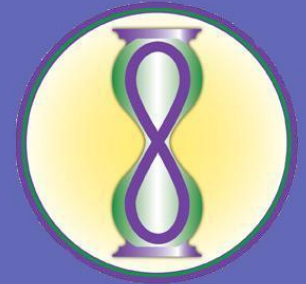


Hyperbaric Oxygen Therapy (HBOT)



James Biddle, MD



Disclaimer

This is simply an educational program and is not intended to diagnose or treat any individuals. Diagnosis and treatment of any disease should be done by a licensed health care practitioner in an office setting.



Who We Are...

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Who I am

- BA in Biology, University of Missouri – Columbia 1984 (genetics & evolution).
- M.D. @ Univ of MO – Columbia 1989.
- **Internal Medicine** in Portland OR – Board Certified 1992, 2002.
- Practicing Integrative Medicine in Asheville since 1997.
- www.earthaven.org → take a tour.
- www.acam.org → find a doctor.
- www.ncims.com → CHCA group.



What I Do...

Integrative Medicine

Holistic, Nature's Template, Orthomolecular,
Scientific, Sherlock Holmes....

- Bio-Identical 'Natural' Hormones
- Diabetes and Nutrition
- Cardiovascular Support
- Toxic Metal Syndromes
- Arthritis and Fatigue
- Allergies, ADD, Autism
- "Challenging Cases"



Oxygen – The Essential Nutrient

- Treat the person or treat the disease?
- Most Future Doc shows are about specific health challenges – this one is about a type of therapy used for many conditions.

HBOT = HyperBaric Oxygen Therapy.



Oxygen – The Essential Nutrient

- No oxygen? Brain damage in 3-4 minutes.
- No vitamin C? Scurvy in 3-4 months.
- No vitamin D? Osteoporosis in 3-4 years.

We can supplement vitamins and minerals,
but...

How do you get more oxygen?



More Oxygen Per Breath

- Breathing more oxygen not enough.
- Room air contains 21% oxygen, enough to fill most of the oxygen-binding sites on our red blood cells, carried by hemoglobin.
- Breathing even 100% oxygen -
 - Fills the few remaining sites on hemoglobin.
 - Increases blood oxygen by a small percentage.
- Can be life-saving, especially if blood oxygen levels are low, but results in minimal gains when O₂ levels start out normal.



Room Air 160 mmHg

Lung Capillaries 100 mmHg

Leaving Heart 85 mmHg

Peripheral Arterioles 70 mmHg

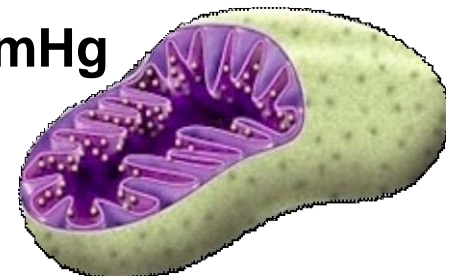
Organ Capillaries 50 mmHg

Cells 1-10 mmHg

**Mitochondria 0.5 mmHg
(0.3% of inhaled oxygen)**

**The brain makes up
2% of body weight
but uses 20% of
body oxygen**

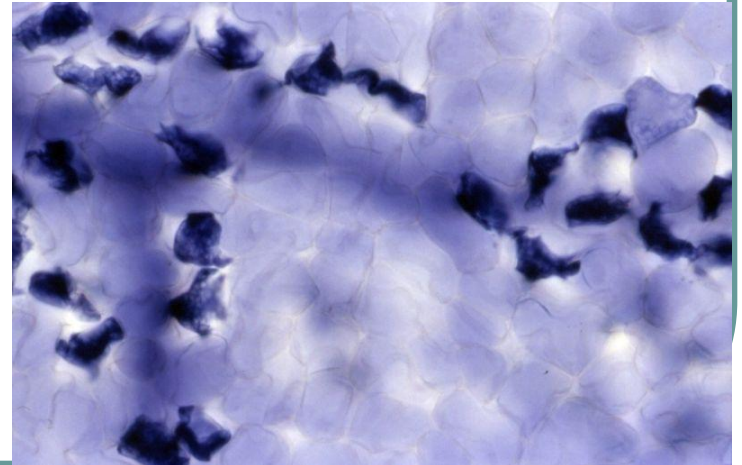
**Mitochondria is the final
site of energy production**





Idling Cells

- Recent studies suggest low oxygen state after a **stroke, cerebral palsy, autism, or chronic viral infections.**
- Some of the cells around the area of injury are still alive - not sufficient oxygen to function well.
- Not dead, but too little oxygen to do their jobs.





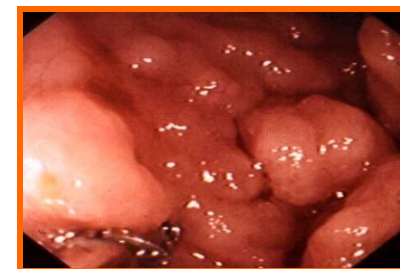
Low Oxygen Tissues

- Thousands of people are affected every year by an event or condition that causes some body tissues to live in a perpetually-low oxygen state. Can be improved with acceptable blood flow, oxygen saturation.
- Head injury
- Surgical wound
- Skin graft
- Plastic surgery
- Limb reattachment
- Radiation therapy
- Severe burns
- Carbon-monoxide poisoning



Oxygen Deprived Tissues

- Acute Conditions – Event in which blood flow is restricted to certain areas, causing damaged areas and “idling cells”
 - Traumatic Brain Injury
 - Stroke
 - Heart Attack
 - Surgical Wound
 - Slow healing wounds or diabetic ulcers
- Chronic Conditions – Inflammation or infection causes damage in many cells, causing certain tissues to have decreased functioning.
 - Autism, Cerebral Palsy
 - Diabetes
 - Lyme Disease
 - Inflammatory Conditions such as Crohn’s or arteriosclerosis





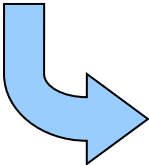
Oxygen Under Pressure

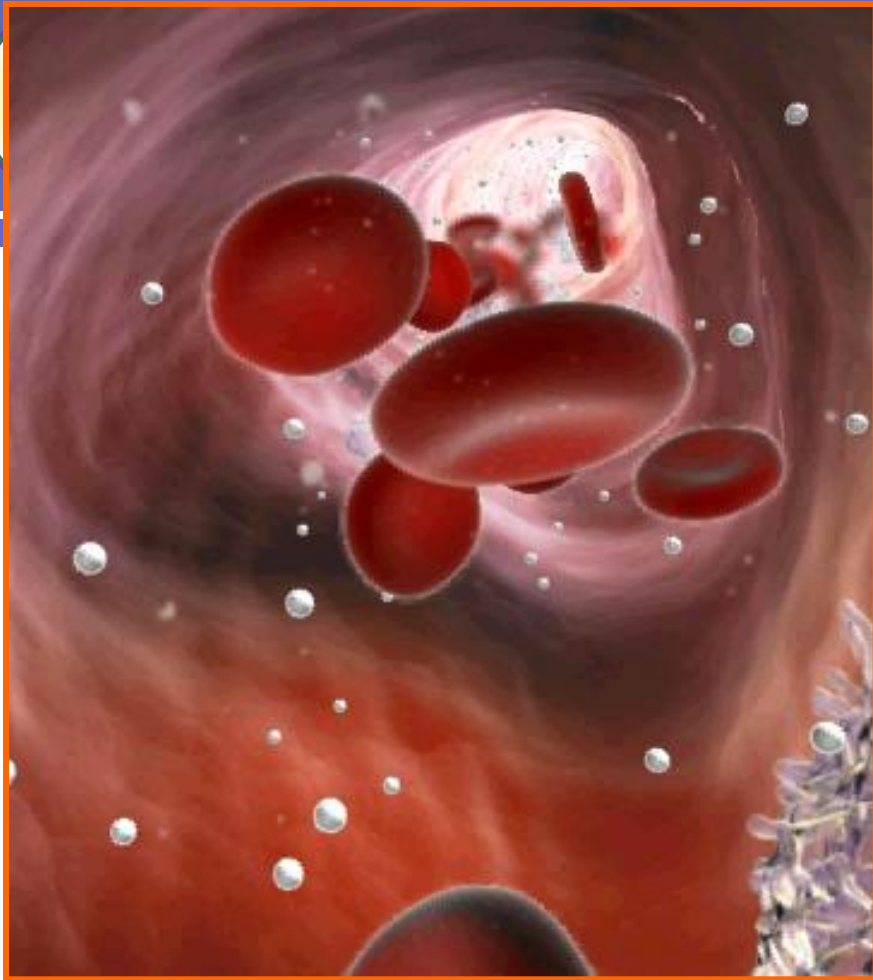
- Encourage oxygen to dissolve in serum and plasma by increasing pressure of oxygen.
- Pressure is provided by a chamber with above-normal pressure, called a “hyperbaric” oxygen chamber.
- Patient enters chamber and pressure is slowly increased to a level appropriate for the person’s condition.



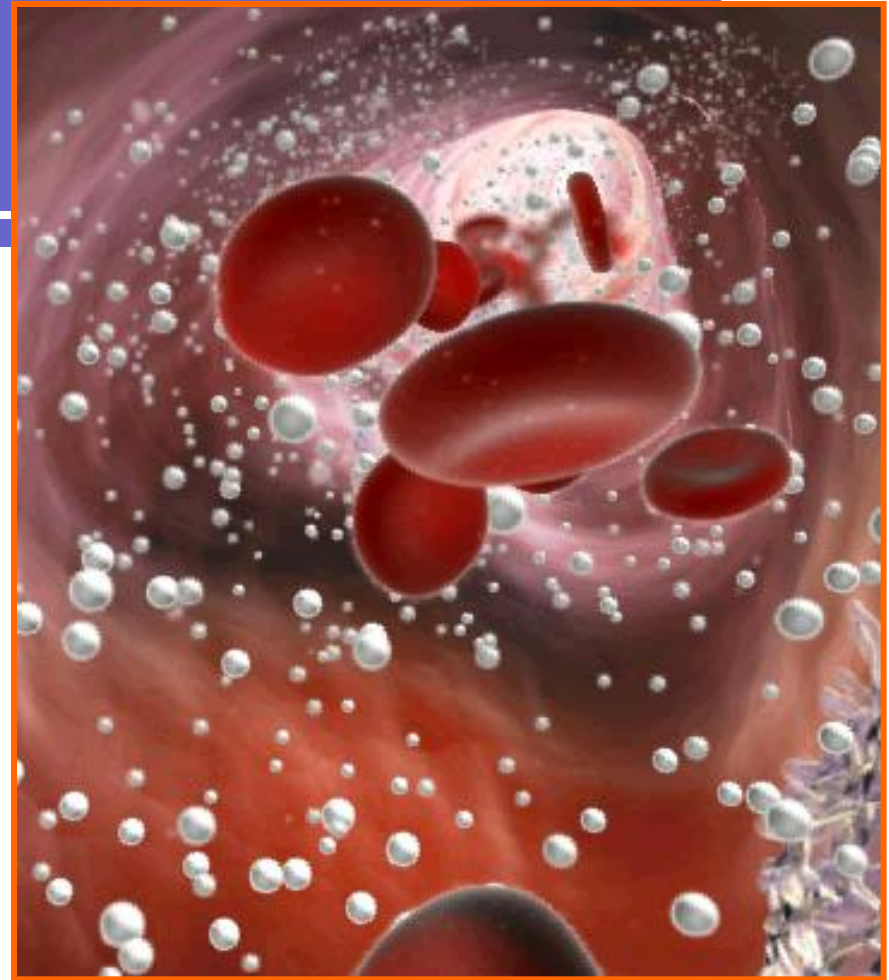
Henry's Law

- *At a constant temperature, the amount of a given gas dissolved in a given type and volume of liquid is directly proportional to the partial pressure of that gas in equilibrium with that liquid.*

 A high concentration of oxygen in the alveolus creates a high concentration in the blood going to the tissues.



Before HBOT



After HBOT

Rossignol DA (2007)



Oxygen Partial Pressures

Rossignol DA (2007)

At sea level, partial
pressure air = 760 mm

Air has 21% oxygen, partial
pressure oxygen = 160 mm

1.0 atm
21% oxygen

160 mm Hg
Oxygen

Arterial =
100 mmHg

Venous =
39 mmHg

1.3 atm
24% oxygen

237 mmHg
Oxygen

Arterial =
149 mmHg

Venous =
58 mmHg

1.3 atm
100% oxygen

988 mmHg
Oxygen

Arterial =
632 mmHg

Venous =
246 mmHg

1.5 atm
100% oxygen

1143 mmHg
Oxygen

Arterial =
1036 mmHg

Venous =
404 mmHg



Pressurized Oxygen

Oxygen Pressure

- Normal Air
- 100% O₂ @ 1 Atmos.
- 100% O₂ @ 1.3 Atm.
- 100% O₂ @ 1.5 Atm.

Capillary Pressure

- 50 mm Hg pO₂
- 75 mm Hg pO₂
- 246 mm Hg pO₂
- 437.5 mm Hg pO₂

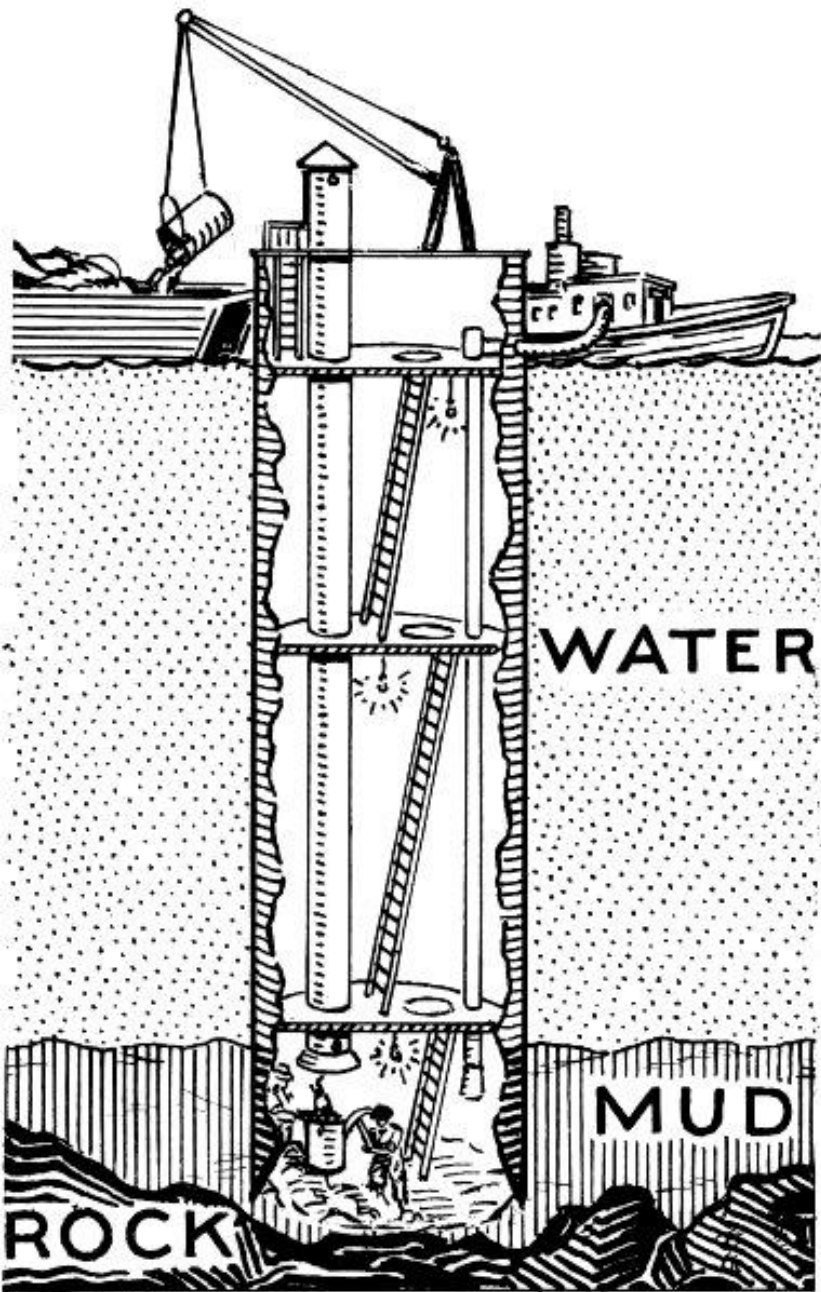


Hyperbaric Oxygen Use

HBOT chambers developed at turn of 19th Century to treat caisson workers and deep-sea divers who suffered from decompression sickness.



- Caisson Workers
- Deep Sea Divers

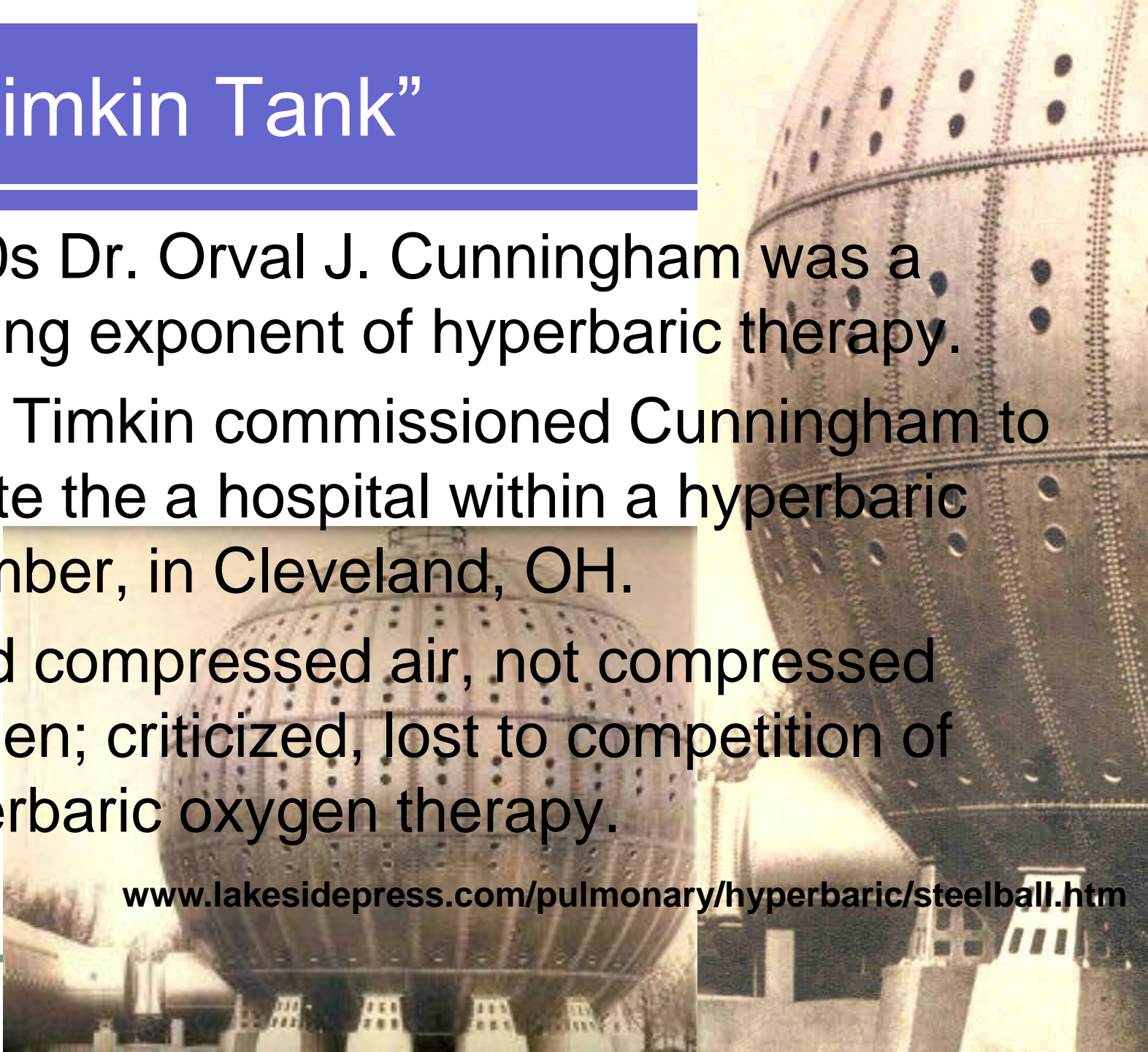




“Timkin Tank”

- 1920s Dr. Orval J. Cunningham was a leading exponent of hyperbaric therapy.
- H.H. Timkin commissioned Cunningham to create the a hospital within a hyperbaric chamber, in Cleveland, OH.
- Used compressed air, not compressed oxygen; criticized, lost to competition of hyperbaric oxygen therapy.

www.lakesidepress.com/pulmonary/hyperbaric/steelball.htm





HBOT Use

- Used medicinally since 1970s in Russia, Europe, China, and the Far-East.
- Only recently available in hospitals.
- UK most chambers financed by the National Health Service; Some (Multiple Sclerosis centers) are non-profit.
- Widespread use in private facilities in US since mid-90's.



Monoplace Chambers

- One person, supine position
- Lower cost (\$60-100K)
- Portable



Multiplace Chambers



- 2-10 patients sitting or laying down.
- Most common in hospitals.

SKIP; shsskip.swan.ac.uk



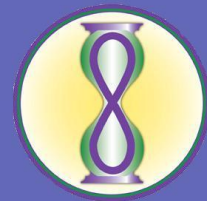
Portable Mild Hyperbaric





Hyperbaric Oxygen

- Patient breathes air (enriched with oxygen?) at greater than atmospheric pressure.
- Therapeutic principle = Drastically increases partial pressure of oxygen in tissues.
 - Immediate support to poorly perfused areas of compromised blood flow.
 - Supports compromised tissues, such as with occlusive vascular disease.



Hyperbaric Oxygen Treatments

- Patient enters chamber, which is sealed and filled with compressed air (&/or oxygen).
- Monitored by pressure gage on exterior of chamber by trained technician.
- A treatment session – 1 hour or more:
 - Exact length and frequency depends on condition.
 - Acute vs. chronic conditions need varied treatments.
 - Few treatments vs. ongoing sessions.
 - Often 40-80 sessions for optimal results.



A Typical Session

- Wear comfortable clothing, like cotton shorts (without metal, ie. zippers, buckles, underwire bras, clasps, or watches).
- CD & MP3 players and books or magazines to read, if $< 25\%$ O₂. At some offices, movie players are installed.
- Parents often accompany young children.
- 100% oxygen delivered directly into hard chamber or a nasal cannula (given at initial visit) or oxygen hood may be used.



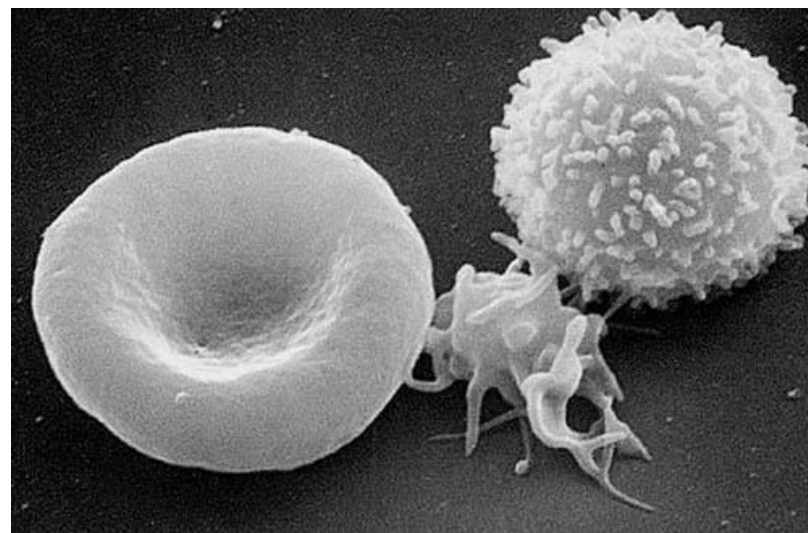
Mechanisms of Action

Primary

- Hyper-oxygenation & Gas Bubble Shrinkage

Secondary

- Vasoconstriction
- Angiogenesis
- Fibroblast Proliferation
- Antibiotic Synergy
- Toxin Inhibition
- Oxygenation of Mitochondria
- Leukocyte oxidative killing



- Michael Neumeister, MD Hyperbaric Oxygen Therapy, www.emedicine.com/plastic/topic526.htm. Jul 21, 2005.



General Benefits

- Reduces Swelling & Inflammation.
- Inhibits lipid peroxidation.
- Enhances defenses against viruses.
- Stimulates repair of blood vessels.
- Promotes new blood vessels growth.
- Activates Stem Cells.
 - Hink, J. and E Jansen. "Are superoxide and/or hydrogen peroxide responsible for some of the beneficial effects of hyperbaric oxygen therapy?" *Medical Hypotheses*, 2001. 57(6):764-769.

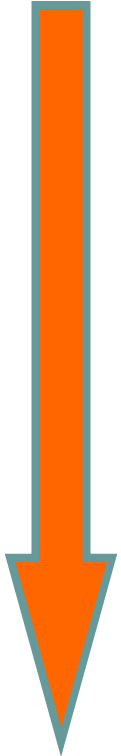


Additional Effects

- Promotes wound healing.
- Kills certain anaerobes.
- Prevents growth of species such as *Pseudomonas*.
- Prevents production of clostridial alpha toxin.
- Restores neutrophil-mediated bacterial killing in previously hypoxic tissues.
- Reduces leucocyte adhesion in reperfusion injury, preventing release of proteases and free radicals which cause vasoconstriction and cellular damage. Leach, R M et al. BMJ 1998;317:1140-1143



Side effects of HBOT



- Barotrauma (2%)
- Sinus squeeze
- Serous otitis
- Claustrophobia
- Reversible myopia
- Seizures (0.01 – 0.03%)

Rossignol DA (2007).



Contra-Indications for HBOT

- Ruptured eardrum risk.
- Dropped lung (pneumothorax).
- Diabetic retinopathy.
- Cataracts.
- Cancer?
- Seizures?



Types of HBOT Use

- Some conditions are served better with
 - **Immediate** use following acute event,
 - *Stroke, Head Injury, Heart Attack*
 - **Ongoing** use to treat chronic condition,
 - *Autism, Lyme Disease, Multiple Sclerosis*
 - **Temporary** use to improve isolated condition.
 - *Plastic Surgery, Wound Healing, Sports Injury*



HBOT “Approved” Indications

- Air or gas embolism
- Carbon Monoxide Poisoning
- Gas gangrene
- Crush injuries and compartment syndrome
- Decompression sickness
- Wound healing
- Severe anemia
- Intracranial abscess
- Necrotizing soft tissue infections
- Refractory osteomyelitis
- Skin flaps and grafts
- Delayed radiation injury
- Thermal burns



“Off-label” Studied Uses of HBOT

- Cerebral Palsy (Montgomery, 1999; Collet 2001; Marois; 2006)
- Amyotrophic Lateral Sclerosis (Steele, 2004)
- Complex Regional Pain Syndrome (Kiralp, 2004)
- Fetal Alcohol Syndrome (Stoller, 2005)
- Ischemic Brain Injury (Neubauer, 1992; Neubauer, 1998)
- Traumatic Midbrain Syndrome (Holbach, 1974)
- Closed Head Injury (Rockswold, 1992)
- Lupus (Wallace, 1996)
- Stroke (Nighoghossian, 1995)
- Myocardial Infarction (Shandling, 1997)



More Benefiting Conditions

- Autism
- Multiple Sclerosis
- Lyme disease
- Hepatitis
- AIDS
- Brown Recluse Spider Bites
- Heart Attack
- Sports training recovery
- Sports injuries
- Plastic surgery
- Near drowning





Necrotic heel of diabetic patient before and after 14 weeks of hyperbaric oxygen therapy



Leach, R M et al. *BMJ* 1998;317:1140-1143

BMJ



Necrotic heel of diabetic patient before and after 14 weeks of hyperbaric oxygen therapy



Leach, R M et al. *BMJ* 1998;317:1140-1143

BMJ



Plastic Surgery

- Creates favorable environment for healing process by
 - Reducing swelling and inflammation
 - Inhibiting bacterial infection
 - Stimulating new blood vessel growth.
- Recommended for liposuction, laser peels, fat transplants, hair transplants.
 - Less pain, bruising, swelling, scars, and less down time for patient.



Sports Injuries and Rehab

- Shown to reduce recovery time for soft-tissue injuries and bone fractures.
 - Reduces swelling and pain
 - Prevents Hypoxia of the traumatized tissues
 - Speeds up the healing of tissues, ligaments and fractured bones
 - Reduces scar tissue formation and damage
 - Helps return players to the game sooner ,
- Professional NBA, NHL and NFL teams (including the New York Giants and the Dallas Cowboys) own or lease hyperbaric oxygen chambers for treating their players. (Terrell Owens)



Myocardial Infarction and HBOT

- Cardiopulmonary bypass
 - “...Pretreatment with Hyperbaric Oxygen can reduce neuropsychometric dysfunction and also modulate the inflammatory response after cardiopulmonary bypass.”
 - Laden, Alex J. Pretreatment with Hyperbaric Oxygen and its effect on neuropsychometric dysfunction and systemic inflammatory response after cardiopulmonary bypass: a prospective randomized double-blind trial. *J Thorac Cardiovasc Surg.* 2005 Dec;130(6):1623-30. Epub 2005 Oct 26.



Myocardial Infarction and HBOT

“Adjunctive hyperbaric oxygen therapy after thrombolysis in acute myocardial infarction has a favorable effect on left ventricular systolic function and the remodeling process.”

Dekleva M ., Adjunctive effect of hyperbaric oxygen treatment after thrombolysis on left ventricular function in patients with acute myocardial infarction. Am Heart J. Volume 148 , Issue 4 , Page 589.

<http://linkinghub.elsevier.com/retrieve/pii/S0002870304001577>

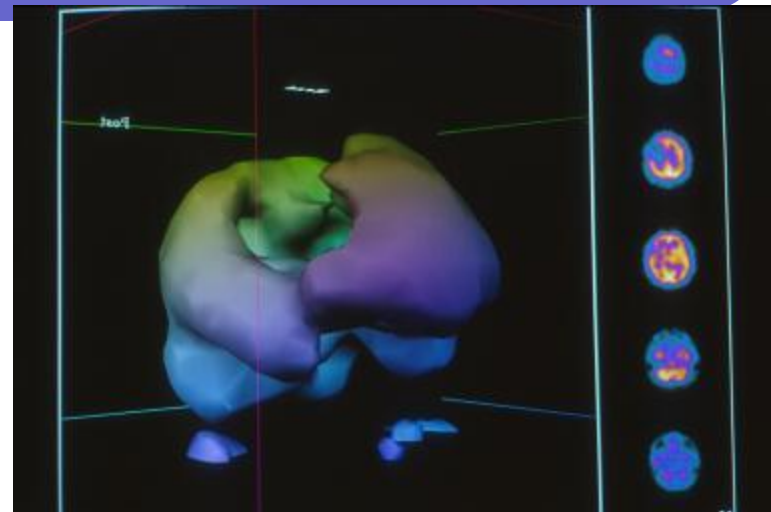
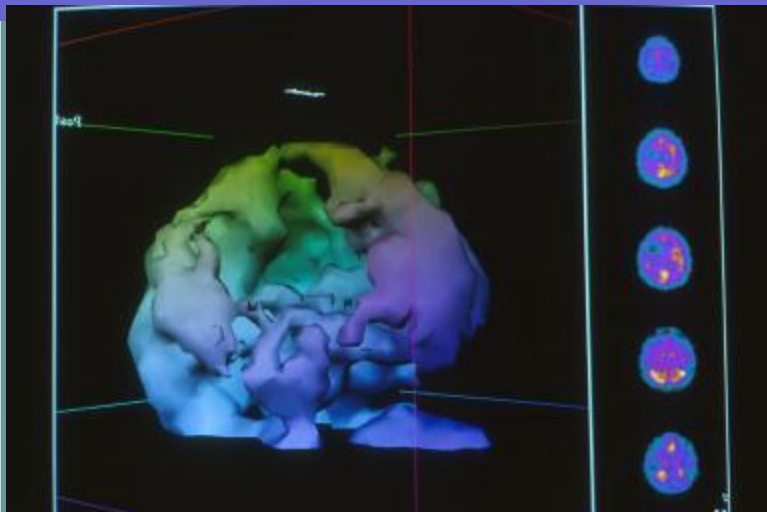


Traumatic Brain Injury (TBI)

- Condition in which certain nerve cells in the brain may be permanently destroyed.
 - Some permanent damage
 - much larger area surrounding the damaged area also affected.
- Larger area dormant (penumbra) due to reduced oxygen from decrease in blood flow.
 - Swelling and a change in cell physiology can cause reduced blood flow.



SPECT Scans

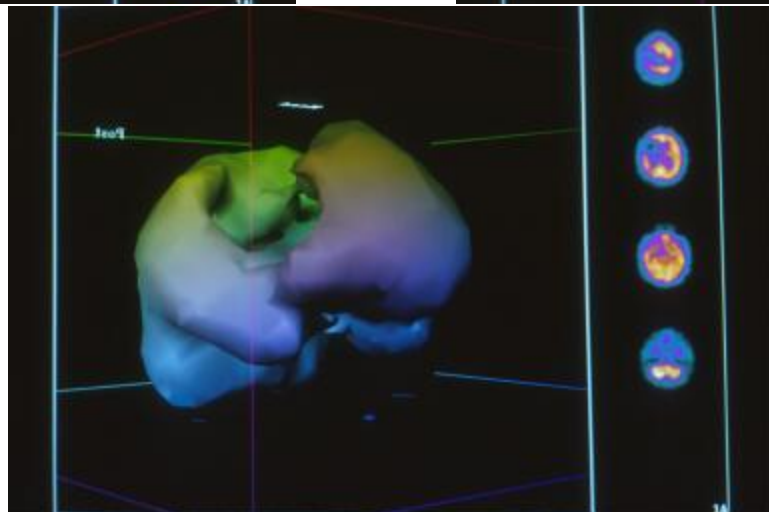


29 y.o. female
victim of gunshot
to the head.

Left: Prior HBOT

Right: 1 Session

Below: 80 Dives



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& Paul G. Harch, M.D.
2008



Traumatic Brain Injury and HBOT

- Five patients with TBI, > 3 years post injury, 120 HBOT's at 1.5 ATA for 60 min.
- “Treated TBI patients had permanent increases in penumbral area [cerebral blood flow].... Speech fluency universally improved, as did group mean scores of memory, attention, and executive function. Improvement peaked at 80 HBOT”
 - Barrett, K, 1998



Traumatic Brain Injury and HBOT

“HBOT at 1.5 ATA is a promising therapy to achieve cognitive improvement and **permanently improve** the penumbral brain flood flow in chronic stable TBI **where no improvement would have been expected.**”

Barrett, K, et al. COGNITIVE AND CEREBRAL BLOOD FLOW IMPROVEMENTS IN CHRONIC STABLE TBI...Undersea and Hyperbaric Medical Society, Inc. 1998

<http://archive.rubicon-foundation.org/582>



Stroke

- Sudden loss of blood and oxygen to a specific area of the brain which kills the central core of brain cells.
- Other “marginal” cells damaged from swelling, loss of blood and oxygen.
- HBOT for Stroke first studied in 1980
 - Early Intervention vs.
 - Immediate vs.
 - Delayed treatment



Stroke

- **HBOT can restore cell functioning:**
 - Overcomes ischemia/hypoxia, breaks ischemic cascade.
 - Reduces cerebral edema
 - Restores blood-brain barriers and cell-membranes
 - Stimulates cell transport mechanisms and metabolism.
 - Scavenges free radicals
 - Stimulates Angiogenesis

Neubauer, R.A. Gottlieb, S.F. Stroke Treatment [Letter] Lancet 337:1601, 1991.



Stroke

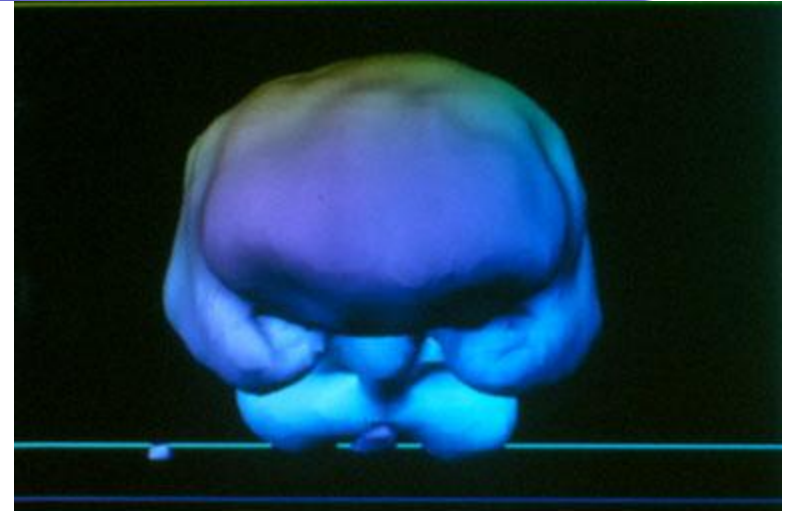
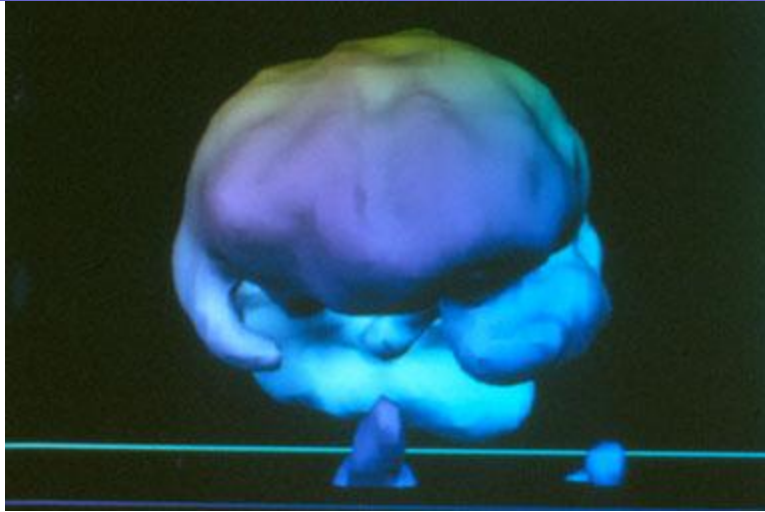
- Recovery from cerebrovascular disease is often 40-100% - higher than conventional methods.
 - Most patients in these studies were chronic post-stroke stage.

Jain, K.K. *Cerebral Insufficiency*. Chicago: Year Book Medical Publishers, 1990.

- Patients have improved SPECT scans, regain quality of life, have shorter hospital and long term care stays.



Stroke



- 68 y.o. male; third stroke two years prior
- Left: Scan prior to HBOT treatments
- Right: Scan after 1 month of HBOT treatments

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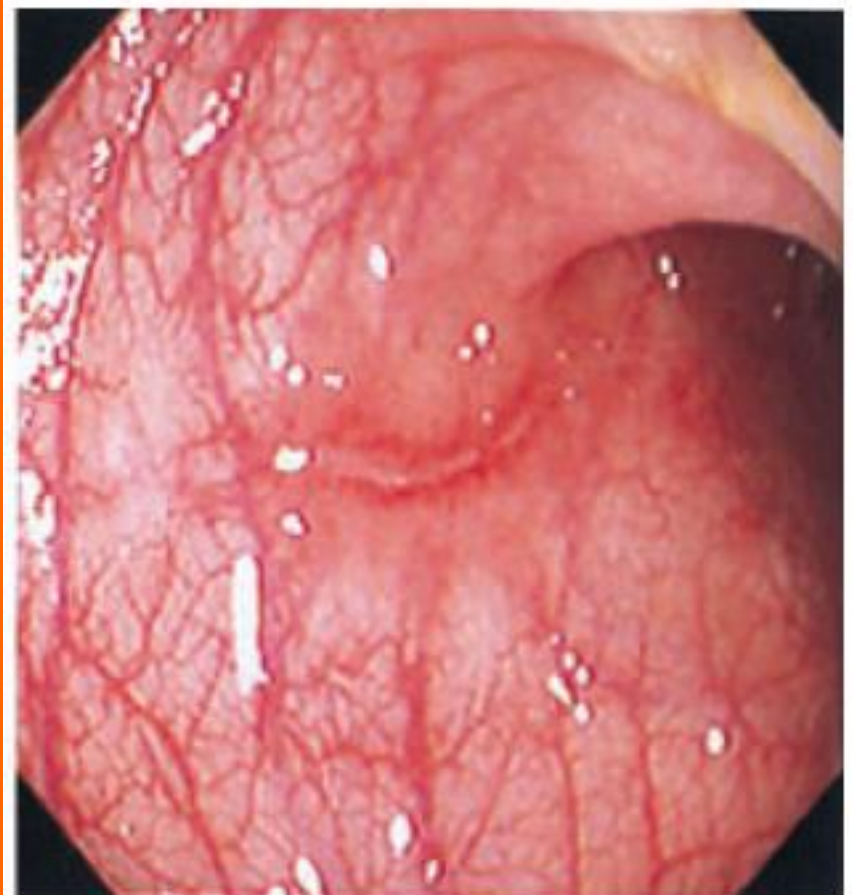
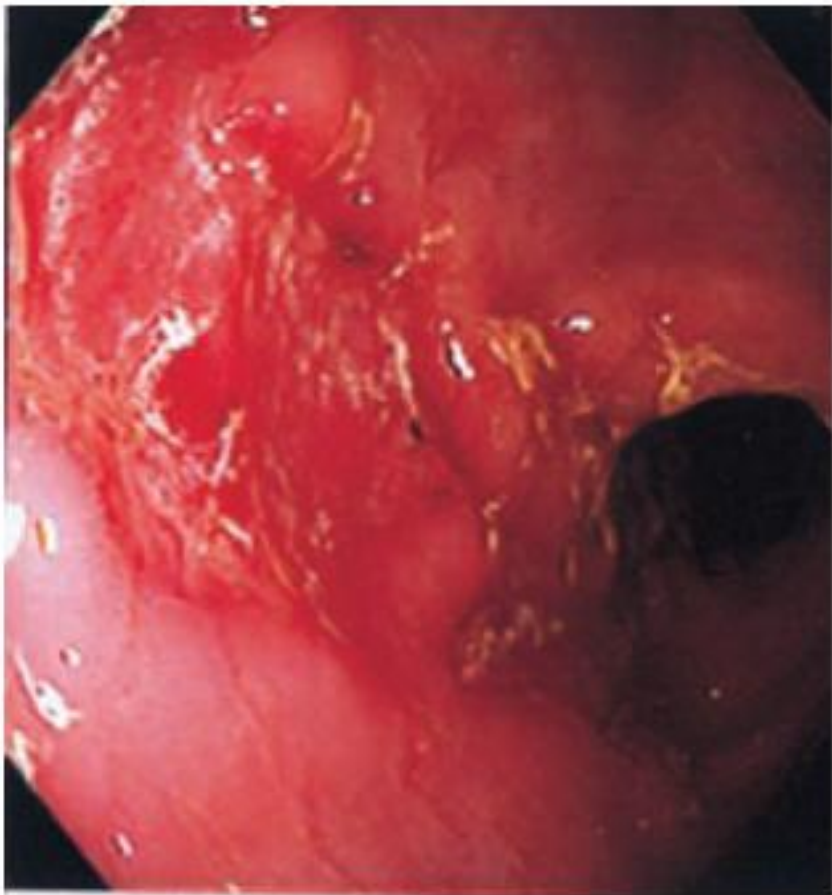


Chronic Conditions

Inflammation or infection causes damage in many cells, causing certain tissues to have decreased functioning.

Hyperbaric Oxygen as Adjunct Therapy for Crohn's Intractable Enteric Ulcer

Takeshima et al., 1999
Am J Gastroenterol
94(11):3374-5





Lyme Disease

- *Borrelia burgdoferi* (Bb), w/ co-infections
- First recognized in 1977; transmitt'd by ticks
- Initial, flu-like symptoms, Lyme rash (bull's eye)
- Muscle and joint pain, sore throat, fever, swollen glands, classic "brain fog"
- Treated with antibiotics
 - Standard vs. Aggressive (Oral or IV)
- Jarisch-Herxheimer Reaction – "Get worse before you get better"
 - Can be indication of infection, as well as effective treatment.



Lyme Disease and Oxygen

- Lyme bacteria found to be microaerophilic, or debilitated in high oxygen environments (between 30 -160 mmHg pO₂).
 - Austin, F.E. 1993. Maintenance of infective *Borrelia burgdorferi* Sh-2-82 in 4% oxygen – 5% carbon dioxide in vitro. Canadian Journal of Microbiology 39:1103-1110.
- Synergistic Therapy with Antibiotics
- Angiogenesis
 - New blood vessels may better reach Lyme, which evades blood flow.



Lyme Disease and HBOT

- 91 Patients (veterans of antibiotic therapy) treated with 1,995 total HBOT sessions in a multiplace chamber at 2.36 ATA, as well as breathing 100% pure oxygen.
- “84.8% of those treated showed significant improvement by a decrease or elimination of symptoms. Only 12 subjects (13.1%) claimed no apparent benefit.”
- Jarisch-Herxheimer reaction after first 5 days of HBOT, sometimes until 1 mo after stopping treatment.
- “Most subjects then began to show major improvement that in some instances has continued for 8 months.”

Fife, William, PhD. “Effects of Hyperbaric Therapy on Lyme Disease.” Texas A&M Hyperbaric Laboratory, 1997.



Multiple Sclerosis and HBOT

“Recent evidence that hyperbaric oxygen inhibits the actions of certain cytokines, acts as an immune modulator and may help cognitive dysfunction has resulted in a re-examination of its potential role in rheumatic diseases.”

Wallace, D.J., Silverman, S., Goldstein, J., Hughes, D. (1995). Occasional Review: Use of hyperbaric oxygen in rheumatic diseases: case report and critical analysis. *Lupus* 4: 172-175.



Multiple Sclerosis and HBOT

- Exp. grp:100% O₂; Placebo grp:10% O₂, 90% N₂ ATA for 90 min/ day, total 20 dives.
- Exp. grp - objective improvement in 12 of 17 vs. 1 of 20 in placebo group.
- Less severe condition = better, long-lasting improvements.
- 12% Exp group experienced deterioration (same who hadn't improved initially)

Barnes MP, Bates D, Cartlidge NEF, *et al.* Hyper-baric oxygen and multiple sclerosis: short term results of a placebo-controlled, double-blind trial. *Lancet* 1985; ii:297-3006.



Multiple Sclerosis HBOT Studies

- Oriani G, Barbieri S, Pirovano C, Mariani C (1987) Hyperbaric oxygen in chronic progressive multiple sclerosis : a placebo-controlled, double-blind, randomised study with evoked potentials evaluation. In: Oriani G (ed) Proceedings of the thirteenth annual meeting of the European Undersea Biomedical Society. Palermo: European Undersea Biomedical Society: 196-203.
- Pallotta R, Longobardi G, Fabbrocini G (1986) Experience in protracted follow-up on a group of multiple sclerosis patients periodically treated with hyperbaric oxygen therapy. In Baixe J-H (ed). Symposium sur le traitement de la sclerose multiple par l'oxygene hyperbare. Paris.
- Perrins DJD, James PB.(1994) The treatment of Multiple Sclerosis with prolonged courses of hyperbaric oxygen. Proceedings of the 1st European Consensus Conference on Hyperbaric Medicine. Lille : 245-263.
- Perrins DJD, James PB.(1994) The treatment of Multiple Sclerosis with prolonged courses of hyperbaric oxygen. Proceedings of the 1st European Consensus Conference on Hyperbaric Medicine. Lille : 245-263.
- Wiles CM, Clarke CRA, Irwin HP et al (1986) Hyperbaric oxygen in multiple sclerosis: a double blind study. Br Med J 292:367-371



Cerebral Palsy

- TBI - Damage to motor areas in the brain disrupts the brain's ability to properly control the movement of the body's muscles.
- Improper communication in brain could be result of damage to myelin sheath, without which the brain cell deteriorates.
- HBOT “wakes-up” dormant cells around damaged areas.



Cerebral Palsy

- Randomized, delayed entry trial
- Protocol 40 one-hour sessions at 1.5 ATA 2 x day, 5 day/wk, 4 wks.
- “Our conclusion is that, for some children with moderate to severe CP, there is evidence that HBOT improves motor skills, attention, language, and play.”

Packard, Maurine, M.D. The Cornell Study of Hyperbaric Oxygen Therapy (HBOT) for Cerebral Palsied Children. University of Graz, November 2000



Cerebral Palsy and HBOT

“Improved gross motor function..., improved fine motor function..., reduced spasticity in 3 of 4 muscle groups when assessed by a physician specializing in CP, and improvements [as scored by] parents.

HBO therapy appears to be a promising treatment for children with CP.”

Montgomery, D., PhD, et al. Effects of Hyperbaric Oxygen Therapy In Children with Spastic Diplegis Cerebral Palsy. McGill University 1998.



Cerebral Palsy – More Studies

- Jose Jorge Machado, *Clinically Observed Reduction of Spasticity in Patients with Neurological Diseases and in Children with Cerebral Palsy from Hyperbaric Oxygen Therapy*. Machado is Neurological Advisor of "Centro Brasileiro de Medicina Hyperbarica" - Rua Bento de Andrade, 70, Sao Paulo, Brazil.
- James, Phillip. *Hyperbaric Oxygen Therapy for Cerebral Palsy Children*.
- Paleg, Ginny. *Hyperbaric Oxygen Therapy for Individuals with Neurological Dysfunction*.
- Ocean Hyperbaric Center. *New Hope for the Neurologic Damaged Child, Cerebral Palsy, Anoxic Ischemic Encephalopathy and Traumatic Brain Injury*
- Southern Medical Journal, September 1994, Vol. 87, No. 9; *An Investigation of the Treatment of Cerebral Palsy Children with Hyperbaric Oxygenation Using Spect Imaging*.
- National Foundation for Brain Research, *Cerebral Palsy*, 1996.



Autism





Selected areas of hypoperfusion in autism and clinical correlation

<i>Area of Hypoperfusion</i>	<i>Clinical Correlation</i>
Thalamus	Repetitive, self-stimulatory, and unusual behaviors [Starkstein, 2000]
Temporal lobes	Desire for sameness and social/communication impairments [Ohnishi, 2000]
Temporal lobes and amygdala	Impairments in processing facial expressions/emotions [Critchley, 2000]
Fusiform gyrus	Difficulty recognizing familiar faces [Pierce, 2004]
Wernicke's and Brodmann's areas	Decreased language development and auditory processing problems [Wilcox, 2002; Boddaert, 2002]
Temporal and Frontal lobes	Decreased IQ [Hashimoto, 2000]



Summary: Effects of HBOT on the problems found in autism

<i>Problem</i>	<i>Autism Finding</i>	<i>HBOT Effect</i>
Cerebral perfusion	↓	↑
Neuroinflammation and GI inflammation	↑	↓
Immune function	↓	↑
Oxidative stress	↑	↓
Mitochondrial function	↓	↑
Neurotransmitter abnormalities	↑	↓
Dysbiosis	↑	↓
Stem cells		↑



Common HBOT Effects for Autism

- 1st 10-15 treatments → sometimes will have some hyperactivity / increased self-stimulatory behavior.
- Sometimes see an increase in yeast, especially in children with high intestinal amounts of *Clostridia*.
- Improvements in bowel function, especially diarrhea, in first 10 treatments.
- Most clinical improvements are in the 25-40-80 session range.

Rossignol DA (2007).



Take Home: HBOT Pressures

- Elevated inflammation = Elevated urinary neopterin, antibodies to brain tissue:
 - Often need higher pressures and an anti-inflammatory medication (e.g. Spironolactone): 1.5 – 1.75 atm
- Mitochondrial dysfunction = Elevated ammonia, lactate, decreased carnitine:
 - Often need higher pressures and high-doses of antioxidants (e.g. Acai, Co-Enzyme Q10, Vitamin C and E)
- Seizure disorder:
 - Need to start at very low pressures, sometimes even below 1.3 atm without additional oxygen as seizures will sometimes transiently increase with HBOT



Autism and HBOT

Rossignol DA (2007). "Hyperbaric oxygen therapy might improve certain pathophysiological findings in autism".
Med Hypotheses **68** (6): 1208–27



Autism Testimonial

“...Through the course of the next few months, Jackson’s presence became more and more obvious. He was able to make and keep friends for the first time in his life! He really had a difficult time before with any social skills whatsoever. We believe that the hyperbaric therapy helped him to make tremendous strides in the social realm....”

Jill Urwick, Charlotte, NC



Autism Testimonial

“...Shortly after purchasing the chamber, I was away at an autism conference. I talked regularly with my children on the phone. Once, I honestly thought I was talking with my older son, Kendall and was blown away to realize that it was actually Jackson! The only thing that made me realize this was that he said something about buying a new train. He was actually able to sustain a conversation with me on the phone without me having to guide him through it!...”

Jill Urwick, Charlotte, NC



HBOT Results Vary

- Results depend on the individual and their specific challenge.
- Studies are underway to help decide who will have the best outcomes and achieve the desired result.
- Results are often remarkable and dramatic:
 - Faster healing time
 - Reduced spasticity
 - Abilities regained or appear for the first time
 - Decreased inflammation
- Specific protocols to treat certain conditions are being developed.
 - World Federation of Neurology has protocols for some types of strokes.



HBOT Therapy in Hospitals

- Help wounds heal
- Help heal sores caused by diabetes
- Treat some infections
- Help the body make new blood vessels
- Preserve damaged tissue
- Rid the body of poisons such as carbon monoxide
- Remove bubbles of air or gas from the blood
 - May be covered by insurance or Medicaid
 - www.missionhospitals.org/body.cfm?id=293



Mild HBOT

- Soft-sided chambers, lower level of pressure.
 - Applied in many more conditions not covered by insurance.
 - Available to more persons in need.
 - Less expensive, safer, easier to use.
 - Portable chambers available in physician offices, outpatient facilities, private homes.
- Less research, but still improved outcomes in most areas mentioned, as well as in performance and wellness.



HBOT Therapy at an Independent Facility

- International Indications, such as those listed earlier (Approved AND “Off-Label”).
- Able to treat more types of conditions than at a hospital.
- Costs vary, usually \$100 + per session.
- Renting chambers from \$500 per week.
 - Can have up to two sessions per day.
- “Off-label” uses not typically covered by insurance.



Further Research and Progress

- Mild HBOT vs. Hard Shell
- Trials of 1-20 vs. 20 + dives
- When should hospitals extend HBOT treatments to other conditions?
- How can we get these covered by insurance?
- What other conditions could benefit from HBOT?
 - Loss of neurological capabilities like neuromuscular coordination and memory.



Learn more, or find a Hyperbaric facility near you

- International Hyperbarics Association, Inc.
 - www.ihausa.org
- Underseas Hyperbaric Medicine Society
 - uhms.org
- More Information
 - www.hbot.com, www.hbot4u.com,
www.hboevidence.com, www.hbotoday.com