

A study on the tonic stretch reflex (TSR) and the tonic vibration reflex (TVR) in Huntington's disease patients

Student: Hasibul Haque

Supervisors' names: Dr. John Burne and Dr Ian Cathers

PhD (FT) Semester 1

Introduction:

Huntington's disease (HD) is a hyperkinetic disorder presenting with motor disturbances including chorea, dystonia and rigidity. Preliminary reports indicate the presence of reflex abnormalities in HD. Though the reflex contribution to the movement disorder is unclear, it is likely that stretch reflexes may contribute to the muscle rigidity seen in these patients. A better understanding of the reflex mechanisms could be of immense value to therapy. Reflex measures may also produce much needed disease markers. Our laboratory previously investigated the mechanism of spasticity in stroke and spinal cord injury patients¹. The present proposed study is designed to study in detail the stretch reflex response in HD patients in terms of reflex gain, phase relationships and delay using a continuous perturbation over low (TSR) and high (TVR) frequency bands. This would be the first reported study of the TSR and TVR in HD. Also in previous studies, our laboratory has reported that electrical stimulation of muscle tendons leads to strong inhibition of the voluntary EMG. From such studies the possible contribution of a tendon reflex abnormality to rigidity and tremor in Parkinson's disease was proposed³. We will thus use this method to test for abnormal inhibitory mechanisms in the HD spinal cord.

Aims:

- 1) To investigate the stretch reflex abnormalities underlying rigidity and bradykinesia in HD.
- 2) To investigate the spinal inhibitory mechanism in HD and its relationship to the movement disorder.

Methods:

After obtaining informed consent, a 2 minute broadband chirp perturbation of 25-60 Hz generated by a servo motor will be applied to the right wrist joint of 15 patients with HD and 15 control subjects, while subjects make a contraction of the wrist flexors or extensors equivalent to 10% of maximum (MVC). In the same setting a mechanical vibrator will be applied to the tendons of flexor carpi radialis (FCR) and extensor carpi radialis (ECR), while contracting at 10% of MVC, at frequencies of 150, 200, 250 and 300 Hz each for 1 min. Muscle EMG signals will be correlated against the joint angle records, thus enabling estimation of reflex gain, coherence, phase and delay as a function of perturbation and vibration frequency. In addition, electrical stimulation of the FCR and ECR tendons will be carried out with voltage pulses of 50 μ s duration and of 350 V amplitude. Amplitudes and latencies of muscle inhibitory and excitatory EMG response components will be calculated and compared with those from normal subjects and previous Parkinson's disease and essential tremor studies^{2,3}.

Future Studies:

This study is expected to describe the spinal motoneuron abnormality in HD patients through a detailed reflex study that will later guide a similar study of spinal motoneurons in an HD animal model to detect persisting abnormalities in membrane properties of spinal motoneurons. This model may provide the potential for in vitro testing of a new range of therapeutic compounds that specifically target spinal inhibitory mechanisms.

Reference:

1. Burne JA, Carleton V, O'Dwyer N (2005) The spasticity paradox: movement disorder or disorder of resting limbs. *J. Neurol Neurosurg Psychiatry*. In press.
2. Burne JA, Blanche T, Morris JG (2002) Loss of inhibition following muscle tendon stimulation in essential tremor. *Muscle & Nerve* 25: 58-62.
3. Burne JA, Lippold OCJ (1996). Loss of tendon organ inhibition in Parkinson's disease. *Brain* 119:1115-1121.