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Association of sleep duration and physical frailty with cognitive function in older patients with coexisting atrial fibrillation and heart failure

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Abstract

Aim: To investigate the associations of sleep duration and physical frailty with cognitive function in older patients with both atrial fibrillation and heart failure.

Design: This study used a cross-sectional, secondary data analysis design.

Method: We included outpatients aged ≥ 65 years with coexisting atrial fibrillation and heart failure in South Korea. We used a sample of 176 patients (men = 100) with HF among 277 data from the parent study. The data were collected through a self-report, structured questionnaire and electronic medical record.

Results: Our main finding showed that long sleep duration and physically frail status were significant predictors of cognitive impairment in older adults with both atrial fibrillation and heart failure. Healthcare providers should be aware of the importance of assessing sleep duration and physical activity in older adults with both atrial fibrillation and heart failure to prevent or delay cognitive impairment.

KEYWORDS
atrial fibrillation, cognitive impairment, frailty, heart failure, sleep

1 | INTRODUCTION

Atrial fibrillation (AF) is the most prevalent arrhythmia and frequently concomitant with heart failure (HF) as AF facilitates the occurrence of HF and vice versa (Dalgaard et al., 2020; Heo et al., 2020). AF and HF are linked by similar risk factors (old age, obesity, hypertension and diabetes) (Yang et al., 2022). The prevalence of AF and HF increases with age, which has been a significant global burden (Chamberlain et al., 2017; Coats, 2019). A previous prospective study has showed that individuals with AF had a significantly higher risk for HF hospitalization than those without AF (Yang et al., 2022). In addition, another study has reported that the rate of one-year mortality for patients with both AF and HF was 27%–36% compared with AF or HF alone (Horodinschi & Diaconu, 2021). Effective self-care behaviours including taking medications and lifestyle modifications can reduce adverse events including readmission, emergency department visits and mortality among patients with AF and HF (Hendriks et al., 2015; Jaarsma et al., 2021). However, multimorbidity can make it difficult to manage treatment strategies and care plans compared to single chronic diseases (Fabbri et al., 2015; Zathar et al., 2019). Furthermore, older adults with chronic diseases are less likely to engage in their self-care behaviours than younger patients due to age-related cognitive decline (Rohde et al., 2017; Uchmanowicz et al., 2017).

Studies reported the prevalence of cognitive impairment among older people with AF and HF, ranging from 19% to 30% (Potter et al., 2021; Wang et al., 2020). Previous studies emphasized that AF may be an important exacerbating factor of cerebral hypo-perfusion

in older patients with HF, resulting in cognitive impairment (Alosco et al., 2015; Myserlis et al., 2017). As a result, the coexistence of AF and HF in older patients is more likely to aggravate the decline in cognitive functions which can cause adverse health outcomes such as substantial risk of morbidity and mortality (Jaarsma et al., 2021). Hence, there is a need for better understanding factors related to a higher risk of cognitive impairment so that individualized care plan can be designed to reduce cognitive decline in older patients with AF and HF. Regarding possible risk factors of cognitive decline, many studies have mainly focused on biological factors such as chronic inflammation, silent cerebral ischaemia and genetic factors (Goh et al., 2022; Tangestani Fard & Stough, 2019). Recently, sleep duration and physical frailty have emerged as modifiable risk factors of cognitive impairment among older people.

Optimal sleep duration plays a vital role in enabling cognitive function and maintaining good health and well-being (Covassin & Singh, 2016). A longitudinal study with two nationally representative ageing cohorts have showed that insufficient or sleep duration predicted cognitive decline (Ma et al., 2020). A systematic review of thirty-two studies has also reported that both short and long sleep duration were significantly associated with worse cognitive function (Devore et al., 2016). Evidence shows that abnormal sleep duration is linked to increased prevalence and morality rate among patients with cardiovascular diseases (Covassin & Singh, 2016; Kuehn, 2019). Increased sympathetic nerve activity may be related to sleep problems with these populations (Kuehn, 2019). However, there are few knowledge about a significant association of sleep duration with cognitive impairment in patients with both AF and HF although some studies have showed a possible link between sleep duration and the incidence of AF or HF (Kwon et al., 2015; Wannamethee et al., 2016). Physical frailty, medical syndrome with multiple cause, is described as diminished physiologic function characterized by causing vulnerability (Li et al., 2021; Wang et al., 2020). Physical frailty is an especially prevalent condition in older adults with AF or HF due to physical limitations and dyspnoea as their typical symptoms (Son & Seo, 2018; Wang et al., 2020). It is also a predictive factor for major negative health-related outcomes, including dementia, in older adults with AF or HF (Chamberlain et al., 2017; Lee et al., 2018). As ageing increases physical frailty and cognitive impairment (Tamura et al., 2018), it is meaningful to examine the extent of the influence of physical frailty on cognitive impairment in older people with multimorbidity. Although there are several studies on the relationship between physical frailty and cognitive impairment in older people with AF or HF (Goh et al., 2022; Lee et al., 2018; Mailhot et al., 2020; Marino et al., 2019), studies on older patients with concomitant AF and HF are scarce.

Generally, sleep problems and physical frailty are commonly observed in older patients with chronic diseases including AF and HF (Baniak & Chasens, 2018; Fu et al., 2020; Mehawej et al., 2022; Zhao et al., 2021). However, there is limited evidence on identifying modifiable risk factors of cognitive impairment in older people with coexisting AF and HF. Notably, the proportion of individuals with both AF and HF in Korea has been on the rise in recent years due to consequence of rapidly ageing population (Lee et al., 2016). Unfortunately, studies on the cognitive impairment in older people with AF or HF are not well investigated. Thus, we aimed to investigate the prevalence of cognitive impairment and determine the association of sleep duration and physical frailty with cognitive impairment in Korean older patients with both AF and HF.

2 | METHODS

2.1 | Study design and participants

This study was a secondary data analysis of cross-sectional data using a convenience sampling method, which focused on the association of cognitive impairment with adherence to antithrombotic therapy in Korean older patients with AF in Korea (Seong et al., 2019).

We used a sample of 176 patients with HF among 277 data from the primary data. In brief, data were collected from February to August in 2018, using a structured questionnaire to collect data by two trained research nurses, in a tertiary general hospital in Korea.

The participants were all outpatients aged ≥ 65 years who were diagnosed with AF through electrocardiography and HF through echocardiography by a physician (Joung et al., 2018; Park et al., 2021). We used G*power 3.1 to calculate the adequate sample size for this study (Faul et al., 2009). It was determined that the sample size of 170 patients was adequate for two-tailed logistic regression analysis with an alpha level of 0.05, power of 90% and 1.9 odds ratio (OR) based on previous study (Pulignano et al., 2016); therefore, the sample size of 176 patients was sufficient.

2.2 | Measurements

2.2.1 | Patients' general characteristics

Socio-demographic characteristics were obtained as follows: age, gender, education, living arrangement, smoking, alcohol consumption and body mass index (BMI, kg/m^2). BMI was classified based on the Korean Society for the Study of Obesity criteria (Kim et al., 2021) as follows: normal (BMI 18.5–22.9 kg/m^2), overweight (BMI 23.0–24.9 kg/m^2), obesity (BMI 25.0–29.9 kg/m^2). Clinical information including time since HF diagnosis, New York Heart Association (NYHA) functional classification, left ventricular ejection fraction (LVEF, %), physician-diagnosed comorbidities and prescribed cardiac medications was collected from each patient's electronic medical records.

2.2.2 | Sleep duration

For assessing sleep duration, we used the self-reported single item 'How many hours do you sleep on average per night?' Based

on the recommendation of sleep duration from the American Academy of Sleep Medicine, participants were classified into ≤5 h (short sleep), 6–8 h (adequate sleep) and ≥9 h (long sleep) (Watson et al., 2015).

2.2.3 | Physical frailty

For evaluating frail status of the patients, we used the Korean version of fatigue, resistance, number of illnesses, ambulation and loss of weight (K-FRAIL) (Jung et al., 2016) originally developed by Morley et al. (2012). This scale is highly cited instrument and easy to apply clinically in older adults (Buta et al., 2016; Li et al., 2021). A total score of 3–5 is classed as frail, 1–2 is classed as pre-frail and 0 is classed as robust (Jung et al., 2016).

2.2.4 | Cognitive function

To assess cognitive function, we adopted the Korean version of the Mini-Mental State Examination (K-MMSE) (Kang et al., 1997). There are a total of six domains, consisting of 12 items of orientation about time and spatial orientation, memory registration, attention, word recall and registration, calculation, language function, comprehension, and decision (Kang et al., 1997). This creates a total score of 30 points, and a higher score indicates better cognitive function. To identify cognitive impairment, a cut-off score of 24 was used based on prior studies of older adults with AF (Rohde et al., 2017). Cronbach's α was 0.75 in this study.

2.3 | Ethical considerations

This study had institutional review board (IRB) approval from the primary author's institution (IRB No. 1041078-202,105-HRSB-139-01). All participants were recruited by well-trained research nurses using a convenience sampling method after obtaining their full consent.

2.4 | Data analysis

IBM Statistical Package for the Social Sciences (SPSS) version 26.0 (SPSS Inc.) was performed. Descriptive statistics were provided to describe the patients' general characteristics and study variables. Independent t-test and a one-way analysis of variance (ANOVA) with post hoc Scheffe's method for continuous data and the chi-square test for categorical data were presented, respectively. To elucidate the associations of sleep duration and physical frailty with the risk of cognitive impairment after adjusting for confounding factors, multiple logistic regression was used to estimate odds ratio (OR) with 95% confidence intervals (CIs). For all statistical analysis, a 0.05 level of significance was set.

3 | RESULTS

3.1 | Description of sociodemographic characteristics and its differences by cognitive function

The prevalence of cognitive impairment (<24) was 35.2% among 176 older adults with both AF and HF. As shown in Table 1, men were 56.8%. The mean age was 74.72 (SD = 7.28) years, and 36.4% of patients were aged > 80 years. 61.4% of those with a below middle school education were found. Most patients had a spouse (64.8%) without a job (81.3%). Moreover, most patients answered that they were currently non-smokers (95.5%). The mean BMI was 24.21 (SD = 2.88) kg/m^2, and 52 (29.5%) patients had a normal BMI.

There were significant differences in age ($\chi^2 = 19.93$, $p < 0.001$), educational level ($\chi^2 = 15.01$, $p < 0.001$) and spouse ($\chi^2 = 9.16$, $p = 0.002$) according to cognitive function. However, there were no significant differences in gender, job, current smoker, alcohol consumption and BMI (Table 1).

3.2 | Description of clinical characteristics and its differences by cognitive function

In Table 2, among total patients, the mean duration of HF diagnosis 7.46 (SD = 5.74) years, and 103 (58.5%) patients had a HF diagnosis duration of more than 5 years. The mean LVEF was 56.63% and 97 (55.1%) patients were NYHA class I. The most prevalent comorbidity was hypertension (77.8%), followed by coronary artery disease (51.1%), diabetes (27.8%) and stroke (19.3%).

There were no significant differences in clinical characteristics of the patients by cognitive function (Table 2).

3.3 | Description of sleep duration and physical frailty and its differences by cognitive function

As shown in Table 3, for sleep duration, only 42.1% slept for 6–8 h, and the patients having short (≤5 h) or long (≥9 h) sleep duration were 32.5% or 24.4%, respectively. Physical frailty status was distributed as follows: 30.7% robust, 46.6% pre-frail and 22.7% frail.

There were significant differences in sleep duration ($\chi^2 = 8.41$, $p = 0.015$) and physical frailty ($\chi^2 = 19.84$, $p < 0.001$) according to cognitive function.

3.4 | Impact of sleep duration and physical frailty on cognitive impairment

Table 4 presents the multiple logistic regression results. After adjusting for age, educational level and spouse, a sleep duration of ≥9 h (adjusted OR: 2.72, 95% CIs: 1.05–7.03, $p = 0.039$) and

TABLE 1 Sociodemographic characteristics by cognitive function ($N = 176$).

Characteristics	Total ($N = 176$)	Cognitive function		
		Normal ($n = 114$)	Impairment ($n = 62$)	
		n (%) or M ± SD		χ^2 (p-value)
Gender				
Men	100 (56.8)	70 (61.4)	30 (48.4)	2.77 (0.096)
Women	76 (43.2)	44 (38.6)	32 (51.6)	
Age (years)	*74.72 ± 7.28*	*72.76 ± 6.60*	*78.34 ± 7.15*	
65–69	52 (29.5)	44 (38.6)	8 (12.9)	19.93 (<0.001)
70–79	60 (34.1)	41 (36.0)	19 (30.6)	
≥80	64 (36.4)	29 (25.4)	35 (56.5)	
Educational level				
Below middle school	108 (61.4)	58 (50.9)	50 (80.6)	15.01 (<0.001)
Over high school	68 (38.6)	56 (49.1)	12 (19.4)	
Spouse				
No	62 (35.2)	31 (27.2)	31 (50.0)	9.16 (0.002)
Yes	114 (64.8)	83 (72.8)	31 (50.0)	
Employment				
No	143 (81.3)	89 (78.1)	54 (87.1)	2.15 (0.143)
Yes	33 (18.8)	25 (21.9)	8 (12.9)	
Current smoking				
No	168 (95.5)	110 (96.5)	58 (93.5)	0.80 (0.371)
Yes	8 (4.5)	4 (3.5)	4 (6.5)	
Alcohol consumption				
No	91 (51.7)	55 (48.2)	36 (58.1)	1.55 (0.213)
Yes	85 (48.3)	59 (51.8)	26 (41.9)	
BMI (kg/m^2)	*24.21 ± 2.88*	*24.24 ± 2.70*	*24.16 ± 3.21*	
Normal (18.5–22.9)	62 (35.2)	41 (36.0)	21 (33.9)	0.53 (0.790)
Overweight (23.0–24.9)	52 (29.5)	35 (30.7)	17 (27.4)	
Obesity (25.0–29.9)	62 (35.2)	38 (33.3)	24 (38.7)	

Abbreviations: BMI, body mass index; SD, standard deviation.

physical frailty (adjusted OR: 5.73, 95% CIs: 1.84–17.87, $p = 0.003$) were identified as strong associations with patients' cognitive impairment.

4 | DISCUSSION

Older patients with multi-morbidities such as coexisting AF and HF are more likely to have difficulty managing self-management due to cognitive decline and ageing (Carlisle et al., 2019). We found that the prevalence of cognitive impairment measured by MMSE (<24) was 35.2% among older adults with coexisting AF and HF. This finding was similar to a previous study that 30% of older people with AF and HF had a mild cognitive impairment evaluated using the Montreal cognitive assessment (MoCA) (Potter et al., 2021). On the contrary, our finding was considerably higher compared with the findings from previous studies that 14.4% of patients with AF only (Malavasi et al., 2021) and 29.3% of patients with HF only (Uchmanowicz et al., 2017) had cognitive impairment based on the same tool and cut-off score. There was inconsistency with a prior study that patients with both AF and HF suffered from cognitive impairment in year than individuals without HF using MoCA (18.9% vs. 14.9%) (Wang et al., 2020). These inconsistent results may be explained by different assessment tools and cut-off scores for cognitive impairment, multimorbidity and cultural diversity. Nevertheless, our results revealed that coexisting AF and HF may increase the higher risk of cognitive impairment compared with those who with AF or HF alone. Hypo-perfusion and micro-infarction in the brain due to decreased cardiac output may be important conditions of cognitive impairment in older people with HF and are exacerbated by AF (Alosco et al., 2015). Therefore, healthcare providers should understand the impact of coexistence of AF and HF on cognitive impairment and be aware of the importance on early detection and prevention of cognitive decline

TABLE 2 Clinical characteristics by cognitive function ($N = 176$)

Characteristics	Total ($N = 176$)	Cognitive function		
		Normal ($n = 114$)	Impairment ($n = 62$)	
		n (%) or M ± SD		χ^2 (p-value)
Duration of HF diagnosis	*7.46 ± 5.74*	*7.63 ± 5.94*	*7.16 ± 5.39*	
<5 years	73 (41.5)	47 (41.2)	26 (41.9)	0.01 (0.927)
≥5 years	103 (58.5)	67 (58.8)	36 (58.1)	
NYHA class				
I	97 (55.1)	68 (59.6)	29 (46.8)	2.77 (0.250)
II	54 (30.7)	32 (28.1)	22 (35.5)	
III–IV	25 (14.2)	14 (12.3)	11 (17.7)	
LVEF	*56.63 ± 14.21*	*56.90 ± 14.21*	*56.72 ± 14.78*	
≤40%	24 (13.6)	14 (12.3)	10 (16.1)	0.88 (0.646)
41–49%	18 (10.2)	13 (11.4)	5 (8.1)	
≥50%	134 (76.1)	87 (76.3)	47 (75.8)	
Hypertension				
No	39 (22.2)	28 (24.6)	11 (17.7)	1.08 (0.298)
Yes	137 (77.8)	86 (75.4)	51 (82.3)	
Diabetes mellitus				
No	127 (72.2)	81 (71.1)	46 (74.2)	0.20 (0.657)
Yes	49 (27.8)	33 (28.9)	16 (25.8)	
CAD				
No	86 (48.9)	58 (50.9)	28 (45.2)	0.53 (0.469)
Yes	90 (51.1)	56 (49.1)	34 (54.8)	
Stroke				
No	142 (80.7)	92 (80.7)	50 (80.6)	0.00 (0.993)
Yes	34 (19.3)	22 (19.3)	12 (19.4)	
CKD				
No	172 (97.7)	111 (97.4)	61 (98.4)	0.19 (0.665)
Yes	4 (2.3)	3 (2.6)	1 (1.6)	
Anticoagulant				
No	68 (38.6)	44 (38.6)	24 (38.7)	0.00 (0.988)
Yes	108 (61.4)	70 (61.4)	38 (61.3)	
ACEI or ARB				
No	68 (38.6)	44 (38.6)	24 (38.7)	0.00 (0.988)
Yes	108 (61.4)	70 (61.4)	38 (61.3)	
BB or CCB				
No	39 (22.2)	22 (19.3)	17 (27.4)	1.54 (0.215)
Yes	137 (77.8)	92 (80.7)	45 (72.6)	
Diuretics				
No	133 (75.6)	90 (78.9)	43 (69.4)	2.00 (0.157)
Yes	43 (24.4)	24 (21.1)	19 (30.6)	

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; BB, beta blocker; CAD, coronary artery disease; CCB, calcium channel blocker; CKD, chronic kidney disease; HF, heart failure; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; SD, standard deviation.

in older patients. Furthermore, multi-centre prospective cohort studies are required to evaluate the incidence and patterns of cognitive decline during illness trajectories, which is beneficial to provide individualized care for older adults with both AF and HF.

Our main finding showed that long sleep duration and physical frailty were significantly associated with the risk of cognitive impairment. Unfortunately, we were not able to directly compare our results with previous findings due to lack of studies on this population with the same tools. Similarly, our finding was supported by a prior study with Chinese older community-dwelling adults that long sleep duration and frailty were significantly related to cognitive decline (Zhao et al., 2021). Our result is also partly supported by those of previous studies on the significant association between frailty and cognitive impairment in patients with AF or HF (Lee et al., 2018; Wang et al., 2020). When common symptoms such as dyspnoea and palpitation in patients with AF and HF worsen, sleep is disturbed and physical frailty occurs (Heo et al., 2020). The reason may be related to disturbance in the circadian rhythm, which could cause abnormal regulation of the nervous and immune responses and may worsen blood circulation due to a decrease in activity owing to physical frailty (Hjelm et al., 2013), eventually increasing the risk of cognitive impairment. However, there is a possibility of confounder effect on their relationship with sleep duration such as depressive symptoms and sleep disorders (Cowie et al., 2021; Deschênes et al., 2019) and thus *requires careful interpretation*. In addition, our finding was inconsistent with a prospective study that insufficient (4 h or less) or excessive (10 h or more per night) sleep duration was significantly related to cognitive decline among general ageing population (Ma et al., 2020). In this study, we used a self-reported sleep duration. It would be better to use actigraphy for objectively assessing sleep duration and a self-reported sleep quality. In addition, overall sleep duration should be measured several times than one time to ensure accuracy.

Regarding physical frailty, our result showed the higher prevalence (69.3%) of physical frailty including pre-frail and frail status compared with previous studies on 50% of older patients with AF only (Orkaby et al., 2021) and 63% of HF patients (Dewan et al., 2020). Symptoms such as dyspnoea on exertion and palpitation were common in AF (Wang et al., 2020). If AF patients with these symptoms have comorbid HF, the symptoms may be affected by one other, leading to more severe symptoms (Heo et al., 2020). Furthermore, the coexistence of AF and HF may increase energy consumption and reduce food intake due to dyspnoea, thus increasing the risk of progression to be physically frail (Dewan et al., 2020). Chronic inflammation commonly occurs in AF and HF and manifests as a key feature of physical frailty, such as fatigue or reduced activity tolerance (Carlisle et al., 2019). However, this study was not included information on detail nutritional status such as dysphagia, poor dental status and inflammatory biomarkers related to physical frailty. In addition, this study was not evaluated bidirectional association between sleep duration and physical frailty in this population. Exploring the relationship of these variables may be helpful to investigate the pathway from sleep duration or physical frailty to cognitive decline in older patients with both AF and HF considering other possible factors including biological markers and psychological factors such as anxiety and depression.

TABLE 3 Differences in sleep duration and physical frailty by cognitive function ($N = 176$)

		Cognitive function		
	Total ($N = 176$)	Normal ($n = 114$)	Impairment ($n = 62$)	
Variables	*n* (%) or	*n* (%)	*n* (%)	χ^2 (*p*-value)
Sleep duration				
≤5 h	60 (34.1)	38 (33.3)	22 (35.5)	8.41 (0.015)
6–8 h	73 (41.5)	55 (48.2)	18 (29.0)	
≥9 h	43 (24.4)	21 (18.4)	22 (35.5)	
Physical frailty				
Robust	54 (30.7)	44 (38.6)	10 (16.1)	19.84 (<0.001)
Pre-frail	82 (46.6)	55 (48.2)	27 (43.5)	
Frail	40 (22.7)	15 (13.2)	25 (40.3)	

4.1 | Limitations

There are several limitations of this study that should be acknowledged. First, we used the cross-sectional data with convenience

TABLE 4 Impact of sleep duration and physical frailty on cognitive impairment ($N = 176$)

		Unadjusted		Adjusted*	
Variables	Categories	Odds ratio (95% CI)	*p*-Value	Odds ratio (95% CI)	*p*-value
Sleep duration	6–8 h	1 (Reference)		1 (Reference)	
	≤5 h	1.77 (0.84–3.74)	0.135	0.65 (0.26–1.64)	0.361
	≥9 h	3.20 (1.44–7.13)	0.004	2.72 (1.05–7.03)	0.039
Physical frailty	Robust	1 (Reference)		1 (Reference)	
	Pre-frail	2.16 (0.95–4.94)	0.068	1.42 (0.54–3.72)	0.471
	Frail	7.33 (2.87–18.75)	<0.001	5.73 (1.84–17.87)	0.003

Note: *Adjusted for age, education and spouse.

Abbreviation: CI, confidence interval.

sampling method to recruit older AF patients with HF during a specific period from a single centre. Thus, it may limit the generalizability and causality of the results. Second, MMSE is a validated and widely used tool for evaluating cognitive function. Although this screening tool is simple and provides a quantitative assessment, caution is needed to interpret the results because it relies upon patient self-reporting. Third, obesity in the study participants was determined by Korean BMI criteria. Thus, it would be difficult to directly compare our finding with the results from other studies. Finally, we investigated sleep duration using a single question. Although self-reported sleep duration is widely used because of its ease of use, the correlation between self-reported and actigraphy-measured sleep duration has not been strong (Jackson et al., 2020). Accordingly, longitudinal studies are needed to determine the association between sleep duration and cognitive impairment using comprehensive assessment tools for sleep duration.

5 | CONCLUSION

This study is one of the first studies to identify modifiable risk factors of cognitive impairments in older adults with both AF and HF. In our Korean sample, more than a third of patients are more likely to have cognitive impairments. More importantly, we demonstrated that long sleep duration and greater physical frailty may increase the prevalence of cognitive impairment among older people with both AF and HF. Thus, early assessment for sleep duration and physically frail status may be beneficial to delay or prevent cognitive impairment in this vulnerable population. Combined interventions targeted at promoting sleep quality and physical function should be considered when providing patient-centred care for multimorbid older patients with cognitive impairment. Multi-centre longitudinal studies are required to support our findings using more objective assessment tools.

AUTHOR CONTRIBUTIONS

EJS and YJS participated in conceptualizing the study, data analysis, data interpretation and drafting and revising the manuscript. MHW analysed the data and drafted the manuscript. All authors approved the final version for submission.

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CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICAL APPROVAL

This study was conducted in accordance with the Declaration of Helsinki and was approved by Chung-Ang University Institutional Review Board **(IRB No. 1041078-202,105-HRSB-139-01)**.

PATIENT OR PUBLIC CONTRIBUTION

No patient or public contribution was required to design, to outcome measures or undertake this research.

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