

HYPOXIC INDUCED APOPTOSIS

What Is Hypoxia?

Oxygen starvation

What Is Apoptosis?

Programmed cellular degeneration

What Drives Apoptosis?

Hypoxia

Hypoxia Triggers And Drives Apoptosis

Oxygen deprivation (hypoxia) is the central issue to the vast majority of disease and progressive neurologic disorders. The lack of adequate blood flow (ischemia) results in regional and cellular hypoxia that triggers and drives cellular degeneration – apoptosis i.e. insidious spread of demyelination disorders.

Simply stated – 'it is like rust spreading in an old car' (notice clumping of long nerve tracts - picture)

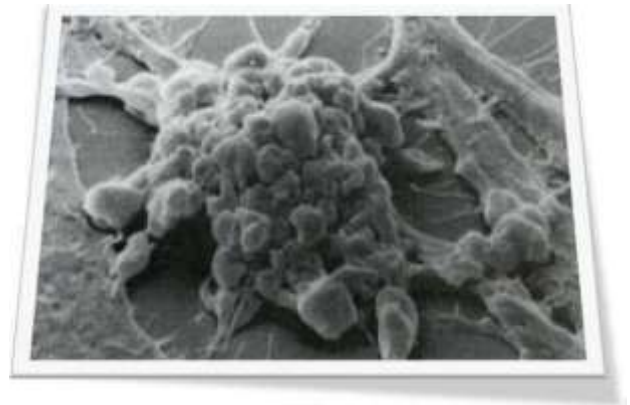
Apoptosis has been identified with virtually all neurodegenerative disorders including progressive brain and spinal cord injury.

Apoptosis fosters the cycle of continued dysfunction, degeneration and ultimate neuronal death. In fact many brain and spinal cord patients continue to get worse and this is evidenced by additional MRIs of the region 3-5 years post the initial injury; in many cases there is further expansion of the original primary lesion and a cascade of secondary degenerative effects (encephalomalacia).

Hypoxic Induced Apoptosis modifies the expression of plasticity (the ability of the central nervous system to re organize and repair).

Apoptotic bodies and altered DNA fragmentations (mitochondrial damage) are observed in the avascular ischemic region with increased inhibitory biochemical factors (proteins) released into the damaged parts of the brain and spinal cord causing further deterioration. Hypoxic Induced Apoptosis has also been linked with cancer proliferation.

Unless the central core issue is resolved the capacity of the body to heal is significantly compromised; the disease process continues!



The Cascading Effects Of Hypoxia

- Hypoxia results in chronic swelling (edema) of damaged nerves leading to poor metabolic activity often described - dormant and non-functional responses
- Hypoxia causes inadequate capillary development as evidenced by SPECT and Functional BOLD MRI
- Hypoxia creates a 'weakened site'. Healing responses slow with inadequate and inferior material laid in the damaged region
- Hypoxia leads to development delay with normal milestones not achieved
- Hypoxia results in inadequate myelination of nerve coverings. This progressive disability causes spasticity and regions of low and hi tone
- Hypoxia causes inappropriate neural connections and abnormal biochemical responses resulting in modified or inappropriate mental function
- Hypoxia results in regions of poor energy which fosters opportunistic infections that thrive in low Oxygen environments – chronic bacterial and viral infections
- Hypoxia triggers Apoptosis and drives the cycle of continuing neurovascular degeneration with a greater incidence of further injury and insult
- Hypoxia results in a 'cascade of degeneration'. Interval mris several years after injury confirm further neurovascular degeneration

What Corrects Tissue Hypoxia And Ultimately Slows The Rate Of Apoptosis?

Hyperbaric Oxygenation.

Hyperbaric Oxygenation (HBOT) directly increases the saturative effects of tissue Oxygenation slowing and reversing hypoxic induced apoptosis - restoring blood supply to the compromised region by the development of new capillary networks (neovascularization) enabling the body to alter the course and impact of the disease process.

What Is Hyperbaric Oxygenation And How Does It Work?

Hyperbaric Medicine (Hyperbaric Oxygen Therapy or HBOT) is a method of safely delivering high doses of 100% Oxygen to the body while inside a pressurized chamber. Most treatments to enhance immune responses, athletic performances and the effective treatment of chronic degenerative neurological conditions are safely performed between 1.75-2.0 ATA.

Hyperbaric works by increasing the saturative effect of dissolved Oxygen into the blood and surrounding tissue structures that have been deprived of vital Oxygen (hypoxic tissue). The pressure inside the chamber causes the Oxygen breathed to be dissolved at greater levels in the blood. Recent studies have reported that HBOT results in about a 15-20 fold increase in Oxygen saturation. This is about a 2,000% increase of dissolved Oxygen into the brain and spinal cord structures!

Approximately 20-30% of the body's consumption of Oxygen occurs within 3-5% of the body mass - the brain and spinal cord. These structures are extremely sensitive to Oxygen deficiency, and can have the most dramatic results with the use of HBOT. This increased tissue Oxygenation significantly accelerates the rate of healing, stabilization and repair.

HBOT mobilizes and elevates the body's circulating stem cells. American Journal Physiology - Heart and Circulatory Physiology (2005) reports a single 2-hour exposure to HBOT at 2 ATA doubles circulating CD34+ progenitor stem cells (primordial cells targeted to salvage and restore damaged structures); and at approx. 40-hours of HBOT; circulating CD34+ cells increases eight fold (800%)!

Why The Use Of Hyperbaric Oxygenation For Brain And Spinal Recovery?

Hyperbaric Oxygenation provides a fertile platform for mobilizing the patient's own stem cell capacity whilst preparing the body for further stem cell implantation techniques.

Hyperbaric Oxygenation acts as a catalyst promoting neurovascular salvage and repair. The rule of thumb is that most brain and spinal cord patients require an absolute base line of between 80-100 hours with most cases commencing and receiving around 100-150 hours. Complex conditions may require several hundred hours to penetrate the deeper neurovascular structure with blocks of sessions coordinated every 4-6 months after the initial saturation (40-60 hours).

Generally an initial HBOT introduction is around the 40-60 hours mark for brain injured children with most parents making some comment of positive changes which indicates that the child is making progress and Hyperbaric Oxygenation is in the right direction. However some children begin to make positive gains within 20-hours and yet other children can literally require several hundred hours before functional gains are observed. Unfortunately there is NO hard and fast rule and we cannot give unconditional guarantees!

Adult patients suffering brain and spinal injury require an absolute base line of around 100-150 hours to penetrate the deeper structures and commence recovery. Complex disorders may require literally several hundred hours combined with assertive physical therapy, Lokomat and neuro-acupuncture – hard work is required by all!

What Is LOKOMAT Robotic Gait Assisted Walking

LOKOMAT and other forms of Activity Based Modalities are based on the principle of neuroplasticity (the ability of the neurons in the nervous system to develop new connections and 'learn' new functions). Normal function is a learned response; neuro-rehabilitation requires accurate functional repetitions to 're-learn' function. HBOT is the fuel and acts as a catalyst to the central issue (hypoxia); Lokomat and other forms of intensive and innovative physical therapy validate; retrain and reconnects function.

This combination Hyperbaric | LOKOMAT approach 'awakens' dormant neural pathways and LOKOMAT provides accurate functional neurological repetition enhancing and validating neural connections and pathways in the brain and spinal cord.

Patients have the ability to regain walking ability or learn to walk!

What Are The Benefits Of HyperMED Hyperbaric Oxygenation

- Mobilizes the patient's own circulating stem cells providing a fertile neurovascular platform for further stem cell related therapies and implantation
- Elevates the amount of dissolved Oxygen into compromised and damaged tissue structures. Accelerates recovery and promotes stabilization of individuals suffering complex and progressive neurodegenerative illness and disease
- Enhances immune capabilities - increasing white blood cell (WBC) and Natural Killer Cell (NK) function; accelerating wound healing and infection control. This has a 'killing' effect which dramatically raises the potential to fight chronic infection and overcome delayed healing
- Accelerates new tissue formation (fibroblast and collagen synthesis – ligaments, disc, muscle and bone structures)
- Increases blood flow into retarded tissue by fostering new blood vessel capillary growth into the damaged and compromised areas. This is called neovascularization
- Activates damaged and non-functional neurons (nerve cells). This is extremely important in chronic injury including spinal cord, brain injury and neurologically impaired patients. Chronic swelling and inflammation deprives vital Oxygen, which results in nerve cells becoming abnormally low in metabolic function. In fact, in many spinal cord and brain injured patients', nerve cells are not completely severed but remain intact. However, the nerve cells are 'non-functional' because of the massive swelling that ultimately results in progressive scar formation because of Oxygen deprivation. Studies have demonstrated by raising the amount of Oxygen efficiency into the damaged area scar formation is reduced, blood flow is improved and dormant, non-functional and damaged nerve cells can be reactivated. Obviously, the best outcome is to start with aggressive HBOT in the early stages of injury
- Reinstates lymphatic drainage creating a 'clearance' effect reducing chronic swelling causing painful inflammation
- Many prescribed drugs, antibiotics and immune stimulating vitamins and amino acids require Oxygen and are in fact greatly enhanced with benefits of Hyperbaric tissue Oxygenation
- HBOT changes cellular metabolism by altering Oxygen deprivation towards Oxygen efficiency at a cellular level; changing the cellular substrate from an anaerobic metabolism (energy poor) into an aerobic metabolism (energy rich). This has a net clearance effect enabling the body at a cellular level to detoxify and reverse the radical accumulation of toxins that ultimately mutate into abnormal cells (including cancer cells)
- Significantly reduces the ability of chronic infections including bacterial, viral and cancer cells to replicate and proliferate. Chronic infections do not survive in a high Oxygenated environment

What Is A Herxheimer Reaction?

The **Herx reaction** occurs when large quantities of toxins are released into the body as chronic underlying bacteria and viral based infections die during Hyperbaric Oxygenation saturation. If you are also undertaking antibiotic treatment the Herx reaction may be heightened!

Typically the death of these bacteria and the associated release of endotoxins occurs faster than the body can remove the toxins. To assist the body clearance - drink plenty of water, minimize alcohol consumption, avoid junk foods, avoid excessive physical activity and get plenty of rest.

Herx reaction is manifested by night sweats, fever, chills, headache, myalgia (muscle pain), diarrhoea and exacerbation of skin lesions. The intensity of the reaction reflects the intensity and chronic nature of inflammation and infection.

Further Clinical Review

Refer to the HyperMED website under Clinical Research

