

Traumatic Brain Injury

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Cerebral oxygenation and the recoverable brain.

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Oxygenation is the most critical function of blood flow and a sudden reduction in oxygen availability is an inevitable consequence of severe ischemia. The resulting cascade of events may result in the failure of membrane integrity of some cells and necrosis, but in the surrounding zone of tissue, less affected by hypoxia, cells survive to form the ischemic penumbra. The timing of these events is uncertain, but sufficient oxygen is available to these cells to maintain membrane ion pump mechanisms, but not enough for them to generate action potentials and therefore function as neurons. The existence of such areas has been suspected for some time based upon the nature of clinical recovery, but has now been demonstrated by SPECT imaging with a high plasma oxygen concentration under hyperbaric conditions as a tracer. A course of hyperbaric oxygen therapy frequently results in a permanent improvement in both flow and metabolism. These changes apparently represent a reversal of the changes that render neurones dormant and the activity of cells, previously undetectable by standard electrophysiological methods, can now be demonstrated. Three patients are presented in whom recoverable brain tissue has been identified using SPECT imaging and increased cerebral oxygenation under hyperbaric conditions. Improved perfusion from reoxygenation has correlated with clinical evidence of benefit especially with continued therapy.

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