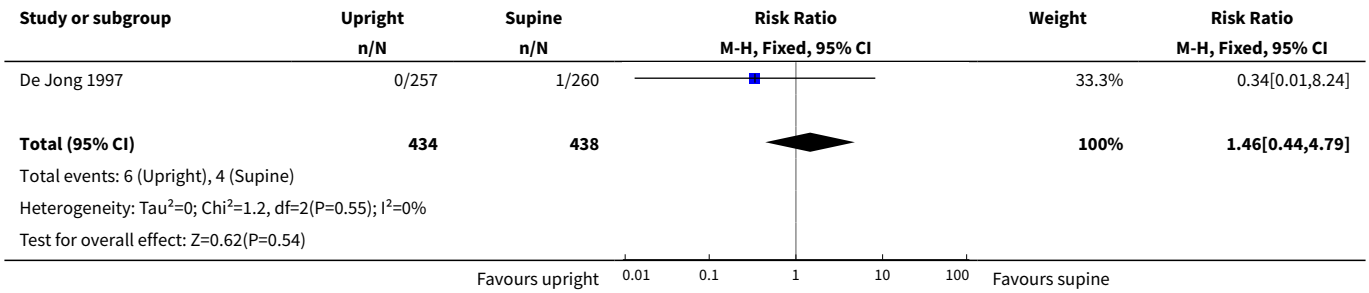
Favours upright — Favours supine

Analysis 5.5. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 5 Third/fourth degree tears.

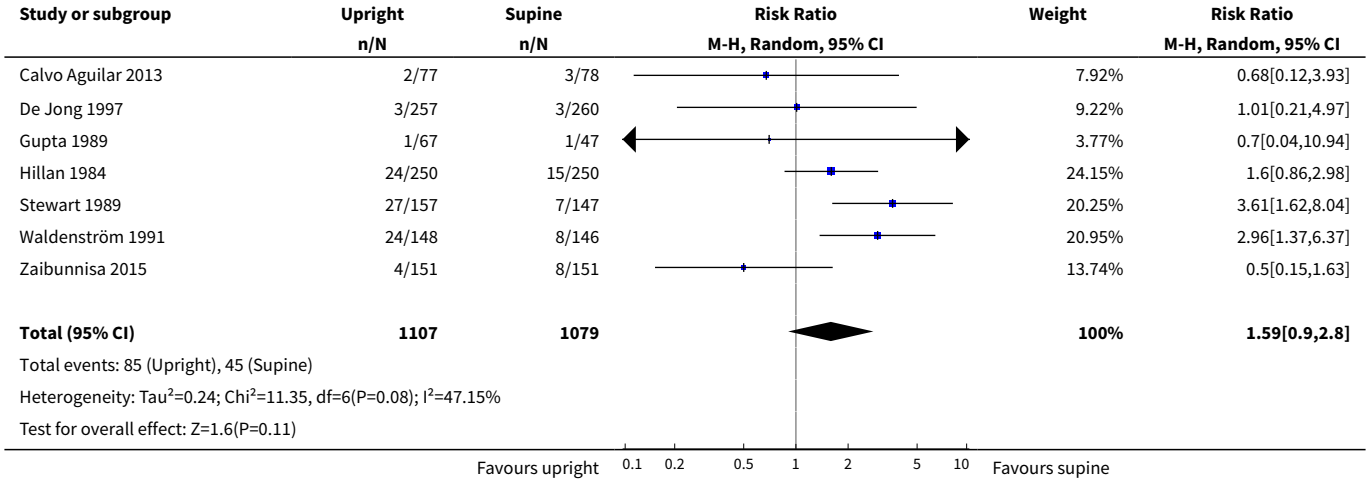
Study or subgroup	Upright n/N	Supine n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
Allahbadia 1992	3/100	1/100		22.33%	3[0.32,28.35]
Calvo Aguilar 2013	3/77	2/78		44.37%	1.52[0.26,8.84]

Favours upright — Favours supine

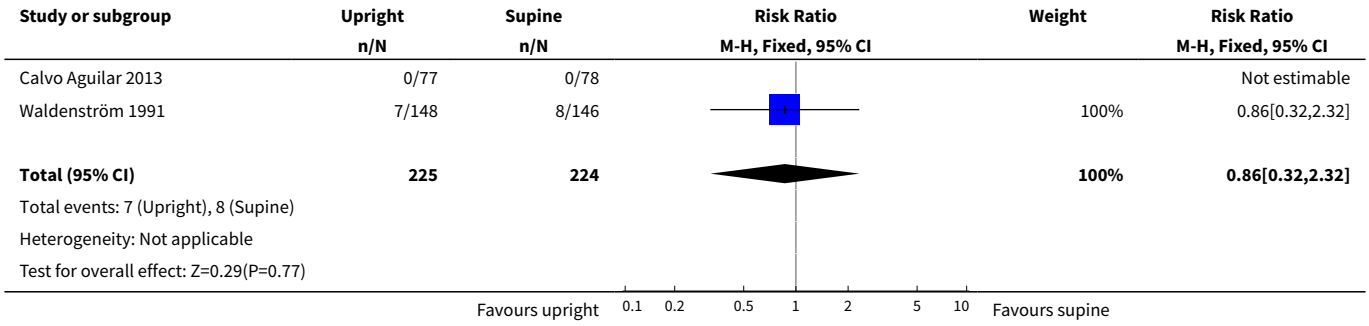
Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.



Analysis 5.6. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 6 Blood loss > 500 mL.



Analysis 5.7. Comparison 5 Sensitivity analysis based on trial quality (Comparison 1), Outcome 7 Admission to neonatal intensive care unit.



WHAT'S NEW

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Date	Event	Description
30 November 2016	New search has been performed	Eleven new trials have been added to the review (Liu 1986; Schneider-Affeld 1982; Amiri 2012; Azhari 2013; Calvo Aguilar 2013; Phumdoung 2010; Phumdoung 2013; Sekhavat 2009; Schirmer 2011; Zaibunnisa 2015; Zhang 2016) and two trials excluded (Corton 2012; Thies-Lagergren 2011). One trial, Hofmeyr 2015, is ongoing. Two studies, previously excluded have been included in this update (Liu 1986; Schneider-Affeld 1982), although they did not contribute any outcome data. One trial previously included has now been excluded as it was found to compare two recumbent positions(Brément 2007). There are now a total of 32 studies in the review, with 30 trials contributing data.
30 November 2016	New citation required but conclusions have not changed	Conclusions have not changed.

HISTORY

Protocol first published: Issue 1, 2000
Review first published: Issue 1, 2000

Date	Event	Description
28 February 2012	New citation required but conclusions have not changed	New co-author helped prepare this update. The overall conclusions have not changed.
28 February 2012	New search has been performed	Four new studies, previously awaiting classification, have now been incorporated into the review: three studies have been included (Bomfim-Hyppólito 1998; Brement 2007a; Nasir 2007) and one excluded (Ragnar 2006). Two studies (Humphrey 1973; Johnstone 1987) which were previously included have now been reclassified as excluded studies. New search conducted in February 2012 identified three studies: one has been included (Jahanfar 2004) and two excluded (Altman 2007; Thies-Lagergren 2011). We also identified additional reports for Bhardwaj 1994; Jahanfar 2004 and Thies-Lagergren 2011. This updated review is now comprised of 22 included studies and 16 excluded studies.
12 June 2009	Amended	Search updated. Three reports added to Studies awaiting classification (Brement 2007a; Nasir 2007; Ragnar 2006).
12 May 2009	Amended	Contact details updated.
20 September 2008	Amended	Converted to new review format.
12 December 2005	New search has been performed	New search conducted in September 2005 identified two new studies (Downe 2004; Karraz 2003), which were subsequently excluded. Suwanakam 1988, which was excluded in the previous version, has now been included. Bomfim-Hyppolito1998a, which was previously excluded as large numbers of women were excluded from the analysis, is now in Characteristics of studies

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Date	Event	Description
		awaiting classification. The trial author has been contacted and has confirmed she will send the required data. These data will be analysed in the next update. Data from the report by Stewart 1983 has been superseded by data from another report for Hillan 1984. The methods section has been updated and sensitivity analysis performed based on excluding trials with clearly inadequate allocation concealment (rated C). The conclusions have not changed.
11 November 2004	Amended	The title of this Review has changed from 'Position for women during second stage of labour' to 'Position in the second stage of labour for women without epidural anaesthesia'' to differentiate its scope from the newly registered title 'Position in the second stage of labour for women with epidural anaesthesia'.
12 November 2003	New search has been performed	This update incorporates one new trial, Racinet 1999, and excludes several others.

CONTRIBUTIONS OF AUTHORS

Janesh Gupta is guarantor for this review. Justus Hofmeyr updated an earlier version of the review, and reviewed the current update. Akanskha Sood assessed new papers, extracted data and assessed risk bias for the review and updated the review in light of new evidence. Joshua Vogel helped with analysis and review of the data.

DECLARATIONS OF INTEREST

Janesh K Gupta: I am Editor-in-Chief for the European Journal of Obstetrics and Gynaecology (EJOG); I have received fees for consultancy from Femcare-Nikodem Medicem and expert testimonies in relation to medicolegal reports; my institution has received money from Health Technology Assessment (HTA) grants; I have received royalties from core clinical cases undergraduate text books; and I am an author of a trial included in the systematic review (Gupta 1989) – trial assessment for inclusion, risk of bias, and data extraction were carried out by the other review authors (Justus Hofmeyr and Manjeet Shehmar (author in a previous version)), who were not directly involved in the study.

Akanksha Sood: None known.

G Justus Hofmeyr: GJH is conducting a study which may be considered for inclusion in this review (Hofmeyr 2015). He will not participate in decisions regarding the study.

Joshua P Vogel: JPV is conducting a study which may be considered for inclusion in this review (Hofmeyr 2015). He will not participate in decisions regarding the study.

SOURCES OF SUPPORT

Internal sources

- (GJH) Effective Care Research Unit, University of the Witwatersrand, University of Fort Hare, Eastern Cape Department of Health, South Africa.

External sources

- UNDP-UNFPA-UNICEF-WHO-World Bank Special Programme of Research, Development and Research Training in Human Reproduction (HRP), Department of Reproductive Health and Research (RHR), World Health Organization, Switzerland.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Outcomes were separated into Primary and Secondary outcomes, and the methods have been updated in accordance with the Cochrane *Handbook* (Higgins 2011).

Manual removal of placenta, shoulder dystocia, and need for blood transfusion were included in the review but were not listed as prespecified outcomes in our protocol.

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

The following outcomes were removed from the review for this update.

- Uterine efficiency (contraction intensity, frequency).
- Blood pressure.
- Long-term perineal pain/discomfort.
- Dyspareunia.
- Maternal experience of and satisfaction with second stage of labour.
- Persistent occipito-posterior position at birth.
- Neonatal condition.

INDEX TERMS

Medical Subject Headings (MeSH)

*Labor Stage, Second; Anesthesia, Epidural; Cesarean Section [statistics & numerical data]; Delivery, Obstetric [*methods]; Episiotomy [statistics & numerical data]; Hemorrhage [etiology]; Patient Positioning [adverse effects] [*methods]; Perineum [injuries]; Randomized Controlled Trials as Topic; Supine Position; Time Factors; Uterine Hemorrhage [prevention & control]

MeSH check words

Female; Humans; Pregnancy

Copyright © 2017 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.