

Analgesia and anaesthesia in labour

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Abstract

Labour is one of the most painful experiences women encounter. Modern practice encompasses a number of techniques to alleviate this, from complementary therapies to invasive procedures. Pain induces a physiological stress response which has a number of deleterious effects on the body. Pharmacological methods of pain relief are the most popular – namely nitrous oxide, opioids and epidural analgesia. The latter is by far the most effective and is regarded as the gold standard. Importantly, intrapartum opioid use may be associated with the risk of neonatal respiratory depression. Nonpharmacological techniques vary in their efficacy. Of these hydrotherapy, acupuncture, continuous labour support and intradermal water blocks show the most promise. None of the methods available constitute the ideal analgesic for labour and choice should be based on maternal preference, with regular re-evaluation to ensure adequate effect.

Keywords epidural; labour analgesia; nitrous oxide; opioids; pain relief

Provision of analgesia for women in labour has come a long way since the seminal use of ether by James Young Simpson in 1846. Modern practice encompasses a wide variety of techniques, ranging from complementary therapies to invasive neuraxial blockade. In this article we will examine each of these in turn and look at some of the current controversies within this area of anaesthesia.

Pathophysiology of labour pain

In order to treat labour pain effectively a knowledge of the pathways involved is required. Pain during the first stage of labour results from uterine contraction, thus is visceral and mediated by spinal nerves T10-L1 which innervate the myometrium. An additional somatic component arises from perineal stretching, which begins late in the first stage and persists throughout the second stage. This is transmitted via the pudendal nerve (S2–S4). The third stage is usually not particularly painful in comparison.

Aside from the primordial desire to ease another person's suffering, there are several reasons why adequacy of analgesia in labour should be given due consideration. These are largely

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related to minimising the undesirable systemic effects of severe pain.

Pain induces a physiological stress response which results in increased circulating catecholamine levels. The resultant tachycardia, hypertension and rise in cardiac output all increase myocardial workload and hence oxygen demand. While this is not a problem for most women, it can precipitate heart failure and even ischaemia in those with poor cardiorespiratory reserve. This bares particular importance since cardiac disease remains the leading cause of maternal death in the UK.

Pain also decreases the rate of gastric emptying, increasing the risk of aspiration in the event of emergency general anaesthesia. Additionally, it has been suggested that postnatal depression may be less common among women who receive effective analgesia in labour and that the increased adrenaline levels may in fact prolong labour through beta-receptor mediated uterine relaxation.

Of course the need for maternal analgesia must always be balanced against any potential risks of harm to the foetus, and in the remainder of this article we shall explore this in more detail.

Nonpharmacological methods of analgesia

A huge variety of nonpharmacological approaches to labour pain have been tried over the years, with variable success. Recent clinical trials have yielded promising results for several modalities – namely continuous labour support, acupuncture, intradermal water blocks and hydrotherapy. The availability of these varies geographically, but warrants due consideration as they are largely cheap, with few side effects and may be offered in combination or as adjuncts to pharmacological methods. For many other methods there is insufficient evidence at present to promote their use. We will concentrate on the more popular and promising therapies below.

Arguably the simplest method is continuous labour support, which describes the non-medical care of a parturient throughout her labour and delivery. This may be provided by a variety of personnel, though studies show greatest benefit when trained lay women (doulas) are used rather than midwives or nursing staff. Such practice is currently more widespread in the USA than the UK. Several trials have demonstrated a significant reduction in reported pain and use of analgesia in women receiving such support.

Hydrotherapy is widely available and involves immersion in warm water during labour. It is associated with high maternal satisfaction and lower pain scores; women report an initial reduction in pain on entering the water followed by a slower increase in intensity thereafter when compared to control groups. However there is no evidence for shortening of labour duration or alteration in surgical delivery rates. This form of analgesia is cheap, relatively easy to administer with few side effects when guidelines are followed.

Intradermal water blocks are designed to ease lower back pain in labour, which has an incidence of up to 75%. The blocks involve intradermal injection of 0.05 millilitres sterile water over the posterior superior iliac spines and a point inferomedial to these. There are no known side effects. Although this technique has been shown to consistently reduce back pain, the effect is short-lived lasting between 45 and 120 minutes. Perhaps it is for

this reason that it is not more popular. As the injections specifically relieve back pain, with no effect on abdominal pain, there is no reduction in overall analgesia use.

Maternal mobility has been the focus of a number of studies. Evidence suggests that the vast majority (70%) of women who deliver in the hospital setting do not mobilise following their admission to labour ward. The main reasons cited for this include attachment to monitoring equipment, discouragement from midwives or lack of confidence in motor ability after analgesia administration. This is a marked difference to the recent past when women were encouraged to walk “to bring the labour on”. In addition to hastening foetal descent, mobilisation is known to reduce the severity of pain, either due to a direct effect in altering pelvic outlet diameter or indirectly through distraction. When stationary the upright, sidelying and squatting positions are all reported to cause less pain than lying supine. For these reasons freedom of movement during labour should be encouraged.

Acupuncture is becoming increasingly available, with a number of midwives in the UK now trained to offer this. A traditional form of Chinese medicine, acupuncture involves insertion of fine needles at specific points along channels of energy or “meridians” in the body, followed by stimulation of the needle using electricity, rotation or heat. This is believed to exert an analgesic effect by increasing the release of endorphins. Several studies have demonstrated effective relief of labour pain, with subsequent reduction in pethidine use. Furthermore, there are no known risks to either the mother or foetus, making this a promising area for continued research.

Transcutaneous Electrical Nerve Stimulation (TENS) is a popular method for pain relief in early labour in the UK, with handsets readily available to rent from many pharmacies. The technique uses electrodes placed over dermatomes supplied by the nerves responsible for labour pain (T10-L1 and S2-4). A high frequency low voltage electrical impulse is then passed through these electrodes, which inhibits pain signal transmission in the nerve roots (Gate Theory of pain). Additionally, TENS directly stimulates opioid receptors in the spinal cord leading to a rise in circulating endorphins. Despite its robust scientific roots, there is little convincing evidence for efficacy of TENS, though it has been noted observationally to have a modest effect in the early stages of labour.

Alternative methods including heat and cold application, aromatherapy, massage, hypnosis and audioanalgesia have been the subject of small scale trials and are not in widespread use.

Pharmacological methods of analgesia

Inhalational agents

Perhaps the oldest means of providing pain relief in childbirth is inhalational analgesia, which has been employed for over 100 years. Indeed Queen Victoria famously received chloroform during the birth of two of her children. Historically a variety of agents have been used including trichloroethylene, cyclopropane and methoxyflurane as well as the more familiar nitrous oxide. Common to all is the application of subanaesthetic concentrations to provide analgesia whilst preserving conscious level and protective airway reflexes.

Nitrous oxide: in the UK the most widely used agent is nitrous oxide, estimated to be used by up to 75% of women in labour. It

is usually delivered premixed in a 1:1 ratio with oxygen (Entonox). A demand valve attached to the mouthpiece acts as a safety mechanism – it only opens when negative pressure is applied during inspiration. Hence if the patient becomes drowsy with consequent reduction in respiratory effort, no more Entonox is delivered and the patient will rouse again once the gas is eliminated through expiration.

The mechanism of action of nitrous oxide is not fully understood, though it is believed to result from increasing the activity of inhibitory pain pathways in the brain. It undergoes minimal metabolism and is excreted mainly through expiration, therefore is not dependent on renal or hepatic function for elimination. Due to its low solubility in blood it has a very rapid onset and offset and in healthy individuals has little effect on the cardio-respiratory system.

There are many advantages of nitrous oxide. It can be used at any stage in labour, for any duration, either alone or with other agents. It is cheap, does not require increased levels of monitoring and has an encouraging safety profile, having been used for many years. The drug has no effect on uterine contractions and thus does not alter the progress of labour. In this way it differs from other inhalational agents which have been shown to markedly reduce contractility thereby slowing labour and increasing the risk of postpartum haemorrhage. Importantly nitrous oxide has no effect on the foetus, with several studies demonstrating no alteration in Apgar or neonatal neurobehaviour scores. It is also safe for breast-feeding.

Potential side effects include drowsiness, dizziness and more rarely paraesthesia. Unconsciousness per se is incredibly rare (less than 0.5%) and is safeguarded by the demand valve described above. There is a theoretical risk of oxygen desaturation which is more clinically relevant if given with pethidine. Nausea and vomiting occurs in up to one third of women. However the biggest clinical problem is low efficacy reported by many, particularly during the later stages of labour. This is believed in part to be due to improper timing of use with contractions, as it has been shown that with accurate use good analgesia is provided in over 50% of parturients. Since there is a time lag of 50 seconds to reach peak analgesic effect, for optimal analgesia inhalation should begin in anticipation, approximately 30 seconds before the onset of contraction. This requires meticulous attention to timing which is understandably difficult in such circumstances. The alternative technique of continuous delivery may be more effective but is associated with increased incidence of side effects.

Despite multiple studies there is still little objective evidence for the analgesic effect of nitrous oxide in labour. However its value in managing pain in the early stages is clear. Moreover a great many women who have used it in the past choose to use it again and consider it to be as effective as TENS and more effective than pethidine, though less than epidural analgesia.

Halogenated inhalational agents: isoflurane, sevoflurane and most recently desflurane have all been shown to be beneficial in treating labour pain. However significant maternal sedation precludes clinical use in a labour ward setting. There are a number of reports of use of low doses in conjunction with Entonox – so called “Sevonox” for example – which produces a far superior analgesia than Entonox alone but with minimal

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