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EDITORIAL II

Local anaesthetic wound infusion for acute postoperative pain: a viable option?

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Optimizing postoperative analgesia improves clinical outcomes and increases patient satisfaction while uncontrolled postoperative pain can result in significant morbidity and mortality.[1] Neuraxial (especially epidural) analgesia and peripheral nerve block have been shown to provide excellent postoperative analgesia, but may be limited by potentially high failure rates, adverse effects, and procedure-related complications.[2]

Continous infiltration of local anaesthetic (LA) into surgical wounds as an analgesic technique was first descibed just over a decade ago, after the development of multi-holed catheters.[3] Together with the widespread availability of infusion pumps, placement of multi-holed flexible catheters inside or alongside surgical wounds enables continuous, evenly spread infiltration of LA over an indefinite period. Among its advantages are ease of placement with few complications associated with insertion compared with neuraxial and peripheral nerve techniques. It offers the potential to reduce postoperative opioid requirements and their side-effects and increase postoperative patient mobility, with minimal failure.[4]

Continuous LA wound infusion into a surgical wound relieves pain by direct inhibition of noxious afferent generator potentials from peripheral nerve fibres and attenuation of the local inflammatory response to injury.[5] Several methods are available, with standard epidural catheters being used for continuous regional wound LA infusion analgesia to good effect in some studies.[6] Others have used special multichannel soaker catheters from 2.5 to 25 cm in length designed to infuse LA over a wider area. Both types of catheter deliver a similar dose of LA through each perforation and can be used for postoperative analgesia in large incisions.[7] Portable infusion pumps are now readily available, which enhances capability to continue the regional wound infusion on an ambulatory basis.

Interest in this analgesic technique is typified by the trial reported in this issue of the *British Journal of Anaesthesia*.[8] Fifty men undergoing radical prostatectomy were randomized to receive either continuous low thoracic epidural analgesia or patient-controlled LA infusion. Epidural analgesia provided superior analgesia and better maximum pulmonary expiratory pressure values compared with LA infusion analgesia. Despite this, the investigators suggest that LA infusion analgesia may be a viable alternative when epidural analgesia is contraindicated or technically impossible.

Positioning of the LA catheter seems to be paramount in determining the effectiveness of the technique. Catheters placed in the pre-peritoneal space after laparotomy or open prostatectomy reduce postoperative pain, accelerate recovery, and may have some beneficial effects on postoperative pulmonary function,[9 10] while catheter placement superficial to i.m. fascia was largely ineffective.[11 12] This is further supported by a study of open nephrectomy patients which showed optimal analgesia with one of the catheters traversing between abdominal wall muscle layers and the pre-peritoneum.[7] The use of a transversus abdominal plane (TAP) block is growing and it appears that it may augment analgesia after a range of abdominal surgery.[13] While it is currently described as a single-shot block, its ability to produce prolonged postoperative analgesia is limited. No studies, to our knowledge, have compared LA regional wound infusion analgesia and TAP block. This is particularly important in view of the likely emergence of continuous TAP block infusion analgesia for abdominal analgesia which extends beyond the first postoperative day.[14]

Various LA infusion regimens have been evaluated. After colorectal surgery, bupivacaine 0.5% infused at 4 ml h^{-1} for 72 h[15] and at 2 ml h^{-1} for 60 h[15] both produced adequate analgesia. However, a patient-controlled LA infusion of bupivacaine 0.25%, programmed to deliver a maximum of 9 ml in 60 min, was inadequate, probably because of insufficient dosing.[11] While analgesia has been achieved with a lower concentration of LA (ropivacaine 0.2%),[9 10] it appears that in the setting of laparotomy, a relatively high concentration of a long-acting agent (e.g. bupivacaine 0.5% at 4 ml h^{-1}) provides superior analgesia to placebo. The use of intraperitoneal LA, even as a single shot (e.g. 20 ml of bupivacaine

0.5%), reliably reduces pain and opioid requirement after laparoscopic cholecystectomy,[16 17] again compared with placebo. In the setting of post-Caesarean delivery pain, LA regional wound infusion analgesia with levobupivacaine was inferior to systemic analgesia,[18] although when compared with placebo, continous LA regional wound infusion with either ropivacaine 0.2% or bupivacaine 0.25% was associated with lower rescue opioid requirements.[19]

Having confirmed its analgesic efficacy compared with placebo, however, a major test of a new technique is how it compares with established techniques that are considered the 'gold standard' in postoperative analgesia, that is, epidural analgesia and major peripheral plexus blocks. In this context, a study in patients after laparotomy found less pain after intermittant bolus doses of bupivacaine 0.125% (10 ml) given epidurally when compared with 10 ml boluses of bupivacaine 0.25% by a subfascial wound infusion catheter.[20] This is in agreement with the study reported in this issue of the journal which compared continuous epidural and regional wound infusions of LA, rather than bolus doses, which also reported superior analgesia with the epidural technique.[8]

A comparison of LA regional wound infusion techniques with paravertebral analgesia appeared more encouraging. When compared with single-shot paravertebral block, continous wound infiltration with ropivacaine provided comparable analgesia after surgery for modified radical mastectomy.[21] However, these data should be interpreted cautiously as the paravertebral analgesia was limited to a single bolus dose. A continuous paravertebral infusion of equivalent postoperative duration to the LA regional wound infusion would have been a more valid comparison.

There is considerable heterogenity in the design of trials investigating LA infusion analgesia in orthopaedic surgery. Most studies compare LA infusions with placebo and unsurprisingly show a modest analgesic benefit. For analgesia after hip and knee replacement surgery, LA wound infusion catheters placed between muscle fascia and subcutaneously with ropivacaine 0.2% at 5 ml h^{-1} for 55 h showed significant reduction in pain scores at rest and movement.[22]

Cardiothoracic surgery, particularly thoracotomy, results in pain which is among the most severe for patients and most challenging for clinicians to treat effectively. Several studies describe peripleural LA infusion, including extrapleural, intrapleural, interpleural, and intercostal, producing a reduction in pain scores compared with placebo. There is a dearth of evidence comparing an LA wound infusion technique with established peripheral nerve blocks or epidural analgesia.[23] Most studies show an improvement in either pain scores or decreased opioid requirements when compared with placebo; however, interpleural catheters appear to be of little benefit. Taken together, the evidence indicates that in the abscence of an epidural, LA regional wound infusion analgesia offers a viable alternative when coupled with systemic patient-controlled analgesia after thoracic surgery.[24]

Complications associated with continuous regional wound anaesthetic infusions seem rare but could include delayed wound healing or increased incidence of infection and haematomas. Toxic effects of LAs from systemic administration could occur in the event of migration or misplacement of the catheter to a blood vessel. However, these have not been reported. Cost–benefit analysis of LA infusion analgesia has not been undertaken. One study suggested[7] that it decreased hospital stay after open nephrectomy from 3.2 to 2.1 days compared with control patients who received systemic analgesia only, with significant cost reduction. Further studies are required to confirm this finding.

In summary, while LA regional wound infusion analgesia is demonstrably superior to placebo across a range of acute clinical surgical settings, current evidence indicates it remains inferior to gold standard analgesic techniques such as epidural analgesia and major peripheral plexus blocks. This may be acceptable in certain clinical scenarios, for example, where epidural analgesia is contraindicated, technically impossible, or poorly tolerated. Individual risk–benefit assessments should be undertaken for specific patients, weighing whether the limited analgesia available from the LA infusion technique is adequate when balanced against the risks associated with epidural analgesia in a given clinical situation. Further clinical trials are warranted comparing LA regional wound infusion analgesia with epidural analgesia, major plexus blocks, and with continuous infusion TAP blocks, using similar dose and duration regimens, to obtain valid comparative, safety, and cost-efficacy data.

Conflict of interest

D.J.B. is a member of the editorial board of the *BJA*.

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