



World Anaesthesia Tutorial of the Week

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Analgesia for Labour

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Key Points

There are many different techniques both regional and non-regional to provide labour analgesia.

Non-regional techniques are the most frequently employed methods for labour analgesia.

Meperidine (pethidine) is the most frequently used opioid for labour analgesia. Its limited efficacy and side effects are well documented.

Inhalation of nitrous oxide relieves labour pain to a significant degree and is especially beneficial in hospitals where other analgesic options are not available.

Epidural analgesia, when compared with other methods, provides superior analgesia for labour.

There is no association between epidural analgesia and an increased risk of caesarean delivery or post partum backache. There is an association with prolongation of labour and increased operative vaginal delivery.

Analgesia for Labour

Labour may be the most painful experience many women ever encounter. The experience is different for each woman and the different methods chosen to relieve pain depend upon the techniques available locally and the personal choice of the individual.

Non-regional techniques for labour analgesia

Non-regional methods available for analgesia in labour may be divided into non-pharmacological and pharmacological methods.

Non-pharmacological Methods

Advantages of non-pharmacological techniques include their relative ease of administration and minimal side effects; however there is little evidence to support the efficacy of many of these techniques and some may be costly and time consuming. A selection of non-pharmacological techniques are listed below:

- Transcutaneous electrical nerve stimulation (TENS); see below
- Relaxation/breathing techniques
- Temperature modulation: hot or cold packs, water immersion
- Hypnosis
- Massage
- Acupuncture
- Aromatherapy

Transcutaneous electrical nerve stimulation (TENS)

Electrodes are placed about 2cm over the T10-L1 dermatomes either side of the spinous processes to provide analgesia for the first stage of labour. A second set of electrodes is placed over the S2 – S4 dermatomes for second stage pain relief. Women can alter the amount of current supplied to the electrodes providing some degree of control throughout their labour.

Blockade of pain transmission to the brain through stimulation of A-fibre transmission and local release of β -endorphins are suggested theories for TENS analgesia; however there is no evidence that TENS provides more analgesia than placebo. Despite this, TENS has minimal side effects and may be appropriate for women who have contraindications to other methods of pain relief or where other methods are not available.

Pharmacological agents include inhalational agents and systemic analgesics.

Inhalational Methods

Nitrous oxide

Nitrous oxide has been used in obstetric practice for over a century and a survey in 1990 demonstrated its availability in 99% of UK obstetric units and use by 60 % of parturients. Entonox (50 % nitrous oxide in oxygen) provides analgesia within 20-30 seconds of inhalation with a maximum effect after about 45 seconds.

Advantages include:

- ease of use
- no requirement for physician supervision
- minimal accumulation with intermittent use
- self-administration provides some control.

Disadvantages include:

- drowsiness, disorientation and nausea may occur including brief episodes of loss of consciousness (observed in 0.4% of cases after prolonged use)
- does not provide complete analgesia.

The efficacy of inhaled nitrous oxide for labour pain has been much debated. Current clinical data suggest it relieves labour pain to a significant degree in most women but does not provide complete analgesia for many. Nitrous oxide remains a useful analgesic modality for labour pain and is especially beneficial in units where other analgesic options are limited.

Inhalation of halogenated agents

Several volatile anaesthetic agents have been inhaled intermittently for labour analgesia. Their use is limited by technical difficulties in their safe administration and scavenging.

Systemic analgesics

Meperidine (Pethidine)

Meperidine is a synthetic phenylpiperidine derivative which is commonly administered intramuscularly (IM) in a dose of 1mg /kg. Despite widespread use, its efficacy has been questioned and it has been suggested that it provides merely sedation rather than analgesia in labour.

Meperidine, like other opioids, delays gastric emptying and has been shown to increase gastric volumes in labour. It also causes sedation, dose-dependant respiratory depression and its active metabolite (nor-meperidine) has convulsant properties.

Meperidine crosses the placenta and its effects on the fetus are dependant on dose and timing of administration; the highest fetal plasma concentration occurs 2-3 h after maternal IM administration. Neonatal effects are compounded by production of nor-meperidine which causes further sedation and respiratory depression. Babies of women administered meperidine in labour have been shown to be sleepier, less attentive and less able to establish breast feeding despite normal apgar scores.

Despite these disadvantages, Meperidine remains popular in many obstetric units, is easy to administer and may be a useful analgesic modality where other methods are not available or contraindicated.

Morphine

Morphine shares many of the side effects of meperidine and rapidly crosses the placenta, however its metabolites do not have convulsant effects. The dose used for maternal analgesia is 0.1 – 0.15mg/kg.

Diamorphine

Diamorphine, a more potent drug than meperidine, is increasingly used for labour analgesia in the UK though is currently under threat by problems of supply. It is administered intramuscularly in the dose of 5-7.5mg.

Fentanyl

Fentanyl, a highly potent phenylpiperidine derivative, has a rapid onset of action. It has a longer terminal half life than both meperidine and morphine and repeated dosing may result in drug accumulation in both the fetus and the mother. Advantages include absence of active metabolites and rapid onset of action making it useful for patient-controlled analgesia.

Patient-controlled analgesia (PCA)

If regional analgesia is unavailable or contraindicated, then PCA is a useful method of pain control as long as the equipment and staffing are available. PCA provides some control to the woman, and this in itself is associated with greater satisfaction; however it is important that women are instructed in how to use the device effectively.

Many opioids have been used in PCA devices; drugs currently used include fentanyl and more recently remifentanyl.

A suggested regimen for fentanyl PCA is 20 µg bolus with 5 min lockout; however the ideal loading dose, bolus dose, lockout time and maximum hourly dose remain unclear.

Both parturient and neonate should be carefully monitored during labour and post-partum and PCA settings altered accordingly.

Remifentanyl, an ultra short acting opioid, is rapidly hydrolysed by blood and tissue esterases and does not accumulate even after prolonged infusions. There are increasing reports of its use in PCA though like fentanyl, the ideal regimen remains unclear. A bolus dose of 0.25-0.5 $\mu\text{g Kg}^{-1}$ with 2 minute lock-out has been used successfully. However, close monitoring is essential and supplementary oxygen may be required.

Regional techniques for labour analgesia

Regional techniques represent the “gold standard” for labour analgesia.

Caudal Analgesia

Since the development of epidural catheters, caudal epidural injections have become a less popular technique for labour analgesia. Not only do they provide less effective and less flexible analgesia than lumbar epidurals, there is also a higher risk of inadvertent IV injection.

Lumbar Epidural Analgesia

Epidural analgesia effectively relieves labour pain; however controversy exists as to the effect of epidurals on the progress of labour, mode of delivery and effects on the fetus and neonate.

1. Effect on caesarean section rate

- Numerous studies have attempted to establish the influence of epidural analgesia on progress of labour and method of delivery. When combined these studies clearly indicate that epidural analgesia does not increase the risk of caesarean section.

2. Epidurals and long term backache.

- Back pain is common after child birth with almost 50% of women reporting it 6 months after delivery; however several recently conducted randomised controlled trials confirm that epidural analgesia is not associated with an increased incidence of backache after child birth.

3. Effect on duration of labour and operative vaginal delivery.

- Several studies have demonstrated a modest prolongation of the second stage of labour and an increase in the operative vaginal delivery rate (forceps and vacuum deliveries) of women receiving epidural analgesia for labour.

- It should be remembered that women with complicated, painful labours may request epidural analgesia more frequently and the prolongation of labour caused by epidural analgesia might lead obstetricians to perform an operative delivery more frequently in order to shorten this stage of labour.
- Higher doses of epidural local anaesthetic in labour may lead to an increase in obstetric intervention and methods to reduce the dose to a minimum might influence the incidence of obstetric intervention; see local anaesthetic delivery below.

4. 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.

5. Effect of epidurals on maternal temperature.

- Several studies have demonstrated a significant increase in the temperature of mothers receiving epidural analgesia. The cause of this rise in temperature and significance for the neonate remain unclear.

Epidural Technique

Low dose vs. traditional epidural analgesia.

- Low dose techniques offer the best chance of spontaneous vaginal delivery should epidural analgesia be required.

The Comparative Obstetric Mobile Epidural Trial (COMET) published in 2001 demonstrated a 25% higher incidence of operative vaginal delivery in women who received traditional bupivacaine 0.25% epidural top-ups compared with women receiving low dose local anaesthetic and opioid top ups or infusions. There was no increase in the rate of caesarean section.

Choice of epidural drugs for labour and delivery.

Epidural **bupivacaine** provides excellent sensory block and has been used for labour analgesia for many years. However, concerns about its cardiac toxicity and the intensity of its motor block have led to the investigation of other agents.

Ropivacaine was developed to reduce the incidence of cardiac toxicity in the event of accidental intravenous injection. Early reports suggested it was associated with reduced incidence of operative vaginal delivery and less motor block when compared with bupivacaine. More recent studies have shown ropivacaine is less potent than bupivacaine and there is no evidence to support the view that ropivacaine is superior to bupivacaine for obstetric or neonatal outcome.

Levobupivacaine is a single enantiomer and stereo isomer of bupivacaine and appears equipotent to bupivacaine. In animal studies levobupivacaine is less cardiotoxic than bupivacaine however there is currently insufficient data to determine the role of epidural levobupivacaine for labour analgesia.

Chlorprocaine, an ester local anaesthetic with a rapid onset of action, is used in the United States to top up epidurals for an operative delivery. It is not a suitable agent for labour analgesia due to its short duration of action. Similarly, **lidocaine** which is used in the UK in the same circumstances may cause tachyphylaxis with repeated use and is therefore not a suitable agent for labour analgesia.

Epidural Opioids

The addition of epidural opioids to local anaesthetic solutions has gained popularity over the years. Opioids have a synergistic effect by acting directly on opioid receptors in the spinal cord and help reduce local anaesthetic requirements.

Various opioids have been used; however those with low lipid solubility (e.g. morphine) are associated with delayed respiratory depression and should be used with caution. Fentanyl is a commonly used opioid for labour analgesia in the UK.

Techniques for maintenance of epidural analgesia.

There are advantages and disadvantages to the different techniques available for delivery of epidural analgesia.

Single-shot administration

- A single dose of local anaesthetic injected through the epidural needle during labour may provide relatively fast onset of analgesia; however there are obvious drawbacks to this technique including limited duration of action and the associated risk of injecting a large volume of local anaesthetic without a test dose or ability to administer in small increments.

Intermittent top-ups

- Ideally a low dose mix of local anaesthetic and opioid.
- Relatively safe, simple method of delivery and no need for complex infusion devices.
- May be labour intensive for staff.

Continuous epidural infusion (CEI)

- Typical low dose infusion of bupivacaine 0.0625% - 0.1% + 2 µg/ml fentanyl run at 8-12ml/h titrated to block height.
- Provides adequate analgesia and haemodynamic stability.

- Requires infusion device.
- May increase anaesthetic intervention when analgesia fails compared to intermittent top-ups.
- Increased total dose of local anaesthetic and opioid compared to low dose top ups and PCEA.

Patient-controlled epidural analgesia (PCEA)

- Allows patient to match dose of analgesia to amount of pain as labour progresses.
- Allows for patient variability in local anaesthetic requirement.
- Instills a degree of control to the woman and may improve maternal satisfaction.
- Reduction in the need for clinician top-ups.
- Reduction in the amount of local anaesthetic and opioid delivered.
- Reduction in incidence of motor block.
- Equipment required may be costly.
- Women require instruction in how to best utilise PCEA.
- No difference in obstetric or neonatal outcomes when compared to CEI.

Combined spinal-epidural (CSE) analgesia in labour.

CSE provides the advantages of a spinal (speed of onset) with the ability to prolong labour analgesia with an epidural catheter.

- CSE analgesia in labour usually achieved by short acting lipid soluble narcotic +/- low dose local anaesthetic.
- Combination of fentanyl 10-25 mcg or sufentanil 2.5-10 mcg +/- bupivacaine 2.5mg can be used.
- CSE in labour appears as safe a technique as epidural analgesia and may be associated with greater maternal satisfaction.
- Reduced local anaesthetic requirements and motor block over the course of labour compared with conventional epidural analgesia.
- When compared with epidural analgesia there appears to be no difference in duration of labour and mode of delivery.
- The potential hazards of intrathecal catheter migration with a needle-through needle CSE technique and increase in post-dural puncture headache have not been demonstrated.

Information for obstetric analgesia

Many studies have investigated what information should be provided to women for labour analgesia and how that information should be delivered.

- Many women want to know the risks involved with different types of analgesia including epidural analgesia before they give consent.

- Knowledge of risks does not seem to deter women from choosing epidural analgesia.
- Provision of written information increases the chance that a woman may recall the complications associated with an epidural in the post-partum period.

Summary

The pain of labour is severe and many women seek ways to reduce it. Non-regional techniques include supportive measures, inhalation of nitrous oxide and parenteral opioid administration. Epidural analgesia provides good quality pain relief in labour. Well conducted studies confirm there is no influence on the rate of caesarean delivery or long term back ache; however epidural analgesia is associated with increased duration of labour and increased incidence of operative vaginal delivery.

Analgesia for labour

Self Test MCQs

1. Regarding conduction of pain in labour:
 - A. Pain during the first stage of labour is caused by uterine contractions and dilatation of the cervix
 - B. Afferent nerves from the body of the uterus and cervix travel with sympathetic nerves
 - C. Sensation from the vagina, vulva and perineum is conveyed by the pudendal nerve
 - D. Sympathetic and parasympathetic fibres carry efferent impulses to the uterus and affect its motor function

2. The following are true regarding Trans Cutaneous Electrical Nerve Stimulation (TENS):
 - A. Electrodes placed over the S2-S4 dermatomes aim to provide analgesia for the 1st stage of labour
 - B. Theories behind TENS analgesia include the increased local release of endorphins
 - C. TENS causes significant interference with fetal heart monitoring
 - D. TENS provides better analgesia than placebo

3. The following statements regarding regional analgesia in labour are true:
 - A. Epidurals in labour cause an increase in the caesarean section rate
 - B. Provision of written information increases the chance that women recall complications associated with epidural analgesia
 - C. Ropivacaine is equipotent to bupivacaine at concentrations used in labour analgesia
 - D. Intrathecal opioids may cause fetal bradycardia

4. Nitrous oxide inhaled in labour;
 - A. Provides no significant analgesia when compared with inhaled oxygen or air
 - B. Alters the force of uterine contractions and progress in labour
 - C. Is associated with adverse neonatal outcome
 - D. When administered with other inhalational agents may improve analgesic efficacy

MCQ answers

Question 1

(a) T, (b) T, (c) T, (d) T

Second stage pain is caused by stretching, distension and tearing of fascia, skin and subcutaneous tissues. Although afferent nerves from the uterus are somatic sensory fibres, they travel with sympathetic nerves and enter the sympathetic chain in the lumbar and lower thoracic regions.

Question 2

(a) F, (b) T, (c) F, (d) F

In TENS, most commonly the electrodes are placed over the T10 – T11 dermatomes for first stage labour analgesia and over the S2-S4 dermatomes for second stage labour. Some machines have a “dual channel” function allowing stimulation of all 4 electrodes simultaneously. TENS does not seem to cause significant interference to fetal heart rate monitoring and current studies do not support the notion that TENS provides significantly better analgesia than placebo.

Question 3

(a) F, (b) T, (c) F, (d) T

Epidurals are associated with prolongation of labour and may increase the operative vaginal delivery rate but there is no evidence that they increase the caesarean section rate. Several studies have compared ropivacaine and bupivacaine for labour analgesia and studies consistently show that ropivacaine is less potent than bupivacaine. Several studies suggest intrathecal opioids may increase the incidence of fetal bradycardia; however the magnitude of this increase is difficult to determine and may be small.

Question 4

(a) F, (b) F, (c) F, (d) T

Adverse neonatal outcomes associated with the use of inhaled nitrous oxide have not been demonstrated. The addition of other inhalational agents and use of higher than 50% concentrations of nitrous oxide in air improves efficacy but is associated with increased side effects and technical difficulties in administration and scavenging.