Since epidural analgesia was introduced four decades ago for pain relief in labour, controversy has persisted about its effect on the labour process. As a result of this, considerable research has been performed and findings have led to changes in practice. Epidurals have been credited with prolonging labour; increasing oxytocin requirements, instrumental and operative delivery rates; and causing maternal pyrexia and postpartum back pain. There is increasing evidence that refutes some of these claims.

Despite ongoing controversies, epidural rates have increased; ~25% of women in the UK and 66% of women in the USA receive epidural analgesia in labour. The following statement from the American College of Obstetricians and Gynecologists summarizes the background to these figures: 'labour results in severe pain for many women. There is no other circumstance where it is considered acceptable for a person to experience untreated severe pain, amenable to safe intervention, while under a physician’s care.'

**Effect of epidural analgesia on labour and outcome**

Though women who receive epidural analgesia during labour are more likely to require instrumental or caesarean delivery, there is little evidence to suggest that the epidural itself is to blame. There is an association between epidural analgesia and labour outcome, but this is probably not causative.

Study design is significant when assessing the evidence. In a retrospective analysis, the analgesic technique and type of delivery are reviewed following delivery. In this type of study, there is inevitable selection bias, as women with long painful labours, with increased risk of intervention, are more likely to request epidural analgesia, and those women deemed at high risk are actually recommended or encouraged to have an epidural. Impact studies involve observing labour outcome before and after the introduction of an epidural service or a marked increase in epidural rate within an individual unit. Such studies are of interest because of the large number of patients but the methodology has been criticized: confounding factors, such as changing practice over time, can influence results. Though randomized controlled trials (RCT) are considered the gold standard for research, in labour they can be difficult to blind and therefore, there is potential for observer bias. RCTs were perceived to be difficult to accomplish in labour because of problems with consent, recruitment and high crossover rates. However, there have recently been a number of well-designed RCTs of epidural vs non-epidural analgesia that seem to have finally addressed some of the issues surrounding epidural analgesia in labour.

**Quality of analgesia**

Epidurals have consistently been shown to provide superior analgesia when compared with non-epidural analgesia for labour pain, although this is not always associated with greater maternal satisfaction. Maternal satisfaction is an important measure but is influenced by many other factors, including outcome of labour, support and interaction with staff, and control over pain rather than its amelioration.

**Effect on Caesarean section rate**

Several recent large RCTs comparing epidural with non-epidural analgesia during labour have shown that epidural analgesia does not increase the caesarean section rate, whether attributable to dystocia or fetal distress. These findings are supported by a meta-analysis of impact studies in which a dramatic increase in the epidural rate had no impact on operative delivery rates.

**Effect on instrumental vaginal delivery (forceps and vacuum deliveries)**

The use of epidural analgesia does appear to have an effect on the instrumental delivery rate. A meta-analysis of RCTs comparing epidural with non-epidural analgesia during labour found that instrumental vaginal deliveries were more common in those receiving epidural analgesia, with an odds ratio of 2.19 (95% CI 1.32–7.78). This included 10 studies and 2369 patients of
mixed parity. On the other hand, a more recent meta-analysis of 9 impact studies, including over 37,000 patients, found no increase in instrumental vaginal deliveries when the epidural rate increased by more than 25%. The type of epidural analgesia might influence spontaneous vaginal delivery rates (see COMET study).

**Effect on duration of labour and labour augmentation**

In the same meta-analysis of RCTs of epidural vs non-epidural analgesia, epidural analgesia was found to prolong labour, though only modestly. The first and second stages of labour were prolonged by 42 and 14 minutes, respectively. The clinical relevance of this is unclear. The definition of prolonged second stage in women who have received regional analgesia has been revised by the American College of Obstetricians and Gynecologists (i.e. >3 h for primigravidae and >2 h for multigravidae). This could be considered an arbitrary number if the fetus and mother are both well. There is a theoretical risk of damage to the neurological structures within the pelvis with longer labours, but this is difficult to quantify.

Uterine activity appears to be unaffected by induction of regional block. Fluid preloading has been shown not only to be ineffective in preventing the modest reductions in blood pressure associated with low dose epidurals, but also associated with a decrease in uterine contractions, which may last up to 1 h. The meta-analysis did show more frequent use of oxytocin to augment labour in the epidural group. This may merely reflect the fact that women with complicated, painful labours might request epidural analgesia more often.

**Association with back pain**

Several recent, well-powered RCTs confirm that epidural analgesia during labour is not associated with an increased incidence of back pain after childbirth. Back pain is common after childbirth with almost 50% of women reporting it 6 months after delivery and 28% of back pain occurring for the first time postpartum. After childbirth there is no difference in the incidence of long-term back pain, disability or movement restriction between women who have epidurals and those who have not.

**Effect on the fetus and neonate**

No consistent differences have been identified in neonatal arterial pH or APGAR scores in babies who are born to mothers with epidurals. Some studies report benefits for the neonate, including a reduction in the incidence of low APGAR scores at 5 min and in the need for naloxone. Other workers have reported transient alterations in fetal heart rate, particularly bradycardias, after initiation of epidural analgesia. Various explanations have been proposed, including opioid-induced uterine hyperstimulation and placental hypoperfusion (secondary to a fall in maternal blood pressure and unopposed norepinephrine secretion related to rapid onset analgesia and an ensuing rapid fall in maternal epinephrine concentrations). Once again, the clinical importance of these isolated reports is unclear. However, monitoring of the fetus remains important.

**Effect on maternal temperature**

Epidural analgesia is associated with maternal pyrexia (temperature ≥38°C), with an odds ratio of 4.0 (95% CI 2.0–7.7). The degree of this pyrexia increases with the duration of labour. Nulliparity and labour longer than 12 h were also independent predictors for maternal pyrexia. The main concern is that this pyrexia leads to unnecessary investigations for mother and baby, and a greater use of antibiotics. The cause of the pyrexia is not fully understood but appears to be independent of infection.

**Epidural technique**

Bearing in mind the above, how can we optimize labour epidural analgesia to ensure superior analgesia while minimizing the effects on labour?

**Low dose vs traditional epidural analgesia**

In the Comparative Obstetric Mobile Epidural Trail (COMET) published in 2001, 1054 primigravidae were randomized to receive traditional bupivacaine 0.25% top-ups or one of two mobile techniques: (i) combined spinal–epidural (CSE) with intermittent low-dose local anaesthetic and opioid top-ups; or (ii) epidural low-dose infusion (LDI). Both mobile techniques were associated with a 25% reduction in instrumental vaginal delivery compared with the traditional epidural group, and this was without an increase in caesarean section rate. Presumably this is the result of the preservation of muscle tone and the bearing down reflex. The message from the COMET trial is that low-dose techniques offer the best chance of a spontaneous vaginal delivery (SVD) with satisfactory analgesia. The authors conclude that the continued use of ‘traditional’ epidurals ‘might not be justified’. In a drive to decrease instrumental deliveries, ever-lower dose regimens have been studied and found to provide effective analgesia.

Traditionally, concentrated local anaesthetic (LA) solutions were used in the initial dose to establish epidural analgesia, but lower concentrations of LA and opioid have been shown to establish good analgesia within a satisfactory time scale. Epidural opioids have a LA dose-sparing effect in labour analgesia. The combination of low concentration LA (e.g. bupivacaine 0.1%) and epidural opioids provides good analgesia with less motor block and higher maternal satisfaction rates than LA alone.

**Local anaesthetic drugs**

The ideal local anaesthetic for labour analgesia would produce a reliable sensory block, no motor block and be safe in overdose or when inadvertently administered i.v. Traditionally, bupivacaine has been the most widely used LA in the UK. Bupivacaine provides effective analgesia epidurally but produces dose-dependent motor block and has a poor safety profile, causing life-threatening cardiovascular and neurological sequelae in overdose.
Levobupivacaine is a single enantiomer LA and a stereo-
isomer of bupivacaine. It is equipotent to bupivacaine with a
minimal local analgesic concentration (MLAC) ratio of 0.98.
Levobupivacaine is less cardiotoxic than bupivacaine, with approxi-
mately a 50% greater safety margin in animal trials. Toxicity
concerns may seem irrelevant when low dose techniques are used,
but during protracted labours, the total amount of LA may be
high, and large boluses may be required for operative delivery.
Given the choice, it would seem preferable to use the drug with the
best safety profile, although this will have cost implications.

Ropivacaine is another single enantiomer LA. It has been pro-
moted as having less motor blocking effect as well as a better safety
profile than bupivacaine. However, it appears that the drugs are
not equipotent. In MLAC studies, the relative analgesic potency of
ropivacaine to bupivacaine was 0.6 and the motor blocking
potency was 0.66. This would suggest that ropivacaine does not
have a superior sensory-motor split when compared with
bupivacaine. When used in equipotent doses (0.15% ropivacaine
and 0.1% bupivacaine), the incidence of motor block is the same.

Chloroprocaine and lidocaine are also used in the obstetric
setting; they are not suitable for analgesia. Chloroprocaine is
an ester LA with an extremely rapid onset of action; it is widely
used in the US to top up epidurals for operative delivery. It under-
goes ester hydrolysis; minimizing placental transmission but its
duration of action is too short for analgesia. Lidocaine 1.5–2%
with epinephrine is used for the same purpose in the UK (chloro-
procaine is unavailable). Lidocaine is not popular for labour
analgesia as repeated doses cause tachyphylaxis.

Opioids

Opioids can be added to LA or used as a sole epidural or intra-
thecal agent to provide analgesia for labour (Table 1). Neuraxial
opioids have been associated with pruritus, nausea and vomiting,
hypotension, urinary retention, uterine hyperstimulation, fetal
bradycardia and maternal respiratory depression. Of these, prur-
itus is the most common (up to 48%, 17% requiring treatment).

Morphine, a relatively long-acting opioid, is poorly lipid solu-
able and may accumulate in the CSF where it can spread cephalad,
potentially causing late respiratory depression. Only preservative-
free and may accumulate in the CSF where it can spread cephalad,
though this has will have cost implications.

Examples of typical epidural regimens are shown in Table 2.

Conventional midwife- or anaesthetist-administered top-ups

These are the traditional intermittent boluses of LA, typically
bupivacaine 0.25–0.5%, either in response to discomfort or at
timed intervals, after assessment of block height. This is labour
intensive for staff, provides intermittent analgesia and can cause
haemodynamic instability with each bolus.

Low dose top-ups

These also refer to intermittent boluses by the midwife or anaes-
thesist but with low dose LA, usually with fentanyl. The low-dose
regimen provides effective, rapid onset analgesia and high mater-
nal satisfaction rates when compared with traditional top-ups.
With low dose top-ups, there is a reduction in total LA dose when compared with epidural infusions. Low dose top-ups are
inherently safe; however a midwife should still be present. They do
not last as long as traditional top-ups and may be inadequate for
instrumental vaginal delivery.

Epidural low-dose infusions

Epidural low-dose infusions (LDI) are typically run at 8–16 ml h⁻¹
titrated to block height. In theory, LDI should decrease anaes-
thetic workload, provide more constant analgesia and better hae-
modynamic stability and sterility. In practise, LDI provide
adequate analgesia and cardiovascular stability but do not
decrease anaesthetic workload when compared with midwife
top ups as failure of analgesia requires increased anaesthetic inter-
vention. The total dose of LA and opioid is actually increased
when compared with low dose top-ups. In the COMET study,
women in the LDI group received twice as much fentanyl as the
CSE group and more neonates required resuscitation.

Table 2 Example of typical epidural regimens

<table>
<thead>
<tr>
<th>Epidural regimen</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low dose top-ups</td>
<td>Bupivacaine 0.0625–0.125%, 10 ml and fentanyl 2 μg ml⁻¹</td>
</tr>
<tr>
<td></td>
<td>8–16 ml h⁻¹</td>
</tr>
<tr>
<td>LDI</td>
<td>Bupivacaine 0.04–0.125% and 2 μg ml⁻¹ fentanyl</td>
</tr>
<tr>
<td>PCEA</td>
<td>Bupivacaine 0.0625–0.125%, 3–5 ml and fentanyl 2 μg ml⁻¹</td>
</tr>
<tr>
<td></td>
<td>10–15 min lockout</td>
</tr>
<tr>
<td>CSE</td>
<td>Intrathecal bupivacaine 2.5 mg and fentanyl 25 μg</td>
</tr>
<tr>
<td></td>
<td>As for LDI</td>
</tr>
</tbody>
</table>

LDI, low-dose infusions; PCEA, patient-controlled epidural anaesthesia; CSE, combined spinal–epidural anaesthesia.
Intrathecal clonidine (α-2 agonist), in combination with fentanyl, provides effective analgesia in the first stage of labour without significant motor block. Clonidine has been used for analgesia, in combination and alone, in doses of 30–200 μg. However, its use is associated with sedation and hypotension and it is not widely used in obstetrics. Other drugs that have been investigated include epinephrine, ketamine, neostigmine, remifentanil and midazolam.

**Obstetric management**

Whatever the influence of epidural analgesia on labour, it is obvious that obstetric management will have an impact on the mode of delivery. Variations in practice between obstetricians, even within a single obstetric unit, can and do result in widely different SVD and operative delivery rates. SVD rates vary enormously between studies of epidural vs non-epidural analgesia (30–81%). The use of ‘active management of labour’, which includes strict criteria for the diagnosis of labour, early amniotomy and the use of oxytocin both earlier and later in labour, has been shown to reduce the length of first and second stages of labour in those with regional analgesia. This is thought to be why epidural analgesia seems to have no effect on instrumental vaginal delivery rates in some studies. It is conceivable that as epidural analgesia becomes more refined, the effect of the obstetric management may overshadow that of the epidural analgesia. Good communication and a team effort are needed to reap the benefits of pain-free labour, while minimizing the potential effect of epidural analgesia on labour outcome.

**Conclusion**

Factors contributing to the outcome of labour are multiple and complex. We have a duty to provide optimal analgesia during labour. This is clearly achieved with epidural analgesia. Epidurals do not increase caesarean section rates or the incidence of back pain. However, we must strive to reduce any effect on duration of labour and instrumental vaginal delivery rates by minimizing motor block through the use of low-dose LA and opioid combinations. Further research in the form of well-designed RCTs is needed.

**Key references**


Brown J, Cyna AM, Simmons SW. Combined spinal epidural versus epidural analgesia in labour. *Cochrane Database of Systemic Reviews* 2001, issue 1

See multiple choice questions 75–79.