

Low-cost pain infusion catheter for the control of postoperative pain in ambulatory foot surgery

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Abstract

The authors report the use of a low-cost method of providing prolonged patient controlled anesthesia at the surgical site following elective forefoot surgery performed in ambulatory surgical settings. In this series of 54 patients there were no postoperative complications and 95.92% of patients believed the device helped to control their post-operative pain.

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1. Introduction

When considering elective foot surgery, postoperative pain has been cited as one of the primary concerns expressed by patients [1]. An obvious goal of patient care in the perioperative period is to adequately control pain. It has been noted that patient perception of control and participation in the pain reduction process may positively affect patient satisfaction post-operatively [2].

Continuous peripheral nerve blocks have been utilized by a variety of surgical specialties to decrease postoperative pain. Clinical trials have shown these to be effective in both reducing the amount of pain experienced and in decreasing the oral and intravenous use of narcotics following cardiac [3,4], obstetric [5], plastic [6,7], maxillofacial [7], and orthopedic surgical procedures [7,8]. Similar successes following lower extremity surgery have been reported in the form of continuous sciatic and popliteal blocks [9–13]. Additionally, disposable pain pumps have been successfully utilized for more distal nerve blockade following foot surgery [14].

Although a variety of pain pumps are commercially produced, in some ambulatory settings these pain pumps may not

be available or may prove cost-prohibitive to the patient [15]. The authors report the use of a low-cost method of providing prolonged anesthesia at the surgical site following elective forefoot surgery.

2. Technique

The device consists of a multi-hole, thin (20-gauge) epidural catheter, 3 cm³ needleless syringes, and 0.5% bupivacaine without epinephrine. At the time of surgery, the catheter is placed in the subcutaneous layer of the surgical wound following closure of the deep fascia (Fig. 1). The catheter exits the skin proximally through a separate puncture site and is secured in place with mastisol and steri-strips (Fig. 2). The remainder of the surgical closure is performed and the dressing applied. The dressing incorporates the catheter into the bandages with only the last 2–4 cm visible as it exits the dressing proximally. This allows the patient to connect a sterile syringe to the catheter and self-administer local anesthetic directly blocking any post-operative pain (Fig. 3).

Patient education is undertaken explaining use of the pain infusion catheter. Patients are directed to administer one 3 cm³ syringe at the first indication of pain in the operative site. Patients are also directed to observe for adverse effects

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Fig. 1. Placement of the catheter in the subcutaneous layer at the surgical site.



Fig. 2. The catheter exiting the skin proximally and secured with steri-strips.

such as numbness of the tongue or tinnitus. The telephone number of the surgeon is included on the instruction sheet so that any questions or concerns can be promptly answered in such events. The patient is discharged with alcohol wipes and eight 3 cm³ needleless syringes filled with 0.5% bupivi-



Fig. 3. The syringe attached to the catheter to self-administer local anesthetic.

caine without epinephrine and is given a written copy of the following directions:

Contents of pain kit:

- alcohol wipes;
- eight 3 cm³ needleless syringes with 0.5% bupivacaine.

Frequency of administration:

- One 3 cm³ syringe of 0.5% bupivacaine may be administered no more than every 4 h.

Instructions for step-wise administration of local anesthetic:

- *Step 1:* Clean the end of the catheter with an alcohol wipe.
- *Step 2:* Remove cap from tip of syringe. Do not touch the uncovered end of the syringe; it is sterile.
- *Step 3:* Connect the syringe to the catheter by simply pressing the two together and turning the syringe in a clockwise direction.
- *Step 4:* Apply pressure to the plunger of the syringe slowly infiltrating the skin with local anesthetic over a 1–2 min period.

Removal of catheter:

The catheter must be removed by the end of the third day. This is accomplished by simply pulling the catheter from the bandages. The catheter is secured by a small piece of adhesive tape to the skin under the bandage so removal may require a small tug to free the catheter.

3. Discussion

At the authors' institution the total cost of the apparatus is approximately \$15. The senior author (JBD) has utilized this pain infusion catheter for the control of post-operative pain following surgical correction of hallux abductovalgus in 54 cases. To date there have been no cases of postoperative infection or wound dehiscence.

An attempt was made to contact all 54 patients by telephone. Forty-nine patients were interviewed, one had died of causes unrelated to the surgery, and four were lost to follow-up. Forty-seven patients (95.92%) stated that they believed the device helped to control their post-operative pain and would use the pain infusion catheter again if faced with elective outpatient forefoot surgery.

One patient (2.04%) stated she would not use the pain infusion catheter again, expressing an overall dissatisfaction with the surgical outcome. Another patient (2.04%) did not feel the pain pump was necessary citing very limited post-surgical pain. All 49 patients (100%) stated they experienced no pain or difficulty in removing the catheter from the surgical site.

This method of delivering patient-controlled repeated bolus local anesthesia offers several advantages over other methods. First, the patient is afforded the perception of control and participation in the pain reduction process that has been shown to enhance post-operative patient satisfaction [2]. Secondly, commercially available elastomeric, spring loaded and electronic infusers have been shown to have substantial vari-

ations in rate and duration of infusion related to ambient temperature and power source [16]. One might speculate that these variations in administration might lead to over-infiltration of the subcutaneous tissue with subsequent wound dehiscence. Because the present method involves only small sequential infusions, there is little risk of over infiltration. Additionally, the prolonged presence of local anesthetics has a reported antimicrobial benefit [17–19]. Lastly, the device as presented can be assembled from materials readily available at most hospitals and surgery centers at a very low cost to the patient.

4. Conclusion

The pain infusion catheter as described is a low-cost adjunct to controlling postoperative pain in patients undergoing elective forefoot surgery. Additional prospective clinical validation is needed to compare this and other methods of infusion for peripheral anesthesia following elective outpatient forefoot surgery.

Conflict of interest

The authors have no financial interest in the products mentioned in this article.

References

- [1] Bellacosa RA, Pollak RA. Patient expectations of elective foot surgery. *J Foot Ankle Surg* 1993;32:580–3.
- [2] Perry F, Parker RK, White PF, Clifford PA. Role of psychological factors in postoperative pain control and recovery with patient-controlled analgesia. *Clin J Pain* 1994;10:57–63.
- [3] Dowling R, Thielmeier K, Ghaly A, Barber D, Boice T, Dine A. Improved pain control after cardiac surgery: results of a randomized, double-blind, clinical trial. *J Thorac Cardiovasc Surg* 2003;126:1271–8.
- [4] White PF, Rawal S, Latham P, Markowitz S, Issioui T, Chi L, et al. Use of a continuous local anesthetic infusion for pain management after median sternotomy. *Anesthesiology* 2003;99:918–23.
- [5] Givens VA, Lipscomb GH, Meyer NL. A randomized trial of postoperative wound irrigation with local anesthetic for pain after cesarean delivery. *Am J Obstet Gynecol* 2002;186:1188–91.
- [6] Baroody M, Tameo Michael N, Dabb RW. Efficacy of the pain pump catheter in immediate autologous breast reconstruction. *Plast Reconstr Surg* 2004;114:895–8.
- [7] Rawal N, Axelsson K, Hylander J, Allvin R, Amilon A, Lidegran G, et al. Postoperative patient-controlled local anesthetic administration at home. *Anesth Analg* 1998;86:86–9.
- [8] Ilfeld BM, Morey TE, Enneking FK. Continuous infraclavicular brachial plexus block for postoperative pain control at home: a randomized, double-blinded, placebo-controlled study. *Anesthesiology* 2002;96:1297–304.
- [9] Zaric D, Boysen K, Christiansen J, Haastrup U, Kofoed H, Rawal N. Continuous popliteal sciatic nerve block for outpatient foot surgery—a randomized, controlled trial. *Acta Anaesthesiol Scand* 2004;48:337–41.
- [10] White PF, Issioui T, Skrivaneck GD, Early JS, Wakefield C. The use of a continuous popliteal sciatic nerve block after surgery involving the foot and ankle: does it improve the quality of recovery? *Anesth Analg* 2003;97:1303–9.
- [11] Chelly JE, Greger J, Casati A, Al-Samsam T, McGarvey W, Clanton T. Continuous lateral sciatic blocks for acute postoperative pain management after major ankle and foot surgery. *Foot Ankle Int* 2002;23:749–52.
- [12] Morris GF, Lang SA. Continuous parasacral sciatic nerve block: two case reports. *Reg Anesth* 1997;22:469–72.
- [13] Singelyn FJ, Aye F, Gouverneur JM. Continuous popliteal sciatic nerve block: an original technique to provide postoperative analgesia after foot surgery. *Anesth Analg* 1997;84:383–6.
- [14] Barca F, Bertellini E, Siniscalchi A. Forefoot postoperative continuous pain control by nonelectronic device. *J Foot Ankle Surg* 1995;34:42–5.
- [15] Jacox A, Carr DB, Mahrenholz DM, Ferrell BM. Cost considerations in patient-controlled analgesia. *Pharmacoeconomics* 1997;12:109–20.
- [16] Ilfeld BM, Morey TE, Enneking FK. The delivery rate accuracy of portable infusion pumps used for continuous regional analgesia. *Anesth Analg* 2002;95:1331–6.
- [17] Stratford AF, Zoutman DE, Davidson JS. Effect of lidocaine and epinephrine on *Staphylococcus aureus* in a guinea pig model of surgical wound infection. *Plast Reconstr Surg* 2002;110:1275–9.
- [18] Parr AM, Zoutman DE, Davidson JS. Antimicrobial activity of lidocaine against bacteria associated with nosocomial wound infection. *Ann Plast Surg* 1999;43:239–45.
- [19] Sakuragi T, Ishino H, Dan K. Bactericidal activity of clinically used local anesthetics on *Staphylococcus aureus*. *Reg Anesth* 1996;21:239–42.