Catheter-over-needle method reduces risk of perineural catheter dislocation

Editor—We read with great interest the recent study by Marhofer and colleagues[1] which assessed dislocation rates of interscalene and femoral perineural catheters in volunteers. We wish to commend the authors on addressing and reporting a common problem that most anaesthesiologists encounter when placing continuous catheters yet which is largely ignored in the literature. Obviously, there is a significant problem with leakage, as demonstrated by the effort of many clinicians to secure the catheter with glue (e.g. Dermabond),[2 3] catheter tunnelling, or both.[4] Despite this, most articles focus on reporting high rates of success (and use various definitions of 'success')[5] and do not adequately address problems with leakage or dislodgement. We agree completely with the observations made by Marhofer and colleagues and are not surprised at the reported 15% dislocation rate and the positive correlation between time and rate of dislocations.

At our institution, catheter dislocation and leakage at the insertion site are significant concerns when placing catheters using the traditional catheter-through-needle (CTN) method. Such problems led us recently to conduct studies examining the underlying cause of leakage and dislodgement. After careful study of the physical mechanisms behind perineural catheter insertion, we concluded that dislodgement results primarily from the diameter of the catheter (e.g. 20 G) being smaller than that of the needle (e.g. 18 G) used for initial skin puncture (Fig. 1). Thus, the catheter is not held tightly by the skin, leaving space for local anaesthetic to leak upon injection. A simple solution is to borrow from the commonly used i.v. catheter design, in which the catheter is fitted over the needle. In this design, the gauge of the needle (21 G) and catheter (20 G) is reversed relative to the CTN design, such that the puncture hole diameter is smaller than that of the catheter, creating a tight fit in the skin (Fig. 1). Since this time, we have been using a catheter-over-needle (CON) method successfully for more than 1 yr, and we wish to highlight our experience with this method for perineural catheter insertion. We believe that the CON design offers greater stability and less dislocation compared with traditional designs.

To test CON and CTN catheters in a controlled system, we carried out a laboratory study which demonstrated the superiority of the CON method over the CTN method in preventing leakage.[6] After this, our initial proof-of-concept clinical study showed that a second bolus of local anaesthetic through a supraclavicular CON catheter after surgery was effective in prolonging the block.[7] Our success with this method suggested that the perineural catheter was stable and did not migrate from its perineural location. Despite the fact that we did not assign specific movements for the patients to undertake after the catheter was inserted, as Marhofer and colleagues did, the patients' arm and clavicle did move when the patients transferred themselves from the stretcher to the operating table and vice versa and also during skin preparation before surgery.

We also conducted a randomized, controlled study which demonstrated that interscalene CON catheters leaked less frequently compared with CTN catheters.[8] Leakage has been described as a complication of the CTN perineural catheter[9] which may disrupt the adhesives, causing potential dislodgement of the perineural catheter. Although our study was

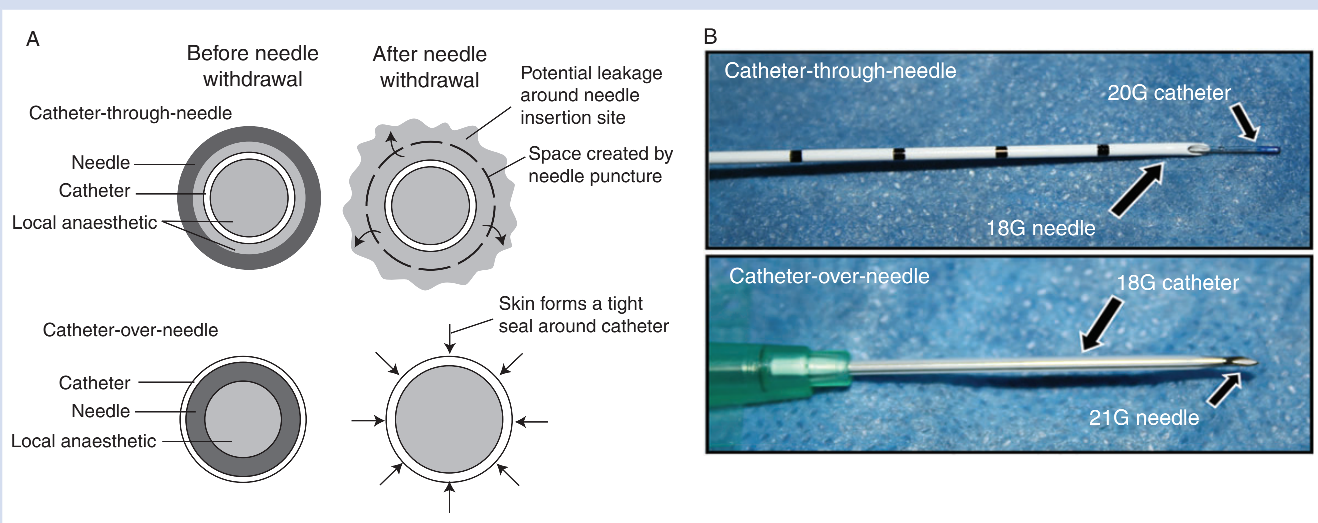

Fig 1 (A) Schematic drawing comparing the catheter-through-needle (top) and catheter-over-needle (bottom) designs for perineural catheter insertion. In the catheter-through-needle design, the diameter of the needle puncture hole is larger than the diameter of the catheter, leaving space for local anaesthetic to leak upon injection. In the catheter-over-needle design, the puncture hole is has a smaller diameter than the catheter, and the catheter is held tightly by the surrounding skin. (B) Photos of the catheter-through-needle (top) and catheter-over-needle (bottom) assemblies showing detail of the needle/catheter tips.

terminated early upon requests from the surgeons due to the potential contamination of the surgical site from leakage of the CTN catheters, we found out that all (4/4) of the CTN catheters leaked while in the patient, whereas none (0/6) of the CON catheters leaked. An additional advantage of the CON design over the CTN design is that local anaesthetic spread can be observed easily since no overfeeding of the catheter beyond the tip of the cannula, as with CTN designs, is involved.

We also wish to share our experience with femoral perineural catheter insertion. Rather than using an out-of-plane approach, we have been using an in-plane approach[10] successfully for almost a decade. The in-plane approach offers several benefits, including increased distance from the fascia iliaca to the catheter tip, which is deep to the femoral nerve at its medial location. This increased distance allows spread of local anaesthetic in proximity to the nerve and improves block efficacy. A second benefit of the in-plane approach is that the trajectory of the 21 G needle is away from the nerve on the lateral aspect, rather than directly onto the nerve. A recent report describes two cases in which an ultrasound-guided femoral CON catheter placed using an in-plane technique was used to successfully manage pain associated with femoral fracture.[11]

In summary, our results using CON catheters for catheterized interscalene, supraclavicular, and femoral nerve blocks demonstrate the CON method's benefits in providing effective analgesia while minimizing risks of dislodgement and leakage at the catheter insertion site.

Declaration of interest

The Pajunk MultiSet 211156-40E is modified and re-designed by B.C.T. B.C.T. also has a patent-licensing agreement with Pajunk.

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Thoracic epidural analgesia, a way forward

Editor—I would like to thank Cook and Columb[1] for the insightful critique of the paper by Leslie and colleagues.[2] I would like to offer a slightly different analysis of the data we have to date on thoracic epidural analgesia.

First, I agree that the MASTERS study remains the most credible paper to date on the use of thoracic epidural analgesia.[3] In this study, the overall mortality rate was higher in the epidural group (although not statistically significant). Had this paper been adequately powered, this affect may have increased and not decreased as most assume it would. In terms of respiratory failure, the MASTERS study suggested 15 patients needed to have epidural management (the number needed to treat, NNT) to prevent one episode of respiratory failure (Pa_{O_2} <8 kPa), provided all the epidurals work well! In the real world, this is likely to be a lot higher.

Secondly, meta-analysis and systemic reviews tend to include thoracic and lumbar epidurals (with variable infusion regimes) and subarachnoid blocks. It is very easy for spinal and lumbar epidurals that have been used predominantly for lower limb surgery to significantly affect overall results. Caution needs to be taken when generalizing these results.

We tend to focus on hypotension as an immediate cause and effect of cardiovascular complications of neuraxial block. The pathogenesis of the majority of myocardial infarcts and strokes is atheromatous plaque rupture and clot formation. The relationship between plaque instability and hypotension is not clear. While hypotension may contribute to poor regional blood flow, it seems unlikely that it initiates the primary event. A degree of hypotension is often aimed for in patients who have had a large myocardial infarct. While it is tempting to find this relationship casual, it is more likely that plaque stability, platelet, and endothelial factors are more important.