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Effectiveness of Simulating Magnetotransfer Therapy in Reducing the Severity of Depression in Post Stroke Patients

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Abstract

Background: Stroke is an acute neurovascular disorder that causes long-term limitations to daily living activities and death throughout the world, causing sufferers to experience motor and cognitive impairment. Until now, patients suffering from brain injuries require Transcranial Magnetic Stimulation with a method that non-invasively stimulates and studies the cerebral cortex which is large enough to produce the release of action potentials.

Objective: The aim of the research is to determine the effect of providing transmagnetic stimulation therapy on improving post-stroke depression.

Method: This research design uses a Nonequivalent control group design, where there are 2 groups, namely a control group and an intervention group, each group is measured 2 times, then the level of improvement in depression is assessed using the Hamilton depression rating scale score.

Results: The results obtained for the control group were 0.302 > 0.05 and the significant value for the intervention group was 0.000 < 0.05.

Conclusion: it can be concluded that there is a significant difference between the average post test score of the control group and the average post test score of the intervention group.

Keywords: Effectiveness; Providing Magnetotransfer Therapy Simulation; Reducing the Severity of Depression Post-Stroke Patients

INTRODUCTION

Post-stroke depression greatly affects the psychology of the sufferer, there will usually be a rejection of therapy so that it causes an inhibition of the healing process and even leads to death. The results of the survey prove that post-stroke depression occurs 2 months to 6 months after the attack occurred (1). The most common post-stroke neuropsychiatric disorder is depression with a prevalence of 6%-52% in 40% of stroke victims and shows depression during therapy. Meanwhile, in the rehabilitation phase, it ranges from 20%-50% of cases (2).

Some data in developed countries related to depression show a fairly high prevalence in post-stroke patients, which is an average of 20-50%. Other studies say that depression appears unpredictable, it can be 2 weeks after the attack occurs or 3-6 months after the attack, the sufferer will experience clinical manifestations of depression (3). A study shows the efficacy of TMS (trans magnetic stimulation) therapy in improving the quality of life after stroke by improving the patient's depression level. Transcranial magnetic stimulation delivers stimulation to the problematic central nervous system. The study explained that trans magnetic stimulation therapy was able to provide a 45% improvement in post-stroke patients who experienced impaired activity and depression with complications. The administration of TMS stimulus can show a higher stimulation effect when given continuously and gradually according to the procedure for implementing therapy (4).

Electromagnetic induction is a principle in Transcranial Magnetic Stimulation (TMS), using the advantage that each electric wave has a magnetic region around it, with wave exchange causing fluctuations in the magnetic region. Transcranial Magnetic Stimulation (TMS) is a method that non-invasively stimulates and studies the brain cortex. In TMS, a rapidly changing magnetic field (B-field) is used to induce an electric field (E-field) inside the brain, mostly confined to the superficial part of the cortex. The E field drives ionic currents that cause local hyperpolarization or depolarization of the neuronal membrane that can be stimulated. Considerable membrane depolarization results in the release of action potentials. So, TMS is essentially electrical stimulation, where the delivery of E-fields to the brain is mediated by magnetic fields. The strength of the magnetic field induced by TMS can be reduced by extracerebral tissues (scalp, bones, meninges), but it is still capable of inducing an electric field sufficient to depolarize the superficial axons and to activate the tissues in the cortex.

In developed countries such as the United States, the practice and administration of trans magnetic stimulation therapy is commonly given to patients who experience depressive psychological disorders, with a record of resistance to pharmacological treatment, while in Indonesia itself this therapy is still very lacking. Post-Stroke Depression is a psychological disorder that occurs after a stroke occurs characterized by a lack of passion, hopelessness, helplessness and surrender. The prognosis of recovery from post-stroke patients is greatly influenced by psychological factors, the more severe the psychological disorder will make it difficult for the patient to get to the healing stage. Prolonged emotional disturbances when depression is the main cause of post-stroke therapy failure, the more difficult it is for patients to cure. Bad mood inability in terms of adaptation is a form of psychological disorder (5).

In theory, there is a strong suspicion of a mechanism from the occurrence of post-depressive stroke due to a disturbance in the left hemisphere that causes emotional disturbances, the left hemisphere frontal is a regulation of feelings and will interfere with the activity of serotonin. Lack of serotonin receptors is associated with the occurrence of depression. Trans Magnetic Stimulation is a method given to stimulate the brain by using electromagnetic coils positioned in the head near the brain and the central nervous system (6). TMS (Trans Magnetic Stimulation) aims to improve the physiological function of the brain, providing stimulation to the surface of the brain or cerebral cortex (7).

TMS therapy induces an electric field, an electric current will flow through a coil of copper wire called a coil aiming to provide an electric current vibration on the surface of the brain, this modulation is done with the aim of generating in response to stimuli. For example, if the TMS stimulus is passed on to the functional representation of the hand (M1), then the body will potentially move, connecting brain signals to the muscles in the contralateral hand that produce muscle contractions. Therefore, activity occurs as a result of tissue connectivity during the administration of TMS therapy. The mechanism of trans magnetic stimulation is described in the Khedr 2015 image.

TMS provides stimulation to brain nerve cells so that impaired brain cells can work better again. TMS is useful for increasing the activity of cells that are not so active through increased activity of neurotransmitters, which are a conductive substance on the pathways of nerve cells. TMS therapy is carried out by providing low-frequency or high-frequency electromagnetic waves to provide an inhibition/inhibitory effect on overactive nerves or activating underactive cells of Sidoarjo Hospital (8).

A major limitation in TMS research is the challenge for the recording of individual neurons during stimulation, due to the strong electromagnetic fields induced by TMS. Recent technical advances, have made it possible to assess neural activity during stimulation using electrophysiological, or functional optical imaging techniques. These studies provide experimental evidence that stimulation of a single magnetic vibration initiates an action potential at the low threshold of interneurons,18 resulting in suppression of the stimulated cortex for about 200 ms after stimulation. 14 In contrast, high-frequency repetitive magnetic stimulation (10 Hz; or single vibration stimulation of higher intensity) shifts

the balance between excitation and inhibition towards excitation.24 Recent research has also shown that rTMS can depolarize the pre- and post-synaptic neuronal compartments simultaneously, i.e., through the potential induction of anterograde and backward propagation action. Therefore, simultaneous recordings of different cells or multiple recordings of individual neurons, e.g. somato-dendritic recordings, are expected to provide important new insights into the effects of rTMS during stimulation at the single-cell level. The impact of rTMS on non-neuronal cell types in the brain (e.g., astrocytes, microglia, oligodendrocytes, endothelial cells, immune cells) has yet to be discovered.

The results of this study showed a significant decrease in pain intensity in the group given r-TMS for 10 cycles. Another relevant research according to Baruno Adi Christiantoro et al. (2019) entitled the effectiveness of repetitive transcranial magnetic stimulation (rTMS) on improving cognitive function in patients with vascular cognitive impairment (9). Post-stroke cognitive impairment often occurs in stroke patients. In this study, two groups of subjects with similar variables where the first group received rTMS therapy while the other group did not receive rTMS therapy. Both groups received cognitive training therapy and secondary infarct stroke prevention therapy, the results of this study showed a significant improvement in global cognitive function as assessed by the MoCA-INA score in patients with post-infarct stroke cognitive impairment shortly after rTMS treatment.

METHOD

The type of research used was a quasi-experimental pre-post control group, namely 2 research groups (intervention group and control group) for the treatment group located at the Medika Farma Clinic and the control group at Daya Makassar Hospital. Sampling techniques in Purposive Sampling research. The number of samples in this study was 50 respondents of which 25 respondents were in the intervention group and 25 respondents were in the control group. The design of this study uses a Nonequivalent control group design, where there are 2 groups, namely the control group and the intervention group, each group is measured 2 times, then the rate of depression improvement is assessed using the Hamilton depression rating scale (HDRS) score. The assessment was carried out twice, namely on the 1st and 15th days of the study, then compared the HDRS score according to the level of depression and compared the difference in HDRS scores in the two groups.

RESULT

Table 1. Distribution of respondents by age

Age	f	%
50 - 59 Years	23	46
60 - 69 years old	27	54

Table 1, the age of respondents 50-29 years old was 23 otang (46%) and the age of respondents 60-69 years was 27 people (54%).

Table 2. Results of Analysis of Independent T Test Post-test

Levene's Test for Equality of Variances		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
F	Sig.	t	D	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
.211	.698	5.023	48	.203	200.000	155.027	111.703	511.702
		6.023	44.359	.000	660.000	109.581	439.205	880.795

Based on table 2, the independent output of the sample test was known to have a significance value of 0.302 > 0.05 in the contraband group and a significant value in the intervention group of 0.000 < 0.05, Thus it can be concluded that there is a significant difference between the mean post test score of the control group and the average post test score of the intervention group.

DISCUSSION

In this study, the pre-test assessment or assessment before giving intervention to the experimental group was carried out for 2 days and for the control was also carried out for 2 days, the purpose of the pre-test was to find out the value of HDRS (Hamilton depression rating Scale), namely the value of the patient's sleep quality disorder, the results obtained for the 2nd pre-test score of the group were 0.203 > 0.050 which means there was no difference, This gives an idea that the intervention and control groups have the same problem and do not have significant differences, thus the researcher will more easily control the 2 groups.

Meanwhile, in the results of the post test conducted 4 weeks after the previous measurement (pre-test), 0.302> 0.050 for the control group and 0.000 < 0.05 for the intervention group, thus it can be concluded that there is a significant difference between the average post test scores of the 2 groups. According to the researcher, the difference in results from the 2 groups was due to the TMS therapy given to the intervention group, so the results showed a difference. This is in line with previous research according to Khedr, Ahmed, Fathy, Rothwell, 2015) routine administration of rTMS therapy for 2 weeks can stimulate the repair of damaged and dead neurons to regenerate by creating new pathways that can improve depression.

Another study that supports the improvement of synapses after stroke is explained by (Takeuchi, et al 2018) in the study it is stated that rTMS provides stimulation of neurons resulting in a shift of ions around the stimulated neuronal region, then the shift that occurs will manifest into a change in the platiness of the synapse, which stimulates the cerebral cortex so that it causes contractions in the muscles along with it (Bulter 2017) also states that rTMS regulates Transmission of synapses is chemical, synaptic remodeling occurs after the administration of electromagnetic stimulus for 10 sessions, in 15 people who experience ischemic disease. In this study, data were obtained before rTMS was carried out on respondents with ischemic stroke, including; who were not depressed as many as 1 person or (6.7%) while after receiving rTMS therapy with a frequency of 5-10 Hz, data were obtained as many as 4 people or (26.7%), this proves that depression improvement occurs after being given electromagnetic wave stimulation because rTMS is able to regenerate neuronal cells that are ischemic so that neurotransmitter dysfunction does not occur and depression improvement occurs continuously. (Robinson, 2018) used HDRS (Hamilton Depression Rating Scale) to measure depression improvement in ischemic stroke patients, after receiving rTMS therapy for 10 sessions, a p value of 0.015 was obtained with a sample of 50 people.

CONCLUSION AND SUGGESTION

The provision of Magnetotransfer Therapy Simulation in post-stroke patients was a significant difference between the average post test score of the control group and the average post test value of the intervention group.

Studies in large groups of healthy subjects have shown that individual responses to the rTMS approach vary greatly between individuals. Several factors such as age, genetic factors, and the electrophysiological nature and connections of motor tissue have been discussed to critically influence how TMS interacts with the brain. All of these factors are related to interpersonal variability in responding to rTMS in healthy subjects. Considering the heterogeneity of stroke lesions and their compensation, the number of differences in individual susceptibility to rTMS in stroke patients may even exceed the differences observed in healthy subjects.

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