

# Treatment of Complex Regional Pain Syndrome with Peripheral Nerve Blocks: A Case Series of Nine Patients

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## Summary

This case series describes nine patients suffering from Complex Regional Pain Syndrome (CRPS) that were treated with a combination of peripheral nerve blocks, myofascial injections of Marcain into trigger points and medications for neuropathic pain such as carbamazepine and opiates. Patients were treated from April 2002 to August 2003 in a private clinic outpatient setting in Invercargill and Wellington. Allodynia, hyperalgesia and sleep disturbance subsided in 8 of nine patients. The average Visual Analogue scale scores improved from 9/10 to 2/10. This case series indicates that peripheral nerve blocks in combination with appropriate medications can provide good relief of CRPS. Further studies to validate this treatment protocol are planned.

Keywords: Peripheral nerve blocks; Pain management; Complex Regional Pain Syndrome.

## Introduction

Complex regional pain syndromes (CRPS) cause significant pain and suffering and are often poorly controlled by conventional therapies<sup>1</sup>. Clinical features of CRPS include allodynia, pressure hyperalgesia, vasomotor changes, sudomotor changes, temperature changes, trophic changes of the skin, motor impairment and Osteoporosis<sup>2</sup>. CRPS can often progress to permanent impairment.

Type I CRPS (Reflex sympathetic dystrophy) is present when no apparent nerve injury precedes pain, allodynia or pressure hyperalgesia. Pain, allodynia or hyperalgesia present is out of proportion to the injury. Type II CRPS (Causalgia) is present when a nerve injury precedes pain, allodynia or pressure hyperalgesia. The pain is not necessarily limited to the distribution of the nerve. The IASP diagnostic criteria also require evidence of oedema, changes in skin flow or abnormal sudomotor activity in the region of pain<sup>2</sup>. The absence of another diagnosis to account for the pain is also a diagnostic criteria.

Abnormal transmission of pain from the periphery to the brain is thought to be responsible for the exaggerated pain experience. Changes at one site in the pain transmission pathways are unlikely to explain all cases of this bizarre pain syndrome. Some cases may develop central nervous system plasticity in the spinal cord or brain to account for symptoms and some patients are likely to have changes in peripheral nerves<sup>2</sup> that account for symptoms. Both central and peripheral mechanisms may be operating. Four possible explanations for the mechanisms of pain have been offered in review articles<sup>2</sup>- The Ephapse model, The model of sympathetic afferents, neuromas and ectopic signal generation in the dorsal horn.

The natural history of CRPS may be derived from a randomized prospective single blinded study<sup>1</sup> comparing occupational therapy, physical therapy and a control group in patients with RSD (complex regional pain syndrome type I). 135 patients with symptoms of less than 12 months duration were randomly allocated into the three groups. Impairment using the American Medical Association (AMA) Guides to the Evaluation of Permanent Impairment was rated at inclusion and after 12 months. In all three groups the impairment was approximately 20% whole person impairment at inclusion and 20% whole person impairment at one year after treatment without a difference in each group. The natural history is of no improvement in impairment using the AMA Guides to the Evaluation of Impairment after 12 months in these 135 patients.

## Literature on Nerve blocks for treatment of CRPS

A Medline search for case series or trials using peripheral nerve blocks for treatment of CRPS from 1966 to 2003 revealed very few papers. The keywords Complex regional pain syndrome, causalgia, reflex sympathetic reflex dystrophy and local anesthetics were used. Case reports of single patients were not included. Kingery<sup>3</sup> in his review of controlled clinical trials for CRPS and neuropathic pain found no controlled trials using peripheral nerve blocks. Robinson<sup>4</sup> reviewed treatment of CRPS Type I and also did not find any case series using peripheral nerve blocks. There were some case series using local anaesthetics and opiates which are described below.

A case series<sup>5</sup> using brachial plexus blockade with an infusion pump of Bupivacaine (0.5%, 3ml/hour) with six patients reported three patients responded favourably. The treatment interval varied from three to six months. The time between diagnoses and treatment was from two to seven months for five patients with one patient having an interval of 25 months.

Azad et al<sup>6</sup> reported a pilot study using morphine through an axillary brachial plexus catheter. Nine patients with upper limb CRPS (mostly under 12 months duration) were given an average of 17 days of infusion. All patients were kept in hospital for treatment and received physiotherapy. Follow up at five months found a reduction in VAS at rest and during motion of 50%.

Linchitz and Raheb<sup>7</sup> wrote a case series on nine patients treated with continuous subcutaneous lidocaine infusions for four to eight weeks. Five patients completed the infusions and responded positively with reduced pain, allodynia, colour, temperature changes and changes in hair and nail. VAS pain scores were reduced by approximately 50% in the Five patients that completed the treatment. Another study<sup>8</sup> however found little effect of intravenous lidocaine on allodynia and mechanical pain in a double blind, placebo controlled trial with 16 patients.

A trial<sup>9</sup> looking at the treatment effects of high dose topical capsaicin used regional nerve blocks prior to applying capsaicin due to the burning that develops on applying high dose capsaicin. They found patients receiving more than one treatment obtained additional relief with subsequent treatments. The treatment effects may have been due to the peripheral nerve blocks rather than the large dose of capsaicin applied.

### Methods

Seven patients were referred to a private clinic in Invercargill and two patients in a private clinic in Wellington. Each patient was diagnosed with complex regional pain syndrome after satisfying IASP diagnostic criteria. Patients were assessed with full history and examination carried out. The patients were prescribed medication to help with neuropathic pain and sleep. Carbamazepine in a dose of 200 nocte increasing to 400mg nocte after three nights was prescribed as well as tramadol 50 to 100 mg upto three times a day. Patients were advised the purpose of the medication was mostly to improve sleep disturbance as well as reduce neuropathic pain. All medication was stopped after 8 weeks when symptoms improved.

A handout (appendix 1) was given to patients. The purpose of the handout is to explain the treatment and condition. This relieves the significant anxiety patients present with when they develop this severe symptoms complex which is difficult to explain.

Peripheral nerve blocks using marcaïn 3ml proximal to the site of pain were performed. If symptoms were at the ankle then nerve blocks were performed around the knee region. The nerve blocks were given to alleviate all symptoms in patients giving them a break from their symptoms as well as changing the sensitivity of the nerve. Nerve blocks were repeated at two to three week intervals with a maximum of three performed.

The demographics of the patients are outlined in Table 1. 5 Females and 4 males aged with an average age of 41 years (range 22 to 61) were treated. Two patients were referred with lower limb pain and 7 with upper limb pain.

*Table 1 Patient demographics*

| Patient | sex    | Age    | Ethnicity | occupation     | Pain location |
|---------|--------|--------|-----------|----------------|---------------|
| 1       | F      | 45     | European  | Process worker | R arm         |
| 2       | F      | 22     | European  | Teacher        | R knee        |
| 3       | M      | 61     | European  | Farmer         | L elbow       |
| 4       | F      | 54     | European  | Home help      | Rthumb        |
| 5       | F      | 33     | European  | Office         | L Hand        |
| 6       | F      | 20     | European  | mechanic       | R Elbow       |
| 7       | M      | 51     | European  | Retail         | L knee        |
| 8       | M      | 47     | European  | Office         | L elbow       |
| 9       | M      | 36     | European  | Haulage        | L elbow       |
|         | 5F, 4M | AVE 41 |           |                |               |
|         |        | Range  |           |                |               |
|         |        | 22-61  |           |                |               |

The nature of trauma, date of injury and the duration of pain at presentation are seen in Table 2. Four suffered major trauma and five suffered minor trauma. The duration of symptoms ranged from two months to 12 months (average six

months). At the time of presentation 5 were off work, one was working half time and 3 were working fulltime with limitations.

*Table 2 Trauma site and mechanism of injury*

| Patient | Trauma |       | Pain location | Description        | DOI        | Pain Duration | time off work |
|---------|--------|-------|---------------|--------------------|------------|---------------|---------------|
|         | Major  | Minor |               |                    |            |               |               |
| 1       | x      |       | Right arm     | Forklift hit elbow | 18/09/2002 | 4 months      | OFF           |
| 2       |        | x     | R knee        | Twisting injury    | 4/05/2002  | 12months      | Nil           |
| 3       | x      |       | L elbow       | Crutching machine  | 29/03/2003 | 2 months      | Off           |
| 4       | x      |       | R Thumb       | Injection          | 1/10/2001  | 15 months     | Half hours    |
| 5       | x      |       | L hand        | Door 4x4           | 9/02/2003  | 2 months      | OFF           |
| 6       |        | X     | R elbow       | Forceful gripping  | 9/08/2002  | 2 months      | OFF           |
| 7       |        | x     | L knee        | Fall onto knee     | 2/01/2003  | 7 months      | Nil           |
| 8       |        | x     | L elbow       | Nil rememb         | Feb-03     | 6 months      | Nil           |
| 9       |        | x     | L elbow       | blunt trauma       | 28/05/2001 | 11 Months     | Off           |

ave 6.7

Table 3 outlines the clinical features of the nine patients prior to treatment. Table 4 provides a summary of the clinical features present. Allodynia, pressure hyperalgesia, erythema and sleep disturbance were present in all patients.

*Table 3 Clinical features prior to treatment*

| Patient | Allodynia | Hyperalgesia | Erythema | Sweating | Heat/cold | Pins/needles | Numb/ting | Sleep disturb |
|---------|-----------|--------------|----------|----------|-----------|--------------|-----------|---------------|
| 1       | x         | X            | X        | X        |           | X            | X         | x             |
| 2       | x         | X            | X        |          | x         | X            | x         | x             |
| 3       | x         | X            | X        |          |           | X            |           | x             |
| 4       | x         | X            | X        |          |           |              |           | x             |
| 5       | x         | X            | X        |          |           | X            | x         | x             |
| 6       | x         | X            | X        | X        |           | X            | x         | x             |
| 7       | x         | X            | X        |          |           |              |           | x             |
| 8       | x         | X            | X        |          |           |              |           | x             |
| 9       | x         | X            | X        | X        |           |              |           | x             |

*Table 4 Summary of Clinical features*

| Feature               | Out of 9 Patients |
|-----------------------|-------------------|
| Allodynia             | 9                 |
| hyperalgesia          | 9                 |
| erythema              | 9                 |
| sweating              | 3                 |
| heat/cold             | 1                 |
| Pins and needles      | 5                 |
| Numbness and tingling | 4                 |
| Sleep disturbance     | 8                 |

The medical personnel seen prior to their first appointment are outlined in table 5. More than one cross is present if more than one health care provider was seen in that group. The investigations ordered prior to the first appointment are outlined in table 6. Table 7 lists the medications that were tried prior to the first appointment.

*Table 5 Medical personnel seen prior to treatment*

| Patient | GP | ED | Physio | Ortho Surgeon | Rheum | OCC Therapy |
|---------|----|----|--------|---------------|-------|-------------|
| 1       | X  |    | Xxx    | X             |       |             |
| 2       | X  | X  | Xxx    | X             | X     |             |
| 3       | X  | X  | X      | X             |       |             |
| 4       | X  | X  | x      | X             |       |             |
| 5       | x  | X  | x      | X             |       |             |
| 6       | x  | x  | x      |               |       |             |
| 7       | x  |    | xx     | X             |       |             |
| 8       | x  |    | x      |               |       | x           |
| 9       | x  |    | x      | X             |       |             |

*Table 6 Investigations carried out on patients seen prior to treatment*

| Patient | MRI | CT scan | NCS | Bone scan |
|---------|-----|---------|-----|-----------|
| 1       |     |         | X   |           |
| 2       | x   |         |     |           |
| 3       |     |         |     |           |
| 4       |     |         |     | X         |
| 5       |     | x       |     |           |
| 6       |     |         | X   |           |
| 7       | x   |         |     |           |
| 8       |     |         |     |           |
| 9       |     |         |     |           |

*Table 7 Medications/injections tried by patients prior to treatment*

| Patient | NSAID | Panadol | steroid inj |
|---------|-------|---------|-------------|
| 1       | x     | X       |             |
| 2       | x     |         |             |
| 3       |       |         |             |
| 4       | x     |         | x           |
| 5       | x     | X       |             |
| 6       | x     | X       |             |
| 7       | x     | X       |             |
| 8       | x     |         |             |
| 9       | x     |         | X           |

The patients were all treated with peripheral nerve blocks as identified in table 8. Approximately 3ml of Marcain % was used when performing the nerve blocks. After experience it was less painful for patients to perform nerve blocks proximal to the site of site of neuropathic pain. Trigger point injections were tried on some patients after the case series began. Follow-up was carried out using the questionnaire below. Seven Patients were followed up by phone and two patients were followed up at consultation. Three patients are still continuing with treatment every three to four weeks.

*Table 8 Treatment received after referral*

| Patient | Tegretol | Paradex | tramadol | DHC | First visit | second visit | Third | fourth |
|---------|----------|---------|----------|-----|-------------|--------------|-------|--------|
| 1       | X        |         | X        |     |             | NB           | NB    | NB     |
| 2       | X        |         | X        |     | NB          | NB           | NB    | Nil    |
| 3       |          |         | X        |     | NB          |              |       |        |
| 4       | X        | x       |          |     | NB          | NB           | Nil   |        |

|   |   |   |   |   |    |    |     |            |
|---|---|---|---|---|----|----|-----|------------|
| 5 | X |   | X | x | NB | NB | NB  |            |
| 6 |   |   |   |   | NB | NB | Nil |            |
| 7 | X |   | X |   | NB | NB | Nil |            |
| 8 | X | x |   |   | NB | NB | NB  | NB/Steroid |
| 9 | X |   | X |   |    | NB | NB  |            |

NB = Nerve Block, TP = Trigger point injections, Steroid =Kenacort/marcain injection

#### Phone questionnaire follow-up

Use of pain medication (Are you taking any medications for pain due to the site of CRPS?).

Daily pain experienced (What is the best and worst pain experienced during the day out of 10?).

Disturbed sleep (Is sleep disturbed by pain?).

Allodynia (Is it painful to lightly touch the area?).

Pressure hyperalgesia (is it painful when pressure is applied to the area?)

Limitations (What activities are you limited in at present from the site of CRPS?)

Are you working your full hours?

Are redness/mottling still present?

#### Results

The time since treatment ended is outlined in table 9. Three patients have not been discharged from the clinic and are being followed three weekly to monthly. Table 9 shows the time since treatment ceased if the patient is discharged. For those still undergoing treatment 0 months is taken as the time since treatment.

*Table 9 Time from last appointment to follow-up*

| Patient | Followup   | Time since treatment |
|---------|------------|----------------------|
| 1       | 29/08/2003 | 0M                   |
| 2       | 20/08/2003 | 0M                   |
| 3       | 26/08/2003 | 3M                   |
| 4       | 27/08/2003 | 5M                   |
| 5       | 27/08/2003 | 2M                   |
| 6       | 26/08/2003 | 9M                   |
| 7       | 28/08/2003 | 0M                   |
| 8       | 26/08/2003 | 0M                   |
| 9       | 26/08/2003 | 8M                   |

The clinical features of the patients are seen in table 10 with a summary of the clinical features before and after treatment outlined in table 11. The Visual analogue scores for pain before and after treatment are outlined in table 12.

*Table 10 -Clinical features at follow-up*

| Patient | Allodynia | Hyperalgesia | Erythema | Sweating | Heat/cold | Pins/needles | Numb/ting |
|---------|-----------|--------------|----------|----------|-----------|--------------|-----------|
| 1       | Yes       | Yes          | Yes      | Yes      | Yes       | Yes          | Yes       |
| 2       | No        | No           | No       | No       | No        | No           | No        |
| 3       | No        | No           | No       | No       | No        | No           | No        |
| 4       | No        | No           | No       | No       | No        | No           | No        |
| 5       | No        | Yes          | Yes      | No       | No        | ?            | ?         |
| 6       | No        | No           | No       | No       | No        | No           | No        |
| 7       | No        | No           | Yes      | No       | No        | No           | No        |
| 8       | No        | No           | No       | No       | No        | No           | No        |
| 9       | No        | No           | No       | No       | No        | No           | No        |

*Table 11 Summary of clinical features at Follow-up*

| Feature      | Pre-treat | Follow-up |
|--------------|-----------|-----------|
| Allodynia    | 9         | 1         |
| Hyperalgesia | 9         | 2         |

|                   |   |   |
|-------------------|---|---|
| Erythema          | 9 | 3 |
| Sweating          | 3 | 1 |
| Heat/Cold         | 1 | 1 |
| Pins/Needles      | 5 | 2 |
| Numb/Ting         | 4 | 2 |
| Sleep Disturbance | 9 | 1 |

Table 12 VAS pain scores at first consultation and at follow-up

| Patient | Pain at start | pain at end | Follow-up |
|---------|---------------|-------------|-----------|
| 1       | 9             | 4           | 0M        |
| 2       | 10            | 0           | 0M        |
| 3       | 7             | 2           | 3M        |
| 4       | 9             | 2           | 5M        |
| 5       | 9             | 5           | 2M        |
| 6       | 8             | 0           | 9M        |
| 7       | 10            | 7           | 0M        |
| 8       | 10            | 0           | 0M        |
| 9       | 10            | 0           | 8M        |
|         | 82            | 20          |           |
|         | 9             | 2           |           |

Patients responded well to the treatment with over 80 percent reduction in the average scores on the VAS. Allodynia and sleep disturbance resolved in 8 out of 9 patients. Pressure hyperalgesia subsided in seven of nine patients. The reduction in symptoms also coincided with the decrease in disability among patients. Three patients were working full time at the start of the series with 7 patients working full time at the follow up period. Of those working fulltime their tasks at the work place became easier to perform.

### Follow-up March 2005

| Patient | Followup | Pain at start | pain at end | Time since treatment |
|---------|----------|---------------|-------------|----------------------|
| 1       | 03/2005  | 9             | 6           | 18M                  |
| 2       | 03/2005  | 10            | 5           | 18M                  |
| 3       | 03/2005  | 7             | 0           | 21M                  |
| 4       | 03/2005  | 9             | 2           | 23M                  |
| 5       | 03/2005  | 9             | 1           | 25M                  |
| 6       | 03/2005  | 8             | 0           | 34M                  |
| 7       | 04/2005  | 10            | 0           | 18M                  |
| 8       | 03/2005  | 10            | 0           | 18M                  |
| 9       | 03/2005  | 10            | 0           | 26M                  |
|         |          | 82            | 14          |                      |
|         |          | 9             | 1.5         |                      |

| Patient | Sleep dist | Allodynia | Erythema | Meds                       | sought treatmt | Limitations        | Working     |
|---------|------------|-----------|----------|----------------------------|----------------|--------------------|-------------|
| 1       | yes        | yes       | yes      | Tried gabapentin<br>epilim | yes            | Using hand walking | No Fulltime |
| 2       | No         | No        | No       | nil                        | nil            | nil                | Fulltime    |
| 3       | No         | No        | No       |                            |                | nil                | Fulltime    |

|   |    |    |    |     |     |     |            |
|---|----|----|----|-----|-----|-----|------------|
| 4 | No | No | No | nil | nil | nil | Fulltime   |
| 5 | No | No | No | nil | nil | nil | Fulltime   |
| 6 | No | No | No | nil | nil | nil | Fulltime   |
| 7 | No | No | No | nil | nil | nil | Fulltime   |
| 8 | No | No | No | nil | nil | nil | Fulltime   |
| 9 | No | No | No | nil | nil | nil | Unemployed |

### Conclusions

Patients with CRPS type I present with neuropathic pain that is abnormally exaggerated. The heightened response is likely to reflect changes in the peripheral and central nervous system pain pathways. In six of the nine cases once the neuropathic pain, allodynia and hyperalgesia settled there was underlying somatic pain present. A deep dull ache remained after treatment. Three patients fulfilled the diagnostic criteria for lateral epicondylitis and were treated with a steroid and marcin injection into the lateral epicondyle with marked relief of somatic pain. One patient responded to a steroid injection into the knee with relief of somatic pain.

Two patients with CRPS of the knee continued to experience a deep dull ache after the neuropathic pain, allodynia and hyperalgesia settled. Both had decreased weight bearing because of the severe pain experienced. One of these patients experienced morning stiffness for 10 minutes. With the lack of weight bearing for extended periods peri-articular osteoporosis and cartilage deterioration are likely to develop. This process may contribute to ongoing somatic pain after neuropathic pain subsides.

Patients with CRPS are often not diagnosed. Only two patients of the nine presented with a diagnosis of CRPS. Inappropriate medications were also prescribed at presentation. Non steroidal have been shown to be ineffective in neuropathic pain<sup>4</sup> but eight of nine patients presented taking non steroidal anti-inflammatory medications. One patient of nine presented taking membrane stabilizing medication.

The pain is out of proportion to the injury in most of the cases of CRPS. The severe pain and often crippling disability is often difficult to comprehend for health care providers. Most patients were unable to tolerate the site of pain within their sheets when sleeping and kept the site of pain over the edge of the bed. Many of the cases of upper limb CRPS were limited in brushing teeth, writing and using a hairbrush. One patient with lower limb CRPS was walking with two crutches. The disabilities subsided when the pain subsided.

The treatment effects are several;

1. Patients receive an explanation of their condition which gives them a reason for the exaggerated pain response and reduces patient anxiety.
2. The treatment is based on a logical and believable premise that is easily understood by most people.
3. The analgesic medication and neuropathic medication improves patients' sleep and pain.
4. The nerve block eliminates all pain for a certain period of time giving acute relief.

The results of this case series show nerve blocks are promising for the treatment of CRPS Type I. Although the neuropathic pain has responded in eight of the nine cases there has been residual somatic pain present. The one patient who did not respond to injury had CRPS type II with nerve damage present. Disability has also declined significantly with treatment and four of six patients that were off work returned to work after treatment.

This case series is a preliminary report and has not been subjected to scientific scrutiny. A follow-up case series with questionnaires and/or interviews administered by a person other than the treatment provider before and after treatment may help validate this treatment protocol. This would address the question of bias in reporting favourable results i.e. the patient telling the doctor what the doctor wants to hear. A multi centre case series/controlled trial may be appropriate due to the limited number of cases seen in our population.

Peripheral nerve blocks with bupivacaine and appropriate medication for neuropathic pain seems to be a promising treatment for the neuropathic symptoms of CRPS type I in patients with symptoms for less than 12 months. 7 of 9 patients had markedly reduced pain with allodynia, hyperalgesia, sleep disturbance and disability reduction. The VAS scores also decreased from an average of 9 to 1.5. Further studies need to be performed to validate the treatment of this exquisitely painful and debilitating condition.

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### Appendix 1- Patient advice regarding condition and treatment

The advice given to patients regarding this treatment is based loosely on scientific facts to give the patients a framework upon which to conceptualise what is happening to them. Often patients are reassured that there is an explanation for their exaggerated symptoms. Other explanations can be used but I have found this one easily understood by most patients.

Complex regional pain syndrome (CRPS) type I is an unusual pain pattern that develops when the pain and sensitivity experienced is out of proportion to the injury sustained. Often a minor sprain may precede the development of CRPS. The nerves transmitting pain to the brain have exaggerated the message.

In a normal nerve sodium enters the nerve and potassium leaves the nerve in channels present along the length of the nerve. This creates a message along the nerve that is transmitted to the central nervous system. In the normal nerve channel one potassium leaves the nerve and one sodium enters the nerve. In CRPS there are ten times the normal amounts of sodium entering the nerve and 10 times the number of potassium leaving the channels. This creates an increased pain experience and increases the sensitivity of the skin.

The treatment of nerve blocks aims to make the area pain free for a certain period of time giving some relief. The nerve blocks are performed central to the area of sensitivity at a convenient point. The purpose of the nerve blocks is to block all the channels transmitting the nerve messages so that when they wake up they will be back to normal and transmit only one sodium and one potassium through the channel. This is similar to turning off a computer when it crashes. Often by switching the computer on and off the computer often returns to normal. It may take a few attempts to completely change the channels and the nerve block may be repeated at two to three week intervals for a maximum of three nerve blocks depending on response.

Medication for neuropathic pain is also used as this may help both sleep and also help dampen the nerve channels. Medication is usually taken for a short period of a few months or less and then can be withdrawn.

Figure 1. Normal nerve conduction- A nerve fibre is shown with the sodium (Na) and potassium (K) channels.

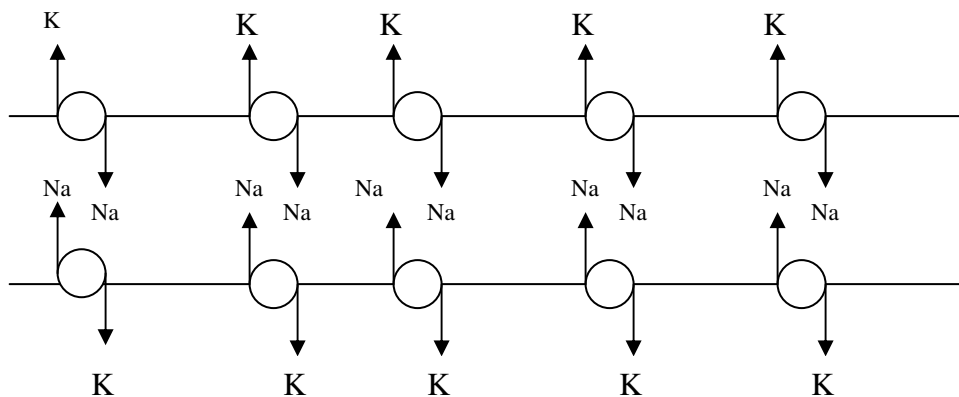


Figure 2- Nerve conduction in CRPS. The increased numbers of Sodium (Na) and Potassium (K) entering and leaving the nerve are increased resulting in an increased pain response.

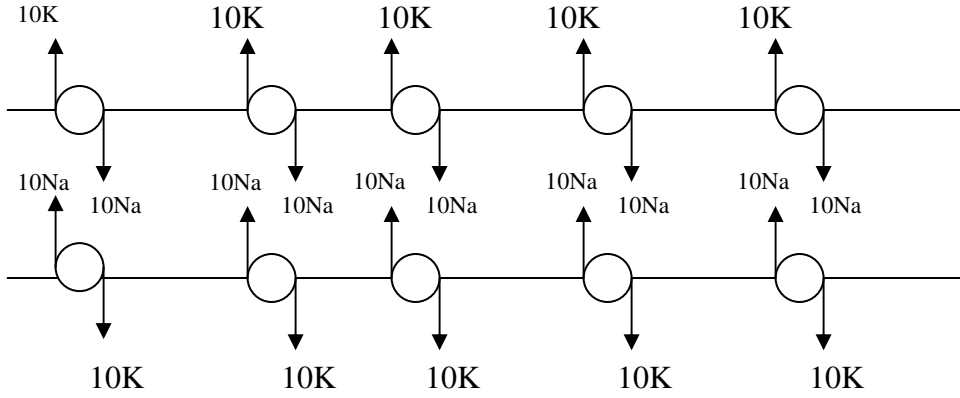


Figure 3- Effects of a nerve block with local anaesthetic. All channels are blocked and there is no conduction of signals.

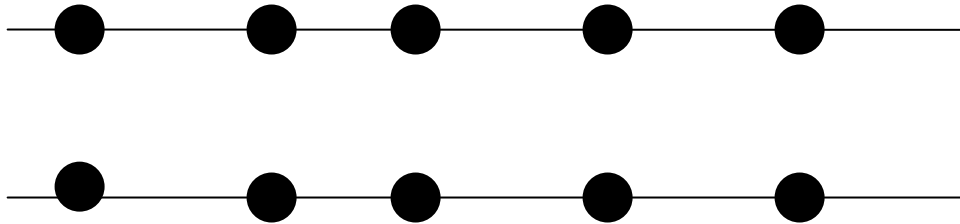


Figure 5- Nerve conduction returns to normal resulting in decreased pain signals

