Balance Ability and Quality of Life in Older Adult with Recovery from Mild COVID-19

The running title: Older adult with recovery from mild COVID-19

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ABSTRACT

Background: In this study, we aimed to assess the ability to balance and quality of life (QoL) among older adults without a history of coronavirus disease 2019 (COVID-19 and those who had recovered from mild COVID-19. **Methods:** We recruited 80 older adults and categorized them into the following two groups based on their history of COVID-19: those without COVID-19 (n=40) and those who had recovered from mild COVID-19 (n=40). We assessed the participants’ ability to balance using the multi-directional reach test (MDRT) and timed up and go (TUG) test, and evaluated their QoL using the short form-36 (SF-36).

**Results:** Compared with older adults without a history of COVID-19, those who had recovered from mild COVID-19 demonstrated no differences in the scores of the forward, backward, right, and left directions (p >0.05), but a significantly longer duration for the TUG test (p=0.02) and a reduced QoL. **Conclusion:** Our study results demonstrated decreased ability to balance and poor QoL among older adults who had recovered from mild COVID-19.
Keywords: post-COVID-19, older adult, balance, quality of life, mild-COVID-19, TUG test
Introduction

The coronavirus disease 2019 (COVID-19) first appeared in Wuhan, China, and spread rapidly worldwide (1). It is known to cause serious health problems including croup, cold, and bronchiolitis (2). In addition, COVID-19 affects the neurological system, particularly the ability to balance (3). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) binds to angiotensin-converting enzyme 2 (ACE2) receptors and invades human cells, resulting in adverse effects on the central nervous system (CNS) (4, 5) and leading to blood-brain barrier damage (6). Moreover, SARS-CoV-2 activates neuroinflammation resulting from the influx of cytokines into different sites of the CNS (6). These factors lead to neurological and neuromuscular systems dysfunction, resulting in postural instability and impaired ability to balance (3, 4, 7). Furthermore, these impairments are not present in the acute phase of COVID-19 but rather appear post-COVID-19 (7). Previous studies have reported that patients post-COVID-19 experience memory loss, headache, vertigo, sleep disturbances, myalgia, brain fog, peripheral neuropathies, fatigue, and depression (3, 7). Therefore, neuromuscular changes caused by SARS-CoV-2 infection lead to poor postural balance, resulting in a low patient quality of life (QoL) post-COVID-19 (8, 9). Previous studies have reported poorer postural balance in patients post-COVID-19 compared to healthy controls, which is related to fatigue and low QoL (8, 9). Older adults with COVID-19 show symptoms of multisystem involvement and an increased risk of death (10, 11). In addition, older adults with prolonged COVID-19 infection exhibit neurocognitive symptoms, such as mood disorders, mental conditions, and anxiety (12). However, the ability to balance and QoL in older adults who have recovered from mild COVID-19 have not yet been evaluated. Therefore, in this study, we aimed to assess the ability to balance using the multi-directional reach test (MDRT) and timed up and go (TUG) test and evaluate QoL using the short form-36 (SF-36) in older adults who had recovered.
from mild COVID-19 and those with a history of COVID-19. This study would offer valuable insights to older adults who are recovering from mild COVID-19, aiding in the identification of balance disorders. We hypothesized that older adults recovering from mild COVID-19 would have reduced ability to balance and poor QoL than those of older adults without a history of COVID-19.

**Materials and methods**

**Study design and participants**

This cross-sectional study assessed the ability to balance using the MDRT and TUG tests and evaluated QoL using the SF-36 in older adults without a history of COVID-19 and older adults who had recovered from mild COVID-19. This study was approved by the Clinical Research Ethics Committee of the University of Phayao, Phayao, Thailand (IRB code 1.3/032/65). We recruited 80 older adults without a history of COVID-19 and those who had recovered from mild COVID-19 and categorized them into two groups (n=40/group). The sample size was calculated using a power of 0.90, power analysis with an alpha of 0.05, and effect size d of 0.4 (13). The inclusion criteria were as follows: patients aged 60 years or above, without a history of COVID-19 or those recovering from mild COVID-19 with confirmation of infection by SARS-CoV-2 using polymerase chain reaction (PCR) or antigen test kit performed at least 3 months before the evaluation procedure, with normal body mass index (BMI) values (18.5–24.9 kg/m²) (14), and ability to stand and walk without assistive walking devices. The exclusion criteria were participants who had problems with hearing, communication, vision, standing, or walking; balance impairment; history of back or lower limb surgery, inability to raise the arms to 90°; or scoliosis affecting the ability to stand or walk.

**Procedures**
We assessed older adults without a history of COVID-19 and those who had recovered from mild COVID-19 using the MDRT, TUG, and SF-36.

The MDRT protocol encompassed assessments in forward, backward, right-sided, and left-sided directions. A 100-centimeter yardstick attached to a tripod was set parallel to the floor at the height of the participant’s acromion process. The participants were instructed to stand on the floor without wearing shoes and to lift an outstretched arm to shoulder height. We recorded the lengths at the fingertips as the initial reach data. Subsequently, the participants were instructed to reach as far as they could while maintaining alignment with the yardstick, without moving their feet or taking a step from the floor (15). They were then instructed to lean back as far as possible to determine the extent of reach in the backward direction. For the right and left directions, they were instructed to lean as far as possible toward the right and left, respectively. The distance score for each direction was calculated from the initial reach. We recorded three successful trials for each direction (15).

In the TUG test protocol, the participants were instructed to get up from the chair at the signal, walk to a marker, go around it, return to the chair, and sit down promptly resuming a sitting posture. The test commenced with participants seated upright with a vertical posture, hands resting on the thighs, and feet planted flat on the ground. The participants were reminded that the test was time-bound and the goal was to walk expeditiously without running (16).

We assessed the participants’ QoL using the SF-36. This questionnaire includes eight dimensions comprising a list of questions about various aspects of QoL, including physical functioning, physical role limitations, bodily pain, general health perceptions, vitality, social functioning, emotional role limitations, and mental health (17). The result is a
score ranging from 0 to 100, with higher scores indicating a better QoL (17). Figure 1 is a flow diagram of the participants at each stage of the study.

**Statistical analysis**

Descriptive statistics were used to present the demographic data. The independent sample t-test was used to compare MDRT scores, TUG test duration, and SF-36 scores between older adults without a history of COVID-19 and those who had recovered from mild COVID-19. We performed the statistical analysis using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA), with a p-value <0.05 indicating significance.

**Results**

A total of 80 older adults without COVID-19 and those who recovered from mild COVID-19 voluntarily participated in this study. The participants’ characteristics are summarized in Table 1. Most participants were female, and the average age and BMI did not differ between the two groups.

All participants completed the MDRT. We observed no differences in the scores of the forward, backward, right-side, and left-side directions between older adults who had recovered from mild COVID-19 and those without a history of COVID-19 (p >0.05). The highest and lowest MDRT scores were observed in the forward and backward directions, respectively (Table 2).

All participants successfully completed the TUG test. Older adults who had recovered from mild COVID-19 demonstrated a significantly longer duration for the TUG test than those of the older adults without a history of COVID-19 (p=0.02) (Table 3).
Our results demonstrated significantly lower scores in terms of physical functioning, physical role limitations, bodily pain, general health perceptions, vitality, social functioning, emotional role limitations, and mental health among older adults who had recovered from mild COVID-19 than among those without a history of COVID-19 (p < 0.05) (Table 4).

Discussion

The results of the present study demonstrated decreased ability to balance and poor QoL among older adults who had recovered from mild COVID-19. Additionally, this group demonstrated longer duration for the TUG test and worse scores for the eight dimensions of the SF-36 questionnaire than those of the older adults without a history of COVID-19; however, no difference was observed for the scores in the four directions of the MDRT.

We observed no difference in MDRT scores in any direction between older adults with no history of COVID-19 and those who had recovered from mild COVID-19. These results may be because the participants in both the groups had similar BMI. A previous study reported lower ability to balance among older adults who were overweight or obese than among those with normal weight (18). Moreover, older adults who were overweight or obese had significantly reduced MDRT scores in the forward, backward, right-side, and left-side directions than those of older adults with normal weight (18). The amount of adipose tissue is increased in individuals with overweight and obesity, leading to reduced stability of postural control in these individuals (19). In addition, individuals with overweight and obesity have an increased base of support and decreased walking velocity due to increased ankle muscle activity, which leads to an abnormal gait pattern (20). Additionally, our results revealed the highest and lowest MDRT scores in the forward and backward directions, respectively, among older adults without a history of COVID-19 and those who had recovered from mild COVID-19. This is because the ankle and foot biomechanical...
arrangements provide greater forward walking ability than backward walking ability (15). Moreover, humans have greater control over balance in the forward direction because they are involved in moving the body forward in activities of daily life (ADL) (15). Additionally, significant energy is required to shift the body weight to the rear because a person cannot exert visual control over the feet during movement (21). These findings indicate that older adults without a history of COVID-19 and those who had recovered from mild COVID-19 exhibit greater ability to balance in the forward direction than in the backward direction or to the right or left direction.

Balance is important not only for posture stability but also for performing safe ADL. ADL are associated with multiple tasks, including rising from a chair, standing, walking, and turning (22). Therefore, the TUG test was used to assess these conditions. This test can assess various aspects of ability to balance, including posture, mobility, agility, transitioning from sitting to standing position, walking stability, and gait speed, in older adults (16, 23). Older adults with TUG test duration of >13.5 seconds are at a higher risk of experiencing falls (24, 25). However, in the present study, older adults without a history of COVID-19 and those who had recovered from mild COVID-19 had average TUG test duration of <13.5 seconds, indicating normal balance ability. However, older adults who had recovered from mild COVID-19 required significantly more time to complete the tests than that of older adults without a history of COVID-19. These findings suggested that older adults who had recovered from mild COVID-19 had reduced ability to balance than those without a history of COVID-19. These findings are consistent with those of a previous study demonstrating lower postural balance among patients with post-acute COVID-19 syndrome than among healthy controls (8). These results may be due to the activation of neuroinflammation by SARS-CoV-2 resulting from the influx of cytokines into different sites of the CNS, leading to prolonged generalized symptoms such as impaired postural balance and fatigue (6).
Compared to older adults without a history of COVID-19, those who had recovered from mild COVID-19 exhibited lower QoL, including physical functioning, physical role limitations, bodily pain, general health perceptions, vitality, social functioning, emotional role limitations, and mental health. These results are consistent with those of previous studies demonstrating significant decreases in the eight domains of the SF-36 questionnaire among patients post-COVID-19 compared to a healthy controls (9, 26). In addition, a previous study reported notable declines in the domains of physical functioning, physical role limitations, bodily pain, general health perceptions, and mental health in the SF-36 among patients with post-acute COVID-19 syndrome than among healthy controls (8). These results may be attributed to dyspnea, impaired mental health, and neuropsychological disorders, resulting in decreased QoL in patients with prolonged COVID-19 infection (27, 28). Therefore, the reduced QoL in older adults recovering from mild COVID-19 may occur from their reduced ability to balance.

In conclusion, the present study is the first to comprehensively assess the impact of COVID-19 on individuals’ ability to balance in various directions and performing ADL. The findings from the present study indicated a decreased ability to balance and poor QoL among older adults recovering from mild COVID-19 than in those without a history of COVID-19.

This study may be limited by variables that can influence an individual’s ability to balance. Factors, including muscle strength and endurance of the lower limbs, may attain statistical significance with more suitable variables. Future studies should investigate these variables to enrich our understanding of balance dynamics and its implications for individuals’ well-being.