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ROM And CIMT Treatment Effects To Stroke Patients's Upper Extremity Functional Ability

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Abstrak

Stroke merupakan gangguan fungsional otak akibat terganggunya suplai darah ke otak. Stroke merupakan salah satu penyebab terbanyak kelemahan atau hemiparesis pada ekstremitas. Penderita stroke yang mengalami hemiparesis jika tidak dilatih maka dapat mengakibatkan kontraktur pada sendi dan semakin lama akan menjadi cacat permanen. Penelitian ini bertujuan untuk mengetahui pengaruh kombinasi Range Of Motion Exercise (ROM) dan Constraint Induced Movement Therapy (CIMT) terhadap perubahan kemampuan fungsional ekstremitas atas pada pasien stroke dengan hemiparesis di Ruang Interna 1 RSUD dr. R. Soedarsono Pasuruan, Penelitian ini menggunakan desain Quasi eksperimental dengan rancangan Non Equivalent Control Group. Pengambilan responden menggunakan teknik Consecutive Sampling dengan jumlah 34 responden yang dibagi menjadi dua kelompok 15 responden sebagai kelompok perlakuan diberi terapi kombinasi Range Of Motion Exercise dan Constraint Induced Movement Therapy, 15 responden sebagai kelompok kontrol diberi terapi Range Of Motion Exercise. Uji statistik menggunakan uji Paired T-test dan uji Independent T-test. Berdasarkan hasil uji statistik Paired T-test terdapat perbedaan hasil kemampuan fungsional ekstremitas atas pada kelompok perlakuan setelah diberikan intervensi kombinasi Range Of Motion Exercise dan Constraint Induced Movement Therapy dengan Pvalue 0,000 (p < 0,05) dan uji statistik Independent T-test terdapat pengaruh intervensi kombinasi Range Of Motion Exercise dan Constraint Induced Movement Therapy terhadap kemampuan fungsional ekstremitas atas dengan Pvalue = 0,047 (p < 0,05). Dapat disimpulkan bahwa kombinasi Range Of Motion Exercise dan Constraint Induced Movement Therapy dapat memberikan perubahan bahkan meningkatkan kemampuan fungsional ekstremitas atas sehingga dapat digunakan sebagai alternative terapi latihan dalam meningkatkan kemampuan fungsional ekstremitas atas pasien stroke dengan hemiparesis.

Kata kunci *: ROM; CIMT; stroke*

Abstract

Stroke is a brain functionality disorder caused by disruption of blood supply into the brain. Stroke is one of the leading causes of weakness or hemiparesis on ekstremities. A stroke patient who encounter hemiparesis may suffer joints contracture which then can become permanently disabled if it is not trained. In hospitals, Range of Motion Exercise is often performed, but the results are less optimal. This research aims to discover the combination effects of Range of Motion Exercise (ROM) and Constraint Induced Movement Therapy (CIMT) to the changes of upper extremity functional ability by using a measuring tool Chedoke Arm and Hand Activity Inventory form (CAHAI) to stroke patients with hemiparesis at Interna 1 of dr. R. Soedarsono Regional Public Hospital, Pasuruan. This research uses Quasi Experimental with non-Equivalent Control Group design. The respondents were chosen by using Consecutive Sampling technique with a total of 34 respondents divided into two groups. 17 respondents as the treatment group were given combination therapy

of ROM and CIMT and 17 respondents as control group were given ROM therapy only.. The Statistical test was done by using Paired T-test and Independent T-test. According to the result of Paired T-test, there are differences found in the result of upper extremity functional ability after the combination intervention of ROM and CIMT had been given in the treatment group with P Value 0.000 (p < 0.05). Then, the independent t-test stated that the intervention of ROM and CIMT hold an influence to upper extremity functional ability with P Value = 0.047 (p < 0.05). This research concludes that the combination of Range of Motion Exercise (ROM) and Constraint Induced Movement Therapy (CIMT) can increase the upper extremity functional ability so that it can be used as an alternative of exercise therapy to increase the upper extremity functional ability of stroke patients.

Keywords: *ROM; CIMT; stroke*

INTRODUCTION

Stroke is the second biggest cause of death in the world and is also the top cause of long-term disability that occurs in the age of adulthood (1). Irfan (2010) mentions that the manifestation of the stroke depends on the magnitude of the lesions that may lead to hemiparese, hemiplegia, hemiparestesia, afasia/motor disfasia or sensory, hemianopsia, dysarthria, non-symmetrical face, and agile movement disorders or non-coordinated movements (2). This condition, in addition to the functional limitations and dependence of stroke patients, also has an impact on socioeconomic and may induce the risk of depression among the patients and their families who take care of them (3).

Around the world there are 15 million people suffering from strokes each year, including deaths occurring in 5 million people and 5 million others experiencing permanent disability (4). Basic health Research (Riskesdas) in 2013 found that the prevalence of stroke in Indonesia amounted to 12.1 per 1000 inhabitants. The number has increased compared to the result reported by Riskesdas in 2007, which is 8.3 per 1000 inhabitants (5). Based on the diagnosis of East Java Province Nakes (2013) the number of patients was estimated to reach 190,449 people (16%) (6). Basic health Research in East Java Province (2018) displays that 39.53% of stroke patients experience total dependence, 33% experience mild dependence, 8.36% experience severe dependence and 7.63% experience moderate dependence (7). Depkes RI (2014) further identifies that based on some research 65% of stroke patients are experiencing defects (8). Stroke is also the main cause of functional disorders whereby 20% of the patients are in need of advanced care in health institutions after 3 months and 15%-30% of patients with stroke are permanently disabled (3).

Based on the preliminary survey conducted at Interna 1 of dr. R. Soedarsono Regional Public Hospital, Pasuruan, stroke is still a serious problem because it belongs to the category of the big 5 most common diseases. Stroke ranks first at Interna 1 of dr. R. Soedarsono Regional Public Hospital, Pasuruan, as a disease mostly suffered by the patients. The prevalence of stroke at Interna 1 reaches 452 of 2,161 visitors throughout 2018, where 74% of patients have a case of non-hemorrhagic stroke and 26% of which have a case of hemorrhagic stroke. Meanwile, based on Stroke patient's data during

2019 there were 159 cases, with female patients as much as 80 cases and males of 79 cases. Many cases of stroke attacked patients at the age of > 44-66 years old.

Stroke is a brain disease occured due to the stopping of blood supply to the brain caused by obstruction (non-hemorrhagic stroke) or bleeding (hemorrhagic stroke) (9). Stroke can result in motor disorders from no oxygen supply to the brain (10). Motor disorders caused by stroke as a result of muscular weakness will inflict paralysis or loss of ability to move the upper or lower limbs or known as hemiparesis (11). Patients with hemiparesis, if not trained, will suffer from joints contracture and in longer term will be permanent disabled. Patients with impaired stroke will be followed by aging process in the brain and nerve tissue that, if not treated early on, will trigger some problems such as motion disorder, balance disorder, etc (12).

The treatment of post-stroke rehabilitation is an absolute necessity for stroke patients to improve their mobility and motor function. The earlier the rehabilitation is carried out, the greater the expectation mobility and function will increase (13). Rehabilitation is expected to restore the old ability of the body of hemiparesis, introduce and train new abilities for the limbs that do not experience hemiparesis, and regain the capacity of the lost capabilities.[27] Some rehabilitation methods of stroke patients have shown improvement and even restore the function of upper limb experiencing hemiparesis after stroke (14).

The rehabilitation approach consists of physical therapy, occupational therapy and speech therapy. Physical therapy and occupational therapy are the scope of rehabilitation in patients with hemiparesis (15). Physical therapy and occupational therapy in the rehabilitation of stroke patients has shown to increase even the function of the upper limb that is subjected to hemiparesis after stroke, one of

which is with Range of Motion Exercise Physical Therapy and Occupational Therapy Constraint Induced Movement Therapy (13).

Range Of Motion Exercise is one of the therapies used to prevent contracture andmuscle atrophy, increase blood circulation to the extremities, reduce vascular paralysis and provide comfort in patients (16). Constraint Induced Movement Therapy (CIMT) is a method of rehabilitation intended for people with hemiparesis stroke. The sufferer is encouraged to use/move the arm with hemiparesis. This method was done to restrict movement to the arm that does not undergo hemiparesis (13) Intensive exercises, concentration, duration and multiplicity of CIMT exercises can make changes in the functioning of motor and brain organizations. Functional improvements can bring neurological improvements (13).

Previous studies mentioned that the modified CIMT intervention could reduce the level of disability, improve the ability to use extremities that undergo paresis, and increase spontaneity during movement. However, there is still limited evidence related to CIMT's affectiveness in the kinematic analysis (17). Kurniawan (2013) conducted a research on the use of CIMT method with daily equipment to improve functional ability and independence in the extremities of stroke patients. The result shows that the method truly has some influence by increasing the functional ability and independence of the upper extremities on those patients (18). Similar research conducted by Erni, Lestari and Astuti (2017) on the modified influence of CIMT and the Range Of Motion Exercise (ROM) of motor ability in non-hemorrhagic stroke patients showed that it was more effective in influencing the motor capability of non-hemorrhagic stroke patients (19).

MATERIALS AND METHODS

Based on its type, this research is categorized as *Quasy experimental Research.*

The design used was *Non Equivalent Control Group*, allowing the researcher to compare intervention results in a similar control. The samples on the treatment group and the control group were not grouped randomly. This method can also be called as *Non random control group pre test post test* (14).

Respondents were divided into two groups, the control group and the treatment group. The first group received a Range of Motion exercise treatment once a day for 10-15 minutes in accordance with the hospital procedures. Meanwhile the treatment group received a combination treatment of Range of Motion Exercise and Constraint Induced Movement Therapy by using daily tools that the researchers have prepared for 20 minutes a day. Both groups were given a treatment within the same period of five days during hospital treatment. The two groups conducted a functional ability assessment of the upper extremities by using form blowing Chedoke Arm and Hand Activity Inventory (CAHAI) before treatment. Then, both groups were given treatment according to their respective group. After the treatment, the two groups conducted a functional ability assessment of the extremities once again by using form blowing Chedoke Arm and Hand Activity Inventory (CAHAI).

The population studied in this research was the entire stroke patients with hemiparesis hospitalized at Interna 1 of dr. R. Soedarsono Regional Public Hospital, Pasuruan. The number of patient visits in the inpatient room of Interna 1 with stroke in the last 3 months (May - July 2019) was 37 patients. The sampling technique used in this study was the Consecutive Sampling. Research subjects who meets the criteria of study were chosen as the research sample until a certain period of time. Thus, the required number of clients was fulfilled. Meanwhile, the number of samples were set based on the Slovin (1960) formula (20).

There were 34 respondents in which 17 respondents were put into intervention group and were given a combination of Range Of Motion (ROM) Exercise and Constraint Induced Movement Therapy (CIMT). Then, the other 17 respondents were chosen as the control groups in which they were given Range of Motion (ROM) exercise only. Sample of 15 or more studies in experimental quasi research is considered to represent the accuracy of the population. In this research, 7 samples were dropped out because 2 people were not willing to be intervened, 3 people were allowed to go home before the intervention was conducted in 5 days, 1 person was not cooperative in the middle of the implementation of interventions (patients raging) and 1 person could not follow the intervention for 5 days due to a declining state so that he had to move to another room.

The inclusion criteria of the respondents were as follows: 1) Male/female stroke patients treated at Interna 1 of Dr. R. Soedarsono Hospital, Pasuruan, 2) Patients with unilateral hemiparesis, 3) Patients with composmentis consciousness, 4) Patients who are able to communicate well and 5) Patients who are willing to become respondents and get treatment.

The exclusion criteria of the respondents were as follows: 1) Stroke patients with complications, 2) Patients who cancel their participation due to certain reasons, 3) Patients who loss their consciousness thus moved into another room, 4) Uncooperative patients 5) Patients with repeated stroke.

Data collection instruments in this research include: 1) SOP of ROM and CIMT act as the basis for intervention, 2) CAHAI Guide as a basis for the functional ability of upper extremities, 3) CAHAI assessment Form to measure the functional ability level of upper extremities, 4) Patient observation sheet and 5) Stationery and notebooks.

The tools used for the data collection include: 1) Table, 2) Chairs or bed patients

without a hand rest, 3) Plastic Jars 200 gr, 4) Phone/mobile, 5) Plastic ruler 30 cm, 6) Paper size A4 50 gr, 7) Wooden pencil, 8) Plastic water kettles Size 2.3 L, 9) Glass plastic size 250 mL, 10) Small towel, 11) Plastic basin, 12) Vest/shirt/ shirt with studs and 13) Patient bath towel.

The univariate data analysis was carried out by using the relative frequency distribution of the variable characteristics of the respondents such as age, gender and type of stroke, and variable of upper limb functional ability before and after treatment.

The Bivariate statistical analysis method used in this study was the Paired T Test and the Independent T test. The Paired T test was used to test two interconnected data samples or pre-post-upper extremity functional capabilities both in the control group and the treatment group. Meanwhile, Independent T test was used to test the two samples of data that are not interconnected or in pair with the functional ability of upper extremity between the control group and the treatment group.

RESULTS AND DISCUSSION

The characteristic data of respondents includes: gender, age and the stroke type suffered by the respondents.

Gender

Table 1 shows that the percentage of males in the treatment group is 47.1%, which is smaller than the control group (58.8%). The percentage of females in the treatment group is 52.9%, which is larger than the control group (41.2%).

Age

Table 2 indicates that the average age of the treatment groups is 55 years (middle age).

Table 1. Frequency Distribution Of Respondents By Gender

Gender	Treatment Group		Control Group	
	N	Percentage %	N	Percentage %
Male	8	47,1	10	58,8
Female	9	52,9	7	41,2

The range of the age starts from 45 years (middle age) to 75 years (old). Meanwhile, the average age of the control group is 58 years (middle age). The range of the age starts from 47 years (middle) to 67 years (elderly).

Stroke type

Table 3 indicates that the percentage of hemorrhagic stroke type in the treatment group is the same as the control group (29.4%) with 5 respondents. The percentage of non-hemorrhagic stroke type in the treatment group (70.6%) is also similar to the control group (70.6%) with 12 respondents.

Table 3. Frequency Distribution Of Respondents By Stroke Type

Stroke type	Treatment Group		Control Group	
	N	Percentage %	N	Percentage %
Hemorrhagic stroke	5	29,4	5	29,4
Non hemorrhagic stroke	12	70,6	12	70,6

Overview of upper extremity function of ROM and CIMT treatment group

Table 4 depicts the average pre-test value of the treatment group is 16.47 which is categorized as low function and the post-test value is 19.76 which is categorized as medium function with a minimum value of 7 and maximum value of 28.

Table 2. Frequency Distribution Of Respondents By Age

Respondent's age variable	Treatment Group					Control Group				
	N	Min	Max	Mean	Std.Dev	N	Min	Max	Mean	Std.Dev
	17	45	75	54,71	7,59	17	47	67	58,29	5,04

Table 4. Overview Of Upper Extremity Function Of ROM And CIMT Treatment Group

ROM and CIMT Treatment Group					
Variable	N	Min	Max	Mean	SD
Pre-test CAHAI	17	7	28	16,47	5,039
Post-test CAHAI	17	9	34	19,76	5,414

Overview of upper extremity function of ROM control group

Table 5 shows the average pre-test value of the control group is 16.06 which is categorized as low function and the post-test value is 16.41 which is categorized as low function with a minimum value of 9 and maximum value of 26.

Table 5. Overview Of Upper Extremity Function Of ROM Control Group

ROM Control Group					
Variable	N	Min	Max	Mean	SD
Pre-test CAHAI	17	9	24	16,06	3,176
Post-test CAHAI	17	9	26	16,41	3,906

The differences of upper extremity function before and after intervention of the ROM and CIMT treatment group by using Paired T-Test

Based on the results of the normality test, the results of the data were normally distributed so that the bivariate analysis in this study used the Paired T test statistical test.

Table 6 shows that the result of Paired T-Test between pre-test and post-test of the treatment group, the SIG value. (2-tailed)

Table 6 The Differences Of Upper Extremity Function Before And After Intervention Of The ROM And CIMT Treatment Group By Using Paired T-Test

Groups	Functional ability	N	Mean	SD	Sig.(2 tailed)
ROM and CIMT Treatment Group	Pre test	17	16,47	5,039	,000
	Post test	17	19,76	5,414	

=,000 is smaller than 0.05 which means that there is a significant difference of the upper extremity function before and after combination intervention of ROM and CIMT.

a. The differences of upper extremity function before and after intervention of the ROM control group by using Paired T-Test

Based on Table 7 it shows that the result of Paired T-Test between pre-test and post-test of the control group, the SIG value. (2-tailed) =, 055 is bigger than 0.05, meaning that there is no significant difference of the upper extremity functional ability of control group before and after ROM intervention.

Table7 The Differences Of Upper Extremity Functional Ability Before And After Intervention Of The ROM Control Group

Groups	Functional ability	N	Mean	SD	Sig.(2 tailed)
ROM Control Group	Pre test	17	16,06	3,716	,055
	Post test	17	16,41	3,906	

b. Comparison of the upper extremity functional ability of the treatment and control group in patients with hemiparesis stroke by using Independent T-Test

Table 8 shows P value = 0.047 < 0.05 which rejects the null hypothesis. Based on the result of Independent T-Test, there is an outcome difference of the upper extremity functional ability between treatment and control group in stroke patients with hemiparesis.

Discussion

The results indicated that there was a noticeable improvement of upper extremity

Table 8. Comparison Of The Upper Extremity Functional Ability Of The Treatment And Control Group In Patients With Hemiparesis Stroke By Using Independent T-Test

	F	Sig.	T	Df	Mean difference	Std. Error mean	P value
Comparison of treatment and control groups	1,078	,307	2,071	29,105	3,353	1,619	,047

functional ability of the treatment group after intervention, while in the control group the scores increased but the improvement was not too significant compared to the treatment group because the intervention given to the control group was less routine, less scheduled and was given with less intensity than the intervention given to the treatment group. This is in accordance with the existing concept that the ability of moving the joints among stroke patients can be sustained and improved by ROM training therapy. The ROM therapy improved the upper extremity functional ability of stroke patients and improved more significantly when it was combined with CIMT therapy. CIMT therapy forces the use of the hemiparesis arm-hand by restraining the less-affected arm so that it may maximize the functional use of hemiparesis arm - hand.

There are two types of treatment for managing stroke. They are pharmacological and non-pharmacological treatment. Non-pharmacological treatment consists of position setting, blood pressure monitoring as well as exercise therapy (21). Range of Motion refers to an activity aimed at maintaining and improving movement of the joints normally and maximally in order to increase muscle mass and muscle tone. ROM therapy will stimulate the muscles to produce a volunteer movement initiated by the motion which is given actively or passively. It was aimed to stimulate the impulses in motor nerve and sensory brain which then stimulates contraction and relaxation of muscles. If it is done regularly, movement in the extremities will recover or even increase (2). Due to repeated stimulation or the activation results of increased stimulation and facilitation of relevant synapses transmission, repetition of exercise could improve performance and learning. Thus, synaptic transmission and the effectiveness of continuous synaptic connections will make the central and peripheral nervous system work, resulting in the increasing of the upper extremity functional ability (22). Research results conducted by IKA and Rahayu (2014) showed P-Value < 0.05. It can be concluded that there was an influence of ROM therapy to motor skills of the post-stroke patients at RSUD Gambiran Kediri 2014 (23).

Constraint Induced Movement Therapy is a multifaceted neurorehabilitation technique aimed at improving motor function and increasing the use of upper extremities affected hemiparese in real world activities (24). There is similar research conducted by Kurniawan (2013) that is in line with the research conducted by researchers. Kurniawan's research showed the influence of CIMT therapy with daily equipment in increasing the functional ability and the upper extremities independence in stroke patients (18). ROM and CIMT that are applied with intense treatment, concentration, duration & the number of exercises are two important factors in improving motoric function and brain organization. CIMT evokes neuronal plasticity in stroke patients, increasing the number of neurons associated with the movement of extremities that are hemiparesis in stroke. Due to repeated stimulation or activation results of increased stimulation and facilitation of relevant synapses transmission, repetition of exercise cam improve performance and learning. Thus, synaptic transmission and the effectiveness of continuous synaptic connections will make the central and peripheral nervous system work (22).

Researchers argue that the functional ability of the upper extremities in the treatment group given the combination therapy of ROM and CIMT undergo an increased because the therapy is given with intense exercises, concentration, duration & the number of more frequent and scheduled exercises twice a day. The result of the upper extremity functional ability of the treatment group showed significant improvements compared to the control group. Researchers argue that this is because the

control group is only given ROM therapy without combined it with CIMT with the intensity and duration in accordance with the hospital program which is carried out once a day.

CONCLUSIONS AND SUGGESTIONS

There is a significant improvement of upper extremity functional ability between pre and post test results in the treatment group (ROM and CIMT). However, there is no significant improvement of upper extremity functional ability between the pre and post test results in the control group (ROM). There is a comparison of changes in the extremity functional ability of stroke patients with hemiparesis between the treatment groups (ROM and CIMT) and the control group given ROM therapy. Communities and respondents who suffer from stroke can apply and share information to nearby families to use both of these workout therapy combinations independently at home as a pharmacological therapeutic companion to improve upper extremity functional ability. To get optimal results, this combination of exercise therapy should be done continuously. The intensity, concentration, duration and the number of exercise should be done regularly and carried out in comfortable environment.

Further research This research can be used as a reference. Further research may try different method by controlling the scaffolding factor and by using larger samples, ample time and efficient inclusion criteria. Thus, the results can be more accurate and maximized.

This research can be used as a reference in providing activity therapy for stroke patients with hemiparesis. Further research can try different methods by controlling the scaffolding factor and by using a larger sample, using different measuring instruments, a wider coverage of stroke problems, sufficient and maximum intervention time and efficient inclusion criteria. Thus, the results can be more accurate and maximum.

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