

3. Aquatic Therapy Model as a Physical Exercise Program for Post Stroke

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Aquatic Therapy Model as a Physical Exercise Program for Post Stroke

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Abstract –

in Indonesai many springs can be easily found in many places and some are used for therapy pool. One of those places is Klaten in Central Java which has 191 springs. Common complication found in stroke is associated to neurological syndrome including agonist or antagonist, weakness, and lack of coordination. Aquatic therapy intervention focuses on techniques enhancing flexibility, ROM, strength, cardiovascular, balance, and coordination. People believe that Umbul Brintik (Brintik Spring) has higher mineral than any other springs located surrounding the area. A study conducted by Suharjo in 2008 revealed that the spring contains lower cation than anion $\text{HCO}_3 + \text{CO}_3$. It is, therefore, suitable for aquatic therapy and drinking water. During one year observation, the number of visitors in this spring increased gradually from 12,5% in the first period, 27,5% in the second period, and 60% in the third period. Visitors are catagorized into three groups: sick visitors, healthy visitors, dan common visitors. Even though there are many comparative studies discussing the benefits of several methods for stroke therapy, aquatic therapy can gain optimum results when combined with rehabilitation training. *Kata kunci* – physical exercise program, aquatic therapy, spring.

Introduction

When the blood supply to the area of brain is interrupted due to either blood clot or broken blood vessels, brain tissue depriving of oxygen and nutrient is damaged ^{[1][2]}. Stroke recovery process involves treatment, immediate recovery, and return to daily living ^[3]. Since stroke patient has complex individual rehabilitation needs, the progress and recovery process is different from one patient to another ^[4-6]. Stroke treatment starts from the hospital with “acute treatment”. This first treatment helps patients to survive, to prevent other stroke, and to manage other health problems ^{[7][8]}. Some patients are able to recover naturally and regain the lost skills ^[9].

This process may take a few weeks or more after stroke occurs ^[10]. Rehabilitation, another part of treatments, helps patients maintain their skills and relearn lost skills to regain independence. ^{[11][12]}. The decision regarding rehabilitation is made by patients, their family, and hospital staff before patients are released ^[13]. The last process of stroke recovery is when patient return to their daily living after acute treatment and rehabilitation ^[14]. In this process, the family should learn how to live with a stroke survivor as poststroke patients are unable to do every day tasks as they used to. For an example, they should wear shoes without lace or write using the opposite hand. ^{[15][16]}.

Stroke can be caused by ischemic condition or hemorrhagic process which occurs when an artery blood vessel breaks or ruptures. About two third of stroke cases is ischemic whereas a third is hemorrhagic ^[17]. Ischemic stroke happens as a result of an obstruction within blood vessel supplying blood to the brain. ^{[3][18]}. Hemorrhagic stroke is the result of broken micro-aneurysm. The majority of stroke occurs when the blood vessels become narrow or clogged by fatty deposits or plaque, which cut off the blood flow to the brain. In addition, uncontrolled high blood pressure has been the most common risk factor of ischemic stroke. ^{[2][19]}. About 13% of hemorrhagic stroke occurs when a blood vessel in the brain or near the brain breaks. The result is blood seeping into the brain tissue, weakening and causing brain cell deaths. ^{[2][20]}.

Motor deficit after stroke can lead to several symptoms (clonus, dystonia, muscle weakness, abnormal reflex response) ^{[3][20]}. Spasticity is the result of muscle control disorder and induces rheumatic muscle changes such as stiffness, fribosis and atrophy. This affects patients with neurological conditons such as stroke, multiple scleroris, traumatic brain, and spinal cord injury ^{[6][20]}. Martin (2014) reported that out of 24

studies about epidemiology feet flexibility, 28-38% of stroke patients experienced spasticity^{[18][21]}. Aquatic therapy can be done only when poststroke patients with mild spasticity is so stable that they can recover faster. However, it is important to consider frequency, intensity, and types of exercise to obtain the maximum result.

Method

This research uses preliminary research design. Data obtained in preliminary research are the observation result, interviews and documentation. The variables used are factors influencing visitors' health improvement. Visitors are classified into three groups: sick visitors, healthy visitors, and common visitors.

The research was conducted from January to December 2018 in Umbul Brintik, Central Java, Indonesia. Data were obtained from the list of visitors documented by Umbul Brintik management.

The research was done in three periods. The first period was from January to April 2018 and there were 100-200 visitors daily. The second period was from May to August 2018 and there were 300-800 visitors daily. The last period was from September to December 2018 and there were 700-2000 visitors daily.

Descriptive analysis is used to identify the objectives of visitors when doing aquatic activities. Data display is applied to reveal the relationship among variables. The samples are 6 visitors; 4 males and 2 females who suffer from mild stroke, moderate stroke and severe stroke.

Results and Discussion

Sick visitors are those coming for aquatic therapy by doing exercise without any assistance or with aids. Healthy visitors are those having only mild health problems and doing aquatic activities to keep themselves healthy. Common visitors are those coming to spend their free time and to have fun.

Not only does spasticity cause severe physical disorder, it also triggers psychological and social disorders.^[22-25] Despite the availability of non-operative treatment in stroke, surgery has been the primary choice to improve the quality of life and to prevent complication^[26]. When evaluating spasticity, it is important to focus on three aspects related to functional problems: identifying clinical patterns of motor dysfunction and its sources, identifying patient's ability to control muscles involved in clinical patterns, and distinguishing muscle stiffness and contracture^{[4][27-29]}.

Neuroimaging study states that certain parts of the brain (e.g. SMA, CMA and secondary somatosensory cortex) contribute to the flexibility and motor dysfunction^{[4][30][31]}. Each patient determines his/her own goals in aquatic therapy exercise.^[32-35] Patients are advised to do all aquatic therapy methods even though they experience motor dysfunction only on one part of the body.^[36] The large number of people coming for aquatic therapy shows that most of them have health problems^{[37][38]}. This was supported by the findings in the observation that the number of stroke patients exceeded other patients^{[39][40]}.

Table 1. The highest number of visitors

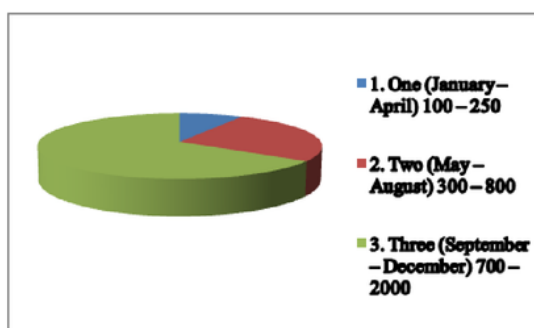
No	Catagory	Number	Percentage
1.	Sick	1.500	75%
2.	Healthy	450	22,5%
3.	Common	50	2,5%

Table 1 shows that Umbul Brintik was visited by 150 to 200 people everyday on weekdays and 500-700 everyday on weekends

Table 2. The Catagory of Visitors

No	Group (month)	Number	% (per year)
1.	One (January – April)	100 – 250	12,5%
2.	Two (May – August)	300 – 800	40 %
3.	Three (September – December)	700 – 2000	100%

Table 2 shows the gradual increase of visitors from January to December 2018. More people are interested in aquatic therapy in Umbul Brintik. They apply natural method or other methods that they are familiar with. Based on their own experience and knowledge, they move their body in the water until they reach the target in a certain period.



Picture 1. Diagram of Visitor Catagory

Picture 1 depicts that the number of sick visitors (stroke patients and poststroke patients) is higher than others. A research (Anita, 2018: 3) also reported that out of 45 patients coming to Umbul Brintik, 32,50% are stroke patients^[55].

WHEN TO DO THERAPY

Table 3. Aquatic Method

No	Type of Stroke	Mean	Aquatic Method
1	Mild	27%	Swimming
2	Moderate	32%	Water massage, submerging and diving
3	Severe	41%	Submerging and leg exercise.

The choice of strategy and selective medication in post stroke spasticity (PSS) management should have positive impacts on functional movement^[41]. Inappropriate aquatic therapy can disturb functional recovery and increase complication. It can affect not only on muscle tonus but also on strength, coordination, endurance, and neuron. Thus, spasticity is not the major cause of dysfunction when it is found later that there is a upper motor neuron syndrome^[43].

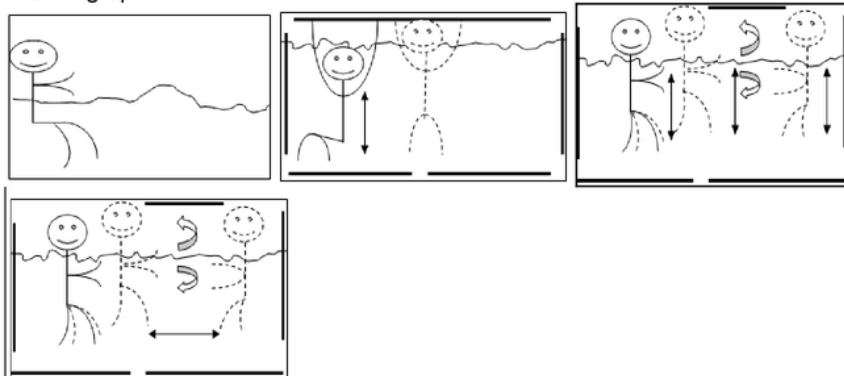
To improve function and well-being in daily life, patients need to be assisted when doing aquatic therapy. The exercise is not limited on the rehabilitation of passive muscle stretching ability or lost stretching ability [44]. Aquatic therapy which stimulates neurons and trains muscle strength can be administered when patient's condition is stable. The optimum combination between rehabilitation techniques, aquatic therapy, and movement exercise is beneficial for poststroke syndrome for all level of patients [5][45].

Aquatic Therapy

Spasticity and spastic paresis is primary motor dysfunction after stroke and the challenge of ROM recovery [46]. Spasticity appears and disappears during the process of complete motor recovery. Both spasticity and motor recovery are related to neuron plasticity after stroke [47]. Nevertheless, the researcher has not apprehended this relationship. In the beginning of recovery phase, strength recovery and motor function is related to cortex plasticity reorganisation. On the other hand, the most sensible mechanism of poststroke flexibility is the result of maladaptive plasticity called hyperexcitability reticulospinal (RS). It is essential to differentiate and understand the basis of motor recovery and spasticity mechanism. [46][47]. The success of motor recovery relies on neuron plasticity modulation and facilitation through rehabilitation strategy such as intensive and repetitive intervention, suitable non-invasive brain stimulation, and proper pharmacology [6][48][49]. Aquatic therapy must be done in the spring with flowing water. For safety reason, a poststroke patient should be assisted by a therapist in doing aquatic therapy because he/she lost either his/her mobility or his/her strength. Life jacket or inflatable swimming aids can be used when helping severe poststroke patients. They are unable to keep the balance in the water or to move their body. The pool should be 0,75 – 1 meter deep.

Aquatic Method For Post Stroke

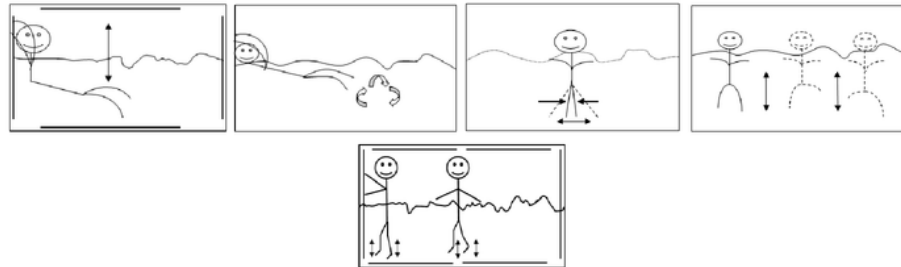
Warming-up



Picture 2. Warming-up method in the water

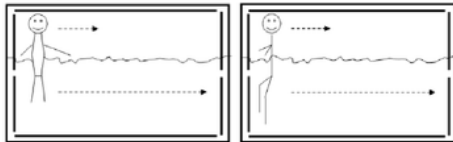
First of all, wet the body to adapt with water and then plunge into the To keep the body temperature, move both hands like in swimming using breast stroke style and this can be done by walking around the pool. Life jacket should be worn by severe poststroke patients. The are four movements: plunging into the pool, submerging, moving both hands like swimming using breast stroke style.

The Main Exercise Leg exercise



Picture 3. Leg exercise on the spot

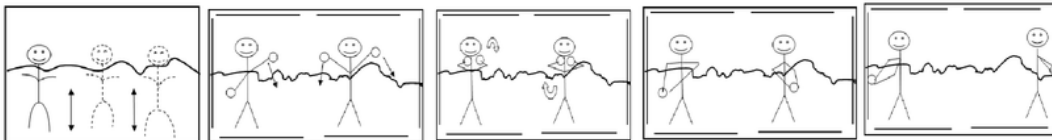
There are 5 movements for this exercise: moving the legs like in swimming using freestyle and breast stroke style, opening and closing the legs, jumping, and tiptoeing. If a patient is unable to do these motions perfectly, an assistant can help him/her to move the legs. These motions focus on increasing strength and flexibility.



Picture 4. Sidestepping exercise

There are two movements: taking sideways steps to the right and to the left, stepping forwards and backwards. It aims at increasing strength and coordination.

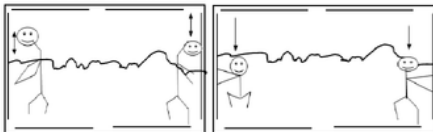
Arm Exercise



Picture 5. Arm exercise

There are 5 arm movements: pressing the water, splashing the water, rotating hands while holding the shoulders, moving hands forwards, and placing them on the pool wall while stretching them. These motions are to improve flexibility.

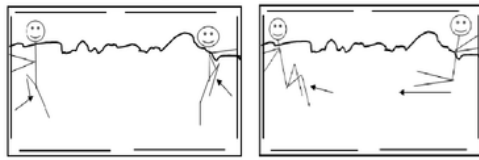
Cardiovascular exercise



Picture 6. Cardiovascular

There are two movements: submerging the head with short breath and holding the breath as long as possible. These aims at enhancing lung and heart endurance.

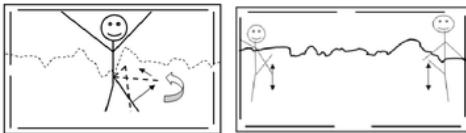
Muscular Strength Exercise



Picture 7. Muscular strength exercise

There are 2 movements: crossing the thighs and pushing the legs forwards. The purpose is to increase ROM, strength, balance, and coordination.

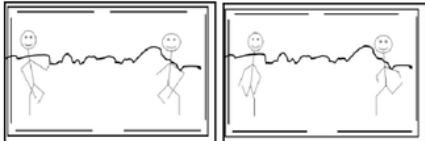
Flexibility Exercise



Picture 8. Flexibility exercise

There are 2 flexibility movements: moving one leg in a forward direction with the knee straight, and kicking the water to downward direction. The objective of these motions is to increase flexibility and balance.

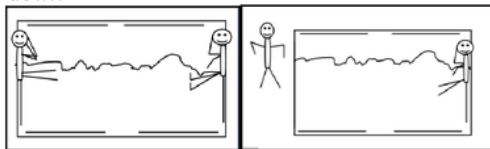
Coordination Exercise



Picture 9. Coordination Exercise

There are two movements: touching the right foot with the left hand (crossing position) in front of the body and behind the body. These help boosting coordination, balance and flexibility.

Cooling down



Picture 10. Cooling down

Cooling down movement is done by kissing the knees and shaking the hands. In order to reduce pain and soreness, the knee kissing motion is done near the pool wall with the water level as high as the hip.

Conclusion

Neuron plasticity is an important process of motor function recovery after stroke but some changes may be maladaptive. Hyperexcitability RS is the mechanism which can explain flexibility whereas strength recovery and motor function are related to cortex reorganisation. It is important to understand that motor recovery and flexibility have their own mechanism [6][50][51]. Small study conducted to six poststroke patients suffering from spinal medulla injury found that spasticity lessened when measured with modified Barthel Index ADL in standing position [8][52]. Patients with certain conditions such as being in post surgery period, suffering from osteoporosis, having limited range of motion, and being unstable are not suggested to perform the exercise [7][53][54].

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