Multiple simultaneous perineural infusions for postoperative analgesia in adolescents in an outpatient setting

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We report a case series of five adolescents who were managed with dual simultaneous perineural infusions after orthopaedic surgery on an outpatient basis. Adolescents undergoing orthopaedic procedures involving more than one extremity or nerve distribution can be managed after operation with multiple catheters. Use of low concentrations of local anaesthetic infusions along with good patient and family education and close follow-up by a dedicated paediatric pain management team can make this feasible in an outpatient setting.

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Acute pain management using continuous peripheral nerve blockade (CPNB) after orthopaedic procedures in children has been reported,1–3 including a case report describing the use of dual catheters in an inpatient setting.4 Ambulatory CPNB after paediatric orthopaedic surgery2 and for management of complex regional pain syndrome in children has also been described.5 However, there are no reports of outpatient CPNB using multiple simultaneous catheters in children. We describe a case series of five adolescents who were discharged home with dual CPNB catheters.

Case reports

Case 1

A 13-yr-old girl who underwent bilateral knee arthroscopy and chondroplasty had bilateral femoral nerve catheters placed under general anaesthesia (GA) for postoperative analgesia. Non-stimulating catheters were placed after boluses of 30 ml each of bupivacaine 0.125% was administered through the needles on each side. No opioids were administered intraoperatively. After operation, bupivacaine 0.125% at 6 ml h⁻¹ was infused in each catheter through separate infusion devices (Elastomeric ON-Q® pump, I-Flow Corporation, VQ OrthoCare, Irvine, CA, USA). The patient received 3 mg of morphine in the post-anaesthesia care unit (PACU).

The patient was discharged home with bilateral femoral nerve catheters on postoperative day (POD) 1. During her 23 h hospital stay, the patient received a total of 20 mg (four times 5 mg) of oxycodone for pain scores >3 on the numeric verbal scale. The patient and her parents received verbal and written education before discharge home about the continuous infusion device system, techniques to remove the catheter, recognition of potential complications that included local infection, signs, and symptoms of local anaesthetic toxicity, and catheter dislodgement. The patient and parents were cautioned to avoid weight bearing on weak extremities and to protect insensate areas from physical injury. Instructions included clamping the catheter in case of clinical signs of local anaesthetic toxicity or excessive leakage. The parents were asked to abandon difficult attempts at catheter removal and call the pain service. They were also given emergency contact information for the pain service and encouraged to call with any questions. A home nurse visited the patient on POD 2 and POD 3 to check the catheter site. The patient used oxycodone 5 mg on a PRN basis at home and reported no nausea or vomiting. Both catheters were removed uneventfully by a parent on POD 3.

Case 2

A 13-yr-old boy who underwent bilateral knee arthroscopy and drilling had bilateral femoral nerve catheters placed
under GA for postoperative analgesia. Non-stimulating catheters were placed after boluses of 30 ml each of bupivacaine 0.125% was administered through the needles on each side. An infusion of bupivacaine 0.125% at 6 ml h\(^{-1}\) for each catheter was started in the PACU. The patient was discharged home with bilateral femoral nerve catheters on POD 1. The discharge instructions were similar to case 1 and a home nurse visit was arranged on POD 2. The patient did not require opioids perioperatively. Both catheters were removed uneventfully by a parent on POD 2; 48 h after the infusions were started.

**Case 3**

A 14-yr-old boy who underwent bilateral knee arthroscopy and drilling had bilateral femoral nerve catheters placed under GA for postoperative analgesia. Stimulating catheters were used in this patient and 30 ml each of 0.125% bupivacaine was injected through both catheters. An infusion of bupivacaine 0.125% at 6 ml h\(^{-1}\) was started in each catheter after operation. The patient was discharged home on POD 1. The discharge instructions were similar to case 1 and a home nurse visit was arranged on POD 2. The patient did not require any opioids perioperatively. Both catheters were removed uneventfully by a parent on POD 2; 48 h after the infusions were started.

**Case 4**

A 12-yr-old girl underwent right tibial and fibular ostotomies, placement of malleolar screw, anterior and lateral compartment fasciotomy with placement of an external fixator. She had right femoral and right sciatic perineural catheters placed under GA. Stimulating catheters were used and after placement, 40 ml of bupivacaine 0.125% was injected through the femoral catheter and 20 ml of ropivacaine 0.1% was injected through the sciatic catheter. After operation bupivacaine 0.125% at 8 ml h\(^{-1}\) was infused via the femoral catheter and ropivacaine 0.1% at 8 ml h\(^{-1}\) was infused via the sciatic catheter. Ropivacaine was preferred to bupivacaine for the sciatic block, to minimize the risk of motor blockade. However, the patient developed a motor block on POD 1 in the sciatic nerve distribution, which resolved after the infusion rate was decreased to 4 ml h\(^{-1}\). The patient was discharged home on POD 2, with both perineural catheters in place. The discharge instructions were similar to case 1 and a home nurse visit was arranged on POD 3 and POD 4. The patient did not require any opioids perioperatively. Both catheters were removed uneventfully by a parent on POD 4, 92 h after the infusions were started.

**Case 5**

A 17-yr-old male underwent resection of a proximal left tibial chondromyxoid fibroma with reconstruction using a gastrocnemius flap. He had femoral and sciatic perineural catheters placed under GA. Stimulating catheters were used and after placement, 30 ml of bupivacaine 0.125% was injected through the femoral catheter and 20 ml of bupivacaine 0.125% was injected through the sciatic catheter. No intraoperative opioids were needed. Ropivacaine 0.15% at 8 ml h\(^{-1}\) and bupivacaine 0.125% at 8 ml h\(^{-1}\) were infused via the femoral and sciatic catheters, respectively. The patient received a single dose of morphine (3 mg) on POD 1 for pain at the sciatic catheter insertion site. The infusion rate on the sciatic catheter was changed to ropivacaine 0.1% at 6 ml h\(^{-1}\) on POD 2 as the patient had a partial motor blockade in the distribution of the common peroneal division of the sciatic nerve. The patient was discharged home on POD 2 with both perineural catheters in place. A home nurse visit was arranged on POD 3 and POD 4. Both catheters were removed uneventfully by a parent on POD 4, 90 h after the infusions were started.

**Discussion**

To our knowledge, this is the first report describing the use of dual CPNB in adolescents in an outpatient setting. Use of CPNB facilitated early discharge of these patients from the hospital and also resulted in decreased opioid usage and the related side-effects. These reports demonstrate the feasibility of providing postoperative analgesia in adolescents with dual simultaneous perineural infusions in an outpatient setting.

The first three patients were ready for discharge the same day of surgery but were admitted as short-stay and discharged on POD 1 as per the surgeon's preference. A review of the postoperative course of patients who underwent identical procedures in the past has shown that the pain reported by children is significantly higher when they undergo bilateral procedures. Our observations showed that nerve block provides good analgesia for such procedures. However, a single injection nerve block is often insufficient in terms of duration of analgesia; hence continuous nerve block is required for a smooth postoperative course.

In the past, procedures similar to those performed in the fourth and fifth patients resulted in 4–5 days of hospitalization because of the need for i.v. opioids to achieve adequate analgesia. The use of CPNB enabled early discharge and the opioid sparing effects most likely contributed to the absence of any reported nausea or vomiting in these patients.

The safety and feasibility of outpatient CPNB is well documented in adults and with adequate follow-up, very few interventions are required.\(^7\) The major concern during multiple infusions of local anaesthetics is local anaesthetic toxicity. Several authors have shown that by keeping the bupivacaine infusion below 0.375 mg kg\(^{-1}\) h\(^{-1}\), plasma bupivacaine concentrations can be kept at a safe level even at 48 h.\(^8\)–\(^10\) In our first three cases, the cumulative bupivacaine infusion ranged from 0.23 to 0.32 mg kg\(^{-1}\) h\(^{-1}\) and in case 4, the bupivacaine was administered at 0.12 mg kg\(^{-1}\) h\(^{-1}\).
and the ropivacaine at 0.05–0.1 mg kg$^{-1}$ h$^{-1}$ all of which are well below the recommended upper limit.$^{10}$ No data on plasma level of bupivacaine and ropivacaine after continuous infusion at different peripheral nerve sites are available. However, considering the greater margin of safety provided by ropivacaine$^{11}$ and levobupivacaine$^{12}$ compared with bupivacaine, it may be advisable to avoid bupivacaine in these settings.

We routinely use dilute concentration of local anaesthetics to prevent motor blockade and facilitate identification of symptoms typical of compartment syndrome. This may explain the occasional need for oral opioids by these patients. Also, before embarking on peripheral nerve blockade in patients undergoing procedures with a higher risk of compartment syndrome, one must discuss the plan with the surgeon as some of them do not prefer peripheral nerve blockade in these types of cases.

In conclusion, it is possible to provide effective postoperative analgesia for adolescents in an outpatient setting using dual continuous CPNB by a dedicated regional anaesthesia service involved in the postoperative care of these patients. Emphasis must also be placed on appropriate patient and parent education. We recommend using dilute concentrations of local anaesthetics which can provide a balance between adequate sensory block and prevention of local anaesthetic side-effects.

References

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