Introduction

In the 1970s, bolus doses of concentrated local anaesthetic solution were commonly given for epidural analgesia in labour. Despite the use of epidural catheters, infusions were not commonly used and many anaesthetists continued to use the bolus technique for initiating and maintaining analgesia (the top-up) during labour – a throw-back to the single-shot injection via an epidural or caudal needle often used in North America in the 1960s. A top-up is administered usually at the patient’s request for additional analgesia. Alternatively, the top-up can be repeated at regular scheduled intervals, irrespective of whether there is a return of patient discomfort.\(^1\) If some discomfort is present at the time of the top-up, satisfactory analgesia occurs within 10–15 minutes\(^2\) but onset time depends on the local anaesthetic being used,\(^3\) its volume,\(^4\) pH\(^5\) and/or the use of analgesic adjuncts such as opioids or \(\alpha_2\)-agonists. Pain may be more difficult to overcome by top-ups as labour progresses.\(^6\)

The continuous infusion technique became popular in the 1980s with the development of small, accurate infusion pumps. I administered one of my first epidural infusions using a technique described by Taylor in the Canadian literature,\(^7\) because at the time there was not a dedicated epidural infusion pump in the labour and delivery suite. Taylor’s modified arterial line flush unit allowed a reproducible constant infusion rate of 6 ml/h and we used 0.25% or 0.375%
bupivacaine. However, shortly, companies such as Abbott, Bard and Baxter were distributing sophisticated but easily-programmed computerised syringe pumps which became universally popular. In the late 1980s, experience was gained in the use of more dilute local anaesthetic solutions and today most units in North America use 0.125% or 0.0625% bupivacaine infusions often mixed with analgesic adjuncts such as fentanyl, sufentanil, epinephrine or clonidine.

By the 1990s a third option for epidural drug delivery had appeared, namely, *patient-controlled epidural analgesia* (PCEA). The advantage of PCEA is to allow the parturient to self-administer, in a timely manner, small increments of local anaesthetic solution. This confers a degree of control to the parturient and hence reduces the anxiety associated with the anticipation of return of pain. It takes both doctor and nurse out of the loop and significantly reduces the analgesic demand-to-delivery time compared with intermittent top-ups.

### Top-ups versus continuous infusion

Some of the first studies to compare these two modes of drug delivery were published in the mid-to-late 1980s. Gaylard et al. described an infusion technique that could be adjusted by midwives and compared it with conventional top-up doses. The authors concluded that the infusion provided comparable analgesia to top-ups but increased bupivacaine dose requirement. Smedsted et al. described the efficacy of a continuous infusion of bupivacaine 0.25% compared with intermittent bolus doses for labour analgesia. The incidence of missed segments, degree of motor block, height of sensory block, satisfaction with pain relief, length of labour and neonatal outcome were similar between groups. The total dose of local anaesthetic was greater in the infusion group, as was the incidence of low forceps delivery. In the same year, Hicks et al. presented the results of a comparison of these two techniques but using a lower concentration of bupivacaine in the infusion group, who received 12–18 ml/h of 0.075% bupivacaine compared with smaller volumes of 0.25% bupivacaine in the top-up group. Despite this disparity the authors found that the infusion produced a higher quality analgesia, although the total dose of bupivacaine given did not differ between groups. A larger study the following year compared the two techniques and concluded that infusions resulted in fewer top-up doses, less hypotension and a decrease in non-reassuring fetal heart rate patterns and in caesarean delivery. During the 1990s Eddleston et al. focused on the maternal and fetal effects associated with the two techniques. Their infusion group received 0.125% bupivacaine and the top-up group 0.25% bupivacaine. The investigators found no differences in the incidence of maternal effects or significant fetal effects.

Today, boluses are frequently used to provide supplemental analgesia to a parturient receiving a continuous epidural infusion or PCEA. Supplemental boluses may be required as labour progresses, especially if there is a degree of dystocia or malrotation of the presenting part. The options for dosing are varied and in my practice include 10–15 ml of the solution being infused, 50–100 μg fentanyl in 5–10 ml preservative-free normal saline, 8–10 ml 0.25% bupivacaine, 8–10 ml 2% chloroprocaine or 10 ml 0.5% lidocaine plus 1:800 000 epinephrine. However, each individual anaesthetist and/or institution will have a different pattern of practice and the decision will be influenced by assessment of the existing sensory level, the presence of missed segments, back pain, rectal pressure or vaginal discomfort.