

Non-neuraxial analgesia in labour

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Abstract

Pain in labour is often described as one of the most severe pains experienced. Neuraxial techniques provide the most effective form of labour analgesia. However, not all women wish to have this or indeed want complete pain relief in labour. There are also subgroups of women in whom neuraxial techniques are contraindicated or attempted placement is unsuccessful. Therefore delivery units must be able to offer a range of non-neuraxial analgesia options for labour.

Keywords Analgesia; diamorphine; Entonox; labour; non-neuraxial; opioids; patient-controlled; pethidine; remifentanyl

Royal College of Anaesthetists CPD Matrix: 1A02, 1D02, 2B01

Women in labour expect to have effective analgesia and are disappointed when this is not the case. The degree of analgesia desired varies widely, with two-thirds of women questioned wanting the minimum amount of drugs to allow them to cope with the pain of labour.¹ It is therefore important that we are able to offer a range of analgesic options and ensure we give good-quality information about the different options available to aid women in making a choice most appropriate to their needs.

This article will focus on non-neuraxial techniques of analgesia: non-pharmacological and pharmacological (Table 1).

Non-pharmacological

Labouring women use a range of non-pharmacological techniques for pain relief with varying effects and evidence for their use. There is some evidence to support the use of relaxation, immersion in water, acupuncture and massage, but insufficient evidence for the use of transcutaneous electrical nerve stimulation (TENS), sterile water injections, aromatherapy, biofeedback and hypnotherapy.² Even the techniques with poor evidence of efficacy are found useful by many women and can improve maternal satisfaction.

Relaxation

Relaxation techniques (breathing exercises) are often taught in antenatal classes. By focussing on breathing, it helps women to

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Learning objectives

After reading this article, you should be able to:

- state the options available for non-neuraxial analgesia for labour
- outline the efficacy of the non-pharmacological and pharmacological methods of labour analgesia described
- outline the adverse effects of each of the methods of non-neuraxial analgesia

stay in control and conserve energy. Relaxation techniques are thought to provide analgesia and better maternal satisfaction with childbirth.³

Immersion in water

The Changing Childbirth Report by the Department of Health in 1993 led to the acceptance of immersion in water for labour and birth by the Royal College of Midwives in 1994. Baths are used to allow sufficient warm water (<37.5°C) to completely cover the pregnant abdomen. The use of birthing pools in the first stage of labour reduces the need for neuraxial techniques but does not affect the requirements for opioids, the duration of labour, the need for operative delivery or neonatal outcome.⁴

Transcutaneous electrical nerve stimulation (TENS)

A TENS machine consists of electrodes attached to a portable, hand-held device. The electrodes are attached to the skin over the dermatomes responsible for the painful stimulus (lower back) and an electrical current is applied and increased as required. TENS uses Melzack and Wall's gate control theory of pain and is a common treatment modality for both acute and chronic pain.

NICE does not support the use of TENS in established labour.⁵ In 1994, it was used by 16% of low-risk primiparous labouring women.⁶ Despite the limited evidence for TENS providing labour analgesia, most women said they would use TENS again in the future.⁶

Injections of sterile water

Injections of sterile water, also known as water blocks, are injections of approx 0.1 ml of sterile water, injected intracutaneously or subcutaneously, into four areas of the lower back. They are performed at the peak of contraction to minimize the pain from the injection itself. Water blocks became popular for relieving back pain in labour but a recent review has found no evidence of benefit.⁷

Pharmacological

Inhalational

Entonox: Nitrous oxide (N₂O) was discovered in the 1700s but it was not until 1961 that Tunstall introduced it as Entonox: 50% nitrous oxide (N₂O) and 50% oxygen (O₂) to obstetric practice. Entonox is now the most commonly used method of analgesia for labour in the UK and is available in 100% of UK obstetric units⁸ but it is not commonplace in the USA or many European countries.

Methods of non-neuraxial analgesia in labour

Non-pharmacological	Relaxation techniques Immersion in water Acupuncture Massage Transcutaneous electrical nerve stimulation (TENS) Sterile water injections Aromatherapy Biofeedback Hypnosis
Pharmacological – inhalational	Entonox Volatile anaesthetic agents
Pharmacological – parenteral opioids	Bolus Patient-controlled analgesia

Table 1

Nitrous oxide is a colourless, sweet-smelling gas with a minimum alveolar concentration (MAC) of 105 and a blood gas partition coefficient of 0.46 giving it the benefit of rapid onset and offset of action. Onset of action is within 30 seconds with full analgesic effect by 50 seconds and as it is eliminated via the lungs, it does not accumulate. It is thought to act via non-competitive inhibition of N-methyl-D-aspartate (NMDA) subtype of glutamate receptors.

Entonox is self-administered by breathing through a demand valve attached to either a mask or mouthpiece. As well as analgesia, Entonox can cause euphoria. The side effects: dizziness, hallucinations, nausea and vomiting and drowsiness, can sometimes limit use. Methionine synthase activity may be completely inhibited after a few hours of nitrous oxide administration.

A recent systematic review found very few good-quality studies on nitrous oxide use for labour pain and concluded that there was insufficient evidence for the effectiveness of nitrous oxide in managing labour pain.⁸

Most studies have not found adverse outcomes in the babies of mothers using nitrous oxide for labour but the quality of the studies has been poor. APGAR scores are no different between babies born to mothers who used nitrous oxide for labour and those mothers who used other or no pharmacological labour analgesia. Animal studies have found that fetal exposure to mixtures of anaesthetic drugs including nitrous oxide can cause significant neuroapoptosis during periods of rapid synaptogenesis (mid-gestation to several years old). We do not know the human relevance of these effects yet.

Entonox can be stored in cylinders making it suitable for women who choose to have home births. It has a pseudocritical temperature of -5.5°C at 137 bar. At this temperature it separates out into its two constituent components: N_2O and O_2 . If the cylinder is then used, initially the woman will get little analgesia as most of the gas will be oxygen and then subsequently she will be at risk of inhaling a hypoxic mixture of nitrous oxide. This is important knowledge for community midwives – if their Entonox cylinder has been exposed to temperatures below freezing, it

should be warmed at room temperature and the contents adequately mixed prior to use.

Volatile anaesthetic agents: 3% of obstetric units in the UK⁹ use volatile anaesthetic agents for labour analgesia. The fluorinated agents (e.g. isoflurane and sevoflurane) can be used at sub-anaesthetic doses to provide analgesia whilst maintaining airway reflexes. Inspired fractions of 0.8% sevoflurane have been found to provide optimum analgesia¹⁰ with no increase in the incidence of post-partum haemorrhage. However, the use of volatile agents requires specialist equipment such as a draw-over Oxford miniature vaporizer and adequate scavenging in the labour room, which has practical and financial implications.

Opioids (Tables 2 and 3)

Bolus: about 95.5% of UK obstetric units use either intramuscular (IM) pethidine or diamorphine. Units usually co-administer antiemetics (73.7%) with IM opioids.¹¹ Tramadol, meptazinol and pentazocine are not widely used in the UK and there is no current evidence that they confer any advantage over pethidine.

Pethidine – Developed in 1939, pethidine (meperidine) has been approved for independent use by midwives since 1950. It was introduced into practice without any evidence from randomized controlled trials on its efficacy for labour pain and there have been concerns that its main effect is sedation rather than analgesia. It is still the most commonly used intramuscular opioid analgesic in UK consultant-led maternity units (84.4%).¹¹

Intramuscular pethidine acts within 40 minutes to give 2–3 hours of clinical effect. It is metabolized in the liver to norpethidine and pethidinic acid, which are further conjugated before being excreted in the urine. Norpethidine is an active metabolite with half the analgesic effect of pethidine. However, its effects cannot be reversed with naloxone.

Pethidine is highly lipid soluble and crosses the placenta: at delivery, the mean cord blood concentration is 75–90% of the maternal venous concentration. Maternal administration of pethidine has significant effects on the fetus: there is maximal risk of neonatal respiratory depression if delivery occurs within 2–3 hours of the maternal dose. Altered neonatal neurobehaviour, decreased wakefulness and attentiveness and

Side effects of opioids

Maternal side effects

Nausea and vomiting
Sedation
Dizziness
Respiratory depression
Euphoria/dysphoria
Delayed gastric emptying
Hallucinations
Urinary retention

Fetal/neonatal side effects^a

Loss of fetal heart variability
Respiratory depression
Sedation
Delay in breast-feeding
Decreased neurobehavioural scores

^a No current evidence for these fetal/neonatal side effects with remifentanyl.

Table 2

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