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Suture Catheter for Rescue Perineural Catheter Placement When Unable to Position a Conventional Through-the-Needle Catheter: A Case Report

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The main purported benefit of suture-style catheters is the ability to secure the catheter at 2 sites, thereby decreasing the likelihood of catheter dislodgement. An additional benefit is the ability to precisely control the placement of the orifice to infuse local anesthetic. Here we present the case of a patient undergoing open ankle surgery for whom placement of a conventional through-the-needle popliteal sciatic perineural catheter for postoperative analgesia was attempted. Despite multiple attempts, the catheter repeatedly advanced beyond the nerve. Placement of a suture catheter was then attempted, and the catheter was successfully placed on the first attempt. (A&A Practice. XXX;XXX:00–00.)

GLOSSARY

NS = normal saline; **SN** = sciatic nerve

The common delivery system for perineural catheter placement uses catheters that are inserted either through or over a straight hollow-bore needle, and there has been little change in this design in the past several decades.[1,2] In February 2018, the US Food and Drug Administration approved a new delivery system for perineural catheter placement. This system utilizes a catheter attached to the end of a hollow, suture-shaped needle that pulls the catheter through tissue (Figure 1A). The needle is directed under ultrasound guidance through the skin and adjacent to the target nerve then continues to be advanced back out of the body through a second skin penetration site. Fluid—local anesthetic or saline—may be injected through the tip of the needle via a removable adapter to hydrodissect or anesthetize the exit site as the needle penetrates the skin (Figure 1B). The needle is disengaged from the catheter and discarded, while the catheter itself is then secured to the skin surface at both entry and exit points, and local anesthetic is infused via a port in the proximal catheter (Figure 2).[3,4] The main purported benefit of this method is that the catheter is secured in 2 locations (entry and exit) and, therefore, may be less likely to dislodge. An additional benefit of this technique is the ability to precisely position the orifice of the catheter under ultrasound visualization using echogenic markings on the catheter (Figure 3). We present a case in which a traditional through-the-needle catheter could not be placed directly adjacent to the target nerve after 2 attempts and a suture-style catheter was used as a rescue device.

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CONSENT FOR PUBLICATION

The University of California San Diego Institutional Review Board (San Diego, CA) waives review requirements for case reports. The patient signed a consent form permitting use of her relevant medical history, nonidentifying photographs, and sonographic imaging for publication in the form of a case report.

CASE REPORT

A 50-year-old woman presented for open reduction and internal fixation of a left ankle fracture. Preoperative popliteal sciatic continuous nerve block was planned for postoperative analgesia. After positioning the patient prone and applying standard monitors and oxygen by nasal cannula, she was sedated with 2 mg of midazolam and 50 µg of fentanyl. Using a high-frequency linear probe (13–6 MHz, HFL38, Edge-II; SonoSite, Bothell, WA), the sciatic nerve was identified approximately 3 cm proximal to the bifurcation. The area was prepped with chlorhexidine gluconate and draped. A 17-gauge Tuohy needle was advanced toward the nerve with an in-plane, ultrasound-guided technique. Lidocaine 2% with 1:400,000 epinephrine (15 mL) was used to hydrodissect the nerve from surrounding tissue, and a 19-gauge flexible catheter (Arrow, FlexTip Plus; Teleflex, Research Triangle Park, NC) was inserted through the needle, and approximately 3 cm of catheter was threaded past the needle tip under ultrasound guidance before withdrawing the needle. After placement of the catheter and removal of the Tuohy needle, the catheter location was checked by administration of 1-mL normal saline and found to be >2 cm medial to the nerve having advanced its way between the semimembranosus muscle and underlying fascia. The catheter was removed and the 17-gauge Tuohy needle was reinserted and again positioned adjacent to the nerve. A new 19-gauge catheter was advanced under

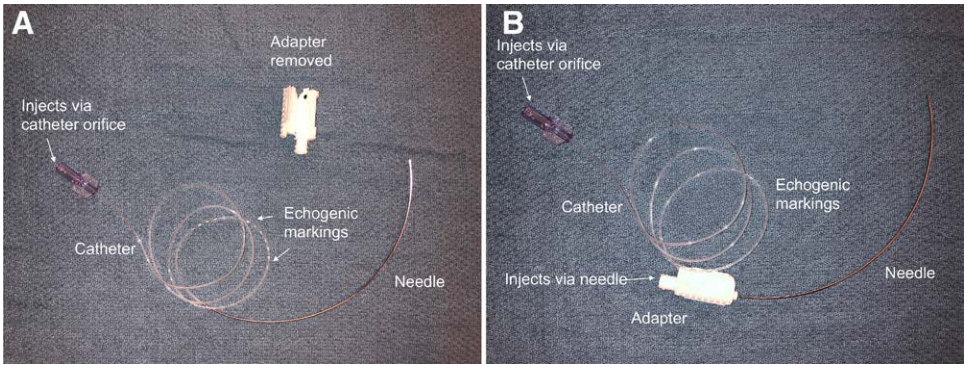

Figure 1. Suture-catheter components. A, Suture catheter with adapter in place, which allows for injection of fluid via the needle tip. B, After removal of the adapter, the catheter can be pulled through tissue and echogenic markings allow for positioning of the catheter orifice adjacent to the target nerve.

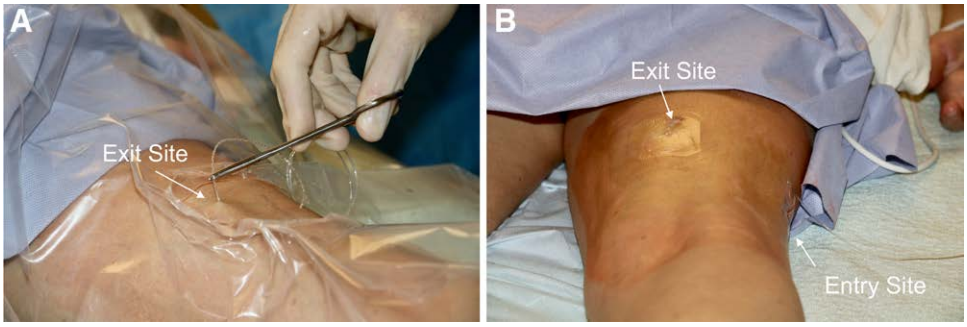

Figure 2. Suture-catheter entry and exit sites. A, The excess catheter at the exit site is trimmed with sterile scissors. B, The catheter is secured with clear, occlusive dressings at both the entry and exit sites.

ultrasound guidance and appeared to be in proper position while advancing. However, when the position was checked after placement, the catheter tip was again found to be approximately 2 cm medial to the nerve.

The decision was then made to place a suture-type catheter, given that this type of catheter allows the operator greater control in positioning the orifice of the catheter compared to conventional through-the-needle catheters. A 19-gauge suture catheter (Certa; Ferrosan Medical Devices, Szczecin, Poland) was inserted through the previously anesthetized skin, passed immediately superficial to the sciatic nerve, and brought through a more medial site on the skin, after anesthetizing this site with 1% lidocaine. The orifice of the catheter was positioned under ultrasound visualization using the echogenic markings on the catheter (Figures 1 and 3). After confirmation that the orifice was adjacent to the nerve by injection of 2-mL normal saline through the catheter and visualizing spread of the fluid around the nerve (Figure 3E, F), the suture needle and excess catheter were trimmed (Figure 2A), and the catheter was secured at both sites—entry and exit—with sterile, occlusive dressings (Figure 2B). A single injection saphenous nerve block was also performed with 0.5% ropivacaine with 1:400,000 epinephrine (15 mL) administered via a 20-gauge Tuohy needle under direct ultrasound visualization. After 30 minutes, sensory block was confirmed in the tibial, superficial peroneal, deep peroneal, sural, and saphenous nerve distributions by loss of temperature discrimination to ice.

The patient underwent an uncomplicated surgery under general anesthesia lasting approximately 2.5 hours. In the recovery unit, she rated her pain as 0/10.

The patient was discharged home with a 3-day ropivacaine 0.2% infusion (6 mL/h with a 4-mL bolus, 30-minute lockout) using a portable infusion pump. The patient was called daily for the duration of her continuous block and reported minimal pain, primarily in a saphenous distribution, that was easily controlled with oral analgesics. On the fourth postoperative day, the patient removed the catheter at home without complication by first removing the proximal occlusive dressing, applying simple traction on the catheter, and then removing the distal occlusive dressing.

DISCUSSION

Perineural catheter design has changed little over the past half century.[1,2] However, a recently approved delivery system for perineural catheter placement, suture catheters,[3,4] may have several benefits over conventional through- or over-the-needle techniques. The main purported benefit of the suture catheter design is the ability to secure the catheter in 2 locations—entry and exit—and, in so doing, theoretically decrease the likelihood of the catheter dislodging. This case demonstrates that a suture catheter technique may be used to place a perineural catheter when conventional through-the-needle technique fails to properly position the tip of the catheter adjacent to the nerve. The reason for this is that, unlike conventional through-the-needle perineural catheters which require the catheter to be advanced in an uncontrolled manner past the tip of the needle, suture-type catheters allow for precise placement of the catheter orifice under ultrasound guidance.

Utilizing a suture catheter is one option for addressing the problem of a catheter advancing too far medial to the sciatic nerve during placement of a continuous popliteal sciatic block. Alternative methods for resolving this issue include the use of multiorifice catheters, decreasing the volume of local anesthetic used to hydrodissect around the nerve before catheter placement, and insertion of the catheter at or distal to the level of the bifurcation while remaining within the paraneural sheath.[5] However, none of these methods allow as precise placement of the infusing orifice

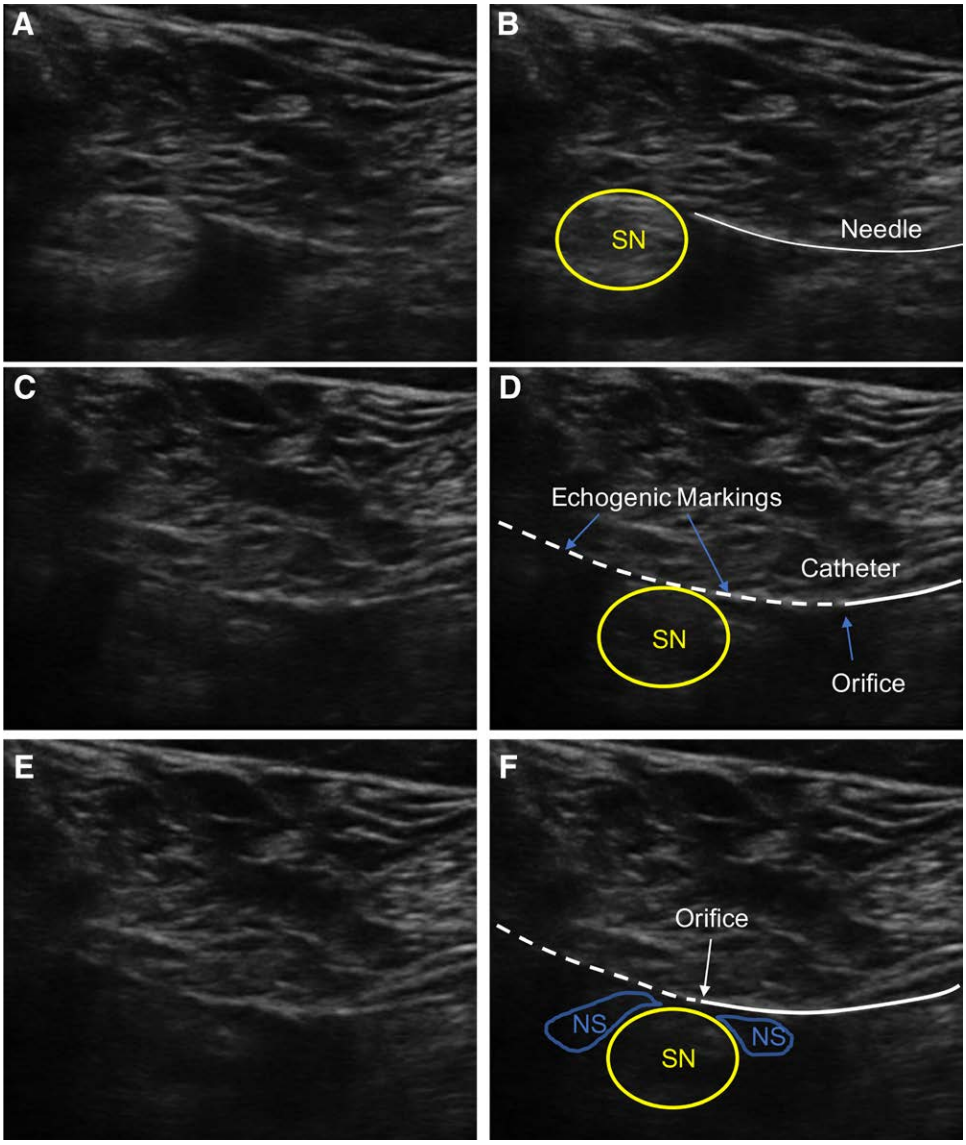

Figure 3. Ultrasound guided placement of a suture-catheter. A, The suture needle is advanced toward the SN. B, The needle and SN are labeled. C, The echogenic markings on the catheter are used to position the orifice adjacent to the nerve. The orifice is located where the echogenic markings terminate. D, The echogenic markings, catheter, orifice, and SN are labeled. E, Correct positioning of the orifice directly adjacent to the SN is confirmed by injection of NS through the catheter and visualization of spread around the nerve. F, The orifice, SN, and NS are labeled. NS indicates normal saline; SN, sciatic nerve.

onto the nerve as when compared to a suture catheter. Additionally, both the use of skin adhesives and tunneling of perineural catheters have been advocated to prevent dislodgement.[6–8] However, both of these options have the same disadvantage that the orifice of the catheter is free to move within the patient, behind a highly mobile joint. In contrast, suture catheters are fixed at 2 locations, theoretically decreasing the likelihood of dislodgement.

To date, there have been no randomized, controlled comparisons between suture catheters and conventional perineural catheters to assess the relative risks and benefits of each technique. While the suture catheter design offers the benefits of increased control when positioning the catheter orifice, 2 points of catheter fixation, and ability to reposition the catheter after placement by pulling on either end of the catheter, there are potential disadvantages. Suture catheters require the skin to be punctured in 2 locations, and, although the risk of infection with continuous peripheral nerve blocks is extremely low,[9] this additional skin puncture may increase the infection risk. Prospective, randomized, and controlled trials will be required to further evaluate the risks and benefits of suture catheters and conventional perineural catheters for continuous peripheral nerve blocks. ■

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