

ABSTRACT

Combination of Transcranial Magnetic Stimulation and Rehabilitation Program on Post Stroke Ischemia

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Background: Neurogenesis in the brain after stroke shows the phenomenon of plasticity and cortical reorganization in the ischemic brain area. In the area of the motor cortex, ischemia decreased cortical stimulation in the acute phase, while in the lateral control motor cortex increased stimulation and increased somatomotor representation. Transcranial Magnetic Stimulation (TMS) with low frequency over the motor cortex in the part of the brain that is not affected by lesions and rehabilitation programs can improve upper extremity motor function in hemiparesis stroke patients, but the mechanisms underlying the changes are difficult to understand. Brain Derived Neurotrophic Factor (BDNF) is one of the factors involved in synaptic plasticity in the motor cortex. Meanwhile, individual variation responses to TMS and rehabilitation programs depend on differences in BDNF concentrations.

Purpose: See the combination of Transcranial Magnetic Stimulation 1 Hz and rehabilitation programs for changes in BDNF upper extremity expression after stroke ischemia, see the combination of Transcranial Magnetic Stimulation 1 Hz and rehabilitation programs for changes in upper extremity motor function after stroke ischemia, see the combination of Transcranial Magnetic Stimulation 1 Hz and rehabilitation program towards improving upper extremity functional ability after stroke ischemia and seeking the contribution of BDNF expression with motor function and upper extremity functional ability after stroke ischemia.

Methodology: Transcranial Magnetic Stimulation and rehabilitation program was carried out by randomized controlled trial (RCT). The design to test the hypothesis used a pretest-posttest group design with consecutive sampling. Consisting of 11 subjects in 2 groups who meet predetermined inclusion criteria. TMS testing and a rehabilitation program to determine its effect on BDNF protein expression (marker human BDNF) in blood serum of post-ischemic stroke patients, motor function with Upper Extremity Fugl Meyer Assessment (UEFMA) measurements and functional ability by measuring the Wolf Motor Function Test (WMFT) upper extremity Post stroke ischemic patients were compared with the control group (TMS only) for 7 days.

Results: The results showed that there was no statistically significant effect on increasing and decreasing BDNF protein expression and the p-value was obtained (> 0.05). While the BDNF expression increased for 1 respondent (16.6%) in the control group and 5 respondents (83.8%) in the treatment group which was achieved on day 7. There was a statistically significant effect on the pre-post BDNF, motor function and functional ability were obtained. p-value (< 0.05). The motor function contributes to the effect of BDNF levels by 72.1%. The functional ability of the treatment group and the control group also contributed to the effect of BDNF levels by 70%.

Conclusion: The combination of TMS frequency 1 Hz and the rehabilitation program in post-ischemic stroke patients showed higher BDNF expression, motor function and upper extremity functional ability in the treatment group than in the control group. Increased BDNF expression affected motor function and functional ability for 7 days, up to 6 months after the attack.

Keywords: BDNF, Motor Function, Functional Ability, Rehabilitation Program, Stroke Ischemia, TMS

INTISARI

Kombinasi *Transcranial Magnetic Stimulation* dan Program Rehabilitasi Pasca Stroke Iskemia

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Latar belakang: Neurogenesis di otak setelah stroke menunjukkan fenomena plastisitas dan reorganisasi kortikal di area otak iskemia. Pada area kortek motorik iskemia mengalami penurunan stimulasi kortikal pada fase akut sedangkan pada kortek motorik kontrolateral meningkatkan stimulasi dan memperbesar representasi somatomotor. *Transcranial Magnetic Stimulation* (TMS) dengan frekuensi rendah di atas kortek motorik pada bagian otak yang tidak terkena lesi dan program rehabilitasi dapat meningkatkan fungsi motorik *upper extremity* pada pasien stroke hemiparese namun mekanisme yang mendasari perubahannya sulit difahami. *Brain Derived Neurotrophic Factor* (BDNF) adalah salah satu faktor yang terlibat dalam plastisitas sinap pada kortek motori. Sedangkan respon variasi individu terhadap TMS dan Program rehabilitasi bergantung pada perbedaan konsentrasi BDNF.

Tujuan: Melihat kombinasi *Transcranial Magnetic Stimulation* 1 Hz dan program rehabilitasi terhadap perubahan ekspresi BDNF *upper extremity* pasca stroke iskemia, melihat kombinasi *Transcranial Magnetic Stimulation* 1 Hz dan program rehabilitasi terhadap perubahan fungsi motor *upper extremity* pasca stroke iskemia, melihat kombinasi *Transcranial Magnetic Stimulation* 1 Hz dan program rehabilitasi terhadap peningkatan kemampuan fungsional *upper extremity* pasca stroke iskemia dan mencari kontribusi ekspresi BDNF dengan fungsi motor dan kemampuan fungsional *upper extremity* pasca stroke iskemia.

Metodologi: *Transcranial Magnetic Stimulation* dan program rehabilitasi dilakukan *randomized controlled trial* (RCT). Desain untuk menguji hipotesis menggunakan *pretest-posttest group design* dengan *consecutive sampling*. Terdiri dari 11 subjek dalam 2 kelompok yang memenuhi kriteria inklusi yang telah ditetapkan. Pengujian TMS dan program rehabilitasi untuk mengetahui pengaruhnya terhadap ekspresi protein BDNF (marker human BDNF) di serum darah pasien pasca stroke iskemia, fungsi motor dengan pengukuran *Upper Extremity Fugl Meyer Assessment* (UEFMA) dan kemampuan fungsional dengan pengukuran *Wolf Motor Function Test* (WMFT) *upper extremity* pasien pasca stroke iskemia dibandingkan dengan kelompok kontrol (TMS saja) selama 7 hari.

Hasil: Hasil penelitian menunjukkan tidak ada pengaruh yang signifikan secara statistik pada peningkatan dan penurunan ekspresi protein BDNF diperoleh nilai *p-value* (>0.05). Sedangkan ekspresi BDNF meningkat untuk 1 responden (16.6%) pada kelompok kontrol dan 5 responden (83.8%) pada kelompok perlakuan yang dicapai pada hari ke 7. Ada pengaruh yang signifikan secara statistik pada pre-post BDNF, fungsi motor dan kemampuan fungsional diperoleh nilai *p-value* (<0.05). Fungsi motor memberikan kontribusi pengaruh kadar BDNF sebesar 72,1%. Kemampuan fungsional pada kelompok perlakuan dan kelompok kontrol juga memberikan kontribusi pengaruh kadar BDNF sebesar 70%.

Kesimpulan: Kombinasi TMS frekuensi 1 Hz dan program rehabilitasi pada pasien stroke pasca iskemia menunjukkan ekspresi BDNF, fungsi motor dan kemampuan fungsional *upper extremity* lebih tinggi kelompok perlakuan daripada kelompok kontrol. Meningkatnya ekspresi BDNF mempengaruhi fungsi motor dan kemampuan fungsional selama 7 hari, maksimal sebelum 6 bulan pasca serangan.

Kata kunci: BDNF, Fungsi Motor, Kemampuan Fungsional, Program rehabilitasi, Stroke Iskemia, TMS