Posture and fluids for preventing post-dural puncture headache (Review)

Arevalo-Rodriguez I, Ciapponi A, Munoz L, Roqué i Figuls M, Bonfill Cosp X

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TABLE OF CONTENTS

[Intervention Review]

Posture and fluids for preventing post-dural puncture headache

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ABSTRACT

Background

Post-dural puncture headache (PDPH) is a common complication of lumbar punctures. Several theories have identified the leakage of cerebrospinal fluid (CSF) through the hole in the dura as a cause of this side effect. Therefore, it is necessary to take preventive measures to avoid this complication. Prolonged bed rest has been used as a therapeutic measure once PDPH has started, but it is unknown if it can be also be used to prevent it. Similarly, the value of administering fluids additional to those of normal dietary intake to restore the loss of CSF produced by the puncture is unknown.

Objectives

To assess whether prolonged bed rest combined with different body and head positions, as well as administration of supplementary fluids after lumbar puncture, prevent the onset of PDPH in people undergoing lumbar puncture for diagnostic or therapeutic purposes.

Search methods

We searched the Cochrane Controlled Trials Register, MEDLINE, EMBASE, and LILACS up to June 2013.

Selection criteria

We identified randomized controlled trials (RCTs) that compared the effects of bed rest versus early/immediate mobilization, head-down tilt versus horizontal position, prone versus supine positions during bed rest, and administration of supplementary fluids versus no/less supplementation, as prevention measures for PDPH in people who have undergone lumbar puncture.

Data collection and analysis

Two review authors independently assessed the studies for eligibility through the web-based software EROS (Early Review Organizing Software). Two different review authors independently assessed risk of bias using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions*. We solved any disagreements by consensus. We extracted data on cases of PDPH, severe PDPH, and any headache after lumbar puncture and performed intention-to-treat analyses and sensitivity analyses by risk of bias.

Main results

We included 23 trials (2477 participants) in this review. There was no beneficial effect associated with bed rest compared with immediate mobilization on the incidence of PDPH (risk for bed rest 26.4%; risk for mobilization 20.5%; risk ratio (RR) 1.30; 95% confidence interval (CI) 1.09 to 1.55), severe PDPH (risk for bed rest 10.6%; risk for mobilization 10.7%; RR 1.00; 95% CI 0.75 to 1.32), and presence of any headache after lumbar puncture (risk for bed rest 33.6%; risk for mobilization 28.6%; RR 1.18; 95% CI 1.05 to 1.32). Analyses restricted to the most methodologically rigorous trials gave similar results. Likewise, the two trials that assessed fluid supplementation did not find this preventive measure to be useful in the prevention of PDPH.

Authors' conclusions

There is no evidence from RCTs that suggests that routine bed rest after dural puncture is beneficial for the prevention of PDPH onset. The role of fluid supplementation in the prevention of PDPH remains unclear.

PLAIN LANGUAGE SUMMARY

Postures and fluids for preventing post-dural puncture headache

Some doctors advise their patients to remain in bed after a lumbar puncture and to increase fluid intake to prevent the occurrence of a complication called post-dural puncture headache (PDPH). PDPH limits a person's mobility and daily activities while presenting additional efforts for both the patient and the health institution. This review found that bed rest does not prevent the onset of headaches after lumbar puncture procedures, regardless of the duration of rest, or the body or head positions assumed by the patient. We also found few data on the usefulness of additional fluid intake, which showed no preventive effect on the onset of headaches. We believe that these practices should no longer be routinely recommended to patients for the prevention of headaches after lumbar puncture.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON *[Explanation]*

Bed rest compared with ambulation for preventing post-dural puncture headache

Patient or population: participants undergoing lumbar puncture
Intervention: bed rest
Comparison: ambulation

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Ambulation	Bed rest				
Post-dural puncture headache participant's report Follow-up: 0-15 days	**205 per 1000**	**267 per 1000** (224 to 318)	**RR 1.30** (1.09 to 1.55)	1519 (12 studies)	⊕⊕⊕○ **moderate**[1]	
Severe post-dural puncture headache participant's report Follow-up: 0-15 days	**107 per 1000**	**107 per 1000** (81 to 142)	**RR 1** (0.76 to 1.33)	1568 (9 studies)	⊕⊕⊕○ **moderate**[1]	
Any cephalea participant's report Follow-up: 0-15 days	**Study population**		**RR 1.18** (1.05 to 1.32)	2477 (18 studies)	⊕⊕⊕○ **moderate**[1]	
	287 per 1000	**339 per 1000** (301 to 379)				
	Moderate					
	231 per 1000	**273 per 1000** (243 to 305)				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (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.

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Blinding of outcome assessment (detection bias) as well as randomization features (selection bias) are unclear in several trials.

BACKGROUND

Description of the condition

Post-dural (post-lumbar or post-spinal) puncture headache (PDPH) is one of the most common complications of diagnostic, therapeutic, or inadvertent lumbar punctures (Bezov 2010; Davignon 2002). PDPH is defined as any headache after a lumbar puncture that worsens within 15 minutes of sitting or standing and that is relieved within 15 minutes of lying down (IHS 2004). Ninety per cent of PDPHs occur within three days of the procedure and 66% start within the first 48 hours (Turnbull 2003).

The pathophysiology of PDPH has not been fully described. It is well known that puncture in the dura allows cerebrospinal fluid (CSF) to leak from the subarachnoid space, resulting in a decrease in CSF volume and pressure (Grande 2005). This CSF volume loss may cause a downward pull on pain-sensitive structures resulting in a headache (Ahmed 2006; Baumgarten 1987; Davignon 2002; Denny 1987; Harrington 2004). Alternatively, the loss of CSF may cause an increase in blood flow, resulting in arterial and venous vasodilation and PDPH. A third explanation involves the role of substance P (a neurotransmitter/neuromodulator involved in pain perception) and the regulation of neurokinin 1 receptors (NK1R) (Clark 1996).

Occurrence of PDPH varies from 1% to 40%, according to needle gauge, needle orientation, operator skill level, and presence of risk factors such as patient's age or history of PDPH (Turnbull 2003). During anaesthetic procedures (e.g. epidural anaesthesia), PDPH is most commonly caused by an unintentional dural puncture (Thew 2008; Turnbull 2003). In contrast, during diagnostic or therapeutic lumbar punctures, the need for adequate CSF flow requires an intentional lesion that may give rise to PDPH (Kuczkowski 2006). Estimated frequencies vary from less than 10% following spinal anaesthesia (Hafer 1997; Vallejo 2000), to 36% following diagnostic lumbar punctures (Lavi 2006; Vallejo 2000) and up to 81% in women with inadvertent dural puncture during active labour. Reported risk of inadvertent dural puncture placement during epidural anaesthesia in women ranges from 0.04% to 6% (Berger 1998; Choi 2003). A significant number of mothers cannot provide adequate care for their newborn because of the headache (Sprigge 2008).

The features of PDPH are often variable. PDPH may be accompanied by neck stiffness, tinnitus, hearing loss, photophobia, or nausea. Other features, such as the localization and duration of the headache, are less predictable (Grande 2005). Although PDPH is not a life-threatening condition, it often restricts physical activity. Likewise, length of hospital stay and medical monitoring increases, especially because patients are usually required to stay in bed for an entire day after the intervention (Angle 2005), as well as direct and indirect costs.

The variability of symptoms makes PDPH a diagnosis of exclusion. Alternative diagnoses, such as viral meningitis, sinus headache, or intracranial haemorrhage should be ruled out first (Turnbull 2003). Once PDPH is diagnosed, the initial treatment involves conservative measures such as bed rest and analgesics. If PDPH continues for more than 72 hours, a more specific treatment is indicated (Ahmed 2006). Severe PDPH may respond to some therapeutic drugs and administration of an epidural blood patch (Boonmak 2010; Lavi 2006). Two Cochrane reviews on drug therapy for the prevention and treatment of PDPH are currently under way (Basurto Ona 2009a; Basurto Ona 2009b).

Description of the intervention

Many publications and reviews of PDPH have focused on treatment after the onset of symptoms. However, the prevention of PDPH is an equally important topic. Immobilization and fluid intake are the two proposed preventive methods that may foster recovery or even prevent PDPH following lumbar puncture.

Sicard first recommended bed rest after lumbar puncture in 1902. He asserted that patients should rest for 24 hours to prevent onset of PDPH (Armon 2005; Coriat 1903). Although the effectiveness of resting for symptom relief is well known, it is debatable whether bed rest prevents the development of symptoms (Davignon 2002). In addition, there is disagreement over the appropriate length of bed rest; some authors suggest that around four hours is sufficient, whereas others suggest 24 hours or more (Thoennissen 2001). It is also believed that certain body postures after lumbar puncture, such as a prone position with or without head-down tilt, may help in the prevention of PDPH onset.

The effectiveness of fluid intake on PDPH prevention has not been investigated thoroughly. Basic characteristics, such as amount of fluid intake and time of treatment, have not been established, although some studies suggest that three additional litres per day for five days is appropriate (Ahmed 2006). Despite lack of evidence, Vanzetta et al. found that hydration is a common recommendation for patients after a dural procedure. Ninety per cent of centres interviewed reported implementing it to prevent the onset of headache (Vanzetta 2005).

How the intervention might work

Prophylactic bed rest may have a mechanism of action similar to the one that has been proposed for therapeutic immobilization after the development of PDPH. CSF leakage is thought to be fundamental in the development of PDPH. Therefore, postures such as prone position after a lumbar puncture may reduce hydrostatic pressure. This may in turn reduce pressure in the subarachnoid space and allow a seal to form over the dura, thus enabling CSF leakage repair. As such, this posture may be effective in preventing PDPH onset.

Additional fluid intake may work by replacing lost corporal fluid and increasing CSF production (Ahmed 2006), thus preventing

a hydrostatic pull on pain-sensitive structures and vasodilation (Janssens 2003). By this mechanism, hydration may prevent the development of PDPH.

Why it is important to do this review

Lumbar puncture is a common clinical practice despite its potential adverse effects (Evans 2009; Grande 2005). The morbidity associated with CSF loss, besides PDPH, includes peripartum seizures, cranial subdural hematomas, and subdural fluid collection (Arendt 2009). PDPH may be the first step in a chain of adverse events that can be avoided by following a series of simple recommendations (Janssens 2003). Patient immobilization and oral intake of fluids may be valuable to avoid deleterious complications. Even though most cases of PDPH resolve within a few days, a significant number of people have at least one week of disability, while others require prolonged or recurrent hospitalization (van Kooten 2008).

A 2002 Cochrane Review on strategies to prevent PDPH included published and unpublished literature up to the year 2000 (Sudlow 2002). It is imperative to update these results in order to generate relevant recommendations for consumers, patients, and health practitioners.

OBJECTIVES

To assess the effects of posture (bed rest and different positions after lumbar puncture) and administration of supplementary fluids on the prevention of PDPH in people who underwent dural puncture for diagnostic or therapeutic purposes.

METHODS

Criteria for considering studies for this review

Types of studies

We included randomized controlled trials (RCTs) in any clinical/research setting where dural puncture was conducted. Quasi-RCTs were not included.

Types of participants

Studies that recruited males and females of all ages who had undergone lumbar puncture for medical reasons (therapeutic or diagnostic).

Types of interventions

The studies on participants undergoing lumbar puncture must have assessed one of the following interventions:

1. a period of bed rest after lumbar puncture alone or in combination with a head-down/up tilt strategy, with or without a specific body position, or even a combination of several postural strategies with immobilization, versus early mobilization;
2. head-down/up tilt versus no head-down/up tilt in participants prescribed with a period of bed rest;
3. prone versus supine posture in participants assigned to immobilization;
4. administration of supplementary fluids (oral or intravenous) after lumbar puncture versus no/less administration; and
5. any combination of points 1 to 4.

Types of outcome measures

Primary outcomes

We assessed the presence of PDPH defined as each headache that worsened within 15 minutes of sitting or standing and that was relieved within 15 minutes of lying down as the primary outcome (IHS 2004). We used the valid PDPH diagnosis criteria specified by the International Headache Society (IHS) (IHS 2004), as well as the definition used in each study.

Secondary outcomes

We assessed the presence of severe PDPH using the definition used in each study, which could be based on specific features (e.g. duration of PDPH), a visual analogue score (VAS), or other criteria, such as need of specialized treatments to relieve the headache (e.g. epidural blood patch). Likewise, we assessed information on any headache subsequent to the lumbar puncture procedure in order to incorporate any possible data that had not been catalogued as PDPH.

Search methods for identification of studies

Electronic searches

We used the Cochrane Central Register of Controlled Trials (CENTRAL) as the primary source where all relevant RCTs could be identified (The Cochrane Library 2013, Issue 6). We used a modified version of the CENTRAL search for searching MEDLINE (1966 June week 4, 2013), EMBASE (1974 to 2013 week 4) and LILACS (inception to June 2013). The search terms were a combination of thesaurus-based and free-text terms, both related to the intervention (lumbar puncture in neurological, anaesthesia or myelography settings) and the outcome. We applied no language restrictions.

See Appendix 2, Appendix 3, Appendix 4 and Appendix 5 for details of the CENTRAL, MEDLINE, EMBASE, and LILACS search strategies.

Searching other resources

We handsearched reference lists from retrieved studies as well as information from clinical trial registration web-sites. We used unpublished information collected by previous authors of a systematic review that assessed strategies aimed at preventing PDPH to gather information on allocation and blinding of outcomes (Sudlow 2002).

Data collection and analysis

Selection of studies

Two review authors (IA and LM) independently conducted a selection of eligible studies through the web-based software EROS (Early Review Organizing Software) (Ciapponi 2011; Ciapponi 2011a; Glujovsky 2010). The review authors reviewed titles and abstracts of all identified studies to determine if they fulfilled the inclusion criteria. Full-text publications of the selected studies were assessed to confirm their relevance for inclusion. We solved any disagreements through discussion with a third review author (AC). Review authors were not blinded to name and affiliation of study authors, journal of publication, or study results at any stage of the review.

Data extraction and management

Two review authors (IA and LM) used pre-designed and tested data extraction forms to extract information on participants, methods of randomization, blinding, comparisons of interest, number of participants originally randomized by arm, people lost to follow-up, and outcomes. Reasons for exclusion of potential studies were recorded in the Characteristics of excluded studies table. We clarified any disagreements by discussion with a third review author (MR). We entered extracted data into Review Manager 5 for analysis (RevMan 2011).

Assessment of risk of bias in included studies

Two review authors (MR and AC) independently assessed risk of bias of the included studies using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We considered five domains (sequence generation, allocation concealment, blinding in outcomes assessment, incomplete outcome data and selective reporting bias); each one of them was classified as low risk of bias, high risk of bias, or unclear risk of bias. We resolved any disagreements by discussion or by consulting a third review author (XB).

Measures of treatment effect

We presented results as summary risk ratios (RR) with 95% confidence intervals (CIs). We used the numbers needed to treat for an additional harmful outcome (NNTH) statistic as an absolute measure of harm. We calculated NNTH as the reciprocal of risk differences (RD) (McQuay 1998).

Dealing with missing data

We retrieved levels of attrition data when available. We conducted sensitivity analyses to explore the impact of including studies with high levels of missing data in the overall assessment of treatment effect. When possible, we carried out analyses on an intention-to-treat (ITT) basis (i.e. we attempted to include all participants randomized to each group). We assumed that any participant lost to follow-up had not experienced the respective outcome.

Assessment of heterogeneity

We assessed heterogeneity of effect sizes by means of the I^2 statistic. An I^2 greater than 30% was indicative of heterogeneity.

Data synthesis

We carried out statistical analysis using the Cochrane Review Manager 5 software (RevMan 2011). If we detected homogeneity of effects sizes (I^2 < 30%), we combined the data using the fixed-effect model. For I^2 ranging from 30% to 60%, we planned to use a random-effects model after a full assessment of clinical similarity among the studies (Higgins 2003). If clinical heterogeneity was present, we did not combine the studies.

Subgroup analysis and investigation of heterogeneity

For included studies that provided the necessary data (> 200 people), we assessed the following subgroup analyses:

1. participants undergoing dural puncture for anaesthesia only, diagnosis only, or myelography only;
2. subgroup analysis for gender;
3. subgroup analysis for age;
4. subgroup analysis for posture during the lumbar puncture (e.g. lateral or sitting up);
5. subgroup analysis for needle gauge (e.g. 22, 29);
6. subgroup analysis for needle tips (e.g. pencil-point, diamond, double bevel); and
7. subgroup analysis for amount of CSF aspirated.

Sensitivity analysis

Sensitivity analyses included assessment of the effect on the primary outcome by excluding any study with high or unclear risk of bias in any of the following:

1. allocation features;
2. levels of missing data; or
3. blinding of outcome assessment.

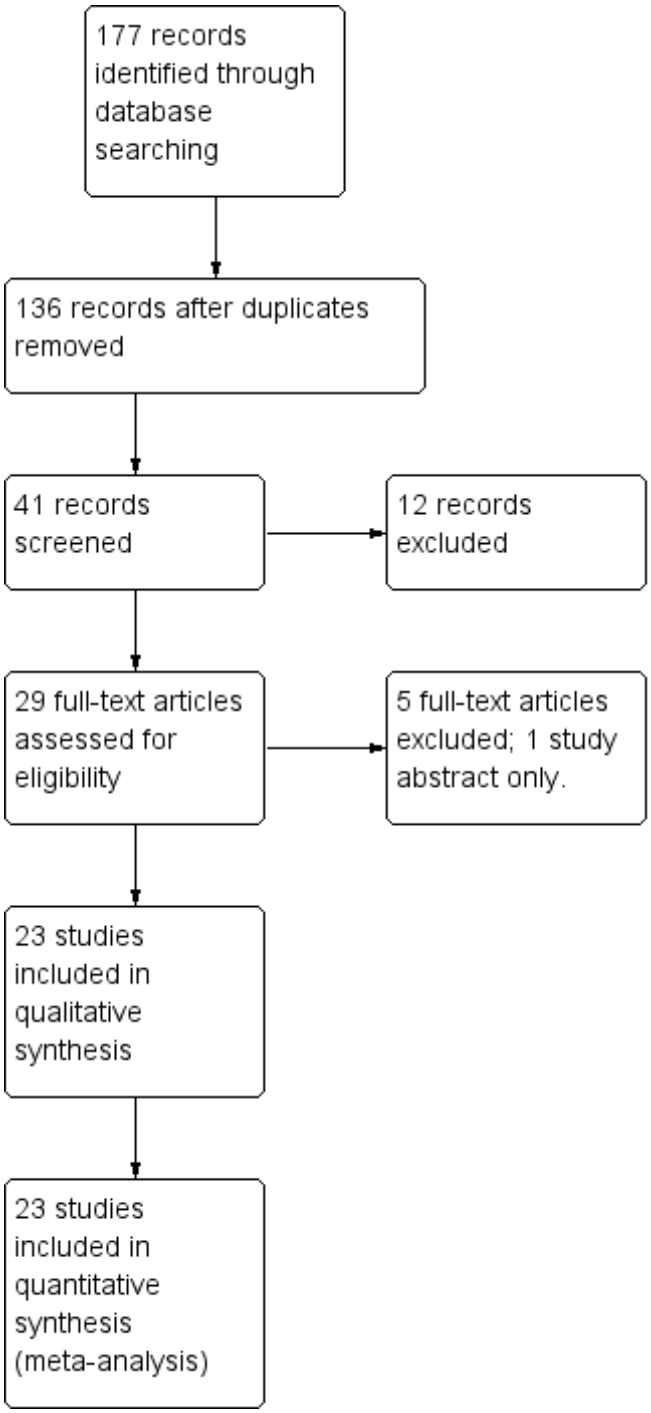
RESULTS

Description of studies

Results of the search

We identified 29 studies for possible inclusion: 26 on postures and bed rest, and three on supplementary fluids (Figure 1). Most of the studies were published in the 1980s (Andersen 1986; Carbaat 1981; Congia 1985; Cook 1989; Dieterich 1985; Dieterich 1988; Gulati 1981; Handler 1982a; Hilton-Jones 1982; Jensen 1987; Macpherson 1983; Macpherson 1984; Macpherson 1985; Robertson 1980; Smith 1980; Teasdale 1983; Thornberry 1988; Vilming 1988), one was published in 1978 (Eldevik 1978), and nine were published after 1990 (Cucereanu 2010; Ebinger 2004; Fassoulaki 1991; Hafer 1997a; Hallam 1993; Johannsson 1992; Murata 2003; Spriggs 1992; Tejavanija 2006; Vimala 1998).

Figure 1. Study flow diagram.



We excluded five of the 29 trials assessed for inclusion because they were not fully randomized (Carbaat 1981; Gulati 1981; Hafer 1997a; Hallam 1993; Spriggs 1992). One study was available only in abstract form, which had been submitted for a European Congress (Cucereanu 2010). This study was included as an ongoing trial, awaiting future full-text publication. One study was published in two different articles (Andersen 1986). Details of excluded and ongoing studies are shown in the Characteristics of excluded studies and Characteristics of ongoing studies tables.

Consequently, 23 RCTs were included. Their main features are shown in the Characteristics of included studies table. Eighteen trials with 2477 people compared either bed rest versus immediate mobilization or a longer versus a shorter period of bed rest (Andersen 1986; Congia 1985; Cook 1989; Dieterich 1985; Ebinger 2004; Fassoulaki 1991; Jensen 1987; Johannsson 1992; Macpherson 1983; Macpherson 1984; Macpherson 1985; Murata 2003; Robertson 1980; Teasdale 1983; Tejavanija 2006; Thornberry 1988; Vilming 1988; Vimala 1998). Nine of these trials involved 723 people undergoing diagnostic lumbar puncture (Congia 1985; Dieterich 1985; Ebinger 2004; Handler 1982a; Hilton-Jones 1982;Johannsson 1992;Smith 1980; Tejavanija 2006; Vilming 1988); four trials involved 381 people undergoing spinal anaesthesia for orthopaedic, urological, or obstetric procedures (Andersen 1986; Cook 1989; Fassoulaki 1991; Thornberry 1988); and seven involved 1165 people undergoing myelography (Jensen 1987; Macpherson 1983; Macpherson 1984; Macpherson 1985; Murata 2003; Robertson 1980; Teasdale 1983). One trial involved 208 people undergoing lumbar puncture for any reason (Vimala 1998).

Three trials compared the effects of a head-tilt versus no head-tilt in addition to bed rest among 106 people undergoing diagnostic lumbar puncture (Hilton-Jones 1982; Robertson 1980; Smith 1980). One of these trials also compared the effects of prone versus supine position during bed rest (Hilton-Jones 1982), while another compared prone positioning versus head-tilt followed by supine positioning (Handler 1982a). Two trials assessed the effects of supplementary fluids among 200 people undergoing either diagnostic lumbar puncture or myelography (Dieterich 1988; Eldevik 1978).

Risk of bias in included studies

Summary details of methods used in the studies are shown in the Characteristics of included studies table and illustrated in Figure 2 and Figure 3.

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

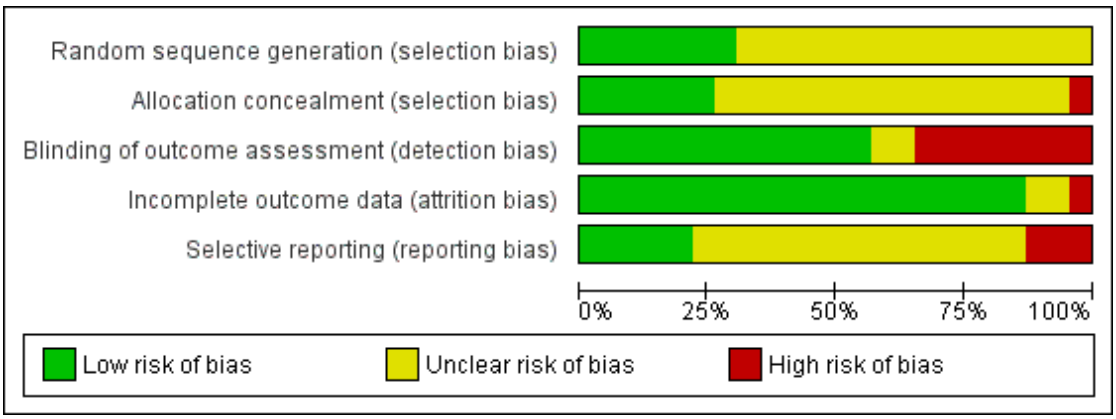
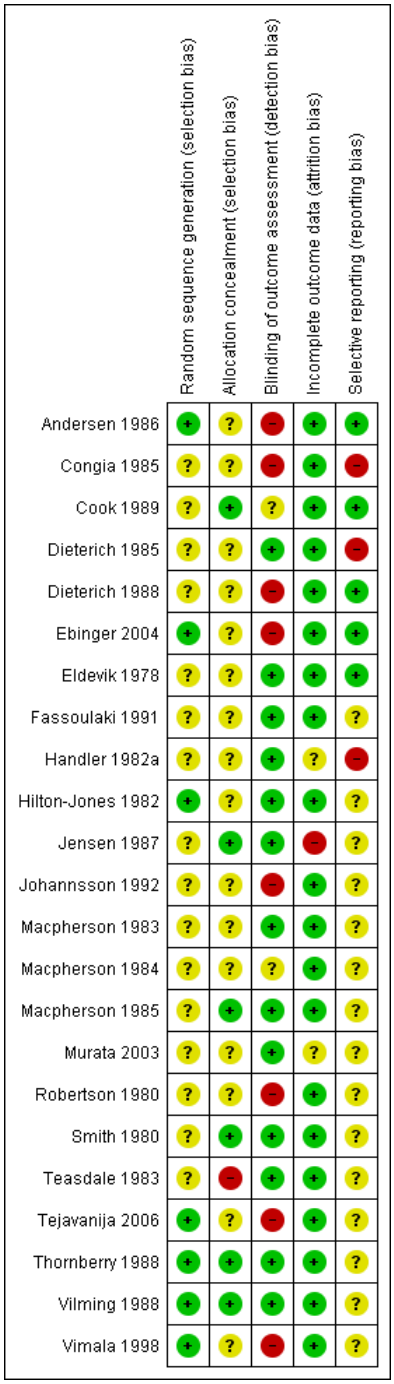


Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.



Random sequence generation and allocation concealment (selection bias)

All 23 included trials were described as randomized, although only seven contained published or unpublished information about the methodology used to allocate treatments (Andersen 1986; Hilton-Jones 1982; Tejavanija 2006; Thornberry 1988; Vilming 1988; Vimala 1998). Similarly, only six trials provided published or unpublished information about allocation concealment (Cook 1989; Jensen 1987; Macpherson 1985; Smith 1980; Thornberry 1988; Vilming 1988). Fifteen trials had an unclear risk of bias for allocation concealment (selection bias). Only two trials had low risk of bias both for random sequence generation and allocation concealment (Thornberry 1988; Vilming 1988).

Blinding (detection bias)

We did not evaluate blinding of participants and researchers in our review due to the nature of the intervention (bed rest or supplementary fluids). Outcome assessment was blinded in 13 trials (Eldevik 1978; Fassoulaki 1991; Handler 1982a; Hilton-Jones 1982; Jensen 1987; Macpherson 1983; Macpherson 1985; Murata 2003; Smith 1980; Teasdale 1983; Thornberry 1988; Vilming 1988). These trials reported assessment of cephalea by another physician or researcher who did not know the results of the randomization scheme. Seven trials did not report information about blinding or the reported information was classified as high risk of bias (Andersen 1986; Congia 1985; Dieterich 1988; Ebinger 2004; Robertson 1980; Tejavanija 2006; Vimala 1998).

Incomplete outcome data

The duration of follow-up varied between five hours to one month after lumbar puncture. In one trial, 27 of the 129 participants included for randomization were either excluded subsequently due to protocol violations or were lost to follow-up without mention of randomization group (Cook 1989). Three other trials documented minor exclusions (Handler 1982a; Murata 2003; Vimala 1998). No participants were reported as lost to follow-up in the remaining trials. Thirty-one patients who were excluded from the different analyses due to protocol violations were included in accordance to ITT analysis.

Selective reporting

High risk of reporting bias was identified in three trials given that no results were found for variables included in the methodology section (Congia 1985; Dieterich 1988; Handler 1982a). Fourteen of the 23 trials included did not provide sufficient information to assess risk of bias and were classified as having an unclear risk of bias.

Other potential sources of bias

Trials were generally small. The number of participants in each trial varied from 39 to 382. Ten trials included fewer than 100 people (Congia 1985; Fassoulaki 1991; Handler 1982a; Hilton-Jones 1982; Jensen 1987; Johannsson 1992; Robertson 1980; Smith 1980; Tejavanija 2006; Thornberry 1988). Only one trial used a power calculation to determine the number of people that had to be recruited (Vimala 1998).

Effects of interventions

See: **Summary of findings for the main comparison** Bed rest compared with ambulation for preventing post-dural puncture headache; **Summary of findings 2** Fluids compared with less or no fluids for preventing post-dural puncture headache

Bed rest versus early mobilization (Comparison 1)

Post-dural puncture headache (Analysis 1.1)

Information on PDPH was available from 12 of the 18 trials that had compared either bed rest versus immediate mobilization or a longer versus a shorter period of bed rest, comprising 61% of the people randomized in these trials (Analysis 1.1). There was no statistical heterogeneity between the results of individual trials for the primary outcome (I^2 = 0%). Bed rest resulted in more cases of PDPH compared with early ambulation (RR 1.30; 95% CI 1.09 to 1.55), corresponding to an NNTH of 17 (95% CI 10 to 50).

Severe post-dural puncture headache (Analysis 1.2)

Nine trials had data on severe PDPH, comprising 63% of people. Approximately 47% of PDPHs recorded were considered to be severe (Analysis 1.2). There were no differences between bed rest and early mobilization. In this analysis, it is unclear whether bed rest was associated with an increase or a decrease in PDPH onset due to the 95% CI (RR 1.00; 95% CI 0.75 to 1.32).

Any headache (Analysis 1.3)

All 18 trials in this comparison had outcome data for 'any headache' (Analysis 1.3). The results were very similar to those of PDPH (RR 1.18; 95% CI 1.05 to 1.32; NNTH 20; 95% CI 13 to 50). The funnel plot for this analysis was presented in Figure 4. In addition, a L'Abbé plot of bed rest versus early mobilization event rates was presented in Figure 5 (L'Abbe 1987).

Figure 4. Funnel plot of comparison: 1 Bed rest versus ambulation, outcome: 1.3 Any cephalea.

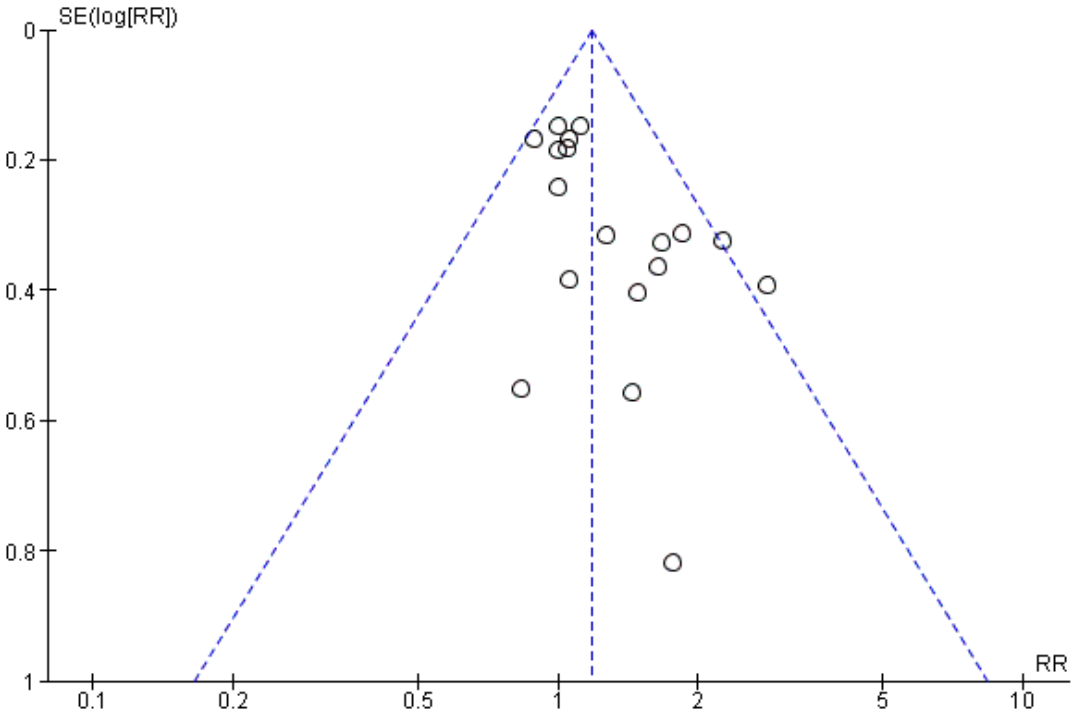
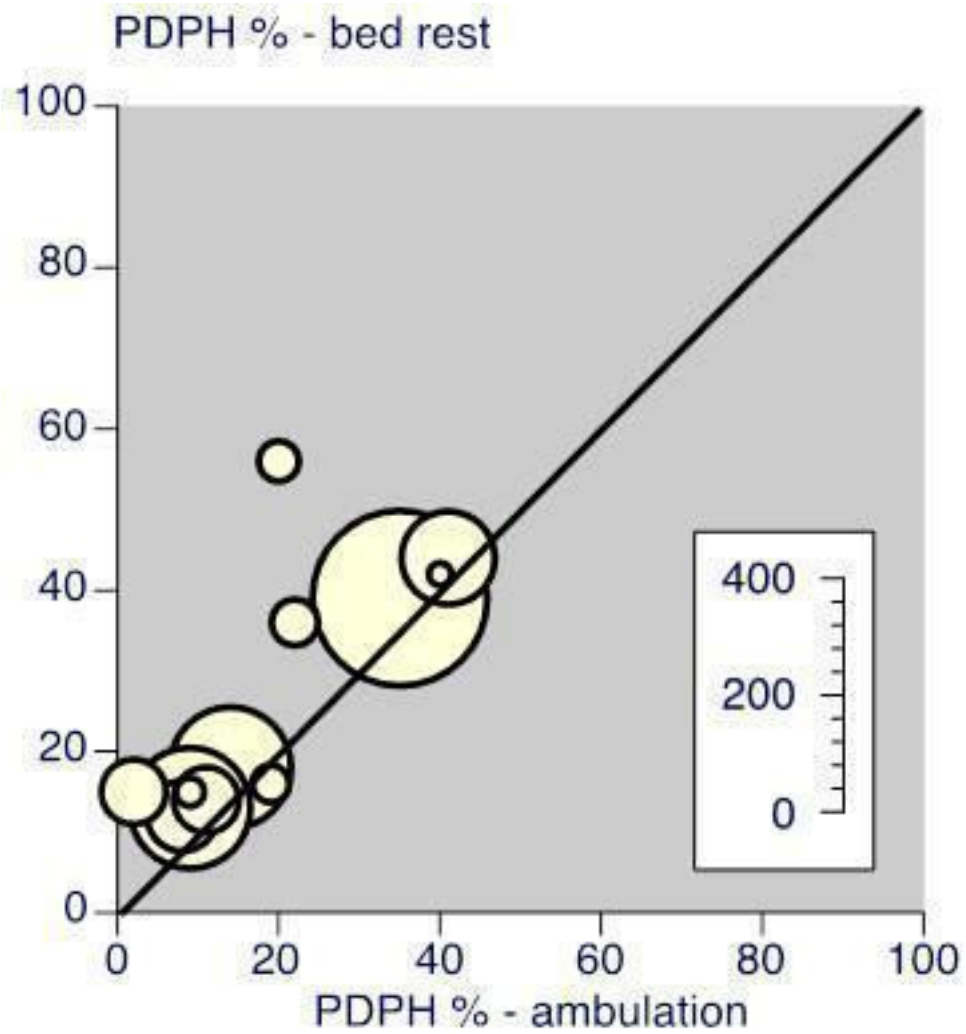


Figure 5. L'Abbé plot: Bed rest versus ambulation rates.



Bed rest versus bed rest with head-down tilt (Comparison 2)

Only one trial including 29 people had outcome data for 'any headache after lumbar puncture', comprising 1% of people randomized in the 21 included trials (Analysis 2.1). This trial suggested that there was no difference between bed rest with or without head-down tilt regarding incidence of cephalea after lumbar puncture (RR 0.81; 95% CI 0.48 to 1.38).

Prone versus supine posture (Comparison 3)

Only two trials including 120 people had outcome data for 'any headache' comprising 4.4% of people randomized in the 21 included trials (Analysis 3.1). There was no statistical heterogeneity between the results of individual trials for this outcome (I^2 = 0%). There was no difference between positions regarding incidence of cephalea after lumbar puncture (RR 0.86; 95% CI 0.54 to 1.37).

Prone or supine posture versus prone or supine posture with head-down tilt (Comparison 4 and 5)

Regarding supine position, only two trials including 87 people had outcome data for 'any headache', comprising 3.2% of people randomized in the 21 included trials (Analysis 4.1). There was no

statistical heterogeneity between the results of individual trials for this outcome (I^2 = 0%). There were more headaches associated with the supine posture with head-down tilt compared with supine position alone (RR 1.75; 95% CI 1.11 to 2.74).

Regarding prone position, only one trial including 39 people had outcome data for any headache, comprising 1.4% of people randomized in the 21 included trials (Analysis 5.1). There were no differences between prone with head-down tilt versus prone position alone regarding incidence of any cephalea after lumbar puncture (RR 1.18; 95% CI 0.58 to 2.42).

Supplementary fluids (Comparison 6)

Only one trial including 100 people had outcome data for the incidence of PDPH and severe PDPH, comprising 50% of people randomized in the two trials that studied this intervention. Data suggest that there were no differences between fluid supplementation and no supplementation on incidence of PDPH (RR 1; 95% CI 0.59 to 1.69) or incidence of severe PDPH (RR 0.67; 95% CI 0.26 to 1.73) (Analysis 6.1; Analysis 6.2). Similar results were found regarding incidence of any cephalea after lumbar puncture, which was analysed by the two trials that investigated supplementary fluids (RR 0.94; 95% CI 0.67 to 1.34) (Analysis 6.3).

Subgroup analysis

There was insufficient information on age, gender, postures during lumbar puncture, needle gauge, needle tip, and amount of CSF aspirated in order to perform the planned subgroup analysis. Information on reason for puncture was available only for trials comparing bed rest versus early mobilization.

Reason for puncture (Analyses 7.1 to 7.3).

Regarding PDPH (Analysis 7.1), there was no difference between bed rest and early mobilization in three of the four separate categories of lumbar puncture: diagnostic lumbar puncture (RR 1.16; 95% CI 0.94 to 1.43), myelography (RR 1.48; 95% CI 0.67 to 3.27), and mixed (RR 1.27; 95% CI 0.68 to 2.35). There was a small significant difference between bed rest and immediate mobilization on spinal anaesthesia data (RR 1.82; 95% CI 1.20 to 2.78), suggesting an increase in the risk of PDPH with bed rest. However, the number of people included in these trials was small and the validity of these results remains unclear.

There was no difference in severe PDPH between bed rest and early mobilization with regards to reason of lumbar puncture (Analysis 7.2), including: diagnostic lumbar puncture (RR 0.92; 95% CI 0.62 to 1.37), anaesthesia (RR 2.89; 95% CI 1.12 to 7.45), and mixed (RR 0.25; 95% CI 0.05 to 1.15). There was no information on severe PDPH in myelography trials.

There was no difference on 'any headache' after lumbar puncture between bed rest and early mobilization (Analysis 7.3) in three of four separate categories of lumbar puncture: diagnostic lumbar puncture (RR 1.16; 95% CI 0.95 to 1.42), myelography (RR 1.06; 95% CI 0.91 to 1.24), and mixed (RR 1.27; 95% CI 0.68 to 2.35). There were more headaches following spinal anaesthesia after bed rest than after immediate mobilization (RR 1.87; 95% CI 1.28 to 2.73; NNTH 14; 95% CI 4 to 17).

Sensitivity analyses (Analysis 8.1)

Two trials including 380 people had low risk of bias with regards to blinding of outcome assessment, losses to follow-up, adequate randomization and allocation concealment (Analysis 8.1). These trials compared bed rest versus early ambulation. Analysis restricted to these trials showed no difference between bed rest and early ambulation in incidence of PDPH (RR 1.19; 95% CI 0.90 to 1.56). There was no statistical heterogeneity between studies (I^2 = 0%).

ADDITIONAL SUMMARY OF FINDINGS *[Explanation]*

Fluids compared with less or no fluids for preventing post-dural puncture headache

Patient or population: participants undergoing lumbar puncture
Intervention: fluids
Comparison: less or no fluids

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Less or no fluids	Fluids				
Post-dural puncture headache participant's report	**360 per 1000**	**360 per 1000** (212 to 608)	**RR 1** (0.59 to 1.69)	100 (1 study)	⊕⊕⊕○ **moderate**[1]	
Severe post-dural puncture headache participant's report	**180 per 1000**	**121 per 1000** (47 to 311)	**RR 0.67** (0.26 to 1.73)	100 (1 study)	⊕⊕⊕○ **moderate**[1]	
Any cephalea participant's report	**396 per 1000**	**372 per 1000** (265 to 531)	**RR 0.94** (0.67 to 1.34)	200 (2 studies)	⊕⊕⊕○ **moderate**[2]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (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.

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] High risk of detection bias (blinding of outcome assessment) plus unclear risk related to randomization features.
[2] High risk of detection bias in one study; unclear risk of selection bias in both trials included.

DISCUSSION

Summary of main results

Regarding bed rest, this systematic review of all available RCTs found no evidence to suggest that a period of bed rest following dural puncture reduces the risk of PDPH, severe PDPH, or any headache. Furthermore, immobilization could even increase the risk of headache in people undergoing lumbar puncture. When we only considered trials with low risk of bias in methodological aspects such as randomization methods and blinding of outcome assessment, again there was no evidence of benefit of bed rest on the incidence of PDPH. Figure 5 shows the proportion of PDPH events in both groups (bed rest and early ambulation) by study and sample size (L'Abbe 1987). The graphics illustrate that the estimated harm could be explained by the studies with smaller sample sizes. Meanwhile studies with sample sizes of 200 or more people showed no effect (benefit or harm) due to intervention, despite the null estimation of heterogeneity. However, it could be misleading since they do not account for sampling error in both observed event rates (Sharp 1996).

A total of 26.4% of people randomized to the bed rest group in the included studies experienced a postural headache, compared with 20.5% randomized to the early mobilization groups. These figures show that 49 additional participants out of 1000 receiving bed rest will have a PDPH (with a minimum of eight and a maximum of 98). Sensitivity analysis considering only trials with low risk of bias consistently showed the lack of benefit of bed rest compared with early mobilization. Subgroup analyses only show differences in the anaesthesia subgroup (four trials), but only one trial in this analysis had low risk of bias in all categories assessed. It is also important to consider that the low number of participants involved in this analysis (381) may not be sufficient to detect differences between interventions.

These results suggest that there is no role for prolonged immobilization in lumbar puncture practice. Given that bed rest does not provide any benefit in the prevention of headaches after lumbar puncture, it becomes unnecessary to discuss the position that should be adopted during bed rest as well as modification of head postures (head-down or head-up tilt). In any case, the results of our review do not suggest any benefits related to specific body and head postures on the incidence of cephalea after lumbar puncture.

Regarding fluid supplements, we identified two trials (200 people) that studied the role of fluid supplementation following lumbar puncture. Only one of these trials provided data on incidence of PDPH and severe PDPH, and found no beneficial effect associated with fluid supplementation. Similar results were found for incidence of any headache, which was assessed by both trials. The wide 95% CIs of these comparisons preclude us from making solid conclusions about fluid supplementation in the prevention of PDPH. Sudlow et al previously estimated that a sample size of 100 to 3000 participants per arm, assuming baseline risks of 20% and 8%, respectively, would be necessary to identify a beneficial effect of this intervention (Sudlow 2002). Recruitment of this number of participants would require the involvement of several centres, as well as a considerable amount of work and resources to conduct the corresponding clinical trial.

Overall completeness and applicability of evidence

Included studies evaluated a wide range of bed rest times in order to determine if extended bed rest had any effect on the prevention of PDPH. Rest periods additional to those indicated as a result of the medical/surgical procedure ranged from 4 to 24 hours. Several head and body positions were evaluated taking into account physiological theories about PDPH. Studies that focused on supplementary fluids only assessed additional fluid intake of 1.5 to 2 L, which does not allow extrapolation to other forms of hydration, such as parenteral supplementation. Considering the nature of the medical problem and its interventions, it is likely that the evidence obtained from the included RCTs could be applied to similar populations outside of trials. It seems unlikely that publication bias could have influenced the main findings of this review, since such bias usually involves the preferential publication of trials with differences between groups. Furthermore, the funnel plot generated for the comparison with more RCTs included showed no severe asymmetries (Figure 4).

Quality of the evidence

Lack of information in published reports was a problem when assessing risk of bias. Many trials did not adequately report the study characteristics that are important to evaluate the quality of the evidence. Also, participants included in these trials cannot be blinded to the assigned interventions, which poses a possible source of bias.

Another possible source of bias in these trials arises from the nature of the outcome (headache after lumbar puncture), which depends strongly on the subjective report of participants rather than on an objective assessment. This phenomenon may have influenced the results, especially those related to an excess of PDPH risk in people on bed rest. People with limited mobility may be more susceptible to report minor discomforts or to over-rate its seriousness. Some trials implemented a blinded assessment of outcomes to partially avoid this potential source of bias. However, this assessment was misreported and its quality was unclear in several cases.

Agreements and disagreements with other studies or reviews

The previous version of this review highlighted the lack of benefit of both interventions for the prevention of PDPH of any kind (including those non-postural) (Sudlow 2002). The new evidence

identified does not alter the conclusions of the previous review but provides a warning about the probability of deleterious effects associated with bed rest. One review that included 16 trials with 1083 participants also found that extended rest did not prevent the appearance of headaches after lumbar puncture (Thoennissen 2001). No other reviews were identified on the effectiveness of fluid supplementation.

AUTHORS' CONCLUSIONS

Implications for practice

There is no evidence to support longer bed rest or fluid supplementation for preventing headache following lumbar puncture. The adoption of this practice against the evidence implies unnecessary hospital costs, patient discomfort (e.g. among women who give birth via a caesarean section), or even complications such as venous stasis in people with risk factors. Thus, rest after lumbar puncture to prevent post-dural puncture headache (PDPH) should not be routinely recommended. Instead, people should be allowed to move freely in accordance with their ability and medical recommendations.

There are no clear benefits or adverse side effects associated with additional oral fluid supplementation. People should be free to decide whether or not to increase fluid intake after lumbar puncture, unless there are medical reasons that recommend one or the other.

Implications for research

Additional research focused on longer bed rest for prevention of PDPH would not identify additional benefits associated with this intervention, which makes further studies unnecessary. Regarding fluid supplementation, more research would be desirable given the uncertainty of its role on the prevention of PDPH. However, such research would be limited and costly, and fluid supplementation is harmless and can be adopted freely with no delay of hospital discharge.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

Andersen 1986

Methods	Participants admitted to urology department who received spinal anaesthesia were randomized by means of random numbers
Participants	112 participants included in analysis
Interventions	Group A: 24-hour flat bed rest postoperatively; Group B: mobilization after anaesthesia
Outcomes	PDPH and any headache after LP
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Immediately after surgery, patients were randomized (random numbers) to group A: 24 hour flat bed rest postoperatively, or Group B: mobilization after anesthesia" - "All patients were assigned under the principle of randomness (drawing lots)"
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	Patient interviews were used to conduct pre- and postanaesthesia assessments. There was no information on whether standardized forms were used or on how incidence of headaches was collected. Follow-up assessments (2 weeks) were completed using autoadministered standardized questionnaires about headaches (quality and duration)
Incomplete outcome data (attrition bias) All outcomes	Low risk	"112 pt [patients] were included in the study". Data on tables and text corresponds to 112 participants
Selective reporting (reporting bias)	Low risk	Technical difficulties in spinal anaesthesia: number of attempts, blood in the cerebrospinal fluid Symptoms: spinal headache (incidence, onset, and duration), visual disturbances, tinnitus, low back pain, paraesthesia, leg

Andersen 1986 (*Continued*)

		cramps, satisfaction with anaesthesia

Congia 1985

Methods	Participants with indication of LP for neurological diagnostic were randomized to 2 groups. Details about random sequence generation were not provided
Participants	39 participants were included in the analysis
Interventions	Group A: bed rest for 24 hours; Group B: mobilization after LP
Outcomes	PDPH
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Randomly, 20 patients were invited to get up immediately afterwards and 19 to stay in bed for 24 hours". No details on sequence generation were provided
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	There was no information on this item
Incomplete outcome data (attrition bias) All outcomes	Low risk	39 participants were included and randomized
Selective reporting (reporting bias)	High risk	Results concerning nausea, vomiting, and neck stiffness (soon after puncture and at 7 days), as well as electroencephalography results (before and after puncture, at 24 hours and at 7 days) were not provided

Cook 1989

Methods	Participants undergoing potentially minor urological or gynaecological surgery, who received spinal anaesthesia were randomized to 2 groups
Participants	129 participants were included, but only 102 were analyzed

Cook 1989 (*Continued*)

Interventions	Group A: bed rest for 4 hours after operation; group B: bed rest for 24 hours after operation
Outcomes	PDPH and severe PDPH scored subjectively by patient
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Patients were allocated randomly after operation to either the 4-hour (Group 1) or 24-hour (Group 2) recumbency groups". No details on sequence generation were provided
Allocation concealment (selection bias)	Low risk	Information retrieved by Sudlow 2002: sealed envelopes (sequentially numbered and opaque)
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Described as "blinded trial": "Patient follow-up was achieved either by patients returning a questionnaire through the post, or more commonly by direct telephone interview on the fourth day after operation. The telephone interviewer was unaware of the length of the patient's postoperative recumbence" "No indication was given to the patient at interview of the nature of the investigation" "No particular emphasis was placed on any one of these symptoms. No indication was given to the patient that a headache was a well recognised complication of spinal anesthesia"
Incomplete outcome data (attrition bias) All outcomes	Low risk	129 participants entered, 9 lost to follow-up, 18 breaches of study protocol. 102 participants were assessed
Selective reporting (reporting bias)	Low risk	Participants were asked if they had suffered from any postoperative complaints: cough, dizziness, headache, or backache. Participants were asked to grade subjectively any complaint as mild, moderate, or severe and if any complaint was posture dependent (i.e. worse on standing)

Dieterich 1985

Methods	Participants with indication of diagnostic LP were randomized to 2 groups. Details about random sequence generation were not provided
Participants	160 neurological patients were included and analyzed
Interventions	Group A: bed rest for 30 minutes with head-down tilt at an angle of 10°. Group B: immediate mobilization
Outcomes	PDPH, severe PDPH rated by the participants (major complaints)
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"To examine the prophylactic efficacy of this postural manoeuvre in a prospective study, patients were randomly allocated to one of two groups: the members of one group were to lie with their heads tilted down at an angle of 10° for 30 min, the members of the other group were to get up immediately after LP". No details on sequence generation were provided
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	There was no information on this item
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	High risk	Results about localization and duration of PDPH were not reported

Dieterich 1988

Methods	Participants with indication of diagnostic LP were randomized to 2 groups. Details about random sequence generation were not provided
Participants	100 participants were included and assessed
Interventions	Group A: participants were asked to drink 1.5 L of fluids per day for 5 days in addition to normal clinic diet; Group B: participants were asked to drink 3 L of fluids per day for 5 days in addition to normal clinic diet

Dieterich 1988 (*Continued*)

Outcomes	PDPH; severe PDPH defined as any headache that started within a few seconds to 10 minutes after mobilization and severe enough to make the patient spend the rest of the day lying in bed (≤ 10 minutes)
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Diagnostic LP was performed on 100 age-matched, randomly allocated, neurological patients". No details about sequence generation were provided
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	There was no information on this item
Incomplete outcome data (attrition bias) All outcomes	Low risk	100 participants randomized and assessed
Selective reporting (reporting bias)	Low risk	The intensity, nature, localization, and duration of PDPH. Symptoms were recorded only if they could be convincingly reproduced by a change of position and typically improved by bed rest

Ebinger 2004

Methods	Participants 2-17 years of age who received diagnostic LP were openly randomized to 1 of 2 groups using a list of randomly assigned numbers
Participants	111 neurological participants were included and assessed
Interventions	Group A: bed rest for 24 hours. Group B: mobilization afterwards
Outcomes	PDPH and any headache after LP
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement

Ebinger 2004 (*Continued*)

Random sequence generation (selection bias)	Low risk	"Those who consented were openly randomized to one of two treatment groups using a list of randomly assigned numbers that were made known only upon consent to study participation"
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome data "were recorded by the patient, his/her parents, or the nursing staff". "Patients discharged from the hospital were contacted by telephone. Patients' complaints were assessed each day by the same person"
Incomplete outcome data (attrition bias) All outcomes	Low risk	"A total of 111 patients were included"; "Data analysis on an intent-to-treat basis was performed" No apparent missing outcome data
Selective reporting (reporting bias)	Low risk	"For the first 4 days following puncture, reports of positional headache, general headaches, backaches, nausea, or neck stiffness" "Complaints that began or became more severe following lumbar puncture and that were at least of moderate severity, affecting patients' general feeling of well-being were recorded"

Eldevik 1978

Methods	Participants who received a lumbar myelography were randomly divided into 2 groups. Details about randomization procedure were not provided
Participants	100 participants were included and assessed
Interventions	Group A: participants received 1 L of 0.9% saline and 1 L of 0.5 glucose intravenously for the last 2 hours before myelography. Group B: participants did not receive any supplementary fluids
Outcomes	PDPH and any headache after LP
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Eldevik 1978 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	"Patients were randomly divided into two groups". No details on generation were provided
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Twenty-four and 48 hours after the study, they were interviewed and examined by one of the authors who did not know which patient received fluids"
Incomplete outcome data (attrition bias) All outcomes	Low risk	"One hundred patients were included in the study." 100 participants were randomized and assessed
Selective reporting (reporting bias)	Low risk	"Each patient was asked to describe side effects, specifically headaches, nausea, vomiting, back pain and dizziness"

Fassoulaki 1991

Methods	Participants scheduled for transurethral resection of prostate under spinal anaesthesia were randomized to 1 of 2 groups. Details about randomization procedure were not provided
Participants	69 participants were included and assessed
Interventions	Group A: bed rest for 24 hours. Group B: mobilization after 8 hours
Outcomes	PDPH, severe PDPH (when patient needed bed rest plus systemic analgesics)
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Patients were randomly allocated to either early mobilization or to 24 hours bed rest ". No details on sequence generation were provided
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Each patient was asked blindly about incidence of any headaches 24, 48 and 72 hours postoperatively by one of the authors other than the anesthetist that had performed the

Fassoulaki 1991 (*Continued*)

		subarachnoid anesthesia"
Incomplete outcome data (attrition bias) All outcomes	Low risk	"Sixty-nine patients gave their consent to participate in the study." 69 participants were randomized and assessed
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Handler 1982a

Methods	Participants scheduled for diagnostic LP were randomized to 1 of 2 groups. Details about randomization procedure were not provided
Participants	50 participants were randomized but only 44 were analyzed
Interventions	Group A: 4 hours of prone bed rest following the procedure. Group B: 30 minutes of 30° head-down tilt followed by 3.5 hours of supine bed rest, following the procedure
Outcomes	Any headache after LP
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Fifty patients (27 female, 23 male) requiring diagnostic lumbar puncture, admitted as day cases, were randomly allocated to a trial group (four hours prone bed rest) or a control group (30 minutes 30° head-down tilt followed by three and a half hours supine bed rest) following the procedure". No details on sequence generation were provided
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Described as "prospective single blind trial" "Patients were interviewed blindly by one observer at five hours and again at one week or by postal questionnaire. They were asked 'How do you feel?' and if any symptoms were reported they were asked to rate them on a three-point scale. No mention was made before the procedure of headache or any other symptom"

Handler 1982a (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	50 participants were randomized. "Forty-four patients were completely assessed; 6 were excluded from the study as they could not be contacted for review at one week". The group that these participants belonged to or the reasons for discontinuation were not clear
Selective reporting (reporting bias)	High risk	Participants were asked 'How do you feel? ' and if any symptoms were reported they were asked to rate them on a 3-point scale. Any headache, neck stiffness, back pain, nausea, or vomiting was recorded

Hilton-Jones 1982

Methods	Participants admitted to neurological wards and scheduled for LP were randomized to 1 of 4 groups by drawing a card from a series of sealed envelopes
Participants	76 participants were included and assessed
Interventions	Group A: posture tilted and supine. Group B: posture tilted and prone. Group C: posture horizontal and supine. Group D: posture horizontal and prone
Outcomes	Any headache after LP
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Patients were randomly allocated to one of four groups by drawing a card from a series of sealed envelopes. Stratification by the three operators was performed prior to randomization"
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Participants were asked whether they had developed any pain, discomfort, or any other problems after LP. Headache was not specifically mentioned by the questioner. "In an attempt to exclude bias by the person who had performed the LP, all questioning of the patients was performed by the senior nurse on the ward"

Hilton-Jones 1982 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	76 participants were randomized and assessed
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Jensen 1987

Methods	Participants scheduled for lumbar myelography were randomized to 1 of 2 groups. Details about randomization procedure were not provided
Participants	81 participants were randomized but only 77 were analyzed
Interventions	Group A: bed rest for 24 hours, the first 6 hours with elevated headboard. Group B: immediate mobilization
Outcomes	Any headache after LP
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	There was no information on this item
Allocation concealment (selection bias)	Low risk	"Patients were randomized to two regimens (closed code)"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"The headache was divided into three degrees by a physician who did not know what regimen the patients had followed"
Incomplete outcome data (attrition bias) All outcomes	High risk	81 participants were randomized (40 + 41) , 3 + 1 losses to follow-up. 77 participants (37 + 40) analyzed
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Johannsson 1992

Methods	Participants scheduled for LP were randomized to 1 of 2 groups. Details about randomization procedure were not provided	
Participants	52 participants were included and analyzed	
Interventions	Group A: bed rest for 4 hours. Group B: immediate mobilization after 30 minutes	
Outcomes	PDPH, severe PDPH	
Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Mentioned but not described: "Patients were randomized by age and sex"
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	"A week after the survey asked all active on creation of the position-dependent headache with relief of scheduling"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	"Also asked about neck pain, neck stiffness, nausea, vomiting, tinnitus, photophobia, dizziness, double vision, and possibly other symptoms"

Macpherson 1983

Methods	Participants referred to radiculography were randomized to 1 of 2 groups. Details about randomization procedure were not provided	
Participants	119 participants were included and assessed	
Interventions	Group A: bed rest after procedure. Group B: immediate mobilization	
Outcomes	Any headache after LP	
Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Macpherson 1983 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	Mentioned but not described: '..random selection scheme recommended by Gore (1981)'
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	'A radiographer, unaware into which group the patient had been placed, interviewed the patient and nursing staff at approximately 24 hours and 48 hours noting any complications'
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Macpherson 1984

Methods	Participants who received iopamidol radiculography were randomly allocated into 2 groups. Details about randomization procedure were not provided
Participants	200 participants were included and assessed
Interventions	Group A: bed rest after procedure. Group B: immediate mobilization
Outcomes	Any headache after LP
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Mentioned but not described: "..Following random allocation (Gore 1981) patients were then either confined to bed overnight (B) or allowed to remain ambulant (A) after the examination"
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	"A radiographer, unaware of the group to which the patient had been assigned, interviewed the patient and nursing staff approximately 24 and 48 hours after the pro-

Macpherson 1984 (*Continued*)

		cedure to collect information on any complications"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Macpherson 1985

Methods	Participants who received iopamidol myelography were randomly allocated into 2 groups. Details about the randomization procedure were not provided
Participants	382 participants were included and assessed
Interventions	Group A: bed rest after procedure; Group B: immediate mobilization
Outcomes	Any headache after LP
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Mentioned but not described: "...Following random allocation (Gore, 1981) patients were then either confined to bed overnight (B) or allowed to remain ambulant (A) after the examination"
Allocation concealment (selection bias)	Low risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	A radiographer, unaware of the group to which the patient had been assigned, interviewed the patient and nursing staff approximately 24 and 48 hours after the procedure to collect information on any complications
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Murata 2003

Methods	Participants undergoing lumbar myelography were randomized in 1 of 2 groups. Details about the randomization procedure were not provided
Participants	207 participants were included and randomized, but only 198 were assessed
Interventions	Group A: bed rest for 20 hours without the head elevated. Group B: immediate mobilization
Outcomes	PDPH
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Mentioned but not described
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"An observer, who did not know the ambulatory status of the patients, reviewed each patient after myelography and questioned them regarding headaches"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not strict ITT analysis: "Nine patients (5 men and 4 women) in group B were excluded from the study because they could not maintain bed rest for 20 hours." The incidence of these figures on primary outcomes is low
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Robertson 1980

Methods	Participants undergoing metrizamide lumbar myelography were randomized to 1 of 3 groups. Details about the randomization procedure were not provided
Participants	90 participants were included and assessed
Interventions	Group A: horizontal position and bed rest for 1-2 hours. Group B: horizontal position and strict bed rest for 1-2 hours (bathroom privileges were denied) + head elevation to 45°/30°. Group C: immediate mobilization
Outcomes	Any headache after LP

Robertson 1980 (*Continued*)

Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Mentioned but not described
Allocation concealment (selection bias)	Unclear risk	There was no information about this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not mentioned: "The patients were followed up by a neurologist and their symptoms were recorded"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Smith 1980

Methods	Participants scheduled for LP were randomized to 1 of 2 groups. Details about the randomization procedure were not provided	
Participants	50 participants were included and assessed	
Interventions	Group A: 30 minutes 30° head-down tilt followed by 3.75 hours of supine bed rest. Group B: 4 hours of supine bed rest	
Outcomes	Any headache after LP	
Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Mentioned but not described: "Fifty patients admitted for day case lumbar puncture were randomly allocated to a control group or a trial group"
Allocation concealment (selection bias)	Low risk	Information retrieved by Sudlow 2002: The authors used opaque, numbered and sealed envelopes

Smith 1980 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Patients were blindly assessed by one observer, 5 hours and again a week after the intervention, and were asked to rate any headache on a three point scale"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	Insufficient information to permit judgement of 'high' or 'low' risk of bias

Teasdale 1983

Methods	Participants scheduled for cervical myelography were randomized to 1 of 2 groups. Details about the randomization procedure were not provided
Participants	120 participants were included and assessed
Interventions	Group A: bed rest for 24 hours with back and head elevation for the first 6 hours. Group B: immediate mobilization
Outcomes	Any headache after LP
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Mentioned but not described. Reference to Gore 1981
Allocation concealment (selection bias)	High risk	"Prior to the LP, randomized, consecutive numbers were allocated to each patient. Those receiving an even number were asked to lie supine in bed for 4 hours and were nursed in that position, while those receiving an odd number were advised to walk around at will"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"A questionnaire concerning possible side effects was completed immediately after the myelogram by the examining radiologist and again at 24 and 48 hours by a radiographer who was unaware of the category into which the patient had been allocated"

Teasdale 1983 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Tejavanija 2006

Methods	Participants undergoing diagnostic LP were randomized to 1 of 2 groups by block randomization
Participants	96 participants were eligible, but only 65 were included and assessed
Interventions	Group A: 6 hour - supine recumbence. Group B: early ambulation (< 1 hour - supine recumbence)
Outcomes	PDPH
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"After LP, patients were randomized to the standard group (6 hour-supine recumbence) or early ambulation (< 1 hour-supine recumbence) by block randomization"
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	"The authors recorded associated symptoms of PDPH such as nausea, vomiting. Severity, pain scale and treatment were assessed". No information about blinding was provided
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Thornberry 1988

Methods	Women that received subarachnoid anaesthesia for second- and third-stage procedures, excluding caesarean section, were randomized to 1 of 2 groups
Participants	80 women were included and assessed.
Interventions	Group A: 24 hours bed rest. Group B: 6 hours postspinal rest and later mobilization
Outcomes	PDPH, severe PDPH (when the patient described it as such and was obviously distressed, or if it was debilitating, persistent, and associated with additional neurological symptoms such as neck stiffness, blurred vision, or tinnitus)
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Information retrieved by Sudlow 2002: the authors used opaque, numbered and sealed envelopes
Allocation concealment (selection bias)	Low risk	Information retrieved by Sudlow 2002: the authors used opaque, numbered and sealed envelopes
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Information retrieved by Sudlow 2002: blinding of outcome assessment: yes
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Vilming 1988

Methods	Neurological patients scheduled for LP were randomized to 1 of 2 groups by drawing sealed envelopes
Participants	300 participants were included and assessed
Interventions	Group A: bed rest for 6 hours. Group B: immediate mobilization
Outcomes	PDPH; severe PDPH (postural headache that made the patient bedridden part of the day or entire day)
Notes	

Vilming 1988 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Before the study started, 300 forms were prepared, 150 for men and 150 for women. Half the forms were marked "ambulation" and half "bed rest". By drawing 1 of these forms the participants were randomly allocated to 1 of the 2 groups
Allocation concealment (selection bias)	Low risk	Information retrieved by Sudlow 2002: "pre-labelled forms stratified by gender, with appropriate pre-allocation concealment"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"Four to 6 days after the LP each patient, on his own and without interference from any other person, answered on a written form whether he as a consequence of the LP had experienced (...). If the patient had experienced headache, further questions were posed by one of us, who did not know the patient's post-LP posture:..."
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

Vimala 1998

Methods	Participants scheduled to LP for any reason were randomized to 1 of 2 groups by block randomization
Participants	208 participants were included, but only 204 were assessed
Interventions	Group A: bed rest for 24 hours; Group B: immediate mobilization
Outcomes	PDPH; severe PDPH (described by the patient)
Notes	

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Vimala 1998 (*Continued*)

Random sequence generation (selection bias)	Low risk	"Patient were randomized in two groups (medical wards and neuro [neurological] wards) to either ambulation or bed rest using a block of four"
Allocation concealment (selection bias)	Unclear risk	There was no information on this item
Blinding of outcome assessment (detection bias) All outcomes	High risk	"Patients were interviewed by a single investigator on days 0, 1, 2 and 7 on the presence and nature of headache and associated symptoms". Blinding was not mentioned
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent missing outcome data
Selective reporting (reporting bias)	Unclear risk	There was insufficient information to determine 'high' or 'low' risk of bias

LP: lumbar puncture; PDPH: post-dural puncture headache.

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

Study	Reason for exclusion
Carbaat 1981	Non-randomized comparison of 24 hours of bed rest versus immediate mobilization
Gulati 1981	Treatment allocation by alternation inadequately concealed. (Comparison of 24 hours bed rest versus immediate mobilization)
Hafer 1997a	Treatment allocation by month of year of surgery inadequately concealed. (Comparison of 24 hours bed rest versus early mobilization)
Hallam 1993	Non-randomized comparison of 24 hours bed rest versus early ambulation
Spriggs 1992	Treatment allocation by odd/even numbers inadequately concealed. (Comparison of 4 hours of bed rest versus immediate mobilization)

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

Cucereanu 2010

Trial name or title	Restrictive versus liberal perioperative fluid administration in spinal anesthesia for arthroscopic surgery
Methods	Controlled clinical trial between liberal and restrictive fluid administration in spinal anaesthesia for non-bleeding arthroscopic surgery analysing intra- and postoperative outcome
Participants	217 American Society of Anesthesiologists 1-2 participants undergoing arthroscopic surgery under spinal anaesthesia
Interventions	group L (112 participants) received liberal fluid administration (1900 ± 300 mL) and group R (105 participants) received 10 mL/kg crystalloids
Outcomes	Arterial pressure, heart rate, the need for ephedrine infusion, haemodynamic impact after tourniquet release and postoperative incidents such as headache, the need for bladder catheterization, infections
Starting date	No information about starting date
Contact information	
Notes	Published on Abstracts of the XXIX Annual European Society of Regional Anaesthesia (ESRA) Congress 2010

DATA AND ANALYSES

Comparison 1. Bed rest versus ambulation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 PDPH	12	1519	Risk Ratio (M-H, Fixed, 95% CI)	1.30 [1.09, 1.55]
2 Severe PDPH	9	1568	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.75, 1.32]
3 Any cephalea	18	2477	Risk Ratio (M-H, Fixed, 95% CI)	1.18 [1.05, 1.32]

Comparison 2. Bed rest versus bed rest with head tilt

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Any cephalea	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

Comparison 3. Supine versus prone

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Any cephalea	2	120	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.54, 1.37]

Comparison 4. Supine versus supine with head tilt

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Any cephalea	2	87	Risk Ratio (M-H, Fixed, 95% CI)	1.75 [1.11, 2.74]

Comparison 5. Prone versus prone with head tilt

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Any cephalea	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

Comparison 6. Fluids versus less or no fluids

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 PDPH	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2 Severe PDPH	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3 Any cephalea	2	200	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.67, 1.34]

Comparison 7. Reason for puncture: bed rest versus ambulation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 PDPH	12	1519	Risk Ratio (M-H, Fixed, 95% CI)	1.30 [1.09, 1.55]
1.1 Diagnostic	6	723	Risk Ratio (M-H, Fixed, 95% CI)	1.16 [0.94, 1.43]
1.2 Myelography	1	207	Risk Ratio (M-H, Fixed, 95% CI)	1.48 [0.67, 3.27]
1.3 Anaesthesia	4	381	Risk Ratio (M-H, Fixed, 95% CI)	1.82 [1.20, 2.78]
1.4 Mixed	1	208	Risk Ratio (M-H, Fixed, 95% CI)	1.27 [0.68, 2.35]
2 Severe PDPH	9	1568	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.75, 1.32]
2.1 Diagnostic	3	509	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.62, 1.37]
2.2 Myelography	2	582	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.59, 1.58]
2.3 Anaesthesia	3	269	Risk Ratio (M-H, Fixed, 95% CI)	2.89 [1.12, 7.45]
2.4 Mixed	1	208	Risk Ratio (M-H, Fixed, 95% CI)	0.25 [0.05, 1.15]
3 Any cephalea	18	2477	Risk Ratio (M-H, Fixed, 95% CI)	1.18 [1.05, 1.32]
3.1 Diagnostic	6	723	Risk Ratio (M-H, Fixed, 95% CI)	1.16 [0.95, 1.42]
3.2 Myelography	7	1165	Risk Ratio (M-H, Fixed, 95% CI)	1.06 [0.91, 1.24]
3.3 Anaesthesia	4	381	Risk Ratio (M-H, Fixed, 95% CI)	1.87 [1.28, 2.73]
3.4 Mixed	1	208	Risk Ratio (M-H, Fixed, 95% CI)	1.27 [0.68, 2.35]

Comparison 8. Low risk of bias: bed rest versus ambulation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 PDPH	2	380	Risk Ratio (M-H, Fixed, 95% CI)	1.19 [0.90, 1.56]

Analysis 1.1. Comparison 1 Bed rest versus ambulation, Outcome 1 PDPH.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 1 Bed rest versus ambulation

Outcome: 1 PDPH

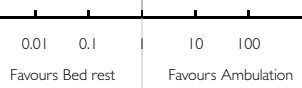
Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Andersen 1986	8/57	6/55		4.0 %	1.29 [0.48, 3.47]
Congia 1985	8/19	8/20		5.1 %	1.05 [0.50, 2.23]
Cook 1989	7/59	5/61		3.2 %	1.45 [0.49, 4.31]
Dieterich 1985	34/78	34/82		21.5 %	1.05 [0.73, 1.51]
Ebinger 2004	9/59	1/52		0.7 %	7.93 [1.04, 60.52]
Fassoulaki 1991	22/39	6/30		4.4 %	2.82 [1.31, 6.07]
Johannsson 1992	4/26	2/23		1.4 %	1.77 [0.36, 8.78]
Murata 2003	14/106	9/101		6.0 %	1.48 [0.67, 3.27]
Tejavanija 2006	5/32	6/32		3.9 %	0.83 [0.28, 2.46]
Thornberry 1988	14/39	9/41		5.7 %	1.64 [0.80, 3.34]
Vilming 1988	59/150	53/150		34.4 %	1.11 [0.83, 1.49]
Vimala 1998	19/104	15/104		9.7 %	1.27 [0.68, 2.35]
Total (95% CI)	**768**	**751**		**100.0 %**	**1.30 [1.09, 1.55]**

Total events: 203 (Bed rest), 154 (Ambulation)

Heterogeneity: Chi^2 = 11.02, df = 11 (P = 0.44); I^2 =0%

Test for overall effect: Z = 2.92 (P = 0.0035)

Test for subgroup differences: Not applicable



Analysis 1.2. Comparison 1 Bed rest versus ambulation, Outcome 2 Severe PDPH.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 1 Bed rest versus ambulation

Outcome: 2 Severe PDPH

Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Cook 1989	2/59	1/61		1.2 %	2.07 [0.19, 22.20]
Dieterich 1985	11/78	15/82		17.3 %	0.77 [0.38, 1.57]
Fassoulaki 1991	6/39	3/30		4.0 %	1.54 [0.42, 5.65]
Johannsson 1992	0/26	1/23		1.9 %	0.30 [0.01, 6.94]
Macpherson 1984	15/100	12/100		14.2 %	1.25 [0.62, 2.53]
Macpherson 1985	13/191	17/191		20.1 %	0.76 [0.38, 1.53]
Thornberry 1988	8/39	1/41		1.2 %	8.41 [1.10, 64.17]
Vilming 1988	27/150	26/150		30.7 %	1.04 [0.64, 1.69]
Vimala 1998	2/104	8/104		9.5 %	0.25 [0.05, 1.15]
Total (95% CI)	**786**	**782**		**100.0 %**	**1.00 [0.75, 1.32]**

Total events: 84 (Bed rest), 84 (Ambulation)

Heterogeneity: Chi^2 = 10.23, df = 8 (P = 0.25); I^2 =22%

Test for overall effect: Z = 0.03 (P = 0.98)

Test for subgroup differences: Not applicable

Analysis 1.3. Comparison 1 Bed rest versus ambulation, Outcome 3 Any cephalea.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 1 Bed rest versus ambulation

Outcome: 3 Any cephalea

Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Andersen 1986	19/57	11/55		3.2 %	1.67 [0.88, 3.17]
Congia 1985	8/19	8/20		2.2 %	1.05 [0.50, 2.23]
Cook 1989	7/59	5/61		1.4 %	1.45 [0.49, 4.31]
Dieterich 1985	34/78	34/82		9.4 %	1.05 [0.73, 1.51]
Ebinger 2004	23/59	11/52		3.3 %	1.84 [1.00, 3.41]
Fassoulaki 1991	22/39	6/30		1.9 %	2.82 [1.31, 6.07]
Jensen 1987	22/40	9/37		2.6 %	2.26 [1.20, 4.26]
Johannsson 1992	4/26	2/23		0.6 %	1.77 [0.36, 8.78]
Macpherson 1983	32/58	32/61		8.8 %	1.05 [0.75, 1.47]
Macpherson 1984	37/100	37/100		10.5 %	1.00 [0.70, 1.44]
Macpherson 1985	48/191	54/191		15.3 %	0.89 [0.64, 1.24]
Murata 2003	14/106	9/101		2.6 %	1.48 [0.67, 3.27]
Robertson 1980	16/30	16/30		4.5 %	1.00 [0.62, 1.61]
Teasdale 1983	36/60	36/60		10.2 %	1.00 [0.75, 1.34]
Tejavanija 2006	5/32	6/32		1.7 %	0.83 [0.28, 2.46]
Thornberry 1988	14/39	9/41		2.5 %	1.64 [0.80, 3.34]
Vilming 1988	59/150	53/150		15.0 %	1.11 [0.83, 1.49]
Vimala 1998	19/104	15/104		4.2 %	1.27 [0.68, 2.35]
Total (95% CI)	**1247**	**1230**		**100.0 %**	**1.18 [1.05, 1.32]**

Total events: 419 (Bed rest), 353 (Ambulation)

Heterogeneity: Chi^2 = 20.38, df = 17 (P = 0.26); I^2 =17%

Test for overall effect: Z = 2.79 (P = 0.0052)

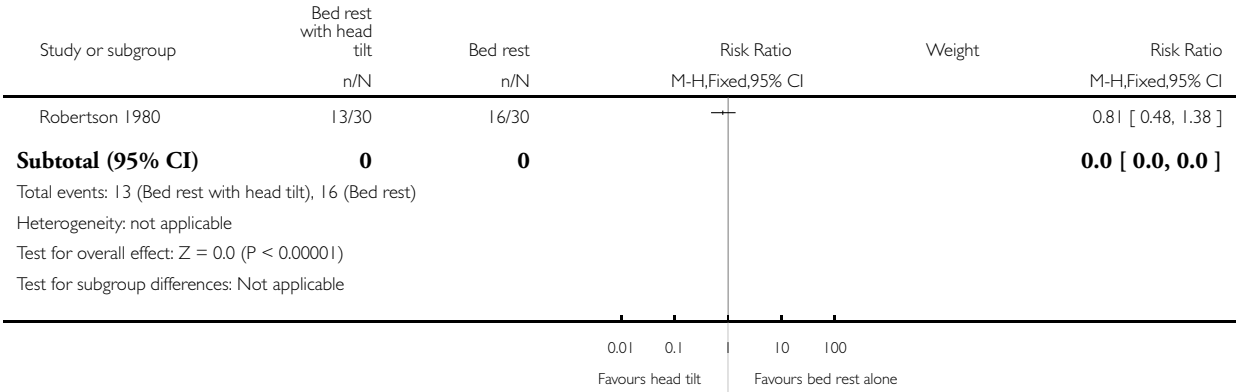
Test for subgroup differences: Not applicable

Analysis 2.1. Comparison 2 Bed rest versus bed rest with head tilt, Outcome 1 Any cephalea.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 2 Bed rest versus bed rest with head tilt

Outcome: 1 Any cephalea

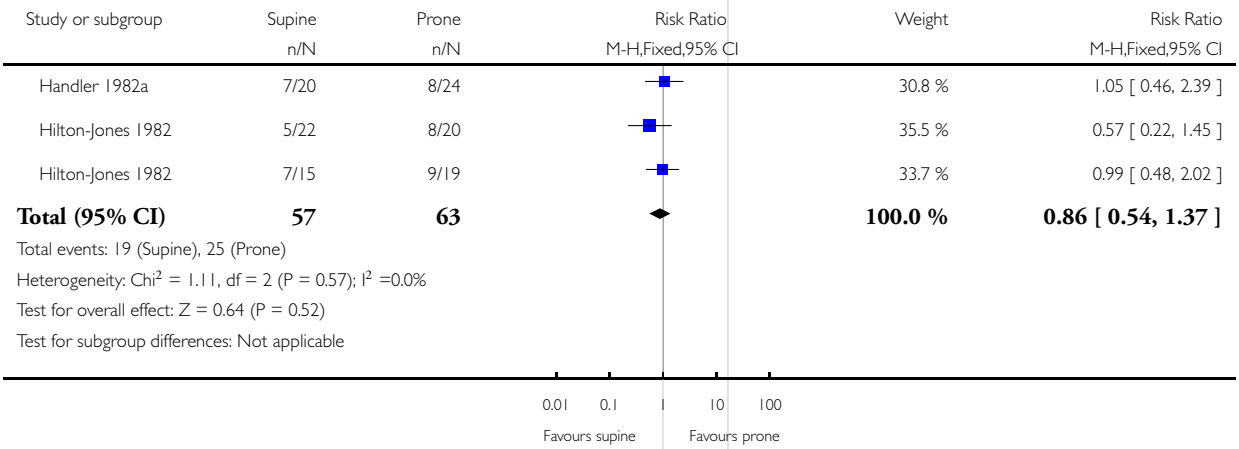


Analysis 3.1. Comparison 3 Supine versus prone, Outcome 1 Any cephalea.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 3 Supine versus prone

Outcome: 1 Any cephalea



Analysis 4.1. Comparison 4 Supine versus supine with head tilt, Outcome 1 Any cephalea.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 4 Supine versus supine with head tilt

Outcome: 1 Any cephalea

Study or subgroup	Supine with head tilt n/N	Supine n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Hilton-Jones 1982	7/15	5/22		26.9 %	2.05 [0.80, 5.26]
Smith 1980	18/25	11/25		73.1 %	1.64 [0.99, 2.71]
Total (95% CI)	**40**	**47**		**100.0 %**	**1.75 [1.11, 2.74]**

Total events: 25 (Supine with head tilt), 16 (Supine)

Heterogeneity: $Chi^2 = 0.18$, df = 1 (P = 0.67); $I^2 = 0.0\%$

Test for overall effect: Z = 2.43 (P = 0.015)

Test for subgroup differences: Not applicable

Analysis 5.1. Comparison 5 Prone versus prone with head tilt, Outcome 1 Any cephalea.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 5 Prone versus prone with head tilt

Outcome: 1 Any cephalea

Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Hilton-Jones 1982	9/19	8/20			1.18 [0.58, 2.42]
Subtotal (95% CI)	**0**	**0**			**0.0 [0.0, 0.0]**
Total events: 9 (Bed rest), 8 (Ambulation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P < 0.00001)					
Test for subgroup differences: Not applicable					

Analysis 6.1. Comparison 6 Fluids versus less or no fluids, Outcome 1 PDPH.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 6 Fluids versus less or no fluids

Outcome: 1 PDPH

Study or subgroup	Fluids n/N	Less/no fluids n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Dieterich 1988	18/50	18/50			1.00 [0.59, 1.69]
Subtotal (95% CI)	**0**	**0**			**0.0 [0.0, 0.0]**
Total events: 18 (Fluids), 18 (Less/no fluids)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P < 0.00001)					
Test for subgroup differences: Not applicable					

Analysis 6.2. Comparison 6 Fluids versus less or no fluids, Outcome 2 Severe PDPH.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 6 Fluids versus less or no fluids

Outcome: 2 Severe PDPH

Study or subgroup	Fluids n/N	Less/no fluids n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Dieterich 1988	6/50	9/50			0.67 [0.26, 1.73]
Subtotal (95% CI)	**0**	**0**			**0.0 [0.0, 0.0]**

Total events: 6 (Fluids), 9 (Less/no fluids)
Heterogeneity: not applicable
Test for overall effect: Z = 0.0 (P < 0.00001)
Test for subgroup differences: Not applicable

Analysis 6.3. Comparison 6 Fluids versus less or no fluids, Outcome 3 Any cephalea.

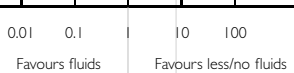
Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 6 Fluids versus less or no fluids

Outcome: 3 Any cephalea

Study or subgroup	Fluids n/N	Less/no fluids n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Dieterich 1988	18/50	18/50		45.5 %	1.00 [0.59, 1.69]
Eldevik 1978	19/49	22/51		54.5 %	0.90 [0.56, 1.44]
Total (95% CI)	**99**	**101**		**100.0 %**	**0.94 [0.67, 1.34]**

Total events: 37 (Fluids), 40 (Less/no fluids)
Heterogeneity: Chi^2 = 0.09, df = 1 (P = 0.77); I^2 =0.0%
Test for overall effect: Z = 0.32 (P = 0.75)
Test for subgroup differences: Not applicable

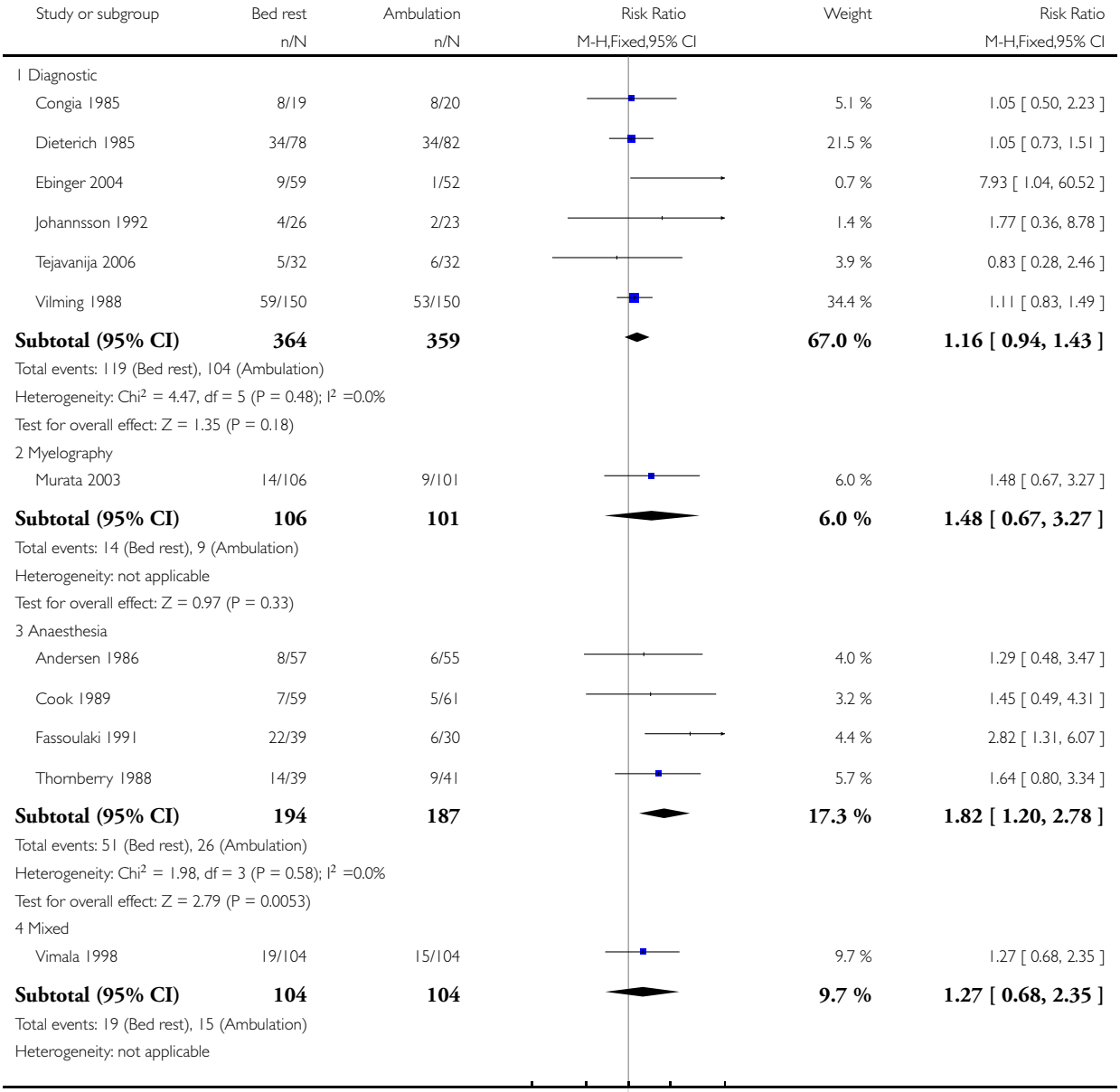


Analysis 7.1. Comparison 7 Reason for puncture: bed rest versus ambulation, Outcome 1 PDPH.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 7 Reason for puncture: bed rest versus ambulation

Outcome: 1 PDPH



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Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.75 (P = 0.45)					
Total (95% CI)	**768**	**751**		**100.0 %**	**1.30 [1.09, 1.55]**
Total events: 203 (Bed rest), 154 (Ambulation)					
Heterogeneity: Chi^2 = 11.02, df = 11 (P = 0.44); I^2 =0%					
Test for overall effect: Z = 2.92 (P = 0.0035)					
Test for subgroup differences: Chi^2 = 3.72, df = 3 (P = 0.29), I^2 =19%					

Analysis 7.2. Comparison 7 Reason for puncture: bed rest versus ambulation, Outcome 2 Severe PDPH.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 7 Reason for puncture: bed rest versus ambulation

Outcome: 2 Severe PDPH

Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Diagnostic					
Dieterich 1985	11/78	15/82		17.3 %	0.77 [0.38, 1.57]
Johannsson 1992	0/26	1/23		1.9 %	0.30 [0.01, 6.94]
Vilming 1988	27/150	26/150		30.7 %	1.04 [0.64, 1.69]
Subtotal (95% CI)	**254**	**255**		**49.9 %**	**0.92 [0.62, 1.37]**
Total events: 38 (Bed rest), 42 (Ambulation)					
Heterogeneity: Chi^2 = 0.97, df = 2 (P = 0.62); I^2 =0.0%					
Test for overall effect: Z = 0.42 (P = 0.67)					
2 Myelography					
Macpherson 1984	15/100	12/100		14.2 %	1.25 [0.62, 2.53]
Macpherson 1985	13/191	17/191		20.1 %	0.76 [0.38, 1.53]
Subtotal (95% CI)	**291**	**291**		**34.3 %**	**0.97 [0.59, 1.58]**
Total events: 28 (Bed rest), 29 (Ambulation)					
Heterogeneity: Chi^2 = 0.95, df = 1 (P = 0.33); I^2 =0.0%					
Test for overall effect: Z = 0.14 (P = 0.89)					

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Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
3 Anaesthesia					
Cook 1989	2/59	1/61		1.2 %	2.07 [0.19, 22.20]
Fassoulaki 1991	6/39	3/30		4.0 %	1.54 [0.42, 5.65]
Thornberry 1988	8/39	1/41		1.2 %	8.41 [1.10, 64.17]
Subtotal (95% CI)	**137**	**132**		**6.3 %**	**2.89 [1.12, 7.45]**
Total events: 16 (Bed rest), 5 (Ambulation)					
Heterogeneity: Chi^2 = 2.04, df = 2 (P = 0.36); I^2 =2%					
Test for overall effect: Z = 2.19 (P = 0.028)					
4 Mixed					
Vimala 1998	2/104	8/104		9.5 %	0.25 [0.05, 1.15]
Subtotal (95% CI)	**104**	**104**		**9.5 %**	**0.25 [0.05, 1.15]**
Total events: 2 (Bed rest), 8 (Ambulation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.78 (P = 0.075)					
Total (95% CI)	**786**	**782**		**100.0 %**	**1.00 [0.75, 1.32]**
Total events: 84 (Bed rest), 84 (Ambulation)					
Heterogeneity: Chi^2 = 10.23, df = 8 (P = 0.25); I^2 =22%					
Test for overall effect: Z = 0.03 (P = 0.98)					
Test for subgroup differences: Chi^2 = 8.18, df = 3 (P = 0.04), I^2 =63%					

Analysis 7.3. Comparison 7 Reason for puncture: bed rest versus ambulation, Outcome 3 Any cephalea.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 7 Reason for puncture: bed rest versus ambulation

Outcome: 3 Any cephalea

Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Diagnostic					
Dieterich 1985	34/78	34/82		9.4 %	1.05 [0.73, 1.51]
Congia 1985	8/19	8/20		2.2 %	1.05 [0.50, 2.23]
Vilming 1988	59/150	53/150		15.0 %	1.11 [0.83, 1.49]
Johannsson 1992	4/26	2/23		0.6 %	1.77 [0.36, 8.78]
Ebinger 2004	23/59	11/52		3.3 %	1.84 [1.00, 3.41]
Tejavanija 2006	5/32	6/32		1.7 %	0.83 [0.28, 2.46]
Subtotal (95% CI)	**364**	**359**		**32.2 %**	**1.16 [0.95, 1.42]**
Total events: 133 (Bed rest), 114 (Ambulation)					
Heterogeneity: Chi^2 = 3.24, df = 5 (P = 0.66); I^2 =0.0%					
Test for overall effect: Z = 1.48 (P = 0.14)					
2 Myelography					
Robertson 1980	16/30	16/30		4.5 %	1.00 [0.62, 1.61]
Teasdale 1983	36/60	36/60		10.2 %	1.00 [0.75, 1.34]
Macpherson 1983	32/58	32/61		8.8 %	1.05 [0.75, 1.47]
Macpherson 1984	37/100	37/100		10.5 %	1.00 [0.70, 1.44]
Macpherson 1985	48/191	54/191		15.3 %	0.89 [0.64, 1.24]
Jensen 1987	22/40	9/37		2.6 %	2.26 [1.20, 4.26]
Murata 2003	14/106	9/101		2.6 %	1.48 [0.67, 3.27]
Subtotal (95% CI)	**585**	**580**		**54.6 %**	**1.06 [0.91, 1.24]**
Total events: 205 (Bed rest), 193 (Ambulation)					
Heterogeneity: Chi^2 = 7.57, df = 6 (P = 0.27); I^2 =21%					
Test for overall effect: Z = 0.77 (P = 0.44)					
3 Anaesthesia					
Andersen 1986	19/57	11/55		3.2 %	1.67 [0.88, 3.17]
Thornberry 1988	14/39	9/41		2.5 %	1.64 [0.80, 3.34]
Cook 1989	7/59	5/61		1.4 %	1.45 [0.49, 4.31]
Fassoulaki 1991	22/39	6/30		1.9 %	2.82 [1.31, 6.07]
Subtotal (95% CI)	**194**	**187**		**9.0 %**	**1.87 [1.28, 2.73]**

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Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 62 (Bed rest), 31 (Ambulation)					
Heterogeneity: Chi² = 1.57, df = 3 (P = 0.67); I² =0.0%					
Test for overall effect: Z = 3.25 (P = 0.0012)					
4 Mixed					
Vimala 1998	19/104	15/104		4.2 %	1.27 [0.68, 2.35]
Subtotal (95% CI)	**104**	**104**		**4.2 %**	**1.27 [0.68, 2.35]**
Total events: 19 (Bed rest), 15 (Ambulation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.75 (P = 0.45)					
Total (95% CI)	**1247**	**1230**		**100.0 %**	**1.18 [1.05, 1.32]**
Total events: 419 (Bed rest), 353 (Ambulation)					
Heterogeneity: Chi² = 20.38, df = 17 (P = 0.26); I² =17%					
Test for overall effect: Z = 2.79 (P = 0.0052)					
Test for subgroup differences: Chi² = 7.53, df = 3 (P = 0.06), I² =60%					

Analysis 8.1. Comparison 8 Low risk of bias: bed rest versus ambulation, Outcome 1 PDPH.

Review: Posture and fluids for preventing post-dural puncture headache

Comparison: 8 Low risk of bias: bed rest versus ambulation

Outcome: 1 PDPH

Study or subgroup	Bed rest n/N	Ambulation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Thornberry 1988	14/39	9/41		14.2 %	1.64 [0.80, 3.34]
Vilming 1988	59/150	53/150		85.8 %	1.11 [0.83, 1.49]
Total (95% CI)	**189**	**191**		**100.0 %**	**1.19 [0.90, 1.56]**
Total events: 73 (Bed rest), 62 (Ambulation)					
Heterogeneity: Chi² = 0.96, df = 1 (P = 0.33); I² =0.0%					
Test for overall effect: Z = 1.24 (P = 0.22)					
Test for subgroup differences: Not applicable					

APPENDICES

Appendix 1. Glossary of terms

Term	Definition
Analgesia, epidural	The relief of pain without loss of consciousness through the introduction of an analgesic agent into the epidural space of the vertebral canal
Analgesia, obstetrical	The elimination of pain, without the loss of consciousness, during obstetric labour; obstetric delivery; or the postpartum period, usually through the administration of analgesics
Blood patch, epidural	The injection of autologous blood into the epidural space either as a prophylactic treatment immediately following an epidural puncture or for treatment of headache as a result of an epidural puncture
Cerebrospinal fluid pressure	Manometric pressure of the cerebrospinal fluid as measured by lumbar, cerebroventricular, or cisternal puncture. Within the cranial cavity it is called intracranial pressure
Dura mater	The outermost of the 3 meninges, a fibrous membrane of connective tissue that covers the brain and the spinal cord
Fluids	Compounds that permit restore the volume and composition of the body fluids to normal and which are administered orally, intravenously, by intermittent gavage or by hypodermoclysis
Myelography	X-ray visualization of the spinal cord following injection of contrast medium into the spinal arachnoid space
Postures	The position or attitude of the body
Primary prevention	Specific practices for the prevention of disease or mental disorders in susceptible individuals or populations. These include health promotion, including mental health; protective procedures, such as communicable disease control; and monitoring and regulation of environmental pollutants
Post-dural puncture headache	A secondary headache disorder attributed to low cerebrospinal fluid pressure caused by spinal puncture, usually after dural or lumbar puncture
Spinal puncture	Tapping fluid from the subarachnoid space in the lumbar region, usually between the third and fourth lumbar vertebrae

Source: www.ncbi.nlm.nih.gov/mesh

Appendix 2. Cochrane Controlled Trials Register search strategy

#1 MeSH descriptor: [Post-Dural Puncture Headache] this term only
#2 (PLPH or PPH or PDPH or Post dural or Post-dural):ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Anesthesia, Epidural] explode all trees
#5 MeSH descriptor: [Anesthesia, Spinal] this term only
#6 MeSH descriptor: [Injections, Spinal] explode all trees
#7 MeSH descriptor: [Myelography] this term only
#8 MeSH descriptor: [Spinal Puncture] this term only
#9 (spinal or intraspinal or dural or intradural or epidural or lumbar* or theca* or intrathecal or subarachnoid* or "sub arachnoid*" or Myelograph*):ti,ab,kw (Word variations have been searched)
#10 #4 or #5 or #6 or #7 or #8
#11 (puncture* or inject* or anesth* or anaesth* or needle*):ti,ab,kw (Word variations have been searched)
#12 #10 and #11
#13 MeSH descriptor: [Headache] this term only
#14 (Headach* or cephalea* or cephalalgi*):ti,ab,kw (Word variations have been searched)
#15 #13 or #14
#16 #12 and #15
#17 #3 or #16
#18 MeSH descriptor: [Bed Rest] this term only
#19 (Patient position* or Bed rest or bedrest or recumb* or posture* or rest in bed):ti,ab,kw (Word variations have been searched)
#20 #18 or #19
#21 #17 and #20
#22 MeSH descriptor: [Fluid Therapy] explode all trees
#23 (Fluid Therap* or Rehydrat* or Oral fluid* or Fluid Admin* or Fluid intake* or supplementary fluid* or fluid supplement* or hydrat*):ti,ab,kw (Word variations have been searched)
#24 #22 or #23
#25 #17 and #24

Appendix 3. MEDLINE (OVID) search strategy

1 Post-Dural Puncture Headache/
2 (PLPH or PPH or PDPH or Post dural or Post-dural).tw.
3 or/1-2
4 exp anesthesia, epidural/ or anesthesia, spinal/
5 exp Injections, Spinal/
6 Myelography/
7 Spinal Puncture/
8 (spinal or intraspinal or dural or intradural or epidural or lumbar* or theca* or intrathecal or subarachnoid* or "sub arachnoid*" or Myelograph*).tw.
9 or/4-8
10 (puncture* or inject* or anesth* or anaesth* or needle*).tw.
11 9 and 10
12 Headache/
13 (Headach* or cephalea* or cephalalgi*).tw.
14 or/12-13
15 11 and 14
16 3 or 15
17 Bed Rest/
18 (Patient position* or Bed rest or bedrest or recumb* or posture* or rest in bed).tw.
19 or/17-18
20 16 and 19

21 exp Fluid Therapy/
22 (Fluid Therap* or Rehydrat* or Oral fluid* or Fluid Admin* or Fluid intake* or supplementary fluid* or fluid supplement* or hydrat*).tw.
23 or/21-22
24 16 and 23
25 20 or 24
26 randomized controlled trial.pt.
27 controlled clinical trial.pt.
28 randomized.ab.
29 placebo.ab.
30 drug therapy.fs.
31 randomly.ab.
32 trial.ab.
33 or/28-34
34 exp animals/ not humans.sh.
35 33 not 34
36 25 and 35

Appendix 4. EMBASE (OVID) search strategy

1 Post-Dural Puncture Headache/
2 (PLPH or PPH or PDPH or Post dural or Post-dural).tw.
3 or/1-2
4 exp anesthesia, epidural/ or anesthesia, spinal/
5 exp Injections, Spinal/
6 Myelography/
7 Spinal Puncture/
8 (spinal or intraspinal or dural or intradural or epidural or lumbar* or theca* or intrathecal or subarachnoid* or "sub arachnoid*" or Myelograph*).tw.
9 or/4-8
10 (puncture* or inject* or anesth* or anaesth* or needle*).tw.
11 9 and 10
12 Headache/
13 (Headach* or cephalea* or cephalalgi*).tw.
14 or/12-13
15 11 and 14
16 3 or 15
17 Bed Rest/
18 (Patient position* or Bed rest or bedrest or recumb* or posture* or rest in bed).tw.
19 or/17-18
20 16 and 19
21 exp Fluid Therapy/
22 (Fluid Therap* or Rehydrat* or Oral fluid* or Fluid Admin* or Fluid intake* or supplementary fluid* or fluid supplement* or hydrat*).tw.
23 or/21-22
24 16 and 23
25 20 or 24
26 random$.tw.
27 factorial$.tw.
28 crossover$.tw.
29 cross over$.tw.
30 cross-over$.tw.

31 placebo$.tw.
32 (doubl$ adj blind$).tw.
33 (singl$ adj blind$).tw.
34 assign$.tw.
35 allocat$.tw.
36 volunteer$.tw.
37 Crossover Procedure/
38 double-blind procedure.tw.
39 Randomized Controlled Trial/
40 Single Blind Procedure/
41 or/26-40
42 (animal/ or nonhuman/) not human/
43 41 not 42
44 25 and 43

Appendix 5. LILACS (BIREME) Search strategy

(MH Cefalea Pospunción de la Duramadre OR PLPH OR PPH OR PDPH OR Post dural OR post-dural OR Pós-Punção OR Pospunción) [Words] and (MH Anestesia Epidural OR MH Anestesia Raquidea OR MH Inyecciones Espinales OR MH Mielografía OR MH Punción Espinal OR Extradural OR Peridural OR Raquianestesia OR Mielograf$ OR Myelograph$ OR spinal OR intraspinal OR dural OR intradural OR epidural OR lumbar$ OR theca$ OR intratecal$ OR intrathecal OR subarachnoid$ OR sub arachnoid$ OR subaracnoid$) [Words] and (Punção OR puncion$ OR puncture$ OR inject$ OR Injeçõ$ OR inyec$ OR Anestesi$ OR anesth$ OR needle$ OR aguja$ OR Agulha$)) AND (MH Cefalea OR Cefale$ OR Cefalalgi$ OR Cephalgi$ OR Hemicrani$ OR Enxaqueca$ OR Jaqueca$ OR Cefalgi$) [Words]

CONTRIBUTIONS OF AUTHORS

All review authors contributed to the writing of the protocol. IA, AC, and LM conducted the search and selection of studies. IAR, LM, XB, and MR conducted data extraction and 'Risk of bias' assessment. IA and MR were in charge of all the statistical analyses. All authors contributed to writing the final document. IA entered data into RevMan and will carry out futures updates of this review.

DECLARATIONS OF INTEREST

None known.

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INDEX TERMS

Medical Subject Headings (MeSH)

*Bed Rest; *Early Ambulation; *Posture; Fluid Therapy [*methods]; Head; Patient Positioning [*methods]; Post-Dural Puncture Headache [*prevention & control]; Spinal Puncture [adverse effects]

MeSH check words

Humans