

Research Article

The Effect of Bilateral Arm Training on Daily Activity in Stroke Patients

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Abstract. Stroke patients frequently experience weakness and even paralysis in certain body parts, which can make daily chores more challenging. Therefore, we need interventions that can increase the daily activity of stroke patients so that they can carry out their daily activities successfully. This study aimed to determine the effect of bilateral arm training on daily activity in stroke patients. This study used a quasi-experimental approach with a two-group pretest-posttest design. There were 38 respondents, with 19 in each group. After conducting the pretest, respondents in the intervention group were given bilateral arm training for two weeks, and after the posttest, the control group was given this training as well. The Barthel Index questionnaire was used to assess the activity level of stroke patients in this study. The paired t-test and independent t-test were utilized for statistical analysis. The intervention group's daily activity levels increased, as measured by the mean score, which increased from 62.89 to 68.16 ($p = 0.009$). The scores in the control group remained constant from before to after the intervention periods, ranging between 40 and 80 with a mean of 60.00. The independent t-test showed a significant difference in the post-test scores between the two groups ($p = 0.040$). It can be concluded that bilateral arm training can improve daily activity in stroke patients. Additionally, this intervention can be performed in a hospital setting and nurses can teach the patient, family, and caregiver as part of discharge planning.

Keywords: activity daily living, bilateral arm training, stroke

1. Background

Stroke is a sudden and acute focal or global impairment of brain function that lasts longer than 24 hours due to infarction or bleeding in the brain or spine [1,2]. Stroke is the world's third-biggest cause of morbidity and mortality, behind heart disease and cancer. Globally, 70%-87% of deaths and disabilities due to stroke occur in low- and middle-income countries [2]. Stroke prevalence in Indonesia is increasing every year, as well as the incidence of Stroke in West Java Province exceeds the national incidence rate by reaching 11.4 per mile [3].

Stroke patients face physical and psychological weakness due to blocked or ruptured blood arteries in the brain [4,5]. Numerous complications frequently occur, including

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speech disorders, walking disorders, paralysis of one side of the body, depression, easily fatigued, unstable emotions, memory disorders, balance and or coordination disorders, sensory and motor function disorders, and even total bed rest, which makes patients unable to perform their activity daily living [6,7]. Stroke is usually associated with hemiparesis. More than half of stroke patients lose control of their arm temporarily or permanently due to upper extremity paralysis, making them unable to conduct Activity Daily Living (ADL) [8]. ADL is a collective word that refers to the basic skills required to care for oneself, such as eating, bathing, and mobility, when impaired, such as in stroke patients, can lead to an adverse quality of life [9,10]. This loss of function and independence in stroke patients can also put a burden on the family, as the family is responsible for meeting the patient's basic needs, such as eating, eliminating, and personal hygiene, all of which are included in stroke patients' daily activities [11].

Numerous therapies have been developed to improve the ADL in post-stroke patients, such as range of motion (ROM), mirror therapy (MT), and Bilateral Arm Training. Bilateral Arm Training is a therapy that promotes simultaneous use of the affected extremity, which has been shown an improved in motor function. It has been used to treat people with hemiplegia and has been utilized to restore function in hemiplegic patients [8]. Additionally, it was shown that Bilateral Arm Training had been evidenced to stimulate the cerebral hemispheres and activate the central nervous system. Around 90% of the nerve fibers in the cerebral cortex and spinal cord are responsible for contralateral movement, while 10% are responsible for ipsilateral movement. Upper limb movement on the unaffected (healthy) side can affect upper limb movement on the affected side. Physical activity management alleviates symptoms and helps prevent the incidence of repeated strokes [12,13].

According to previous study, Bilateral Arm Training affects both hemispheres more than unilateral training does, through lowering inhibition in the cerebral cortex and optimizing the combined effect of temporal and partial neural networks in the brain and cortex [14]. Furthermore, the study suggests that this training can increase the Activity Daily Living with ($p\text{-value} < 0.5$). It has been reported that Bilateral Arm Training occurs. This exercise can enhance daily living activity by ($p\text{-value} < 0,5$). Based on previous studies, Bilateral Arm Training can be alternative management to increase ADL in stroke patients. As a result, researchers are interested in determining the effect of Bilateral Arm Training on Activity Daily Living (ADL) among stroke patients.

2. Methods

2.1. Research design and sample

This study is a quantitative study that used the experimental two-group pretest-posttest design. This study used a control group, so the first observation was carried out before the intervention (Pretest) and after the intervention (Posttest), and the sample was selected randomly. This study aimed to investigate the effect of bilateral arm training on ADL in stroke patients.

The sampling technique used purposive sampling. Samples were obtained from all stroke patients who fulfilled the previously defined inclusion criteria. Respondents in this study were individuals who met the study's inclusion criteria, which included the following: Patients with muscle strength 3 (0-5), Communicable patients, and Patients with stable hemodynamics. The sample calculation using the G-Power 3.1.9.2 application by using t-test, the difference between two dependent means under the assumption of two-tails showed a minimum projected sample size of 34 and a 10% attrition rate, a total sample size of 38 respondents is needed.

2.2. Instrument

The Barthel Index is being used in the study to assess the character of Activity Daily Living (ADL) in stroke patients. Mahony created this instrument at 1965 and been it into Indonesian with validity score range between 0.616 and 0.856 [15,16]. This questionnaire was used to assess the effectiveness of Bilateral Arm Training in improving ADL. This questionnaire has ordinal data type, allowing for the calculation and summarization of values with ten statement items, each representing a different ADL component Transfer between wheelchair and bed and likewise 3). Clean yourself; 4) Toilet use; 5) Showering; 6) Walking on the floor; 7) Using stairs; 8) Dressing; 9) Defecation control; and 10) Eliminating control. This Bartel Index offers a total score of 0 for patients who cannot perform, 5 for patients who require assistance, 10 for patients who can complete tasks but not optimally, and 15 for patients who can perform activities independently distributed to stroke patient respondents at the beginning and end of the Bilateral Arm Training.

2.3. Procedure

The intervention group received therapy for two weeks, with the duration of training was around 30 minutes each. After obtaining post-test scores, the control group received the same intervention as the intervention group. Pre- and post-tests were administered to both groups. The intervention was conducted according to the research protocol, which included explaining the relationship between Activity Daily Living and the implementation of Bilateral Arm Therapy, followed by a demonstration of the therapy and video playback to assist respondents in performing exercises.

2.4. Data Analysis Data analysis was

The analysis in this study was carried out with univariate and bivariate analysis using the SPSS 22.0 program. Descriptive analysis was used to describe the variables on this study (univariate) and paired t-test, independent t-test was used for bivariate analysis, and bivariate analysis in this study to determine differences in ADL between two groups before and after Arm Bilateral Training. Before conducting the bivariate analysis, a statistical data normality check was performed using Shapiro Wilk with the results of all variables normally distributed with ($p\text{-value} > 0.05$).

3. Results

This study showed a description of demographic features with age data primarily in the 51-70 year age range in both the control and intervention groups. The majority of respondents in this survey were female. Most of the respondents had a stroke during the last two years (Table 1).

According to Table 2, the results of this study reveal that the intervention group's Activity Daily Living (ADL) has a score range of 40-95 (mean \pm SD 62.89 \pm 15.927). Post-test scores ranged between 55 and 59 (mean \pm SD 68.16 \pm 14.163). This result indicates that the intervention group's mean value of ADL has increased.

As seen in Table 3. the bivariate test used Paired T-Test analysis to determine the difference in mean ADL scores between the intervention and control groups showed a significant difference in mean values between pre-and post-test ($p\text{-value} 0.009$). This result indicating that there is a difference in pre-and post-test scores in the intervention group. While the control group achieved a $p\text{-value}$ of 0.163, indicating that no significant change occurred in that group (Table 3).

TABLE 1: Characteristics of respondents in the intervention and control groups (n=38).

Characteristics		Control Group		Intervention Group	
		N	(%)	N	(%)
Age					
	40 - 50 Years	5	26.3%	3	15.8%
	51 - 60 Years	7	36.8%	9	47.4 %
	61 – 70 Years	6	31.6%	5	26.3
	> 70 Years	1	5.3 %	2	10.5%
Gender					
Male 6 31.6% 12 63.2% Female 13 68.4 % 7 36.8%					
Stroke duration					
	< 2 Years	5	26.3%	9	47.4 %
	2 Years	9	47.4 %	5	26.3%
	> 2 Years	5	26.3%	5	26.3%

TABLE 2: ADL scores pre-test and post-test Bilateral Arm Training in the intervention and control groups.

Variable	Intervention		Control (n=17)		
	Range	Min-Max	Mean ± SD	Range Min-Max	Mean ± SD
Pre-Test	40-95		62.89 ±15.927	40 - 80	60.00 ± 9.428
Post-Test	55-95		68.16 ± 14,163	40 - 80	60.00 ±9.428

The mean ADL score following intervention or post-test is 68.16 in the group intervention group and 60.53 in the control group, as shown in Table 4. The mean difference between the two groups is 7,632, indicating that the intervention group's mean ADL score is greater than the control group's after the intervention. The p-value is 0.040 or alpha 0.05, which showed a statistically significant difference between the intervention and control groups. Thus, it can be stated that the Bilateral Arm Training intervention increases ADL scores in stroke patients and that the intervention group's ADL value is higher than the control group's after the intervention.

TABLE 3: Differences in ADL scores before and after Arm Bilateral Training

	Mean	Std. Deviation	95% CI		p-Value
			Low	Upper	
Intervention	-5263	± 7901	-9071	-1455	p = 0.009
Control	-0526	± 1577	-1286	.234	p = 0 .163

TABLE 4: Differences in ADL scores between the Bilateral Arm Training intervention and the control group after Arm Bilateral Training

	Mean	Std. Deviation	Mean Difference	p-Value
Intervention Group (n=17)	68.16	± 14.163	7.632	p = 0.040
Group Control (n=17)	60.53	± 8.959		

4. Discussion

The univariate results from the implementation of Bilateral Arm Training on respondents reported that eight people aged 40-50 years (21.1%), sixteen people aged 51-60 years (42.1%), eleven people aged 61-70 years (28.9 percent), and three people aged more than 70 years participated (7,9 percent). This is consistent with the previous studies with respondents mostly in the 51-60 age range [17,18]. This study corroborates the hypothesis that an individual's risk of stroke increases with age [5]. Based on the univariate results, it can be stated that women tend to suffer from stroke. This result was consistent with survey data which indicates 355.72 males and 358.056 females [3]. According to the respondents' stroke duration, it is known that there are 14 individuals with a stroke duration of fewer than two years (36.8 percent), 14 people with a stroke duration of two years (36.8 percent), and ten people with a stroke duration of more than two years. (26.3). The duration of a person's stroke must be considered when providing therapy because it affects the motor abilities encountered [19].

The results of this study, which revealed a significant difference in mean ADL scores before and after the intervention, indicated that the intervention group saw an increase in ADL scores. This is consistent with prior research indicating that Bilateral Arm Training is a therapy that promotes concurrent use of the afflicted extremity and has not been documented to provide motor advantages. It has been used to treat people with hemiplegia and has been utilized to restore function in hemiplegic patients [8]. Additionally, it was mentioned that Bilateral Arm Training had been demonstrated to stimulate the cerebral hemispheres and activate the central nervous system. Around 90% of the nerve fibers in the cerebral cortex and spinal cord are responsible for contralateral movement, while 10% are responsible for ipsilateral movement. Upper limb movement on the unaffected (healthy) side can impair upper limb movement on the affected side.

The results of previous studies, which was examined the effectiveness of Bilateral Arm Training in improving extremities function and ADL in stroke patients [8]. This study concluded that bilateral arm training could enhance extremities function and

activities of daily living in stroke patients ($p < 0.05$). Additionally, another study with 20 respondents on the effect of bilateral arm training on the ADL of stroke patients. Bilateral arm exercise, the study indicated, can improve ADL in stroke patients ($p < 0.05$) [14]. Their also note that bilateral movements are theoretically founded on coordination concepts between impacted and unaffected sides. Because bilateral movement stimulates both hemispheres and reduces interhemispheric inhibition, bilateral movement can affect the unaffected sides. Thus, it is reported that Bilateral Arm Training can improve stroke patients' ADL by ($p\text{-value} < 0.05$). The researcher recognizes that there are still many limitations in this study, both in terms of research time and the COVID-19 pandemic's conditions, which necessitate researchers to alter their material delivery via audio-visual media.

5. Conclusion

The ADL data indicates that the mean before and after the intervention increases in the intervention group but does not change in the control group. The bivariate test utilizing the Paired T-Test revealed a significant difference between the intervention and control groups ($p\text{-value} < 0.009$), in contrast to the control group, which did not demonstrate a significant difference in mean. The study's findings on Bilateral Arm Training can be disseminated in hospitals as part of the discharge planning materials for stroke patients, caregivers, and families in order to promote Activity Daily Living.

References

- [1] Hankey GJ. Hankey's clinical neurology. 2nd ed. 2014.
- [2] WHO. Policy brief: Saving lives from strokes - Gearing towards better prevention and management of stroke. Geneva: World Health Organization; 2016.
- [3] Riset Kesehatan Dasar. Badan penelitian dan pengembangan kesehatan kementerian RI tahun 2018. 2018.
- [4] Woodward S, Mestecky A-M. Neuroscience nursing evidence-based practice. Chichester: Wiley-Blackwell; 2011.
- [5] Hickey JV. The clinical practice of neurological and neurosurgical nursing. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2014.
- [6] Rayanti RE, Karwur FF, Karwur DJ. The daily life of post stroke patients in Tomohon City, North Celebes, Indonesia. Silliman Journal. 2015;56(1):121-42.

- [7] Susanti S. Pengaruh kombinasi proprioceptive neuromuscular facilitation (PNF) dan mirror therapy terhadap peningkatan activity daily living (ADL) ekstremitas atas pada pasien stroke hemiparese. Universitas Muhammadiyah Malang. Malang; 2019.
- [8] Lee MJ, Lee JH, Koo HM, Lee SM. Effectiveness of bilateral arm training for improving extremity function and activities of daily living performance in hemiplegic patients. *Journal of Stroke and Cerebrovascular Diseases*. 2017;26(5):1020-5.
- [9] Sa'adah E, Yuniartika W. Upaya peningkatan intoleransi aktivitas pada pasien stroke. Universitas Muhammadiyah Surakarta; 2017.
- [10] Edemekong PF, Bomgaars DL, Sukumaran S, Levy SB. Activities of daily living. Treasure Island: StatPearls Publishing; 2021.
- [11] Nurrandi SR, Putri TARK. Family experience as caregivers in the rehabilitation of stroke patients: A literature review. *KnE Life Sciences*. 2021;2021:736-44.
- [12] Putri TARK, Rahayu LP, Agustina EN. Stroke recurrence based on stroke prognosis instrument II (SPI-II) and the attack number of stroke. *KnE Life Sciences*. 2019;2019:923-30.
- [13] Rahayu LP, Sudrajat DA, Nurdina G, Agustina EN, Putri TARK. The risk factor of recurrence stroke among stroke and transient ischemic attack patients in Indonesia. *KnE Life Sciences*. 2019;2019:87-97.
- [14] Kim SH, Park JH. The effect of occupation-based bilateral upper extremity training in a medical setting for stroke patients: A single-blinded, pilot randomized controlled trial. *Journal of Stroke and Cerebrovascular Diseases*. 2019;28(12).
- [15] Mahony F, Barthel D. Functional evaluation: The Barthel index. *Rehabilitation. Md State Med J*. 1965;(14):61-5.
- [16] Pongantung H, Lorica J, Rosdewi S, Solon M. Construct validity Indonesian version of Barthel index for post stroke. *Indian Journal of Public Health Research & Development*. 2020;11(3).
- [17] Siwi ME, Lalenoh D, Tambajong H. Profil pasien stroke hemoragik yang dirawat di ICU RSUP Prof. Dr. RD Kandou Manado periode Desember 2014 sampai november 2015. *e-Clinic*. 2016;4(1).
- [18] Suwaryo PAW, Widodo WT, Setianingsih E. Faktor risiko yang mempengaruhi kejadian stroke. *Jurnal Keperawatan*. 2019;11(4):251-60.
- [19] Puspitasari D. Pengaruh terapi AIUEO terhadap kemampuan komunikasi pada afasia motorik pasien pasca stroke di kota pontianak. *Journal Proners*. 2017;3(1).