The role of Transcranial Magnetic Stimulation in Neurological Diseases

A thesis submitted for partial Master Degree in Neuropsychiatry
By

Sherine Mohamed Kamel El-Mously
M.B.B.Ch

Under supervision of

Professor Dr / Mohamed Anwar Etribi
Professor and chairman of Neuropsychiatry Department
Faculty of Medicine
Ain shams University

Doctor / Nahed Salah El- Din Ahmed
Assistant Professor of Neuropsychiatry
Faculty of Medicine
Ain shams University

Doctor / Nivert Zaki Mahmoud Hashem
Lecturer of Neuropsychiatry
Faculty of Medicine
Ain shams University

Faculty of Medicine
Ain shams University
2004

Summary

TMS is a non-invasive tool for electrical stimulation of the neural tissue. Single and paired pulse TMS studies have been done mainly for pathophysiological purposes; however, r-TMS have been used largely for therapy.

The aim of this study was to review the diagnostic and therapeutic applications of TMS in different neurological diseases and to test its effectiveness in PD.

Magnetic stimulation was first discovered by **Faraday M,** in 1831. Several subsequent experimental studies were done in this field till **Barker AT** introduced TMS in 1985; which opened a new horizon in research and clinical applications in neurophysiology, neurology, neuroscience and psychiatry.

The principle of TMS is based on the electromagnetic induction. When rapidly changing magnetic pulses are generated and penetrate the scalp and the skull to induce a secondary ionic current in the brain, TMS can activate the motor system directly or indirectly.

During TMS, the operator can change the intensity of stimulation, the focus of the magnetic field and the location of stimulation, but, the most important is the control of frequency of delivered stimuli which critically determine the effects of TMS on the targeted regions of the brain.

Single pulse TMS activates the corticospinal neurons which finally leads to a muscle twitch in one or more of the adjacent muscles. The muscle twitch has an electrical counterpart which is the MEP recorded by surface electrodes. Neurophysiologists measured several MEP variables such as the threshold ,amplitude, duration, cortical and peripheral latency, central motor conduction time and silent period.

These variables vary in different neurological diseases and hence can be used in diagnostic researches. The paired pulse technique is used for the examination of intracortical inhibitory and facilitatory mechanisms of the motor cortex and the examination of interhemispheric interactions.

As regard r-TMS, the higher the stimulation frequency and intensity, the greater is the modulation of cortical function, r-TMS can also alter the cortical excitability depending on the stimulation variables particularly the frequency of stimulation.

In this study, we reviewed the role of TMS as a diagnostic and prognostic tool in stroke, multiple sclerosis, epilepsy, migraine, ataxias, movement disorders and amyotrophic lateral sclerosis. Recently, TMS was introduced as a mode of therapy in stroke, ataxia, movement disorders and neurogenic pain .Its therapeutic role in epilepsy and amyotrophic lateral sclerosis still under trials.

TMS has been applied in neurosurgery as a preoperative assessment tool and for intraoperative monitoring.

As a diagnostic tool in PD, the most constant findings were shortening of the silent period and diminished short interval intracortical inhibition.

Many studies have been applied to investigate the therapeutic role of TMS in PD using different r-TMS frequencies of stimulation ranging from 0.2-20Hz. Most of these studies were satisfactory and proved that r-TMS is capable of alleviating PD symptoms and signs.

Our study induced six PD medicated patients as a trial to assess the effectiveness of this promising tool on these patients.

The study showed beneficial results as there was significant improvement of the total motor UPDRS score and self assessment scale score 1-week and 2 weeks after 1Hz r-TMS course.

The study showed nearly significant improvement of the tremors at rest (subitem of UPDRS) 1 week and 2 weeks following r-TMS course. Subjectively on the self assessment scale, the tremors improved significantly 1 week and 2 weeks following r-TMS course.

Arising from chair and bradykinesia as subitems of UPDRS improved significantly after 2 weeks of r-TMS course.

The cluster of symptoms consisting of rigidity and bradykinesia showed significant improvement after 2 weeks following r-TMS course; and the cluster of symptoms consisting of leg agility and arising from chair showed significant improvement 1 week and 2 weeks after r-TMS course.