



THE ROLE OF HYPERBARIC OXYGENATION IN TREATMENT OF NEUROLOGICAL CAUSES OF CHRONIC PAIN IN HUMANS: SCOPING REVIEW

Neurology

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ABSTRACT

Hyperbaric oxygenation or hyperbaric oxygen therapy (HBOT) has a spectrum of applications in the clinical setting. It is used non-empirically in pain management, hypoxic encephalopathy and critical post-cardiac arrest care. Clinical outcome improvement varies case-by-case. We reviewed the literature for etiologies of neurological causes of chronic pain and role of HBOT in the management of chronic pain in these conditions.

KEYWORDS

REVIEW

Pain is subjective symptom and interventional and prognostic studies with goal of improving the pain base their study's outcome on pain surveys, pain scores, improvement in quality of life and time required to return to activities of daily living. Chronic pain is defined as being refractory to first, second and third line therapy for a duration of three months or more. This set of patients have the highest risk for opioid abuse and systemic complications of long-term use of pain relievers. It is essential to develop unconventional modes of treatment per the etiology of chronic pain. Animal studies have shown decreased allodynia and pain scores by hyperbaric oxygenation. We reviewed the etiologies of neurological causes of chronic pain (aside from arthritis, osteoarthritis, rheumatoid arthritis, cancer, irritable bowel syndrome, endometriosis, and inflammatory bowel disease) and role of hyperbaric oxygenation in the treatment of chronic pain as a supplemental or sole therapy [1-5]. Chronic neuropathic pain is a condition that is affecting an increasing number of individuals within the general population, and its effective management requires a comprehensive and multidisciplinary approach. The use of hyperbaric oxygen therapy (HBOT) in various chronic neuropathic pain conditions is supported by a growing body of evidence, although its precise role and effectiveness are still not fully understood. The objective of this study was to provide a summary of the current evidence regarding the mechanistic rationale behind HBOT in chronic neuropathic pain conditions and to evaluate its clinical efficacy.

Persistent Injury Or Trauma

Non-healing injuries due to diabetes and immuno-compromised status of the patient can lead to chronic pain lasting more than 3 months. Hyperbaric oxygenation has been extensively used as an adjunctive therapy for chronic wounds, including non-healing ulcers, burns, and tissue damage. HBOT has shown to reduce deep tissue hypoxia and tissue edema. By increasing oxygen supply to the wound site, hyperbaric oxygenation promotes wound healing and helps reduce associated pain [1].

Complex Regional Pain Syndrome (CRPS)

Hyperbaric oxygenation has been used as an adjunctive therapy for CRPS, a chronic pain condition characterized by severe pain, swelling, and trophic changes in skin temperature and appearance. Some studies suggest that hyperbaric oxygenation may help reduce pain, edema, and improve functional outcomes in CRPS patients, but more research is needed to establish its effectiveness unequivocally [2].

Fibromyalgia

Hyperbaric oxygenation has been studied as a potential treatment for fibromyalgia, a condition characterized by diffuse pain, fatigue, and

tender points. Comparative analytical studies have shown equivocal results on utility of HBOT in fibromyalgia, with some reporting positive effects on pain and quality of life, while others found no significant benefit. The mechanism of action of HBOT in fibromyalgia is a neuroplasticity effect of HBOT on the central nervous system [3].

Neuropathic Pain

Nerve damage or dysfunction can lead to chronic pain. Hyperbaric oxygenation has been explored for the management of neuropathic pain in conditions such as peripheral neuropathy, diabetic neuropathy, trigeminal neuralgia, multiple sclerosis, radiation-induced plexus neuropathies, Lyme disease, chronic kidney disease, and post-herpetic neuralgia. The rationale is that increased oxygen levels may improve tissue oxygenation, chronic primary bladder pain syndrome, reduces the levels of TNF alpha thereby reducing the neural inflammation. The outcome of comparative research, both objective and subjective, have variably improved patient outcomes in studies. However, the evidence supporting its use for neuropathic pain is limited and inconclusive. Robust evidence supporting the use of HBOT in a clinical setting was found for chronic regional pain syndrome and chronic primary bladder pain syndrome. Additionally, some evidence indicated its potential benefits for chronic secondary neuropathic pain, including radiation-induced plexus neuropathies, postherpetic neuralgia, and trigeminal neuralgia [4].

Migraines

Migraines are one of the commonest presentation in the neurology outpatient office. HBOT has been studied as an intervention in the treatment of migraine and cluster headaches. One Cochrane review has shown positive utility of HBOT in termination of migraine and cluster headaches but have no prophylactic utility in these conditions [5].

Structural Abnormalities

Structural abnormalities in the body can contribute to chronic pain. Examples include herniated discs, spinal stenosis, spondylolisthesis, and scoliosis. The role of HBOT is not well studied and has a potential for future research to explore patient characteristics, risk stratification, cost-effectiveness, and clinical efficacy of HBOT in treatment of chronic LBP pre- and/or post-spinal surgery or other interventions [6-7].

Psychological Factors

Psychological factors, such as stress, anxiety, depression, and past traumatic experiences, can influence the perception and experience of pain. In some cases, psychological factors may exacerbate or contribute to chronic pain [4].

Central Sensitization

Central sensitization refers to an abnormal amplification of pain signals in the central nervous system leading to allodynia. It can occur as a result of prolonged exposure to pain, leading to increased sensitivity and a lower pain threshold [4].

Unknown Causes

In some cases, the exact cause of chronic pain may remain unknown, even after extensive evaluation and testing. This is often referred to as idiopathic or unexplained chronic pain [4].

CONCLUSION

Clinical observation and biological plausibility indicate that HBOT (Hyperbaric Oxygen Therapy) may have valuable advantages and therapeutic effects in various chronic neuropathic pain disorders. In conclusion, HBOT has demonstrated antinociceptive and analgesic effects in animal models of inflammatory, neuropathic, and chronic pain. Small scale comparative human studies have shown favorable effects of HBOT in improving clinical outcomes, such as pain scores, pain-related symptoms, and quality of life. However, further research employing a systematic approach to HBOT application is necessary to establish its safety and efficacy that should prioritize the identification of a subgroup of chronic pain patients who could potentially experience positive outcomes through HBOT.

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