Influence of proprioceptive neuromuscular facilitation toward activities of daily living ability in post stroke patients

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Abstract. The stroke is among one disease caused mortality in the worldwide. The stroke patients who have limitation in implementing activities of daily living which affected their independent. Proprioceptive Neuromuscular Facilitation (PNF) method among one effective method used to increase activities of daily living in the stroke patients. The study aims to understand the influence of PNF exercise toward activities of daily living (ADL) among the stroke patients. The study was used quasi experimental research with pretest-posttest time series design. The study samples were 20 stroke patients and 12 times of PNF exercise was given to the stroke patients which met the inclusion criteria such as stroke patients (diagnosed by neurology doctor) with activities of daily living problem who had Barthel index score at least 62, attended physiotherapy for 12 times and willing to be respondents. The data was collected included activities of daily living level ability that measured using Barthel index. The result showed influence of PNF exercise toward activities of daily living ability among post stroke patients after received 6 times of PNF exercise (p=0.046) but 12 times of PNF exercises (p=0.001) gave optimum result. The study showed there was increment of activities of daily living ability in post stroke patients after received PNF exercise.

1. Introduction

World Health Organization (WHO) is mentioned approximately 15 million people suffers stroke every year in worldwide [1]. In additions, estimation of 10% of death globally due to stroke which contributed the stroke is second disease cause the death and third cause of disability [2]. Meanwhile, systematic review of population based studies between 1970 and 2008 found the stroke prevalence reduced in high income countries but increased in low and middle-income countries [3]. Based on National Basic Health Survey (Risksesdas) in 2013, highest stroke patients is recorded in South Sulawesi (17.9%), Yogyakarta (16.9%), Central Sulawesi (16.6%) and East Jawa (16%) [4].

In additions, 60% of stroke patients will suffers disabilities in the leg or arm and estimate one-third requires staying in nursing home or needing the assistant device for daily life [5] . The stroke is correlated with aging and lifestyle and stroke risk factors such as diabetes mellitus, smoking, high blood pressure, obesity, inactive in physical activity, alcohol consumption, depression and cardiovascular diseases [6]. WHO is defined stroke as “acceleration of clinical signs of focal disturbance of cerebral function which lasting more than 24 hours or cause mortality with present of vascular origin” [7]. There is estimation of 2 million brain cells died in every minute in stroke patients which increase the risk of brain damage, disability and mortality [8].
The stroke also refers as brain attacks and characterized by suddenly loss of blood circulation to the brain which may result in neurological function disruption. Neurological function disorders will result in decrease daily functional activity ability of the individual which activities of daily living is major cause of functional disorder [9].

Physiotherapists can provide various methods to increase ADL in the post stroke patients. PNF method is chosen because more effective to improve ADL than other method which PNF approach is more geared towards movement with diagonal and spiral patterns in accordance with movement used in daily activities. Natarajan et al. (2008) mentioned PNF is effectively used to facilitate movement in patients with post stroke [10]. Meanwhile, Moon et al. (2010) stated PNF proved effective in improving functional movement and walking ability in stroke patients [11]. Furthermore, Kim et al. (2011) mentioned PNF can improve Functional Reach Test (FRT) and increase muscle activity [12]. The study aims to understand the influence of PNF exercise toward activities of daily living (ADL) among the stroke patients.

2. Methodology
The study was used experimental research with pretest-posttest time series design. The study was conducted at Asy-Syifa clinic and Physio Sakti clinic Makassar. The study population was all stroke patients who had treatment at Asy-Syifa clinic and Physio Sakti Makassar clinic. The study samples were 20 stroke patients which met the inclusion criteria included stroke patients (diagnosed by neurologist doctor) with activities of daily living ability had Barthel index at least 62, attended 12 times of physiotherapy and willing to be respondents.

The data was collected through primary data which obtained from stroke patient medical record. The activities of daily living ability in stroke patients was measured with Barthel index for 5 times which activities of daily living ability was measured before being given PNF exercise and after given of 3 times, 6 times, 9 times and 12 times of PNF exercises. The activities of daily living level was categorized into 3 types included moderate dependency, light dependency and self-reliance.

The data was analysed statistical test with SPSS program. Wilcoxon test was conducted to determine the relationship between effectiveness of PNF exercise toward activities of daily living ability in post stroke patients. The data was represented in tables and narratives.

3. Result and Discussion
3.1. Result
Table 1 shows that there was 9 respondents (45%) were aged between 51 years and 60 years and only 1 respondent (5%) was aged between 31 years and 40 years. In additions, 6 respondents were aged between 41 years and 50 years and 4 respondents (20%) were aged 61 years and 70 years. Meanwhile, half of respondents were male which total of 10 respondents and there were 10 female respondents involved in this study.

| Characteristic | N  | %  |
|---------------|----|----|
| Age (years old) |    |    |
| 31-40         | 1  | 5  |
| 41-50         | 6  | 30 |
| 51-60         | 9  | 45 |
| 61-70         | 4  | 20 |
| Total         | 20 | 100|
| Gender        |    |    |
| Male          | 10 | 50 |
| Female        | 10 | 50 |
| Total         | 20 | 100|

Table 1. Respondent characteristic distribution.
Table 2 shows that 19 respondents (95%) had moderate dependency and only 1 respondent had light dependency in activities of daily living ability during pretest. Meanwhile, 18 respondents (90%) had moderate dependency and 2 respondents (10%) had light dependency in activities of daily living ability during 3 times of PNF exercise. There were 15 respondents (75%) had moderate dependency and 5 respondents (25%) had light dependency in 6 times of PNF exercises. In additions, 14 respondents (70%) had moderate dependency and 6 respondents (30%) had light dependency in activities of daily living ability during 9 times of PNF exercises. Furthermore, there were 2 respondents (10%) were self-reliance and 9 respondents (45%) were light dependency in their activities of daily living ability during 12 times of PNF exercises.

**Table 2. Distribution of pretest-posttest in activities of daily living ability.**

| Activities of daily living ability | Pretest | Posttest 3x | Posttest 6x | Posttest 9x | Posttest 12x |
|-----------------------------------|---------|------------|------------|------------|-------------|
|                                   | N   | % | N   | % | N   | % | N   | % |
| Moderate dependency               | 19  | 95 | 18  | 90 | 15  | 75 | 14  | 70 | 9  | 45 |
| Light dependency                   | 1   | 5  | 2   | 10 | 5   | 25 | 6   | 30 | 9  | 45 |
| Self-reliance                      | 0   | 0  | 0   | 0  | 0   | 0  | 0   | 0  | 2  | 10 |
| Total                              | 20  | 100| 20  | 100| 20  | 100| 20  | 100| 20 | 100|

Meanwhile, minimum and maximum were 62 and 96 with median 74.00 during 3 times of PNF exercises. The result showed p value= 0.317 meant there was no significant influence between 3 times of PNF exercises and activities of daily living ability in the post stroke patients.

**Table 3. Influence of 3 times of PNF exercises on activities of daily living ability.**

| Barthel index | Minimum | Median | Maximum | Sig. (P)* |
|---------------|---------|--------|---------|-----------|
| Pretest       | 62      | 67.50  | 95      | 0.317     |
| Posttest 3x   | 62      | 74.00  | 96      |           |

In additions, minimum and maximum were 62 and 98 with median of 79.50 during 6 times of PNF exercises. There was significant influence between 6 times of PNF exercises and activities of daily living ability among post stroke patients (p=0.046<0.05).

**Table 4. Influence of 6 times of PNF exercises on activities of daily living ability.**

| Barthel index | Minimum | Median | Maximum | Sig. (P)* |
|---------------|---------|--------|---------|-----------|
| Pretest       | 62      | 67.50  | 95      |           |
| Posttest 6x   | 62      | 79.50  | 98      | 0.046     |

In pretest, minimum and maximum were 62 and 95 with median of 67.50. In additions, minimum and maximum were 62 and 99 with median of 85.00. There was significant relationship between 9 times of PNF exercises and activities of daily living ability in post stroke patients (p=0.025< 0.05).
Table 5. Influence of 9 times of PNF exercises on activities of daily living ability.

| Barthel index | Minimum | Median | Maximum | Sig. (P)* |
|--------------|---------|--------|---------|-----------|
| Pretest      | 62      | 67.50  | 95      | 0.025     |
| Posttest 9x  | 62      | 85.00  | 99      |           |

Furthermore, minimum and maximum were 66 and 100 with median of 91.00 in 6 times of PNF exercises posttest. The result showed there was significant influence between 12 times of PNF exercises and activities of daily living in post stroke patients.

Table 6. Influence of 12 times of PNF exercises on activities of daily living ability.

| Barthel index | Minimum | Median | Maximum | Sig. (P)* |
|--------------|---------|--------|---------|-----------|
| Pretest      | 62      | 67.50  | 95      | 0.001     |
| Posttest 6x  | 66      | 91.00  | 100     |           |

3.2. Discussion
The result found highest number of stroke incidence was ranges of 51 years to 61 years old. Furthermore, 10 male respondents and 10 female respondents which there was no relationship between gender and stroke incidence. Sensöz et al. (2018) found high stroke prevalence in person aged more than 44 years and female had high risk than men in suffers risk in Karabük city Turkey [13]. Besides, stroke factors such as age factors, hypertension and diabetes mellitus. Focht et. al. (2014) mentioned women had suffered high poststroke disability which delay in seeking treatment [14].

The 3 times of PNF exercises provision has been ineffectively and 6 times of PNF exercises had a bit effect on ADL ability but the effect was not yet significant and 9 times of PNF exercises showed significant influence on ADL ability in post stroke patients. In additions, 12 times of PNF exercises showed most significant influence toward ADL ability in post stroke patients (p= 0.001<0.05). Tung et al. (2010) found 12 times of PNF exercises had improved balance level and muscle strength in the stroke patients [15].

The recovery process after stroke is distinguished for neurological restoration of brain nervous function and functional recovery (ability to perform functional activity). Neurological restores occurs early after the stroke. The underlying mechanism is the brain cell function recovery in the penumbra area around real infarct area and diachysis recovery while the functional capability recovers with the neurological recovery capabilities that occur.

After the cerebral lesion settles, functional recovery can continue to occur to some extent especially between 3 months and 6 months after the stroke. PNF is therapeutic exercise approach that combined a functional diagonal pattern with neuromuscular facial techniques to generate motor responses and improve neuromuscular control and function.

The occurrence of increment in ADL ability in post stroke patients due to its practice, PNF is more geared toward movement with diagonal and spiral patterns together with movement used in daily activities in accordance with neuroplasticity of the nerves. In PNF exercises, there was strengthening and functional movement that occurs simultaneously while conventional exercises that strengthening and functional motion did not occurs simultaneously.

4. Conclusion
In conclusion, there was influence on the 6 times, 9 times and 12 times of PNF exercise toward activities of daily living ability in the post stroke patients. The 12 times of PNF exercise demonstrated more significant influence than 6 times and 9 times of PNF exercise toward activities of daily living ability in post stroke patients. The physiotherapist in the hospital and clinic are expected to choose the
PNF exercise modality as one of the selected modalities to improve activities of daily living ability in the post stroke patients.

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