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## Hyperbaric Oxygen Therapy & Autoimmune Disease

**Background:** Autoimmunity is an overwhelmingly prominent spectrum of health concerns. Despite, its prevalence effective, safe, durable options still elude us.

Hyperbaric oxygen interestingly has a wealth of data supporting its use in autoimmunity.

Although Hyperbaric Oxygenation stimulates intracellular reactive oxygen species (ROS) production, as well as leukocytic oxidative action the evidence overwhelmingly supports positive effect in numerous autoimmune diseases.

Looking at underlying mechanisms of Hyperbaric therapy in autoimmunity is the first place to explore:

Firstly, on the topic of ROS, activity of the enzymatic antioxidants superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase (CAT) is upregulated in response to generation of reactive oxygen species.

Data from human MS patients demonstrate that superoxide dismutase and catalase values significantly increase after Hyperbaric Oxygen as a natural mechanism to combat excess ROS with modest changes in GPx (Ansari 1986).

According to Butler (2009) the positive clinical effects that HBOT has in the treatment of chronic inflammation may relate to its suppressive effects on secretion of pro-inflammatory cytokines such as IL-1, IL-6, and TNF- $\alpha$ .

Hyperbaric Oxygen causes downregulation of cytokines and upregulation of growth factors and levels of prostaglandin E2 and cyclo-oxygenase-2 are markedly reduced (also inflammatory).

In the study of a Rheumatoid Arthritis model exposed to Hyperbaric Pressures, Harnanik (2020) found a significant decrease in the expression of Th17, IL-17a, RF levels, and the clinical scores and the expression of inflammation regulating Treg cells increased significantly.

The in autoimmunity, Hyperbaric Oxygen displays immunosuppressive effects including decreased production CD4 cells (Helper T) and increased percentage of CD8 cells (Al-Waili et al. 2006)

Hyperbaric Oxygen exposures may contribute to the repair of focal areas of damage from autoimmunity via the release of stem cells. One human study found a course of 20 sessions at 2.4 ATA 5 days a week for a month in human patients was found to increase circulating stem cells eightfold (Thom et al. 2006).

## **Psoriasis**

Several cases of psoriasis have been reported to be successfully treated by HBO.

HBO has been used as an adjunct to phototherapy in the treatment of 45 patients. The course of the disease was shortened as compared with conventional treatment with an average duration of remission of 18 months.

Butler (2009) showed good results in two patients with the use of multiple sessions of Hyperbaric Oxygen at 2.8 ATA for 60 min.

Case 1: A 40-year-old man with disseminated full body psoriasis (had a history of psoriasis from infancy) and also had psoriatic arthritis since childhood. He was not taking any medications at the time of treatment.

He underwent Hyperbaric treatment once a day, 5 days per week for a total of eight sessions, resulting in significant amelioration of symptoms.

Most of the psoriatic lesions were cleared, with marked reduction in itching and scaling.

Follow up at 18 months revealed that the patient had only mild skin symptoms with degenerative changes of the arthritis.

Case 2: A 55-year-old man was referred for Hyperbaric treatment for management of chronic leg ulcers and bone infection; he also had extensive psoriasis.

He underwent Hyperbaric treatment at 2.0 ATA for 90 minutes, once a day, 5 days per week.

After six sessions his redness, scaling and itching were reduced and after 15 sessions he had improved even more.

The time course of response to treatment imply that both cases benefitted from Hyperbaric Oxygen. The authors suggest that appropriately elevated levels of ROS might prevent and treat psoriasis through enhancing Treg function.

Our Naturopathic Doctors have a lot of experience with Psoriasis; it seems to be a common condition in Edmonton.

The Naturopathic approach favors identification of food allergens, modification of gut flora and improving gut integrity.

Several investigators have observed marked improvement or complete resolution of skin lesions in patients with psoriasis after they went on allergen reduced diets and our Naturopaths have seen similar results.

Essential fatty acids, Vitamin D and Curcumin are also frequent considerations of ours in Psoriasis.

### **Rheumatoid Arthritis**

Saikovsky et al. (1986) used Hyperbaric treatment of 20 patients with rheumatoid arthritis and recommend it as an appropriate therapy especially if systemic symptoms were present.

Lukich et al. (1991) treated 35 patients with rheumatoid arthritis with Hyperbaric Oxygen. Each patient received 21 sessions of 1.7 ATA for 40 min and good clinical results were obtained.

The authors suggested Hyperbaric treatment "intensified the suppressive function of T lymphocytes and decreased the serum concentration [of] immune complexes."

Rui-Chang (1994) treated 37 patients with rheumatoid arthritis with Hyperbaric Oxygen Therapy and found relief of pain and swelling with improved mobility.

Nine patients (24.3 %) recovered completely, 19 (51.4 %) improved markedly, and 6 (16.2 %) showed slight improvement. Only 3 (8.1 %) patients failed to respond.

Naturopathic medicine once again uses foods as the foundation primarily because numerous investigators have reported that food allergy is an etiological or triggering factor in some patients with RA.

Identification and avoidance of allergenic foods resulted in improvement or complete resolution of symptoms, which our Naturopaths have confirmed in clinical practice.

In one study, twenty-two patients with RA consumed a diet that excluded common allergens. Twenty of which (91%) experienced an improvement in symptoms, and 19 found that ingestion of specific foods repeatedly exacerbated their symptoms.

Borage seed oil is a Naturopathic favorite. Borage seed oil contains a high concentration (23%) of the anti-inflammatory omega-6 fatty acid, gamma-linolenic acid (GLA).

In one study, thirty-seven patients with active RA were randomly assigned to receive (providing 1.4 g/day of Borage or placebo for 24 weeks. Compared with baseline, BSO reduced the number of tender joints by 36%, improved the tender-joint score by 45%, improved the swollen-joint score by 41%, and reduced the swollen-joint count by 28%.

### **Myasthenia Gravis**

Myasthenia gravis has a specific antibody against the acetylcholine receptor and is characterized by skeletal muscle weakness that increases with exertion and improves with rest.

Li et al. (1987) carried out a study with Hyperbaric Therapy in 40 patients with Myasthenia Gravis; one group was treated with HBOT alone and the other with HBOT plus steroids.

The rate of improvement with just Hyperbaric Oxygen was 88.9 % and HBO plus steroids was 86.5 %; and in the control group (just steroids) rate of improvement was 45 %.

Levels of antibodies IgA and IgM were reduced in the Hyperbaric groups, indicating an immunosuppressive effect of the Hyperbaric Therapy.

Although less commonly seen, our Naturopaths focus on Food Allergy, Gut Flora and boosting acetylcholine levels to maintain muscular strength for Myasthenia Gravis.

### **Inflammatory Bowel Disease**

In a case report by Buchman et al. 2001 Hyperbaric Oxygen has also been used in the treatment of a patient with Ulcerative Colitis, refractory to conventional therapies.

The patient was a 24-year-old man diagnosed with pan-colonic ulcerative colitis at the age of 17 years. His current exacerbation was of 22 months' duration, and he had remained corticosteroid-refractory over that time period.

He had 4 to 10 bowel movements daily and, occasionally, up to 15 daily, approximately 50% with blood. Hyperbaric Therapy consisted of 30 courses of 100 % oxygen at a pressure of 2.0ATA.

Clinical remission was achieved after Hyperbaric Treatment, and corticosteroids were successfully tapered off.

At the conclusion of HBOT, the patient had achieved two normal bowel movements daily.

In case reports by Green et al. 2013 two pediatric patients with exacerbations of Crohn's disease without improvement despite standard therapy underwent cycles of Hyperbaric Oxygen Therapy.

Following Hyperbaric treatment both patients showed resolution of the inflammatory lesions and improvement in conditions, enabling them to reduce drug therapy.

The authors concluded "this [Hyperbaric] therapy seems to have offered a safe adjunct in the treatment of refractory exacerbations."

A systematic review of the effect of Hyperbaric Oxygen was based on 17 studies involving 613 patients with IBD of which 286 were diagnosed as Crohn's disease and 327 as Ulcerative Colitis (Dulai 2014).

The overall response rate in Crohn's disease patients was 86 % and in Ulcerative Colitis 88 %.

Of the 40 ulcerative colitis patients with endoscopic follow-up reported, the overall response rate to HBO was 100 %. The conclusion was that HBO is a relatively safe and potentially effective treatment option for IBD patients.

The following studies reported on a total of 327 Ulcerative Colitis patients and 286 Crohn's disease patients.

The majority of IBD patients had failed 5-ASA, steroids and immunomodulator therapy prior to initiating HBOT.

### **Select Crohn's Hyperbaric Studies**

Grigoreva, 2011 - 242 patients      1.7 ATA for 40 min, 12–32 sessions      208/242 improved during HBOT

Iezzi, 2011 - 14 patients      2.4 ATA for 120 min, 10–50 sessions  
11/14 improved during HBOT

Colombel, 1995 - 10 patients      2.5 ATA for 120 min  
6/10 improved during HBOT

Lavy, 1994 - 10 patients 2.5 ATA for 90 min, 20-60 sessions  
8/10 improved during HBOT

### **Select Colitis Hyperbaric Studies**

Grigoreva, 2011 - 277 patients 1.7 ATA for 40 min, 12–32 sessions 238/277  
improved during HBOT

Karkumov 1994 - 34 patients 2.4 ATA for 120 min, 12 sessions  
All improved during HBOT

Demirturk, 2002 - 2 patients 2.0 ATA for 120 min, 30 sessions  
Both improved.

Gurbuz, 2003 - 1 patient 2.0 ATA for 120 min, 30 sessions  
Clinical remission

Reference: Dulai 2014

Refractory Perianal Crohn's Disease is an extremely difficult condition to treat medically or surgically. There are anecdotal case reports of patients who respond dramatically to HBO treatment after failure of multiple medical and surgical treatments.

Seven patients with perineal CD were subjected to daily sessions of HBO in a multiplace hyperbaric chamber with good clinical effects (Weisz et al 1997).

Each patient received a total of 20 sessions during a time period of 1 month. IL-1, IL-6, and TNF- $\alpha$  measurements were done several times during the initial sessions and after completing therapy.

During the first 7 days of treatment, IL-1, IL-6, and TNF- $\alpha$  levels from stimulated monocytes derived from patients' peripheral blood were decreased compared to pretreatment levels.

Parallel measurements of serum IL-1 levels revealed an initial elevation and thereafter decreased levels, which remained low throughout the first week of HBO treatment.

After completion of therapy, cytokine levels increased to pretreatment values.

Dulai, in a review, showed that overall response rate for perianal CD to HBO therapy was 88 % with 18 of 40 patients having complete healing and 17 had partial healing.

Perianal fistula - Hyperbaric treatment has been shown to be effective in the treatment of perianal fistulas. Spontaneous fistula closure is rare, and most patients require medical and/or surgical intervention.

In a 2020 trial, 20 Crohn's patients with perianal fistulas failing conventional treatment were studied. 40 daily 80 minute hyperbaric oxygen sessions.

In total, 50 external fistula openings were present at baseline, of which 24 were closed at Week 16 (48%).

Chronic diarrhea, inflammation, tissue damage and subsequent malabsorption can lead to multiple nutritional deficiencies, including deficiencies of calories, protein, essential fatty acids, and a wide range of vitamins and minerals in both Crohn's and Ulcerative Colitis.

Our Naturopathic Doctors have seen impressive results in many of our Edmonton IBD patients with the use of IV Therapy.

Numerous studies have shown that remission of active Crohn's disease and Ulcerative Colitis can be induced in up to 90% of patients by feeding a hypoallergenic elemental diet.

Therefore our Naturopaths usually begin with food allergy or food sensitivity in our Edmonton IBD patients. We've seen impressive results with precise dietary modification in many IBD patients.

In a 2005 study by Holt, five patients with Ulcerative proctitis and five with Crohn's disease were given oral Curcumin.

All proctitis patients improved, with reductions in concomitant medications in four, and four of five Crohn's disease patients had lowered disease activity scores and inflammation rates.

So Curcumin is an extract our Naturopaths use frequently in the management of Inflammatory Bowel Disease at our Edmonton clinic.

## **Multiple Sclerosis**

Hyperbaric Oxygen therapy ameliorated symptoms in Experimental Allergic Encephalomyelitis (EAE) the animal model of multiple sclerosis in numerous studies in the 1970s which led to subsequent human studies primarily in the 1980s.

For instance, Pallota et al. (1986) followed 22 RRMS patients over an 8 year period.

All MS patients had an initial course of 20 Hyperbaric Oxygen Treatments, and 11 were treated thereafter with two Hyperbaric treatments every 3 weeks.

The relapse frequency decreased dramatically in the long term treatment group.

Data from the United Kingdom, looked at 703 patients (predominantly females with Chronic progressive MS) suggested that after twenty treatments, 70 % of patients obtained relief of two or more symptoms.

An analysis suggested that one treatment every 2 weeks was required to retard the progression of relapsing/remitting state where as once weekly was even more effective.

We find this data encouraging as 1 treatment every 2 weeks seems reasonable for motivated patients to complete over a long term.