

# INDONESIAN JOURNAL OF Physical Medicine & Rehabilitation

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# Editorial Note

## Regenerative Rehabilitation

Rehabilitation is the health strategy which, based on WHO's integrative model of functioning, disability and health applies and integrates approaches with the goal to enable persons with health conditions experiencing or likely to experience disability to achieve and maintain optimal functioning. The function status associated with physical activity is a health indicator and is the domain of quality of life. Human functioning is a major target of the rehabilitation program.

Regenerative therapy could be done with introduction of stem cells, progenitor cells, or biologically active molecules and the implantation of bioengineered scaffolds or ex vivo grown tissues. Restoring or establishing normal function is the goal of regenerative medicine.

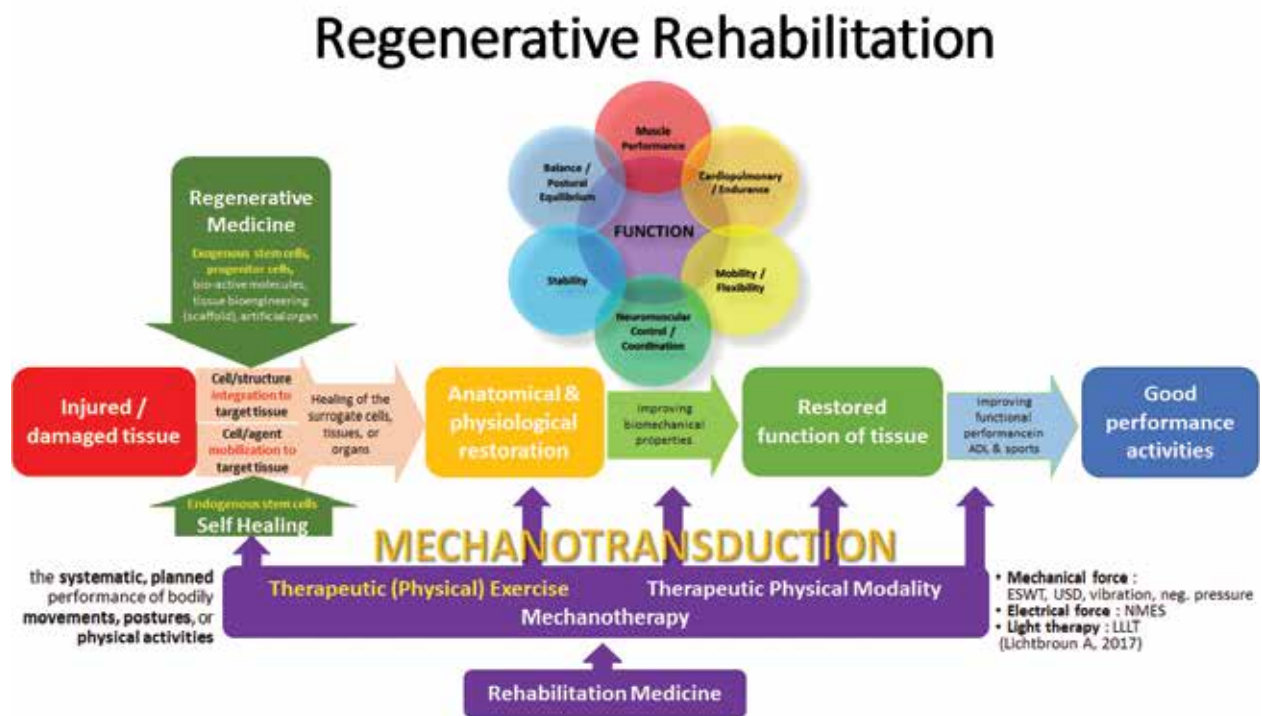
Restoration of function from diseased or injured tissue is the ultimate goal of both regenerative medicine and medical rehabilitation interventions. Good performance in daily and sport activities could be done with intact anatomical, functional and biomechanical properties. Integration and healing of the surrogate cells, tissues, or organs after regenerative medicine intervention are often dependent on the fulfilling the therapeutic physical stimuli needs.

Strategies to maintain and/or improve proper cell function and survival within the environments they reside (origin and target tissue) and travel should be a primary focus for cell therapy. Individuals who receive regenerative therapies will require rehabilitation to make best use of their restored anatomy and newly regained abilities.

Regenerative rehabilitation represents a collaborative approach whereby rehabilitation specialists, basic scientists, physicians, and surgeons work closely to enhance tissue restoration by creating tailored rehabilitation treatments. This definition includes restoring function after tissue regeneration or repair, facilitating regeneration and repair at the tissue level during healing.

A part of regenerative rehabilitation which uses the biomechanical approach is mechanotherapy, which is defined as “any intervention that introduces mechanical forces with the goal of altering molecular pathways and inducing a cellular response that enhances tissue growth, modeling, remodeling, or repair.” The mechanotherapy will deliver mechanical signals (extrinsically eg with physical modality and intrinsically eg via therapeutic exercise prescription) to create a tissue force with the goal of evoking a cellular and molecular response. This process in turn activates specific biological responses in tissues to enhance the integration, healing, and restorative capacity of implanted cells, tissues,

or synthetic scaffolds. Physical modality and exercise have the potential to influence any one, a combination, or all of these processes.



**DR.Dr. Damayanti Tinduh, SpKFR(K)**  
Faculty of Medicine, University of Airlangga

ORIGINAL ARTICLE

## Cognitive and Balance Performance among Elderly in Nursing Home

**Mathilda Albertina, Herdiman Bernard Purba, Siti Annisa Nuhonni**

Department of Physical Medicine and Rehabilitation, Faculty of Medicine, University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia

### ABSTRACT

**Introduction:** Cognitive disorders have associated with incidence of fall. Cognitive problem is more frequent in elderly living in nursing homes compared to those who live in community. The aim of this study is to determine correlation between balance performance and cognitive status among elderly in nursing home.

**Methods:** This study was conducted in a nursing home in Jakarta. Balance performance was evaluated using Timed Up and Go (TUG) test and Berg Balance Scale (BBS), while cognitive status was examined using Mini Mental State Examination (MMSE).

**Results:** There were 35 participants, consisted of male 10(28.6%) and female 25(71.4%) with median aged 69 years old, included in this study. Median MMSE result was 21 (6-30). The median result of TUG was 14.13 (9.66-88.50) seconds. The median BBS result was 50 (18-56). MMSE have negative strong correlation with TUG ( $r = -0.693$ ;  $p = 0.000$ ) and positive strong correlation with BBS ( $r = 0.640$ ;  $p = 0.000$ ).

**Conclusion:** Cognitive function has strong correlation with balance performance among elderly in nursing home. Therefore, cognitive aspect should be included in fall prevention program.

**Keywords:** *Balance, cognitive, elderly, nursing home*

## ABSTRAK

**Pendahuluan:** Gangguan kognitif memiliki hubungan dengan kejadian jatuh. Masalah kognitif lebih sering terjadi pada lansia yang tinggal di panti jompo dibandingkan dengan mereka yang tinggal di komunitas. Tujuan penelitian ini adalah menentukan korelasi antara status kognitif dengan keseimbangan pada lansia di panti jompo.

**Metode:** Penelitian ini dilakukan di panti jompo di Jakarta. Performa keseimbangan dievaluasi menggunakan tes *Time Up dan Go* (TUG) dan Skala Keseimbangan *Berg* (BBS), sementara status kognitif diperiksa dengan *Mini Mental State Examination* (MMSE).

**Hasil:** Terdapat 35 partisipan, terdiri dari pria 10(28.6%) dan wanita 25(71.4%) dengan nilai tengah berumur 69 tahun, yang disertakan pada penelitian ini. Nilai tengah hasil MMSE adalah 21 (6-30). Nilai tengah hasil dari TUG adalah 14.13 (9.66-88.50) detik. Nilai tengah hasil BBS adalah 50 (18-56). MMSE memiliki korelasi negatif yang kuat dengan TUG ( $r = -0.693$ ;  $p = 0.000$ ) dan korelasi positif yang kuat dengan BBS ( $r = 0.640$ ;  $p = 0.000$ ).

**Kesimpulan:** Fungsi kognitif memiliki korelasi yang kuat dengan performa keseimbangan diantara lansia di panti jompo.

**Kata kunci:** Keseimbangan, Kognitif, Lansia, Panti Jompo

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Correspondent Detail:

**Mathilda Albertina**

Email: mathilda.md@gmail.com

Faculty of Medicine University of Indonesia  
Jakarta, Indonesia

## INTRODUCTION

Improvement of health services result in increase of life expectancy and percentage of elderly population. In Indonesia, citizen above 60 years old in 2017 is 9.03% among population and is estimated to reach 15.8% in 2035.<sup>1</sup> Therefore, health problems in old age deserve more attention. One of them is

high incidence of falls. The mean fall rate among elderly is 0.65 falls per person-year in community, and 1.7 for those living in nursing homes.<sup>2</sup>

Balance is the ability of the body to maintain equilibrium or prevent fall. Balance involves complex motor control. Sensory systems detect body position and movements. Those impulses send to central nervous systems that select and integrate incoming inputs to create the right perception. Central nervous systems then select muscle contraction pattern and sends impulse to the motor systems to give adequate musculoskeletal systems in controlling body position. Besides that, central nervous systems also play roles in anticipation movement and adjustment.<sup>3</sup>

There are many kinds of balance assessment. Dynamic balance or functional mobility tests are balance assessment methods that is most related to the risk of fall. The examples of those are Berg Balance Scale (BBS) and Timed Up and Go (TUG) test. Both tests are often used in elderly and have a good correlation with objective balance test.<sup>4</sup>

Aging causes decrease of sensory, motor and cognitive function that can cause balance problem. Cognitive disorders have long been associated with incidence of fall, especially during dual-task activity.<sup>5</sup> Degradation of cognitive function is more frequent in elderly living in nursing homes compared to those who lives in community.<sup>6</sup> This study aimed to determine correlation between balance performance and cognitive status among elderly in nursing home.

## METHODS

This study was conducted in Panti Sosial Tresna Wreda (nursing home) Budi Mulia 1, East Jakarta. Balance performance was evaluated using Timed Up and Go (TUG) test and Berg Balance Scale (BBS), while cognitive status was examined using Mini Mental State Examination (MMSE).

Timed Up and Go (TUG) measures how long time needed by a participant to stand from a standard chair, walk for 3-meters, turns 180°, walk back and sit down on the same chair. The longer time it takes, the balance become worse. Otherwise, for Berg Balance Scale (BBS), higher score of it means better

balance. The BBS consists of 14 tasks to examine static and dynamic balance, scored 0 to 4 for each task.<sup>7,8</sup>

The inclusion criteria for subjects were: sixty years old or older, able to do ambulation with/without walking aid, manual muscle test (MMT) at least 4 in all extremity, able to understand instruction, willing to participate in this study. The exclusion criteria were uncorrected visual acuity < 3/60 with finger count examination, uncorrected hearing problem that cause communication problem, severe neuromuscular or musculoskeletal condition.

Data were managed using SPSS 20 program. Since data were not normally distributed, Spearman test was done to analyze correlation between MMSE and balance performance (TUG and BBS).

## RESULTS

There were 35 participants included in this study. Their characteristics are listed in table 1. The median age was 69 (60-94) years old. Median MMSE result was 21 (6-30). Most of the subjects (31.5%) had not complete elementary school, even some of them (14.3%) are illiterate. Only quarter of subjects earned secondary or higher education.

**Table 1. Subject characteristics**

Variable	N	%	Median (Min-Max)
Age (years)			69 (60 – 94)
Sex			
<i>Male</i>	10	28.6	
<i>Female</i>	25	71.4	
Educational level			
<i>Illiterate</i>	5	14.3	
<i>Elementary incomplete</i>	11	31.5	
<i>Elementary complete</i>	10	28.5	
<i>Secondary or higher</i>	9	25.7	
MMSE			21 (6 – 30)
TUG (seconds)			14.13 (9.66 – 88.50)
BBS			50 (18 – 56)

The median result of TUG was 14.13 (9.66-88.50) seconds. The median BBS result was 50 (18-56). As shown in table 2, MMSE have negative strong correlation with TUG ( $r = -0.693$ ;  $p = 0.000$ ) and positive strong correlation with BBS ( $r = 0.640$ ;  $p = 0.000$ ).

**Table 2. Correlation of MMSE with balance performance**

	<b>r</b>	<b>p</b>
MMSE – TUG	-0.693	0.000
MMSE – BBS	0.640	0.000

## DISCUSSION

This study held in a public nursing home in Jakarta, where most of the inhabitants were homeless. This economic background might

be the reason why most of the subjects had low education level. The illiteracy rate in this study is 14.3%, that is higher compared with illiteracy rate in Jakarta (0.73%), even in total Indonesia population (10.6%).<sup>9</sup>

As mention earlier, median subject's age was 69 years old and median MMSE was 21. Few studies had been done to get median value of MMSE based on age and education. A study in healthy individuals in Medan found the same number for median results of MMSE in above 60 years old population. However, similar study in Jakarta got higher result (26). For population in low education level (0-6 years of education), the median results of MMSE in both studies were 24 and 26.<sup>10</sup> A study by Crum et al also found slightly higher results of MMSE among 65-69 years old elderly with 0-4 years of education, that was 22.<sup>11</sup> It means, subjects in this study had lower cognitive



performance compared to population of same age and same education level.

Elderly living in nursing home tend to have more cognitive problem compared to them in community. Beside low economy and educational level issues, it might because older adults having cognitive problem are more frequently sent to nursing home by their family. Their placement on nursing home itself is also a risk factor for further cognitive decline.<sup>6</sup>

The result of TUG was 14.13 (9.66-88.50) seconds. Shumway-cook et al published that TUG results 13.5 seconds is a cut off to predicts fall in elderly.<sup>12</sup> SD=6, range=65–85 It means subjects in this study had risk of fall. Berg Balance Scale (BBS) results, that was 50 (18-56), however it still better than its cut off for fall risk, that is 46.<sup>13</sup>

Both TUG and BBS had strong correlation with cognitive performance. The better cognitive status, measured by MMSE, the shorter time needed for TUG test ( $r = -.693$ ) and higher BBS score ( $r = .640$ ).

Cognitive and balance relationship usually studied in dual-task activity, such as walking while performing another task.<sup>5</sup> In this study, our balance measurements are single task, however their correlation are strong for cognitive function. However, Tangen et al also found association between single-task balance test (Balance Evaluation System Test) and cognition.<sup>14</sup> Single-task balance examination using posturography also associated with brain atrophy and hippocampal volume.<sup>15,16</sup>

One of the components of TUG test is gait

speed. Few studies had been performed to see relation of cognitive function and gait speed. A meta-analysis concludes that the evidence for an association between gait speed and cognition in elderly is strong.<sup>17</sup>

The most cognitive domain that has been associated with balance and gait is executive function. Executive functions are mental processes needed when a person need to concentrate and pay attention. Although attention is more needed in dual-task walking, single-task balance assessment also associated with executive function.<sup>5,14</sup> Hyperintensity of the white matter has been associated with lower executive function in elderly.<sup>18</sup>

The strong correlation between cognitive and balance gives challenge to prevent fall among elderly. A fall prevention program in nursing homes must include cognitive aspect in their physical activity and balance exercise. The most important is prevention and early detection for cognitive decline.

## CONCLUSION

Cognitive function has strong correlation with balance performance among elderly in nursing home. Therefore, cognitive aspect should be included in fall prevention program.

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## ORIGINAL ARTICLE

## Foot Posture Characteristics in Medial Knee Osteoarthritis Patients

**Leni Kopen, Angela BM. Tulaar, Nyoman Murdana**

Department of Physical Medicine and Rehabilitation, Faculty of Medicine, University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia

### ABSTRACT

**Introduction:** Alteration of foot posture may influence the knee loading, particularly in medial compartment. The purpose of this study was to find the relation of foot postures with clinical finding in medial knee osteoarthritis (KOA).

**Methods:** Subjects with medial KOA who met inclusion criteria were recruited consecutively, in Nursing home on August to October 2018. The foot posture has determined by Foot Posture Index (FPI). The severity of KOA has measured by Kelgreen-Lawrence (KL) grading system, and pain level using numeric rating score (NRS).

**Results:** There were 37 subjects consisted of male and female with normal foot subsequently 17(8.5%) and 3(15%), male and female with abnormal food subsequently 3(15%) and 1(16%). There were 12 (32.43%) of pronated foot, 5 (13.51%) of supinated foot, and 20 (54.06%) of normal foot subjects. The subjects with abnormal foot posture have severe medial KOA ( $p<0.001$ ), while the pain sensation similar between groups ( $p=0.321$ ,  $p=0.688$ ).

**Conclusion:** There was a correlation between foot posture and the severity of medial KOA.

**Keywords:** *Foot posture, Knee osteoarthritis, Foot posture index, Numeric rating score*

## ABSTRAK

**Pendahuluan:** Kelainan postur kaki dapat mempengaruhi beban lutut, terutama pada kompartemen medial. Tujuan dari penelitian ini adalah menemukan hubungan dari postur kaki dengan penemuan klinis pada osteoarthritis lutut medial (KOA).

**Metode:** Subyek KOA medial yang sesuai dengan kriteria inklusi, direkrut secara konsekutif, di Panti Jompo pada Agustus-Oktober 2018. Postur kaki ditentukan dengan Foot Posture Index (FPI). Keparahan KOA diukur dengan Kelgreen-Lawrence (KL), dan level nyeri menggunakan numeric rating score (NRS).

**Hasil:** Terdapat 37 subjek yang terdiri dari pria dan wanita dengan kaki normal 17(8.5%) dan 3(15%), pria dan wanita dengan kaki abnormal 3(15%) dan 1(16%). Terdapat 12 (32.43%) kaki pronated, 5 (13.51%) kaki supinated, dan 20 (54.06%) subjek kaki normal. Subjek dengan postur kaki abnormal memiliki KOA medial yang parah ( $p < 0.001$ ), sementara sensasi nyeri hampir sama diantara kelompok ( $p = 0.321$ ,  $p = 0.688$ ).

**Kesimpulan:** Terdapat korelasi antara postur kaki dan keparahan KOA medial.

**Kata kunci:** *Postur kaki, osteoarthritis lutut, Index Postur Kaki, Numeric rating score*

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### Correspondent Detail:

**Leni Kopen**

Email: doleko\_1503@yahoo.com

Faculty of Medicine University of Indonesia  
Jakarta, Indonesia

## INTRODUCTION

Knee osteoarthritis (KOA) is one of the most common degenerative joint disease and the major cause pain and activity limitation.<sup>1-4</sup> It affects 12.1% of the population aged 60 years in United States and around 15% in Indonesia.<sup>5,6</sup> Medial KOA is the most common type of KOA.<sup>1,2</sup> It caused by the greater loading occurred in medial compartment of knee joint. During walking, medial compartment bears approximately 60-70% of body weight whereas the lateral compartment bears the remaining weight.<sup>5</sup> Moreover, knee joint

loading is highly predicted by knee adduction moment (KAM). The determinants of KAM are magnitude of ground reaction force (GRF) related to a certain point in the center of knee. The origin of GRF is determined at the approximate location of the center of plantar pressure (COP) and transmitted through the kinetic chain of the lower extremity include knee joint,<sup>5,7</sup> that's way any alteration in foot posture can therefore have direct influence on the GRF and tend to have a significant implication on knee load distribution. Since the GRF is not transmitted to knee joint equally between medial and lateral compartment during walking, the load applied to medial compartment 2.5 times greater and that's way medial KOA occurs ten times more frequent than the lateral one.<sup>7,8</sup>

Foot posture has been ascertained to participate to the development of KOA as it may alter the mechanical alignment and dynamic function of knee during most weight bearing activities.<sup>9</sup> Specific

foot posture might cause greater mechanical stress over knee joint.<sup>10</sup> Meanwhile, KOA may also affect foot motion during walking,<sup>10</sup> hence foot posture might play significant role in KOA setting. There are several type of foot postures. According to The Foot Posture Index (FPI), there are three types of foot posture; normal, pronated and supinated feet.<sup>11</sup> Levinger and colleagues stated that people with medial KOA exhibit a more pronated foot compared to controls, as indicated by the FPI, navicular drop and arch index.<sup>9</sup> In line with Levinger, Reilly and colleagues observed similar findings in people with medial KOA using several foot measures.<sup>12</sup> In Surlakar and colleagues's research, they reported that there were 36% participants with pronated foot, 36% subjects with supinated foot and the rest with normal foot and among medial KOA subjects, there were 83.30% subjects have pronated foot.<sup>10</sup>

As foot posture can directly influence the distribution of knee loading in medial KOA patients,<sup>10</sup> a conservative strategy using orthoses and footwears were developed to decrease the medial loading of knee joint. There are various kinds of foot orthoses that have been applied to decrease knee pain and improve functional capacity of the patients suffering from KOA. Several orthoses were recommended include lateral wedged insoles, valgus knee brace and modification shoes.<sup>8</sup> Those were widely used as one of optional conservative treatments particularly in medial KOA to offload the medial compartment of knee.<sup>5</sup>

Previous studies said that those orthoses were able to shift laterally the medial compartment load by reducing KAM.<sup>13-15</sup> However, the effectiveness of orthoses in reducing KAM is still inconsistent in many previous studies.<sup>16</sup> Chapman et al (2011) and Beardsley (2015) used insoles

in their study and stated that the highly varies effects of insoles in medial KOA patients might be related to foot posture.<sup>16,17</sup> Foot characteristic is one of important aspect initially contribute to KOA and its progression.<sup>9</sup> However, Chapman and Breadsley stated several foot types are not expected to provide a good response in reducing KAM such as pes cavus, pes planus and calcaneus varus.<sup>16,17</sup> Furthermore, Sawada et al proved that foot posture influences the effectiveness of orthoses. Medial KOA patients with normal foot were likely had a more positive beneficial after the use of specific orthoses.<sup>18</sup> Despite the genuine importance of understanding foot characteristics of people with medial KOA, only limited KOA studied have included foot posture even though it is very important.<sup>9</sup> Therefore, the purpose of this study was more focused to investigate the prevalence of foot posture in medial KOA patients and their correlation with clinical profiles.

## METHODS

The research protocol was approved by Health Research Ethics Committee, Faculty of Medicine, Universitas Indonesia-Cipto Mangunkusumo National Hospital and conducted at Cipto Mangunkusumo National Hospital in Indonesia. A cross sectional study was generated on 37 patients who were clinically diagnosed as KOA according to American College of Rheumatology (ACR) criteria and selected by a consecutive technique sampling.<sup>19</sup> We determined as medial KOA based on radiologic findings in combination with osteoarthritic signs according to Kellgren-Lawrence (KL) system of grade 1-3 were located over medial tibiofemoral compartment. Subjects were required to undergo an examination using the numeric rating scale (NRS).<sup>20</sup> Subjects met

with above criteria were recruited as participants, then they were divided in two groups: normal foot and abnormal foot group. The demographic, severity of KOA and pain level were obtained at the same time

To determine types of foot posture, we were using the foot posture index (FPI). This instrument demonstrated good intra-rater reliability (intraclass correlation coefficient (ICC) 1,1 = 0.87) from previous study.<sup>11</sup> The FPI consist of 6 items evaluation: talar head palpation, supra and infra curvature of lateral malleolus, calcaneus inversion/eversion, prominence of talonavicular joint, congruence of the internal longitudinal arch, abduction or adduction of the forefoot with respect to the rear foot. Based on those observations, type of foot posture was categorized into three groups as follows: normal foot (total score between +0 and +5), pronated foot (total score between +6 and +9), and supinated foot (total score between -1 and -4). In present study, the pronated and supinated foot subjects were included as abnormal foot group.

Data were collected included demographic and clinical profiles and analyzed using the Statistical Package for Social Sciences (SPSS) program version 20 for statistical analysis. Some data were presented in percentage and drawn in a table or graphic. We also ascertained whether the results had a normal distribution using Shapiro-Wilk test. Based on this test, the difference of pain level and severity of KOA were compared between two groups by using the appropriate test and presented as means (SDs) or range (minimal-maximal). Statistical significance was set at  $p < 0.05$ .

## RESULTS

Among 37 participants included in this study, 89.19% participants were female and only 10.81% were male. The average age of the sample was  $60.11 \pm 8.96$  years and dominated by participants with obesity (54.05%). The data are listed in table 1 below.

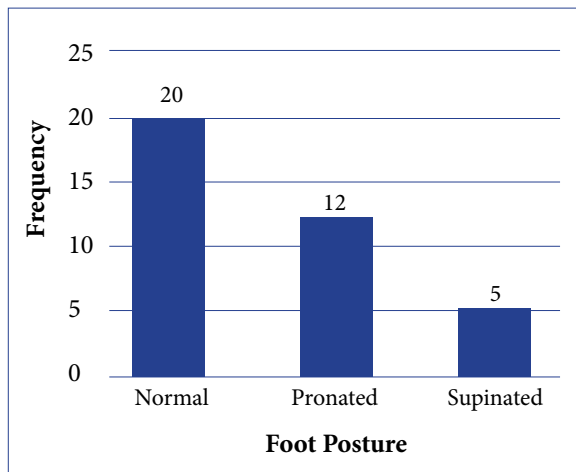
**Table 1. Baseline demographic characteristics**

Variable	Normal foot n=20, (%), SDs	Abnormal foot n=17, (%), SDs	P values
<b>Age (year)</b>	57,40 ( $\pm 9,81$ )	63,29 ( $\pm 6,79$ )	0,04 <sup>a</sup>
<b>Gender</b>			
Female	17 (85%)	16 (94%)	0,609 <sup>b</sup>
Male	3 (15%)	1(6%)	
<b>Nutritional status</b>			
No obesity	12 (60%)	9 (52,94%)	0,666 <sup>c</sup>
Obesity	8 (40%)	8 (47,06%)	
<b>Occupation</b>			
Housewife/retirement	11 (55%)	17 (100%)	0,002 <sup>b*</sup>
Work outside home	9 (45%)	0 (0%)	

<sup>a</sup>Independent t-test, <sup>b</sup>Fisher exact, <sup>c</sup>Chi square, \*statistically significant  $p < 0,05$ , SDs= standard deviation.



The prevalence of foot posture among medial KOA patients was found to be very variable. The foot posture type is presented in Figure 1. The pronated and supinated foot later will mention as abnormal foot. In this study, range of FPI score for pronated foot between +6 and +8. It means there was no subject categorized as highly pronated, whereas in supinated, all five participants have FPI score -2.



**Figure 1. Type of foot posture among subjects**

Clinical profiles of participants included KL-grading system and pain level. There was no significant different for knee pain level for both groups, but for those with more severe KOA tend to occur in abnormal foot groups ( $p < 0.001$ ).

## DISCUSSION

In many previous studies, there were various strategies for conservative treatments in KOA patients. One of conservative treatment is orthoses and footwears. The efficacy of those orthoses is still a crucial issue.<sup>9,18</sup> Some researcher said that they might be help but others stated vice versa. Despite, the potential benefit of using orthoses in KOA patients, one must fully understand about foot characteristic, since it can alter the mechanical alignment and dynamic function of the lower limb and may therefore be related to the development of lower limb musculoskeletal conditions, included the progression of KOA.<sup>9</sup> Moreover, several recent studies have drawn special attention to the possibility of increasing foot orthoses benefits by assessing more carefully the foot posture.<sup>8,9,16</sup> Assessing foot characteristics of people with medial KOA may therefore advance our understanding of the potential role of foot orthoses and footwear modifications on lower limb alignment and function.<sup>9,18</sup>

In this study, we investigated foot characteristics of people with medial KOA

**Table 2. Clinical profiles**

Variable	Normal foot n=20, (%), SDs	Abnormal foot n=17, (%), SDs	P values
KL grading			
I-II (mild-moderate)	19 (95%)	4 (23,52%)	<0,001 <sup>a*</sup>
III (severe)	1 (5%)	13 (76,48%)	
NRS			
Right knee	4,45 (±1,57)	5,00 (3-8)	0,321 <sup>b</sup>
Left knee	4,85 (±1,95)	5,12 (±2,06)	0,688 <sup>c</sup>

<sup>a</sup>Chi square, <sup>b</sup>Mann Whitney, <sup>c</sup>independent t-test \*statistically significant  $p < 0,05$ , SDs= standard deviation, KL=Kelgreen&Lawrence, NRS= Numeric rating scale

using the FPI. We exhibited a high prevalence of abnormal foot (45.94%). This result was similar with Levinger's, Surlakar's and Reilly's research. Pronated feet were the most frequent among the abnormal foot.<sup>9,10,12</sup> This situation might be a consequence for medial KOA or as risk factor, to date it still cannot be determined yet. Patient with medial KOA tend to have a more varum alignment of the knee.<sup>7,8</sup> This condition caused the trajectory of GRF to pass more medially with the respect to the center of knee joint result in higher KAM which furthered increased load in medial compartment.<sup>7</sup> Previous literature revealed that pronated foot might be as one of compensation strategy performed by patient naturally in order to decrease the pain.<sup>9</sup> Pronated foot more frequent in medial KOA might due to biomechanical changes that occurs during abnormal loading of knee joint during weight bearing activities.<sup>9,10</sup> In order to decrease KAM, foot adapts subtalar joint in to pronated position.<sup>10</sup> Thus, shift the knee load more laterally and further decrease load on medial compartment. However, there were some individual in medial KOA with supinated foot. In Surlakar's study and this present study, there were 11.54% and 13.51% medial KOA patients with supinated foot respectively. Since, there is only very lack data investigated about foot posture in medial KOA patients, we still can't determine the reason behind the phenomena yet. In authors opinion, this could be explained by the fact that there was a possibility of supinated foot did exist before medial KOA was developed.

Another compensation strategy to decrease knee load on medial compartment is gait modification. The KAM can be decrease with

several gait modifications such as increase in ipsilateral trunk lean, medial thrust gait, toeing out, and reducing speed.<sup>7</sup> Those gait modifications can alter COP and reduce the moment arm of GRF. Those are known consistently resulting in decreasing knee KAM particularly in medial KOA.<sup>16</sup> Since the origin of GRF is determined at the approximate location of COP and transmitted through the kinetic chain of the lower extremity include knee joint,<sup>7</sup> that brings any alteration in foot posture can therefore have direct influence on the origin of GRF and tend to have a significant implication on load distribution of the knee. However, whether those kinds of gait modifications can also cause foot deformity or increase progression of KOA must be furthered investigated.

Yasuda and Sasaki used insoles in medial KOA patients and found that insoles gave more benefit only for those medial KOA subjects with mild severity (KL 1-2).<sup>21</sup> Moreover, Chapman predicted only normal foot allows orthoses to raise some biomechanical benefits in order to decrease knee pain.<sup>17</sup> The effect of using orthoses in reducing pain in KOA patients was reported through the mechanism of shifting the COP laterally so that GRF come closer to the center of the knee resulting in decrease of KAM.<sup>13-15</sup> KAM itself in many previous studies were said to be as the strongest predictor that determine greater burden of load over medial knee.<sup>13-15</sup> Chapman and Beardsley predicted that normal foot would have a more significant pain reduction effect in relate to the use of orthoses. They stated that the use of insoles in KOA patients was more effective in subjects with normal foot.<sup>16,17</sup> It might be because normal foot allows the presence of

laterally knee load shifting which is very likely that situation was not occur in abnormal foot. This statement is in line with Sawada et al who conducted a study that identified the magnitude of lateral shifting of COP after the use of insoles in normal and abnormal foot group. The lateral shift of COP and significant KAM reduction were more significant in normal foot than that of abnormal foot.<sup>18</sup> We think the reason why many previous studies have found inconsistent results in reducing pain level after using orthoses might be because mostly those studies did not consider the foot posture, even though it is said to have a vital role in determining whether the lateral shift of COP can occur or not. Based on this, we should consider foot posture as one important aspect in orthoses prescription otherwise the optimal benefit of orthoses couldn't be achieved.

This present study also revealed that medial KOA patient with abnormal foot tend to have a more severe KOA. In agreement with this, Reilly also found for people with severe medial KOA have a more pronated feet compared to control.<sup>9,12</sup> Those with medial KOA commonly with a varum deformity which can worsen the progression of KOA due to there is increase load on medial compartment.<sup>7</sup> Changes in knee alignment would probably modify the normal static and dynamic function of ankle and subtalar joint, lead to abnormality of the foot posture.

In Lukum's study the more severe KOA, the greater pain level will raise. However, in this present study, there was no significant different in pain level for both groups, the abnormal foot with a more severe KOA didn't experience

higher pain level. This discrepancy might be caused by the different characteristic of subjects. In Lukum's study, subjects with KL 3 were dominant whereas in this present study there were only 13 out of 37 subjects with KL 3. Patients with KOA KL3 commonly had a varus deformity.<sup>7,22</sup> Varus deformity is very suggestive for higher medial compartment load and in line with more severe pain.

As aforementioned above, clinicians while evaluating KOA patients should be more careful, not only evaluate pain level but also foot posture itself. In our opinion, foot posture has a vital role in treating KOA patients. Each KOA individuals have their own characteristic and their orthoses or footwears should be specially designed based on those characteristics. Moreover, the highly prevalence of abnormal foot found in this study subsequently implicate a consideration. Assessing foot posture no longer as an optional examination but must include as a routine examination in KOA patients in order to develop a new strategy in treating KOA patients, particularly when provide orthoses and footwears, otherwise the optimal beneficial effect of those orthoses couldn't be achieved.

## CONCLUSION

This present study showed that higher prevalence of abnormal foot was found in medial KOA patients. So, examine individual foot alignment can be suggested as a routine assessment in medial KOA patients in order to develop a suitable orthoses or footwears.

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ORIGINAL ARTICLE

## Six-minute Walk Test in Children with Cerebral Palsy: Comparing the Walking Distance between Different Level of Communication Function

**Budiati Laksmitasari, Luh Karunia Wahyuni, Tirza Z Tamin**

Department of Physical Medicine and Rehabilitation, Faculty of Medicine, University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia

### ABSTRACT

**Introduction:** Children with cerebral palsy (CP), six-minute walk test (6MWT) is more difficult to perform because some children have communication impairment. The objective to study the distance of 6MWT among different level of communication in children with CP.

**Methods:** This study was cross-sectional study, in a Rehabilitation Clinic, on Juli to December 2018. The subjects were children aged 7-18 years old with cerebral palsy with Gross Motor Function Classification System (GMFCS) I-III, Communication Function Classification System (CFCS) I-III, able to walk independently with or without aid, and understand the instruction of 6MWT. All the subjects performed 6MWT. Level of communication function was evaluated by CFCS. The 6MWD between CFCS groups were compared.

**Results:** There were 23 subjects mean aged 9 years old, consisted of 17(73.9%) male and 6(26.1%) female, with GMFCS level I-III in sequence were 3(13%), 11(47.8%), and 9(39.1%), also with CFCS level I-III in sequence were 5(21.7%), 7(30.4%), and 11(47.8%). Subjects with verbal communication were 14(60.9%) and nonverbal communication were 9(39.1%). The median of 6MWD in group with CFCS level I, II, and III respectively were 115 (60-282), 161 (17.5-281), and 135 (23-280) m. There was no significant difference in 6MWD between different groups of CFCS ( $p=0.960$ ).

**Conclusion:** There were no difference in walking distance on 6MWT among different level of communication function in children with CP.

**Keywords:** *Cerebral palsy, Six-minute walk-test, Six-minute walking-distance, Communication Function Classification System (CFCS)*

## ABSTRAK

**Pendahuluan:** Uji berjalan 6 menit (6MWT) lebih sulit dilakukan pada anak dengan cerebral palsy (CP), karena adanya gangguan komunikasi. Tujuan penelitian ini adalah untuk perbedaan jarak tempuh 6MWT pada anak CP yang memiliki gangguan fungsi komunikasi dengan tingkat yang berbeda

**Metode:** Penelitian ini menggunakan metode potong lintang, di sebuah klinik Rehabilitasi, pada Juli-Desember 2018. Subjek adalah anak-anak usia 7-18 tahun dengan cerebral palsy dengan Gross Motor Function Classification System (GMFCS) I-III, Communication Function Classification System (CFCS) I-III, dapat berjalan sendiri dengan atau tanpa bantuan ambulatori, dan mengerti instruksi 6MWT. Semua subjek melakukan 6MWT. Level fungsi komunikasi dievaluasi dengan CFCS. 6MWT antara kelompok CFCS dibandingkan.

**Hasil:** Terdapat 23 subjek dengan nilai rata-rata 9 tahun, terdiri dari 17(73.9%) pria dan 6(26.1%) wanita, dengan GMFCS level I-III secara berurutan yaitu 3(13%), 11(47.8%), dan 9(39.1%), juga dengan CFCS level I-III secara berurutan 5(21.7%), 7(30.4%), dan 11(47.8%). Subjek dengan komunikasi verbal sebanyak 14(60.9%) dan komunikasi sebanyak 9(39.1%). Nilai tengah dari kelompok 6MWT dengan CFCS level I, II, dan III adalah 115 (60-282), 161 (17.5-281), dan 135 (23-280) m. Tidak terdapat perbedaan signifikan pada 6MWT antara kelompok CFCS yang berbeda ( $p=0.960$ ).

**Kesimpulan:** Tidak terdapat perbedaan jarak tempuh pada anak CP dengan gangguan fungsi komunikasi yang berbeda.

**Kata kunci:** *Cerebral palsy, Tes berjalan enam menit, Jarak berjalan enam menit, Sistem Klasifikasi Fungsi Komunikasi (CFCS)*

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### Correspondent Detail:

**Budiati Laksmi**

Email: blaksmi@gmail.com

Faculty of Medicine University of Indonesia  
Jakarta, Indonesia

## INTRODUCTION

Cerebral palsy (CP) is the most common cause of physical disability in the children.<sup>1,2</sup> Riset Kesehatan Dasar (RISKESDAS) 2010 reported

prevalence of children aged 24-59 months with CP was 0.09%.<sup>3</sup> Children with CP have lower physical fitness and aerobic capacity than healthy children. It can be caused by motor activation abnormalities and physical inactivity.<sup>4</sup> Gross motor function of children with CP, can be categorised into 5 different levels using a tool called the Gross Motor Function Classification System (GMFCS). (Table 1)

Children with CP, exercise stress test can be performed to evaluate functional capacity and/or prescribe the exercise intensity.<sup>5</sup>



**Table 1. Gross Motor Function Classification System (GMFCS)**

Level	Gross Motor Function
I	Walks without restrictions, with limitation for running and jumping
II	Walks with assistance from small appliances and/or crutches, with slight community ambulation limitations
III	Walks with the assistance of walker and/or crutches, with community ambulation difficulties
IV	Walks with the assistance of walker but with limitations and requires a wheelchair for community ambulation
V	Severely limited mobility, even with appliances and adaptations, with wheelchair adaptation required.

Cardiopulmonary exercise testing (CPET) is the gold standard for cardiorespiratory fitness test because it can directly measure the  $VO_2$  peak.<sup>6,7</sup> When CPET is not feasible, submaximal or maximal stress test can be used as an alternative to predict  $VO_2$  peak.<sup>5</sup> Six-minute walk test (6MWT) is one of a simple test with easy procedure and low cost.<sup>8</sup> Guideline of 6MWT has been developed by American Thoracic Society (ATS), with six-minute walking distance (6MWD) as the main outcome.<sup>9</sup> Several studies reported that 6MWT was reliable in children with ambulatory CP.<sup>10,11,12</sup> Validity study by Leunkeu et al. reported high correlation between 6MWD and  $VO_2$  peak of 6MWT ( $r=0.948$ ,  $p<0.001$ ). It also reported significant correlation between 6MWD and  $VO_2$  peak of cycle ergometer ( $r=0.625$ ,  $p<0.05$ ).<sup>12</sup>

In children with disabilities, stress tests were more difficult to perform because

some children have difficulty in receiving instructions, lack of motivation, low attention, or motor impairment.<sup>13</sup> Communication function comprised the expressive and receptive component. An individual with receptive dysfunction may not understand even the simplest instruction.<sup>14</sup> Communication impairment is common comorbidity in children with CP. Zhank et al. identified 55.15% children with CP to have communication impairments. Of these, 32.3% were unable to communicate verbally.<sup>15</sup> Study by Miguna et al. identified CFCS of children with CP in outpatient hospital setting. Among 36 subjects, 15 subjects were identified with CFCS level V, 8 subjects with CFCS level IV, 8 subjects with CFCS level III, 1 subject with CFCS level II, and 4 subjects with CFCS level I.<sup>16</sup>

Communication is defined as the process to exchange information and ideas, needs and desires. It requires sender and receiver, and each must be alert to the informational needs of the other to ensure that messages are conveyed effectively with the right intended meanings.<sup>17</sup> Communication can be verbal or nonverbal. Verbal mean the communication use words and speech in sentences, phrase, or one word to send the messages. Nonverbal mean the communication may include vocalization, gesture, body movement, and writing.<sup>18</sup> Study from the CP register of Western Sweden reported that half the children used speech, 32% used communication boards/books and 16% relied on body movements, eye gaze and sounds.<sup>19</sup>

Children with CP commonly have communication problem as a result of many factors. It can be directly caused by motor

impairment and associated with cognitive and/or sensory processing deficits.<sup>18</sup> Cerebral palsy may significantly affect tone, which in turn affects ability to use those muscles appropriately to perform the necessary movements for speech production, resulting in motor speech dysfunction, specifically dysarthria.<sup>20,21</sup> Visual impairments can affect language development and interpersonal interaction. Hearing impairments affect speech development. Spoken and written language development of communication may also be affected by decreased of children interaction with their environment and limited activity.<sup>21</sup> Language capacity depends on the level of motor, cognitive, and sensory abilities.<sup>18,19</sup> Expressive language disorder was more associated with motor dysfunction whereas receptive language disorder was more related with cognitive problem in children with CP.<sup>22</sup> Nonverbal status and severe dysarthria in CP were associated with intellectual status. Previous study found that the proportion of intellectual impairment in children who able to produce one-word was significantly greater than children who able to use sentences. Most (88%) of the nonverbal children had severe intellectual impairment. It also shows that only 24% children with severe dysarthria had normal intellectual level compared with 83% children with normal speech or mild dysarthria.<sup>18</sup>

Recently, overall communication and functional speech abilities in individuals with CP was classified at the level of activities and participation within the International Classification of Functioning, Disability and Health (ICF). The Communication Function Classification System (CFCFS) classify overall communication effectiveness in everyday

situations based on the individual's ability to act as both a sender and receiver of information, regardless of modalities used.<sup>20,23</sup> CFCFS has five levels of communication abilities (Table 2).<sup>24</sup>

**Table 2. Level of Communication Function Classification System for Cerebral Palsy**

Level	Communication function
I	Effective Sender and Receiver with unfamiliar and familiar partners.
II	Effective but slower paced Sender and/or Receiver with unfamiliar and/or familiar partners
III	Effective Sender and Receiver with familiar partners
IV	Inconsistent Sender and/or Receiver with familiar partners
V	Seldom Effective Sender and Receiver even with familiar partners

The CFCFS was designed to be applied to individuals across all ages without regard for developmental variables.<sup>20,23</sup> The classification should be made by someone who is familiar with the child's everyday communication. This classification has been found to have very good test-retest reliability and moderate to strong inter-rater reliability.<sup>20</sup> Hustad et al. reported reliability rate was 75% between two professional raters with 0.67.<sup>23</sup>

This study was intended to know the effect of communication function to the 6MWT performance. The objective of the study was to know whether different level of CFCFS may cause significantly different walking distance (6MWD) in children with CP.

## METHODS

The study was performed on July to December 2018, at Yayasan Pembinaan Anak Cacat (YPAC)-Jakarta, Kitty Centre-Tamansari and Kitty Center-Sunter. All locations have the same characteristic as a center of children education and therapy at community setting. The subjects were children aged 7-18 years old with CP GMFCS I-III, CFCS I-III, able to walk independently with or without ambulatory aid, and understand the instruction of 6MWT. The subjects were excluded from the study if they had cardiorespiratory problem that could affect the walk test, severe intellectual disability, body mass index below 10 percentile or above 90 percentile, visual field or visual acuity problem that could not be corrected and could affect walking ability, severe hearing loss that could not be corrected, and moderate to severe pain on lower extremities. The subjects were recruited by consecutive sampling. The parents/guardian of the subjects who gave consent must fill out and sign the informed consent.

### *Study Design*

The design was cross-sectional. Subjects who met the criterias, were assessed for some measurements by a medical doctor. Subjects were evaluated for gross motor function by GMFCS and communication function by CFCS. GMFCS and CFCS were assessed by direct observation and interview with the parent and/or guardian who were familiar with the subject.

### *Measurement*

All the subjects were asked to perform 6MWT. Before performing the walk test, the parents/guardian were informed about walk test

preparation. Subjects must use comfortable clothes and footwear, bring their walking aid, get breakfast at least 2 hours before the test, not doing vigorous exercise at least 2 hours before the test. The walking tests were performed between 8 am and 12 am. The 15-m walking track was marked by a yellow ribbon that formed one straight line. A cone was placed at both ends of the walking track. A chair was placed near the start of the walking track.

The subjects were instructed to walk as far as possible on the track for 6 minutes. The assessor gave instruction continued by demonstration of 6MWT to the subjects until they understand. When subjects were performing the 6MWT, they were followed by the assessor from 1-2 meter behind them. During the test, assessor gave verbal encouragement at each minute of walking and 30 seconds and 15 seconds before the end of the test. The assessor told the subjects how much time had elapsed and the remaining time and gave scripted encouragement. At the end of the 6 minutes, the subject was told to stop. The distance walked was recorded as six-minute walking distance (6MWD). The walk test was terminated if the subjects had chest pain, severe dyspnoea, leg cramp, diaphoresis, pale skin or cyanosis.

### *Statistical analysis*

Statistical analysis was carried out with SPSS for Windows version 20. Saphiro-Wilk was used to test the normality of variable distribution. To compare 6MWD between CFCS groups, one-way ANOVA would be used if the data distributions were normal, and Kruskal-Wallis would be used if the data distributions were not normal. The alpha level was 5%.

## RESULTS

Total number of subjects in this study was 23 children. Subjects' characteristics were present in the table 3. The median age was 9 (7-17) years old. Male subjects were 17(73.9%), while female subjects were 6(26.1%). Based on topography of CP, most subjects were spastic diplegic 12(52.5%). Other types were spastic hemiplegic in 3 subjects (13%), spastic triplegic in 2 subjects (8.7%), ataxic in 5 subjects (21.7%), and one subject of mixed type (4.3%). Subjects with GMFCS level II were most common, consist of 11 subjects (47.8%), followed by GMFCS III (39.1%), and GMFCS I (13%).

**Table 3. Characteristics of Subjects**

Characteristics	N	%	Median (min-max)
Age (years)			9.0 (7-17)
Sex			
Male	17	73.9	
Female	6	26.1	
Topography			
Spastic diplegic	12	52.5	
Spastic hemiplegic	3	13	
Spastic triplegic	2	8.7	
Dyskinetic	0	0	
Ataxic	5	21.7	
Mixed type	1	4.3	
Verbal Communicator	14	60.9	
Nonverbal Communicator	9	39.1	
GMFCS level			
I	3	13	
II	11	47.8	
III	9	39.1	
CFCS level			
I	5	21.7	
II	7	30.4	
III	11	47.8	

In this study, 14 children (60.9%) were verbal communicator whereas 9 children (39.1%) were nonverbal communicator. According to communication function, subjects were dominated by CFCS level III which were 11 subjects (47.8%), followed by CFCS II in 7 subjects (30.4%), and CFCS I in 5 subjects (21.7%). Of all subjects, the mean of 6MWD was  $134.3 \pm 80.3$  m. Normality test by Shapiro-Wilk identified 6MWD on CFCS subgroup as not normally distributed. Six-minute walking distance on each CFCS level was presented in table 4.

**Table 4. Six-minute walking distance (6MWD) based on CFCS level**

CFCS level	Median of 6MWD (min-max) m	p-value
I	115 (60-282)	0,960
II	161 (17.5-281)	
III	135 (23-280)	

Group of subjects with CFCS level II has the highest 6MWD 161 (17.5-281) m. Group with CFCS level III and level I, the median of 6MWD subsequently were 135 (23-280) m and 115 (60-282) m. Comparison of 6MWD between CFCS level was analysed using Kruskal-Wallis test. The analysis found no significant difference in 6MWD between different groups of CFCS ( $p=0.960$ ).

## DISCUSSION

In this study, 39.1% subjects were nonverbal communicator. This is consistent with previous study by Zhank et al. that identified 32.3%

children with CP were unable to communicate verbally.<sup>15</sup> Most common CFCS level of all subjects was CFCS level III. Children with CFCS level III are effective sender and receiver with familiar partners. With this level, communication is not consistently effective with most unfamiliar partners, but is usually effective with familiar partners.<sup>24</sup>

The proportion of CFCS level in this study is not consistent with previous study by Miguna et al. Most common subjects in that study have CFCS level V. It can be caused by different study objective and inclusion criteria. The present study examined six-minute walk test in community setting. Therefore, the subjects must have certain level of gross motor and communication function. In the other side, Miguna et al. studied the correlation between GMFCS and CFCS in hospital setting. They included all level of gross motor and communication function.<sup>16</sup> There were some studies that evaluated 6MWT in children with CP, but none of those studies reported CFCS level.<sup>10,11,12</sup>

Most common topography of CP on previous study was spastic quadriplegic, which was not found in the present study.<sup>16</sup> Some studies found that CFCS was significantly related with GMFCS.<sup>16,25</sup> Children with spastic quadriplegic usually have the poorest gross motor function and mostly are unambulatory.<sup>26</sup> This study only included subjects with CFCS level I to III to make sure that subjects can understand and follow the walk test instruction. Even though subjects with level III were not consistently received the information from unfamiliar partner, but the assessor was allowed to give the instruction and demonstration repeatedly

until the subjects understand.

All subjects in present study could finish the 6MWT. The mean of 6MWD of all subjects was lower than previous studies.<sup>11,12,13</sup> The shorter walking distance in present study may be caused by difference of subject's characteristics, difference of 6MWT procedure, or lower endurance level of subjects. The present and previous studies show that 6MWT is feasible to perform in children with CP. The 6MWT can be an alternative of cardiorespiratory fitness test in children with CP, as the 6MWD was significantly correlated with  $VO_2$  peak of cycle ergometer.<sup>12</sup>

In present study, statistical analysis found no significant difference of 6MWD between CFCS level. The walk test performance of children with disabilities may be affected by many factors, not only communication function but also cognitive function. Cerebral palsy, especially spastic types, are commonly accompanied by cognitive disorders including executive function, attention, and memory problem that can affect learning processes.<sup>27,28</sup> Several factors may also cause variability of 6MWD in healthy subjects or patients with chronic diseases, such as sex, anthropometry, motor function, or motivation. Variability factors that caused by the walk-test procedure must be controlled optimally.<sup>9</sup>

Because the subjects were children with disabilities, 6MWT procedure in this study has undergone some modification. The assessor gave demonstration of 6MWT procedure to the subjects until they understand. It is one of the modelling methods. Study by Tamin also used modelling method for 6MWT in children with

intellectual disabilities.<sup>13</sup>

During the walk-test, assessor behind subjects was informing the remaining time and giving verbal encouragement at certain times. This verbal encouragement was also used by previous studies about 6MWT in children with intellectual disabilities<sup>13</sup> and children CP.<sup>10,11,12</sup> It is one of prompting method and complies with the 6MWT guideline by ATS.<sup>9</sup> Children with intellectual disability or communication problem need longer learning process, more repetition, and adaptation according to their learning ability.<sup>27</sup> Modification of 6MWT procedure such as modelling and prompting method may improve the ability of the subjects with intellectual or communication problem to understand and perform the walk-test instructions.

This is the first study that aimed to know the effect of communication function on 6MWD in children with CP. The other strength of this study is the use of methods to overcome difficulty of performing 6MWT in children with disabilities. This study also tried to control other factors that may be potential to affect 6MWD by limiting subject inclusion.

There were some weaknesses of present study. First, the cognitive and communication function were not specifically assessed. The future study should assess all component of cognitive and communication function that may affect the walk test performance. Second, this study did not analyse the effect of other factors other than communication function to 6MWD. To know the effect of communication to the 6MWD, another method of statistical analysis can be used, such as multiple regressions of several potential factors.

## CONCLUSION

The 6MWT was feasible for children with CP. There was no significant difference of walking distance between subjects with different level of communication function. Different level of communication function may not become an issue that could affect 6MWT performance in CP children with CFCS level I-III.

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## CASE REPORT

### Active Cycle Breathing Exercise on Post Tuberculosis Bronchiectasis

**Ricky Gustian Halim, Siti Chandra Widjanantie, Selly C Anggoro**

Department of Physical Medicine and Rehabilitation, Faculty of Medicine University of Indonesia/Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia

Department of Physical Medicine and Rehabilitation, Persahabatan Hospital, Jakarta, Indonesia

#### ABSTRACT

**Introduction:** Tuberculosis (TB) has remained as a major global health issue in Indonesia. Bronchiectasis frequently occurs in healing process, followed by excessive phlegm and low physical activity.

**Methods:** A case presentation of 49 years old female diagnosed as bronchiectasis post tuberculosis, difficulty to clear the phlegm, and inactive. Patient has undergone pulmonary rehabilitation by active cycle breathing exercise, 5 days a week, 30 minute/session, for 2 weeks.

**Results:** There was no dyspnea, patient easily remove phlegm, and can be more active, after cycle breathing exercise program.

**Conclusion:** Active cycle breathing exercise effective to relieve dyspnea, improving patient ability to clearance the phlegm, and increase physical activity.

**Keywords:** *Bronchiectasis, active cycle breathing exercise, phlegm clearance, physical activity*

#### ABSTRAK

**Pendahuluan:** Tuberkulosis (TB) bertahan sebagai permasalahan kesehatan mayor secara global di Indonesia. Bronkiektasis biasanya terjadi pada proses penyembuhan, diikuti dengan dahak eksekif dan aktivitas fisik yang kurang.

**Metode:** Seorang wanita berumur 49 tahun didiagnosis sebagai bronkiektasis pasca tuberkulosis, kesulitan mengeluarkan dahak, dan tidak dapat melakukan aktivitas sedang. Pasien sudah menjalani rehabilitasi paru dengan latihan siklus penafasan aktif, 5 hari dalam seminggu, 30 menit/sesi, selama 2 minggu.

**Hasil:** Setelah 2 minggu tidak didapati sesak napas, pasien mudah mengeluarkan dahak, dan fisik menjadi lebih aktif.

**Kesimpulan:** Latihan siklus penafasan aktif efektif untuk memperbaiki sesak napas, meningkatkan kemampuan mengeluarkan dahak, dan meningkatkan aktivitas fisik.

**Kata kunci:** *Bronkiektasis, Latihan Siklus Penafasan Aktif, Pengeluaran Dahak, Aktivitas Fisik.*

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Correspondent Detail:

Ricky Gustian Halim

Department of Physical Medicine and Rehabilitation, Faculty of Medicine University of Indonesia/

Dr. Cipto Mangunkusumo Hospital,  
Jakarta, Indonesia

## INTRODUCTION

Tuberculosis (TB) has remained as a major global health issue for almost two decades including in Indonesia.<sup>1</sup> The number of TB prevalence and incidence has remained high. According to World Health Organization (WHO) in Global Tuberculosis Report 2018, Indonesia has a total of 360.565 TB cases that were notified by national authorities, while the estimated TB incidence was 1.020.000 and the annual incidence rate for 2017 was estimated at 319 per 100 000 population per year for tuberculosis infection.<sup>2</sup> Jakarta has 36.241 cases in 2018 which are one of the highest number of cases for tuberculosis infection in Indonesia.<sup>3</sup>

Bronchiectasis frequently occurs in association with healed pulmonary tuberculosis that may be due to multiple factors, including traction from surrounding tissue fibrosis, caseous necrosis that makes its way into the bronchi, and elevated luminal pressure due to coughing.<sup>4,5</sup> In Indonesia, there is no clear data about the etiology of bronchiectasis. In China, Xu et al. in 2013 found that the main causes of bronchiectasis were pulmonary TB (31.17%),

bacterial infection and pertussis.<sup>6</sup> Similar with this report is several studies, a study by Dhar et al. identified post-infection (41%) to be the primary cause for bronchiectasis with predominant etiology is post tuberculosis infection (29.8%), other study by Palwatwichai et al. in Thailand found that the commonest etiology of bronchiectasis is post tuberculosis associated disease.<sup>7</sup> prevalence and clinical features. Most bronchiectasis is reported to be idiopathic however post-infectious aetiologies dominate across Asia especially secondary to tuberculosis. Most focus to date has been on the study of airway bacteria, both as colonisers and causes of exacerbations. Modern molecular technologies including next generation sequencing (NGS

Bronchiectasis is a respiratory syndrome characterized by permanent and irreversible bronchial dilatation often accompanied by the formation of a chronic inflammatory exudate. The clinical presentation of bronchiectasis includes chronic productive cough, obstructive airways disease and recurrent respiratory infections.<sup>8-10</sup> Patients with bronchiectasis experience a reduction in exercise capacity and quality of life, fatigue and also episodic infective exacerbations that may lead to recurrent hospitalization.<sup>10,11</sup> Patients with bronchiectasis usually receive pulmonary rehabilitation as management, especially in an outpatient context.<sup>12</sup>

Pulmonary rehabilitation (PR) is a non-pharmacological intervention that is designed for patients with chronic respiratory disease that includes exercise training, disease education and behavioral interventions to improve physical and psychological conditions

of people with chronic respiratory disease and to promote the long term adherence to health-enhancing behaviors. For patients with bronchiectasis, pulmonary rehabilitation aims to improve exercise capacity, enhance disease management and improve quality of life.<sup>11</sup> For the pulmonary rehabilitation programs are patients should be taught an airway clearance technique and take regular exercise.<sup>13</sup> microbiology, physiotherapy, thoracic surgery, primary care, methodology and patients considered the most relevant clinical questions (for both clinicians and patients

## CASE PRESENTATION

A 49 years old female patient diagnosed with post tuberculosis bronchiectasis from Pulmonary Department is consulted to Physical Medicine and Rehabilitation Department in Persahabatan Hospital. The patient complained about productive cough with white phlegm without blood streak especially in the morning and sometimes it was difficult to remove her phlegm. This condition already happened for about one month, but there was no episode of dyspnea except when she tried too hard to cough to remove her phlegm. She has no limitations in performing activities of daily living and can climb the stairs without breathlessness. The patient didn't has any episode of sleep disturbances caused by dyspnea. From her viewpoint, she is quite healthy and has only mild medical conditions. Her child also has the same viewpoint about her mother's medical conditions.

As the history of past illness, she complained

of productive cough with blood streak phlegm, decreased bodyweight about 10 kg and diagnosed with lung tuberculosis in March 2018 and has already completed the medications in December 2018. According to the patient, she felt improvement after doing the treatments. There is no history of hospitalization related to her cough since she completed the medications. As for her family members, only her grandson that got the medical check-up to rule out the possibility of tuberculosis infection and her grandson was stated didn't have tuberculosis infection. The patient also has diabetes mellitus type 2 controlled with glimepiride and insulin injection once daily, hypertension controlled with amlodipine once daily and dyslipidemia controlled with simvastatin once daily.

The patient's education level is 5<sup>th</sup> grade of elementary school with low-income level. She is unemployed, but she usually is helping her child in a stall in front of her house. Her child's education level is 6<sup>th</sup> grade of elementary school, and the income for her family is from selling drinks and foods in her stall. Nowadays, she lives with her child and grandchild in 12-meter square rent house. The rent house is located in a crowded environment area with little sun exposure and have little ventilation. She usually drops off and picks up at the hospital by her child using a motorcycle. She stills can and has no difficulties in joining the activities in her neighborhood.

From her physical examination, the vital sign (blood pressure, heart rates, respiratory rates, oxygen saturation) is normal. The patient's body mass index is 26,4 kg/m<sup>2</sup> (Obesity Grade I according to Asia-Pacific Task Force). For the respiratory, there are no abnormal findings

in inspection, palpation, and percussion of both sides of the chest, no additional lung sounds but there is limited chest expansion (3-3-4 cm). The peak flow rate is 370 L/min and peak cough flow is 370 L/min. From the musculoskeletal, the muscles are normotrophy, normotones, limitation of range of motion from all extremities and normal muscle strength. The patient already done 6 minutes walking test and can achieved 408,5 meter with 4,4 METS.

For the management of this patient, she is programmed for pulmonary rehabilitation to be done for 6 to 8 weeks which consist of education, hospital-based rehabilitation and home-based rehabilitation programs. The education given to her is about the condition of her lungs, medical condition (bronchiectasis, obesity, diabetes mellitus type 2, hypertension and dyslipidemia), how important to control her medical conditions, plan for her rehabilitation programs, importance of compliance in doing the programs and the target of programs. Besides verbal education, she has also been demonstrated how to do the breathing and airway clearance techniques especially active cycle breathing techniques. For the hospital-based rehabilitation programs, she is planned to do some programs such as breathing exercises, chest mobilization techniques, active cycle breathing techniques and targeted endurance exercise with a static cycle. For the home-based rehabilitation programs, she is planned to do breathing exercises, chest mobilization techniques, active cycle breathing techniques, proper posture and walking for specific durations and distances according to 6 minutes walking test result. She has been reminded via phone-calls to ensure she took the medications

and done the home-based programs. After 2 weeks been doing the rehabilitation programs, the examination revealed there was no episode of dyspnea, she could remove her phlegm easily, and can be more active, after active cycle breathing program.

## DISCUSSION

Regardless of the etiology, the cardinal symptoms of bronchiectasis are chronic cough and sputum production, almost all patients with bronchiectasis (>90%) present with persistent cough.<sup>9,14</sup> The chief complaint of the patient, in this case, is a productive cough without blood streak phlegm that occurs especially in the morning. The common presenting features of bronchiectasis include recurrent cough, recurrent lower respiratory tract infections and less frequently hemoptysis. Cole's vicious cycle hypothesis of infection and inflammation provides a bronchiectasis pathophysiology. The inflammation of airway in bronchiectasis eventually promotes mucus hypersecretion, lowering the threshold for cough, contribute to changes in bronchial wall geometry and promote mucus retention, hemoptysis and airway wall mechano-receptors.<sup>10</sup>

From her physical examinations, we found she has reduced chest expansion. The possible causes of reduction in chest expansion in the patient are bronchiectasis and obesity. A 6-minute walk test was done for evaluating her exercise capacity. The 6-minute walk test was recommended by the British Thoracic Society in guideline for bronchiectasis in adults for evaluation of exercise capacity pre and post pulmonary rehabilitation.

European Respiratory Society in guidelines for the management of adult bronchiectasis recommended pulmonary rehabilitation as part of management for bronchiectasis which benefits are achieved in 6 to 8 weeks and maintained for between 3 to 6 months.<sup>13</sup> microbiology, physiotherapy, thoracic surgery, primary care, methodology and patients considered the most relevant clinical questions (for both clinicians and patients Pulmonary rehabilitation (PR) is a non-pharmacological intervention designed for patients with chronic respiratory disease that includes exercise training, disease education, and behavioral interventions.<sup>11</sup> As in this case's patient, she is programmed for pulmonary rehabilitation which consists of education, hospital-based rehabilitation, and home-based rehabilitation programs. She has been programmed for breathing exercises, chest mobilization techniques, active cycle breathing techniques, and targeted endurance exercise. In accordance with the American Thoracic Society/European Respiratory Society, the pulmonary rehabilitation individuals with chronic respiratory disease includes exercise training, education, exacerbation management, and physical activity.<sup>11</sup>

Communication and education are a must and important in this case's patient especially the understanding of her medical condition and the programs that were planned for her because from the viewpoint of her and her family, she only has a mild medical condition. She has multiple medical conditions from metabolic syndrome (obesity, diabetes mellitus type 2, hypertension and dyslipidemia), pulmonary problems (bronchiectasis post tuberculosis).

Behar-Horenstein et al. in 2005 and The Joint Commission in 2010 concluded that patients who understand the information that is delivered by his/her healthcare providers can lead to enhanced satisfaction, better compliance with treatment instructions, improved outcomes, and decreased treatment times and costs.<sup>15</sup> As a foundation of the pulmonary rehabilitation program, improving individuals' knowledge through the educational process of how to manage their disease is a must and important. The education of patients and their families should be a component of a pulmonary rehabilitation program. The patients that educated can become more skilled at collaborative self-management and have more compliance with their treatment plan which in turn may result in a reduction in hospital admissions.<sup>11</sup> Some identified barriers included travel issues, competing commitments such as work and caring, fears that pulmonary rehabilitation would have little benefit or be detrimental to health, smoking history, degree of breathlessness, available social support and also the amount of information and enthusiasm of the referring physician.<sup>16</sup> The educational component of pulmonary rehabilitation has gradually changed from a didactic approach to the promotion of adaptive behavior change, especially collaborative self-management.<sup>11</sup> As in this patient, the education given to her is about her medical condition, the importance of the programs, the need for collaborating in the management. She has been demonstrated how to do the breathing techniques, chest mobilization techniques, active cycle breathing techniques, and proper posture. Besides that, she also been called via phone-call for educational purposes.



As stated by the European Respiratory Society, patients with bronchiectasis that comply to pulmonary rehabilitation, show improvements in exercise capacity, cough symptoms and quality of life, and possibly a reduction in exacerbations.<sup>13</sup> microbiology, physiotherapy, thoracic surgery, primary care, methodology and patients considered the most relevant clinical questions (for both clinicians and patients). In this patient, she already feels easier to remove her phlegm after two weeks and no episode of dyspnea. She feels easier to remove her phlegm especially after doing active cycle breathing techniques. This condition is in accordance to Elsayed et al. study, the active cycle of breathing technique is an effective method for airway clearance and improving functional capacity in patients with bronchiectasis.<sup>17</sup>

## CONCLUSION

Active cycle breathing exercise for 2 weeks, 5 days a week for 30 minute each session, can relieve dyspnea, improving phlegm mobilization, and increase physical activity in patient with post Tuberculosis Bronchiectasis.

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*CASE REPORT*

## Pulmonary Rehabilitation After Lobectomy On Pulmonary Aspergilloma: Case Report

**Andwi Setiawan Kokok, Selly Christina Anggoro, Siti Chandra Widjanantie**

Department of Physical Medicine and Rehabilitation, Faculty of Medicine University of Indonesia/Dr.  
Cipto Mangunkusumo Hospital, Jakarta, Indonesia

Department of Physical Medicine and Rehabilitation, Persahabatan Hospital, Jakarta, Indonesia

### ABSTRACT

**Introduction:** Complete resection of aspergilloma in chronic pulmonary aspergillosis (CPA), may has several health problem after surgery berupa sesak napas, batuk yang tidak efektif.

**Methods:** A case presentation of 45 years old woman, after lobectomy on right upper of lung due to aspergilloma, with history of cough and haemoptysis for 3 months. Pulmonary Rehabilitation were breathing retraining exercise (BE), mobilization technique (MT), chest mobility exercise (CM), active cycle breathing technique (ACBT), postural correction exercise (PC) for three weeks.

**Results:** There were dyspnea, peak flow rate (PFR:60-70-60), peak cough flow (PCF: 70-90-60 L/m), and abnormal chest expansion (CE: 2.5 – 3 – 2) cm. After three weeks of Pulmonary Rehabilitation, there were no dyspnea, increased the PCF: 193L/m, and CE: 2.5-4-3.

**Conclusion:** Pulmonary Rehabilitation programs for three weeks were relieved dyspnea, increased cough capacity and CE

**Keywords:** *Aspergilloma, Lobectomy, Bell's Palsy, Rehabilitation program, Cough capacity, Chest expancy*

## ABSTRAK

**Pendahuluan:** Reseksi komplet pada aspergilloma paru memiliki masalah kesehatan pascaoperasi berupa sesak napas dan batuk yang tidak efektif.

**Metode:** Laporan kasus seorang wanita, 45 tahun dengan riwayat lobektomi kanan atas karena aspergilloma yang awalnya datang dengan batuk dan muntah darah selama 3 bulan. Ia diberikan latihan nafas ulang (BE), teknik mobilitasi (MT), latihan mobiltas dada (CM), teknik siklus pernafasan aktif (ABCT), latihan koreksi postural (PC).

**Hasil:** Ditemukan adanya batuk yang tidak efektif (PCF: 90L/m) dan pengembangan dada abnormal (2.5 - 3 - 2 cm). Setelah menjalani program Rehabilitasi Paru selama 3 minggu, tidak ditemukan sesak napas, terdapat peningkatan PCF: 193L/m, and CE: 2.5-4-3.

**Kesimpulan:** Program Rehabilitasi Paru selama 3 minggu memperbaiki sesak napas, meningkatkan kapasitas batuk dan pengembangan dinding dada.

**Kata kunci:** *Aspergilloma, Lobectomy, Bell's Palsy, Program Rehabilitasi Paru, Kapasitas Batuk, Pengembangan Dada.*

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Correspondent Detail:

Andwi Setiawan Kokok

Department of Physical Medicine and Rehabilitation, Faculty of Medicine University of Indonesia/

Dr. Cipto Mangunkusumo Hospital,  
Jakarta, Indonesia

## INTRODUCTION

According to the WHO report in 2011, around 1.2 million people in the world have been estimated to have chronic pulmonary aspergillosis (CPA) as a sequel to tuberculosis (TB) and most cases occur in South-East Asia, Western Pacific and African regions.<sup>1</sup> Pulmonary aspergilloma may present as simple

aspergilloma (SA) or complex aspergilloma (CA) depending on the thickness of the wall of the cavity and presence or absence of the disease in the surrounding lung, pleura and rest of the lung. Haemoptysis is one of most common symptoms ranging from minor to life-threatening episodes. The use of antifungal agents, whether systemic or intracavitary, has shown little success in “curing” aspergilloma. Furthermore, these drugs rarely achieve the minimal inhibitory concentrations within the lung cavities. Complete resection of aspergilloma with clear margins offers the most consistent chance of cure. However, the mortality and morbidity reported with surgery has deterred treating physicians from utilizing the surgical option.<sup>2</sup>

Aspergilloma (fungus ball), one of the clinical forms of aspergillosis, develops primarily in

post-tuberculous cavities and may constitute a significant therapeutic problem due to recurrent haemoptysis and symptoms of chronic infection. Antifungal agent penetration into the cavity of the fungus ball is scant; therefore, in many cases, the only treatment option is to resect the pulmonary parenchyma colonized by the fungus. Notwithstanding, surgical treatment is associated with many technical difficulties and a relatively high risk of postoperative complications, particularly in patients who are emaciated or treated with immunosuppression.

Bell's palsy is an acute idiopathic facial nerve paralysis of sudden onset. It is the most common cause of lower motor neuron facial nerve paralysis with an annual incidence of 15-30 per 100,000.<sup>2</sup> The pathogenesis of Bell's palsy is presented as retrograde epineurial compression edema with ischemia of the facial nerve.<sup>3</sup> Bell's palsy is thought to result from compression of the seventh cranial nerve at the geniculate ganglion. The first portion of the facial canal, the labyrinthine segment is the narrowest and it is here that most cases of compression occur. Due to the narrow opening of the facial canal, inflammation causes compression and ischemia of the nerve. The most common finding is a unilateral facial weakness that includes the muscles of the forehead.<sup>4</sup>

The main presenting problems of postoperative patients who have undergone thoracic surgery include improper patient positioning; incision and/or chest drain pain; ineffective cough; reduced lung volume; postoperative pulmonary complications (PPCs), which can be non-infectious (e.g., atelectasis and respiratory

failure) or infectious (e.g., pneumonia); impaired airway clearance; frozen shoulder on the thoracotomy side; postural abnormalities; and persistent chest wall tightness. These problems, particularly PPCs, can lead to delayed patient recovery, prolonged hospitalization, and increased morbidity and mortality. Physical rehabilitation and medicine (PMR) has been routinely implemented after thoracic surgery as a fundamental component of postoperative management. Recently, PMR has been recommended by the European Society of Thoracic Surgeons, the European Respiratory Society, and the American College of Chest Physicians, and it is now considered an essential element of enhanced recovery protocols (ERPs) or "fast-track" protocols in thoracic surgery that accelerate the functional recovery of postoperative patients and minimize the length of the hospital stay. Therefore, the role of PMR in these "fast-track" protocols after thoracic surgery warrants further clarification.<sup>5</sup>

Early mobilization is considered an important element of postoperative care. Mayor et al. did a study implementing thoracic enhanced recovery with ambulation after surgery program and found that the median length of stay was 1 day compared to 2 days before implementation ( $P < 0.001$ ). Pneumonia rates were also significantly reduced from 6% to 0.7%.<sup>6</sup> Castellino et al. did a Systematic Review and Meta-Analysis for early mobilization in patient post thoracotomy and found that although bed rest is harmful, there is little available evidence to guide clinicians in effective early mobilization protocols that increase mobilization and improve outcomes.<sup>7</sup>

The central aim for respiratory rehabilitation is to optimize ventilation and clear airway secretions in order to improve gas exchange and make breathing easier. One of the techniques that can increase lung volumes is deep breathing exercises with or without devices (e.g. incentive spirometry). Breathing techniques may improve respiratory function postoperatively by increasing functional residual capacity (FRC) and ventilation, and by minimizing closing volumes.<sup>8-13</sup>

## CASE PRESENTATION

A 45-year-old woman presented with chief complaint of productive cough and haemoptysis for 3 months. She denied fever, chills, night sweats, shortness of breath, chest pain and any other symptom. She had a history of pulmonary TB at age 42. She has no prior diabetes mellitus and never smoked. After surgery, she complained about her inability to cough sputum and pain at post-surgical wound. The intensity of post-surgical wound pain was 2 – 3, which minimally pain by visual analogue scale (VAS). There was a hypertensive (150/90 mmHg), dyspnea that appearance by use of accessories breathing muscles (upper trapezius, scalenes, sternocleidomastoid, and pectoralis), decreased breath sound and crackles at right hemithorax scattered on right lung, and decreased chest expansion (2.5 – 3 – 2 cm). Patient condition after surgery were still had central venous catheter (CVC), given oxygen supplementation via nasal canula, and underweight (body mass index was 16.6). She had weak cough and had low peak flow rate (PFR: 60 – 70 – 60 L/m), as well as peak cough flow (PCF: 70 – 90 – 60 L/m).

## Laboratory

Laboratory results showed low albumin level (2.3 g/dL), mild hyponatremia (133 mEq/L), mild hypokalemia (3.2 mEq/L), mild anemia (11.4 g/dL), increased leukocyte (21.600/  $\mu$ L), but otherwise normal. Acid-fast bacillus (AFB) smear and culture were negative on three sputum samples. HIV test was also negative.

## Imaging

CT of the chest revealed cavity with halo sign and surrounded by fibroinfiltrate in the upper lobe of the right lung (S1 and S2).

## Management

After surgery patient had Fluconazole, B12 vitamin supplementation, Ampicillin Sulbactam for antibiotics, N-acetylcystein (NAC), methylprednisolone for cough, and ketorolac for pain management. Pulmonary Rehabilitation program were breathing retraining exercise (BE) using deep breathing technique without mechanical devices 5 times/ hour, early mobilization (EM) by walking at ward's alley 10 minutes, twice/day, chest mobility exercise (CM) by physiotherapist once daily, active cycle breathing technique (ACBT) was taught to be used when she cough, postural correction exercise (PC) by physiotherapist once daily.

She was a mother with 3 children, that lived at her mother's house together with 8 peoples in the house, so education about to let sunlight in into the house to reduce humidity and reduce fungal overgrowth. Follow up would be done after discharge to measure cough capacity and chest expansion on this patient. Functional outcome such as 6 minutes-walk test, sit-to-stand test, and Time Up and Go test (TUG) test would be measured.

### ***Outcome and Follow-Up***

At 2 days follow up, she reported that she is able to cough more easily and able to stand up. During observation, she was still unable to breathe easily, and she still uses accessories inspiratory muscles. During mobilization challenge she is able to sit independently without any difficulty and increased heart rate (resting HR 100 bpm), but when she was asked to stand up, she experienced increased heart rate to 115 bpm, even though she did not experience any dizziness or other symptoms. She was also able to stand without any balance disorders, she is able to walk several steps. We also notice improvement in her facial expression with less dropped eye and mouth (House Brackmann III). She was not given any analgesic anymore and she rated her post-surgical wound pain with VAS 1 – 2. She was then prescribed out of bed mobilization (around her bed) with supervision and was asked to do exercise at our outpatient clinic. She was also scheduled for 6-minute walk test to measure her cardiovascular capacity, PFR and PCF measurement to measure coughing capability. We then decided that the discharge planning of this patient is to be able to ambulate safely around 20 – 30 meters, with rate of perceived exertion (RPE) no more than 11, and able to cough sufficiently (PCF: more than 160 L/m). The patient should meet the requirements and able to perform all of the exercises prior to discharge. Outpatient pulmonary rehabilitation program should also be set up before discharge.

During 3 weeks follow up, she already able to walk independently without walking aid. She is able to walk without dyspnea around 300 meters (Borg scale 11 – 0 – 0). She was able to do more effective cough, increase cough

capacity PCF: 193 L/m, and chest expansion 2.5 – 4 – 3 cm.

## **DISCUSSION**

This case highlights the challenge of establishing a diagnosis of pulmonary aspergilloma. On admission, the main differential diagnoses were pulmonary TB, tuberculoma, aspergilloma, and malignancy. The fact that the patient had a history of pulmonary TB made the diagnosis more challenging because both disorders, TB and aspergillosis, have very similar presentations and can even coexist. In this case during chest CT, it was revealed that she had pulmonary mycosis at S1 and S2 segment of upper lobe of the right lung. This case also emphasizes the importance of differential diagnosis of aspergilloma in patient who presents with haemoptysis. This is in accordance with two recent case report by Ding, et. al.<sup>11</sup> and Betancourt, et. al.<sup>4</sup> which also reported that patient with aspergilloma presenting with haemoptysis as its chief complaint.

Unfortunately, we have no data regarding her lung condition before aspergilloma infection. but according to literature, tuberculous cavity may predispose aspergilloma to grow. She also went through 3 months anti-fungal therapy and did not experienced improvement. She was then decided to have lobectomy of the upper lobe of her right lung.

As described at the literature review, post thoracotomy has several problems which presents in this patient such as improper patient positioning, incision and/or chest

drain pain, ineffective cough, reduced lung volume, infectious postoperative pulmonary complications (PPCs), impaired airway clearance, and postural abnormalities. Pain management is crucial in post thoracotomy rehabilitation, to correct postural abnormalities, prevent frozen shoulder, and optimal chest expansion. Deep, segmental, and splinting breathing exercise was then prescribed at this patient to reduce pain during breathing and increase chest expansion.<sup>5</sup> Tactile stimuli, which was conducted via larger nerve fiber ( $A\beta$  fiber), may inhibit pain transmission, which was conducted via smaller nerve fiber ( $A\sigma$  and C fiber). With gentle pressure, it also makes sure that the wound does not move too much, hence, less pain is perceived by the patient.<sup>12</sup> Once pain has lessen, the patient will be able to breathe deeper (to allow cough) and more easily, therefore preventing accessories inspiratory muscle use. Less muscle use to breathe results in less effort and therefore making the patient able to do activity of daily living (ADL) more independently (without dyspnea). Other than BE, the patient was also prescribed CM to prevent frozen shoulder, postural correction, and further increasing chest expansion. In order to have sufficient cough capacity to expel sputum, the patient need to have better chest expansion and tidal volume. This finding is in according to previous study by Woo et. al. that the breathing with mainly inspiration group (BMIG) showed significant differences in chest size during inspiration (CSI), chest expansion values (CEVs), forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow (PEF) after four weeks.<sup>12</sup>

We also taught the patient to do ACBT in order to expel sputum with less effort. During 2 days

follow up, we found CVC was remain attached. We suspect that this may cause leucocytosis in this patient (21. 600/  $\mu$ L), and therefore suggest that the CVC to be removed had it was not used anymore. Mobilization technique was also introduced to this patient to further increasing cough capacity. Active mobilization has been linked with better sputum expulsion.<sup>13</sup>

There were several limitations at the rehabilitation management, such as prescription of inspiratory muscle trainer (IMT) or incentive spirometry, as a major component of preoperative pulmonary rehabilitation programs. A recent study by Brocki et al. has shown that the addition of IMT to standard breathing exercise improved hypoxaemic status in high-risk patients after lung cancer surgery. Due to economic issues of this patient and BPJS insurance does not cover the prescription of IMT, therefore we did not prescribe IMT for this patient. Another limitation is unclear follow up. Since this case report only describe present condition.

## CONCLUSION

Pulmonary Rehabilitation after lobectomy on aspergilloma, included BE, MT, CM, ACBT, and PC for three weeks improved cough capacity and chest expansion, after all relieved dyspnea.

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## CASE REPORT

# Rehabilitation Medicine in Pellegrini-Stieda Syndrome with Myositis Ossificans and Neglected Patella Fracture

**Ronni Untung Handayanto, Tanti Ajoe Kesoema, Rahmi Isma AP**

Department of Physical Medicine and Rehabilitation, Faculty of Medicine Diponegoro University/Dr. Kariadi Hospital, Semarang, Indonesia

## ABSTRACT

**Introduction:** Pellegrini-Stieda Syndrome (PSS) is calcification of the medial collateral ligament (MCL). The manifestation are restricted motion and pain of the knee. PSS usually associated with trauma or repeated strain.

**Methods:** A case report of 30 year old physically active men has a severe stiffness and pain on the left knee while walking for six months. He had neglected trauma 9 years ago. There were antalgic gait, mild swelling, warm, and tenderness on medial aspect, restricted range of motion (ROM) by pain on the left knee; flexion 150. The knee X-Ray has shown the myositis ossificans and Pellegrini-Stieda lesion. Subject had undergone Rehabilitation Program, i.e. progressive gradual motion exercise and cryotherapy

**Results:** There were reduced of pain, and increase the Left knee PROM were 15° restricted of extension and 30° flexion, became 8°restricted of extension and 55° flexion, after one month of program.

**Conclusion:** Pellegrini-Stieda Syndrome (PSS) is a possible complication in major knee trauma. The patient showed improvements in pain, and ROM after one month of rehabilitation programs.

**Keywords:** *Pellegrini-Stieda Syndrome (PSS), Range-of-Motion (ROM), Medial Collateral Ligament (MCL).*



## ABSTRAK

**Pendahuluan:** Pellegrini-Stieda Syndrome (PSS) adalah kalsifikasi ligamen medial kolateral (MCL) yang bermanifestasi berupa gerak lutut yang terbatas, disertai nyeri.

**Metode:** Laporan kasus pada pria 30 tahun dengan kondisi fisik yang aktif datang dengan riwayat kekakuan parah enam bulan dan nyeri pada lutut kiri terutama saat berjalan. Ditemukan pola jalan pincang, pada lutut kiri terasa hangat, dan nyeri pada aspek medial dari lutut kiri. Pada X-Ray lutut ditemukan adanya myositis ossificans dan lesi PSS. Dilakukan program rehabilitasi seperti latihan gerak gradual progresif, dan krioterapi.

**Hasil:** Didapatkan adanya perbaikan berupa berkurangnya nyeri dan peningkatan ROM setelah satu bulan program rehabilitasi, yaitu PROM lutut kiri sebelum program, yaitu terhambat 15° ekstensi dan 30° fleksi, menjadi terhambat 8° ekstensi dan 55° fleksi.

**Kesimpulan:** Pellegrini-Stieda Syndrome (PSS) adalah komplikasi yang mungkin pada trauma lutut mayor. Manajemen konservatif menggunakan program rehabilitasi menunjukkan perbaikan yang baik pada penurunan nyeri dan peningkatan ROM.

**Kata kunci:** *Pellegrini-Stieda Syndrome (PSS), Rentang gerak (ROM), Ligamen Medial Kolateral (MCL).*

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### Correspondent Detail:

Ronni Untung Handayanto

Email : ronnikhoe.md@gmail.com

Department of Physical Medicine and Rehabilitation, Faculty of Medicine  
Diponegoro University

Dr. Kariadi Hospital,

Semarang, Indonesia

## INTRODUCTION

Pellegrini in 1905 was the first to describe the sign of Pellegrini–Stieda<sup>1</sup> and, subsequently, in 1908 Stieda reported the first series of 5 cases.<sup>2</sup> The radiological sign of Pellegrini–Stieda is the proximal calcification of the medial

collateral ligament of the knee, after a direct or indirect trauma thereof. The radiological findings plus the clinical symptomatology of pain and restriction in the ranges of motion are known under the name of PSS.<sup>3</sup> The incidence of the PSS is unknown, but the preponderance in the male gender between 25 and 40 years of age is clear, being rare in children and older people.<sup>4</sup> Calcification may occur in the month following the trauma, and in some cases, it has exceptionally spontaneously disappeared.<sup>6</sup> The pathophysiology of the disease is also unclear. The trigger for the PSS could be an avulsion of the medial femoral condyle or a tear of ligaments, tendons (ischiocondylar portion of the adductor magnus). In some cases, Pellegrini Stieda disease has been seen in patients without knee trauma but concomitant spinal cord injury or traumatic brain injury.<sup>3,4</sup>

It is postulated that soft tissue edema and the subsequent deposition of hydroxyapatite or calcium pyrophosphate is generated after a traumatic injury. The majority of patients are asymptomatic. In the clinical examination can be found pain localized in the medial aspect of the knee and limitation of the flexion-extension movements of the joint.<sup>7</sup> Ossification could happen within 11 days to 6 weeks after post trauma. A network of the new bone formation around the periphery of the mass of the medial condyle is formed in 6 to 8 weeks. Duration of the condition is usually about 5 to 6 months.<sup>8,9</sup>

After a while, the phenomena could occur: the inflammation subsides with partial or complete resorption of the calcium salts, or the mass becomes ossified and may be connected by a pedicle to the femoral condyle. The last is called Pellegrini-Stieda syndrome.<sup>10</sup>

The treatment of the PSS is usually conservative. Treatment ranges from rest, physical therapy, use of NSAID, glucocorticoid injection, and even surgery in severe and recalcitrant cases.<sup>10,11</sup>

Measures such as rest, physical therapy, steroids, and lidocaine injections have been successfully used. When a full range of motion of the knee is attained, no any form of pain, no limitation on activities and also, the muscles, Quadriceps, and Hamstrings, have fully recovered. This means full recovery.<sup>10,11</sup>

## CASE PRESENTATION

30 years old physically active man who worked as a chef, come with stiffness and pain on the left knee since six months ago, that become more severe since three months ago. The pain felt continuously and progressively, but he can walk independently. He was hit by a motorcycle since nine months ago, with swollen and bruised left knee, but he didn't go to doctor. He was treated by alternative medicine (traditional massage) for months. He didn't feel better, so he decided to go hospital and he referred to Kariadi General Hospital for further examination and treatment.

On physical examination, he walk in antalgic gait, vital signs were normal, from the localized examination, inspection of lower extremity, there was mild edema on the left knee, with no muscle atrophy. From palpation, felt warm and pain. There was limitation in range of motion of left knee. It found there was limitation in full passive extension and flexion. In neutral position, the flexion was 15°, passive extension cannot be achieved and still in flexion 15°, passive flexion was 30°. Ligamentous laxity test was difficult to be examined because of pain.



**Figure 1. Left Knee Appearance**

### **Imaging**

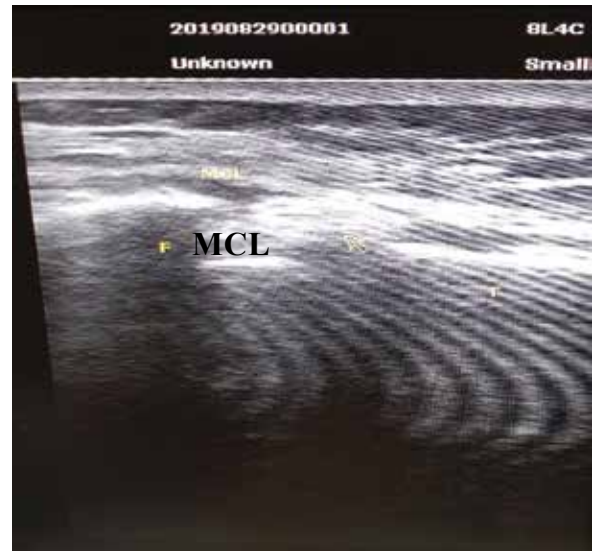
Knee X-ray examination showed defect on patellar bone (old patellar fracture) and medial condyle distal femoral bone, also malunion distal femoral bone suggestive myositis ossificans. There was soft tissue opacity around it extend to the femoral bone. Furthermore, at the medial knee aspect there was calcification of the proximal aspect of the MCL suggestive for **Pellegrini-Stieda lesion (PSS)**. There was no narrowing knee space compartment, intact knee joint alignment.

From ultrasound examination (Figure 3) showed calcification at the MCL's deep band of left knee (PSS lesion).

There was no MRI examination. A diagnosis of PSS, old patellar fracture and myositis ossificans in this case was made based on the imaging and clinical findings.



**Figure 2. Old fracture of os patella and calcification over the medial collateral ligaments suggestive Pellegrini-Stieda appearance**



**Figure 3. Ultrasound examination of MCL.**

### **Management**

In Physical Medicine and Rehabilitation Unit, the patient managed conservatively with medical rehabilitation programs, and home programs with a good result.

The medical rehabilitation programs consist of cold therapy, and passive range of motion (PROM) exercise. Cold therapy administered by cryotherapy for reducing pain and inflammation that still remained in affected knee. Meanwhile for the passive range of motion (PROM) exercise was conducted using continuous passive motion (CPM) device, this exercise aimed to achieve the functional knee motion. It was operated gradually from lesser to greater angle that still well tolerated by the patient. All the rehabilitation protocols are performed half an hour each session, repeated two times a week in hospital. The home programs consisted of range of motion exercise and ice compress that must be done at least twice daily. From the orthopedic

department the patient has already given natrium diclofenac 50 mg twice daily.

### **Home Programs**

First conservative was avoiding overload and micro-trauma, therefore forced rehabilitation or early high impact activity is to be avoided.<sup>10</sup> Ice compress is useful, it is important to apply for the knee 2-3 times per day. This should be done for 10-20 minutes at a time. The best time to do ice compress was after exercise or do a lot of walking, by knee extended in straight position with a towel rolled under the ankle. It is recommended not to sit for more than 45 minutes at any given time because the knee may become stiff. It is recommended whether sitting for a prolonged time the patient must immediately go stand and walk a short distance and attempt to bend and straighten your knee several times.

The home exercise program will assist recovery and improve strength. It consisted of motion and muscle exercises. Patient must take time to exercise every day. The exercise program will take approximately 30 minutes to complete and should be done twice per day minimally. Home exercise program should be simple, easy, and tolerable to patient.

The different steps of the functional rehabilitation can be completed, only in a more controlled and slow manner. The rehabilitation progressivity should be done in step by step procedure to avoid overload and micro trauma on the knee complex region which may prolong the recovery.

The serial exercises has done to 3 sets each moment, and 20 repetitions in one set, performed twice a day. The exercise programe were:

#### 1. Ankle pumps:

Patient lying flat on back with knee straight, bend ankle up and down as far as possible in both directions. This exercise benefit to reduce the edema and swelling at the lower extremities.



**Figure 4. Ankle Pumps**

#### 2. Heel slides:

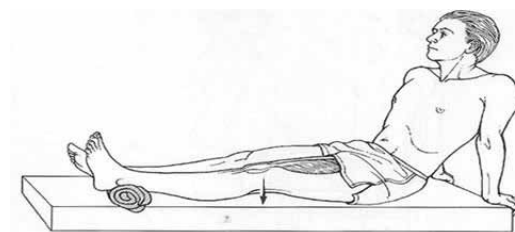
Lying flat on back with knees straight, slowly slide your heel in toward your buttocks. Patient should then straighten to the starting position. Please keep your foot on the surface at all times.



**Figure 5. Heel Slides**

#### 3. Knee press:

With legs straight and a towel rolled up under the ankle, press knee down for contracting the thigh muscle. Hold for 5 seconds and then relax.



**Figure 6. Knee Press**

4. Straight leg raise:

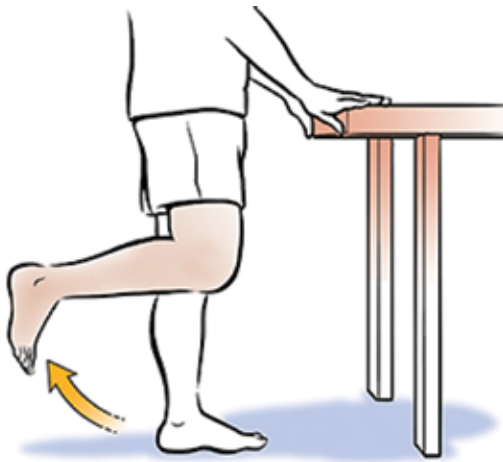
While lying flat on the back with uninvolved leg bent and your foot flat on the surface, tighten thigh and lift the involved leg. Keep the knee straight. Only lift to the height of the uninvolved knee.



**Figure 7. Straight Leg Raise**

5. Standing knee bending:

While holding on to a supportive surface, on standing position, bend the involved knee so that the foot rises toward your buttock.



**Figure 8. Standing Knee Bending**

6. Heel raises:

Stand and holding on to a supportive surface, lift both heels off the ground toward the ceiling. Hold for 5 seconds and then slowly return to the starting position.



**Figure 9. Heel Raises**

7. Quad set:

Quadriceps activation exercise. Patient lay on the ground or table and place a rolled up towel/shirts under the knee. This will act as a lever which will make it easier to activate quadriceps muscle, then attempt to squeeze the towel.



**Figure 10. Quad Set**





**Figure 11. Rehabilitation programs using continuous passive motion.**

### ***Outcome***

After underwent the rehabilitation programs the patient showed an overall improvement, especially on the range of motion (ROM) of left knee and pain reduction which helped patient to ambulate easier. After one-month-rehabilitation programs, left knee's range of motion (ROM) are improved, neutral position was measured on flexion 8°, PROM extension was not fully achieved and still in flexion 8° position, PROM for flexion was 55° flexion. Compared to one month earlier neutral position was restricted on flexion 15° and 30° of flexion. There was reduced of pain. Further evaluation using gait analysis devices are needed in this case. Follow up and continuing medical rehabilitation programs are needed, aimed for the better result in knee's functional motion, and walking function.

## **DISCUSSION**

Pellegrini–Stieda Syndrome is the proximal calcification of the medial collateral ligament of the knee, after a direct or indirect trauma thereof, causing valgus stress with disruption

of the MCL fibers.<sup>9</sup> The radiological findings plus the clinical symptomatology of pain and restriction in the ranges of motion are known under the name of PSS.<sup>1,6</sup> Diagnosis is established from anamnesis, general inspection, and measurements such as palpation, range of motion (ROM) examination, gait, radiological imaging using X-ray, and for the further details there should be MRI imaging diagnostic applied to this patient. Some of studies proven that musculoskeletal ultrasonography has also proven useful in diagnosing Pellegrini–Stieda lesions and can often elicit associated edema, which then be performed in this patient. The presence of symptoms associated with radiological findings is known as Pellegrini–Stieda syndrome (PSS).<sup>4</sup> Even so sometimes still difficult to discern PSS from heterotopic ossification and myositis ossificans. From this patient clinical symptoms, physical examination and radiological imaging result, these related conditions can be diagnosed as PSS.

The objective of medical rehabilitation principles in this condition were: control edema, activation of Quadriceps muscles, restore the functional motion of the knee.<sup>10,11</sup>

Despite of PSS, patient was also diagnosed with old patellar fracture which already resolved and myositis ossificans at the lateral part of the left knee, all of these musculoskeletal conditions may showed that the mechanism of injuries which we considered as major trauma are playing a part to developed this condition. We knew that patellar fracture mechanism in traumatic case may caused by direct blow such as fall on flexed knee which caused high axial loading on knee compartment with valgus or varus stress.<sup>1,12</sup>

We concluded from this injury mechanisms are the causative problem to developed this condition in this case report. The rehabilitation program in this patient are consist of two major aspects, first is the hospital based medical rehabilitation, the second is home programs. Both are conservative programs which showed to be effective and improve the overall patient's condition, as for in this patient, the clinical result still can be achieved for more. Follow up and continuing the rehabilitation programs in this patient are recommended.

## CONCLUSION

PSS is possible complication on major knee trauma, which these conditions mostly are managed conservatively. In this case report showed that PSS followed with myositis ossificans and old patellar fracture can be treated by intensive physical medicine and rehabilitation programs consist of motion and muscle exercise combined with cold therapy and oral medication (NSAID) with a good result. After underwent one month rehabilitation programs we reported improvement on functional motion on the left knee and pain reduction, thus may increase patient's gait function.

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