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Rates of caesarean section and instrumental vaginal delivery in nulliparous women after low concentration epidural infusions or opioid analgesia: systematic review

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Abstract

Objective To compare the effects of low concentration epidural infusions of bupivacaine with parenteral opioid analgesia on rates of caesarean section and instrumental vaginal delivery in nulliparous women.

Data sources Medline, Embase, the Cochrane controlled trials register, and handsearching of the *International Journal of Obstetric Anaesthesia*.

Study selection Randomised controlled trials comparing low concentration epidural infusions with parenteral opioids.

Data synthesis Seven trials fulfilled the inclusion criteria for meta-analysis. Epidural analgesia does not seem to be associated with an increased risk of caesarean section (odds ratio 1.03, 95% confidence interval 0.71 to 1.48) but may be associated with an increased risk of instrumental vaginal delivery (2.11, 0.95 to 4.65). Epidural analgesia was associated with a longer second stage of labour (weighted mean difference 15.2 minutes, 2.1 to 28.2 minutes). More women randomised to receive epidural analgesia had adequate pain relief, with fewer changing to parenteral opioids than vice versa (odds ratio 0.1, 0.05 to 0.22).

Conclusions Epidural analgesia using low concentration infusions of bupivacaine is unlikely to increase the risk of caesarean section but may increase the risk of instrumental vaginal delivery. Although women receiving epidural analgesia had a longer second stage of labour, they had better pain relief.

Introduction

Although regional anaesthesia has been associated with a reduction in anaesthesia related maternal mortality, there is continuing controversy over whether epidural analgesia impedes the progress of labour by causing dystocia and increasing operative delivery rates.¹⁻³ Previous reviews have included disparate regimens for epidural analgesia and women of mixed parity.⁴⁻⁶ We focused on epidural infusions containing low concentrations of local anaesthetic as these are

associated with a lower risk of operative delivery.⁷ To overcome the confounding effect of parity, we selected nulliparous women, who have a higher risk of dystocia. We assessed all operative deliveries (caesarean section, forceps, vacuum assisted).

Methods

We searched Medline, Embase, and the Cochrane controlled trials register for all relevant clinical reports published before June 2003, using thesaurus and MeSH terms for epidural analgesia, labour, forceps, vacuum assisted delivery, caesarean section, and instrumental delivery. We searched the bibliographies of relevant studies for other reports.

We identified potentially relevant randomised controlled trials that specifically addressed whether epidural analgesia affected the risk of instrumental delivery. We then selected trials in which epidural infusions of low concentration local anaesthetic were compared with parenteral opioids and where the epidural infusions were continued during the second stage of labour.

Trial validity was assessed by using the Scottish Intercollegiate Guideline Network checklist.⁸ We independently assessed and scored each article and independently abstracted data in duplicate and cross checked for transcription errors and discrepancies. Trials included for meta-analysis used low concentrations of bupivacaine ($\leq 0.125\%$) in continuous epidural infusions during the first two stages of labour in nulliparous women. All the trials had outcomes for caesarean section and instrumental vaginal delivery.

Results of the trials were combined in a meta-analysis. We used odds ratios and 95% confidence intervals for categorical outcomes and weighted mean differences for continuous outcomes. Random effects models were used for all analyses, and heterogeneity was assessed. Sensitivity analyses were carried out if there was heterogeneity in the outcome measures.



This is the abridged version of an article that was posted on bmj.com on 28 May 2004: <http://bmj.com/cgi/doi/10.1136/bmj.38097.590810.7C>

Results

Our search identified 17 potentially relevant randomised controlled trials. After exclusions, seven trials were included in the meta-analysis (see bmj.com). All seven had adequate allocation concealment. Treatment groups were similar at the start of the trials and seemed to have been treated equally. Intention to treat analyses were performed, and there were no losses to follow up. In none of the trials were the patients or investigators blinded.

These seven trials used low concentration bupivacaine infusions (0.125% or 0.0625%) but varied in the addition of opioids. They included only women with full term uncomplicated pregnancies with cephalic presentation. One trial included patients in spontaneous or induced labour, with separate data for those in spontaneous labour.

Quantitative data analysis

Caesarean section

Data were analysed for 2962 nulliparous women. Rates of caesarean section did not differ between women receiving epidural analgesia and those receiving parenteral opioids (odds ratio 1.03, 95% confidence interval 0.71 to 1.48; fig 1). One trial showed a greatly increased risk of caesarean section with epidural analgesia. This small trial caused heterogeneity in the meta-analysis; when we excluded it from sensitivity analysis, the risk was slightly changed (1.01, 0.80 to 1.28), and there was no heterogeneity. Separate analyses of caesarean section rates for dystocia and for fetal distress also showed no significant differences (1.00 (0.64 to 1.58) and 1.15 (0.79 to 1.67) respectively). Analysis including only women in spontaneous labour also showed no significant difference (1.08, 0.65 to 1.82).

Other maternal outcomes

Rates of instrumental vaginal delivery were higher with epidural analgesia (1.63, 1.12 to 2.37); however, two trials included elective forceps delivery and forceps deliveries for training purposes, and two other trials included women who had their labour induced. When we excluded these, the risk was higher but not significant (2.11, 0.96 to 4.65; fig 2). Total operative delivery was more likely with epidural analgesia (1.63, 1.09 to 2.42). This risk was slightly reduced when we excluded the two trials with elective forceps deliveries and with forceps deliveries for training purposes (1.55, 1.03 to 2.32). Epidural analgesia was associated with a longer second stage of labour (weighted mean difference 15.2 minutes, 2.1 to 28.2 minutes). Non-compliance with allocated analgesia was much less with epidural analgesia (0.19, 0.11 to 0.33). Fewer women changed from the epidural group to the opioid group than vice versa (0.10, 0.05 to 0.22).

Neonatal outcomes

Fewer neonates in the epidural groups had Apgar scores of less than 7 at five minutes and umbilical artery pHs of less than 7.2, but these differences were not statistically significant (0.72 (0.26 to 2.04) and 0.72 (0.40 to 1.27) respectively). Although only two trials provided data on requirement of naloxone by

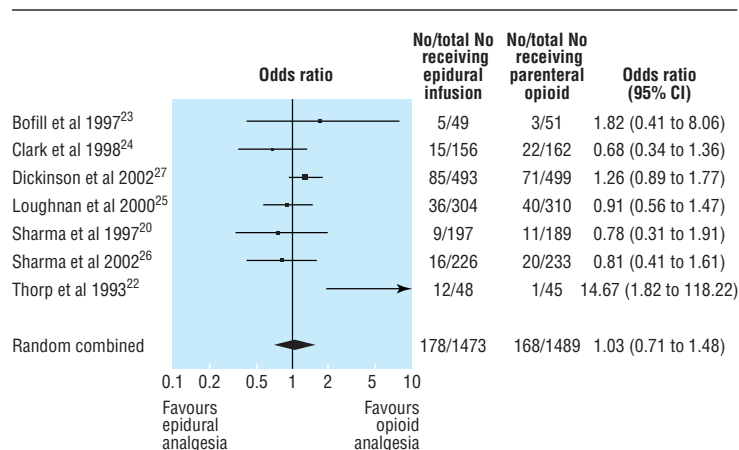


Fig 1 Rates of caesarean section in trials of nulliparous women receiving epidural analgesia or parenteral opioids

neonates, it was lower in neonates whose mothers had had epidural analgesia (0.1, 0.01 to 0.89).

Discussion

Nulliparous women who receive epidural analgesia during labour do not seem to be at an increased risk of delivery by caesarean section; the wide confidence intervals introduce some uncertainty. Epidural analgesia may be associated with a higher risk of instrumental vaginal delivery. Although epidural analgesia was associated with a longer second stage of labour, neonates seemed unharmed. We found no worsening of Apgar scores or umbilical acid-base status in neonates whose mothers had received epidural analgesia, despite the increased risk of instrumental vaginal delivery. These neonates were also less likely to need naloxone than neonates whose mothers received opioid analgesia.

One limitation of these trials is the disparity in the quality of pain relief between epidural analgesia and parenteral opioids, which would have made blinding of clinicians difficult. Bias may have been present owing to a lower threshold for performing instrumental vaginal delivery in the presence of epidural analgesia.

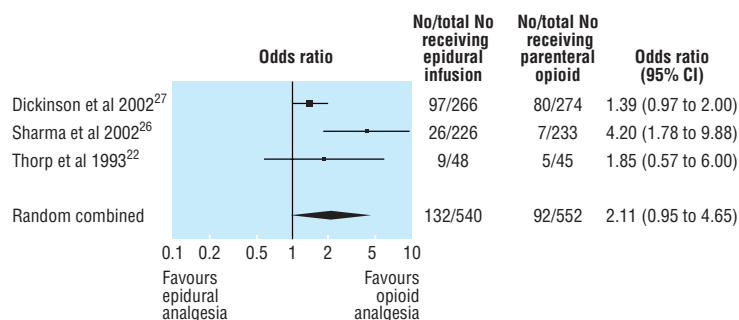


Fig 2 Rates of instrumental vaginal delivery and odds ratios in trials of nulliparous women receiving epidural analgesia or parenteral opioids; trials were excluded when elective forceps were permitted or where labour was induced

What is already known on this topic

Epidural analgesia during labour is effective but has been associated with increased rates of instrumental delivery

Studies have included women of mixed parity and high concentrations of epidural anaesthetic

What this study adds

Epidural infusions with low concentrations of local anaesthetic are unlikely to increase the risk of caesarean section in nulliparous women

Although epidural analgesia is associated with an increased risk of instrumental vaginal delivery, operator bias cannot be excluded

Epidural analgesia is associated with a longer second stage labour and increased oxytocin requirement, but the importance of these is unclear as maternal analgesia and neonatal outcome may be better with epidural analgesia

Differences in protocols for management of labour could have contributed to the differences in rates of instrumental vaginal delivery.

Another limitation was the large number of women who changed from parenteral opioids to epidural analgesia. Our intention to treat approach would likely render any estimation of the effects of epidural analgesia more conservative, but it was necessary to prevent selection bias. Comparing a policy of offering epidural analgesia with one of offering parenteral opioids reflects real life. As the definitions of stages of labour varied between trials, we were unable to determine if epidural analgesia prolonged the first stage, and the actual duration can only be estimated. Unlike previous reviews, we focused on nulliparous women because the indications for, and risks of, caesarean section differ with parity.

We limited our analysis to trials that used infusions of bupivacaine with concentrations of 0.125% or less, to reflect current practice. In a randomised controlled trial, low concentrations have been shown to reduce the rate of instrumental delivery.⁷

Epidural analgesia may increase the risk of instrumental delivery by several mechanisms. Reduction of serum oxytocin levels can result in a weakening of uterine activity.⁹⁻¹⁰ This may be due in part to intravenous fluid infusions being given before epidural analgesia, reducing oxytocin secretion.¹¹ The increased use of oxytocin after starting epidural analgesia may indicate attempts at speeding up labour. Maternal efforts at expulsion can also be impaired, causing fetal malposition during descent.¹² Previously, the association of neonatal morbidity and mortality with longer labour (second stage longer than two hours) had justified expediting delivery, leading to increased rates of instrumental delivery.¹³

Delaying pushing until the fetus's head is visible or until one hour after reaching full cervical dilation may reduce the incidence of instrumental delivery and its attendant morbidity.¹³ Although women receiving epidural analgesia had a longer second stage labour,

this was not associated with poorer neonatal outcome in our analysis.

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Corrections and clarifications

The logrank test

An error in this Statistics Notes article by J Martin Bland and Douglas G Altman persisted to publication (1 May, p 1073). The third sentence—relating to the values in a table of survival times—should have ended: “but is this sufficient to conclude that in the population, patients with anaplastic astrocytoma have better [not ‘worse’] survival than patients with glioblastoma?”

Minerva

In the seventh item in the 17 April issue (p 964), Minerva admits to not being religious. Maybe this is why she reported that in the Bible Daniel has 21 chapters. It doesn't; it has only 12.

Exploring perspectives on death

In this News article by Caroline White (17 April, p 911), we referred to average life expectancy as running to 394 000 minutes—a rather brief life span, some might think, given that there are only 525 600 minutes in one non-leap year. Assuming that the average life expectancy referred to in the article was intended to relate to UK males (that is, 75 years), some straightforward maths reveals that 75 years (even discounting the extra length of leap years) in fact contain 39 420 000 minutes. Quite a lot of minutes were lost somewhere in our publication process.