Therapeutic use of omega-3 fatty acids in severe head trauma

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Michael Lewis, MD; Parviz Ghassemi; Joseph Hibbeln, MD

BACKGROUND:

On January 2, 2006, in Upshur County, West Virginia, USA, there was an explosion in the Sago Coal Mine. The blast trapped 13 miners for nearly two days; only one miner survived. The lone survivor was Randal L. McCloy, Jr., age 26. He was found practically dead, unconscious and suffering from carbon monoxide poisoning, a collapsed lung, brain hemorrhaging, edema, muscle injury, faulty liver and heart function, and almost no brain electrical activity. His initial prognosis for recovery was grim, expecting permanent damage to his brain. However, McCloy recovered almost fully.

McCloy is the longest exposure to carbon monoxide poisoning to have survived. His doctors predicted that if he did survive, he would be severely brain damaged since the carbon monoxide had stripped the protective myelin sheath from most of his brain's neurons.

McCloy's neurosurgeon started to enternally feed him a daily dose of 15,000 milligrams (mg) docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) fish oil.

Soon, his brain electrical activity returned and he emerged from his coma, gradually regaining his ability to walk, talk, and see. Apparently the omega-3s helped rebuild the damaged gray and white matter of his brain. McCloy is now married, has children, and is largely functioning normally.

The authors of this study state:

"We are aware of only one report where n-3FA were used, that being the survivor of the Sago Mine accident in January 2006 suffering from hypoxia and exposure to toxic gases, dehydration, and rhabdomyolysis."
[Roberts L, Bailes J, Dedhia H, et al.; Surviving a mine explosion; J Am Coll Surg, 207 (2) (2008), pp. 276–283] {Dr. Bailes was McCloy's neurosurgeon}

These authors then present a case study stating:
"To our knowledge, this is the first report of specific use of substantial amounts of n-3FA following severe TBI."

- A teenager sustained a severe TBI in a motor vehicle accident.

- His extrication prolonged, he was in a coma, he sustained a subdural hematoma that was surgically decompressed.

- The attending neurosurgeons believed the injuries were likely fatal.

- On day 10, (still in a coma), MRI showed significant subdural hemorrhage and diffuse axonal injury. His doctors believed him to be in a permanent vegetative state.

- A tracheotomy and percutaneous endoscopic gastrostomy (PEG) tube were placed for custodial care and enteral feedings were started.

- On Day 11, 9,756 mg eicosapentaenoic acid (EPA) and 6,756 mg docosahexaenoic acid (DHA) per day were added to enteral feedings.

- On day 21, he was weaned off the ventilator and transported to a specialized rehabilitation institute 3 days later.

- 3 months after the injury the patient attended his high school graduation to receive his diploma.

- 4 months after the injury the patient was discharged to home.

- For the following year, the patient continued to take 16,500 mg of EPA + DHA fish oil supplements per day along with 6000 IU of vitamin D3; his improvement continued and he experienced no adverse effects.

KEY POINTS FROM DAN MURPHY:

1) The primary management of severe traumatic brain injury (TBI) is often surgical or intensive care unit, with the goals of maintaining adequate oxygenation, controlling intracranial pressure, and ensuring proper cerebral perfusion pressure.

2) "The secondary injury phase of TBI is a prolonged pathogenic process characterized by neuroinflammation, excitatory amino acids, free radicals, and ion imbalance. There are no approved therapies to directly address these underlying processes." [remember, the 2 primary excitatory amino acids are glutamate and aspartate; both are commonly added to processed foods as taste enhancers: glutamate is often called MSG for monosodium glutamate, but is routinely called dozens of different things on packaging labels. Aspartate is half of the artificial sweetener aspartame. Both of these should be avoided in the manage of traumatic brain injury]

3) These authors present a case that was intentionally treated with substantial amounts of omega-3 fatty acids (n-3FA) to provide the nutritional foundation for the brain to begin the healing process following severe TBI. N-3FA, "must be in

place if the brain is to be given the opportunity to repair itself to the best possible extent."

4) N-3FA administration is best if given early in the course of treatment, in the emergency department or sooner.

5) "It is well recognized that n-3FA are important for proper neurodevelopment and function."

6) "Average Western dietary intakes result in a deficiency of n-3FA and an over-dominant intake of pro-inflammatory omega-6s (n-6FA)."

7) "The ratio of n-3:n-6FA in the Western diet can be as low as 1:50. Such imbalance is reflected directly in the composition of neuron membrane phospholipids favoring inflammatory processes."

8) "Arachidonic acid is the primary n-6FA in the brain, is metabolized by cyclooxygenase and lipoxygenase enzymes to proinflammatory eicosanoids that enhance vascular permeability, increase local blood flow, increase infiltration of leukocytes, and enhance production of proinflammatory cytokines."

9) "Omega-3 fatty acids attenuate release of these proinflammatory cytokines, decrease cyclooxygenase activity, inhibit formation of proinflammatory eicosanoids and cytokines, and promote levels of anti-inflammatory docosanoids."

10) "Docosahexaenoic acid, in particular, promotes neuronal survival, neurogenesis, neurite development, neuronal cell migration, synaptogenesis, and modulation of inflammatory cascade."

11) N-3FA may help improve clinical outcomes when administered before or following TBI, spinal cord injury, and brain ischemia.

12) Omega-3 fatty acids "significantly reduce the number of injured axons."

13) "When DHA was given within an hour of spinal cord injury, neuromotor function was maintained; but the effect was lost when treatment was delayed for 4 hours."

14) "Early nutritional intervention in TBI is underappreciated. Patients not fed within 5 and 7 days after TBI have a 2- and 4-fold increased likelihood of death, respectively."

15) Our experience suggests that aggressively adding substantial amounts of n-3FA to optimize the nutritional foundation of severe TBI patients will significantly improve clinical outcomes. "An optimal nutritional foundation must be in place if the brain is to be given the best opportunity to repair itself."