

Traumatic Brain Injury: out of the “game”, but not out of danger !

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Awareness of concussion as a consequence of playing professional football and other sports and exposure to blast injuries for military veterans has reached an all – time high. A single bomb blast causes soldiers NFL – like brain trauma. The message has been received by the public: concussion is a real injury and you should **NOT** “go back into the game” after the injury. However the long term medical consequences of the injury - particularly if the brain has not healed - are less well established. With the recognition of acute and sub - acute concussion, players make decisions to stop playing sports altogether – they “**get out of the game**” while they believe they are still “cognitively clear”. But does that solve the problem ?

Young military veterans taken out of active duty or medically discharged don’t recover from their concussions even years after their injury and are often never able to re-enter the work force. The American Headache Association presented data at their July 2012 meeting that even 8 years post concussion – injury, most veterans continued to have persistent headaches, sleep disturbance, cognitive and emotional problems. The link between concussion injury and neurodegenerative conditions in the NFL has been acknowledged (at least by the players and the judge) and resulted in a huge settlement to compensate injured players – and studies of concussion injured military veterans are supporting that conclusion. It is clear that a new approach to post – concussion management is necessary. It is time to put together a game plan to save the brain.

Our brains are like computers.

The brain is a complex network of fiber tracts: to carry out any brain function there is a locus of control and a network that needs to be activated. Our brains are much more like computers than we would have believed. If the locus of control that triggers the algorithm / pathway is knocked out or there are “glitches in the system” the network cannot function as a cohesive system and the task is not completed. Multiple concussions destroy the control and networking of the brain and result in poor cognitive ability and a consequent failure to function in society.

Connections that extend from the neuron cell body and make connections with other areas of the brain are called axons. Axons gathered together form fiber tracts. The hallmark of concussive brain injury is diffuse shear injury to axons. The shear injury may involve only the fatty covering around the axon (the myelin) or it may also involve the underlying axon structural components. The extent of injury to the axon affects the ability to recover from the injury. A shear injury in the brain is like a glitch in a computer network.

Network connections are critical.

Fiber tract connections create networks. Fiber tracts formed from the right hemisphere (for example) connect to the left hemisphere through the corpus callosum. Connections through the corpus callosum allow the right side of the brain to know what the left side of the brain is doing and vice versa. Fiber tracts from the parietal lobes of the brain (which perform sensory integration / visual association) connect with the occipital lobes of the brain (primary visual information processing) so we can tell the difference between our visual reality versus stored visual images: is it real or a hallucination ? Fiber tracts connect the frontal lobes (which are responsible for decision making) with the temporal lobes of the brain (which store our memories of past experiences) so we can use our experience to help us make good decisions. All these connections form networks which allow us to function in our world. If you disrupt these connections throughout the brain these disconnections or “glitches” result in poor cognitive function. And then things get worse.

Disconnections and loss of brain cell function are the basis for post – concussion symptoms.

Disconnections create problems in an acute injury, but if these connections never heal, there is chronic brain injury. Even if new networks are formed by “re-wiring”, the injured brain cells begin a degenerative process and as the neurons “die back” *brain cells are lost. Dysfunction worsens over time if new connections are not formed and old connections and damaged neurons do not heal.* Healing is not guaranteed. Spontaneous healing in both the Central Nervous System (CNS) and the Peripheral Nervous System (PNS) is a very slow process. Amazing cases of people “waking up” after

spending many years in a persistent vegetative state following brain injury are examples of people naturally healing over time.

A traditional approach to recovery is observation and supportive care.

Medications do not create healing. Medications do not inhibit cell death or any neurodegenerative process. Non-healing is where the pathology of neurodegenerative disease begins. The current medical model of treatment for an individual who has sustained a concussion is to avoid further injury and let the brain heal itself over time using adjunctive therapies such as physical therapy, speech therapy and occupational therapy. Re-evaluations by neurologists may establish that a concussion injured person has achieved a certain baseline of functional recovery, *but that is not confirmation that injury has healed and that an individual will avoid future consequences of that injury.* There is no standard of care therapy that has been recognized to treat brain injury.

Making the connection: the consequences of injury.

The consequence of significant untreated concussion injury is early onset neurodegenerative disease. The more concussions, the worse the cumulative brain injury. *Injured brain cells that do not heal die, and may help to create the clinical syndromes of Alzheimer's disease, Parkinson's disease and ALS for example.* SPECT scans have been a helpful tool to identify injured areas of brain. New imaging techniques such as brain MRI with DTI may be a better choice to show the disruption of connections caused by concussion as well as providing a follow – up measure of healing. It's time to refocus our thinking on healing. The future is now and therapies to recover brain function are available.

HBOT is essential because every healing reaction requires oxygen.

Revolutionary emerging technologies will change neurological recovery forever. The operative term here is the **recoverable** brain. Our brains are designed to learn all throughout our life, and brain cells may heal given the proper support. Hyperbaric Oxygen Therapy (HBOT) is the first therapy that has been demonstrated to heal brain injury. The extensive research of Dr. Paul Harch covers the basic science of healing with HBOT, animal research and human research and his work has been submitted to the FDA confirming the effectiveness. There has been more research on HBOT than

on any drug or device ever approved by the FDA. Dr. Harch's textbook "The Oxygen Revolution" outlines his years of research and experience in treating brain injury. HBOT therapy is radically different than simply providing oxygen by nasal cannula in a hospital setting at atmospheric pressure. HBOT creates oxygen radicals which in a hyperoxic environment stimulate healing mechanisms including activation of intracellular healing processes, stem cell mobilization and modification of gene expression.

Brain recovery requires building from basic nutritional essentials.

For healing to take place, nutrient optimization including consumption of proper fats, adequate proteins, critical trace minerals, balanced electrolytes and smart sugars. Without the proper building blocks for recovery, the brain cannot recover. Please see our article, written with neuropharmacologist Dr. Tim Marshall: "Nutrition for the wounded warrior: it takes more than a vitamin" for details.

Neurobiofeedback is a simple retraining of the brain.

Brain waves may be retrained to a pattern that will minimize an anxiety reaction or to help activate less active areas of the brain. Even an injured brain is able to learn, re – wire, re – network. Brain Paint for example is an excellent Neurobiofeedback program for recovery. Re-establishing the normal rhythms of the electrical activity of the brain promotes functional recovery.

Magnetic fields enhance intracellular energy so that healing can take place.

Magnetic fields, particularly pulsed electromagnetic field therapy or PEMF results in direct energy transfer intracellularly to facilitate healing. PEMF has been used in Germany to treat advanced dementia and Down's syndrome with great results. It is being studied in the US for TBI recovery. A similar but more focused tool is transcranial magnetic stimulation (TCMS) which has been FDA approved to treat depression and is being studied in various neurology centers to treat patients post – stroke.

Autologous stem cell transplants boost recovery.

Safe, effective mechanisms for obtaining autologous stem cell transplants are available in the US. These procedures are primarily still under IRB protocols and are self – pay but are proving to be a powerful adjunctive therapy for recovery. Initial results from physicians performing that procedure indicate that it is a very safe treatment and results for patients with neurodegenerative conditions including severe TBI have been positive.

Save your brain.

Concussion is a major contributing factor to neurodegenerative conditions; although there are many other factors impact brain health and healing. A potentially huge “at risk” population for neurodegenerative disease exists and it is not only an “end – of – life” phenomenon. Functional recovery of an injured brain has never been as possible as it is now. Combining available therapies, a good nutritional baseline and lifestyle habits the best neurological recovery can be achieved. It is critical to anticipate the consequences of post – concussion injury and actively pursue healing therapies.