

## **New Hope for the Neurologic Damaged Child, Cerebral Palsy, Anoxic Ischemic Encephalopathy and Traumatic Brain Injury.**

A new era of therapy is now advancing for the treatment of neurologically disabled children at the Ocean Hyperbaric Center. In the United Kingdom there is a charity for CP (cerebral palsy) and the TBI (traumatic brain injury) child utilizing HBO (hyperbaric oxygen). We understand that a new trial for the same is beginning at McGill University in Montreal.

CP a catchall term describes brain injuries either in utero, at the time of delivery, or in the post partum period. These injuries cause a type of damage to the brain by trauma or by cutting cerebral circulation producing an AIE (anoxic ischemic encephalopathy).

The reason for not giving oxygen (normobaric) to the hypoxic (low oxygen) neonate or premature baby is that surface oxygen may cause a type of blindness called retrolental fibroplasia. The use of hyperbaric oxygen however, does not produce this same effect.

Many children hypoxic at birth are not given HBO to correct the condition with the exception of South America and Russia. The incidence of CP is dramatically less in those areas than in the United States. (Again HBO does not produce the complication of blindness).

Thousands of children have a near drowning episode each year. This leads to a permanent neurologic damaged state ranging from a persistent vegetative coma to being unable to return to society.

TBI may occur at birth, from the shaken baby syndrome, to the battered child, or due to the automobile accidents, etc. Such episodes produce an internal type of brain injury, which again results in many years of care and lack of normal life.

New techniques with brain imaging, especially SPECT (single-photon emission- computed tomography) clearly show the functional status of the brain at a point and time. HBO, that is 100% oxygen at greater than surface pressure, which is administered to children in small sequential doses of 1.5 ATA (about 18 feet below sea level), one hour each, one to two times a day for multiple treatments, depending upon the response. Sequential SPECT scan not only measures blood flow, but also metabolism. Such data has been useful in determining the dose\* of HBO. As the SPECT scans improve, frequently, so do the children. There is about a 90% correlation.

All modalities of Speech, OT, PT, biofeedback and herbal remedies depending on the age are also utilized as a multi disciplinary brain repair regime.

More recent innovations include the use of human growth hormone and alphalearning, which is a composite of biofeedback, audio-visual, and EEG brain balancing technique.

A summary of the effects of HBO both in acute and semi-acute and long-term neurologic conditions are as follow:

HBOT reduces any pressure within the brain caused by swelling, restoring the functions of the blood brain barrier and cell membrane. It neutralizes toxic products in the brain, and over a period of time, enhances growth of new blood vessels. It also acts as a scavenger of free radicals and promotes internal cleaning of debris. HBO also reduces the stickiness of blood products (white blood cells and platelets), and makes oxygen available for use without energy transfer (when the hemoglobin carries oxygen, it requires energy to deliver to the tissue spaces). With HBO the free oxygen is available immediately for metabolic use.

Theoretically the use of HBOT in CP, TBI and in the very young will actually give the brain a jump-start. It also produces an ideal internal environment for the growth of new brain tissue.

There are however many other problems in the neo or perinatal which may be amenable to HBOT. A) Microbial origin (German measles, syphilis, herpes, hepatitis, meningitis, cytomegaly, listeriosis and toxoplasmosis), B) toxicity (thalidomide, purimotamine, psychotropic, carbon monoxide, alcohol abuse and smoking), C) metabolic disturbances (diabetes, malnutrition, hypotension, hemorrhages and eclampsis).

It is hoped that this new innovative approach with scientific documentation will become more available and such children will be treated at the time of injury, rather than waiting for permanent devastating changes to occur.

The following cases represent several of the many cases treated to date at the HBO center. Several hundred cases, with encouraging results, are now under treatment in the UK sponsored by the Hyperbaric Oxygen Trust, (a charity that is dedicated to the treatment of CP in the brain-injured child).

\*(i.e. depth of pressure, length of treatment, frequency and total amount of treatments)

JAIN KK. Textbook of Hyperbaric Medicine. 2nd revised edition USA, Hogrefe & Huber, 1996.

Neubauer RA, Walker M. Hyperbaric oxygen therapy. USA, Avery, 1998.

Machado JJ. Reduction of spasticity, clinically observed in patients with neurological diseases, submitted to hyperbaric oxygen-therapy specially children with cerebral palsies. Presented at: New Horizons in Hyperbaric Medicine, Orlando, Florida, April 26-30, 1989.

Zerbini, Solonay. Personal communication. (city), 1998.

## Cases:

DW (Figs 1A & 1B): 3 year old white male suffered perinatal hypoxic ischemic encephalopathy with renal failure consisting of acute tubular necrosis, thrombocytopenia, sepsis, respiratory insufficiency, hypovolemia and apnea related to seizure disorder. The CT scan showed progressive cortical atrophy.

It is remarkable that this patient survived with the multiple illnesses. The patient received 21 treatments of HBO and is now able to sit up, hold a cup for the first time in his life and is more attentive. He is much more alert, makes new vocal sounds, is more aware of his surroundings and is beginning to grab at everything. These changes parallel SPECT scan imprint. It is hoped that future HBO treatments will be available with all types of supportive therapy.

DS (Figs 2A & 2B): 4 year old white male was seen with a severe traumatic birth, which caused a left mid cerebral rupture and then further developed Lennox-Gastaut syndrome (severe seizure disorder). He was seen four years later and had been continuously receiving PT, OT, and SP three days per week.

He had done well on a ketogenic diet and developed the ability to chew. On the daily scale of infant development, mental status, he was less than 50 (normal = 90-110) basically with about an eight month level. He was seen with a spastic paraplegia, barely able to ambulate with assistance. The patient received 92 HBO treatments and improved dramatically. The patient has become very much more active, following more commands, beginning to use his right hand to hold things, responds to his name and now able to run, but still with a slight limp.

TB (Figs 3A & 3B): 8 year old girl in motor vehicle accident, closed head trauma and 3 mo coma, total occlusion of the R mid-cerebral artery and spastic hemiparesis on the left. She wore a brace, had severe limp, speech deficits and was slow mentally, although attempting to go to school. SPECT scan showed an extensive deficit or complete infarct with the R middle cerebral artery distribution. She was seen 11 months post incident. SPECT scan before and after HBO showed substantial improvement. She was only able to stay for 24 treatments, but with HBO along with therapy, she was able to remove the brace. She became sharp mentally and was able to almost enter into full activities with other children. She was most pleased to become more socially accepted by her peers.

From: Neubauer RA, Uszler JM, James PB. Hyperbaric oxygenation: The recoverable brain in certain pediatric patients. (conference)

Case EC. A 2 1/2 year old boy was seen 1 1/2 months after a near-drowning episode. The child hit his head and fell into the swimming pool. It is not known how long he was submerged. The family was told that the child was blind and he presented in a persistent vegetative state with severe spasticity on the left side and hypomobility of the right leg. He was fed by PEG tube. Initial SPECT imaging showed extensive and

symmetrical deficit throughout frontal, temporal, parietal and occipital lobes. After three treatments with hyperbaric oxygen therapy the patient began moving more, trying to speak, and "acting up" when angry. The patient began crying with tears for the first time after 16 treatments. After 26 treatments the patient was smiling, much more alert, laughing, crying, sleeping much better and laughing while dreaming. Following 34 treatments the patient was more aware, developing much more eye contact and was clearly not blind. To-date the patient has received 199 treatments and now sees clearly, is speaking bi-lingually, standing and taking a few steps. He is now able to eat and drink normally. He was given back a life.

From: Neubauer RA, James PB. Cerebral oxygenation and the recoverable brain. *Neuro Res*: 20 (Suppl 1) S33-S36, 1998.