Analgesia in labour: induction and maintenance

Graeme G Flett

Abstract

Since the introduction of epidurals for labour analgesia in 1946, it has become the gold standard on delivery units throughout the world. Controversy remains as to the effects of neuraxial block upon the fetus, however it is now widely accepted that there are beneficial and not just detrimental effects. With the introduction of low-dose anaesthetic solutions the major cardiovascular effects and concerns with toxicity have become much less prominent and the lack of profound motor block associated with traditional dosing has resulted in greater maternal satisfaction, although not the mobile revolution which was once anticipated. As research continues to search for the ideal labour analgesia, newer technologies are evolving making epidurals ever safer, individualized and tailored to the modern women on the delivery suite, as they demand greater control and autonomy over their deliveries. No current method has been able to emulate these ideals, but in the meantime women can enjoy safe and effective analgesia with minimal risks to either themselves or their babies.

Keywords Adjuncts; combined spinal epidural; continuous spinal analgesia; epidural; labour analgesia; PCEA; smart pumps; test dose

Royal College of Anaesthetists CPD Matrix: 1D02, 2B01, 2B04

Learning objectives

After reading this article, you should:

- understand the methods of induction and maintenance available
- be aware of the common drugs and concentrations used within the UK
- understand the potential effects on both mother and fetus and their implications
- have some insight into the potential advancements of labour analgesia

Induction of analgesia

The ideal analgesia for labour would be easy to initiate and maintain, safe for both the mother and fetus, require little in the way of additional monitoring and be effective both in the early and late stages of labour. Currently no form of analgesia fulfils these ideal criteria, however epidurals continue to represent the gold standard. Approximately 25% of labouring women in the UK receive epidural analgesia, 58% in the USA, representing upwards of 140,000 epidural procedures, with the vast majority of these receiving high-quality analgesia without complication.[1] There is considerable variation in the availability of epidural analgesia between hospitals in the same country ranging from unavailable up to 40% in some units.[2] Other forms of analgesia therefore remain popular such as nitrous oxide and transcutaneous electrical nerve stimulation in the early stages of labour and intramuscular opioids such as pethidine and diamorphine in the later stages. Other newer modalities have emerged which have complemented the place of epidurals such as combined spinal–epidural (CSE), spinal catheters and now remifentanil patient-controlled analgesia (PCA); however none of these has replaced the role of a functional epidural.

Epidural

Epidurals have been used in labouring women since 1946. Traditional epidural techniques have involved concentrations of at least 0.25% bupivacaine, but are associated with greatly increased rates of instrumental delivery and significant motor block which precludes mobilization. With low-dose (0.1%) and ultra-low-dose (0.0625%) local anaesthetic (LA) solutions this decreases the rate of instrumental and assisted delivery as well as other side effects.[3] Lower concentrations (Table 1), are able to establish adequate labour analgesia within a satisfactory time scale without subsequent dense motor block, and this has been facilitated greatly by the introduction of epidural opioids.

Prior to induction, it is essential practice to administer a test dose. Various forms of test dose have been advocated, though huge individual variation remains. Common examples are 5–10 ml of a low-dose mixture or 3–4 ml of 2% lignocaine with or without epinephrine. This is routinely placed down the catheter once sited, rather than directly through the Tuohy needle. The purpose of this dose is to identify a potential intrathecal or intravascularly placed catheter and it is not intended to directly initiate a more rapid onset of block. Intrathecal placement would result in the rapid onset of sensory/motor block (sacral and ankle) with associated sympathetic blockade (hypotension). Intravascular placement may result in perioral tingling though with low-dose solutions this may be subtle. The addition of epinephrine is not common practice within the UK, but when used can result in tachycardia.

Combined spinal–epidural (CSE)

CSE involves the initial placement of an intrathecal dose of either LA or opiate, or in combination. A common dose is 3–5 ml of low-dose epidural solution (0.125% bupivacaine with 2 μg/ml of fentanyl) although other options exist. This is either then followed by low-dose epidural top-up (10–20 ml every 30–60 minutes) or infusion once the initial spinal component has begun to recede. CSE has some support within the UK with up to 5% of neuraxial labour analgesia being initiated by this means.[2] CSE was originally introduced in an attempt to reduce the adverse effects associated with traditional epidural dosing improving maternal mobility

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Summary of typical local anaesthetic drugs and doses for epidural and combined spinal–epidural

Drug	Induction dose	Intermittent top-ups	Infusion	Patient-controlled epidural analgesia
Epidural				
Bupivacaine 0.1% + fentanyl 2 μg/ml	10–20 ml in 10-ml divided doses	10–20 ml every 30–60 minutes	8–15 ml/hour	Blouses 5–10 ml lockout 15–30 minutes
Bupivacaine 0.0625% + sufentanil 0.25 μg/ml	10–20 ml in 10-ml divided doses	10–20 ml every 30–60 minutes	8–15 ml/hour	Blouses 5–10 ml lockout 15–30 minutes
Combined spinal–epidural				
Spinal component – 2.5 mg bupivacaine ± 25 μg fentanyl		As above	As above	As above
Spinal component – 2.5 ml epidural mixture (0.1% bupivacaine + 2 μg/ml fentanyl)		As above	As above	As above

Table 1

while providing a more rapid onset of analgesia (characteristically within 5–10 minutes) which could contribute to increased maternal satisfaction.[4] Traditional epidural doses have now largely been supplanted by low-dose techniques, with only 10% of units in 2009 still employing 0.25–0.5% concentrations[5] and thus the perceived benefits are no longer as apparent. A Cochrane review in 2012 stated that there appears to be little basis for offering CSE over low-dose epidurals in labour, with no difference in overall maternal satisfaction despite a slightly faster onset with CSE and less pruritus associated with low-dose mixtures.[6] CSE therefore still has a place where the rapid onset of analgesia is required in a severely distressed parturient. This can be achieved however without the addition of spinal opiate which does not improve the initial analgesia and, indeed, risks fetal bradycardia.

Continuous spinal analgesia (CSA)

Intentional placement of spinal catheters is not routinely performed in the UK due to the unacceptably high incidence of post-dural puncture headache (PDPH) and association with a higher risk of permanent neurological damage.[6] A 2007 Obstetric Anaesthetists' Association survey identified that CSA was used in only 6% of units, with all women being high-risk cases with a headache rate of 4.9%. However CSA may also be appropriate after accidental but confirmed dural puncture occurs. Under these circumstances, the catheter should be clearly labelled to prevent confusion as to its position and this should be clearly documented in the notes. Any top-ups should be done by the anaesthetist only, especially where spinal catheters are not routine. Top-ups can be done with 3–5 ml of low-dose solutions, or low-dose continuous infusion of up to 5 ml/hour. CSA under these circumstances does not reduce the incidence of PDPH or subsequent blood patch, but may reduce the risk of additional dural puncture from attempted resite.[7]

Dural puncture epidural

Newer techniques have been proposed such as dural puncture epidural where the dural membrane is deliberately punctured with either a 25 or 27G spinal needle once the epidural space has been located. The epidural catheter is then threaded into the epidural space without intrathecal dosing. The epidural is then topped up as normal with the expectation that LA mixture traverses into the intrathecal space thereby increasing the quality of the analgesia obtained. This is generally only effective with a 25G needle thereby creating an increased headache risk and as such has not gained widespread popularity.

Maintenance of analgesia

Mothers have multidimensional expectations of labour analgesia, and the ideal would be seamless through all phases of labour and individualized while preserving maternal autonomy. A range of methods have been utilized to achieved these aims while maintaining adequate analgesia (Table 2) such as intermittent boluses, continuous infusions, patient-controlled epidural analgesia (PCEA) and newer variations of these techniques. The attainment of this ideal has been greatly enhanced since the introduction of low-dose LA mixtures.

Intermittent boluses

This refers to the intermittent administration by an anaesthetist or midwife of 10–20 ml low-dose LA every 30–60 minutes (Table 1). These concentrations are inherently safer than traditional top-ups with better maternal satisfaction, less motor block and a reduced incidence of instrumental deliveries. They achieve a better initial block due to more uniform epidural spread, and have a lower total LA consumption compared to infusion alone. They do however require close monitoring of mother and fetus especially around the time of top-up. They also have the increased potential of infection due to repeatedly breaking into the epidural line.

Methods of maintenance of epidural labour analgesia

- Intermittent bolusing – Low-dose top-up
- Continuous infusions
- Patient-controlled epidural analgesia (PCEA)
- Intermittent continuous infusions
- Programmable intermittent epidural boluses (PIEB)
- Smart pumps: uses feedback from patient during labour to reprogramme the pump according to their needs during labour

Table 2