Regional versus general anaesthesia for caesarean section (Review)

Afolabi BB, Lesi FEA

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[Intervention Review]

Regional versus general anaesthesia for caesarean section

Bosede B Afolabi[1], Foluso EA Lesi[2]

[1]Department of Obstetrics and Gynaecology, University of Lagos, Lagos, Nigeria. [2]Department of Paediatrics and Child Health, College of Medicine of the University of Lagos, Lagos, Nigeria

Contact address: Bosede B Afolabi, Department of Obstetrics and Gynaecology, University of Lagos, College of Medicine, PMB 12003, Idi-Araba, Lagos, Nigeria. bosedeafolabi2003@yahoo.com.

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ABSTRACT

Background

Regional anaesthesia (RA) and general anaesthesia (GA) are commonly used for caesarean section (CS) and both have advantages and disadvantages. It is important to clarify what type of anaesthesia is more efficacious.

Objectives

To compare the effects of RA with those of GA on the outcomes of CS.

Search methods

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (30 November 2011). We updated the search on 20 August 2012 and added the results to the awaiting classification section of the review.

Selection criteria

Randomised and quasi-randomised controlled trials evaluating the use of RA and GA in women who had CS for any indication. Cluster-randomised trials and trials using a cross-over design are not included.

Data collection and analysis

Two review authors independently assessed trials for inclusion, assessed risk of bias and extracted data. Data were checked for accuracy.

Main results

Twenty-two out of 29 included studies (1793 women) contributed data to this review.

The included studies did not report some our primary outcomes: maternal death, incidence of maternal postoperative wound infection, maternal postoperative other infection such as endometritis and urinary tract infection, neonatal death.

Compared to women who had GA, women who had either epidural anaesthesia or spinal anaesthesia were found to have a significantly lower difference between pre and postoperative haematocrit. For epidural, the mean difference (MD) was 1.70% and 95% confidence interval (CI) 0.47 to 2.93 (one trial, 231 women) and for spinal anaesthesia, the MD was 3.10% and 95% CI 1.73 to 4.47 (one trial, 209 women). Compared with GA, women having either an epidural anaesthesia or spinal anaesthesia had a lower estimated maternal blood loss (epidural versus GA: standardised mean difference (SMD) -0.32 mL; 95% CI -0.56 to -0.07; two trials, 256 women; spinal versus GA anaesthesia: SMD -0.59 mL; 95% CI -0.83 to 0.35; two trials, 279 women). There was evidence of a significant difference

in terms of satisfaction with anaesthetic technique - compared with the epidural or spinal group, more women in the GA group stated they would use the same technique again if they needed CS for a subsequent pregnancy (epidural versus GA: risk ratio (RR) 0.80; 95% CI 0.65 to 0.98; one trial, 223 women; spinal versus GA anaesthesia: RR 0.80; 95% CI 0.65 to 0.99; one trial, 221 women).

No significant difference was seen in terms of neonatal Apgar scores of six or less and of four or less at five minutes and the need for neonatal resuscitation with oxygen.

Authors' conclusions

There is no evidence from this review to show that RA is superior to GA in terms of major maternal or neonatal outcomes. Further research to evaluate neonatal morbidity and maternal outcomes, such as satisfaction with technique, will be useful.

PLAIN LANGUAGE SUMMARY

Regional versus general anaesthesia for caesarean section

Caesarean section is when a baby is born through an incision in the mother's abdomen and uterine wall. This requires effective anaesthesia which can be regional (epidural or spinal) or a general anaesthetic. With regional epidural anaesthesia, the anaesthetic is infused into the space around the mother's spinal column, whilst with regional spinal anaesthesia, the drug is injected as a single dose into the mother's spinal column. With the two types of regional anaesthesia, the mother is awake for the birth but numbed from the waist down. With general anaesthesia, the mother is unconscious for the birth with the anaesthetic affecting her whole body. As well as women having a view as to whether they might wish to be awake or asleep for the caesarean birth, it is important to know the balance of the benefits and adverse effects of these different types of anaesthesia. This review of trials sought to assess these benefits and harms. Twenty-two out of 29 included studies (1793 women) contributed data to this review. There were some differences that favoured regional anaesthesia, for example, less blood loss. The evidence on the differences in pain relief was difficult to evaluate. There were not enough participants to assess the very rare outcome of mortality for the mother, which may be an important aspect. None of the trials addressed important outcomes for women such as recovery times, effects on breastfeeding, effects on the mother-child relationship and length of time before mother feels well enough to care for her baby. As there is insufficient evidence on benefits and adverse effects, women are most likely to choose anaesthesia for caesarean section, depending on whether they wish to be awake or asleep for the birth.

BACKGROUND

Caesarean section refers to the procedure where a baby is delivered through an incision on the abdominal wall and uterus of the mother. It is often life-saving and aims to preserve the health of the mother and her baby. Although the operation has become very safe over the years, it is still associated with greater maternal mortality and morbidity (Enkin 2000; Liu 2007). The risk of maternal death with caesarean section is four times that associated with all types of vaginal birth, which is one per 10,000 births (Enkin 2000). It is known that there is a greater risk of neonatal respiratory distress with caesarean section than vaginal delivery, regardless of gestational age (Zanardo 2004; Kolås 2006). This has been described as mild and transient (Danforth 1985) however, and caesarean section is usually considered safe for the fetus. Caesarean section is often described as elective (when it is planned) or emergency.

The type of anaesthesia used and the care with which it is administered is an important determinant of the outcome of caesarean section (Andersen 1987; Enkin 2000). Regional and general anaesthesia are commonly used for caesarean section and both have their advantages and disadvantages (Thorp 2009). General anaesthesia refers to the loss of ability to perceive pain associated with loss of consciousness produced by intravenous or inhalation anaesthetic agents. For caesarean section, this involves the use of thiopentone for induction, tracheal intubation facilitated by suxamethonium, positive-pressure ventilation of the lungs with a nitrous oxide/oxygen mixture plus a volatile agent, and a muscle relaxant (Thorburn 1998). The risks include the aspiration of stomach contents, awareness of the surgical procedure (due to inadequate anaesthesia), failed intubations, and respiratory problems for both mother and baby (Thorp 2009). When supplemented with halogenated volatile agents, general anaesthesia has also been associated with a greater risk of maternal blood loss compared with regional anaesthesia (Andrews 1992). However, it is a more quickly administered procedure and is often preferred in cases

where speed is important (Thorp 2009). Also recent studies have found no incidence of failed intubation in some large series where general anaesthesia was carried out or supervised by experienced anaesthetists (Djabatey 2009; Ajmal 2011).

Regional anaesthesia refers to the use of local anaesthetic solutions to produce circumscribed areas of loss of sensation. The types of regional anaesthesia used for caesarean section (that is, spinal (subarachnoid) and epidural (extradural) anaesthesia) involve the infiltration of a local anaesthetic agent, usually bupivacaine, into the surroundings of the spinal cord through the lower back of the woman. With spinal anaesthesia, the drug is injected directly into the subarachnoid space while, with epidural, it is injected through a catheter that has been introduced into the extradural space (Thorburn 1998).

Spinal and epidural anaesthesia cause a substantial drop in maternal blood pressure, which may affect both mother and fetus (Visalyaputra 2005; Macarthur 2007), and may be dangerous when the woman has a bleeding complication (Enkin 2000). They are also contraindicated in women with coagulation (clotting) disorders since the insertion of the block may precipitate a bleed. They may cause a severe postdural puncture headache although the incidence of this is now reduced with the use of special needles (Kestin 1991). The advantages of regional anaesthesia include the reduction of the incidence of general anaesthetic complications and that of early bonding between the mother and the newborn, since the mother is awake during the procedure (Enkin 2000). Specifically, spinal and epidural anaesthesia are similar in their safety profiles with a few differences. Spinal anaesthesia has a faster onset of action and requires less of the drug, but causes more hypotensive episodes than epidural anaesthesia (Ng 2004).

Regional anaesthesia is the preferred method for caesarean section in the United Kingdom and the United States of America (USA) (Gibbs 1986; Hibbard 1996). In the USA in particular, regional anaesthesia was used for caesarean section in over 80% of cases as of 1992, regardless of the indication (Hawkins 1997a), and in over 50% of cases as far back as 1981 (Hawkins 1997a). The reasons for this trend have been attributed to the fact that maternal mortality with regional anaesthesia has been reducing steadily over the years while that of general anaesthesia remains the same (Hawkins 1997b), and to the greater familiarity of anaesthesia residents with the procedure (Hawkins 1997a). However, general anaesthesia is still frequently used in some countries, also largely due to greater familiarity with it (Stamer 2005; Furmanik 2010; Ajmal 2011).

The effect on neonates is less clear with some studies showing no difference in neonatal outcome between the two groups (Fox 1979; Zagorzycki 1982) and others maintaining that neonatal outcome is better with regional than with general anaesthesia (Abboud 1985; Ong 1989). Most of the studies that report no difference are those done on women who had elective operations (Korkmaz 2004) while those done on emergencies tend to report a positive difference in neonatal outcome with regional anaesthesia compared with general (Dyer 2003).

Given the benefits and risks of the different techniques, it is important to clarify what type of anaesthesia is more efficacious in terms of various maternal and neonatal outcomes for the different types of, and indications for, caesarean section.

OBJECTIVES

To compare the effects of regional anaesthesia with those of general anaesthesia on the outcomes of caesarean section.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised and quasi-randomised controlled trials. Cluster-randomised trials and trials using a cross-over design are not included.

Types of participants

Mothers having elective or emergency caesarean section for any indication, with the various definitions of elective and emergency taken into consideration.

Types of interventions

Intervention: regional anaesthesia, whether spinal, epidural or any combination of both.
Control: general anaesthesia using any combination of anaesthetic drugs and muscle relaxants.

Types of outcome measures

Primary outcomes

Maternal

1. Maternal death
2. Incidence of postoperative wound infection
3. Incidence of other postoperative infections such as endometritis and urinary tract infection
4. Mean difference between pre and postoperative haematocrit or haemoglobin levels
5. Maternal blood loss greater than 500 mL

6. Mean maternal blood loss
7. Amount of blood transfusion received in units (not prespecified in protocol)
8. Number who received postoperative blood transfusion (not prespecified in protocol)

Neonatal

1. Neonatal death
2. Mean umbilical arterial or venous pH
3. Mean neonatal neurologic and adaptive score
4. Mean neonatal Apgar scores at one and five minutes

Secondary outcomes

Maternal

1. Incidence of intraoperative pain
2. Maternal satisfaction with anaesthetic technique
3. Need for postoperative analgesia
4. Incidence of postoperative nausea and vomiting
5. Time to request postoperative analgesia in minutes (not prespecified in protocol)
6. Adverse events such as anaphylactic reactions, thromboembolic disease and backache. Headache, epigastric pain, blurred vision, convulsions, pruritus, shivering and bradycardia were also measured despite not being prespecified in the protocol

Neonatal

1. Time to sustained respiration
2. Need for oxygen by mask or intubation
3. Apgar score of four or less at one and five minutes (not prespecified in protocol)
4. Apgar score of six or less at one and five minutes (not prespecified in protocol)
5. Apgar score of eight or less at one and five or 10 minutes (not prespecified in protocol
6. Mean neonatal Apgar scores at one and 10 minutes (not prespecified in protocol)

Search methods for identification of studies

Electronic searches

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register by contacting the Trials Search Co-ordinator (30 November 2011). We updated this search on 20 August 2012 and added the results to Studies awaiting classification for consideration in the next update.

The Cochrane Pregnancy and Childbirth Group's Trials Register is maintained by the Trials Search Co-ordinator and contains trials identified from:

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

Details of the search strategies for CENTRAL, MEDLINE and EMBASE, the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the 'Specialized Register' section within the editorial information about the Cochrane Pregnancy and Childbirth Group.

Trials identified through the searching activities described above are each assigned to a review topic (or topics). The Trials Search Co-ordinator searches the register for each review using the topic list rather than keywords.

See Appendix 1 for details of additional searching carried out in the previous version of the review.

We did not apply any language restrictions.

Data collection and analysis

For the methods used when assessing the trials identified in the previous version of this review, *see* Appendix 2.

For this update we used the following methods when assessing the trials identified by the updated search.

Selection of studies

Bosede Afolabi (BA) and Afolabi Lesi (AL) independently assessed for inclusion all the potential studies identified as a result of the search strategy.

Data extraction and management

We designed a form to extract data. For eligible studies, BA and AL extracted the data using the agreed form. We resolved discrepancies through discussion. We entered data into Review Manager software (RevMan 2011) and checked them for accuracy.

In cases when information on the above was unclear, we attempted to contact authors of the original reports to provide further details.

Assessment of risk of bias in included studies

BA and AL independently assessed risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We resolved all disagreements by discussion.

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

We describe for each included study the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.
We assessed the method as:

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

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

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

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

(3) Blinding of participants, personnel (checking for possible performance bias) and outcome assessment (checking for possible detection bias)

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

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

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

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

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

(5) Selective reporting (checking for reporting bias)

We describe for each included study how we investigated the possibility of selective outcome reporting bias and what we found.
We assessed the methods as:

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

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

We describe for each included study any important concerns we have about other possible sources of bias.
We assessed whether each study was free of other problems that could put it at risk of bias:

- low risk of other bias;
- high risk of other bias;
- unclear whether there is risk of other bias.

(7) Overall risk of bias

We made explicit judgements about whether studies were at high risk of bias, according to the criteria given in the *Handbook* (Higgins 2011). With reference to (1) to (6) above, we assessed the likely magnitude and direction of the bias and whether we considered it was likely to impact on the findings. We explored the

impact of the level of bias through undertaking sensitivity analyses - *see* Sensitivity analysis.

Measures of treatment effect

Dichotomous data

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

Continuous data

For continuous data, we used the mean difference if outcomes were measured in the same way between trials. We used the standardised mean difference to combine trials that measured the same outcome, but used different methods.

Unit of analysis issues

Trials with two treatment groups were analysed by including each treatment arm in separate meta-analyses.

Dealing with missing data

For included studies, we noted levels of attrition. We planned to explore the impact of including studies with high levels of missing data in the overall assessment of treatment effect by using sensitivity analysis. For all outcomes, we carried out analyses, as far as possible, on an intention-to-treat basis, i.e. we attempted to include all participants randomised to each group in the analyses, and all participants were analysed in the group to which they were allocated, regardless of whether or not they received the allocated intervention. The denominator for each outcome in each trial was the number randomised minus any participants whose outcomes were known to be missing.

Assessment of heterogeneity

We assessed statistical heterogeneity in each meta-analysis using the T^2, I^2 and Chi^2 statistics. We regarded heterogeneity as substantial if T^2 was greater than zero and either the I^2 was greater than 30% or there was a low P value (less than 0.10) in the Chi^2 test for heterogeneity.

Assessment of reporting biases

In future updates, if there are 10 or more studies in the meta-analysis we will investigate reporting biases (such as publication bias) using funnel plots. We will assess funnel plot asymmetry visually, and use formal tests for funnel plot asymmetry. For continuous outcomes we will use the test proposed by Egger 1997, and for dichotomous outcomes we will use the test proposed by Harbord 2006. If asymmetry is detected in any of these tests or is suggested by a visual assessment, we will perform exploratory analyses to investigate it.

Data synthesis

We carried out statistical analysis using the Review Manager software (RevMan 2011). We use fixed-effect meta-analysis for combining data where it was reasonable to assume that studies were estimating the same underlying treatment effect: i.e. where trials examined the same intervention, and the trials' populations and methods were judged sufficiently similar. If there was clinical heterogeneity sufficient to expect that the underlying treatment effects differed between trials, or if substantial statistical heterogeneity was detected, we used random-effects meta-analysis to produce an overall summary if an average treatment effect across trials was considered clinically meaningful. The random-effects summary was treated as the average range of possible treatment effects and we discussed the clinical implications of treatment effects differing between trials. If the average treatment effect was not clinically meaningful, we did not combine trials.
Where we use random-effects analyses, the results are presented as the average treatment effect with 95% confidence intervals, and the estimates of T^2 and I^2.

Sensitivity analysis

Sensitivity analysis was not required.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.
Twenty-nine studies met the inclusion criteria for this review but only 22 (1793 women) contributed data. For full details of each trial, *see* Characteristics of included studies.
Nine trials were excluded, for more details, *see* Characteristics of excluded studies. Seven trial reports are in Studies awaiting classification.

Included studies

In 18 of the trials, the indication for caesarean section was non-urgent and the women were healthy and stable. In six of the remaining eleven trials, the indication for caesarean was severe pre-eclampsia in three, pre-eclampsia with non-reassuring heart trace in one, pre-eclampsia with caesarean section indications other than fetal distress in another, and pregnancy-induced hypertension in

the sixth one. In the remaining five trials, two were said to have been either emergency or elective, two were emergency only and the last one was said to be for 'proven uteroplacental insufficiency'. Bupivacaine was used for regional anaesthesia in 17 of the trials; other local anaesthetic agents used include lidocaine, levobupivacaine and ropivacaine. For general anaesthesia thiopentone, suxamethonium and a mixture of nitrous oxide and oxygen were used for induction in 15 of the trials. Five trials used thiopentone and succinyl choline. Other combinations used include thiopentone and rocuronium, propofol and succinylcholine and propofol and cis-atracurium. Six of the papers reported the use of halothane as well, six used isoflurane, another six-sevoflurane, one-enflurane and two did not report the use of any volatile agent for anaesthesia.

Risk of bias in included studies

Details for each trial are in the Characteristics of included studies table. Many of the studies were small and most of them did not report their method of randomisation or allocation concealment. Blinding of outcome assessments was done in some studies. Only one study analysed the data in an intention-to-treat manner. Intervention and control groups were comparable in all but one of the studies, in which this was not reported.

Effects of interventions

Maternal outcomes

Maternal deaths

No trial reported on deaths.

Pre and postoperative haematocrit

One study (Lertakyamanee 1999) reported a significant difference which favoured epidural anaesthesia (mean difference (MD) 1.70%; 95% confidence interval (CI) 0.47 to 2.93; 231 women (Analysis 1.13)) and spinal anaesthesia (MD 3.10%; 95% CI 1.73 to 4.47; 209 women (Analysis 2.12)) over general anaesthesia.

Maternal blood loss

Three trials reported on estimated maternal blood loss.
Compared with general anaesthesia, there was significantly less estimated blood loss when using epidural anaesthesia (standardised mean difference (SMD) -0.32 mL; 95% CI -0.56 to -0.07; two trials (Hong 2002; Lertakyamanee 1999), 256 women (Analysis 1.12)) or spinal anaesthesia (SMD -0.59; 95% CI -0.83 to -0.35; two trials (Lertakyamanee 1999; Dyer 2003), 279 women (Analysis 2.11)).

Wound and other infections

No study reported on wound and other infections.

Pain

One study (Lertakyamanee 1999) reported the occurrence of intraoperative pain. It reported that the perception of pain during the caesarean section was less when general anaesthesia was used compared with epidural anaesthesia (MD 0.84; 95% CI 0.45 to 1.23, 223 women) or spinal anaesthesia (MD 0.69; 95% CI 0.32 to 1.06, 221 women) (Analysis 1.23 and Analysis 2.21). However, one study (Hong 2002) reported that the time to request for analgesia postoperatively was longer with epidural compared with general anaesthesia (MD 500.00 minutes; 95% CI 364.36 to 635.64, 25 women) (Analysis 1.22). Another study (Turhanoglu 1999) reported that the time to request postoperative analgesia was longer with spinal than with general anaesthesia (MD 97.80 minutes; 95% CI 90.28 to 105.32; 60 women (Analysis 2.19).

Satisfaction

One study (Lertakyamanee 1999) reported on satisfaction using a visual analogue score and noted that there was no difference in the level of satisfaction when general anaesthesia was compared with either spinal anaesthesia (MD -0.58; 95% CI -1.26 to 0.10; 221 women (Analysis 2.15)) or epidural anaesthesia (MD -0.01; 95% CI -0.63 to 0.61; 223 women (Analysis 1.14)). However, compared with the epidural or spinal group, more women in the general anaesthesia group stated they would use the same technique again if they needed caesarean section for a subsequent pregnancy (epidural versus general anaesthesia: risk ratio (RR) 0.80; 95% CI 0.65 to 0.98; one trial, 223 women (Analysis 1.15); spinal versus general anaesthesia: RR 0.80; 95% CI 0.65 to 0.99; one trial, 221 women Analysis 2.14)).

Adverse events

There was no difference in any of the adverse events reported.

Neonatal outcomes

Neonatal deaths

No study reported on neonatal deaths.

Umbilical artery pH

Eight studies reported on the mean umbilical artery pH in mothers who had epidural anaesthesia: (Hollmen 1978; Datta 1983; Dick 1992; Wallace 1995; Pence 2002; Petropoulos 2003; Yegin 2003; Bengi Sener 2003).

Indications for caesarean section were not urgent in seven of the eight trials, and from these trials there was no difference in the pH in babies whose mothers received epidural anaesthesia compared to general anaesthesia (average MD 0.00; 95% CI -0.01 to 0.02; random-effects, T^2 = 0.00, I^2 = 60%; seven studies, 397 women (Analysis 1.1)). When including the Wallace 1995 study, in which indication for caesarean section was urgent, there was also no overall difference when all the eight trials were combined (average MD 0.00; 95% CI -0.02 to 0.01; random-effects, T^2 = 0.00, I^2 = 67%, 454 women (Analysis 1.1)). These studies showed a significant degree of heterogeneity both for those with non-urgent indications for caesarean section (I^2 = 60%), and overall (I^2 = 67%).

Six trials (Datta 1983; Mahajan 1992; Kavak 2001; Akyol 2006; Moslemi 2007; Mancuso 2010) also reported no significant difference in the mean umbilical artery pH when mothers had received spinal anaesthesia compared to general anaesthesia (MD -0.00; 95% CI -0.01 to 0.00; 459 women (Analysis 2.1)). Dyer 2003 reported a lower median umbilical artery pH when mothers had received spinal compared to general anaesthesia (66 women, *see* Table 1).

Where both spinal and epidural anaesthesia were given in the same woman and compared with general anaesthesia, two studies (Wallace 1995; Petropoulos 2003) found the mean umbilical artery pH to be significantly lower compared with the general anaesthesia group (MD -0.03; 95% CI -0.04 to -0.02; 211 women; (Analysis 3.1)).

Umbilical vein pH

Seven studies (Hollmen 1978; Datta 1983; Dick 1992; Mahajan 1992; Lertakyamanee 1999; Yegin 2003; Yentur 2009) reported on the mean umbilical vein pH in mothers who had epidural anaesthesia. There was no significant difference in pH in babies whose mothers had received epidural anaesthesia compared with general anaesthesia (average MD 0.01; 95% CI -0.01 to 0.02; random-effects, T^2 = 0.00, I^2 = 59%, 505 women (Analysis 1.2)). Four trials (Datta 1983; Mahajan 1992; Lertakyamanee 1999; Nabhan 2009) found that the mean umbilical vein pH of children whose mothers had received spinal anaesthesia was higher than those whose mothers had received general anaesthesia, but this difference did not reach statistical significance either (MD 0.01; 95% CI 0.00 to 0.02; 383 women; (Analysis 2.2)).

Neonatal neurological adaptive score

Two studies (Lertakyamanee 1999; Bengi Sener 2003) reported on the mean adaptive score at two to four hours and noted that there were no differences in the scores in babies delivered following general anaesthesia when compared with epidural anaesthesia (average MD 2.17; 95% CI -1.13 to 5.47; random-effects, T^2 = 5.38, I^2 = 95%; 253 women (Analysis 1.9)).

When looking at the proportion of babies with neurologic and adaptive capacity scores less than 35, Mahajan 1992 noted that there were no differences in the epidural group when compared with the general anaesthesia group at 15 minutes (RR 0.94; 95% CI 0.62 to 1.45, 60 women (Analysis 1.16)) and at two hours (RR 0.67; 95% CI 0.27 to 1.64, 60 women (Analysis 1.17)).

One study (Lertakyamanee 1999) documented the mean adaptive score at two to four hours and noted that there were also no differences in babies whose mothers had received spinal anaesthesia over general anaesthesia (MD 0.40; 95% CI -0.54 to 1.34; 221 women (Analysis 2.3)). In contrast, Mahajan 1992 reported significantly fewer children with adaptive scores less than 35 were born to women who received spinal anaesthesia compared with general anaesthesia at 15 minutes (RR 0.17; 95% CI 0.05 to 0.51; 60 women (Analysis 2.4)) and at two hours (RR 0.05; 95% CI 0.00 to 0.87; 60 women (Analysis 2.5)).

Apgar score

Five studies (Hodgkinson 1980; Lertakyamanee 1999; Mathur 2002; Yegin 2003; Yentur 2009) documented mean Apgar score at one minute comparing epidural anaesthesia with general anaesthesia. They reported that there was no significant difference between the two groups (average MD 0.39; 95% CI -0.34 to 1.12; random-effects, T^2 = 0.52, I^2 = 87%; 408 women (Analysis 1.7)). After analysing five studies comparing spinal with general anaesthesia, (Lertakyamanee 1999; Kavak 2001; Mathur 2002; Akyol 2006; Moslemi 2007), we again found no significant difference in mean Apgar score at one minute (average MD 0.54; 95% CI -0.09 to 1.16; random-effects, T^2 = 0.43, I^2 = 90%; 470 women (Analysis 2.7)).

Four studies comparing epidural with general anaesthesia reported Apgar scores at five minutes (Hodgkinson 1980; Lertakyamanee 1999; Yegin 2003; Yentur 2009) and did not find any significant difference between the two groups (average MD 0.20; 95% CI -0.15 to 0.55; random-effects, T^2 = 0.08, I^2 = 72%, 368 women (Analysis 1.8)). Furthermore, when comparing spinal with general anaesthesia, four studies (Lertakyamanee 1999; Kavak 2001; Akyol 2006; Moslemi 2007) did not find any significant differences in the mean Apgar score at five minutes (average MD 0.24; 95% CI -0.05 to 0.54; random-effects, T^2 = 0.07, I^2 = 83%; 429 women (Analysis 2.8)).

One study (Korkmaz 2004) also found no significant differences in mean Apgar score at one minute (MD 0.25; 95% CI -0.14 to 0.64; 30 women (Analysis 3.5)) or at five minutes (not estimable), when comparing combined spinal and epidural anaesthesia with general anaesthesia. Mathur et al (Mathur 2002) did not find any significant differences in mean Apgar score at ten minutes either, when comparing spinal with general anaesthesia (MD -0.15; 95% CI -0.81 to 0.51, 41 women (Analysis 2.18)), or when comparing epidural with general anaesthesia (MD -0.45; 95% CI -1.03 to 0.13; 40 women (Analysis 1.21)).

One study (Dick 1992) reported on the proportion of babies with Apgar score of four or less, comparing epidural with general anaes-

thesia. The trial did not find any significant difference in the proportion of children with such low Apgar scores at one minute (RR 0.15; 95% CI 0.01 to 2.73; 47 women (Analysis 1.3)) and at five minutes (RR 0.35; 95% CI 0.01 to 8.11; 47 women (Analysis 1.4)).

Two studies (Wallace 1995; Petropoulos 2003) reported on the proportion of babies with Apgar scores six or less in women who received epidural versus general anaesthesia. No significant difference was found at one minute (RR 0.58; 95% CI 0.22 to 1.52; 209 women (Analysis 1.5)) or at five minutes (RR 0.46; 95% CI 0.11 to 1.95; 209 women (Analysis 1.6)). In comparing an Apgar score of six or less at one minute in women who received spinal versus general anaesthesia, five studies (Mahajan 1992; Turhanoglu 1999; Moslemi 2007; Nabhan 2009; Mancuso 2010) found significantly fewer babies in the spinal group (average RR 0.54; 95% CI 0.16 to 1.84; random-effects, $T^2 = 1.32$, $I^2 = 77\%$, 435 women (Analysis 2.9)). At five minutes however, three studies (Mahajan 1992; Turhanoglu 1999; Mancuso 2010) did not find significant differences between groups in terms of Apgar score of six or less (RR 0.56; 95% CI 0.21 to 1.46; 291 women (Analysis 2.10)). No significant differences were seen in the proportion of babies with an Apgar score of six or less when combined epidural and spinal anaesthesia were used compared with general anaesthesia at one minute (RR 0.89; 95% CI 0.38 to 2.07; two trials, 211 women (Analysis 3.2)) and at five minutes (RR 0.60; 95% CI 0.15 to 2.44; 211 women (Analysis 3.3)) in two studies (Wallace 1995; Petropoulos 2003).

Need for oxygen for resuscitation

One study (Petropoulos 2003) comparing epidural versus general anaesthesia reported on the need for oxygen and did not find a significant difference in the need for oxygen (RR 0.86; 95% CI 0.34 to 2.20; 152 women (Analysis 1.19)). Similarly, when combined epidural and spinal anaesthesia were compared with general anaesthesia (Petropoulos 2003), no significant difference was observed for this outcome (RR 1.14; 95% CI 0.49 to 2.65; 158 women (Analysis 3.4)).

DISCUSSION

No trial reported on maternal or neonatal deaths. This attests to the relative safety of caesarean section, especially in the countries where most of the trials in this review were conducted. Larger sample sizes would be needed to detect such outcomes but many of the included studies were underpowered. Also, as a result of the massive shift to the use of regional anaesthesia for caesarean section for maternal reasons (Hawkins 1997b), it is unlikely that such studies will be performed in future.

From the results, epidural and spinal anaesthesia appears to be associated with less blood loss than general anaesthesia. Although this did not translate into a reduction in the need for blood transfusion, it may be clinically significant especially as anaemia is detrimental to postoperative wellbeing and healing.

The finding of less intraoperative pain with general anaesthesia compared with both forms of regional is not surprising as this method is characterised by the abolishment of all sensation. The time to request analgesia, an index of postoperative pain requirements, appeared longer when mothers were given epidural anaesthesia. This is probably because drugs administered into the epidural space last longer and the epidural catheter can be left in situ and topped up for several hours after surgery. However, there was a big difference in standard deviation between the epidural and general anaesthesia groups. This suggests differing distribution of data and some degree of skewing, rendering the mean difference comparisons invalid. Thus, firm conclusions cannot be drawn from these data. With spinal anaesthesia, the longer time to request analgesia was also found in one study. Despite the relatively small sample size, this is an expected advantage of regional anaesthesia as its anaesthetic effect usually persists after the surgical procedure.

One of the big issues in healthcare delivery is client satisfaction; only one trial reported on this and did not find any differences in satisfaction between regional and general anaesthesia. It is clear that this aspect would need to be addressed in the design of new trials. In terms of preference of the same technique again, however, based on the results of one study, women who had general anaesthesia appeared to favour it over regional anaesthesia (both spinal and epidural) for caesarean sections. The reasons for this preference could not be determined from the study.

Regarding neonatal outcomes, neither umbilical artery or vein pH was affected by spinal or epidural anaesthesia when the indications for surgery are not urgent. This differs from the findings of a recent meta-analysis (Reynolds 2005) that showed that spinal anaesthesia resulted in lower umbilical cord pH results than general, but showed no difference when epidural anaesthesia was compared with general anaesthesia. The authors however included both randomised and non-randomised trials and combined both umbilical artery and vein pH data in their analysis of cord pH. Umbilical blood sampling is one of the parameters used in defining and deciding how aggressively one should resuscitate any baby with severe birth asphyxia. Although umbilical artery pH appeared to be favoured by the use of general as compared with combined spinal and epidural anaesthesia, the differences found in this review may not be clinically significant as the mean figures were within normal neonatal limits (7.11 to 7.45). They were also well above the cut-off for defining acidosis (pH less than 7.0) (Stoll 2000).

The Apgar score is a composite measure of the clinical and cardiorespiratory status of the baby at birth. It is measured usually at one minute (to determine the extent of resuscitation required) and at five minutes (to determine the response to resuscitation and to diagnose asphyxia). Apart from a higher mean Apgar score at

one minute in epidural versus general anaesthesia groups, there were no other differences in Apgar score measurements between the three intervention comparison groups. We can thus conclude that practically, one form of anaesthesia has not been shown to be superior to the other, as far as the determination of asphyxia is concerned.

The neonatal neurological adaptive score is an attempt to measure the neurological status of the babies on the assumption that the drugs used in inducing anaesthesia may depress the central nervous system. Overall, the results suggest that regional anaesthesia conveys a more favourable outcome than general anaesthesia, especially when babies are categorised based on a cut-off point of less than 35 and particularly when spinal anaesthesia is used. However, the study which showed a significant effect with spinal anaesthesia was a small one with 30 participants in each arm (Mahajan 1992). Also, there was significant heterogeneity between the two studies that showed a difference in the mean score within two to four hours using epidural anaesthesia (Lertakyamanee 1999; Bengi Sener 2003), which could be because the former study (30 women) was much smaller than the latter (223 women). The larger study did not show a significant difference in the mean score between epidural and general anaesthesia.

AUTHORS' CONCLUSIONS

Implications for practice

There is not enough evidence from this review to show that either regional or general anaesthesia is superior to the other in terms of major maternal or neonatal outcomes. Thus, the choice of one over the other lies with other criteria such as estimated blood loss which appears to be reduced with the use of regional anaesthesia. This may assume greater importance depending on the context in which one is operating.

Implications for research

Trials measuring outcomes such as maternal and newborn morbidity, maternal satisfaction with techniques and adverse events are necessary.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

Akyol 2006

Methods	Women said to have been randomly divided into groups. Blinding of intervention: not done. Blinding of outcome assessment: not stated. No women were excluded from this study. Intention-to-treat analysis: not stated but women remained in their allocated groups
Participants	62 women (30 received spinal, 32 general anaesthesia). Inclusion criteria: ASA-I (American Society of Anesthesiologists) risk group. Women greater than 37 weeks' pregnant, undergoing elective caesarean section. Exclusion criteria: women with complications such as pre-eclampsia, diabetes mellitus, anaemia, premature membrane rupture of fetal complications. Also those with a contraindication to spinal anaesthesia. Setting: Turkey.
Interventions	Regional group had spinal anaesthesia with bupivacaine. General anaesthesia group had thiopental, rocuronium, and a mixture of nitrous oxide and oxygen and sevoflurane
Outcomes	Review outcomes were mean umbilical arterial pH and Apgar score at 1 and 5 minutes Other study outcomes were umbilical blood gas data such as partial pressures of carbon dioxide and oxygen, as well as bicarbonate concentration
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Bengi Sener 2003

Methods	Women said to have been randomly divided into groups but method not stated. Blinding of intervention: not stated. Blinding of outcome assessment: maternal and neonatal assessments were made by blinded observers. No women were excluded from this study. Intention-to-treat analysis: not stated but women remained in their allocated groups
Participants	30 women (15 received epidural, 15 general anaesthesia). Inclusion criteria: ASA I/II women undergoing elective caesarean section for breech presentation, CPD and previous caesarean section, who had not used regional anaesthesia or analgesia before the study. Exclusion criteria: women with pre-eclampsia, eclampsia, morbid obesity, diabetes mellitus, anaemia, fetal anomaly, heart disease, marked airway problems, fetal distress, gestational age below 37 weeks. Setting: Turkey, University Hospital.
Interventions	Regional group had epidural anaesthesia with bupivacaine. General anaesthesia group had thiopental, succinyl choline, mixture of nitrous oxide and oxygen, isoflurane and vecuronium
Outcomes	Review measured neonatal NACS, umbilical arterial pH, Apgar scores, and adverse events Study outcomes were maternal systolic arterial pressure, heart rate, peripheral oxygen saturation, uterine I-D interval, Apgar scores, neonatal NACS, umbilical arterial blood gases, first breastfeeding interval and complications such as nausea, vomiting and allergic reactions
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Braithwaite 1993

Methods	Women said to have been randomly divided into groups by drawing numbers from a hat. Blinding of intervention: not stated. Blinding of outcome assessment: outcome assessments were made by blinded observers. No women were excluded from this study. Intention-to-treat analysis: not stated but women remained in their allocated groups
Participants	50 women (25 received spinal, 25 general anaesthesia). . Inclusion criteria: women undergoing emergency caesarean section, most frequent indications being CPD, previous caesarean section with failed trial of scar, fetal distress and failed induction of labour, who had no contraindications to general or spinal anaesthesia. Exclusion criteria: women who were unwilling, those not having a standardised technique of spinal or epidural, those with shock, bleeding disorders/haemorrhage, sepsis, severe hypertension and fixed cardiac output. Women with allergies to any of the anaesthetic drugs used, relative contraindications such as kyphosis or massive obesity and those with abnormal delays in theatre. Setting: South Africa.
Interventions	Regional group had spinal anaesthesia with Heavy Marcaine. General anaesthesia group had Pentothal, scoline, mixture of nitrous oxide and oxygen, halothane and droperidol and fentanyl
Outcomes	Study outcome was time taken to produce surgical readiness which was not one of the review outcomes thus study data not included in the review
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomly selected by picking numbers from a hat.
Allocation concealment (selection bias)	High risk	No attempt was made to conceal allocation.
Blinding (performance bias and detection bias) All outcomes	High risk	No blinding done.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	High risk	Author states preference for spinal over general anaesthesia.

Datta 1983

Methods	Randomisation was said to be by formal randomisation. Blinding of intervention and outcome: not stated. There was no loss to follow-up. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	30 women (10 received epidural, 10 received spinal and 10 received general anaesthesia) . Inclusion criteria: healthy parturients, elective caesarean section. Exclusion criteria: none stated. Setting: USA, University Hospital.
Interventions	2 types of regional anaesthesia were used in this study - spinal anaesthesia which had 0. 5% tetracaine. General anaesthesia group had thiopental with 50% nitrous oxide in oxygen
Outcomes	Review measured neonatal umbilical arterial and venous pH, Apgar score less than 7 at 1 minute Study outcomes were I-D interval, UI-D interval, Apgar score < 7, maternal pH, neonatal acid-base values
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Dermitzaki 2009

Methods	Randomisation was said to be by a computer-generated table. Blinding of intervention and outcome: not stated. There was some loss to follow-up. gestational age group - 5 women excluded due to intraoperative transfusion, use of postoperative non-steroidal anti-inflammatory drugs and faulty sample withdrawal; Regional group - 5 women due to delay in blood sampling, epidural catheter dysfunction, haemolysis of blood samples and technical laboratory problems. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	25 women (17 received combined spinal-epidural, 18 received general anaesthesia). Inclusion criteria: uncomplicated elective caesarean section. Exclusions: multiple pregnancy, medical problems in pregnancy, weight gain of more than 20 kg in pregnancy, predicted airway difficulty and contra-indication to a specific anaesthetic technique. Setting: Greece, University Hospital.
Interventions	Regional anaesthesia group had combined spinal and epidural anaesthesia with levobupivacaine and fentanyl +/- levobupivacaine respectively. General anaesthesia group had thiopentone, succinylcholine, nitrous oxide/oxygen and sevoflurane, and vecuronium
Outcomes	Study outcomes measured were median Apgar scores at 1 and 5 minutes but this review measures mean Apgar scores The study also measured IL-6 and TNF-alpha levels which are not part of the review outcomes
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer generation.
Allocation concealment (selection bias)	Low risk	Sealed envelopes.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Dick 1992

Methods	Women said to have been randomised but method not stated. Blinding of intervention: not stated. Blinding of outcome assessment: the paediatrician was blind to the type of anaesthesia used. No loss to follow-up. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	47 women (23 received epidural, 24 received general anaesthesia). Inclusion criteria: elective caesarean section for breech presentation or disproportion following a normal uncomplicated pregnancy. Exclusions: none stated. Setting: Germany, University Hospital.
Interventions	Regional anaesthesia group had epidural anaesthesia with 12-15 mL of bupivacaine. General anaesthesia group had thiopentone, succinylcholine, nitrous oxide/oxygen and halothane
Outcomes	Outcomes measured: study measured maternal heart rate, blood pressure, blood gases and haematocrit. Induction-delivery and I-D interval were also measured. Neonatal Apgar scores, umbilical arterial and venous blood gases and acid-base balance and a full set of neurological observations were also measured. Review measured neonatal umbilical arterial and venous pH and Apgar scores of 4 or less at 1 and 5 minutes
Notes	The outcomes measured in the review were those that were reported clearly in the results

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Dogan 2008

Methods	Women said to have been randomised but method not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No loss to follow-up. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	40 women (20 received combined spinal-epidural, 20 general anaesthesia). Inclusion criteria: elective caesarean section in term women in ASA groups I and II. Exclusions: none stated. Setting: Baskent University Hospital, Turkey.
Interventions	Regional anaesthesia group had combined spinal-epidural anaesthesia with bupivacaine. General anaesthesia group had thiopental sodium, atracurium, nitrous oxide/oxygen and sevoflurane
Outcomes	Outcomes measured: study measured outcomes that were different from the outcomes of this review. These included maternal heart rate, blood pressure, ST segment changes on electrocardiogram, serum troponin T, CK-MB and myoglobin concentrations
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Dyer 2003

Methods	Women were said to have been randomised by sealed envelopes. Blinding of intervention: not stated. Blinding of outcome assessment: the paediatrician was blinded to the type of anaesthesia used. No mothers were excluded but there were no data for 1 neonate in the general anaesthesia group as its mother suffered a stillbirth. Intention to treat: not stated (but all women remained in their allocated groups)
Participants	70 women (35 received spinal, 35 received general anaesthesia). Inclusion criteria: pre-eclampsia with non-reassuring fetal heart trace. Exclusion criteria: participant refusal; any other relative contraindication to general or spinal anaesthesia, in particular oral intake other than clear fluids within 4 hours of the intended surgery; body mass index greater than 35 kg/m2; Mallampati score greater than 2; clinical signs of hypovolaemia; abruptio placentae; placenta praevia; coagulation abnormality; thrombocytopenia; local or generalised sepsis; spinal deformity; cord prolapse; less than 30 weeks' gestation; or twin pregnancy. Setting: South Africa.
Interventions	Regional group had spinal anaesthesia using 1.8 mL hyperbaric bupivacaine 0.5% with 10 ug fentanyl. General anaesthesia group had thiopentone, suxamethonium, nitrous oxide/oxygen, isoflurane and magnesium sulphate to control the pressor response to tracheal intubation
Outcomes	Outcomes measured: study primary outcomes were umbilical arterial base deficit, umbilical arterial pH, Apgar scores, requirements for resuscitation, and complications. Secondary outcome measures were maternal pulse rate and non-invasive blood pressure. Review measured umbilical arterial pH, need for oxygen by face mask or intubation, and maternal blood loss
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Low risk	Sealed envelopes.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.

Dyer 2003 (*Continued*)

Other bias	Unclear risk	Not stated.

Hodgkinson 1980

Methods	Women were said to be randomly allocated to groups but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	20 women (10 received epidural, 10 received general anaesthesia). Inclusion criteria: severe gestational hypertension (pre-eclampsia or hypertension with superimposed pre-eclampsia) requiring emergency caesarean section for delivery. Exclusion criteria: not stated. Setting: USA, University Health Science Centre.
Interventions	Regional group had epidural anaesthesia with 12-20 mL of bupivacaine 0.75%. General anaesthesia group had thiopentone, succinyl choline, nitrous oxide and halothane
Outcomes	Outcomes measured: study primary outcomes were systemic and pulmonary blood pressures before, during and after surgery. Review measured maternal adverse events and neonatal Apgar scores at 1 and 5 minutes
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Hollmen 1978

Methods	Inadequate randomisation as women were allocated to groups alternately. Blinding of intervention: not stated. Blinding of assessment: the examiner who performed the neonatal neurologic assessment was blinded to the obstetric and anaesthetic management. No women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	30 women (15 received epidural, 15 received general anaesthesia). Inclusion criteria: healthy women with uncomplicated full-term pregnancies, requiring elective caesarean section. 3 women in each group had mild toxemia, diabetes or hypertension and 1 person in the general anaesthesia group had partial placenta previa and transverse lie. All the women had intact membranes and were not in labour. Exclusion criteria: not stated. Setting: Finland; type of hospital not stated.
Interventions	Regional group had epidural anaesthesia with lidocaine and epinephrine. General anaesthesia group had thiopentone, 1:1 mixture of nitrous oxide and oxygen, and succinyl choline
Outcomes	Outcomes measured: study outcome measures were maternal and fetal blood gases, neonatal Apgar scores and neurological assessment. Review measured neonatal umbilical vessel pH and neurological assessment
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Allocation sequence quasi-randomised.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Low risk	The person who performed the neonatal neurologic assessment was blinded to the obstetric and anaesthetic management
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Hong 2002

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: an anaesthesiologist blinded to the anaesthetic technique measured the estimated blood loss, volume of IV fluids and blood given, and the Apgar scores of the newborn. No women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	25 women (13 received epidural, 12 received general anaesthesia). Inclusion criteria: women with grade 4 placenta previa without bleeding, scheduled for elective caesarean section. Exclusion criteria: not stated. Setting: South Korea, University Hospital.
Interventions	Regional anaesthesia group had epidural anaesthesia with lidocaine (20 mL of 2%), plus epinephrine (1 in 200,000) and morphine (2 mg in 4 mL). General anaesthesia group had thiopentone, succinyl choline, vecuronium, mixture of nitrous oxide and oxygen and enflurane
Outcomes	Outcomes measured: study outcome measures were maternal blood pressure and heart rate, estimated blood loss at surgery, and neonatal Apgar scores, haemoglobin and haematocrit levels at admission and 24 hours after surgery, need for postoperative transfusion, request for analgesics and adverse events. Review measured amount of blood received, need for postoperative blood transfusion, maternal estimated blood loss, need for postoperative analgesia, time to request analgesia, adverse events and Apgar scores
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Jain 2009

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No women were excluded. Intention-to-treat analysis: not stated.
Participants	40 women (20 received spinal, 20 received general anaesthesia). Inclusion criteria: women with proven uteroplacental insufficiency. Exclusion criteria: not stated. Setting: India.
Interventions	Regional anaesthesia group had spinal anaesthesia with heavy bupivacaine with 25 ug Fentanyl. General anaesthesia group had thiopentone and suxamethonium.
Outcomes	Outcomes measured: study outcome measures were maternal blood pressure, median Apgar scores at 1 and 5 minutes, mean umbilical artery pH and mean umbilical vein pH, neonatal need for oxygen and resuscitation
Notes	Study was reported in an abstract; numbers in each group were not stated so comparisons could not be made. The data were therefore not included in the review. Study authors were emailed with no response

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Kavak 2001

Methods	Women were said to have been allocated randomly to groups but the method of randomisation was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. 20 women were excluded; 19 due to incomplete data on their infants and 1 due to congenital malformation in her infant. Intention-to-treat analysis: not stated but women remained in their allocated groups
Participants	104 women (46 received spinal, 38 received general anaesthesia and 20 were excluded; 19 due to incomplete data and 1 for minor fetal congenital malformation). Inclusion criteria: healthy women with uncomplicated singleton cephalic pregnancies undergoing elective repeat caesarean section after 37 weeks' gestation. Exclusion criteria: pregnancies with obstetric or medical complications. Setting: Turkey, hospital not stated.
Interventions	Regional anaesthesia group had spinal anaesthesia with 12.5 mg of 0.5% heavy bupivacaine and morphine. General anaesthesia group had thiopental sodium, succinyl choline, mixture of nitrous oxide and oxygen, sevoflurane and vecuronium
Outcomes	Outcomes measured: study primary endpoints were respiratory depression, perinatal asphyxia, readmission and duration of hospital admission of the infants. Review measured umbilical arterial pH, need for neonatal oxygen therapy and Apgar scores
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Kim 2000

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	30 women (20 received epidural,10 received general anaesthesia). Inclusion criteria: healthy women undergoing caesarean section. Exclusion criteria: not stated. Setting: South Korea, University College of Medicine.
Interventions	Regional anaesthesia group had epidural anaesthesia with bupivacaine. General anaesthesia group had sodium thiopental, succinyl choline, enflurane, mixture of nitrous oxide and oxygen, midazolam and vencuronium
Outcomes	Outcomes measured: study outcome measures were changes in serum interleukin and cortisol levels
Notes	Study outcomes were not relevant to the review so the data were not included

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Korkmaz 2004

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No other method was stated. This was an abstract

Korkmaz 2004 (*Continued*)

Participants	30 women (15 received combined regional, 15 received general anaesthesia). Inclusion criteria: women who had elective caesarean section. Exclusion criteria: not stated. Setting: Turkey, Education and Research Hospital.
Interventions	Regional group had combined spinal and epidural anaesthesia with 5 mg of 0.5% bupivacaine and fentanyl, with additional ropivacaine top-ups if necessary. The general anaesthesia group had sevoflurane
Outcomes	Study outcome measures were heart rate, mean blood pressure, systolic and diastolic blood pressure, Apgar scores at 1 and 5 minutes and umbilical blood gases Review measured Apgar scores at 1 and 5 minutes. Blood gas levels were not reported in the abstract
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Lertakyamanee 1999

Methods	Randomisation was said to be by random numbers. Blinding of intervention: not stated. Blinding of outcome assessment: the assessors of the estimated blood loss levels, haematocrit levels and NACS were blinded to the mode of anaesthesia used. There were no women excluded. Intention-to-treat analysis: not stated but 39 women were changed to another intervention group due to technical difficulty

Lertakyamanee 1999 (*Continued*)

Participants	341 women (120 received epidural, 118 received spinal and 103 received general anaesthesia) Inclusion criteria: term normal women scheduled to have elective or emergency caesarean section. Exclusion criteria: women with abruptio placenta, bleeding placenta praevia, fetal distress, diabetes mellitus, moderate to severe hypertension of pregnancy, severe cardiac or respiratory disease, pregnancy with more than 1 fetus and coagulopathy. Setting: Department of Obstetrics and Gynaecology, Thailand, University Hospital
Interventions	2 types of regional anaesthesia were used in this study - spinal anaesthesia group which used 5% lidocaine and epidural which used 2% lidocaine. The general anaesthesia group had halothane, a mixture of nitrous oxide and oxygen and pancuronium bromide
Outcomes	Study outcome measures were estimated blood loss, IV fluid and blood transfusion, pre and postoperative haematocrit, intraoperative complications, hypo and hypertension, satisfaction towards anaesthetic technique and total pain scores. Apgar scores, umbilical vein gases, neurologic adaptive capacity scores, and maternal systolic blood pressure Review measured difference between pre and postoperative haematocrit, number who had blood transfusion, hypo and hypertension, maternal satisfaction with technique, intraoperative pain, nausea and vomiting, maternal systolic blood pressure, umbilical venous pH, neonatal neurologic and adaptive capacity scores and Apgar scores at 1 and 5 minutes
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Allocation sequence by random numbers.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Low risk	Those estimating blood loss and haematocrit levels and assessors of the NACS were blinded to the type of anaesthesia used
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Mahajan 1992

Methods	Randomisation was adequate (done with a random chart). Blinding of intervention: not stated. Blinding of outcome assessment: the paediatrician who assessed the neonatal NACS was blinded to the anaesthetic technique used. No women were excluded. Intention-to-treat analysis: not stated but all women remained in their allocated groups
Participants	90 women (30 received epidural, 30 received spinal and 30 received general anaesthesia) . Inclusion criteria: healthy women presenting for elective caesarean section, at a gestational age greater than 36 weeks, with infants of a birthweight greater than 2.5 kg, with no evidence of placental insufficiency. Exclusion criteria: not stated. Setting: India; type of hospital not stated.
Interventions	2 types of regional anaesthesia were used in this study - epidural anaesthesia which used 0.5% bupivacaine, and spinal with 1% bupivacaine. General anaesthesia group had thiopentone, suxamethonium, nitrous oxide and oxygen, halothane and pancuronium
Outcomes	Study outcome measures were maternal blood pressure and heart rate, maternal blood gases, umbilical arterial and venous blood gases, time intervals to delivery, Apgar scores and neonatal NACS. Review measured umbilical arterial and venous pH, neonatal NACS and Apgar scores
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Allocation sequence by random numbers chart.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Low risk	The assessors of the NACS were blinded to the mode of anaesthesia used
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Mancuso 2010

Methods	Study was appropriately randomised by computer-generated random numbers. Blinding of intervention: not stated. Blinding of outcome assessment: a paediatrician blinded to the anaesthetic techniques estimated the umbilical artery pHs and the Apgar scores of the newborn. 8 infants were excluded but attrition was still less than 10%. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	179 women (90 received spinal, 89 received general anaesthesia). Inclusion criteria: women with previous caesarean section, maternal-fetal disproportion, restricted pelvis, patient's choice, breech presentation, history of sterility and maternal age, who were scheduled for elective caesarean section. Exclusion criteria: those without the above indications. Setting: Messina, Italy; University Hospital.
Interventions	Regional anaesthesia group had spinal anaesthesia with hyperbaric bupivacaine or isobaric levobupivacaine. General anaesthesia group had propofol, cis-atracurium, sevoflurane and mixture of nitrous oxide and oxygen
Outcomes	Outcomes measured: study outcome measures were neonatal Apgar scores, umbilical artery pH and need for oxygen by face mask
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Allocation sequence generated by computer.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Low risk	The assessors of the umbilical artery pH and Apgar scores were blinded to the mode of anaesthesia used
Incomplete outcome data (attrition bias) All outcomes	Low risk	Not stated.
Selective reporting (reporting bias)	Low risk	Not stated.
Other bias	Unclear risk	Not stated.

Mathur 2002

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. None of the women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	60 women (20 received epidural, 20 received spinal and 20 received general anaesthesia) . Inclusion criteria: women with pre-eclampsia undergoing caesarean section for various indications other than fetal distress. Exclusion criteria: women with medical complications, eclampsia and platelets > 100,000/mm^3. Setting: India, S.N. Medical College, Agra.
Interventions	2 types of regional anaesthesia were used in this study - spinal anaesthesia group which used bupivacaine and epidural which used 2% lidocaine or bupivacaine. The general anaesthesia group had pentothal and succinyl choline, and were maintained on nitrous oxide and oxygen
Outcomes	Study outcome measures were anaesthesia induction to skin incision, skin incision to delivery, uterine incision to delivery, surgery duration, highest and lowest maternal blood pressure, IV fluid input and urinary output, perioperative blood loss, maternal complications such as hyper- and hypo- tension, vomiting, aspiration, postpartum haemorrhage and post spinal headache. Pulmonary oedema, cerebral haemorrhage, convulsions and maternal mortality were also outcome measures but there were no reported incidences Review measured mean Apgar scores at 1 and 10 minutes, and vomiting as an adverse event in the mothers
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	High risk	There were errors in the paper such as the level of platelet count excluded (> 100,000

		instead of < 100,000) as well as some other errors in the tables. There were also a number of typographical errors in the paper

Momani 2001

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. None of the women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	45 women (15 received spinal, 15 received general with bupivacaine supplementation and 15 received general anaesthesia without bupivacaine). Inclusion criteria: healthy women and those with mild systemic disease undergoing elective or emergency caesarean section. Setting: Prince Hashim Ben Al-Hussein Hospital, Amman, Jordan
Interventions	There were 2 groups of general anaesthesia in this study - general anaesthesia with bupivacaine wound infiltration and general anaesthesia without. Thiopentone, suxamethonium, halothane and 50% nitrous oxide in oxygen were used for the general anaesthesia. The regional anaesthesia was spinal anaesthesia group which used hyperbaric bupivacaine; bupivacaine was also infiltrated into the wound
Outcomes	Study outcome measures were reported in a different manner from the review outcome measures and could not be extrapolated or re-calculated thus the data could not be used. They included time to next analgesia (recorded as a range as opposed to mean or median) and pain degree on a visual analogue scale recorded in 7 different time slots including zero and 24 hours after the operation
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.

Momani 2001 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Moslemi 2007

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. None of the women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	60 women, 62 neonates (including 2 sets of twins) (30 received spinal, 30 received general anaesthesia). Inclusion criteria: women with severe pre-eclampsia undergoing caesarean section. Setting: Iran, Tabriz University.
Interventions	Regional anaesthesia group had spinal anaesthesia with hyperbaric bupivacaine and fentanyl. General anaesthesia group had thiopental, succinyl choline, lidocaine, fentanyl, mixture of nitrous oxide and oxygen, halothane and atracurium
Outcomes	Study outcome measures were maternal nausea and vomiting, maternal blood pressure changes, neonatal umbilical artery pH and neonatal Apgar scores
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Nabhan 2009

Methods	Study was appropriately randomised by computer-generated software. Blinding of intervention: not blinded. Blinding of outcome assessment: blinded. None of the women were excluded. Intention-to-treat analysis: analysis was by intention to treat
Participants	82 women (41 received spinal, 41 received general anaesthesia). Inclusion criteria: healthy women for elective caesarean section with singleton normal pregnancies Exclusion criteria: women with intrauterine infection, chromosomal aberration, major malformations, non-reassuring fetal heart rate pattern, antepartum haemorrhage, diabetic and pre-eclamptic pregnancy and cardiac disease. Setting: Egypt; Ain Shams University, Cairo.
Interventions	Regional anaesthesia group had spinal anaesthesia with hyperbaric bupivacaine and fentanyl. General anaesthesia group had sodium thiopental, succinyl choline, isoflurane and mixture of nitrous oxide and oxygen
Outcomes	Study outcome measures were umbilical venous glutathione concentration, umbilical venous malondialdehyde, umbilical venous pH, pO2, PCO2, neonatal Apgar scores, neonatal morbidity and admission to neonatal intensive care unit
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Allocation sequence generated by computer.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Papadopoulou 2005

Methods	Study was said to be a randomised trial but the method used was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. None of the women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	32 women (14 received spinal, 18 received general anaesthesia). Inclusion criteria: women requiring emergency caesarean section. Setting: Hippokrates General Hospital, Thessaloniki, Greece.
Interventions	Regional group had spinal anaesthesia with 10-15 mg bupivacaine. General anaesthesia group had thiopentone and 'Sucin' with sevoflurane and nitrous oxide 50% in oxygen
Outcomes	Study outcome measures that were documented (b-endorphin and cortisol concentration) were different from those measured in the review. Other study outcomes were maternal heart rate and arterial blood pressure, acid base balance of both mothers and newborns and newborn Apgar scores
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Pence 2002

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)

Pence 2002 (*Continued*)

Participants	56 women (26 received epidural, 30 received general anaesthesia). Inclusion criteria: women with a cephalic presentation, having elective caesarean section. Exclusion criteria: women with medical diseases, fetal distress and medication apart from iron. Setting: Turkey.
Interventions	Regional group had epidural anaesthesia with 50 mg bupivacaine and fentanyl. General anaesthesia group had isoflurane with propofol and succinylcholine
Outcomes	Study outcome measures were umbilical artery blood gas levels and malondialdehyde and glutathione levels Review measured umbilical arterial pH.
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Petropoulos 2003

Methods	Randomisation was done with a random-number table and numbered sealed envelopes were used to conceal allocation. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. There was no loss to follow-up. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	230 women (72 received epidural, 78 received spinal and 80 received general anaesthesia). Inclusion criteria: pregnant women presenting for planned elective caesarean section after 38 weeks' gestation.

Petropoulos 2003 (*Continued*)

	Exclusion criteria: multiple gestation, gestational age < 38 weeks and > 42 weeks, placental or cord abnormalities, premature rupture of membranes, abnormal fetal heart tracings, obstetric or medical complications, congenital malformations and incomplete data. Setting: Greece, University Hospital.
Interventions	2 types of regional anaesthesia were used in this study - epidural anaesthesia which used ropivacaine after a test dose of xylocaine. General anaesthesia group had thiopentone, suxamethonium,nitrous oxide and oxygen, sevoflurane and vecuronium
Outcomes	Outcomes measured: study outcomes were maternal blood gases, neonatal blood gases, Apgar scores and need for oxygen or mask ventilation. Review measured neonatal umbilical artery pH, Apgar scores at 1 and 5 minutes less than 7, and need for oxygen or mask ventilation of the neonate
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Allocation sequence computer-generated.
Allocation concealment (selection bias)	Low risk	Sealed envelopes.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Turhanoglu 1999

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	60 women (30 received spinal, 30 received general anaesthesia). Inclusion criteria: pregnant women with hypertension requiring a caesarean section for delivery. Exclusion criteria: women with hypertension existing before pregnancy, thrombocyte

Turhanoglu 1999 (*Continued*)

	count less than 100,000 and with 'extremely damaged fetal parameters'
Interventions	The regional anaesthesia group had spinal anaesthesia with 12.5 mg of 0.5% heavy bupivacaine. General anaesthesia group had propofol, succinyl choline, mixture of nitrous oxide and oxygen and isoflurane. Vecuronium was also added where necessary
Outcomes	Study outcomes were maternal heart rate and arterial blood pressures before during and after surgery, uterine incision-cord clamping interval, postoperative pain scores, time to first postoperative analgesia, and 1 and 5 minute Apgar scores Review measured neonatal umbilical artery pH, Apgar scores at 1 and 5 minutes less than 7, and need for oxygen or mask ventilation of the neonate
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Wallace 1995

Methods	Randomisation was by a random-number table and numbered sealed envelopes were used to conceal allocation. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. 1 woman was excluded from the study after randomisation. Intention-to-treat analysis: not stated. All the remaining women stayed in their allocated groups
Participants	80 women (27 received epidural, 27 received combined spinal-epidural and 26 received general anaesthesia). Inclusion criteria: women undergoing elective or emergency caesarean section for severe pre-eclampsia.

	Exclusion criteria were thrombocytopenia with a platelet count of less than 100,000/ mm^3, eclampsia or medical conditions such as heart disease, diabetes mellitus or chronic renal disease, and non-reassuring fetal heart trace. Setting: Labor and Delivery Unit, USA, University Hospital.
Interventions	2 types of regional anaesthesia were used in this study - epidural anaesthesia which used 2% lidocaine or 3% chloroprocaine. General anaesthesia group had pentothal, succinylcholine, mixture of nitrous oxide and oxygen, isoflurane and atracurium or vecuronium. Lidocaine and nitroglycerin were also administered before intubation to prevent hypertension from tracheal stimulation
Outcomes	Outcomes measured: study outcomes were maternal systolic and diastolic blood pressures, time intervals of preparation for anaesthesia, and surgical and delivery events, IV fluid volumes administered and urine output, neonatal gestational age, birthweight, Apgar scores, umbilical artery blood gases, admission to special care nursery, incidence of small-for-gestational-age infants, those with respiratory distress requiring mechanical ventilation and those with intracranial haemorrhage. Review measured highest and lowest intraoperative blood pressures, umbilical artery pH and Apgar scores
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence computer-generated.
Allocation concealment (selection bias)	Low risk	Sealed envelopes.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Yegin 2003

Methods	Study was said to be a randomised trial but the method was not stated. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. No women were excluded. Intention-to-treat analysis: not stated (but all women remained in their allocated groups)
Participants	62 women (31 received epidural, 31 received general anaesthesia). Inclusion criteria: uncomplicated women who were to give birth at term and classified as ASA I or II. Exclusion criteria: not stated. Setting: Turkey; hospital not stated.
Interventions	Regional group had epidural anaesthesia with 15 mL of 0.5% bupivacaine. The general group had isoflurane with vecuronium, thiopental and suxamethonium
Outcomes	Outcomes measured: study measured umbilical arterial and venous blood gases and mean Apgar scores at 1 and 5 minutes. Review measured umbilical arterial and venous pH and mean Apgar scores at 1 and 5 minutes
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

Yentur 2009

Methods	Study was appropriately randomised by computer-generated software. Blinding of intervention: not stated. Blinding of outcome assessment: not stated. 7 of the 70 women were excluded. Intention-to-treat analysis: not stated but women remained in their allocated groups
Participants	70 women (35 received epidural, 35 received general anaesthesia). Inclusion criteria: low-risk pregnant women, 18 years or older, 37 weeks' gestation or more that were scheduled for elective caesarean section Exclusion criteria: women with pre-eclampsia or eclampsia, heart disease, taking chronic medication or other high-risk pregnancies. Setting: Turkey; Celal Bayal University, Manisa.
Interventions	Regional anaesthesia group had epidural anaesthesia with bupivacaine. General anaesthesia group had thiopental, succinyl choline, isoflurane and mixture of nitrous oxide and oxygen and atracurium
Outcomes	Outcomes measured: study measured maternal rectal temperature, neonatal rectal temperature, umbilical vein pH and neonatal Apgar scores
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Allocation sequence not stated.
Allocation concealment (selection bias)	Unclear risk	Not stated.
Blinding (performance bias and detection bias) All outcomes	Unclear risk	Not stated.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated.
Selective reporting (reporting bias)	Unclear risk	Not stated.
Other bias	Unclear risk	Not stated.

ASA: American Society of Anaesthesiologists classification
CK: creatine kinase
CPD: cephalopelvic disproportion
I-D: incision-delivery
IV: intravenous
kg/m2: kilogram per metre squared

NACS: neurologic and adaptive capacity scoring
ug: microgram
UI-D: uterine incision-delivery

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

Study	Reason for exclusion
Abboud 1985	Randomisation was not done; the women were divided into 3 unequal groups
Akturk 1995	Randomisation was not done; women were assigned to either group according to their individual preference
Fyneface-Ogan 2008	There was no regional anaesthesia group. Instead local anaesthesia was compared with general anaesthesia for caesarean section
Gambling 1995	Randomisation was confined only to the general anaesthesia groups; the women in the spinal anaesthesia group were assigned on request
Kamat 1991	No mention of randomisation.
Navarro 2000	Randomisation was confined to the general anaesthesia groups; the women in the spinal anaesthesia group were assigned on request
Qublan 2001	No randomisation done; the type of anaesthesia was chosen by the woman in consultation with the anaesthesiologist
Ratcliffe 1992	No randomisation done; women were allowed to choose between regional and general anaesthesia
White 1962	Participating obstetricians requested that all the women have spinal anaesthesia towards the end of the study, resulting in an unequal distribution of cases

DATA AND ANALYSES

Comparison 1. Epidural versus general anaesthesia

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mean umbilical arterial pH	8	454	Mean Difference (IV, Random, 95% CI)	-0.00 [-0.02, 0.01]
1.1 Non-urgent indication for caesarean section	7	397	Mean Difference (IV, Random, 95% CI)	0.00 [-0.01, 0.02]
1.2 Urgent indication for caesarean section: severe pre-eclampsia	1	57	Mean Difference (IV, Random, 95% CI)	-0.04 [-0.07, -0.01]
2 Mean umbilical venous pH	7	505	Mean Difference (IV, Random, 95% CI)	0.01 [-0.01, 0.02]
3 Apgar score of 4 or less at 1 minute	1	47	Risk Ratio (M-H, Fixed, 95% CI)	0.15 [0.01, 2.73]
4 Apgar score of 4 or less at 5 minutes	1	47	Risk Ratio (M-H, Fixed, 95% CI)	0.35 [0.01, 8.11]
5 Apgar score of 6 or less at 1 minute (not prespecified in protocol)	2	209	Risk Ratio (M-H, Fixed, 95% CI)	0.58 [0.22, 1.52]
5.1 Non-urgent indication for caesarean section	1	152	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.17, 2.69]
5.2 Urgent indication for caesarean section: severe pre-eclampsia	1	57	Risk Ratio (M-H, Fixed, 95% CI)	0.50 [0.13, 1.91]
6 Apgar score of 6 or less at 5 minutes (not prespecified in protocol)	2	209	Risk Ratio (M-H, Fixed, 95% CI)	0.46 [0.11, 1.95]
6.1 Non-urgent indication for caesarean section	1	152	Risk Ratio (M-H, Fixed, 95% CI)	0.74 [0.13, 4.31]
6.2 Urgent indication for caesarean section: severe pre-eclampsia	1	57	Risk Ratio (M-H, Fixed, 95% CI)	0.17 [0.01, 3.37]
7 Mean Apgar score at 1 minute	5	408	Mean Difference (IV, Random, 95% CI)	0.39 [-0.34, 1.12]
8 Mean Apgar score at 5 minutes	4	368	Mean Difference (IV, Random, 95% CI)	0.20 [-0.15, 0.55]
9 Neonatal neurologic and adaptive capacity score at 2-4 hours	2	253	Mean Difference (IV, Random, 95% CI)	2.17 [-1.13, 5.47]
10 Amount of blood transfusion received in units (not prespecified in protocol)	1	25	Mean Difference (IV, Fixed, 95% CI)	-0.70 [-1.73, 0.33]
11 Number who received postoperative blood transfusion (not prespecified in protocol)	2	256	Risk Ratio (M-H, Random, 95% CI)	0.80 [0.23, 2.76]
12 Maternal estimated blood loss in mL	2	256	Std. Mean Difference (IV, Fixed, 95% CI)	-0.32 [-0.56, -0.07]
13 Difference between pre and postoperative haematocrit (%)	1	231	Mean Difference (IV, Fixed, 95% CI)	1.70 [0.47, 2.93]

14 Satisfaction score on visual analogue scale	1	223	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.63, 0.61]
15 Number who would prefer the same technique again	1	223	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.65, 0.98]
16 Neonatal neurologic and adaptive capacity score of < 35 at 15 minutes	1	60	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.62, 1.45]
17 Neonatal neurologic and adaptive capacity score of < 35 at 2 hours	1	60	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.27, 1.64]
18 Adverse events	5		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
18.1 Headache	1	20	Risk Ratio (M-H, Random, 95% CI)	1.2 [0.54, 2.67]
18.2 Epigastric pain	1	20	Risk Ratio (M-H, Random, 95% CI)	0.14 [0.01, 2.45]
18.3 Blurred vision	1	20	Risk Ratio (M-H, Random, 95% CI)	2.0 [0.47, 8.56]
18.4 Convulsion	1	20	Risk Ratio (M-H, Random, 95% CI)	1.0 [0.17, 5.77]
18.5 Nausea	3	286	Risk Ratio (M-H, Random, 95% CI)	1.82 [0.26, 12.80]
18.6 Vomiting	3	301	Risk Ratio (M-H, Random, 95% CI)	0.86 [0.14, 5.25]
18.7 Pruritus	1	25	Risk Ratio (M-H, Random, 95% CI)	8.36 [0.50, 140.56]
18.8 Shivering	1	30	Risk Ratio (M-H, Random, 95% CI)	0.13 [0.02, 0.88]
18.9 Allergic reaction	1	30	Risk Ratio (M-H, Random, 95% CI)	0.11 [0.01, 1.90]
18.10 Bradycardia	1	30	Risk Ratio (M-H, Random, 95% CI)	1.5 [0.29, 7.73]
19 Need for oxygen therapy or mask ventilation of the neonate	1	152	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.34, 2.20]
20 Maternal blood loss > 500 mL	1	40	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.10, 2.43]
21 Mean Apgar score at 10 minutes	1	40	Mean Difference (IV, Fixed, 95% CI)	-0.45 [-1.03, 0.13]
22 Time to request postoperative analgesia in minutes	1	25	Mean Difference (IV, Fixed, 95% CI)	500.0 [364.36, 635.64]
23 Intraoperative pain score on visual analogue scale	1	223	Mean Difference (IV, Fixed, 95% CI)	0.84 [0.45, 1.23]

Comparison 2. Spinal versus general anaesthesia

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Umbilical arterial pH	6	459	Mean Difference (IV, Fixed, 95% CI)	-0.00 [-0.01, 0.00]
2 Umbilical venous pH	4	383	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.00, 0.02]
3 Neonatal neurologic and adaptive capacity score at 2-4 hours	1	221	Mean Difference (IV, Fixed, 95% CI)	0.40 [-0.54, 1.34]
4 Neonatal neurologic and adaptive capacity score of < 35 at 15 minutes	1	60	Risk Ratio (M-H, Fixed, 95% CI)	0.17 [0.05, 0.51]
5 Neonatal neurologic and adaptive capacity score of < 35 at 2 hours	1	60	Risk Ratio (M-H, Fixed, 95% CI)	0.05 [0.00, 0.87]

6 Neonatal neurologic and adaptive capacity score of < 35 at 24 hours	1	60	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Mean Apgar score at 1 minute	5	470	Mean Difference (IV, Random, 95% CI)	0.54 [-0.09, 1.16]
8 Mean Apgar score at 5 minutes	4	429	Mean Difference (IV, Random, 95% CI)	0.24 [-0.05, 0.54]
9 Apgar score of 6 or less at 1 minute (not prespecified in protocol)	5	435	Risk Ratio (M-H, Random, 95% CI)	0.54 [0.16, 1.84]
9.1 Non-urgent indication for caesarean section	4	373	Risk Ratio (M-H, Random, 95% CI)	0.50 [0.07, 3.39]
9.2 Urgent indication for caesarean section: severe pre-eclampsia	1	62	Risk Ratio (M-H, Random, 95% CI)	0.78 [0.27, 2.29]
10 Apgar score of 6 or less at 5 minutes (not prespecified in protocol)	3	291	Risk Ratio (M-H, Fixed, 95% CI)	0.56 [0.21, 1.46]
11 Maternal estimated blood loss in mL	2	279	Std. Mean Difference (IV, Fixed, 95% CI)	-0.59 [-0.83, -0.35]
12 Difference between pre and postoperative haematocrit	1	209	Mean Difference (IV, Fixed, 95% CI)	3.10 [1.73, 4.47]
13 Number who received postoperative blood transfusion (not prespecified in protocol)	1	209	Risk Ratio (M-H, Fixed, 95% CI)	0.3 [0.07, 1.38]
14 Number who would prefer the same technique again	1	221	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.65, 0.99]
15 Satisfaction score on visual analogue scale	1	221	Mean Difference (IV, Fixed, 95% CI)	-0.58 [-1.26, 0.10]
16 Adverse events	3		Risk Ratio (M-H, Random, 95% CI)	Subtotals only
16.1 Nausea	2	269	Risk Ratio (M-H, Random, 95% CI)	3.14 [0.21, 48.07]
16.2 Vomiting	3	310	Risk Ratio (M-H, Random, 95% CI)	1.88 [0.36, 9.69]
17 Maternal blood loss > 500 mL	1	41	Risk Ratio (M-H, Fixed, 95% CI)	0.24 [0.03, 1.95]
18 Mean Apgar score at 10 minutes	1	41	Mean Difference (IV, Fixed, 95% CI)	-0.15 [-0.81, 0.51]
19 Time to request postoperative analgesia in minutes	1	60	Mean Difference (IV, Fixed, 95% CI)	97.8 [90.28, 105.32]
20 Neonatal need for oxygen by mask or intubation	1	171	Risk Ratio (M-H, Fixed, 95% CI)	0.04 [0.00, 0.60]
21 Intraoperative pain score on visual analogue scale	1	221	Mean Difference (IV, Fixed, 95% CI)	0.69 [0.32, 1.06]

Comparison 3. Combined spinal-epidural versus general anaesthesia

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Umbilical arterial pH	2	211	Mean Difference (IV, Fixed, 95% CI)	-0.03 [-0.04, -0.02]
2 Apgar score of 6 or less at 1 minute (not prespecified in protocol)	2	211	Risk Ratio (M-H, Fixed, 95% CI)	0.89 [0.38, 2.07]

3 Apgar score of 6 or less at 5 minutes (not prespecified in protocol)	2	211	Risk Ratio (M-H, Fixed, 95% CI)	0.60 [0.15, 2.44]
4 Need for oxygen therapy or mask ventilation of neonate	1	158	Risk Ratio (M-H, Fixed, 95% CI)	1.14 [0.49, 2.65]
5 Mean Apgar score at 1 minute	1	30	Mean Difference (IV, Fixed, 95% CI)	0.25 [-0.14, 0.64]
6 Mean Apgar score at 5 minutes	1	30	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

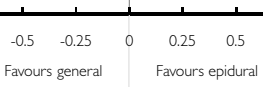
Analysis 1.1. Comparison 1 Epidural versus general anaesthesia, Outcome 1 Mean umbilical arterial pH.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 1 Mean umbilical arterial pH

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
1 Non-urgent indication for caesarean section						
Bengi Sener 2003	15	7.27 (0)	15	7.26 (0)		0.0 [0.0, 0.0]
Datta 1983	10	7.31 (0.03)	10	7.32 (0.03)		-0.01 [-0.04, 0.02]
Dick 1992	23	7.3 (0.04)	24	7.27 (0.04)		0.03 [0.01, 0.05]
Hollmen 1978	15	7.29 (0.03)	15	7.29 (0.04)		0.0 [-0.03, 0.03]
Pence 2002	26	7.36 (0.18)	30	7.35 (0.17)		0.01 [-0.08, 0.10]
Petropoulos 2003	72	7.28 (0.03)	80	7.29 (0.02)		-0.01 [-0.02, 0.00]
Yegin 2003	31	7.27 (0.08)	31	7.25 (0.07)		0.02 [-0.02, 0.06]
Subtotal (95% CI)	**192**		**205**			**0.00 [-0.01, 0.02]**
Heterogeneity: Tau^2 = 0.00; Chi^2 = 12.50, df = 5 (P = 0.03); I^2 =60%						
Test for overall effect: Z = 0.46 (P = 0.64)						
2 Urgent indication for caesarean section: severe pre-eclampsia						
Wallace 1995	31	7.26 (0.06)	26	7.3 (0.05)		-0.04 [-0.07, -0.01]
Subtotal (95% CI)	**31**		**26**			**-0.04 [-0.07, -0.01]**
Heterogeneity: not applicable						
Test for overall effect: Z = 2.75 (P = 0.0060)						
Total (95% CI)	**223**		**231**			**0.00 [-0.02, 0.01]**
Heterogeneity: Tau^2 = 0.00; Chi^2 = 18.14, df = 6 (P = 0.01); I^2 =67%						
Test for overall effect: Z = 0.25 (P = 0.80)						
Test for subgroup differences: Chi^2 = 6.86, df = 1 (P = 0.01), I^2 =85%						



Analysis 1.2. Comparison 1 Epidural versus general anaesthesia, Outcome 2 Mean umbilical venous pH.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

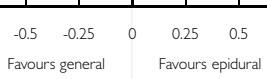
Outcome: 2 Mean umbilical venous pH

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Datta 1983	10	7.37 (0.06)	10	7.36 (0.03)		7.2 %	0.01 [-0.03, 0.05]
Dick 1992	23	7.3 (0.07)	24	7.3 (0.04)		9.9 %	0.0 [-0.03, 0.03]
Hollmen 1978	15	7.34 (0.03)	15	7.33 (0.04)		13.2 %	0.01 [-0.02, 0.04]
Lertakyamanee 1999	120	7.31 (0.06)	103	7.29 (0.05)		19.8 %	0.02 [0.01, 0.03]
Mahajan 1992	30	7.34 (0.04)	30	7.33 (0.05)		14.5 %	0.01 [-0.01, 0.03]
Yegin 2003	31	7.33 (0.03)	31	7.31 (0.04)		17.7 %	0.02 [0.00, 0.04]
Yentur 2009	33	7.31 (0.05)	30	7.33 (0.01)		17.8 %	-0.02 [-0.04, 0.00]
Total (95% CI)	**262**		**243**			**100.0 %**	**0.01 [-0.01, 0.02]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 14.64$, df = 6 (P = 0.02); $I^2 = 59\%$

Test for overall effect: Z = 1.11 (P = 0.27)

Test for subgroup differences: Not applicable



Analysis 1.3. Comparison 1 Epidural versus general anaesthesia, Outcome 3 Apgar score of 4 or less at 1 minute.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 3 Apgar score of 4 or less at 1 minute

Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Dick 1992	0/23	3/24		100.0 %	0.15 [0.01, 2.73]
Total (95% CI)	**23**	**24**		**100.0 %**	**0.15 [0.01, 2.73]**

Total events: 0 (Epidural anaesthesia), 3 (General anaesthesia)

Heterogeneity: not applicable

Test for overall effect: Z = 1.28 (P = 0.20)

Test for subgroup differences: Not applicable

Analysis 1.4. Comparison 1 Epidural versus general anaesthesia, Outcome 4 Apgar score of 4 or less at 5 minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 4 Apgar score of 4 or less at 5 minutes

Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Dick 1992	0/23	1/24		100.0 %	0.35 [0.01, 8.11]
Total (95% CI)	**23**	**24**		**100.0 %**	**0.35 [0.01, 8.11]**

Total events: 0 (Epidural anaesthesia), 1 (General anaesthesia)

Heterogeneity: not applicable

Test for overall effect: Z = 0.66 (P = 0.51)

Test for subgroup differences: Not applicable

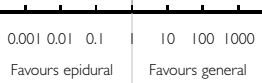
Analysis 1.5. Comparison 1 Epidural versus general anaesthesia, Outcome 5 Apgar score of 6 or less at 1 minute (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 5 Apgar score of 6 or less at 1 minute (not prespecified in protocol)

Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Non-urgent indication for caesarean section					
Petropoulos 2003	3/72	5/80		46.6 %	0.67 [0.17, 2.69]
Subtotal (95% CI)	**72**	**80**		**46.6 %**	**0.67 [0.17, 2.69]**
Total events: 3 (Epidural anaesthesia), 5 (General anaesthesia)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.57 (P = 0.57)					
2 Urgent indication for caesarean section: severe pre-eclampsia					
Wallace 1995	3/31	5/26		53.4 %	0.50 [0.13, 1.91]
Subtotal (95% CI)	**31**	**26**		**53.4 %**	**0.50 [0.13, 1.91]**
Total events: 3 (Epidural anaesthesia), 5 (General anaesthesia)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.01 (P = 0.31)					
Total (95% CI)	**103**	**106**		**100.0 %**	**0.58 [0.22, 1.52]**
Total events: 6 (Epidural anaesthesia), 10 (General anaesthesia)					
Heterogeneity: Chi^2 = 0.08, df = 1 (P = 0.77); I^2 =0.0%					
Test for overall effect: Z = 1.11 (P = 0.27)					
Test for subgroup differences: Chi^2 = 0.08, df = 1 (P = 0.78), I^2 =0.0%					

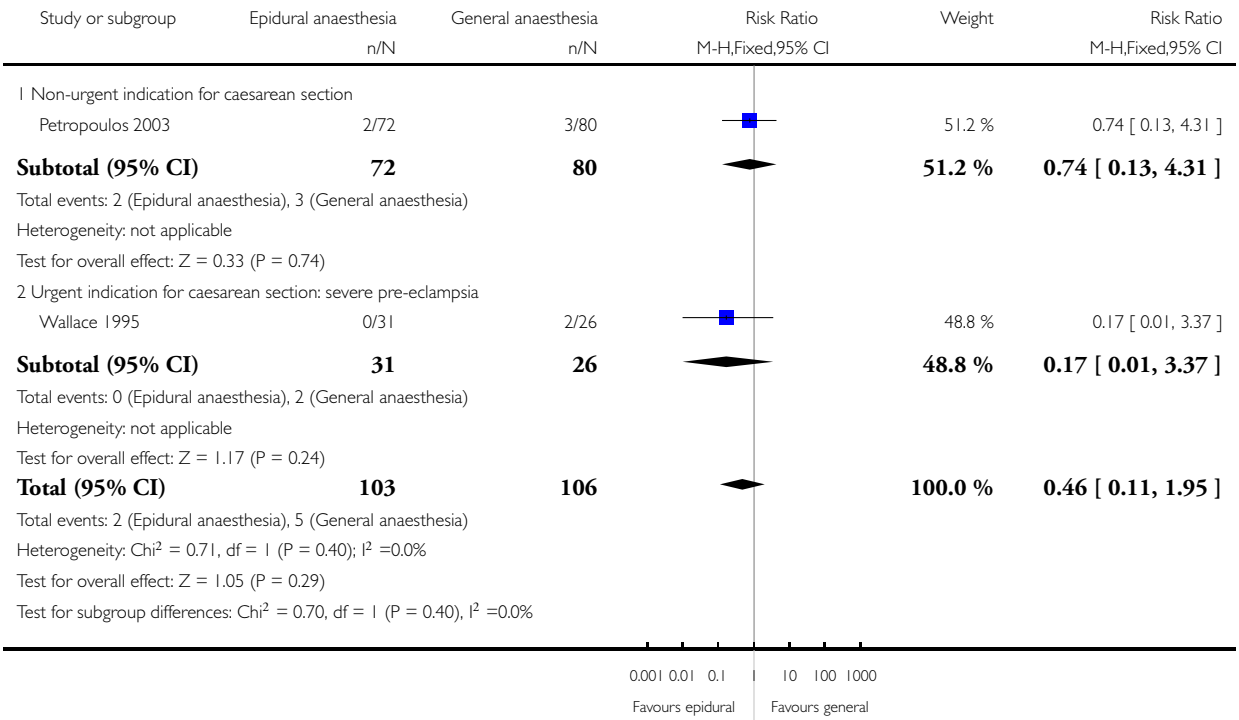


Analysis 1.6. Comparison 1 Epidural versus general anaesthesia, Outcome 6 Apgar score of 6 or less at 5 minutes (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 6 Apgar score of 6 or less at 5 minutes (not prespecified in protocol)



Analysis 1.7. Comparison 1 Epidural versus general anaesthesia, Outcome 7 Mean Apgar score at 1 minute.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

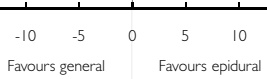
Outcome: 7 Mean Apgar score at 1 minute

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Hodgkinson 1980	10	6.8 (2.9)	10	5.7 (2.31)		7.3 %	1.10 [-1.20, 3.40]
Lertakyamanee 1999	120	8.3 (1.9)	103	6.7 (2.8)		22.1 %	1.60 [0.96, 2.24]
Mathur 2002	20	6.7 (1.2)	20	6.55 (1.32)		20.4 %	0.15 [-0.63, 0.93]
Yegin 2003	31	7.38 (0.55)	31	7.19 (0.7)		25.4 %	0.19 [-0.12, 0.50]
Yentur 2009	33	8 (0.9)	30	8.5 (0.7)		24.7 %	-0.50 [-0.90, -0.10]
Total (95% CI)	**214**		**194**			**100.0 %**	**0.39 [-0.34, 1.12]**

Heterogeneity: $Tau^2 = 0.52$; $Chi^2 = 30.85$, df = 4 (P<0.00001); $I^2 = 87\%$

Test for overall effect: Z = 1.05 (P = 0.29)

Test for subgroup differences: Not applicable



Analysis 1.8. Comparison 1 Epidural versus general anaesthesia, Outcome 8 Mean Apgar score at 5 minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

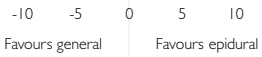
Outcome: 8 Mean Apgar score at 5 minutes

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Hodgkinson 1980	10	7.9 (2.51)	10	8.4 (1.07)		3.9 %	-0.50 [-2.19, 1.19]
Lertakyamanee 1999	120	9.7 (0.9)	103	9.2 (1.6)		29.0 %	0.50 [0.15, 0.85]
Yegin 2003	31	9.87 (0.42)	31	9.54 (0.67)		32.3 %	0.33 [0.05, 0.61]
Yentur 2009	33	9.6 (0.4)	30	9.7 (0.5)		34.8 %	-0.10 [-0.33, 0.13]
Total (95% CI)	**194**		**174**			**100.0 %**	**0.20 [-0.15, 0.55]**

Heterogeneity: $Tau^2 = 0.08$; $Chi^2 = 10.79$, df = 3 (P = 0.01); $I^2 = 72\%$

Test for overall effect: Z = 1.11 (P = 0.27)

Test for subgroup differences: Not applicable

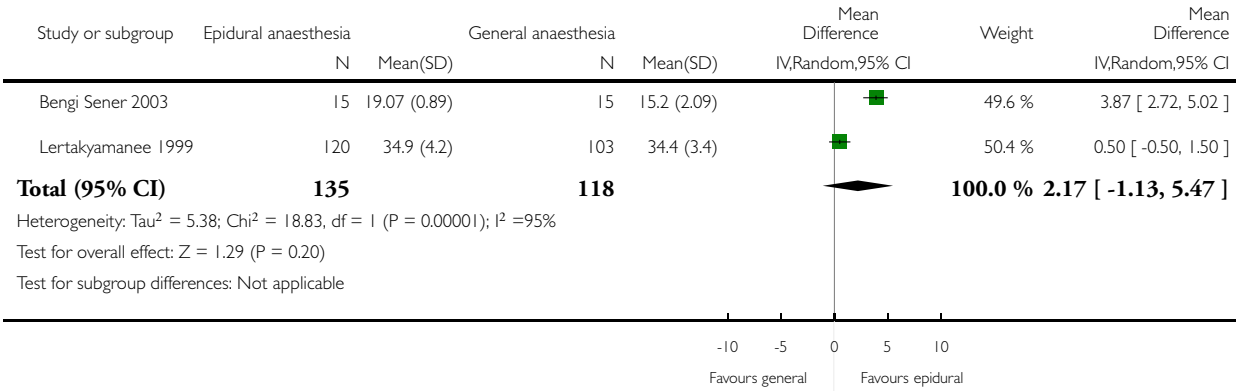


Analysis 1.9. Comparison 1 Epidural versus general anaesthesia, Outcome 9 Neonatal neurologic and adaptive capacity score at 2-4 hours.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 9 Neonatal neurologic and adaptive capacity score at 2-4 hours

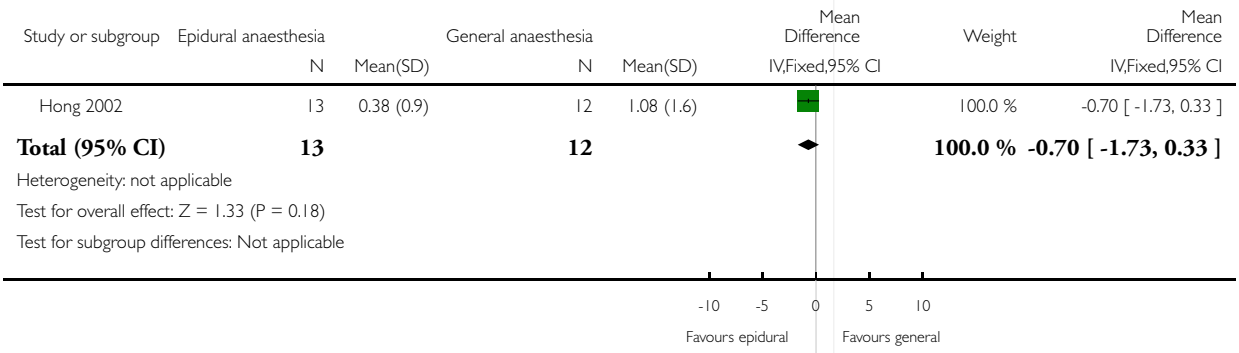


Analysis 1.10. Comparison 1 Epidural versus general anaesthesia, Outcome 10 Amount of blood transfusion received in units (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 10 Amount of blood transfusion received in units (not prespecified in protocol)



Analysis 1.11. Comparison 1 Epidural versus general anaesthesia, Outcome 11 Number who received postoperative blood transfusion (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 11 Number who received postoperative blood transfusion (not prespecified in protocol)

Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Hong 2002	2/13	5/12		39.7 %	0.37 [0.09, 1.56]
Lertakyamanee 1999	11/117	8/114		60.3 %	1.34 [0.56, 3.21]
Total (95% CI)	**130**	**126**		**100.0 %**	**0.80 [0.23, 2.76]**

Total events: 13 (Epidural anaesthesia), 13 (General anaesthesia)

Heterogeneity: $Tau^2 = 0.46$; $Chi^2 = 2.25$, df = 1 (P = 0.13); $I^2 = 56\%$

Test for overall effect: Z = 0.35 (P = 0.73)

Test for subgroup differences: Not applicable

Analysis 1.12. Comparison 1 Epidural versus general anaesthesia, Outcome 12 Maternal estimated blood loss in mL.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

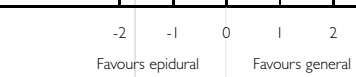
Outcome: 12 Maternal estimated blood loss in mL

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
Hong 2002	13	1418 (996)	12	1623 (775)		9.8 %	-0.22 [-1.01, 0.57]
Lertakyamanee 1999	117	748.2 (363.5)	114	873.6 (403.1)		90.2 %	-0.33 [-0.59, -0.07]
Total (95% CI)	**130**		**126**			**100.0 %**	**-0.32 [-0.56, -0.07]**

Heterogeneity: $Chi^2 = 0.06$, df = 1 (P = 0.80); $I^2 = 0.0\%$

Test for overall effect: Z = 2.51 (P = 0.012)

Test for subgroup differences: Not applicable



Analysis 1.13. Comparison 1 Epidural versus general anaesthesia, Outcome 13 Difference between pre and postoperative haematocrit (%).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

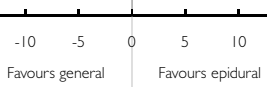
Outcome: 13 Difference between pre and postoperative haematocrit (%)

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Lertakyamanee 1999	117	-3.4 (4.8)	114	-5.1 (4.7)		100.0 %	1.70 [0.47, 2.93]
Total (95% CI)	**117**		**114**			**100.0 %**	**1.70 [0.47, 2.93]**

Heterogeneity: not applicable

Test for overall effect: Z = 2.72 (P = 0.0065)

Test for subgroup differences: Not applicable



Analysis 1.14. Comparison 1 Epidural versus general anaesthesia, Outcome 14 Satisfaction score on visual analogue scale.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

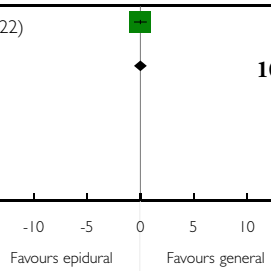
Outcome: 14 Satisfaction score on visual analogue scale

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Lertakyamanee 1999	120	8.06 (2.52)	103	8.07 (2.22)		100.0 %	-0.01 [-0.63, 0.61]
Total (95% CI)	**120**		**103**			**100.0 %**	**-0.01 [-0.63, 0.61]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.03 (P = 0.97)

Test for subgroup differences: Not applicable



Analysis 1.15. Comparison 1 Epidural versus general anaesthesia, Outcome 15 Number who would prefer the same technique again.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 15 Number who would prefer the same technique again

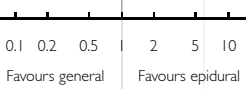
Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Lertakyamanee 1999	65/120	70/103		100.0 %	0.80 [0.65, 0.98]
Total (95% CI)	**120**	**103**		**100.0 %**	**0.80 [0.65, 0.98]**

Total events: 65 (Epidural anaesthesia), 70 (General anaesthesia)

Heterogeneity: not applicable

Test for overall effect: Z = 2.10 (P = 0.035)

Test for subgroup differences: Not applicable



Analysis 1.16. Comparison 1 Epidural versus general anaesthesia, Outcome 16 Neonatal neurologic and adaptive capacity score of < 35 at 15 minutes.

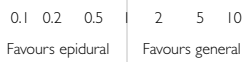
Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 16 Neonatal neurologic and adaptive capacity score of < 35 at 15 minutes

Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Mahajan 1992	17/30	18/30		100.0 %	0.94 [0.62, 1.45]
Total (95% CI)	**30**	**30**		**100.0 %**	**0.94 [0.62, 1.45]**

Total events: 17 (Epidural anaesthesia), 18 (General anaesthesia)
Heterogeneity: not applicable
Test for overall effect: Z = 0.26 (P = 0.79)
Test for subgroup differences: Not applicable



Analysis 1.17. Comparison 1 Epidural versus general anaesthesia, Outcome 17 Neonatal neurologic and adaptive capacity score of < 35 at 2 hours.

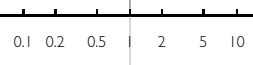
Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 17 Neonatal neurologic and adaptive capacity score of < 35 at 2 hours

Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Mahajan 1992	6/30	9/30		100.0 %	0.67 [0.27, 1.64]
Total (95% CI)	**30**	**30**		**100.0 %**	**0.67 [0.27, 1.64]**

Total events: 6 (Epidural anaesthesia), 9 (General anaesthesia)
Heterogeneity: not applicable
Test for overall effect: Z = 0.88 (P = 0.38)
Test for subgroup differences: Not applicable

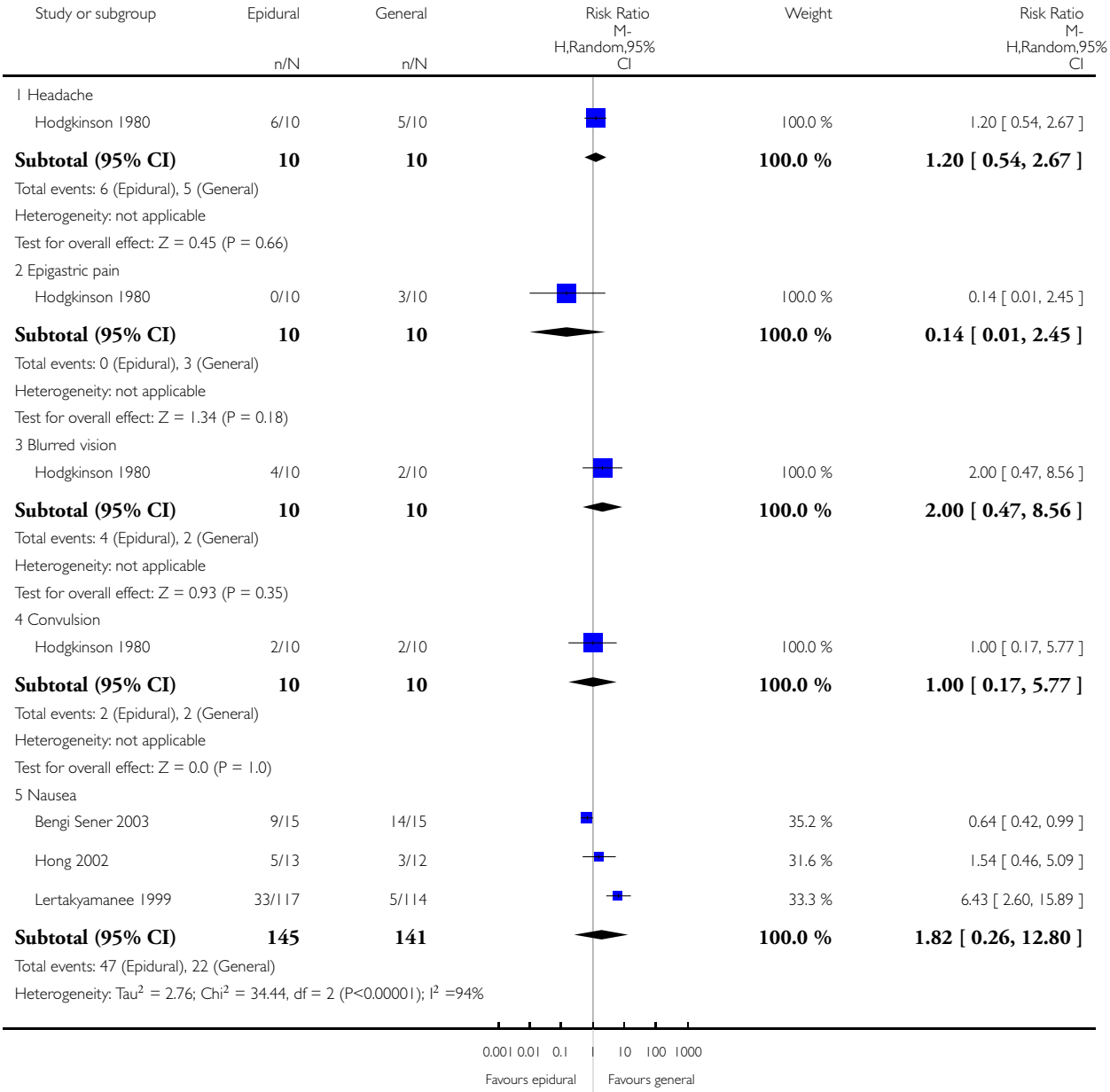


Analysis 1.18. Comparison 1 Epidural versus general anaesthesia, Outcome 18 Adverse events.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 18 Adverse events



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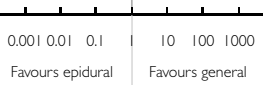
Study or subgroup	Epidural n/N	General n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Test for overall effect: Z = 0.60 (P = 0.55)					
6 Vomiting					
Bengi Sener 2003	2/15	9/15		35.9 %	0.22 [0.06, 0.86]
Lertakyamanee 1999	21/117	8/114		41.6 %	2.56 [1.18, 5.54]
Mathur 2002	1/20	1/20		22.5 %	1.00 [0.07, 14.90]
Subtotal (95% CI)	**152**	**149**		**100.0 %**	**0.86 [0.14, 5.25]**
Total events: 24 (Epidural), 18 (General)					
Heterogeneity: Tau^2 = 1.89; Chi^2 = 9.51, df = 2 (P = 0.01); I^2 =79%					
Test for overall effect: Z = 0.16 (P = 0.87)					
7 Pruritus					
Hong 2002	4/13	0/12		100.0 %	8.36 [0.50, 140.56]
Subtotal (95% CI)	**13**	**12**		**100.0 %**	**8.36 [0.50, 140.56]**
Total events: 4 (Epidural), 0 (General)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.47 (P = 0.14)					
8 Shivering					
Bengi Sener 2003	1/15	8/15		100.0 %	0.13 [0.02, 0.88]
Subtotal (95% CI)	**15**	**15**		**100.0 %**	**0.13 [0.02, 0.88]**
Total events: 1 (Epidural), 8 (General)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.09 (P = 0.037)					
9 Allergic reaction					
Bengi Sener 2003	0/15	4/15		100.0 %	0.11 [0.01, 1.90]
Subtotal (95% CI)	**15**	**15**		**100.0 %**	**0.11 [0.01, 1.90]**
Total events: 0 (Epidural), 4 (General)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.52 (P = 0.13)					
10 Bradycardia					
Bengi Sener 2003	3/15	2/15		100.0 %	1.50 [0.29, 7.73]
Subtotal (95% CI)	**15**	**15**		**100.0 %**	**1.50 [0.29, 7.73]**
Total events: 3 (Epidural), 2 (General)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.48 (P = 0.63)					



Analysis 1.19. Comparison 1 Epidural versus general anaesthesia, Outcome 19 Need for oxygen therapy or mask ventilation of the neonate.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 19 Need for oxygen therapy or mask ventilation of the neonate

Study or subgroup	Epidural anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Petropoulos 2003	7/72	9/80		100.0 %	0.86 [0.34, 2.20]
Total (95% CI)	**72**	**80**		**100.0 %**	**0.86 [0.34, 2.20]**

Total events: 7 (Epidural anaesthesia), 9 (General anaesthesia)
Heterogeneity: not applicable
Test for overall effect: Z = 0.31 (P = 0.76)
Test for subgroup differences: Not applicable

Analysis 1.20. Comparison 1 Epidural versus general anaesthesia, Outcome 20 Maternal blood loss > 500 mL.

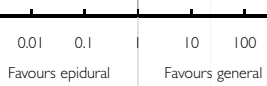
Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 20 Maternal blood loss > 500 mL

Study or subgroup	Epidural n/N	General n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Mathur 2002	2/20	4/20		100.0 %	0.50 [0.10, 2.43]
Total (95% CI)	**20**	**20**		**100.0 %**	**0.50 [0.10, 2.43]**

Total events: 2 (Epidural), 4 (General)
Heterogeneity: not applicable
Test for overall effect: Z = 0.86 (P = 0.39)
Test for subgroup differences: Not applicable



Analysis 1.21. Comparison 1 Epidural versus general anaesthesia, Outcome 21 Mean Apgar score at 10 minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 21 Mean Apgar score at 10 minutes

Study or subgroup	Epidural N	Mean(SD)	General N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Mathur 2002	20	8.25 (0.69)	20	8.7 (1.14)		100.0 %	-0.45 [-1.03, 0.13]
Total (95% CI)	**20**		**20**			**100.0 %**	**-0.45 [-1.03, 0.13]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.51 (P = 0.13)

Test for subgroup differences: Not applicable

Analysis 1.22. Comparison 1 Epidural versus general anaesthesia, Outcome 22 Time to request postoperative analgesia in minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

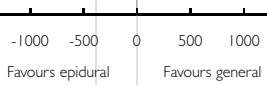
Outcome: 22 Time to request postoperative analgesia in minutes

Study or subgroup	Epidural anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Hong 2002	13	690 (30)	12	190 (238)		100.0 %	500.00 [364.36, 635.64]
Total (95% CI)	**13**		**12**			**100.0 %**	**500.00 [364.36, 635.64]**

Heterogeneity: not applicable

Test for overall effect: Z = 7.22 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 1.23. Comparison 1 Epidural versus general anaesthesia, Outcome 23 Intraoperative pain score on visual analogue scale.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 1 Epidural versus general anaesthesia

Outcome: 23 Intraoperative pain score on visual analogue scale

Study or subgroup	Epidural N	Mean(SD)	General N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Lertakyamanee 1999	120	0.91 (2.15)	103	0.07 (0.34)		100.0 %	0.84 [0.45, 1.23]
Total (95% CI)	**120**		**103**			**100.0 %**	**0.84 [0.45, 1.23]**

Heterogeneity: not applicable

Test for overall effect: Z = 4.22 (P = 0.000025)

Test for subgroup differences: Not applicable

Analysis 2.1. Comparison 2 Spinal versus general anaesthesia, Outcome 1 Umbilical arterial pH.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

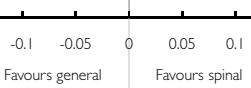
Outcome: 1 Umbilical arterial pH

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Akyol 2006	30	7.31 (0.02)	32	7.31 (0.02)		39.9 %	0.00 [-0.01, 0.01]
Datta 1983	10	7.31 (0.06)	10	7.32 (0.03)		2.3 %	-0.01 [-0.05, 0.03]
Kavak 2001	46	7.24 (0.01)	38	7.25 (0.08)		6.0 %	-0.01 [-0.04, 0.02]
Mahajan 1992	30	7.28 (0.02)	30	7.28 (0.04)		15.5 %	0.0 [-0.02, 0.02]
Mancuso 2010	90	7.27 (0.04)	81	7.28 (0.03)		35.7 %	-0.01 [-0.02, 0.00]
Moslemi 2007	32	7.275 (0.154)	30	7.26 (0.174)		0.6 %	0.02 [-0.07, 0.10]
Total (95% CI)	**238**		**221**			**100.0 %**	**0.00 [-0.01, 0.00]**

Heterogeneity: $Chi^2 = 3.38$, df = 5 (P = 0.64); $I^2 = 0.0\%$

Test for overall effect: Z = 1.09 (P = 0.27)

Test for subgroup differences: Not applicable



Analysis 2.2. Comparison 2 Spinal versus general anaesthesia, Outcome 2 Umbilical venous pH.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 2 Umbilical venous pH

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Datta 1983	10	7.37 (0.03)	10	7.36 (0.03)		15.2 %	0.01 [-0.02, 0.04]
Lertakyamanee 1999	118	7.3 (0.06)	103	7.29 (0.05)		50.0 %	0.01 [0.00, 0.02]
Mahajan 1992	30	7.34 (0.05)	30	7.33 (0.05)		16.4 %	0.01 [-0.02, 0.04]
Nabhan 2009	41	7.25 (0.06)	41	7.25 (0.05)		18.4 %	0.0 [-0.02, 0.02]
Total (95% CI)	**199**		**184**			**100.0 %**	**0.01 [0.00, 0.02]**

Heterogeneity: $Chi^2 = 0.55$, df = 3 (P = 0.91); $I^2 = 0.0\%$

Test for overall effect: Z = 1.56 (P = 0.12)

Test for subgroup differences: Not applicable

Analysis 2.3. Comparison 2 Spinal versus general anaesthesia, Outcome 3 Neonatal neurologic and adaptive capacity score at 2-4 hours.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

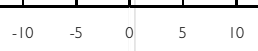
Outcome: 3 Neonatal neurologic and adaptive capacity score at 2-4 hours

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Lertakyamanee 1999	118	34.8 (3.7)	103	34.4 (3.4)		100.0 %	0.40 [-0.54, 1.34]
Total (95% CI)	**118**		**103**			**100.0 %**	**0.40 [-0.54, 1.34]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.84 (P = 0.40)

Test for subgroup differences: Not applicable



Analysis 2.4. Comparison 2 Spinal versus general anaesthesia, Outcome 4 Neonatal neurologic and adaptive capacity score of < 35 at 15 minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 4 Neonatal neurologic and adaptive capacity score of < 35 at 15 minutes

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Mahajan 1992	3/30	18/30		100.0 %	0.17 [0.05, 0.51]
Total (95% CI)	**30**	**30**		**100.0 %**	**0.17 [0.05, 0.51]**
Total events: 3 (Spinal anaesthesia), 18 (General anaesthesia)					
Heterogeneity: not applicable					
Test for overall effect: Z = 3.16 (P = 0.0016)					
Test for subgroup differences: Not applicable					

Analysis 2.5. Comparison 2 Spinal versus general anaesthesia, Outcome 5 Neonatal neurologic and adaptive capacity score of < 35 at 2 hours.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 5 Neonatal neurologic and adaptive capacity score of < 35 at 2 hours

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Mahajan 1992	0/30	9/30		100.0 %	0.05 [0.00, 0.87]
Total (95% CI)	**30**	**30**		**100.0 %**	**0.05 [0.00, 0.87]**

Total events: 0 (Spinal anaesthesia), 9 (General anaesthesia)
Heterogeneity: not applicable
Test for overall effect: Z = 2.06 (P = 0.039)
Test for subgroup differences: Not applicable

Analysis 2.6. Comparison 2 Spinal versus general anaesthesia, Outcome 6 Neonatal neurologic and adaptive capacity score of < 35 at 24 hours.

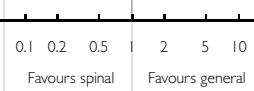
Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 6 Neonatal neurologic and adaptive capacity score of < 35 at 24 hours

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Mahajan 1992	0/30	0/30		0.0 [0.0, 0.0]
Total (95% CI)	**30**	**30**		**0.0 [0.0, 0.0]**

Total events: 0 (Spinal anaesthesia), 0 (General anaesthesia)
Heterogeneity: not applicable
Test for overall effect: Z = 0.0 (P < 0.00001)
Test for subgroup differences: Not applicable



Analysis 2.7. Comparison 2 Spinal versus general anaesthesia, Outcome 7 Mean Apgar score at 1 minute.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

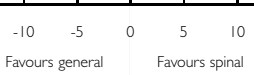
Outcome: 7 Mean Apgar score at 1 minute

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Akyol 2006	30	8.03 (0.67)	32	7.88 (0.66)		22.2 %	0.15 [-0.18, 0.48]
Kavak 2001	46	8.86 (0.5)	38	8.7 (0.6)		22.9 %	0.16 [-0.08, 0.40]
Lertakyamanee 1999	118	8.7 (0.6)	103	6.7 (2.8)		19.9 %	2.00 [1.45, 2.55]
Mathur 2002	21	6.85 (1.3)	20	6.55 (1.32)		17.0 %	0.30 [-0.50, 1.10]
Moslemi 2007	32	7.66 (1.43)	30	7.57 (1.43)		18.1 %	0.09 [-0.62, 0.80]
Total (95% CI)	**247**		**223**			**100.0 %**	**0.54 [-0.09, 1.16]**

Heterogeneity: $Tau^2 = 0.43$; $Chi^2 = 38.73$, df = 4 (P<0.00001); I^2 =90%

Test for overall effect: Z = 1.69 (P = 0.091)

Test for subgroup differences: Not applicable



Analysis 2.8. Comparison 2 Spinal versus general anaesthesia, Outcome 8 Mean Apgar score at 5 minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 8 Mean Apgar score at 5 minutes

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Akyol 2006	30	7.98 (0.55)	32	7.56 (0.46)		25.3 %	0.42 [0.17, 0.67]
Kavak 2001	46	9.9 (0.2)	38	9.9 (0.3)		29.8 %	0.0 [-0.11, 0.11]
Lertakyamanee 1999	118	9.8 (0.7)	103	9.2 (1.6)		22.3 %	0.60 [0.27, 0.93]
Moslemi 2007	32	9.41 (0.5)	30	9.4 (0.77)		22.6 %	0.01 [-0.32, 0.34]
Total (95% CI)	**226**		**203**			**100.0 %**	**0.24 [-0.05, 0.54]**

Heterogeneity: $Tau^2 = 0.07$; $Chi^2 = 18.12$, df = 3 (P = 0.00042); $I^2 = 83\%$

Test for overall effect: Z = 1.61 (P = 0.11)

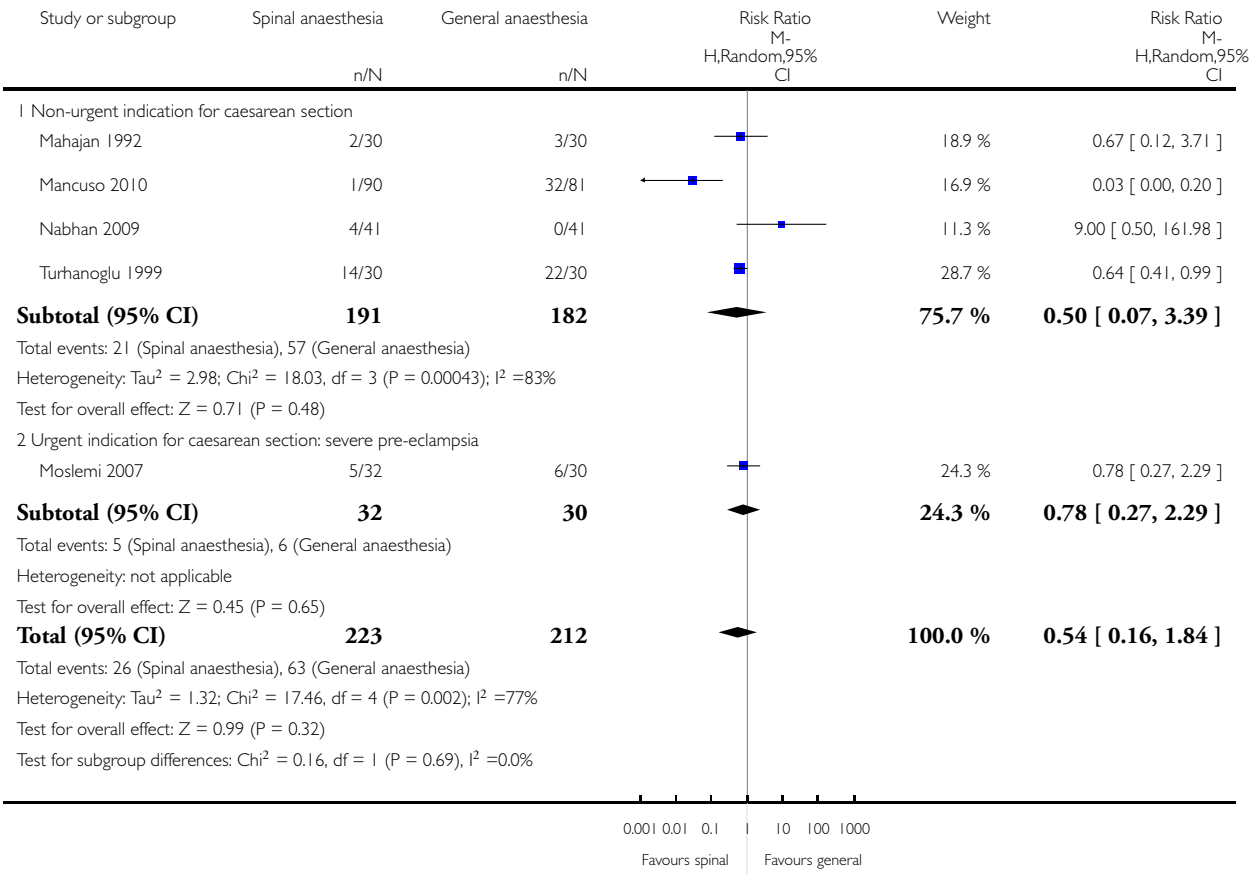
Test for subgroup differences: Not applicable

Analysis 2.9. Comparison 2 Spinal versus general anaesthesia, Outcome 9 Apgar score of 6 or less at 1 minute (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 9 Apgar score of 6 or less at 1 minute (not prespecified in protocol)



Analysis 2.10. Comparison 2 Spinal versus general anaesthesia, Outcome 10 Apgar score of 6 or less at 5 minutes (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 10 Apgar score of 6 or less at 5 minutes (not prespecified in protocol)

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Mahajan 1992	0/30	0/30		0.0 [0.0, 0.0]
Mancuso 2010	0/90	0/81		0.0 [0.0, 0.0]
Turhanoglu 1999	5/30	9/30		0.56 [0.21, 1.46]
Total (95% CI)	**150**	**141**		**0.56 [0.21, 1.46]**

Total events: 5 (Spinal anaesthesia), 9 (General anaesthesia)

Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); $I^2 = 0.0\%$

Test for overall effect: Z = 1.19 (P = 0.23)

Test for subgroup differences: Not applicable

Analysis 2.11. Comparison 2 Spinal versus general anaesthesia, Outcome 11 Maternal estimated blood loss in mL.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 11 Maternal estimated blood loss in mL

Study or subgroup	Favours spinal N	Mean(SD)	General anaesthesia N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
Dyer 2003	35	394 (64)	35	446 (126)		25.5 %	-0.51 [-0.99, -0.04]
Lertakyamanee 1999	95	648 (312)	114	873.6 (403.1)		74.5 %	-0.62 [-0.90, -0.34]
Total (95% CI)	**130**		**149**			**100.0 %**	**-0.59 [-0.83, -0.35]**

Heterogeneity: $Chi^2 = 0.13$, df = 1 (P = 0.72); $I^2 = 0.0\%$

Test for overall effect: Z = 4.81 (P < 0.00001)

Test for subgroup differences: Not applicable

Analysis 2.12. Comparison 2 Spinal versus general anaesthesia, Outcome 12 Difference between pre and postoperative haematocrit.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

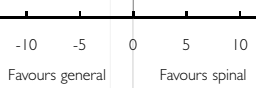
Outcome: 12 Difference between pre and postoperative haematocrit

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Lertakyamanee 1999	95	-2 (5.3)	114	-5.1 (4.7)		100.0 %	3.10 [1.73, 4.47]
Total (95% CI)	**95**		**114**			**100.0 %**	**3.10 [1.73, 4.47]**

Heterogeneity: not applicable

Test for overall effect: Z = 4.43 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 2.13. Comparison 2 Spinal versus general anaesthesia, Outcome 13 Number who received postoperative blood transfusion (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 13 Number who received postoperative blood transfusion (not prespecified in protocol)

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Lertakyamanee 1999	2/95	8/114		100.0 %	0.30 [0.07, 1.38]
Total (95% CI)	**95**	**114**		**100.0 %**	**0.30 [0.07, 1.38]**

Total events: 2 (Spinal anaesthesia), 8 (General anaesthesia)
Heterogeneity: not applicable
Test for overall effect: Z = 1.55 (P = 0.12)
Test for subgroup differences: Not applicable

Analysis 2.14. Comparison 2 Spinal versus general anaesthesia, Outcome 14 Number who would prefer the same technique again.

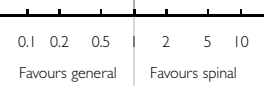
Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 14 Number who would prefer the same technique again

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Lertakyamanee 1999	64/118	70/103		100.0 %	0.80 [0.65, 0.99]
Total (95% CI)	**118**	**103**		**100.0 %**	**0.80 [0.65, 0.99]**

Total events: 64 (Spinal anaesthesia), 70 (General anaesthesia)
Heterogeneity: not applicable
Test for overall effect: Z = 2.08 (P = 0.037)
Test for subgroup differences: Not applicable



Analysis 2.15. Comparison 2 Spinal versus general anaesthesia, Outcome 15 Satisfaction score on visual analogue scale.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

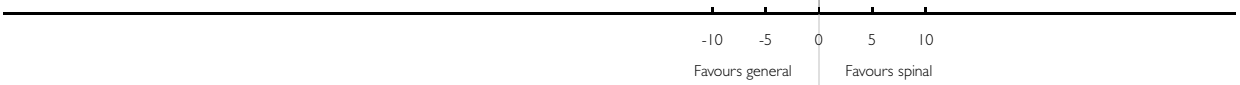
Outcome: 15 Satisfaction score on visual analogue scale

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Lertakyamanee 1999	118	7.49 (2.95)	103	8.07 (2.22)		100.0 %	-0.58 [-1.26, 0.10]
Total (95% CI)	**118**		**103**			**100.0 %**	**-0.58 [-1.26, 0.10]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.66 (P = 0.096)

Test for subgroup differences: Not applicable

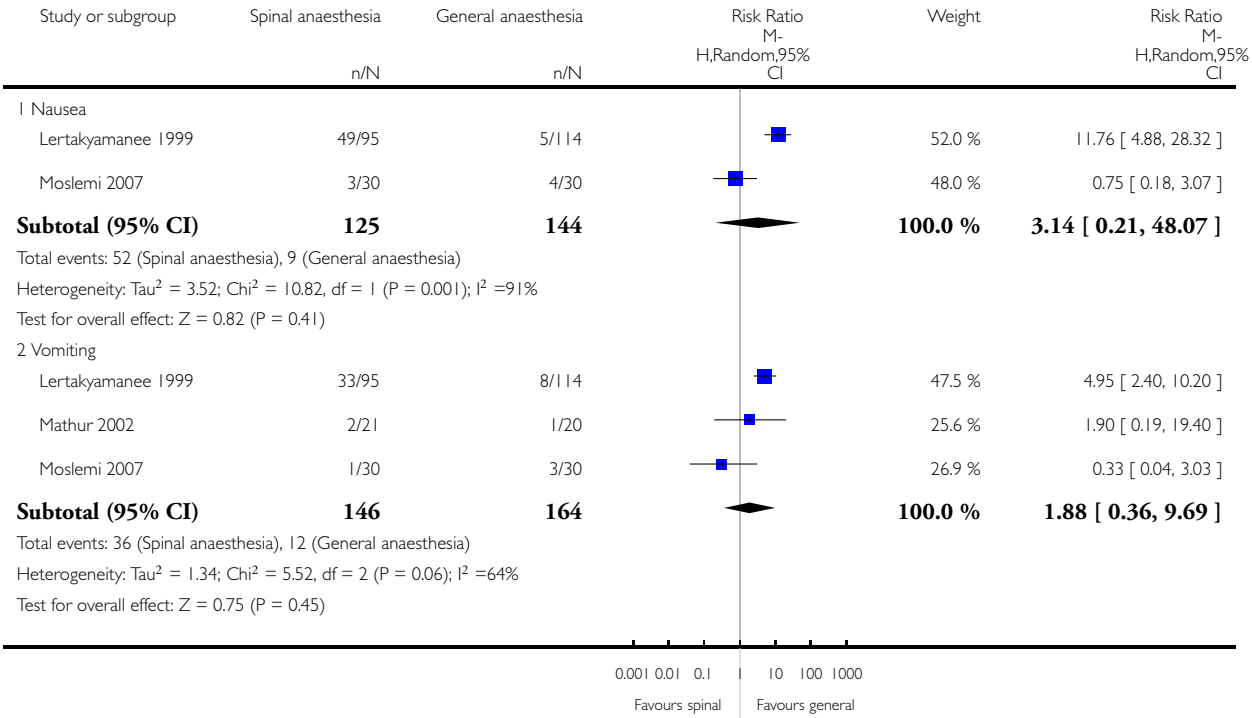


Analysis 2.16. Comparison 2 Spinal versus general anaesthesia, Outcome 16 Adverse events.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 16 Adverse events



Analysis 2.17. Comparison 2 Spinal versus general anaesthesia, Outcome 17 Maternal blood loss > 500 mL.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 17 Maternal blood loss > 500 mL

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Mathur 2002	1/21	4/20		100.0 %	0.24 [0.03, 1.95]
Total (95% CI)	**21**	**20**		**100.0 %**	**0.24 [0.03, 1.95]**

Total events: 1 (Spinal anaesthesia), 4 (General anaesthesia)

Heterogeneity: not applicable

Test for overall effect: Z = 1.34 (P = 0.18)

Test for subgroup differences: Not applicable

Analysis 2.18. Comparison 2 Spinal versus general anaesthesia, Outcome 18 Mean Apgar score at 10 minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 18 Mean Apgar score at 10 minutes

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Mathur 2002	21	8.55 (1)	20	8.7 (1.14)		100.0 %	-0.15 [-0.81, 0.51]
Total (95% CI)	**21**		**20**			**100.0 %**	**-0.15 [-0.81, 0.51]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.45 (P = 0.65)

Test for subgroup differences: Not applicable

Analysis 2.19. Comparison 2 Spinal versus general anaesthesia, Outcome 19 Time to request postoperative analgesia in minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

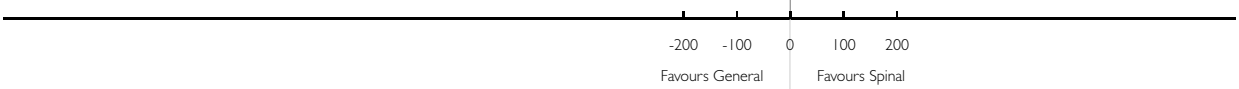
Outcome: 19 Time to request postoperative analgesia in minutes

Study or subgroup	Spinal anaesthesia N	Mean(SD)	General anaesthesia N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Turhanoglu 1999	30	106.6 (20.8)	30	8.8 (2.9)		100.0 %	97.80 [90.28, 105.32]
Total (95% CI)	**30**		**30**			**100.0 %**	**97.80 [90.28, 105.32]**

Heterogeneity: not applicable

Test for overall effect: Z = 25.51 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 2.20. Comparison 2 Spinal versus general anaesthesia, Outcome 20 Neonatal need for oxygen by mask or intubation.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 20 Neonatal need for oxygen by mask or intubation

Study or subgroup	Spinal anaesthesia n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Mancuso 2010	0/90	12/81		100.0 %	0.04 [0.00, 0.60]
Total (95% CI)	**90**	**81**		**100.0 %**	**0.04 [0.00, 0.60]**

Total events: 0 (Spinal anaesthesia), 12 (General anaesthesia)

Heterogeneity: not applicable

Test for overall effect: Z = 2.32 (P = 0.021)

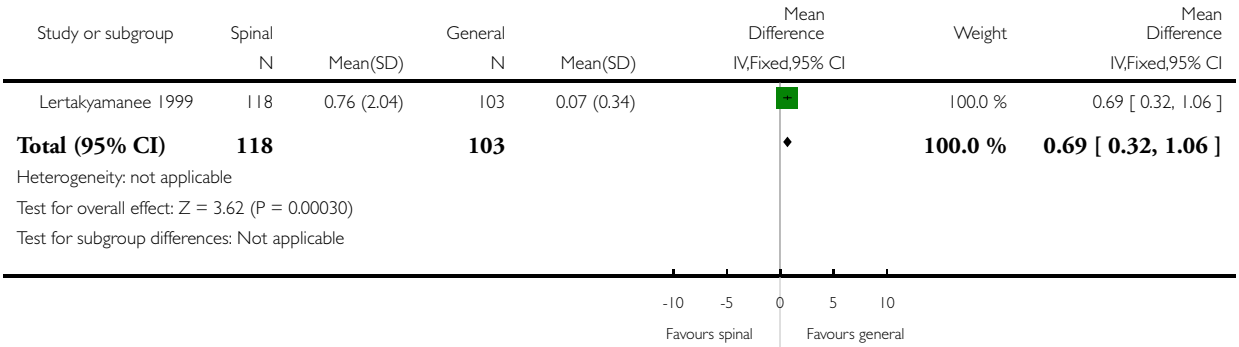
Test for subgroup differences: Not applicable

Analysis 2.21. Comparison 2 Spinal versus general anaesthesia, Outcome 21 Intraoperative pain score on visual analogue scale.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 2 Spinal versus general anaesthesia

Outcome: 21 Intraoperative pain score on visual analogue scale

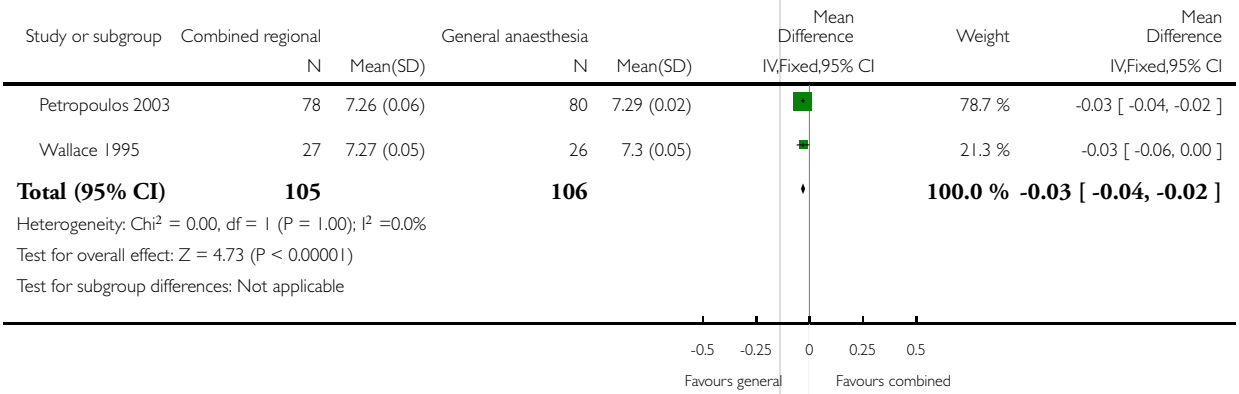


Analysis 3.1. Comparison 3 Combined spinal-epidural versus general anaesthesia, Outcome 1 Umbilical arterial pH.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 3 Combined spinal-epidural versus general anaesthesia

Outcome: 1 Umbilical arterial pH



Analysis 3.2. Comparison 3 Combined spinal-epidural versus general anaesthesia, Outcome 2 Apgar score of 6 or less at 1 minute (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 3 Combined spinal-epidural versus general anaesthesia

Outcome: 2 Apgar score of 6 or less at 1 minute (not prespecified in protocol)

Study or subgroup	Combined regional n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Petropoulos 2003	4/78	5/80		49.2 %	0.82 [0.23, 2.94]
Wallace 1995	5/27	5/26		50.8 %	0.96 [0.32, 2.94]
Total (95% CI)	**105**	**106**		**100.0 %**	**0.89 [0.38, 2.07]**

Total events: 9 (Combined regional), 10 (General anaesthesia)

Heterogeneity: $Chi^2 = 0.03$, df = 1 (P = 0.85); $I^2 = 0.0\%$

Test for overall effect: Z = 0.26 (P = 0.79)

Test for subgroup differences: Not applicable

Analysis 3.3. Comparison 3 Combined spinal-epidural versus general anaesthesia, Outcome 3 Apgar score of 6 or less at 5 minutes (not prespecified in protocol).

Review: Regional versus general anaesthesia for caesarean section

Comparison: 3 Combined spinal-epidural versus general anaesthesia

Outcome: 3 Apgar score of 6 or less at 5 minutes (not prespecified in protocol)

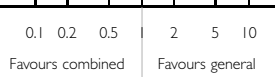
Study or subgroup	Combined regional n/N	General anaesthesia n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Petropoulos 2003	2/78	3/80		59.2 %	0.68 [0.12, 3.98]
Wallace 1995	1/27	2/26		40.8 %	0.48 [0.05, 4.99]
Total (95% CI)	**105**	**106**		**100.0 %**	**0.60 [0.15, 2.44]**

Total events: 3 (Combined regional), 5 (General anaesthesia)

Heterogeneity: $Chi^2 = 0.06$, df = 1 (P = 0.81); $I^2 = 0.0\%$

Test for overall effect: Z = 0.71 (P = 0.48)

Test for subgroup differences: Not applicable

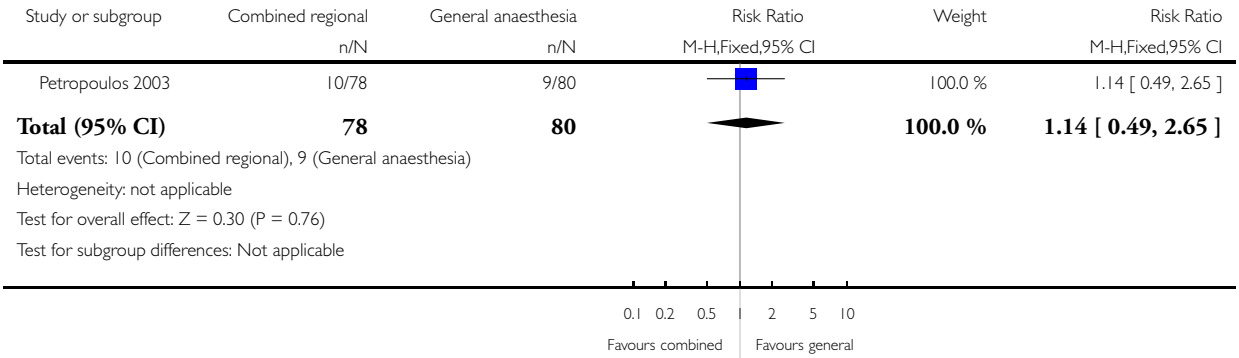


Analysis 3.4. Comparison 3 Combined spinal-epidural versus general anaesthesia, Outcome 4 Need for oxygen therapy or mask ventilation of neonate.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 3 Combined spinal-epidural versus general anaesthesia

Outcome: 4 Need for oxygen therapy or mask ventilation of neonate



Analysis 3.5. Comparison 3 Combined spinal-epidural versus general anaesthesia, Outcome 5 Mean Apgar score at 1 minute.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 3 Combined spinal-epidural versus general anaesthesia

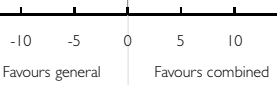
Outcome: 5 Mean Apgar score at 1 minute

Study or subgroup	Combined regional		General anaesthesia		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI		IV,Fixed,95% CI
Korkmaz 2004	15	8.25 (0.62)	15	8 (0.45)		100.0 %	0.25 [-0.14, 0.64]
Total (95% CI)	**15**		**15**			**100.0 %**	**0.25 [-0.14, 0.64]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.26 (P = 0.21)

Test for subgroup differences: Not applicable



Analysis 3.6. Comparison 3 Combined spinal-epidural versus general anaesthesia, Outcome 6 Mean Apgar score at 5 minutes.

Review: Regional versus general anaesthesia for caesarean section

Comparison: 3 Combined spinal-epidural versus general anaesthesia

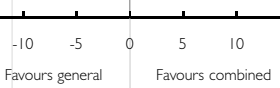
Outcome: 6 Mean Apgar score at 5 minutes

Study or subgroup	Combined regional		General anaesthesia		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
Korkmaz 2004	15	10 (0)	15	9.91 (0.3)		0.0 [0.0, 0.0]
Total (95% CI)	**15**		**15**			**0.0 [0.0, 0.0]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.0 (P < 0.00001)

Test for subgroup differences: Not applicable



ADDITIONAL TABLES

Table 1. Umbilical artery pH

Study ID	(Spinal) Number	Median	Range	(GA) Number	Median	Range
Dyer 2003	34	7.2	6.93-7.34	32	7.23	7.05-7.40

APPENDICES

Appendix 1. Search strategy

For the first version of the review, authors searched CENTRAL (*The Cochrane Library* 2005, Issue 1) using the terms general, regional, spinal, epidural, caesarean section, cesarean section and also MEDLINE (1966 to December, 2005) and EMBASE (1980 to December, 2005) using the following strategy:

1. general
2. regional
3. spinal
4. epidural
5. #1 and (#2 or #3 or #4)
6. anaesthesia
7. anaesthesia
8. #5 and (#6 or #7)
9. caesarean section
10. cesarean section
11. #8 and (#9 or #10)
12. random*
13. controlled-clinical-trial
14. #12 or #13
15. #11 and #14

Appendix 2. Methods used to assess trials included in previous versions of this review

Bosede Afolabi (BA) selected potentially relevant trials from those identified by the search strategy and retrieved the full articles. She ensured that multiple publications from the same data set were only used once. BA and Afolabi Lesi (AL) independently assessed each trial for inclusion in the review using the information described in the section 'Criteria for considering studies for this review'. Studies that did not meet the inclusion criteria were excluded and the reason was stated in the table of 'Characteristics of excluded studies'.

BA and AL independently assessed the methodological quality of the included trials. Generation of allocation sequence, allocation concealment, blinding and loss to follow-up are the quality components that were used. For each trial, each quality component apart from blinding was classed as adequate, inadequate or unclear (Juni 2001). For allocation concealment, the letters A to D were used: where A = adequate, B = unclear, C = inadequate and D = not used. For loss to follow-up, inclusion of 90% of participants was considered adequate. Blinding was assessed using the following criteria: blinding of participants, blinding of caregiver and blinding of outcome assessment. Blinding was assessed as open or single blind. Disagreements were resolved by discussion. Where the method used was unclear, the trialists were contacted to clarify the issue. Nkihu Merah (NM) helped resolve disagreements, commented on and helped revise the draft of the review.

BA and AL extracted data from each included trial independently. BA entered data into Review Manager (RevMan 2003). For binary outcomes we recorded the number of participants experiencing the event in each group of the trial. For continuous outcomes for

each group we extracted information to allow calculation of arithmetic means and standard deviations. If the data were reported using geometric means, we extracted information to calculate standard deviations on the log scale. Medians and ranges were extracted and reported in tables. Statistical analyses were carried out using the Review Manager software (RevMan 2003). Binary data were presented as odds ratio. For continuous data, we used the mean difference.

We assessed heterogeneity amongst trials by inspecting the forest plots and using the I-squared test for heterogeneity, where a figure greater than 50% indicates substantial heterogeneity.

We explored the following potential source(s) of heterogeneity using subgroup analysis:

1. elective and emergency caesarean section;
2. different criteria for the use of the terms 'elective' and 'emergency' caesarean section;
3. different indications for caesarean section.

After including all eligible studies in the primary analysis, we conducted sensitivity analyses for each of the quality factors, where possible, using the subgroups adequate, inadequate, or unclear. We also conducted sensitivity analyses for the different outcome criteria.

WHAT'S NEW

Last assessed as up-to-date: 30 November 2011.

Date	Event	Description
30 November 2011	New search has been performed	Search updated. Eight new studies identified: Six have been included (Jain 2009; Kim 2000; Mancuso 2010; Moslemi 2007; Nabhan 2009; Yentur 2009); one has been excluded (Fyneface-Ogan 2008) and one is awaiting classification (Waris 2002). From the studies previously awaiting classification: Eight studies have now been included (Akyol 2006; Braithwaite 1993; Dermitzaki 2009; Dogan 2008; Mathur 2002; Momani 2001; Papadopoulou 2005; Turhanoglu 1999) and one study has now been excluded (Kamat 1991). Two studies that were previously included as separate studies (Lertakyamanee 1999 and Kolatat 1999) have now been combined under one study identifier (Lertakyamanee 1999) because they are part of the same study. This updated review is now comprised of 29 included studies, nine excluded studies We updated the search on 20 August 2012 and added a further six reports to the one already in Studies awaiting classification for consideration in the next update The methods have been updated.
1 July 2011	New citation required but conclusions have not changed	This review has been updated. The conclusions have not changed

HISTORY

Protocol first published: Issue 3, 2003

Review first published: Issue 4, 2006

Date	Event	Description
1 October 2009	Amended	Search updated. Eight reports added to Studies awaiting classification (Akyol 2006a; Dermitzaki 2009a; Dogan 2008a; Kamat 1991a; Mathur 2002a; Momani 2001a; Papadopoulou 2005a; Turhanoglu 1999a)
25 June 2008	Amended	Corrected minor data entry reported by Charles Agert. The event counts for Wallace 1995 had been swapped for comparison 3.02 and 3.03.
8 May 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

For the 2011 update, Bosede Afolabi and Afolabi Lesi both extracted the data from the relevant trials and entered the data into RevMan 2011. Bosede Afolabi and Afolabi Lesi updated the Results and Bosede Afolabi updated the Background and Discussion sections.

Bosede Afolabi developed and wrote the protocol. She also extracted data from relevant trials, entered the data into Review Manager, and co-wrote the first version of this review. Afolabi Lesi commented on and revised the draft of the protocol during its development. He also extracted data and co-wrote and revised the review.

DECLARATIONS OF INTEREST

None known.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The methods have been update to reflect the latest *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). Our outcomes have been separated into 'primary' and 'secondary' outcomes.

We have also added a number of outcomes which were not prespecified in the protocol:

Primary outcomes

Maternal

- Amount of blood transfusion received in units (not prespecified in protocol)
- Number who received postoperative blood transfusion (not prespecified in protocol)

Secondary outcomes

Maternal

- Time to request postoperative analgesia in minutes (not prespecified in protocol)
- Adverse events such as anaphylactic reactions, thromboembolic disease and backache. Headache, epigastric pain, blurred vision, convulsions, pruritus, shivering and bradycardia were also measured despite not being prespecified in the protocol

Neonatal

- Apgar score of four or less at one and five minutes (not prespecified in protocol)
- Apgar score of six or less at one and five minutes (not prespecified in protocol)
- Apgar score of eight or less at one and five or 10 minutes (not prespecified in protocol
- Mean neonatal Apgar scores at one and 10 minutes (not prespecified in protocol)

INDEX TERMS

Medical Subject Headings (MeSH)

*Anesthesia, Conduction; *Anesthesia, General; *Cesarean Section; Anesthesia, Obstetrical [*methods]; Blood Loss, Surgical [statistics & numerical data]; Hematocrit; Randomized Controlled Trials as Topic

MeSH check words

Female; Humans; Pregnancy