

What is a Concussion: **Concussion is a Traumatic Brain Injury.**

- Post-concussion syndrome (PCS), Mild Traumatic Brain Injury (MTBI) or Traumatic Brain Injury (TBI) generally occur with a jolt or impact to the head.
- A complex injury symptoms are said to be a result of:
 - Changes to the chemistry of the brain altering the delicate balance of our brains neurotransmitters,
 - Change in the blood flow to the brain
 - Swelling (inflammation) of the brain.
 - Bruising of the brain
 - Tearing of blood vessels
 - Injury to the nerves

Brain injury symptoms can be physical, cognitive and emotional.

- **Physical symptoms include:** headache, dizziness, nausea, fatigue, dizziness or dazed, noise and light sensitivity, visual disturbances, ringing in the ears, double vision.
- **Cognitive symptoms include:** confusion, amnesia, impaired reasoning skills, rigid thinking, disorientation, poor concentration, and memory disturbance.
- **Emotional symptoms include:** feeling of depression or moodiness, anxiety, irritability.
- **Physical signs of concussion include:** loss or impaired consciousness, poor coordination or balance, easily distracted, paralysis of the limbs, poor concentration, slowness answering questions and following directions, vomiting, loss of vision and/or hearing, speech impairment, seizures, personality or behavior changes and significantly decreased performance or playing ability.

Please remember that not all concussions will display all of these symptoms. If you are experiencing any of the above mentioned symptoms/signs, contact your primary physician immediately.

Hyperbaric Oxygen Therapy and Concussions

Medical studies, Athletes and individuals are reporting significant improvements in Post-Concussion Syndrome (PCS), Traumatic Brain Injuries (TBI) with the use of hyperbaric oxygen therapy. HBOT has shown to:

- **Reduce Hypoxia (low oxygen levels)**
- **Reduce inflammation**
- **Energize cells damaged by low blood flow**
- **Stimulate release of stem cells**
- **Restore neural cells & neural pathways that re-enable memory & data processing ability**

- **Significantly decrease overall concussion symptoms.**
- **Dramatically increasing cognitive abilities**
- **Improve recovery in affected motor skills**

Hyperbaric Oxygen simply means oxygen given at increased barometric pressure.

The Problem

The complex and almost continuous electrical activity of the brain is so discreet that we are unaware that it is the mechanism behind communication and thus intellectual and motor function. Brain injury can lead to a blockage of the electrical pathways. Depending on the location of the injury, the brain's attempts to re-route through blocked pathways may cause frustrated discharges of activity known as seizures.

What Causes the Blockage?

SPECT scans (computerized brain mapping) show that not only does brain injury produce cell death, but it also reduces essential blood flow to a wider area of brain tissue surrounding the dead cells where signal re-routing might be expected to take place.

How Does This Happen?

After brain injury many blood capillaries around the area of cell death become torn open. The liquid part of the blood (the plasma) then leaks out, causing a swelling that may be very extensive. This reduces cerebral blood flow in the affected areas. Reduction in blood flow means a reduction of essential nutrition (most vital oxygen), and a buildup of waste products from local biochemical reactions (e.g. lactate and calcium), which shuts down normal cell function and further blocks pathways.

Why Doesn't Capillary Healing Happen?

If the capillaries are to heal, they desperately need oxygen. Unfortunately, the tiny tubules leading to the torn capillaries become constricted because of the damage. This means that the red blood cells needed to bring the healing oxygen are too big to get through and simply get stuck in the "pipes." Thus, the plasma that is normally very low in oxygen continues to pour out, maintaining the swelling with all its related problems which, if left unattended, would last for a lifetime.

Effects of Hyperbaric Oxygenation Therapy on Cerebral Metabolism and Intra-cranial Pressure in Severely Brain Injured Patients.

J Neurosurg 2001 Mar;94(3):403-11.

Please note that HDOT/HBOT has been substituted for HBO in this summary.

A prospective randomized trial has already shown that hyperbaric oxygenation therapy (HDOT)HBOT reduces the mortality of severely brain injured patients by 50%. In this study the effects of HDOT on cerebral blood flow (CBF), cerebral metabolism, and intracranial pressure (ICP), have been measured in an attempt to determine the optimum frequency of treatment. 100% at 1.5 atm – 1.75 absolute was delivered to 37 patients for 60 minutes every 24 hours (maximum of seven treatments/patient). The increased cerebral metabolic rate of oxygen (CMRO₂) and decreased cerebrospinal fluid (CSF) lactate levels after treatment indicate that HDOT/HBOT may improve aerobic metabolism in severely brain injured patients. This is the first study to demonstrate a prolonged effect of HDOT/HBOT treatment on CBF and cerebral metabolism. On the basis of their data the authors suggest that shorter, more frequent exposure to HDOT/HBOT may be better.

Comments

1. The authors have not acknowledged that Sukoff and Ragatz actually showed this nearly 20 years ago. Ref: Sukoff MH and Ragatz RE: Hyperbaric oxygenation for the Treatment of Acute Cerebral Edema. Neurosurgery 1982;10: 29-38).
2. One hour of a higher dosage of oxygen in 24 hours is not enough. A total of at least 16 hours in 24 has been given at 2 atm abs in the resuscitation of a patient after cardiac surgery. Ref. Yacoub MH, Zeitlin GL. Hyperbaric Oxygen in the Treatment of the Post Operative Low-Cardiac-Output Syndrome. Lancet 1965; i: 581-83.
3. Giving more oxygen (HDOT)HBOT in the presence of a lack of oxygen is likely to improve the CMRO₂, that is the brain's use of oxygen.
4. The presence of lactate indicates that there is not enough oxygen for (normal) aerobic (air related) metabolism and giving some more (HDOT) allows more normal (aerobic) metabolism. Ref. No reference is needed here either.....I wonder what a physicist would make of this?

Dr P.B. James MB ChB DIH PhD FFOM
Wolfson Hyperbaric Medicine University of Dundee

The most fundamental parameter in determining recovery from any brain injury - whether sustained at birth or at the other end of life is the level of oxygen available. All tissue injury (including surgery) not only causes damage to the tissue itself, it also damages the blood supply and therefore may compromise oxygen delivery. In this condition the universal prescription is to increase the oxygen supply to the tissues and the rate limiting factor is the plasma tension. To suggest that to ensure adequate oxygenation should not be a universal prescription for hypoxia is the same as the suggestion that the administration of water should not be universal in the multifactorial causation of dehydration.

Philip James MD

Hyperbaric oxygen therapy accelerates neurologic recovery after 15-minute complete global cerebral ischemia in dogs.

Crit Care Med 1992 Nov;20(11):1588-94 (ISSN: 0090-3493)

Takahashi M; Iwatsuki N; Ono K; Tajima T; Akama M; Koga Y Department of Anesthesiology, Tohoku University School of Medicine, Sendai, Japan.

BACKGROUND AND METHODS:

Although hyperbaric oxygen therapy is clinically used for the treatment of several types of ischemic brain injury, few basic animal studies are available that provide a rationale for this therapy for complete global brain ischemia. Therefore, we investigated the effect of hyperbaric oxygen therapy on neurologic recovery after 15-min complete global cerebral ischemia in a canine model. Complete global ischemia was induced in 19 dogs by occlusion of the ascending aorta and the caval veins. Nine dogs were randomized to treatment with hyperbaric oxygenation (3 atmospheres absolute, 100% oxygen for 1 hr) at 3, 24, and 29 hrs after ischemia under spontaneous respiration, while the other ten dogs served as the control group without hyperbaric oxygen therapy (group C). Neurologic recovery was evaluated based on the electroencephalogram (EEG) activity score (1 = normal; 5 = isoelectric) and the neurologic recovery score (100 = normal; 0 = brain death) over a 14-day postischemic period. RESULTS: The survival rates were 3/10 (30%) in the control group vs. 7/9 (78%) in the group treated with hyperbaric oxygen ($p < .05$). Over the 14-day postischemic period, the best (lowest) EEG scores of each dog were significantly (1.7 ± 0.2 vs. 2.9 ± 0.3 ; mean \pm SE, $p < .01$) lower in the hyperbaric oxygen-treated group. The best neurologic recovery scores of each dog were significantly (69 ± 6 vs. 48 ± 5 ; mean \pm SE, $p < .05$) higher in the treated animals. The number of dogs that recovered to a neurologic recovery score of > 65 (assessed as a slight disability) were 1/10 in the control group and 6/9 in the group treated with hyperbaric oxygen ($p < .02$). CONCLUSIONS: Hyperbaric oxygen therapy performed in the early postischemic period accelerated neurologic recovery and improved the survival rate in dogs after 15-mins of complete global cerebral ischemia.

Hyperbaric Oxygenation can repair and restore damaged brain -The Impact of Hyperbaric Medicine on Government Health Care, Disability and Education Expenditures

Dr Paul Harch

Reprinted below is a Medical Bulletin of immense importance to parents and caregivers of small children with Cerebral Palsy, Autism and similar Neurodevelopmental Disorders, caused by brain cell damage and/or reduction of blood flow to brain during a critical period in the past.

Please read the testimony (below) on **Dr. Paul Harch's** very recent presentation on "**The Impact of Hyperbaric Medicine on Government Health Care, Disability and Education Expenditures**" which was brought before the Labor, Health and Human Services and Education Subcommittee Of the Committee on Appropriations, United States House of Representatives.

"The Impact of Hyperbaric Medicine on Government Health Care, Disability and Education Expenditures"

The International Hyperbaric Medical Association, Paul Harch, M.D. President

Before the Labor, Health and Human Services and Education Subcommittee Of the Committee on Appropriations, United States House of Representatives May 2, 2002

Chairman Regula, Mr. Obey, and distinguished members of this committee, I am Dr. Paul Harch, President of the International Hyperbaric Medical Association, and a resident of Louisiana. Bob Livingston was my Congressman. Two years ago, Mr. Istook of Oklahoma started the Hyperbaric Oxygen Initiative at the National Institutes of Health. Many of his constituents have become my patients, one of whom I will present today for the first time in a public setting.

We were all taught that brain cells don't regenerate. Four years ago, NIH announced to this panel that medicine had been in error all of these years and challenged the medical community to begin searching for a way to do so. Hyperbaric Medicine has been repairing brain injuries right here in America for 30 years, but no one would look at it because everyone "knew" that it was not possible.

Hyperbaric oxygen therapy (HBOT) involves the delivery of \$7 worth of oxygen in a pressurized environment created by a chamber. Some of these chambers are the size of this table, and others are the size of a small room. **The pressure serves to saturate the tissues of the body, not only the hemoglobin in the blood, but the plasma, lymph and cerebral spinal fluid, all of which go many places that hemoglobin cannot reach, especially in cases of traumatic injury.** The average treatment takes 1 to 1 ½ hours and Medicare reimburses at \$75 per ½ hour of treatment, plus a \$35 physician attendance fee.

Bob Moffitt, Director of Domestic Policy at the Heritage Foundation said, "Congress should authorize an intensive evaluation of Hyperbaric Oxygen Therapy with a view in order to determine its cost effectiveness and its contributions to high quality care." It is in the federal government's financial interest to do so.

I know you have many conflicting priorities Mr. Chairman, and Ms. Pelosi has often said this committee's decisions often involve "the lambs eating the lambs." Unlike many who have testified before the committee, I am not here asking for more money, I'm here to save you money. In the words of one distinguished public health official, "zillions of dollars." This money could be used to fund other pressing priorities and even return some to the taxpayers.

Let me give you a few examples.

40% of my practice is neurologically injured children. You would consider them IDEA children, who cost on average, 2.1 times as much to educate as a non-injured child.

There are 6.548 million IDEA children in the nation, and this year the President has asked for a budget of \$8.5 billion to pay for 18 percent of the obligations of the federal government to the states. These children are costing the state's educational system \$47 billion, for a total of \$55.7 billion. On average, nationally, **they cost \$8,510 more per year to educate than a "normal" child.** Many cannot learn due to their injuries.

The therapy I am here discussing would cost an average, one time expenditure of between \$7,000 and \$14,000 for most children treated long after the injury, the cost of educating them for a year or two. The effects would be permanent and last throughout their lifetime. For many of these children, if they had been treated immediately upon injury, the costs drop to often less than \$1,000. [Pages 4, 5, 6, 8, 10, 15, 17]

Many of these children have neurological injuries that affect their motor skills, learning, speech, etc. They are children injured in birth trauma, accidents, child abuse, fetal alcohol syndrome, maternal drug use, or other such events.

Current practice deals with the brain that is still there and tries to re-train it. The therapy we are discussing has effectively recovered and rebuilt brain tissue through reactivation of stunned tissue, revascularization and, possibly, stimulation of adult stems cells in the brain to repair existing neural pathways and grow new ones.

Follow many of these children into adulthood, and you discover that many wind up in prison, on welfare, Social Security Disability, in long-term care facilities at state or insurance company expense or become a drain on the system in some other fashion. Many of these children suffering from Mental Retardation or Developmental Disabilities, when they grow to adulthood, cost, on average, \$43,000 per year in group home or institutional settings. (3.8 million, 59% under 17, 38% between 17 & 64).

My hyperbaric medical practice has demonstrated that nearly all of these children can be helped, including many with genetic disorders, and many, many, can lead full, normal and productive lives. This is something current medical practices cannot provide for most of them. [Page 9]

I also serve as a prison physician, and can tell you that many prisoners suffer from a neurological injury incurred prior to incarceration and seizure disorders secondary to those injuries. The injury often drives their violent and irrational behavior. The Department of Justice has reported that up to 20% of the inmates report some type of mental impairment. In New Orleans, Louisiana we have a substantial number of our 7,500 inmates in our prison population with seizure disorders. Many ore have experienced head trauma. [Page 13]

Hyperbaric medicine significantly affects other areas of your committee. For example, in patients with diabetic foot wounds, hyperbaric oxygen has been shown to decrease major amputations by over 75%. There are currently 54,000 amputees on the Social Security Disability Income or SSI roles, at an average cost of \$8,467 per year. Many of these amputations could have been prevented through acute and chronic treatment of their medical condition with Hyperbaric Oxygen prior to amputation. Congressman Istook's Deaconess Wound Care Center has less than a 1% amputation rate for those who receive Hyperbaric Treatment. CMS is deciding in 90 days whether amputations or treatment with Hyperbaric Oxygen is more cost effective. All of the other major insurance companies, including Blue Cross/Blue Shield already pay for diabetic wound treatment.

In addition, the latest JAMA article on heart by-pass surgery showed that 30% of those undergoing this procedure have residual brain damage, which could be largely solved by a single \$225 Hyperbaric treatment. Further treatments applied under a surgical protocol could possibly heal patients between 25% and 50% faster, concurrently reducing costs to the insurance company, the government, malpractice insurance and physicians time and fees. The Navy has applied HBOT to fractures and returned many soldiers to duty who would have otherwise been discharged from service, saving the VA hundreds of thousands over the life of a veteran.

In the year 2000, the government spent 5.5 billion Medicare dollars on strokes, or \$3,169 per patient, with little hope of full recovery. Hyperbaric medicine, especially acute treatment, cost effectively offers many such hope. Even chronic stroke patients can experience significant improvement in function and quality of life. [Pages 11, 12]

Social Security disability currently has 61,500 brain injured people on the Disability or SSA roles at a cost of \$8,459 per person per year. Many of these people could be returned to full and productive lives.

Research from health pioneer (and former ANH-USA board member) Dr. Paul G. Harch published in the *Journal of Neurotrauma* indicates that hyperbaric oxygen therapy, or HBOT, is able to dramatically help veterans with post-concussion syndrome (a form of traumatic brain injury) and post-traumatic stress disorder (PTSD). Dr. Harch is an associate clinical professor of medicine at Louisiana State University in New Orleans.

Since January 2007, ANH-USA has been bringing attention to a project to have veterans treated with HBOT. In HBOT, the patient is put in a hyperbaric oxygen chamber, which saturates the tissues with twelve times more oxygen than can be absorbed by breathing. This greatly enhances the body's own healing process.

Under normal circumstances, oxygen is transported throughout the body only by red blood cells. With HBOT, oxygen is dissolved into all of the body's fluids, the plasma, the central nervous system fluids, the lymph, and the bone, and can be carried to areas where circulation is diminished or blocked. In this way, extra oxygen can reach all of the damaged tissues and the body can support its own healing process. The increased oxygen greatly enhances the ability of white blood cells to kill bacteria, reduces swelling, and allows new blood vessels to grow more rapidly into the affected areas. It is a simple, non-invasive, and painless treatment.

According to Dr. Harch's new study, even three years after the vets sustained brain injury, one month of HBOT was able to induce improvements in brain blood flow, cognition, symptoms, and quality of life, while the veterans experienced fewer suicidal thoughts.

Specifically, improvements were seen in 92% of vets experiencing short-term memory problems, 87% of those complaining of headaches, 93% of those with cognitive deficits, 75% with sleep disruption, and 93% with depression. There were also improvements in irritability, mood swings, impulsivity, balance, motor function, IQ, and blood flow in the brain, as well as the reduction in PTSD symptoms and suicidal thoughts. And there was a reduction in—or complete elimination of—psychoactive and narcotic prescription medication usage in 64% of those previously prescribed the medication.

One major problem is that the HBOT treatment is currently “off-label.” In other words, it is an FDA-approved treatment for some conditions—but not for traumatic brain injury (TBI) or PTSD. Because of this, the Department of Defense does not allow HBOT to be prescribed for its veterans—they say they don't prescribe off-label medications and treatments for these diagnoses, and claim that they can only use HBOT after it has been approved by the FDA for this use.

This is a completely false and misleading statement! The Department of Defense often uses off-label antipsychotic drugs for treatment of TBI and PTSD. This should not surprise us. The FDA receives a large proportion of its budget from pharmaceutical manufacturers. And the government turns to drugs, often very inappropriate and damaging drugs, to treat damaged veterans without even considering alternatives.

Nearly 280,000 individuals received antipsychotic medication in 2007. Yet over 60% of them had no record of a diagnosis for which these drugs are approved. Antipsychotic drugs were prescribed off-label for PTSD (42% of the patients), minor depression (40%), major depression (23%), and anxiety disorder (20%)—with about 20% having more than one condition. About 20% of veterans diagnosed with PTSD—or nearly 87,000 patients—are prescribed an antipsychotic each year even though it is an off-label use.

TBI and PTSD severely and disproportionately affect military who have served in Iraq and Afghanistan—approximately 546,000 have TBI, post-concussion syndrome (PCS), and PTSD, and yet their treatment options are limited. HBOT is an effective and economical treatment for PCS and PTSD, without the very dangerous and negative side effects of antipsychotic medication.

The off-label use of HBOT is a huge freedom of choice issue in medicine. But even more important, if we *really* want to support our troops rather than just pay lip service, don't we need to give them the safest, most economical, and most effective treatment for their traumatic brain injuries and PTSD?

Teen suffering from concussion sees improvement with hyperbaric treatment

Posted on December 5, 2012 at 10:40 PM

Dennis Woltering / Eyewitness News

HARVEY, La. -- It was March 2010 when another player hit Nate Geller in the back of the head with a lacrosse stick.

"I fell down and I got back up and I fell back down because I was dizzy," he said. But he continued playing, and his injury to his brain got worse. The next day, he said, he had a huge headache, had trouble keeping his balance and was losing his ability to see clearly.

"My peripheral vision was spinning and blurry," he said. "It's like when you spin around in a circle you kind of lose your balance. It was kind of like that." He said it got worse as he lost the ability to concentrate. He couldn't go to school full time. His mother said a series of doctors told him for more than a year there wasn't much they could besides prescribing Ritalin and narcotics.

"They said, you know, he's not going to get better," said Eileen Geller, Nate's mother.

As we showed you in our first story about Nate last May, when they finally sought out hyperbaric oxygen treatment a year ago, Dr. Paul Harch videotaped Nate's difficulty walking.

"Walking very gingerly, couldn't see well, his balance was off, having trouble cognitively expressing himself," Harch said. "A kid whose life had been significantly altered."

After the first hyperbaric treatment, Eileen Geller said, "Nate came out and said, 'Mom, I feel better already.'" They say a full battery of treatments led to dramatic improvement.

"And Nate this fall was able to go to full-time school. He read the hunger games," Eileen Geller said. "In general it has helped improve focus, headaches, balance," Nate Geller said. Harch said "he's a different person." "I mean he's almost back to his previous life and level of function."

Nate's back this week getting a treatment boost after some symptoms started coming back. Harch said the oxygen treatment repairs tissue damage and could be part of the answer for pro football players who suffer brain injuries on the field.

"With acute concussion when you can do this very, very early," Harch said, "and it's remarkable amelioration of their symptoms and improvement."