Subcutaneous tunnelling of pediatric peripheral nerve block catheters: a novel technique to minimize catheter damage

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To the Editor,

The use of continuous peripheral nerve block (PNB) techniques in pediatric patients is associated with two drawbacks. First, the block catheter is often too close to the surgical site, which is a deterrent to its use. Second, adequate catheter fixation is difficult because children tend to move and sweat more and, when combined with the relatively shallow catheter embedment depth, this can lead to local anesthetic leakage. Moreover, the adhesive tape often cannot adequately fix the catheter to pediatric skin (especially neonatal). Thus, unstable fixation of the catheter leads to unstable analgesia, drug leakage, and the need for frequent changes of the adhesive tape.

At our institution, subcutaneous tunnels are used during continuous erector spinae plane blocks in patients undergoing biliary atresia surgery or right thoracotomy for atrial septal defect, and with continuous femoral and sciatic nerve blocks used for pediatric limb lengthening

procedures. Clinically, we consider that subcutaneous tunnelling is the only way to overcome the above issues. Nevertheless, because of the small size of the equipment used in pediatric patients, it is difficult to perform subcutaneous tunnelling without causing catheter shear or breakage and other needle-related injuries.

Herein, we introduce a simple and safe method of subcutaneous tunnelling for continuous PNB in pediatric patients that involves a “railroading” technique. This tunnelling technique requires a 5- or 8-cm long 19-G pediatric epidural needle with a stainless-steel stylet (Hakko Co. Ltd., Tokyo, Japan), and a long 20-G intravenous (IV) catheter (with the needle removed), the length of which determines the length of the subcutaneous tunnel. We usually use a 51-mm 20-G IV needle (TERUMO, Tokyo, Japan), which allows the creation of a 3–5-cm subcutaneous tunnel.

After completing the PNB using a 19-G 5- or 8-cm long pediatric epidural needle, the block catheter emerges from the skin surface (Figure, panel A). To create the subcutaneous tunnel, the epidural stylet is bent to a 120–150° angle and subcutaneously inserted close to the point of emergence of the block catheter, and parallel to the skin surface, exiting the skin again at a short distance (Figure, panels A and B). The 20-G IV catheter is inserted into the epidural stylet (Figure, panel C), which is then withdrawn along with the IV catheter until it emerges from the first skin insertion site (Figure, panel D). The block catheter is then inserted into the IV catheter, which is withdrawn along with the block catheter (Figure, panel D), which now lies in a subcutaneous tunnel after looping around the skin. Figure E shows the block catheter emerging from the subcutaneous tunnel.

The most important point of our method is that the stainless-steel epidural stylet does not have a sharp edge, so

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Figure Simulation of our subcutaneous needle tunnelling technique for peripheral nerve block (PNB) catheters. (A, B) The bent stylet of an epidural needle is inserted at the initial PNB catheter insertion site and emerges at the desired catheter exit site for the 5–8 cm subcutaneous tunnel. (C) For the catheter, a 20-G intravenous (IV) needle is inserted over the tip of the epidural needle stylet. The IV catheter is then passed through the tunnel, guided by the epidural stylet within it. (D) The PNB catheter is passed into the IV catheter and is pulled out of the tunnel exit site by withdrawing the IV catheter to complete the subcutaneous tunnel (E). Using this technique has the potential to reduce damage to the PNB catheter, as seen on microscopy (F), which can occur when sharper tunnelling needles are used. An eVideo demonstrating the technique is available as electronic supplemental material

does not damage the PNB catheter even if it is inserted into the skin immediately adjacent to the catheter. Additionally, the 20-G IV catheter completely covers the epidural stylet, and emerges from the entrance of the tunnel without causing any PNB catheter damage/shear. Several studies have described subcutaneous tunnelling in epidural anesthesia.^{1,2} Nevertheless, previous tunnelling techniques have involved sharp-edged needles, which could possibly damage the catheter even if they passed adjacent to the catheter. Our ongoing study has found a high chance of microscopic damage (Figure, panel F) to the tunnelled catheters when using sharp-edged needles. Although a recent study showed a new and safe tunnelling technique with an IV needle,³ that technique might cause catheter shear and dilation of the entry hole of the tunnel, which should be avoided in pediatric patients.

In conclusion, our tunnelling technique used for continuous PNB can potentially reduce catheter damage and thus reduce the risk of leakage and/or catheter breakage/retention.

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References

1. Aram L, Krane EJ, Kozloski LJ, Yaster M. Tunneled epidural catheters for prolonged analgesia in pediatric patients. *Anesth Analg* 2001; 92: 1432-8.
2. Tripathi M. Safe practices in epidural catheter tunneling. *J Anaesthesiol Clin Pharmacol* 2012; 28: 138-9.
3. Maguire D, Thorleifson M. Regional anesthesia catheter tunnelling: a simpler approach. *Can J Anesth* 2020; 67: 768-9.

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