

## NH001

### A Treatment for Recovering Consciousness in Brain Injury Patients

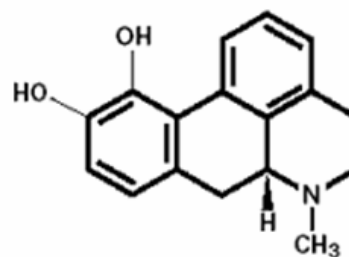
#### Summary

NH001 is a potent and broad acting dopamine agonist to help regain consciousness, accelerate recovery and improve the functional outcome of patients who remain in a vegetative state (VS) or minimally conscious state (MCS) after a traumatic brain injury (TBI). Currently, there are no approved drugs for this indication. In a pilot open label clinical trial, NH001 demonstrated dramatic responses in VS-MCS patients. A Phase II double-blind placebo-controlled trial is currently open for recruitment.

---

#### Active Ingredient and Mechanism of Action

Apomorphine is a broad dopamine agonist active in both D<sub>1</sub> and D<sub>2</sub> class receptors. It is used with syringe injectors for the treatment of hypomobility in advanced Parkinson's disease as a rescue treatment once other less potent drugs have lost efficacy. In patients remaining in vegetative state or minimally conscious state after a TBI, areas of the brain remain viable, but the connections between functional sections are impaired due to the diffuse axonal injury. Apomorphine stimulates the dopaminergic pathways and is expected to promote integration between distant functional regions of the brain, which may result in the regaining of consciousness. Once consciousness is restored, the patient can engage in active rehabilitation. Accelerating the recovery of consciousness will help patients achieve their best possible functional outcome.



**Apomorphine HCl**

---

#### Delivery System

NH001 is delivered subcutaneously, 12 hours per day, through a continuous infusion pump in pre-filled reservoir cartridges. Subcutaneous NH001 is rapidly absorbed and readily crosses the blood-brain barrier, reaching CSF concentrations six times higher than in plasma. NH001 is the only currently available dopaminergic agent that can be delivered parenterally and rapidly achieves, and maintains a steady and high CSF concentration. NH001 treatment is typically administered for a period of 2 to 3 months.

---

#### Market Size

Each year in the U.S., is estimated that 25,000 to 50,000 patients sustain a traumatic brain injury with loss of consciousness for more than 2 weeks. In addition, at any given time there is a pool of up to 200,000 patients in a vegetative state or minimally conscious state. Currently there are no drugs approved for this patient population. The cost of care for severe TBI patients is very high, with the lifetime cost estimated at over \$1 million per patient. With a projected pricing of \$20-40,000 per course of therapy, the U.S. market size for NH001 is estimated at \$1 billion in annual revenue.

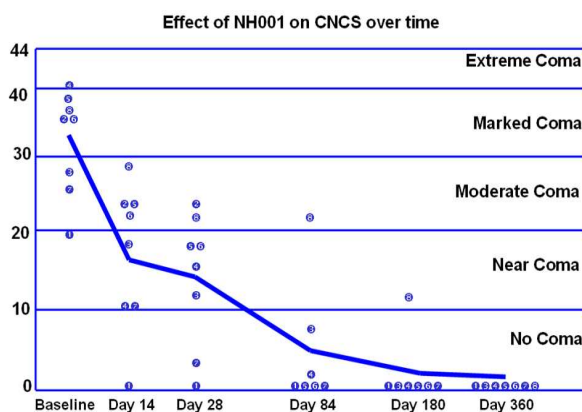
## Intellectual Property & Market Protections

NeuroHealing has filed and fully owns patent applications on methods of using NH001 to treat subjects in an altered consciousness state. One published patent, WO2004082630 “*High Potency Dopaminergic Treatment of Neurological Impairment Associated with Brain Injury,*” includes claims for formulations containing dopaminergic agents optimized for subcutaneous continuous infusion and as a kit attached to an infusion pump. The first patents in this series have issued in Australia and Canada.

NH001 has been granted orphan drug status from the FDA Office of Orphan Products Development. The orphan drug designation covers the use of NH001 for the treatment of patients in a vegetative state or minimally conscious state for up to twelve months following brain injury (TBI or stroke).

## Preliminary Clinical Data

An open-label clinical trial demonstrated that shortly after NH001 administration patients improved their consciousness levels and were able to start active rehabilitation. Patients in the study fared much better than the expected incident of recovery based on published historical data (see below). These data suggest that NH001 may accelerate the recovery of post-TBI patients and patients may achieve a better long-term functional outcome. Papers reporting these results have been published [Fridman et al, *Brain Injury* (2009) and Fridman et al, *Brain Injury* (2010)].



	Incidence of Recovery *	Responses with NH001
	n=434	n=7
Death	33%	14%
Vegetative State	15%	0%
Severe Disability	28%	29%
Moderate Disability	24%	57%
Good Recovery		

\* New England J Medicine 1994 330:1572

## Clinical Development Status

NeuroHealing has begun recruitment for a phase II double-blind placebo-controlled study in 76 unconscious patients (ClinicalTrials.gov identifier: NCT00761228) at the Spaulding Rehabilitation Hospital, a Harvard Medical School affiliated teaching hospital. Ross Zafonte, Chair of the Dept of Physical Medicine & Rehabilitation at Harvard and VP of Medical Affairs for Spaulding, and a recognized leader in the field of dopaminergic treatments for patients with low neurological functioning, is the study’s principal investigator.

NeuroHealing has been awarded an FDA Orphan Drug clinical grant award of \$1 million to initiate this trial. NH001’s IND was filed under 21 CFR 312.81 subpart E: Drugs Intended to Treat Life-threatening and Severely-debilitating Illnesses, also known as “fast track”.