



# HYPERBARIC OXYGEN AS ADJUNCT FOR COMPLEX REGIONAL PAIN SYNDROME (CRPS): CASE REPORT

Debbie L. Pestell, MD; Ian Beauprie, MD  
QEII Health Sciences Centre, Halifax, NS

## Introduction

- Complex regional pain syndrome (CRPS) is a chronic, debilitating disorder characterized by intense, burning (vasomotor) pain, allodynic response to touch, edema, hyperhydrosis and changes in skin color and temperature.
  - CRPS most often develops following minor trauma, but severity of the pain is disproportionate to the injury.
  - Early diagnosis and treatment offers the best outcome, however many cases remain refractory to standard treatment modalities.
  - Although poorly understood, pathogenic mechanisms may include peripheral and central sensitization and altered sympathetic function<sup>1</sup>
- Hyperbaric oxygen (HBO) therapy may offer an additional treatment option; promising results have been seen in earlier case reports and one double-blind randomized placebo-controlled study.<sup>4,6,7</sup>

## Case History

- A 47-year-old male presented with long-standing CRPS following injuries sustained in a snowmobile accident in 2002.
  - frostbite requiring amputation of several right-sided fingers and toes
  - a fractured right arm with open reduction
  - right-sided brachial plexus avulsion at C5 and C6 roots
  - a traumatic brain injury
- The patient awoke from a 2-week coma with excruciating burning right arm pain associated with complete motor paralysis, and atrophic and autonomic local temperature and colour changes consistent with CRPS.
- Over the past 12 years, his pain has remained refractory to all treatment modalities including rehabilitation therapy, high dose narcotic analgesics, stellate ganglion blocks and motor cortex stimulation.
- The arm was cold with blue, mottled skin (Fig 1), daily pain ranked 10/10, sleep disturbance, poor quality of life and disability from work.
- He was treated with 42 sessions of HBO therapy at 2.4 ATA over an 8-week period.
  - He was assessed at baseline, 4 weeks and 8 weeks into treatment.

## Outcome

- The patient gradually improved throughout treatment (Table 1).
- By the end of treatment, his right arm was pink, warm and uniform in colour (Fig 2), his daily pain was 0/10, his narcotics for breakthrough pain had been discontinued, and his daily pain medications were slowly being withdrawn.
  - In addition, the patient had an inexplicable return of sensation to his right arm in the C5 distribution.



Fig 1: Skin Condition, CRPS Right Arm, 2003



Fig 2: Skin Condition after 6 Wks HBO Therapy, 2014

Table 1: Serial Measures Pre- and Post-HBO

	Baseline	Week 4 HBO	Week 8 HBO
<b>Skin</b>	cold, blue, mottled	warm, pink, mottled	warm, pink, uniform colour
<b>Sensation</b>	insensate C5-8	'pins and needles' C5 distribution, insensate C6-8	sensation C5, insensate C6-8
<b>Pain</b>	10/10 constant; McGill: 49/54 <sup>5</sup>	7/10 constant; McGill: 27/54	0/10; McGill: 0/54
<b>Meds*</b>	max dose + breakthrough	max dose, D/C breakthrough	began decreasing meds

\***Meds:** Hydromorph Contin, Gabapentin, Metadol, Olanzapine, Nabilone and Endocet (for breakthrough pain)

## \*Update

- At 6 weeks post-treatment follow-up, patient remained free of daily pain, he was physically active, and his Nabilone had been discontinued.
- Given these results are now a stable improvement, they are less likely to constitute a placebo effect.
- Regular follow-up with gradual attempts to discontinue more medications will continue.

## Interpretation and Debate

- How could hyperbaric oxygen therapy help late CRPS?
  - An animal model of CRPS involves temporary ischemia (the chronic post-ischemia pain model)<sup>2</sup>; HBO elevates tissue oxygen levels and may help to reverse tissue ischemia and microvascular impairment
  - Acute and chronic CRPS involves changes in inflammatory markers; HBO has anti-inflammatory effects
- HBO is also known to cause vasoconstriction, so how would this help a cold, blue limb?
  - Improved oxygenation may have been dominant over vasoconstriction
- Late CRPS is not just pathology of the limb, the brain is altered as well; could this be one of the mechanisms of action for HBO therapy?
  - Cortical representation of the affected limb is altered in CRPS; there may be central effects of HBO similar to those reported in late stroke<sup>3</sup>
- Could this all be placebo effect?
  - Other therapies with strong potential for placebo response such as motor cortex stimulation and sympathetic blocks did not have the profound effect seen with HBO therapy.
- The patient will be followed to determine if these results are lasting, and if his pain medications can be gradually decreased and discontinued.

## Conclusions

- The degree of response in such a refractory case may open up avenues to both the mechanisms and therapy for late CRPS.
- Future studies should be considered to confirm efficacy in similar cases and, if successful, to determine the best point at which to initiate HBO therapy when treating CRPS.

## References

- Bruehl S. An update on the pathophysiology of complex regional pain syndrome. *Anesthesiology*. 2010; 113(3): 713-25.
- Coderre TJ, Xanthos DM, Francis L, Bennett GJ. Chronic post-ischemia pain (CPIP): a novel animal model of complex regional pain syndrome-Type I. *Pain*. 2004; 112: 94-105.
- Efrati S, Fishlev G, Bechor Y, et al. Hyperbaric oxygen induces late neuroplasticity in post stroke patients-randomized, prospective trial. *PLoS One*. 2013;8(1):e53716. [Epub 2013 Jan 15].
- Kiralp MZ, Yildiz S, Vural D, et al. Effectiveness of hyperbaric oxygen therapy in the treatment of complex regional pain syndrome. *J Int Med Res*. 2004; 32: 258-62.
- Melzack R. The McGill Pain Questionnaire: major properties and scoring methods. *Pain*. 1975;1: 277-99.
- Peach G. Hyperbaric oxygen and the reflex sympathetic dystrophy syndrome: a case report. *Undersea Hyperb Med*. 1995; 22: 407-8.
- Spiegel AM. The effectiveness of hyperbaric oxygen therapy in the treatment of chronic regional pain syndrome. *Undersea Hyperb Med*. 2005; 32(4): 276-77.