

# Hypoxic Ischemic Brain Injury

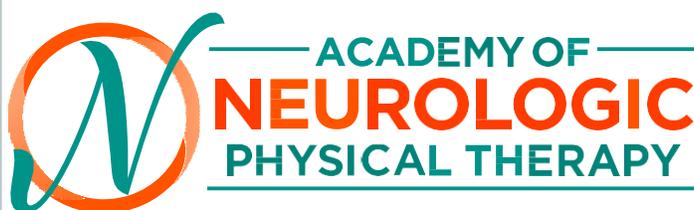
Kimberly Miczak PT, NCS & Carolyn Tassini PT, DPT, NCS

## Background Information

Hypoxic-Ischemic Brain Injury, referred to as HI-BI, refers to a condition in which a decrease or lack of oxygen to the brain causes damage to brain tissue, and thus brain function. Hypoxia indicates that the brain is deprived of adequate oxygen, due to decreased levels of oxygen in the blood traveling to the brain. This happens with respiratory arrest, carbon monoxide (or other gas) exposure, and asthma attacks. Ischemia indicates that there is a lack of blood perfusing the brain, which in turn hinders the delivery (levels) of oxygen to the brain. This can occur during cardiac arrest, drug overdose, near drowning, and near hanging events (2). Regions of the brain that are in watershed vascular areas or those with high metabolic demand are most susceptible to damage from HI-BI (3). Specifically, the cerebellum, hippocampus, thalamus, and basal ganglia are highly vulnerable structures (3). Thus, the functional consequences of HI-BI can be profound, leading to altered levels of consciousness, cognitive deficits, and physical impairments (4). Physical impairments may occur acutely, or in a delayed onset (weeks to month after injury) and can include movement disorders such as dystonia, myoclonus, bradykinesia, or ataxia (4). Additionally, visual disturbances including cortical blindness can result from HI-BI.

## Epidemiology/Statistics

The specific incidence of HI-BI is unknown as it is often a secondary effect of a variety of different causes. However, cardiac arrest is a main contributor to HI-BI and in a report by the American Heart Association (AHA), the incidence of out of hospital cardiac arrest (OHCA) in 2018 was 347,322. Of this, the AHA reports that 29% of individuals with OHCA survive until hospital admission and that 10.8% of individuals will survive to hospital discharge with 9% with “good” neurologic function. (1)



# Hypoxic Ischemic Brain Injury

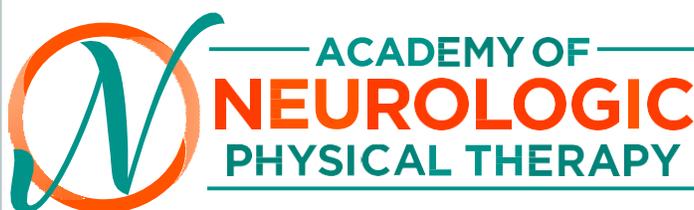
Kimberly Miczak PT, NCS & Carolyn Tassini PT, DPT, NCS

## The Role of Physical Therapy

The role of the physical therapist for an individual with HI-BI is supplementary to medical management, and can be categorized into 2 domains: (1) negating consequences of immobility, and (2) maximizing mobility & interaction with the environment. Due to the presence of altered levels of consciousness and severe cognitive deficits combined with the presence of movement disorders, the efforts of the physical therapist should include maintaining range of motion, optimizing posture including use of seating systems, and maintaining integrity of body systems including cardio-pulmonary, integumentary, and musculo-skeletal. Concurrently, the physical therapist should maximize safe & functional mobility, often using a combination of restorative and compensatory interventions. Unfortunately, there is a paucity of literature related to specific PT interventions for this population. Thus, clinicians may find it useful to access and integrate literature from other populations with similar features, such as using literature about cerebellar disorders to address ataxia or literature about Parkinson's disease to address bradykinesia. (recognize that it may not be fully transferable to the HI-BI population). Typically, the physical therapist will be part of an inter-disciplinary team that may include occupational therapists, speech therapists, and neurologists. Communication between team members regarding the influence of medications or other medical management to treat movement disorders and successful compensatory strategies is integral in promoting improved function for the client.

## Research Updates

In recent years, there has been more investigation into medical treatment interventions for persons with severe movement disorders, including deep brain stimulators and intrathecal medication pumps. Currently, only single case reports exist regarding these interventions (5,6). Future research regarding medical and therapeutic interventions would assist providers to maximize outcomes for this rapidly growing cohort of patients. Regardless of medical and surgical advances, Physical Therapy will remain an important adjunctive role in the treatment of movement disorders.



# Hypoxic Ischemic Brain Injury

Kimberly Miczak PT, NCS & Carolyn Tassini PT, DPT, NCS

## References

1. Benjamin, Emelia J., et al. "Heart disease and stroke statistics—2018 update: a report from the American Heart Association." *Circulation* 137.12 (2018): e67-e492.
2. Busl, K. M. and D. M. Greer (2010). Hypoxic-ischemic brain injury: pathophysiology, neuropathology and mechanisms. *NeuroRehabilitation* 26(1): 5-13.
3. Greer, D. M. (2006). Mechanisms of injury in hypoxic-ischemic encephalopathy: implications to therapy. *Seminars in Neurology* 26(4): 373-379.
4. Lu-Emerson C, Sandeep K. Neurologic sequella of hypoxic ischemic brain injury. *Neurorehabilitation*, 2010. vol 26 no 1pp 35-45
5. Ramdhani RA, Frucht SJ, Kopell BH (2017). Improvement of post-hypoxic myoclonus with bilateral pallidal deep brain stimulation: a case report and review of the literature. *Tremor other Hyperkinet Mov.* 7:461.
6. Whitlock, James A., and Ryan W. Dumigan. "Treatment of Postanoxic Action Myoclonus With Intrathecal Baclofen: A Case Report." *PM&R* (2018).