Case Report

Functional improvement after physiotherapy with a continuous infusion of local anaesthetics in patients with complex regional pain syndrome

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Three patients were referred to our pain clinic with evidence of complex regional pain syndrome in their extremities. Two presented at the atrophic stage with joint contractures. Multiple analgesics had been prescribed without long-lasting relief. Physiotherapy was required to improve physical activity but was severely limited by pain. We instituted local anaesthetic infusion with the possibility of self-supplementation to facilitate physiotherapy; two via brachial plexus catheters for hand pain and one via epidural catheter for knee pain. Although their resultant pain scores were variable after cessation of local anaesthetic infusion, all the affected joints exhibited marked improvement in range of movement. We propose that this technique is a useful option for patients in all stages of complex regional pain syndrome where the emphasis is now directed toward functional improvement.

Accepted for publication 18 June 2002

Key words: chronic pain; complex regional pain syndrome; infusion; local anesthesia; physiotherapy; reflex sympathetic dystrophy; ropivacaïne.


The diagnostic criteria and treatment options for patients with chronic regional pain syndrome (CRPS), formerly called reflex sympathetic dystrophy, have created much controversy recently (1). Nevertheless, once patients have reached the chronic stage of the disease, treatment often becomes difficult. Many patients will have been seen by a number of medical specialists before being referred to a pain clinic and will have been treated with various analgesics (2). In our multidisciplinary pain clinic, we aim to divert our patients' attention to functional improvement rather than concentrating solely on complete pain relief. Physiotherapists and occupational therapists play a very important role in such treatment. However, their success depends on patients' co-operation and compliance with exercise. Pain seems to be the greatest obstacle to their rehabilitation. We present three patients where regional local anaesthetic infusion facilitated physiotherapy and thus resulted in marked improvement in functional status.

Case 1

A 64-year-old man presented to an orthopaedic surgeon with a neuroma in his right median nerve at the mid-humeral level. An excision resulted in persistent neuropathic pain over his right hand. A warm sensation and hair loss were also apparent. Visual analog score (VAS) was three at rest and seven during movement. There was also significant numbness with marked stiffness. Some allodynia with hyperalgesia were observed during light touch. A stellate ganglion block with 7 ml 2% lignocaine was carried out but the result was disappointing. A series of three intravenous regional anaesthetics (IVRA) with lignocaine and bretylium were subsequently performed with only temporary relief. Dihydrocodeine and amitriptyline only partially controlled his pain and gabapentin was not helpful. An axillary catheter was inserted to provide continuous brachial plexus block (Contiplex Tuohy 18G, B. Braun Medical Inc., Germany) guided by a peripheral nerve stimulator (Stimpex – DIG, B. Braun Medical Inc., Germany). Daily active and passive physiotherapy was carried out as before. An infusion of ropivacaïne 0.25% was started at 3 ml h\textsuperscript{-1} with a patient-controlled analgesia (PCA) option of 1 ml boluses. This resulted in a significant functional improvement with a much wider range of movement (Table 1). Unfortunately, the catheter slipped out after 3 days. A second catheter with tunnelling was in-

**Table 1**

<table>
<thead>
<tr>
<th>Improvement of functional status for patient 1</th>
<th>Before physiotherapy</th>
<th>After physiotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index finger MCP joint</td>
<td>No movement</td>
<td>0–65°</td>
</tr>
<tr>
<td>Index finger PIP joint</td>
<td>20–30°</td>
<td>20–90°</td>
</tr>
<tr>
<td>Index finger DIP joint</td>
<td>No movement</td>
<td>0–60°</td>
</tr>
<tr>
<td>Middle finger MCP joint</td>
<td>No movement</td>
<td>0–65°</td>
</tr>
<tr>
<td>Middle finger PIP joint</td>
<td>40–50°</td>
<td>30–115°</td>
</tr>
<tr>
<td>Middle finger DIP joint</td>
<td>No movement</td>
<td>0–60°</td>
</tr>
<tr>
<td>Ring finger MCP joint</td>
<td>No movement</td>
<td>0–70°</td>
</tr>
<tr>
<td>Ring finger PIP joint</td>
<td>30–40°</td>
<td>30–110°</td>
</tr>
<tr>
<td>Ring finger DIP joint</td>
<td>No movement</td>
<td>0–60°</td>
</tr>
<tr>
<td>Little finger MCP joint</td>
<td>No movement</td>
<td>0–65°</td>
</tr>
<tr>
<td>Little finger PIP joint</td>
<td>25–35°</td>
<td>30–110°</td>
</tr>
<tr>
<td>Little finger DIP joint</td>
<td>No movement</td>
<td>0–60°</td>
</tr>
<tr>
<td>Right hand power grip</td>
<td>3 kg</td>
<td>8 kg</td>
</tr>
</tbody>
</table>

In the following week and used for another 4 days. VAS dropped to zero even during exercise. The rate during the second infusion was reduced to 2 ml h\(^{-1}\) because of excessive numbness. There was minimal PCA triggering during both infusion periods. Functional improvement was sustained well after cessation of infusion. He was able to twist a towel and brush his teeth with ease, impossible tasks prior to this procedure. The total dose of ropivacaine was 823 mg, averaging 5.34 mg h\(^{-1}\). Eighteen months after catheter removal, VAS was two at rest and three during exercise.

**Case 2**

A 62-year-old woman had a history of mixed connective tissue disease with Raynaud’s phenomenon. This was complicated by fibrosing alveolitis and was treated with long-term oral steroid therapy. She presented with numbness, drilling and stabbing sensation, sudomotor changes, severe allodynia and hyperalgesia with trophic changes on the nails of her right hand. There was no definite history of trauma. VAS was eight at rest and 10 during movement. Tramadol, dextropropoxyphene and amitriptyline were added to her list of medications without much improvement. Frequent intramuscular opioid administration was needed. Sustained release morphine was eventually tried but pain relief was still unsatisfactory. Stiffness of her fingers became more apparent with attendant loss of function. Stellate ganglion block was considered inadvisable because of poor respiratory function (high risk of phrenic nerve paralysis). A series of three IVRAs with lignocaine and bretuxim were carried out but with only a short-lived effect. Finally, a brachial plexus catheter was inserted with the same technique and equipment as described in case one. It was placed at the right axilla with tunneling and an infusion of ropivacaine 0.2% at 4 ml h\(^{-1}\) with a PCA option of 2 ml boluses was initially prescribed, but subsequently reduced because of numbness. The range of movement improved dramatically with active daily physiotherapy and treatment maintained for 6 days. VAS was zero even during exercise throughout the infusion period. The improvement of hand function was sustained well after cessation of the infusion (Table 2) despite the resumption of potent opioid use. VAS was one at rest and up to eight during movement 12 months after catheter removal. The total ropivacaine consumption was 389 mg, an average of 2.91 mg h\(^{-1}\).

**Case 3**

A 69-year-old man was seen 2 months after emergency surgery for a left patella fracture (open reduction and internal fixation). Pain over his knee had persisted since surgery and contracts soon developed. The orthopaedic surgeon was eager to encourage vigorous physiotherapy to restore mobility. VAS was two at rest and eight during active movement. The range of knee movement was only 15 degrees and considerable allodynia and hyperalgesia were apparent. His symptoms were worse during cold weather or under a light breeze. Naproxen was not effective. An 18G epidural catheter (Portex) was inserted between his second and third lumbar vertebrae to provide pain relief during exercise. An infusion of bupivacaine 0.0625% with fentanyl 3.3 μg ml\(^{-1}\) was started at 8 ml h\(^{-1}\) with a PCA option of 3 ml boluses (Graseby 9300, Ambulatory Infusion Pump, Graseby Medical, UK). Daily physiotherapy, including stretching, walking and weight loading, was performed. VAS dropped to zero at rest and two during exercise. Continuous passive stretching was provided at night-time by a device

**Table 2**

<table>
<thead>
<tr>
<th>Improvement of functional status for patient 2</th>
<th>Before physiotherapy</th>
<th>After physiotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index finger MCP joint</td>
<td>10–20°</td>
<td>10–50°</td>
</tr>
<tr>
<td>Index finger PIP joint</td>
<td>10–30°</td>
<td>0–90°</td>
</tr>
<tr>
<td>Index finger DIP joint</td>
<td>0–10°</td>
<td>0–20°</td>
</tr>
<tr>
<td>Middle finger MCP joint</td>
<td>0–20°</td>
<td>0–80°</td>
</tr>
<tr>
<td>Middle finger PIP joint</td>
<td>40–50°</td>
<td>30–90°</td>
</tr>
<tr>
<td>Middle finger DIP joint</td>
<td>0–10°</td>
<td>0–30°</td>
</tr>
<tr>
<td>Ring finger MCP joint</td>
<td>0–10°</td>
<td>0–90°</td>
</tr>
<tr>
<td>Ring finger PIP joint</td>
<td>30–40°</td>
<td>30–90°</td>
</tr>
<tr>
<td>Ring finger DIP joint</td>
<td>No movement</td>
<td>0–20°</td>
</tr>
</tbody>
</table>

95
attached to the bed. The catheter remained in-situ for 5 days with very little additional boluses required (three demands in 5 days). At the end of this treatment period, his range of movement improved to 120 degrees. This improvement was sustained and the VAS was zero at rest and two during movement 14 months after catheter removal.

Discussion

All three patients described above displayed signs and symptoms of CRPS and fulfilled both the original diagnostic criteria established in 1995 (3) and the modification proposed by Bruehl and Harden in 1999 (4, 5). Unfortunately two were seen late in their disease process and this is a common phenomenon. It has been shown that, on average, patients will have seen 4.8 different physicians and have had a mean of 30 months’ treatment before being referred to a multidisciplinary pain clinic (2). This increases the probability of joint stiffness and contractures.

The exact pathophysiology of CRPS is still unknown. Several theories have been suggested, including peripheral and central mechanisms. It is likely that frequent ectopic discharges continue to sensitize the dorsal horn of the spinal cord leading to the ‘wind-up’ phenomenon (6). Contractures soon develop following disuse. We postulate that, together with pharmacological therapy for neuropathic pain, a local anaesthetic infusion temporarily terminates these abnormal impulses and, thus, interrupts this ‘vicious cycle’.

It is likely that CRPS represents a heterogeneous group of patients with different aetiologies and pathophysiology. It is impractical therefore to think that one single treatment modality will be effective. A new treatment algorithm has been suggested, with the emphasis switched to functional improvement and prevention of contractures (7). Physiotherapy and occupational therapy are both essential in this difficult rehabilitation process. A particularly successful programme described for patients with CRPS involves ‘stress-loading’ exercises to affected ‘stiff’ joints without movement (8). The range of motion and flexibility can then be extended with gentle exercises. Kinesophobia is often more stressful than pain itself (9). This further emphasizes the importance of pain-free exercises to improve function. In our series, we performed brachial plexus and epidural local anaesthetic infusions for our patients because both techniques provide somatic and sympathetic blockade.

Single shot interscalene (10) and axillary block (11) have been described in the past to treat CRPS but we believe that a continuous infusion is more beneficial for prolonged physiotherapy. Multiple attempts at neural blockade (11) also carry a potentially greater risk of nerve injury. Epidural catheters are easier to insert than lumbar plexus catheters for treatment of lower limb CRPS (12). Continuous stellate ganglion blockade has been described and was successful in treating upper limb CRPS (13, 14). However, it is associated with adverse effects and complications such as cervical epidural blockade, Horner’s syndrome, recurrent laryngeal and phrenic nerve palsies.

Several single case reports have suggested the use of catheter insertion with infusion of various drugs and dosage regimens (15–17). It is important that the technique chosen provides effective analgesia facilitating aggressive physiotherapy. A co-ordinated schedule with well-informed realistic treatment goals is necessary to maximize functional improvement. Ropivacaine is theoretically the drug of choice as the degree of motor block is less than with other long acting local anaesthetic agents (18). However, a very low concentration of bupivacaine was used for patient 3 to conform to our hospital acute pain service protocol at that time. Fentanyl was also added, as the presence of opioid receptors in the spinal cord level is well recognized. However, it is unlikely to be beneficial in peripheral nerve blocks (19). Acute tolerance and tachyphalaxis have also been described (20) but were not evident in our series. A PCA option was included because it was thought to be useful during active exercise. The variability of individual exercise programmes resulted in large differences in final dose requirement and individual titration is obviously important.

Since the catheters are required to be left in-situ for several days, we tunnelled them to reduce the risk of infection and dislodgement. Excellent functional improvement was achieved in all patients and we decided to remove the catheters on the fifth to the seventh postinsertion day empirically. This procedure could be repeated if necessary (15). Pain scores after catheter removal were variable, consistent with previous studies (21). Patients should be given realistic and clear objectives prior to commencing treatment. It is, however, very encouraging to observe the sustained improvement in range of movement for over a year in all three patients.

In conclusion, the heterogeneity of symptoms and aetiology of CRPS often leads to differences in response even after identical treatment programmes. Therapeutic interventions now focus on functional improvement. We recommend a short trial of local anaesthetic infusion to the nerve plexus involved if pain
delays the progress of physiotherapy. Despite the possibility of recurrent pain after catheter removal, the sustained improvement in mobilization and function is worthwhile.

References


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