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EFFECT OF 14 POINTS ACUPRESSURE ON UPPER AND LOWER EXTREMITY MUSCLE STRENGTH LEVELS IN PATIENTS WITH NON-HEMORRHAGIC STROKE

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Abstract
Background: Acupressure is considered as one form of holistic therapies that can improve tissue perfusion to improve motor function in patients with stroke.
Objective: To analyze the effect of 14 points acupressure on upper and lower extremity muscle strength in patients with non-hemorrhagic stroke patients.
Methods: This was a quasi-experimental study with pretest posttest control group design. Paired comparative analytic design was also used. Thirty-eight participants were selected, which 19 participants assigned in the experiment and control group. The Medical Research Council (MRC) scale was used to measure the lower and upper muscle strengths.
Results: There was a significant difference between the improvement of the upper muscle strength in the experimental group and the control group at day 3, 4, 5, 6, 7 ($p = 0.010$, $p = 0.000$, $p = 0.000$, $p = 0.000$, $p = 0.000$); and there was a significant difference between the improvement of the lower extremity muscle strength in the experimental group and the control group at day 3, 4, 5, 6, 7 ($p=0.023$, $p=0.000$, $p=0.000$, $p=0.000$, $p=0.000$).
Conclusion: The 14 points acupressure is effective in increasing upper and lower extremity muscle strength in patients with non-hemorrhagic stroke.

Keywords: 14 points acupressure; stroke; upper and lower extremity muscle strength

INTRODUCTION

Stroke is an early and progressive clinical syndrome of focal or global neurologic deficits that lasts 24 hours or more (Mansjoer, 2000). Stroke can cause death due to a non-traumatic blood flow disorder in the brain. Stroke is the most neurological disease that can also lead to serious health problems and affect the disability, motor and sensory dysfunction and death (Manjoer, 2002). Clinical manifestations of acute stroke may include changes in mental status, visual impairment, aphasia, vertigo, nausea, vomiting, headache and decreased motor function as well as decreased extremity muscle strength (Mansjoer, 2000).

These changes affect the physical and mental structures. Thus, it could be said that people with acute stroke will experience a decline in activity such as loss of muscle strength, weakness of the legs and hands, speech impairment, limited view, asymmetry on the

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face and the inability of other motor functions. This condition leads to a decline in the function of individuals economically and socially because many strokes occur in the productive age (Muttaqin, 2009).

Treatment of stroke patients is aimed at increasing blood flow to the brain, preventing death and minimizing the disability. The treatment of acute stroke patients in pharmacological therapy is usually given micro plasmin, infused to insert fluids and nutrients, and then administered mannitol or corticosteroids to reduce swelling and pressure in the brain, due to infiltration of white blood cells. Patients with stroke need good handling to prevent physical and mental disability. Of 30% - 40% of people with stroke can recover completely when being handled within the first 6 hours (golden period), but if in that time stroke patients do not get the maximum treatment then there will be physical disability or weakness and decreased muscle strength such as hemiparesis or hemiplegia (Wiwit, 2010).

Nursing care in stroke patients is divided into three phases namely the acute phase, the post-acute phase, and the rehabilitation phase. In the acute phase, medical and nursing actions aimed at maintaining vital functions in the body. In the post-acute phase, nursing action is intended to maintain body function and prevent complications. One of the non-pharmacological therapy programs provided in stroke patients in the post-acute phase in the treatment room to deal with motor disorders is by early mobilization and range of motion exercises. And in post-hospitalized rehabilitation phase, patients need further treatment for motor recovery. The number of disabilities in stroke patients can be minimized using physiotherapy (Atika, 2013).

Acupressure is one form of holistic therapies that can improve tissue perfusion performed to improve motor function in stroke patients. Acupressure is a non-invasive method whose principles of action are based on acupuncture principles. In traditional Chinese medicine, acupressure has been used for the rehabilitation of upper extremities in patients with stroke experiencing hemiplegia and hemiparesis. Acupressure is one of the traditional Chinese therapies based on meridian acupuncture theory with Yin / Yang theory in eastern philosophy (Black & Hawks, 2005; LeMone, Burke, & Gauthier).

The presence of nerve endings and blood vessels that are widely present around the acupressure points will enlarge the response. Mast cells release histamine, heparin, and dab kinin protease that cause vasodilation of the blood vessels. Histamine causes the release of nitric oxide from the vascular endothelium, which is the mediator of various cardiovascular, neurological, immune, digestive and reproductive reactions. Mast cells will also release platelet-activating factor (PAF), which is then followed, by the release of serotonin from platelets. Serotonin stimulates the nociceptors themselves and increases the nociception response to bradykinin. Bradykinin is a powerful vasodilator that causes increased vascular permeability, this results in an increase in blood circulation of the tissues that will lead to an improvement in skeletal abnormalities thus improving motor function in extremity (Saputra & Sudirman, 2009; Si, Wu, & Cao, 1998).

Shin and Lee reported their results in 30 post-hospital stroke patients with hemiplegic shoulder pain who were divided into 15 patients as controls and 15 other patients given acupressure interventions for 20 minutes 2 times a day for 2 weeks, suggesting that acupressure significantly improved upper extremity muscle strength ($P < 0.01$) (Shin & Lee, 2007).

Other studies that have been performed by Kang et al in post-hospital stroke patients (2009) in 56 consecutive samples were divided into 2 groups (each of 28 patients for the control group and intervention groups showed a significant difference between the control group and the intervention, where the intervention group experienced improvement in extremity and daily life activities after given acupressure daily in 10 minutes for 2 weeks compared with the control group (Kang, Sok, & Kang, 2009).

The results of the study by M. Adam in 34 postpartum stroke patients who experienced muscle weakness and upper extremity motion range showed a significant difference between control and intervention groups, in which the intervention group had an improvement in muscle strength and upper extremity motion range after given acupressure therapy every day for 10 minutes for 7 days compared with the control group (Adam, Nurachmah, & Waluyo, 2014).

Another study in 20 non-hemorrhagic stroke patients with upper extremity muscle weakness showed a significant difference between the control group and the intervention group, in which the intervention group had an improvement in the muscle strength of the upper extremity after given an acupressure at the point of GB 21, LI 15 and TE 14 once daily for 1 month compared with the control group (Sukawana, Sukarja, & Diputra, 2013).

However, acupressure has never been implemented by nurses in hospital as one of therapies to prevent and overcome complications of motor function in stroke patients. Acupressure is one of the nursing actions that can be performed by a nurse and is one of the interventions listed in the Nursing Intervention Classifications (NIC) (Butcher, Bulechek, Dochterman, & Wagner, 2018). It is also said that acupressure is an effective therapy for both prevention and treatment (Longe, 2005).

In addition, acupressure techniques are easy to learn and administered quickly, low cost and effective to overcome various symptoms of disease. The aim of this study was to examine the effect of acupressure on upper and lower extremity muscle strength levels in patients with non-hemorrhagic stroke.

METHODS

Study design

This was a quasi-experimental study with pretest posttest control group design. Paired comparative analytic design was also used.

Setting

The study was conducted at 4 hospitals, namely: the Regional General Hospital of West Nusa Tenggara Province, the General Hospital of Mataram, the Regional General Hospital of West Lombok, and the Regional General Hospital of Central Lombok.

Population and sample

The population in this study was all non-hemorrhagic stroke patients in the four hospitals. Thirty-eight participants were selected, which 19 participants assigned in the experiment and control group. The inclusion criteria of the samples were patients with non-hemorrhagic stroke diagnosis, experienced hemiparesis with muscle strength 1-2 both left and right, composmentis, stable vital signs, admission time less than or equal to 6 hours, first of second stroke attack, both male and female, age ranging from 45-60 years, and willing to be respondents. While the exclusion criteria were patients with decreased awareness, experienced paralysis, unstable vital signs, admission time more than 6 hours, having stroke attack for more than 2 times, age over 60 years, and having contraindication of acupressure such as wounded skin, fracture, and swelling.

Intervention

The provision of acupressure intervention is performed by the researcher who has the competence to perform acupressure after following the acupressure training and has been graduated from the Certified Chiropractors and Acupressure Association of Indonesia (ACASI). The experiment group was given acupressure at 14 points of LI 15 or JianYu, SI 9 or Jian Zhen, TE 14 or Jian Liao, GB 21 or Jian Jing, SI 11 or Tian Zong, SI 12 or Bing Feng, ST 36 or Zusanli, GB 34 or Yanghing Quan, ST 41 or Jiexi, GB 39 or Xuan Zhong, ST 31 or Biguan, GB 30 or

Huan Tiao, SP 10 or Xuchai, ST 34 or Liang Qiu done for 15 minutes, once a day, for 7 days by way of massage using the thumb hand with the technique of sedation (massage with a circular motion counterclockwise) (Adikara R, 2007; Kang et al., 2009) (See Figure 1). The control group was given a treatment (ROM) in accordance with the operational standard of procedure in the Stroke Center.

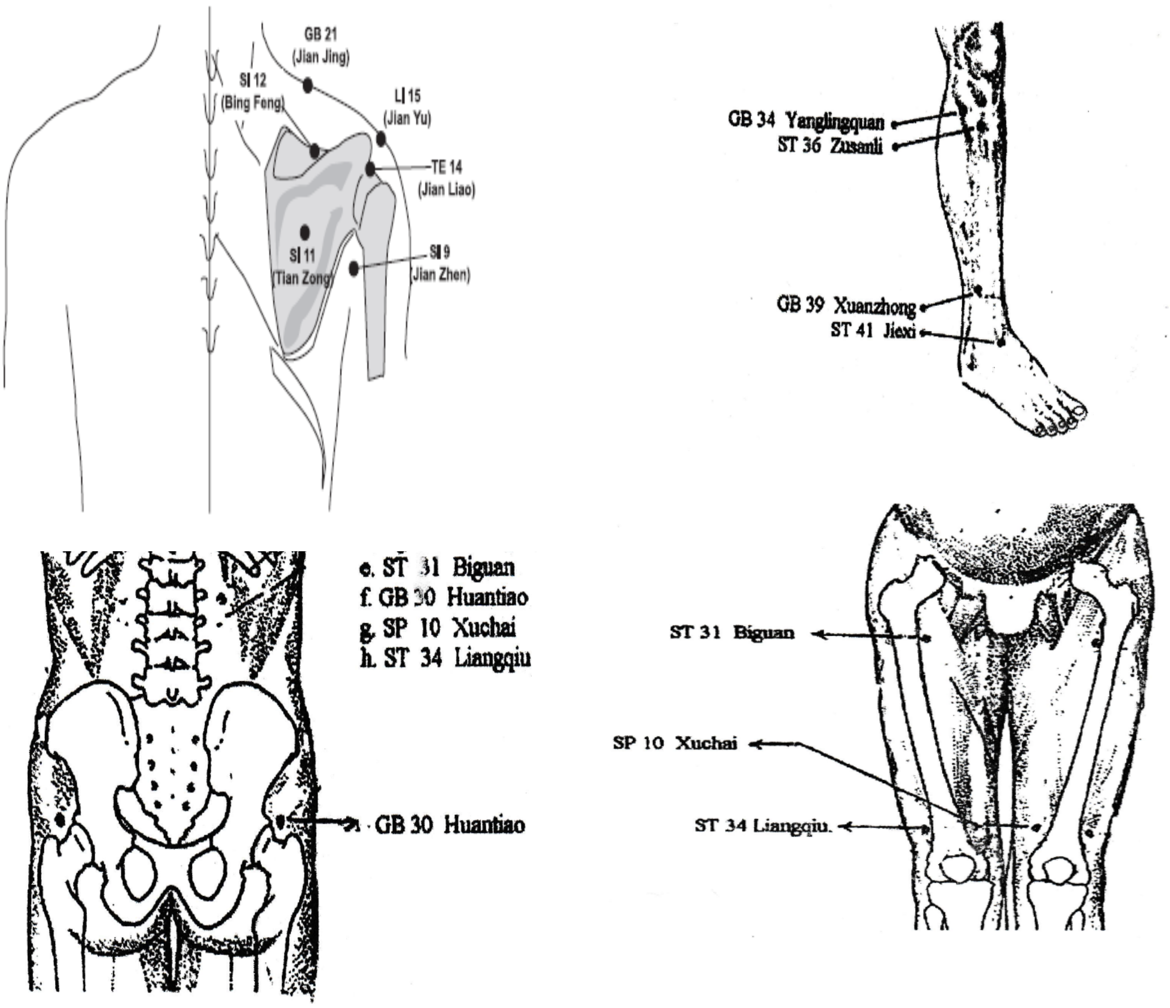

Figure 1 14-accupressure points to strengthen lower and upper extremity muscles

Instruments

Lower and upper muscle strength

The lower and upper muscle strengths were measured using the Medical Research Council (MRC) scale (Warlow et al., 2008). This scale is often used to measure motor weakness and evaluate the progress over time on the weakened muscle strength. Muscle strength can be described as the ability of the muscles to withstand both external and internal forces. Muscle strength is closely related to the neuromuscular system, which is how much the ability of the nervous system to activate the muscles to perform contractions. Muscle strength assessment has a measurement scale commonly used to check patients who experience paralysis, and also to see the progress during treatment (Warlow et al., 2008). The researchers used the same muscle strength assessment sheet, which was used by the previous researcher based on the Lumbantobing standard format used in daily medical and nursing practice (Adam et al., 2014).

The measurements of muscle strength were done by research assistants (professional physiotherapist). This scale consists of 6 grades, ranging from a score of 0 to 5, where a score of 0 = no contraction, 1 = having muscle twitch and slight contraction, 2 = active motion limited to gravity, 3 = active motion that can defy gravity, 4 = active movement, which can resist gravity and hold the examiner slightly, 5 = normal muscle strength. According to Ginsberg, this scale is commonly used in practice by doctors and nurses, and this scale is also the best semi-quantitative scale for assessing muscle strength and detecting muscle weakness (Ginsberg, 2008).

Ethical consideration
This study has been approved by the four hospitals prior to data collection. Each respondent was given and signed informed consent regarding the purpose, benefits and research procedures.

Data analysis
Shapiro-wilk test was used to test the normality of the data. Repeated ANOVA was used to analyze the effect of 14-point acupressure on upper and lower extremity muscle strength. And post-hoc Bonferroni test was used to see the most significant group.

RESULTS

Table 1 shows that the majority of the groups aged 46-65 years, which the mean age of experiment and control group was 94.7%. The number of males and females in both groups were equal, as well as the frequency of stroke in the experiment and control group. There were no significant differences in age gender and frequency of stroke in the experiment and control group with p-value >0.05. While Table 2 shows the difference in time of improvement in upper extremity muscle strength before and after treatment. Acupressure interventions had a significant effect on improving upper extremity muscle strength on day 2 with day 3, day 3 with day 4, day 4 with day 5, day 5 with day 6, day 6 with day 7, and pre-intervention with day 7. In the group control shows that there was a significant influence on day 5 with day 6, day 6 with day 7, and pre-intervention with day 7.

Table 1 Characteristics of respondents based on age, gender, frequency of stroke in the experiment and control group (n=38)

Variable	Group				P-Value
	Experiment		Control		
	N (19)	%	N (19)	%	
Age (Mean±SD)	19 (51.84±4.705)		19 (52.26±4.408)		0.417
26- 45	1	5.3	1	5.3	
46- 65	18	94.7	18	94.7	
Gender					1.000
Male	10	52.6	9	47.4	
Female	9	47.4	10	52.6	
Frequency of stroke					1.000
First attack	10	52.6	9	47.4	
Second attack	9	47.4	10	52.6	

Table 2 Analysis of differences in upper extremity muscle strength before and after given intervention in the experiment and control group (pairwise comparisons) (n=38)

Group	(I) Day	(J) Day	Mean Difference (I-J)	Std. Error	*P*
Experiment	Pre	7	.000	.000	.000
	Pre	1	-.053	.037	.
	1	2	-.474*	.083	.166
	2	3	-.474*	.091	.000
	3	4	-.368*	.095	.000
	4	5	-.263*	.100	.000
	5	6	-.789*	.103	.012
	6	7	-2.421*	.156	.000
Control	Pre	7	.000	.000	.000
	Pre	1	-2.220E-16	.037	.
	1	2	2.220E-16	.083	1.000
	2	3	-.053	.091	1.000
	3	4	-.105	.095	.567
	4	5	-.211*	.100	.277
	5	6	-.316*	.103	.042
	6	7	-.684*	.156	.004

Table 3 Analysis of differences in the improvement of upper extremity muscle strength between experimental and control group (n=38)

Variable				
Improvement of upper extremity muscle strength	Group	Mean	SD	*P*
Pre	Experiment	1.53	0.51	.754
	Control	1.47	0.51	
Day 1	Experiment	1.53	0.51	.754
	Control	1.47	0.51	
Day 2	Experiment	1.58	0.51	.529
	Control	1.47	0.51	
Day 3	Experiment	2.05	0.78	.010
	Control	1.47	0.51	
Day 4	Experiment	2.53	0.70	.000
	Control	1.53	0.61	
Day 5	Experiment	2.89	0.66	.000
	Control	1.63	0.76	
Day 6	Experiment	3.16	0.50	.000
	Control	1.84	0.68	
Day 7	Experiment	3.95	0.71	.000
	Control	2.16	0.69	

Table 3 shows that there was a significant difference between the improvement of the upper muscle strength in the experimental group and the control group at day 3, 4, 5, 6, 7 ($p = 0.010$, $p = 0.000$, $p = 0.000$, $p = 0.000$, $p = 0.000$). Although both groups have an improvement, but the experimental group had a higher rate of muscle strength improvement (mean 3.95) than the control group (mean 2.16). The improvement of upper muscle strength was 61.27%, with an effect size of 1.88.

Table 4 Analysis of differences in lower extremity muscle strength before and after given intervention in the experiment and control group (pairwise comparisons) (n=38)

Group	(I) Day	(J) Day	Mean Difference (I-J)	Std. Error	*P*
Experiment	Pre	7	2.220E-16	.037	.000
	Pre	1	.000	.000	1.000
	1	2	-.421*	.082	.
	2	3	-.579	.082	.000
	3	4	-.316*	.077	.000
	4	5	-.421*	.107	.000
	5	6	-.684*	.107	.000
	6	7	-2.421*	.168	.000
Control	Pre	7	.053	.037	.017
	Pre	1	.000	.000	-.023
	1	2	.000	.082	.
	2	3	-2.220E-16	.082	1.000
	3	4	.000	.077	1.000
	4	5	-.211	.107	1.000
	5	6	-.263*	.107	.056
	6	7	-.421*	.168	.019

Table 4 shows the difference in time of improvement in lower extremity muscle strength before and after treatment. Acupressure interventions had a significant effect on improving lower extremity muscle strength on day 2 with day 3, day 3 with day 4, day 4 with day 5, day 5 with day 6, day 6 with day 7, and pre-intervention with day 7. The group control shows that there was a significant influence on day 6 with day 7, and pre-intervention with day 7.

Table 5 Analysis of Differences in the improvement of lower extremity muscle strength between experimental and control group (n=38)

Variable				
Improvement of lower extremity muscle strength	Group	Mean	SD	*P*
Pre	Experiment	1.53	0.51	1.000
	Control	1.53	0.51	
Day 1	Experiment	1.53	0.51	0.754
	Control	1.47	0.51	
Day 2	Experiment	1.53	0.51	0.754
	Control	1.47	0.51	
Day 3	Experiment	1.95	0.71	0.023
	Control	1.47	0.51	
Day 4	Experiment	2.53	0.70	0.000
	Control	1.47	0.51	
Day 5	Experiment	2.84	0.69	0.000
	Control	1.47	0.51	
Day 6	Experiment	3.26	0.65	0.000
	Control	1.68	0.47	
Day 7	Experiment	3.95	0.71	0.000
	Control	1.95	0.62	

Table 5 shows that there was a significant difference between the improvement of the lower extremity muscle strength in the experimental group and the control group at day 3, 4, 5, 6, 7 (p=0.023, p=0.000, p=0.000, p=0.000, p=0.000). Although both groups have an improvement, but the experimental group had a higher rate of muscle strength improvement (mean 3.95) than the control group (mean 1.95). The improvement of lower muscle strength was 61.27%, with an effect size of 2.53.

DISCUSSION

Findings of this study showed that there was a significant effect of 14-points acupressure on lower and upper muscle strengths. There was a significant difference between the experiment and control group. The results of this study are supported by the research conducted by Shin and Lee stating that acupressure points in the scapula region have a very close relationship with the trigger point to improve the strength of upper extremity muscle (Shin & Lee, 2007). The trigger point is a sensitive point that when it is pressed will cause pain at distant places at that point. This is a local degeneration in muscle tissue caused by muscle spasm, trauma, endocrine imbalance and muscle imbalance. The trigger point can be found in skeletal muscles and tendons, ligaments, joint capsules, periosteum, and skin. Normal muscle has no trigger point (Shin & Lee, 2007).

Presence of nerve endings and blood vessels that are widely present around the acupressure points will enlarge the response. Mast cells release histamine, heparin, and dab kinin protese that cause vasodilation of blood vessels. Histamine causes the release of nitric oxide from the vascular endothelium, which is the mediator of various cardiovascular, neurological, immune, digestive and reproductive reactions. Mast cells also release Platelet Activating Factor (PAF), which is then followed by serotonin release from platelets. Serotonin stimulates the nociceptors themselves and increases the nociception response to bradykinin. Bradykinin is a powerful vasodilator that causes increased vascular permeability, which results in an increase in blood circulation of the tissues that will lead to an improvement in skeletal abnormalities that can more rapidly improve motor function on extremity (Si et al., 1998).

In the control group a passive ROM was administered in accordance with the hospital's procedure for stroke patient treatment. After given passive ROM exercise once daily with duration of 15 minutes for 7 days, patients experienced an increase in upper muscle strength of 31.94%. According to the theory of Susan (1996), providing passive ROM exercises in stroke patients will stimulate the brain's motor neurons with transmitter release (acetylcholine) to stimulate the cells to activate calcium resulting in protein integrity (Hinchliff, Montague, Watson, & Herbert, 2005). If calcium and troponin C are activated then actin and myosin and skeletal muscle function can be maintained, so that there will be an increase in muscle strength. The mechanism of contraction can increase the smooth muscle of the extremity. Passive ROM exercises can cause stimulation, thus increasing the activation of chemicals, neuromuscular and muscular. Smooth muscles on filament of actin and myosin have chemical properties and interact between one another. The interaction process is activated by calcium ions and ATP, and then broken down into ADP to provide energy for contraction of the extremity muscles (Hinchliff et al., 2005).

CONCLUSION

The 14-points acupressure is effective to increase upper and lower extremity muscle strength in patients with non-hemorrhagic stroke. This intervention can be a part of operational standard of procedures in the treatment of non-hemorrhagic stroke patients. Acupressure therapy should be a part of clinical nurse competencies in caring stroke patients.

Declaration of Conflicting Interest
None declared.

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Author Contribution
All authors contributed equally in this study.

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