

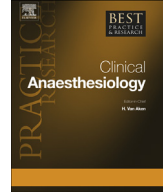


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### Maintenance of epidural labour analgesia: The old, the new and the future



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Neuraxial analgesia is considered the gold standard in labour analgesia, providing the most effective pain relief during child-birth. Improvements have enhanced the efficacy and safety of epidural analgesia through better drugs, techniques and delivery systems. This review describes the history of epidural labour analgesia and recent improvements in labour epidural analgesia. We discuss the role of the combined spinal epidural technique, low-concentration local anaesthetic-opioid epidural solutions, patient-controlled epidural analgesia, and programmed intermittent or automated mandatory boluses in the maintenance of epidural labour analgesia. We also review the newer interactive techniques for drug delivery, such as computer-integrated patient-controlled epidural analgesia and variable frequency automated mandatory bolus. Finally, we discuss future clinical research developments, including the use of data analytics and long-term outcomes associated with childbirth pain management.

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Labour is one of the most painful experiences a woman will endure in her lifetime [1]; approximately 60% of first-time mothers describe their pain as severe or extremely severe. Physical and psychological factors are known to influence the extent and severity of pain suffering [2]. Severe pain during labour is associated with chronic pain, post-partum depression and psychological vulnerability [3].

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With modern obstetric practice, women now have a choice of pain relief during childbirth. Epidural analgesia is a well-established technique that is commonly regarded as the gold standard in labour analgesia. Blockade of pain transmission through the spinal cord provides effective analgesia, yet it allows mothers to fully participate in the childbirth without being sedated. Epidural analgesia provides excellent pain relief and high maternal satisfaction [4]. In addition, it reduces the risk of maternal oxygen desaturation and increases patient satisfaction compared with other methods of pain relief, including intravenous remifentanyl analgesia [5]. Historically, women were asked to delay the request for labour analgesia for fear that early initiation would prolong labour and increase the risk of caesarean delivery. However, data from randomized controlled trials suggest that the timing of initiation of analgesia does not adversely influence the progress of labour. The parturient's request for analgesia is sufficient indication for epidural analgesia [6]. Interestingly, a recent non-inferiority trial showed that epidural analgesia on request was associated with a lower incidence of operative delivery and fewer side effects than routine administration of epidural analgesia [7].

### **The old**

Neuraxial techniques were introduced for labour analgesia in 1946. Advances in the past half century have led to improved efficacy and safety of neuraxial analgesia and ultimately have improved women's satisfaction with the childbirth experience.

After initiation, epidural analgesia is commonly maintained by the administration of analgesic solutions through the epidural catheter. Historically, this was accomplished by manual and repetitive administration of physician- or nurse-administered epidural boluses. However, this technique is labour-intensive and often leads to inconsistent pain relief. There is also higher risk of local anaesthetic systemic toxicity with bolus compared to a continuous infusion technique [8]. With the development of infusion pumps, the maintenance of labour analgesia by a continuous epidural infusion was made possible. Administration of the solution by an infusion pump reduces the number of clinician interventions required to maintain analgesia. Although more consistent analgesia is ensured with continuous infusion techniques, local anaesthetic consumption is greater with infusion than with bolus-administration techniques; thus, infusion techniques are associated with a higher risk of motor blockade. The maintenance of analgesia with intermittent clinician-administered boluses requires vigilance in monitoring, particularly for the onset of inadequate motor block and breakthrough pain as labour progresses.

### **The new**

#### *Role of combined spinal epidural technique*

The initiation of neuraxial labour analgesia using the combined spinal epidural (CSE) technique has gained popularity in recent years. CSE analgesia was initially introduced to reduce the adverse effects associated with traditional epidural analgesia and to improve maternal mobility. Compared with traditional epidural analgesia, the major advantage of CSE analgesia is the rapid onset of uniform analgesia. CSE analgesia reliably blocks both low thoracic and sacral nerve roots with minimal maternal and umbilical cord blood concentrations of analgesics because of the low doses of local anaesthesia and opioid required to initiate spinal analgesia [9,10]. The CSE 'needle-through-needle' technique may improve the proper placement of a functioning epidural catheter; verification of placement of the spinal needle tip in the subarachnoid space by the return of the cerebrospinal fluid through the needle makes it highly likely that the tip of the epidural needle is correctly sited in the epidural space [10–12]. The dural puncture may also allow subarachnoid transfer of epidurally administered drugs, potentially enhancing the spread of the block and the analgesic quality [13].

Despite the widespread use of this technique, CSE analgesia has not been shown to confer advantages compared with epidural analgesia in terms of obstetric or neonatal outcomes [14]. A recent randomized double-blind trial found no differences between CSE and epidural analgesia in neonatal or obstetric outcomes, including foetal heart abnormalities [15]. Interestingly, in a study using non-invasive cardiac output assessment, high baseline systemic vascular resistance and lack of increase

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