

Treating Traumatic Brain Injury with Hyperbaric Oxygen Therapy (HBOT)

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THE IMPROVEMENT OF SPEECH AND LANGUAGE DEFICITS IN 3 APHASIC STROKE PATIENTS BY HBO THERAPY—

A Preliminary Study. Shirachi DY, Hoggard ML and Johnson KE
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INTRODUCTION

We have previously presented a case history at this meeting on the effect of hyperbaric oxygen (HBO) in a 3 year post-stroke aphasic female patient (1). HBO treatment evaluated by the Boston Diagnostic Aphasic Examination (BDAE) showed improvements in following commands and complex ideational material of the auditory comprehension subtests and oral agility, recitation, visual confrontation naming, and oral sentence reading of the oral expression subtests. We now report on the improvement of speech and language deficits observed in 3 aphasic stroke patients by HBO treatment when evaluated by BDAE.

METHODS

The patients were long-term post-stroke and diagnosed aphasic. These patients were treated in a multiplace chamber at 1.5 ATA for 60-90 minutes for 30-40 treatments. The treatments were administered during the week with the weekends off. The BDAE was administered before and after HBO therapy by a speech-language pathologist, who was independent of Chico Hyperbaric Center. All protocols were followed according to the Declaration of Helsinki and the patients signed an informed consent form detailing the treatment and patient rights.

RESULTS

HBO increased the % proficiency levels of auditory comprehension subtests in following commands from 71.0 to 93.0 and in complex ideational materials from 52.7 to 74.3, increases in function of 31% and 41%, respectively.

HBO increased the % proficiency levels of oral expression subtests in nonverbal agility from 58.3 to 77.7 and in oral sentence reading from 63.3 to 83.3, reflecting increases in function of 33.3%, and 31.6%, respectively. HBO treatment significantly increased the proficiency levels of subtest in verbal agility from 50.0 to 79.7 in recitation, singing and rhythm from 43.0 to 76.3 in repeating phrases (high probability) from 45.7 to 70.7; and in repeating phrases (low probability) from 24.7 to 66.7, showing increases in function of 59.4%, 77.4%, 54.7% and 170%, respectively. HBO had very little effect on the % proficiency levels in understanding written language.

DISCUSSION

HBO appears to be relatively effective in improving deficits in auditory comprehension and oral expression of long-term aphasic post-stroke patients. Deficits in understanding written language were essentially not affected. It is not clear how these changes in function might have occurred. What is clear is that these changes occurred over time. This suggests that what must be involved is gene regulation of specific signaling pathway(s) which affect the various aspects of aphasia. What is also apparent is that the HBO effects observed in this report do not require continuous elevated levels of tissue O₂ to maintain the resulting changes.

One probable mechanism that might be invoked is the involvement of vascular endothelial growth factor (VEGF). HBO has been linked to increased VEGF and wound healing (2). In addition VEGF administered by intracerebroventricular injection into the brain in vivo has been shown to stimulate neurogenesis (3). And finally, VEGF applied directly into the dorsal hippocampus increased neurogenesis and facilitated learning and memory (4). Thus, it is possible that HBO increased neovascularization and neurogenesis in the brain via VEGF.

CONCLUSIONS

The results of this study show that (a) BDAE is an effective method of evaluating long-term aphasic stroke patients; (b) HBO therapy improves many aspects of speech and language deficits observed in these stroke patients; and (c) there is a need to study the HBO effect with more patients to further evaluate the effectiveness of HBO therapy on stroke-induced aphasia.

REFERENCES

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2. Sheikh AY, Gibson JJ, Rollins MD, Hopf HW, Hussain Z, Hunt TK. Effect of hyperoxia on vascular endothelial growth factor levels in a wound model. Arch Surg 2000;135:1293-7.
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Neuroprotective effect of hyperbaric oxygen therapy in brain injury is mediated by preservation of mitochondrial membrane properties.

Brain Res. 2008 Jul 24;1221:126-33. Epub 2008 May 11.

- Palzur E, Zaaroor M, Vlodaysky E, Milman F, Soustiel JF.

Acute Brain Injury Research Laboratory, Faculty of Medicine,
Technion Israel Institute of Technology, Haifa, Israel.

Recent experimental data have shown that hyperbaric oxygen therapy (HBOT) was associated increased Bcl-2 expression at the injury site that correlated with reduced apoptosis. We hypothesized that HBOT mediated enhancement of Bcl-2 expression and increased intracellular oxygen bio-availability may both contribute to preserve mitochondrial integrity and reduce the activation of the mitochondrial pathway of apoptosis. For this purpose, a cortical lesion was created in the parietal cortex of Sprague-Dawley rats by dynamic cortical deformation (DCD) and outcome measures in non-treated animals were compared with that of HBOT treated rats. Morphological analysis showed a profound reduction in neuronal counts in the perilesional area and a marked rarefaction of the density of the axonal-dendritic network. In treated animals, however, there was a significant attenuation of the impact of DCD over perilesional neurons, characterized by significantly higher cell counts and denser axonal network. In mitochondria isolated from injured brain tissue, there was a profound loss of mitochondrial transmembrane potential ($\Delta\psi(M)$) that proved to be substantially reversed by HBOT. This finding correlated with a significant reduction of caspases 3 and 9 activation in HBOT treated animals but not of caspase 8, indicating a selective effect over the intrinsic pathway of apoptosis. All together, our results indicate that the neuroprotective effect of HBOT may represent the consequence of preserved mitochondrial integrity and subsequent inhibition of the mPTP and reduction of the mitochondrial pathway of apoptosis.

PMID: 18561900 [PubMed - indexed for MEDLINE]

Hyperbaric oxygen therapy protects against mitochondrial dysfunction and delays onset of motor neuron disease in wobbler mice

Available online 4 June 2003. - K. R. Dave, R. Prado, R. Busto, A. P.

Raval, W. G. Bradley, D. Torbati and M. A. Pérez-pinzón

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Abstract

The Wobbler mouse is a model of human motor neuron disease. Recently we reported the impairment of mitochondrial complex IV in Wobbler mouse CNS, including motor cortex and spinal cord. The present study was designed to test the effect of hyperbaric oxygen therapy (HBOT) on (1) mitochondrial functions in young Wobbler mice, and (2) the onset and progression of the disease with aging. HBOT was carried out at 2 atmospheres absolute (2 ATA) oxygen for 1 h/day for 30 days. Control groups consisted of both untreated Wobbler mice and non-diseased Wobbler mice. The rate of respiration for complex IV in mitochondria isolated from motor cortex was improved by 40% ($P < 0.05$) after HBOT. The onset and progression of the disease in the Wobbler mice was studied using litters of pups from proven heterozygous breeding pairs, which were treated from birth with 2 ATA HBOT for 1 h/day 6 days a week for the animals' lifetime. A "blinded" observer examined the onset and progression of the Wobbler phenotype, including walking capabilities ranging from normal walking to jaw walking (unable to use forepaws), and the paw condition (from normal to curled wrists and forelimb fixed to the chest). These data indicate that the onset of disease in untreated Wobbler mice averaged 36 ± 4.3 days in terms of walking and 40 ± 5.7 days in terms of paw condition. HBOT significantly delayed ($P < 0.001$ for both paw condition and walking) the onset of disease to 59 ± 8.2 days (in terms of walking) and 63 ± 7.6 days (in terms of paw condition). Our data suggest that HBOT significantly ameliorates mitochondrial dysfunction in the motor cortex and spinal cord and greatly delays the onset of the disease in an animal model of motor neuron disease.

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Improving neuropsychological function after chronic brain injury with hyperbaric oxygen.

Golden Z, Golden CJ, Neubauer RA. - University of Florida. Purpose. One suggested treatment for chronic brain injury (CBI) is the use of hyperbaric oxygen therapy (HBOT). The present study was an evaluation of neuropsychological improvement after HBOT in CBI patients.

Method

Study 1 compared test - retest results of 21 CBI children treated with HBOT against test - retest results of 42 untreated brain injured and normal children.

Study 2 compared 21 CBI adults treated with HBOT against 42 untreated normal and brain injured adults.

In each study, subjects received pre and post assessments to evaluate neuropsychological function.

Results

The HBOT-treated children showed significant improvement when compared with the two control groups on measures of daily living, socialization, communication, and motor skills. The treated adults made significant gains in all neuropsychological areas tested as compared to controls.

Conclusion

The studies were strongly supportive of HBOT as a treatment for lessening the neurological impact of CBI. These studies indicate that HBOT can be an effective aid in ameliorating the neuropsychological and physiological effects of CBI. The absence of a clear sham HBOT treatment group is an issue as it could be that there was a placebo effect, but it should be noted that the controls were receiving more traditional interventions during the study.

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Medical Studies/Resources

Brain Injury

Case Study

Abstract: The near drowning of a 3 year old resulted in the child being wheel chair dependent, mental retardation. At 17 years of age, the patient received 52 HBOT sessions ensuing significant improvement. After 200 HBOT sessions the subject now walks upstairs with support, speaks English and Spanish.

Case Study

Abstract: All patients experienced a normal birth. The group consisted of a 4 year old encephalopathy (viral encephalitis infection) and a 6 year old which was in a coma for 3 months. After 4 HBOT sessions there was a decrease in spastic and sporadic movements. After 20 sessions, each patient experienced increased independence; increased use of arms and legs and ability to walk; using toothbrush, juice cup, feeding self; increased interaction, eye contact, smiles, more playful; increased verbal; and decreased drooling.

Golden ZL, Neubauer R, Golden CJ, Greene L, Marsh J, Mleko A. "Improvement in cerebral metabolism in chronic brain injury after hyperbaric oxygen therapy." Ocean Hyperbaric Center, Nova Southeastern University, 3301 College Avenue, Fort Lauderdale, FL 33314, USA.

Abstract: While no research study has yet demonstrated convincing evidence for the efficacy of Hyperbaric Oxygen Therapy (HBOT) in patients with chronic neurological disorders (CND), anecdotal studies have been supportive of its use in improving healing of the damaged brain. The current study hypothesized that (1) individuals with CND show increases in cerebral blood flow and metabolism as measured by Single Positron Emission Computed Tomography (SPECT) in the cerebral hemispheres, but not on measures of cerebellar and pons blood flow; and (2) younger patients show more improvement than older patients. The study used archival data to compare 25 older and 25 younger subjects who were given SPECT scans pretherapy, midtherapy, and posttherapy. ANOVAs using the SPECT scans as a within subjects variable and age as a between subjects variable confirmed the hypothesis that the cerebral measures all changed but that the cerebellar and pons measures did not. Post-hoc t-tests confirmed that there was improvement in blood flow from the beginning to the end of the study. An age effect was found on only two of the five measures; however, there were no interactions. Analysis by post-hoc t-tests showed that the younger group had higher blood flows, but not more improvement than the older group. The results provided the first statistical research data to show the effectiveness of HBOT in improving blood flow in CND. These results indicate that HBOT can be an effective part of the treatment for such clients.

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Dr. Gunnar Heuser, MD, PhD, FACP, Clinical Study: Mild Hyperbarics for Impaired Brain Function

Abstract: Nine patients with exposure to chemical, pesticides, and solvents experienced impaired brain function. The symptoms included decreased memory and attention, and poor balance. After 10 HBO treatments at 1.3 ATA all patients reported improvement. The SPECT revealed improved blood flow and metabolism to brain tissue. HBOT is the most effective treatment for acute and chronic brain injury.

Neubauer, Richard S.; Gottlieb, Sheldon F. Southern Medical Journal, Sept 94, Vol. 87 Issue 9, p 993-996.

Abstract: Traumatic and vascular brain injuries result in the destruction of neurons and to a varying extent the formation of idling neurons. With the use of single photo emission computed tomography the presence of idling neurons and potentially recoverable brain tissue. The conclusion of all therapeutic departments was that HBO therapy and rehabilitative intervention resulted in significant improvements in all areas of previously identified deficits.

Study 1985

Abstract: Twenty coma patients were administered 80-120 HBOT treatments at 1.5 ATA. The length of coma ranged from 3-27 months. Fifty percent of the patients improved from treatment, 35% became self-sufficient, and all experienced less post-coma psychosis.

Calvert JW; Yin W; Patel M; Badr A; Mychaskiw G; Parent AD; Zhang JH. "Hyperbaric oxygenation prevented brain injury induced by hypoxia-ischemia in a neonatal rat model." Brain Research 2002 Sep 27; 951 (1), pp. 1-8.

Abstract: The occurrence of hypoxia-ischemia (HI) during early fetal or neonatal stages of an individual leads to the damaging of immature neurons resulting in behavioral and psychological dysfunctions, such as motor or learning disabilities, cerebral palsy, epilepsy or even death. No effective treatment is currently available and this study is the first to use hyperbaric oxygen (HBO) as a treatment for neonatal HI. Herein, we sought out to determine if HBO is able to offer neuroprotectivity against an HI insult. Seven-day-old rat pups were subjected to unilateral carotid artery ligation followed by 2.5 h of hypoxia (8% O₂) at 37 degrees C). HBO treatment was administered by placing pups in a chamber (3 ATA for 1 h) 1 h after hypoxia exposure. Brain injury was assessed based on ipsilateral hemispheric weight divided by contralateral hemispheric weight, light microscopy, and EM. Sensorimotor functional tests were administered at 5 weeks after hypoxia exposure. After HI, the ipsilateral hemisphere was 52.65 and 57.64% (P<0.001) of the contralateral hemisphere at 2 and 6 weeks, respectively. In HBO treated groups, the ipsilateral hemisphere was 77.77 and 84.19% (P<0.001) at 2 and 6 weeks.

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There was much less atrophy and apoptosis in HBO treated animals under light or electron microscopy. Sensorimotor function was also improved by HBO at 5 weeks after hypoxia exposure (Chi-square, $P < 0.050$). The results suggest that HBO is able to attenuate the effects of HI on the neonatal brain by reducing the progression of neuronal injury and increasing sensorimotor function.

Soldiers' Brain Injuries Going Untreated, Expert Says

BY WINNIPEG FREE PRESS, APRIL 24, 2008

Doctors and psychologists are missing the hidden signs of brain trauma in soldiers returning from war, a military health expert says.

WINNIPEG — Doctors and psychologists are missing the hidden signs of brain trauma in soldiers returning from war, a military health expert says. Dr. Harriet Zeiner, a neuropsychologist at a Veteran's Affairs trauma centre in California, said traumatic brain injury has become more prevalent as the tools of warfare have evolved from bullets to roadside bombs. Zeiner spoke Thursday at a military trauma conference for health professionals in Winnipeg. The conference is aimed at addressing ongoing problems with Canadian soldiers returning home with a host of mental health issues. Zeiner said that if the wars in Iraq and Afghanistan ended today, statistics would show nearly 28,000 U.S. soldiers have been injured in combat — 65 per cent of whom were injured by some sort of explosive blast. While estimates peg the number of U.S. soldiers with brain injury around 10,000, Zeiner said that number is far too low. Anyone who was in the vicinity of a roadside bomb blast could be suffering from a brain injury as a result of the impact and have major problems re-adjusting to daily life once they return home, she said. "This is a gross, gross underestimate," Zeiner said, noting brain injury can leave soldiers with social, memory and psychological problems. "They don't really know why they're thinking and feeling and acting differently." Since 2004, the Operational Stress Injury Clinic at Deer Lodge in Winnipeg has handled about 300 referrals for veterans, military personnel and RCMP. Dr. Nancy Prober, a psychologist at the Winnipeg clinic, said many patients have symptoms of post-traumatic stress along with depression and generalized anxiety. According to spokeswoman from Veteran's Affairs Canada, 11,000 veterans have used their benefits to seek help for psychiatric disorders, including 7,100 people suffering from post-traumatic stress.

They do not track the number of brain injuries and Canadian Forces was unable to say whether they monitor the number of head injuries by press deadline. Meanwhile, the Department of National Defence says suicide rates among their military personnel are actually lower than those among the overall

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population. Suicide rates in the Forces have been decreasing for the past 12 years, according the military's website. Between 2005 and 2007, there were 26 suicides by male personnel and two by female personnel, the website said. Prober said local clinicians are hoping to learn from some of Zeiner's user-friendly tips on signs that could indicate brain injury and specific questions to ask a soldier returning from war.

Headaches, dizziness, sleep and balance problems can indicate a person has a hidden brain injury and that more extensive medical exams are needed.

Zeiner said screening for brain injury is extremely important since soldiers suffering from head trauma may have trouble holding down a job and relationships.

Some women have a particularly difficult time returning home, Zeiner said, because of their stereotypical social roles. While men suffering from head injury can still provide for their families with their military pension, Zeiner said women are more often seen as unable to perform their traditional roles as caregivers. Women may not remember their pregnancy, milestones in their children's life and be unable to recognize social or sexual cues. Zeiner said women with head injuries also get pregnant more often and experience more sexually transmitted infections because they don't remember to use birth control or practice safe sex. "Women aren't treated the same," Zeiner said. "They're frequently demoted after their head injury because they couldn't remember to follow their orders." jen.skerritt@freepress.mb.ca

Canadian Forces expects mental toll of damage from roadside blasts to surface in years ahead

Allan Woods, Bruce Champion-Smith. OTTAWA BUREAU.

Published On Mon July 13 2009 - A helicopter takes off with the bodies of Canadian soldiers killed after a roadside bomb exploded during a mission in the Zhari district of Kandahar province March 20, 2009.

Coalition troops in Afghanistan are being attacked by roadside bombs at record levels, leaving Canadian soldiers with a legacy of traumatic brain injuries that health experts are grappling to understand.

And the mental toll of having to patrol bomb-seeded roads is expected to show itself in the years ahead in a spike in the number of soldiers with post-traumatic stress disorder, military officials say.

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"The view is, clearly, when you're involved with an IED (improvised explosive device), that you may have traumatic brain injuries," said Maj.-Gen. Walter Semianiw, chief of military personnel.

"If you've been exposed to a (traumatic brain injury) the prevalence of then having PTSD may be higher. The facts are very clear," he said in an interview.

"The biggest challenge is not here and today. It's in five years and 10 years. ... Are they going to get the support they need?"

As NATO forces launch offensives in southern Afghanistan, insurgents are fighting back with homemade bombs at levels never before seen in the eight-year conflict.

By the end of June, there had been 2,508 "incidents" involving improvised explosive devices this year, a 60 per cent increase over the same period last year, according to statistics from the Pentagon.

The number of coalition soldiers killed by roadside bombs rose by 21 per cent to 92 in that time – from 76. The number of wounded was up 46 per cent – 467 compared to 320.

July is shaping up to be a record month, with at least 28 coalition troops killed so far by improvised explosives. On Saturday, a roadside bomb killed two U.S. Marines. A day earlier, British officials announced that eight of their soldiers were killed in a 24-hour period.

While Canadian commanders say the bombs are the weapons of cowards, they have proven effective nonetheless, sowing fear and chaos among civilians and soldiers alike.

"I've seen people with all of their teeth gone. The explosion wrecks their feet and wrecks their ankles," said Senator Colin Kenny, chair of the Senate defence committee. "This is the visible problem. The less visible one is two or three years later when we're going to see a lot more post-traumatic stress."

The defence department's chief health concerns arising from the Afghan war are all linked to roadside bombs. The soldiers who have endured amputations – not more than two dozen – require years of recovery and rehabilitation. The other top health concerns – brain injury and mental health problems – are hidden wounds the military is struggling to understand.

"We really don't know about traumatic brain injuries," said Commodore Hans Jung, the new commander of the Canadian Force's health services.

Blast-induced brain injuries range from mild concussions to severe skull fractures and penetrating head wounds that can cause memory loss, anxiety, depression

and post-traumatic stress.

The introduction of better armour and protective equipment means more soldiers are surviving explosions, but they are suffering internal injuries from the shock waves of the blasts.

In recent months, the military has put a greater focus on mental health issues. Last week, the *Star* reported the defence department will overhaul the way it tracks military suicides to give a more accurate accounting of the mental toll on soldiers.

Last month, a report from a Commons committee called on the military to do more to help soldiers suffering from psychological injuries. The report came on the heels of a *Star* investigation that found a growing problem of post-tour violence is landing soldiers in jail and their victims in hospital.

In Iraq, where the tactic of roadside bombs was first popularized, the U.S. military designated traumatic brain injury as one of the "signature" health problems. The U.S. is outfitting soldiers in Afghanistan with helmet sensors to measure the force of blasts to help diagnose brain injuries.

Jung admits "this is an uncharted territory." One of the priorities is to understand the link between a so-called minor traumatic brain injury – a simple concussion – and post-traumatic stress disorder (PTSD).

"What we know by evidence, by science – not conjecture – today is that there is a 95 per cent or more overlap between PTSD symptoms and mild traumatic brain injuries," Jung said, adding concussions and PTSD can be treated, while the truly traumatic brain injuries cause irreversible damage.

Senior leaders from both Britain and the United States warned last week of more casualties to come, due in part to bombs that are more sophisticated and deadly.

Soldiers may suffer from hidden head injuries

Health WINNIPEG, TAMARA KING, The Canadian Press -

Soldiers who are exposed to explosions in countries such as Afghanistan might be suffering a mild brain injury without even realizing it, says an American doctor.

Harriet Zeiner, a clinical neuropsychologist with the Palo Alto Veterans Affairs Healthcare System in California, spoke Thursday at a conference on military trauma.

"It's these other folks that we're missing," Zeiner said in an interview. "That's one thing we have to do, is figure out how to identify people who aren't complaining,"

Unlike moderate or severe brain injuries, where the damage is apparent, mild brain injuries aren't obvious, but can cause a series of problems, including learning impairment, memory loss, severe fatigue, headaches.

"It just looks like a regular person who's not functioning very well, and so you think of them as lazy, or manipulative, or not wanting to work, or just dumb," Zeiner said.

Medical schools really don't offer enough training about head injuries, said Zeiner.

"In the civilian sector, you end up with a lot of physicians who hold up two fingers and say, 'how many fingers?' (The patient says) two and they say, 'great, go home'," she said.

Until recently, that was even the case in the U.S. Veterans Affairs department, Zeiner said.

"We had many, many, many physicians who simply weren't familiar with the characteristics with brain injury."

The topic has received a lot of attention in the U.S., where traumatic brain injuries are known as the "signature wound" of the war in Iraq.

The latest statistics show that approximately 320,000 U.S. soldiers have a traumatic brain injury, said Zeiner.

Good News for Veterans: Hyperbaric Oxygen Treatment for TBI, PTSD and Depression

OCTOBER 8, 2008...8:28 PM - Hyperbaric oxygen therapy (HBOT) appears to be a safe and effective treatment for Traumatic Brain Injury (TBI), Post-Traumatic Stress Disorder (PTSD) and depression. Thanks to the work of the American Association for Health Freedom, and their petition to Congress, it looks as though our veterans will soon be receiving this much-needed treatment.

For each of you who took time to write your representatives regarding this issue – Thank you. The legislation which was passed and signed into law is a start, but this program needs to be funded and sustained. Please see the link at the bottom of this piece to ask Congress for its continued support of HBOT for veterans. From the E-Newsletter, [American Association for Health Freedom]:

AAHF Scores a Victory with HBOT for Wounded Veterans

Hope For Traumatic Brain Injury, Diabetic Failure-to-Heal Wounds, and More?

On September 30, President Bush signed into law the FY2009 Continuing Resolution that contains the Defense Appropriations bill. In doing so, crucial funding became available to complete a scientific study important to all Americans.

Seventeen years ago, Paul G. Harch, M.D., discovered that hyperbaric oxygen therapy at 1.5 atmospheres of pressure (HBOT 1.5) could repair a chronic traumatic brain injury (TBI). Dr. Harch, director of the Hyperbaric Medicine Fellowship at Louisiana State University's School of Medicine and an AAHF board member, has used the therapy on over 700 patients and has taught the technique to hundreds of doctors.

This year Dr. Harch applied HBOT 1.5 to five combat veterans of the current war who have traumatic brain injury and post traumatic stress disorder (PTSD) from concussive blasts. So far, all of the veterans treated have had significant recovery. Eighty percent no longer have PTSD and all are improved.

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Recently, Dr. Harch testified in front of the Surgeon General of the Navy and the Deputy Commandant of the Marine Corps. He told the stories of the five combat veterans he treated with HBOT 1.5; three of those veterans were in the room.

One of them, a judge who served as a general in the Army Reserves, endured a year of treatment failures at Walter Reed. He is now back on the bench, fully recovered in 120 days, after 80 HBOT 1.5 treatments. The Health Freedom Foundation, sponsored a Marine machine gunner who experienced seven concussive events from roadside bombs during two tours in Iraq. Now, after HBOT treatments, his migraine headaches have disappeared, his sleep is restored, his PTSD is gone. He is now actively employed. He has his life back, as do other veterans who have undergone HBOT treatment.

At Louisiana State University in New Orleans, under an approved study protocol, Dr. Harch is now treating another thirty veterans of the war who have TBI and PTSD. AAHF sought funding from Congress for this important study for the past two years. This year, after nearly 200 visits to members of Congress, funding was finally provided.

In April 2008, the RAND Corporation, a non-profit “think tank” highly respected by the government and NGOs, found that of the 1.6 million veterans of the war, 300,000 have PTSD, 320,000 suffer TBI, and 80,000 have depression. Current treatment costs for each of these conditions, when treated separately, is more than the cost associated with HBOT 1.5.

HBOT 1.5 one-time cost is US\$16,000 (80 treatments at US\$200 per session) and appears to treat all three symptoms simultaneously; the earlier a person is treated, the more effective the recovery, and the fewer the treatments needed.

Hyperbaric oxygen therapy at 2.4 atmospheres of pressure is already used 10,000 times a day at over 900 locations for everything from non-healing diabetic wounds and radiation injuries from cancer treatment, to fourteen other Medicare-reimbursable and FDA-approved indications. HBOT 1.5 is a dose of HBOT that clinical experience shows is safe and effective for TBI.

According to Dr. Ted Fogarty, Chairman of Radiology at the University of North Dakota School of Medicine, “Functional neuro-imaging shows HBOT revitalizes brain tissues and restores normal brain metabolism in vastly different areas of the brain in ways that other existing treatments cannot. To leave these injured neurons in our brave veterans to wither on the vine seems criminal when HBOT 1.5 is available and works.”

Today a multi-state coordinated effort is under way to treat vets at 78 locations. We expect this AAHF coordinated effort will result in the necessary scientific proof to establish HBOT 1.5 as the standard of care for acute and chronic neurological injuries, and we hope it will secure reimbursement by the VA, Tri-Care, Medicare, and civilian insurance.

The body of scientific evidence indicates that modern medicine has overlooked hyperbaric oxygen as a key tool in the treatment of strokes, diabetic failure-to-heal wounds, and conditions like reflex sympathetic dystrophy. Timely HBOT therapy could reduce the incidence of stroke (the leading cause of disability in the U.S., with over 500,000 reported cases each year) and amputations due to diabetic failure-to-heal wounds. HBOT has sound science, many years of clinical practice, and a convincing reason for all of us to seek access when it can be of help.

Veterans who wish treatment can visit American Association for Health Freedom to review a comprehensive list of Hyperbaric facilities to find their closest HBOT 1.5 facility. To learn more visit AAHF on line – making hyperbaric oxygen therapy available to all our armed forces who have suffered traumatic brain injury, PTSD, and depression.

Invisible Wounds

By George C. Wilson. Congress Daily, July 14, 2008 - Rep. Gene Taylor, D-Miss., already one of the GI's best friends in Congress, has launched himself on a new mission in hopes of sparing thousands of service men and women the misery of brain damage inflicted by hidden bombs in Afghanistan and Iraq.

Old-fashioned bombs have turned out to be the enemy's most diabolical weapon, inflicting two-thirds of the casualties.

The bombs seem to be everywhere in Afghanistan and Iraq: buried in the ground; crammed into vehicles; under the cloaks of suicidal men, women and children; on the tips of rockets.

The long-lasting damage inflicted on the brains of troopers near the blasts is just beginning to be understood. Congress, the president, the private and government medical communities and thousands of families are staring at an epidemic of brain trauma that will last 50 years.

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"With IEDs [improvised explosive devices], the insurgents have by dumb luck developed a weapon system that targets our medical weakness: treating brain injury," Kevin Parker, assistant professor of biomedical engineering at Harvard University and an Army reserve captain who served in Afghanistan, told Technology Review, a magazine published by the Massachusetts Institute of Technology. The Review's long article, which described new findings about what explosives might be doing to the brains of troopers, helped spur Taylor to action.

One such new finding, or at least a strong suspicion, is that an explosion not only rocks the brain and hurls it against the hard inside surface of the skull but also sends an electromagnetic pulse into the brain.

Scientists studying computer models of the head believe the main passageways to the brain for an explosion's damaging forces are the eyes and sinuses. Present day brain scanners cannot detect damage from electrical hits, according to scientists. Taylor wants to find out if today's helmets could be quickly modified and grounding gear added to body armor to protect troopers' brains.

"The brain is an electrical organ," reasons Army Col. Geoffrey Ling, an Iraqi veteran who is now studying the brain as a neurologist at Walter Reed Army Medical Center and as a program director at the Pentagon's advanced research projects agency. "If an electromagnetic pulse can take out a radio, why not short circuit the brain?" he asked Technology Review.

Taylor told CongressDaily that the logical first step for educating Congress on that and other possible causes of traumatic brain injury is to hear from Ling and other experts.

Taylor said the quickest way for the lawmakers to get educated is to hold a briefing rather than take the time to organize formal hearings. His plan is to start out by mobilizing the House Armed Services Seapower Subcommittee, which he chairs, and the Air and Land Forces Subcommittees, chaired by Rep. Neil Abercrombie, D-Hawaii.

If the experts make the case for redesigning helmets and equipping troopers with ground gear to prevent brain damage, Taylor and others who have pushed the Pentagon into fielding body armor and IED-resistant vehicles almost certainly will demand that the Pentagon do more to safeguard the brains of deployed service people.

Taylor said there is still time for the Senate to add language to its fiscal 2009 defense authorization bill to finance protective gear for the brain if the case is made by the experts.

The House has already passed its authorization bill but could go along during the conference on the two measures with whatever traumatic brain injury language the Senate passed.

"I was not aware of the scale of the problem," Taylor told me.

Beside the disclosures about TBI in MIT's technical journal, the Rand Corp. think tank in a recent report on the invisible wounds suffered by GIs in Afghanistan and Iraq estimated "that approximately 300,000 individuals currently suffer from post traumatic stress disorder or major depression and that 320,000 individuals experienced a probable TBI during deployment."

Despite all the talk in Congress and the Bush administration about giving our GIs top-notch health care, the Rand study concluded that "of those who have a mental disorder and also sought medical care for that problem, just over half received a minimally adequate treatment."

Since the military forces in Afghanistan and Iraq are young, the government will be obligated to treat their invisible wounds for 50 years or more. The cost of that care is incalculable but will certainly be in the high billions of dollars.

Rand estimated that the cost of treating one trooper's TBI problems could run as high as \$408,517 a year in 2007 dollars.

Several non-government physicians I have interviewed while investigating PTSD and TBI predicted the public and private health agencies will be overwhelmed as they try to treat thousands of Afghan and Iraqi veterans suffering from those invisible wounds.

The government will be driven by veterans' needs into a national healthcare system, they further predicted, whether physicians and drug companies like it or not.

In the meantime, it should soon become obvious to all the lawmakers, not just Taylor and his allies, that prevention of invisible wounds is the best cure.

Hyperbaric Oxygen Study Shows Potential Benefit for Patients With Traumatic Brain Injury

MINNEAPOLIS, Jan. 4 /PRNewswire-USNewswire/ -- A 5-year study of patients with severe traumatic brain injury conducted at Hennepin County Medical Center in Minneapolis shows significant benefit of hyperbaric oxygen therapy to improve brain metabolism and its ability to recover from injury. The results were recently published in the *Journal of Neurosurgery*

Every year, more than 1.4 million Americans sustain a traumatic brain injury (TBI) - the leading cause of death and disability in children and young adults. Those who survive often face months or even years of therapy, and sometimes the damage to the brain is irreversible. Decreased utilization of oxygenated blood to brain tissue immediately after the injury is often to blame.

Cells need oxygen to fuel metabolism for cellular growth and repair. Healthy brains produce their own energy to maintain brain tissue and keep the rest of the body doing what it's supposed to do. That includes automatic processes like breathing and circulation, as well as voluntary actions like walking and talking. After a traumatic brain injury, the brain itself needs care. Barriers to blood flow can be compromised from the impact of the injury itself, and then when the brain swells inside the skull, a secondary injury can occur that causes even more brain damage.

"There's a direct correlation between clinical outcome and the degree to which the brain's metabolism is restored," explains one of the study's authors, neurosurgeon Gaylan Rockswold, MD. "In previous research we learned that the brain's energy production is improved and maintained with hyperbaric oxygen treatment, but this study confirms that hyperbaric oxygen treatment has a major impact in terms of increased energy production."

Within 24 hours after injury, eligible patients for the study were randomized into three groups: One group received "normobaric" treatment: oxygen delivered at the patient's bedside; another group received hyperbaric treatment in Hennepin County Medical Center's hyperbaric oxygen

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chamber; and a third (control) group did not receive additional oxygen therapy. All groups received the intensive standard of care for brain injury consistent with good clinical practice. The patients who received higher levels of oxygen (hyperoxia) via the hyperbaric oxygen chamber were found to have a marked increase in positive_ _brain metabolism when compared to the normobaric and control group.

"Our goal was to evaluate the brain's metabolism and intracranial pressure, and whether or not too much oxygen posed a concern with hyperbaric oxygen treatment in these patients," said Dr. Rockswold. "The results indicate that hyperbaric oxygen treatment was found to significantly enhance the brain's energy production and reduce intracranial pressure without any toxic effects on the brain or lungs from too much oxygen."

This research provides important preliminary data for a National Institutes of Health (NIH) supported multicenter trial. NIH trials directly assess the ability to improve clinical outcomes, which is the final step needed to change standard clinical processes. Currently standard clinical practice does not include hyperbaric oxygen for traumatic brain injury.

"TBI is not only devastating for the patient, it's also heart wrenching for his or her family. We couldn't be more pleased about the impact this study will have for patients with traumatic brain injury."

The Traumatic Brain Injury Center at Hennepin County Medical Center offers comprehensive, multidisciplinary patient care education and research to serve people who have sustained a traumatic brain injury. Providing a full range of state-of-the-art medical and rehabilitative services, HCMC's expertise spans the entire continuum of care for adult and pediatric TBI patients, from prevention to emergency care, neurosurgery, critical care, rehabilitation and the Mild to Moderate Traumatic Brain Injury Clinic.

About Traumatic Brain Injuries

Each year, more than 1.5 million Americans sustain a traumatic brain injury (TBI). In Minnesota, nearly 100,000 brain injuries occur annually. A large percentage of those injuries are mild to moderate cases and often go untreated. As a Level 1 Trauma Center, Hennepin County Medical Center admits and treats the most traumatic brain injuries in the state. More information about HCMC's Traumatic Brain Injury Center can be found at www.savethisbrain.org

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The state's only permanent, fully accredited hyperbaric chamber is located at Hennepin County Medical Center. HCMC's Hyperbaric Medicine program is one of only 60 programs in the country to achieve accreditation by the Undersea and Hyperbaric Medical Society (UHMS).

The multi-chambered unit is fully staffed year round and is used for a variety of critical and chronic medical conditions, including treatment for carbon monoxide poisoning. Hennepin County Medical Center is a Level 1 Trauma Center and public teaching hospital repeatedly recognized as one of America's best hospitals by /U.S. News & World Report/.

SOURCE Hennepin County Medical Center **RELATED LINKS**

Hyperbaric Oxygen Therapy for Brain Injuries

By Mark Bingaman, *eHow Contributing Writer* - Physicians, institutions and the military are all utilizing or researching hyperbaric oxygen therapy for traumatic brain injuries. But the chief hyperbaric medical association has yet to approve it for this condition, creating an obstacle for proponents and patients.

Injury

After a severe head injury, traumatic [brain damage](#) may occur as the brain swells, wedging sensitive tissues against the skull. In the book "Hyperbaric Oxygen Therapy," Richard A. Neubauer and Morton Walker write that hyperbaric oxygen therapy (HBOT) works to treat brain injury by "constricting the brain's blood vessels, yet delivering more oxygen." This type of therapy works by increasing oxygen content in plasma, a part of the blood that normally does not carry oxygen throughout the body.

Military Research

The San Antonio Military Medical Center Hyperbaric Center and the Air Force School of Aerospace Medicine are researching hyperbaric oxygen therapy for brain injuries among wounded soldiers. "We hope that hyperbaric oxygen therapy will stimulate the area around injured brain tissue to improve the patients' cognitive functions," says Dr. E. George Wolf, a physician with the SAMMC Hyperbaric Center. The team also plans to closely watch for signals indicating whether or not HBOT may minimize symptoms of post-traumatic stress disorder.

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Private Research

Dr. Paul Harch, head of Harch Hyperbarics Physicians Center in New Orleans, is also involved in private research with other physicians to treat veterans of the Iraqi and Afghanistan wars. According to Dr. Harch, when cells in the brain die, either from trauma or lack of oxygen, blood plasma leaks out into surrounding brain tissue, causing swelling and reducing blood flow. The extra oxygen from HBOT helps to heal injured capillaries and reduce swelling. This restores blood flow and much-needed oxygen to the damaged tissue, reviving the dormant cells and spurring a healthful state.

Barrier

Traumatic brain injury is not one of the 13 "indications" approved by the Undersea and Hyperbaric Medical Society (UHMS) as conditions clearly suited for treatment by HBOT. In 1976, UHMS convened a committee to determine the medical conditions most likely to receive benefit from this therapy. At the time the committee did not recommend oxygen treatment for brain trauma. While many physicians, institutions and patients now utilize HBOT for treatment of brain injury, many insurance plans and the federal government may not cover the financial cost.

Building Support

Hyperbaric oxygen therapy also works to repair what is known as the blood-brain barrier, a defensive layer of cells that pushes away toxins trying to sneak into the brain. This natural protection is often damaged when severe head trauma occurs. According to Dr. Kenneth P. Stoller, Medical Director of the Hyperbaric Medical Center of New Mexico, hyperbaric oxygenation has been shown in a controlled trial to reduce the mortality of head injury by 50 percent.