CONTINUOUS INFRACLAVICULAR BLOCK FOR FOREARM AMPUTATION AFTER BEING BITTEN BY A SALTWATER CROCODILE (CROCODYLUS POROSUS): A CASE REPORT

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Two important issues after a complete right forearm amputation are replantation and ongoing pain management. There are no reports of successful forearm replantation as a consequence of a crocodile bite. Here, we discuss our pain management in a case of complete forearm amputation after a bite from a saltwater crocodile (Crocodylus porosus), which necessitated six further operations to achieve successful replantation. Continuous infraclavicular brachial plexus block was effective for acute pain control in this case. We strongly recommend performing the block with an indwelling catheter under ultrasound guidance for higher accuracy and safety.

Key Words: continuous peripheral nerve block, forearm amputation, ultrasound (Kaohsiung J Med Sci 2009;25:455–9)

Upper extremity amputation caused by an animal bite with subsequent successful replantation is rarely reported. Postoperative care should include analgesia, infection control and rehabilitation. Continuous peripheral nerve block (CPNB) has been reported to provide sufficient intraoperative anesthesia and postoperative analgesia [1]. The application of ultrasound-guided peripheral nerve block has advantages in terms of real-time anatomic evaluation, visual guidance of the block needle, and distribution of local anesthetics [1–4].

We present a 38-year-old veterinarian who suffered from right forearm amputation because of a saltwater crocodile (Crocodylus porosus) bite. The traditional landmark-based and nerve stimulator techniques were risky, with limited applicability to this amputee after replantation. In this case report, we highlight the feasibility of ultrasound-guided continuous infraclavicular brachial plexus block to manage severe postoperative pain after a crocodile bite.

CASE PRESENTATION

A 38-year-old male suffered from right (beneath) elbow amputation as a result of a crocodile bite. When the amputated limb was sent to our hospital 2 hours after the accident, he received emergency replantation surgery. After successful replantation, the patient was sent to the intensive care unit for further care.

Because severe acute pain developed after the emergency replantation, we first used intravenous patient-controlled analgesia (IVPCA) morphine for major pain management. However, the complex nature of the animal-bite wound rendered morphine-based
IVPCA less effective than expected. The visual analog scale (VAS) score at rest was 5–6 points, and the VAS score on motion was 8–9 points.

Four days after the first operation, the infection and postoperative complications were well-controlled and the patient underwent another operation for flap reconstruction. High-frequency ultrasound imaging was performed using a Titan unit (Sonosite, Bothell, WA, USA) using a 7-cm wide 5–10-MHz digital linear transducer. We applied ultrasound-guided infraclavicular brachial plexus block with single dose of 0.25% bupivacaine (15 mL), and subsequently 1% lidocaine (15 mL) daily in combination with IVPCA morphine as adjuvant pain control. Daily morphine consumption decreased from 33.3±8.1 mg to 19.5±9.9 mg. The VAS score on motion and at rest decreased to 5–6 points and 3–4 points, respectively.

Because of the likelihood of multiple operations and the adverse effects of opioids, we tried continuous peripheral nerve block for primary pain management on day 8. An ultrasound-guided infraclavicular brachial plexus block was performed with 0.5% bupivacaine (10 mL) and 2% lidocaine (10 mL) (Figure). We then used ultrasound imaging to guide the insertion of an 18-gauge epidural catheter (Portex Ltd., Hythe, UK). The IVPCA morphine was tapered and the primary pain control regimen was switched to continuous infracavicular brachial plexus block with continuous application of 0.25% bupivacaine (6 mg/hour) and 1% lidocaine (25 mg/hour). The daily morphine consumption decreased to 13.3±1.5 mg and the VAS score at rest decreased to <3 points. His acute severe pain was progressively relieved, and predominantly oral analgesics could provide good pain control for the patient while in the ordinary ward.

The time-course of postoperative analgesia is summarized in Table 1. Table 2 summarizes the morphine consumption and pain intensity.

**DISCUSSION**

This case shows the utility of CPNB in pain management of a complex animal bite wound in which the pain cannot be alleviated by morphine-based IVPCA alone.

**Table 1. Time course of postoperative pain management**

<table>
<thead>
<tr>
<th>Stage 1 (days 1–3)</th>
<th>Stage 2 (days 4–7)</th>
<th>Stage 3 (days 8–10)</th>
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<tbody>
<tr>
<td>IVPCA</td>
<td>IVPCA + single-injection infraclavicular block</td>
<td>Continuous infraclavicular block/taper IVPCA</td>
</tr>
<tr>
<td>Morphine concentration:</td>
<td>0.25% bupivacaine 15 mL + 1% lidocaine 15 mL daily</td>
<td>0.25% bupivacaine 6 mg/hr + 1% lidocaine 25 mg/hr</td>
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<tr>
<td>Loading dose: 4 mg</td>
<td>Debridement (day 4)</td>
<td>Venous graft + thrombectomy (day 8)</td>
</tr>
<tr>
<td>Delivery rate: 0.4 mg/hr</td>
<td>Free flap (day 6)</td>
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<tr>
<td>Bolus dose: 0.9 mg/time</td>
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<tr>
<td>Locking time: 6 min</td>
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<td>Replantation (day 1)</td>
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<tr>
<td>Free flap (day 6)</td>
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</table>

IVPCA = intravenous patient-controlled analgesia.
Because the risky (blind) landmark-based method and traditional nerve stimulator were of limited applicability in this unique case, we also demonstrate the value of ultrasound in performing CPNB.

Because of limited experience in postoperative pain management for limb replantation, we first conservatively tried intravenous morphine via PCA to provide postoperative analgesia. However, the analgesic effect was not satisfactory even when we increased the dose. Because of the complexity of the wound and the possibility of limb amputation, we considered approaches used to manage phantom limb pain [5] and combat casualty [1,6] and tried regional nerve block for pain management because of its good analgesic effect and prophylaxis of phantom limb pain. Potential needle injury to the artery during blind insertion, and the possibility of nerve injury due to needle insertion or drug injection are complications associated with the infraclavicular block, which may lead to failure of replantation surgery [7]. Therefore, we used ultrasound to reduce the complication rate only because nerve stimulation might not be suitable for a replanted and wrapped limb.

Selecting the most suitable access route to the brachial plexus was an important consideration for implanting the CPNB indwelling catheter in this case. Interscalene, supraclavicular, infraclavicular and axillary brachial plexus blocks can provide sufficient analgesia to cover the forearm region [8]. The axillary approach provides an effective block distal to the elbow, but it was impossible for the patient to raise his arm for this technique. The supraclavicular approach provides an effective block for the entire upper extremity, but it is difficult to place the CPNB catheter in the supraclavicular fossa. The interscalene approach provides an effective block for the shoulder and upper arm, but both ulnar sparing and catheter displacement due to neck motion were thought to be a problem in this case. Classic and coracoid infraclavicular blocks offer easy access and effective blocking for the upper extremity below the mid-humerus. In comparison with the coracoid approach, the classic approach was reported to have faster onset of blocking and the three cords of the brachial plexus are grouped close together, superior to the axillary artery in this region [9]. Moreover, the classic infraclavicular approach provides more space for catheterization than the coracoid approach. Therefore, we placed the CPNB catheter via the classic infraclavicular approach.

Despite the initial success of the single injection infraclavicular nerve block, our limited experience in implanting CPNB indwelling catheters and concern of the possibility of nidus infection interfering with the replanted limb made us hesitant to perform CPNB. However, the good analgesic effect of the single brachial plexus block encouraged us to perform CPNB.

Ultrasound-guided nerve block offers many advantages. Direct visualization of the anatomy and path of the catheter can reduce the risks of vascular puncture and nerve damage [7], which are undesirable for a replanted limb. Real-time anatomical evaluation and guidance of needle insertion improve sensory and motor blocks and reduce complications associated with nerve blocks [10,11]. Furthermore, confirmation of catheter tip placement and drug distribution under real-time imaging may reduce drug consumption and decrease the risk of local anesthetic toxicity [12]. Advantages for the patient include minimal insertion, instead of multiple punctures, which can minimize discomfort and increase the patient’s acceptance of the procedure. For the block practitioner, ultrasound-guided nerve block provides a more reliable guide and increases the success rate.

In replantation surgery, the sympatholytic effects of CPNB improve the perfusion of the reattached limb, reduce perioperative blood loss, and support frequent returns to the operating room and postoperative rehabilitation. In terms of postoperative pain control, site-specific analgesia can reduce the dosage of narcotics [13], hence reducing side effects, and provide superior postoperative analgesia. Furthermore, this technique may reduce phantom pain if the replantation surgery is unsuccessful [5].

In conclusion, continuous infraclavicular brachial plexus block is a potentially effective treatment modality for acute pain control for forearm amputation. We strongly recommend performing the block by implanting the indwelling catheter under ultrasound guidance for greater accuracy and safety.

### Table 2. Results of pain management

<table>
<thead>
<tr>
<th></th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily morphine</td>
<td>33.3 ± 8.1</td>
<td>19.5 ± 9.9</td>
<td>13.5 ± 1.5</td>
</tr>
<tr>
<td>consumption (mg)</td>
<td></td>
<td></td>
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<tr>
<td>VAS score at rest</td>
<td>6.67 ± 1.53</td>
<td>3.75 ± 0.96</td>
<td>3 ± 1</td>
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</table>

VAS = visual analog scale.
REFERENCES

鰻魚咬傷致前臂截肢後以連續鎖骨下神經叢
阻斷術止痛之經驗—個案報告

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在前臂完全截肢後的兩大重要課題是重建及後續的疼痛處理。經過文獻搜尋後我們發現未曾有在鰻魚咬傷截肢之後成功重建的案例，在此我們報告一個被鰻魚咬傷後完全截肢患者的疼痛處理，在經歷六次的手術最後得以重建成功。連續鎖骨下臂神經叢阻斷術在這個案例上達到了有效的急性疼痛控制。為了準確性及安全我們建議在超音波引導下進行導管的置放來達到神經阻斷的目的。

關鍵詞：連續性周邊神經阻斷術，前臂截肢，超音波
(高雄醫誌 2009;25:455–9)