

Systematic Review

Impact of first-stage ambulation on mode of delivery among women with epidural analgesia

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Abstract

Background: New techniques for administering epidural analgesia allow increased mobility for labouring women with epidurals.

Aim: To determine the effect of ambulation or upright positions in the first stage of labour among women with epidural analgesia on mode of delivery and other maternal and infant outcomes.

Methods: We undertook a systematic review and meta-analysis of randomised controlled trials (RCT) of ambulation or upright positions versus recumbency in the first stage of labour among women with effective first-stage epidural analgesia in an uncomplicated pregnancy. Trials were identified by searching Medline, Embase and CINAHL databases and the Cochrane Trials Register to March 2004. Trial eligibility and outcomes were prespecified. Group tabular data were obtained for each trial and analysed using meta-analytic techniques.

Results: There were five eligible RCT, with a total of 1161 women. There was no statistically significant difference in the mode of delivery when women with an epidural ambulated in the first stage of labour compared with those who remained recumbent: instrumental delivery (relative risk (RR) = 1.16, 95% confidence interval (CI) 0.93–1.44) and Caesarean section (RR = 0.91, 95% CI 0.70–1.19). There were no significant differences between the groups in use of oxytocin augmentation, the duration of labour, satisfaction with analgesia or Apgar scores. There were no apparent adverse effects of ambulation, but data were reported by only a few trials.

Conclusions: Although ambulation in the first stage of labour for women with epidural analgesia provided no clear benefit to delivery outcomes or satisfaction with analgesia, neither were there any obvious harms.

Key words: ambulation, epidural, forceps, instrumental delivery, meta-analysis, upright.

Introduction

Ambulation or upright positions during labour have a number of physiological benefits, including the effect of gravity and increased pelvic dimensions, which may decrease the need for instrumental deliveries.¹ Given the strong association between epidural analgesia for labour and instrumental delivery,^{2,3} women with epidural analgesia may benefit from walking, or maintaining an upright position, during labour. Traditional epidurals have limited the ability of women to walk and move around during labour because of the effects on lower limb sensation and muscle control. However, recent changes in the administration of regional analgesia for labour allow the maintenance of lower limb motor power, making walking possible. Compared with traditional epidurals, both low-dose ('light') epidurals (epidural opioid with or without a very low dose of a local anaesthetic agent) and combined spinal epidurals (CSE) preserve lower limb motor power.^{4–7} Whether ambulation in the first stage of

labour improves the delivery outcomes for women with an epidural is unclear.

We undertook a systematic review and meta-analysis of randomised controlled trials that compared ambulation or upright positions with recumbent (lying down) positions in the first stage of labour for women with epidural analgesia. We sought to determine the effect of ambulation on mode of

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All authors were involved in preparing the study protocol, selecting studies for inclusion, assessing study quality and extracting data. CR entered the data. CR and CS conducted the meta-analyses. All authors interpreted the data, wrote the paper and approved the final draft for submission.

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delivery and whether there were differences in other maternal and infant outcomes.

Methods

Relevant studies were identified by searching the electronic databases Medline, Embase, CINAHL and the Cochrane Central Register of Controlled Trials up to March 2004. Key word searches were performed using the terms 'obstetric analgesia', 'epidural', 'extradural', 'intrathecal' or 'spinal' anaesthesia and 'labour' (or labor) and 'ambulat*', 'walk*', 'upright' or 'stand*'. The electronic search was supplemented by cross-checking the reference lists of published papers.

The prespecified inclusion criteria were randomised controlled trials of ambulation or upright positions versus recumbency in the first stage of labour for women who had effective regional analgesia established in the first stage of labour in an uncomplicated pregnancy. Mode of delivery was a required outcome. Only published full-text articles were eligible. Abstracts and unpublished trials were ineligible, as were randomised trials that included complicated or high-risk pregnancies. Two reviewers independently assessed each study for inclusion in the review. Each study was also assessed for allocation concealment, loss to follow up and intention-to-treat analysis. Trials were ineligible if there was inadequate allocation concealment (such as alternate allocation or use of record numbers), if outcome data were unavailable for more than 20% of participants or if the analysis was not according to intention-to-treat. Blinding was not possible. Any disagreement over inclusion of a study or quality assessment was to be resolved by consensus after discussion.

Our *a priori* definition of upright positions included walking, standing or sitting and, for recumbence, included supine or lateral positions <45° from the horizontal.

All outcomes were prespecified. The primary outcome was instrumental delivery. Secondary maternal outcomes included Caesarean section (CS), spontaneous vaginal delivery, oxytocin augmentation, length of first stage (time from epidural insertion to full dilatation), length of second stage (time from full dilatation to delivery), perineal laceration (episiotomy, second-, third- or fourth-degree tears), post-partum haemorrhage (estimated blood loss >500 mL), inadequate pain relief, satisfaction with labour care and longer-term outcomes, including urinary or faecal incontinence and sexual problems or back ache. Potential adverse outcomes included maternal hypotension, motor block, bladder catheterisation, fetal heart rate (FHR) abnormalities or falls during ambulation. Secondary infant outcomes included Apgar scores, need for positive pressure ventilation, admission to a neonatal intensive care unit (NICU), birth trauma and perinatal death.

We also prespecified subgroup analyses for factors where clinical heterogeneity seemed plausible: parity (first birth and second or subsequent births), type of regional analgesia (intermittent bolus, continuous infusion or combined spinal epidural) and high study quality (adequate allocation concealment, <20% loss to follow up and intention-to-treat analysis).

Data were independently extracted from each paper by two reviewers onto a standard data extraction form. We performed statistical analyses using STATA statistical software version 7.0 (STATA Corp., College Station, TX, USA). For each dichotomous outcome of interest within individual studies, relative risks (RR) and 95% confidence intervals (CI) were calculated according to the intention to treat. For continuous variables, the weighted mean differences (WMD) and 95% CI were calculated. The assumption of homogeneity of treatment effect between studies was tested using Cochran's *Q*-test statistic and the I^2 test.⁸ Overall estimates of effect were calculated with a fixed effect model (Mantel-Haenszel) but, if the assumption of homogeneity was rejected ($P < 0.1$), a random effects model (DerSimonian) was used.⁹

Results

The search strategy yielded 117 citations, of which 19 were duplicate citations. Of the 98 studies identified initially, 88 were excluded because of lack of an appropriate study population (e.g. not among women with regional analgesia) or study design. A further five were excluded because of lack of randomisation¹⁰⁻¹³ or because ambulation was assessed only in the second stage of labour.¹⁴ Five randomised controlled trials were ultimately included (Table 1).¹⁵⁻¹⁹

All five studies were randomised trials with intention-to-treat analyses. Although blinding of women and carers was not possible, Collis *et al.* reported that obstetricians attending for instrumental deliveries were unaware of the group allocation.¹⁵ Allocation concealment was by computer program in one trial,¹⁸ by opaque sealed envelopes in two trials^{15,16} and not reported in the other two trials.^{17,19} Post-randomisation exclusions were minimal (ranging from 0%¹⁵ to 5.6%¹⁹).

The inclusion criteria for each study were similar (singleton, cephalic presentation at term in uncomplicated pregnancies with epidural analgesia in the first stage of labour). The trials used varying epidural and ambulatory interventions (Table 1). Three studies were limited to nulliparous women.^{15,18,19} Nageotte *et al.*¹⁸ only included women with spontaneous onset of labour, whereas the other four trials also included labour inductions. Only two arms of the latter three-arm trial were included in the present review; the third arm compared a different type of epidural (continuous infusion of 0.125% bupivacaine with 2 µg/mL fentanyl at 10 mL/h), not ambulation.¹⁸ All studies required a period of bed rest after initiation of regional analgesia and assessed women for postural hypotension, motor block and FHR abnormalities prior to ambulation. Three studies specified that another person accompanied the women when they walked.^{16,18,19} In four studies, ambulation occurred only during the first stage of labour,^{15,16,18,19} whereas in the study of Karraz,¹⁷ women also walked during the second stage of labour but returned to bed for delivery (M. A. Karraz, pers. comm., 2003).

There were no statistically significant differences in the mode of delivery (instrumental delivery, CS or spontaneous vaginal birth) for women who were ambulant or recumbent

Table 1 Characteristics of included randomised controlled trials of ambulation versus recumbence in women with epidural analgesia

Reference (location)	Epidural type and dose	Study size	Intervention	Compliance with allocation	Labour management
Collis <i>et al.</i> ¹⁵ (UK)	CSE; spinal 25 µg fentanyl/2.5 mg bupivacaine; epidural (intermittent boluses) 2 µg/mL fentanyl/0.1% bupivacaine	229 nulliparae	Walk, stand or sit in chair at least 20 min every hour <i>vs</i> sit up or lie in bed	Ambulatory: 46% mobile for ≥20 min, 40% for <20 min and 14% remained in bed; recumbent: 13% got out of bed for short periods	Intermittent FHR monitoring; continuous FHR monitoring (if indicated) or use of oxytocin required ambulatory group to walk, stand or sit near the bed; amniotomy and then oxytocin augmentation for lack of progress; return to bed at full cervical dilatation; second stage limited to 2 h and, if birth not, imminent instrumental delivery performed
Frenea <i>et al.</i> ¹⁶ (France)	Intermittent boluses of 0.08% bupivacaine–adrenaline plus 1 µg/mL surfentanal	36 nulliparae, 25 multiparae	Walk for 25% first stage (15 min/h) <i>vs</i> dorsal or lateral recumbence	Ambulatory: 83% walked for a mean of 64 ± 34 min; recumbent: 100% in bed	Continuous FHR monitoring by telemetry for ambulant and fixed for recumbent; intermittent monitoring of BP; oxytocin infusion interrupted for ambulation; return to bed at full cervical dilatation
Karraz ¹⁷ (France)	Intermittent boluses of 0.1% ropivacaine/0.6 µg/mL surfentanal	148 nulliparae, 73 multiparae	Walk, sit in a chair or recline semisupine (<i>n</i> = 141) <i>vs</i> restricted to bed in supine, lateral or semisupine positions (<i>n</i> = 74)	Ambulatory: all walked but duration not recorded (study only in the daytime when more inclined to walk); recumbent: 100% in bed	Ambulatory walked in second stage but returned to bed for delivery; FHR monitoring throughout (portable for ambulatory, fixed for recumbent); portable electrical syringe if oxytocin required for ambulatory group
Nageotte <i>et al.</i> ¹⁸ (USA)	CSE; spinal 10 µg surfentanal; epidural infusion: 0.0625% bupivacaine/2 µg/mL fentanyl at 12 mL/h	505 nulliparae	Walk a minimum of 5 min/h in first stage <i>vs</i> ambulation discouraged	Ambulatory: 66% walked, duration not reported; recumbent: 15% walked	Intermittent FHR monitoring; intermittent monitoring of BP
Vallejo <i>et al.</i> ¹⁹ (USA)	Continuous epidural infusion of 0.07% ropivacaine/2 µg/mL fentanyl at 15–20 mL/h	160 nulliparae	Walking a minimum of 5 min/h, sitting in a chair or both in the first stage <i>vs</i> recumbent with head of bed ≤45°	Ambulatory: 47% walked, 27% sat and 27% both walked and sat; recumbent: 100% in bed	Portable epidural and oxytocin infusion pumps allowed ambulation; continuous FHR monitoring (by telemetry when ambulant)

CSE, combined spinal epidural; BP, blood pressure; FHR, fetal heart rate.

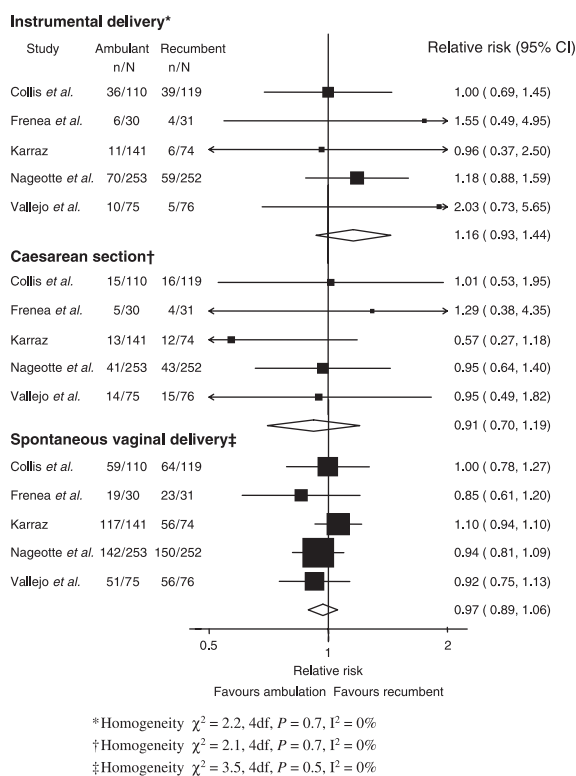


Figure 1 Mode of delivery for ambulant versus recumbent women in the first stage of labour among women with epidural analgesia.

in the first stage of labour, either in any individual study or overall (Fig. 1). This finding was consistent when examined in the prespecified subgroups by parity, type of regional analgesia and study quality.

There was no difference in the use of oxytocin augmentation among ambulant and recumbent women (Table 2). Although three studies specified augmentation after the onset of epidural analgesia^{17–19} and two did not specify the timing of augmentation,^{15,16} analysing these groups separately did not change the finding of no association. The two studies that reported the total duration of labour showed a significant pooled reduction in the length of labour of 49 min for ambulant women (Table 2).^{15,17} However, the pooled results from the two trials that reported the duration of the first and second stages of labour separately reported non-significant increases in the duration of both stages of labour for women who ambulated.^{16,19} The largest trial did not report duration of labour.¹⁸ There were no significant differences between ambulant and non-ambulant women in either the use of extra analgesia or satisfaction with analgesia at 1 day post-partum (Table 2). No pelvic floor outcomes were reported by any of the trials.

Few studies provided information on adverse events, but among those studies that did include adverse events, there were few to report (Table 2). The only study reporting motor block found it to be transient and that women randomised to ambulation subsequently walked.¹⁶ Only one study examined ability to void during labour and found that ambulation led to a significantly fewer women requiring catheterisation in the last hour of labour (Table 2). Two studies noted that there were no falls among ambulant women.^{15,17}

Overall, there was a non-significant reduction in FHR abnormalities associated with ambulation (Table 2). The two studies that reported FHR abnormalities had similar relative risks despite using different definitions (FHR changes requiring fetal blood sampling¹⁵ vs periodic FHR abnormalities¹⁸). Of note, both these studies used intermittent FHR monitoring unless there was an indication for continuous monitoring.

Table 2 Maternal and infant outcome measures for ambulant versus recumbent with epidural analgesia

Outcome	Reference	No. women	Statistical measure (model type†)	Effect size (95% CI)
Maternal outcomes				
Oxytocin augmentation	15, 16, 17, 18, 19	1161	RR (fixed)	0.99 (0.90, 1.08)
Duration of first stage of labour	16, 19	204	WMD (fixed)	32.6 (–4.0, 69.3)
Duration of second stage of labour	16, 19	202	WMD (fixed)	2.5 (–15.2, 20.2)
Duration of labour	15, 17	444	WMD (fixed)	–48.5 (–77.0, –20.1)
Extra doses of analgesia	17, 18	720	RR (random)	0.57 (0.22, 1.48)
Satisfaction with analgesia	15, 16	290	RR (fixed)	1.07 (1.00, 1.16)
Hypotension	16, 17*, 18	781	RR (fixed)	1.12 (0.52, 2.45)
Motor block	16, 17*, 19*	427	RR (single trial)	0.52 (0.10, 2.61)
FHR abnormalities	15, 18	734	RR (fixed)	0.83 (0.56, 1.22)
Bladder catheterisation	16	61	RR (single trial)	0.75 (0.58, 0.96)
Headache	18	505	RR (single trial)	1.00 (0.14, 7.02)
Infant outcomes				
Low Apgar at 1 minute‡	16, 19	212	RR (fixed)	0.87 (0.30, 2.51)
Low Apgar at 5 min§	15, 16*, 18, 19	946	RR (fixed)	1.03 (0.34, 3.12)

*Studies recorded the outcome, but had no events in either group so do not contribute to the pooled result.

†Specifies whether a fixed- or random-effects model was used.

‡1 min Apgar <7.

§5 min Apgar <7^{15,16,18} or <9.¹⁹

RR, relative risk; WMD, weighted mean difference; FHR, fetal heart rate.

The pooled results for low Apgar scores show no statistically significant differences at 1 or 5 min for the babies of ambulant or recumbent mothers (Table 2). Data on the other pre-specified infant outcomes were not reported.

Discussion

The present systematic review and meta-analysis incorporates data on 1161 women from five well-conducted randomised controlled trials. It did not demonstrate any clear clinical benefit from ambulation or upright positions during the first stage of labour for women with epidural analgesia and the confidence intervals for the pooled relative risks make it unlikely that there are important clinical benefits to be gained from ambulation. No harms for mothers or infants were associated with ambulation among women with low-dose epidurals, but reporting of adverse events was lacking in most studies. The possibility that ambulation may increase the risk of instrumental delivery cannot be excluded. The consistency of the findings by parity, type of epidural (intermittent boluses, continuous infusion or CSE) and varying instrumental delivery rates (ranging from 7%¹⁹ to 33%¹⁵ in the controls) suggests the results are likely to be generalisable to delivery suites that offer epidurals for labour analgesia.

The lack of clear advantage or disadvantage associated with ambulation or upright positions in the first stage of labour is consistent with findings of a meta-analysis (five trials, 1034 women)²⁰ and a subsequent large trial ($n = 536$)²¹ of ambulation in the first stage among women without an epidural. The pooled odds ratio of instrumental delivery from the meta-analysis was 0.96 (95% CI 0.72–1.29)²⁰ and the relative risk from the subsequent trial was 1.34 (95% CI 0.72–2.48).²¹ Although women with an epidural are at increased risk of instrumental delivery, we found no evidence that ambulation or upright positions in the first stage of labour reduces this risk. However, our findings are limited to the first stage of labour and should not be generalised to upright positions in the second stage of labour.

There was some variation in the definition of upright positions across the trials (Table 1), in particular some trials had a time goal for the duration of walking as part of the intervention. Compliance with the intervention as designed ranged from 46%¹⁵ to 100%^{17,19} however, it can be seen that compliance was lowest in the most specific intervention (walk, stand or sit = 20 min each hour of the first stage) and highest when the intervention was less specific (no time limit or minimum of 5 min each hour in an upright position). Of note, Karraz¹⁷ limited his trial to the daytime when women are likely to be more inclined to walk and all women in the ambulation group walked, although the duration was not reported. Compliance tended to be higher in the recumbent arms of the trials with three trials reporting 100% compliance with recumbency^{16,17,19} and the other two reporting only minor violations.^{15,18}

The difficulties these trials experienced with compliance reflect the likely reaction if ambulation was encouraged in

a delivery suite. For some women, a request for epidural occurs when pain and possibly exhaustion become overwhelming. Such women may be disinclined to ambulate and would prefer to rest, at least initially. However, studies of positions in labour among women without epidurals indicate that some women will move around if allowed but, unless instructed or encouraged to try an upright position or walk, most are likely to remain in bed.²² Studies of ambulation can only assess the 'intention to ambulate' because women should not be expected to maintain positions they find uncomfortable or exhausting.^{20,22}

Plaat and Razzaque suggest that as long as ambulation with an epidural is shown to be safe, then women with epidurals should be allowed to ambulate.²³ However, there are several barriers that need to be overcome before women with epidurals are encouraged to walk or get out of bed. If ambulation was to be encouraged among women with low-dose epidurals, obstetricians and anaesthetists would need to either forgo continuous electronic fetal monitoring or convince their unit to invest in telemetry. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists recommends continuous electronic fetal monitoring for women with epidural analgesia and this is current practice in most Australian hospitals.^{24,25} Portable syringe pumps for oxytocin may also need to be purchased. Criteria for safe ambulation will need to be developed and adhered to. Douglas suggests the following:⁴ (i) no obstetrical contraindication, such as an unengaged presenting part; (ii) no change (<10%) in lying and sitting blood pressure; (iii) the ability to straight leg raise both legs; (iv) the ability to do one or more deep knee bends at the bedside; and, most importantly, (v) having someone to accompany them. Whether the latter person could be a partner or support person or whether it should be a midwife would need to be specified. Elton *et al.* would add a test of proprioception, such as Romberg's sign, and a supervised trial of walking to the minimum test requirements.⁵ Although none of these requirements is insurmountable, they do require delivery ward staff time and, possibly, the purchase of equipment.

Conclusions

Various strategies have been proposed to deal with the effects of an epidural on the length of labour and delivery outcomes.^{26,27} For women with low-dose epidurals, although ambulation in the first stage of labour provides no clear benefit to delivery outcomes or satisfaction with analgesia, there is no reason why these women should not walk or move around. However, providing support for ambulation in the first stage of labour may consume scarce resources that could be devoted to interventions with demonstrated benefits.

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