Evaluating the validity and reliability of the Korean version of Scales for Outcomes in Parkinson's Disease–Cognition

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Running title: Validity and reliability of the K-SCOPA-Cog

Abstract

Objective: The Scales for Outcomes in Parkinson's Disease–Cognition (SCOPA-Cog) was

developed to screen for cognition in PD. In this study, we aimed to evaluate the validity and

reliability of the Korean version of the SCOPA-cog.

Methods: We recruited 129 PD patients from 31 clinics with movement disorders in South Korea. The original version of the SCOPA-cognition was translated into Korean using the translation-retranslation method. The test-rest method with an intraclass correlation coefficient (ICC) and Cronbach's alpha coefficient were used to assess reliability. The Spearman's Rank correlation analysis with Montreal Cognitive Assessment-Korean version (MOCA-K) and Korean Mini-Mental State Examination (K-MMSE) were used to assess concurrent validity.

Results: The Cronbach's alpha coefficient was 0.797, and the ICC was 0.887. Spearman's rank correlation analysis showed a significant correlation with the K-MMSE and MOCA-K scores (r = 0.546 and r = 0.683, respectively).

Conclusions: Our results demonstrate that K-SCOPA-Cog exhibits good reliability and validity.

Keywords: Parkinson's disease, Dementia, Neurocognitive test, Validation study

Introduction

Cognitive impairment is a major non-motor symptom affecting quality of life in Parkinson's disease (PD).[1] The prevalence of dementia in PD is reported to be approximately 30%, and the risk of dementia in individuals with PD is 4–6 times greater than that in the normal population.[2] The clinical spectrum of cognitive impairment entails PD-mild cognitive impairment (MCI), Parkinson's disease dementia (PDD), and dementia with Lewy body, and the associated criteria are well established.[3, 4] In terms of clinical criteria, neuropsychological tests including screening and the standard battery are essential for the diagnosis of cognitive dysfunction in PD.

Neuropsychological tests usually differ from country to country because of language and cultural differences; therefore, standardization and validation are necessary for their use. In Korea, several screening tests for cognition, including the Mini-Mental State Examination (MMSE), have been developed or translated into Korean.[5, 6] Most of these tests are designed for Alzheimer's disease and related disorders that focus on cognition. In PDD, executive function is usually more prominently impaired than memory or language domains. Therefore, it is not appropriate to investigate PD-MCI and early-stage PDD using these tests. The Movement Disorder Society recommends five scales, including the Dementia Rating Scale, Montreal Cognitive Assessment (MOCA), Parkinson's Disease Cognitive Rating Scale, Mini-Mental Parkinsonism, and the Scales for Outcomes of Parkinson's Disease–Cognition (SCOPA-Cog).[7] Out of these, only the MOCA has been translated and used frequently in Korea.

The SCOPA is composed of a rating scale for motor and non-motor symptoms in PD, including autonomic dysfunction, sleep, and psychiatric symptoms. The SCOPA-Cog is part of SCOPA and consists of 10 items divided over four domains: memory (four items), attention (two items), executive function (three items), and visuospatial function (one item).[8] The optimal cutoff value reported with maximum accuracy is reported at 22/23.[9] While most of the other part of the SCOPA have been translated into Korean with proven validity, the SCOPA-Cog has not been translated and validated yet.[10, 11] Therefore, in this study, we translated it into Korean and investigated the reliability and validity of the Korean version of the SCOPA-Cog (K-SCOPA-Cog).

Materials and Methods

1) Participant recruitment

This was a nationwide multicenter cross-sectional trial. Participants from 31 movement

disorder clinics were recruited. The inclusion criteria were as follows: 1) patients who were

diagnosed with PD according to the United Kingdom Parkinson's Disease Society[12] and 2)

patients who received a stable dose of dopaminergic medications. The exclusion criteria were

as follows: 1) participants taking antipsychotic medication due to psychological issues; 2)

patients with severe cognitive impairment (MMSE<20); and 3) patients with other

neurological diseases, including stroke and Alzheimer's disease. All participants underwent

the Unified Parkinson's Disease Rating Scale part Ⅰ-Ⅲ,Ⅳ, Hoehn and Yahr stage (H&Y

stage), the Montreal Cognitive Assessment-Korean version (MOCA-K), Korean mini-mental

state examination(K-MMSE), and the Korean version of Parkinson's Disease Quality of Life-

39 (PDQ-39) tests to assess the symptoms of PD. All participants provided informed consent.

This study was approved by the Institutional Review Board of XXX (IRB2014GR0273).

2) Translation process into Korean

  The SCOPA-Cog was translated into Korean as follows: two independent bilingual

translators translated the English version of the SCOPA-Cog into Korean. The taskforce

team, consisting of five authors, reviewed the translated SCOPA-Cog and decided on a single

word for the final version. Another bilingual translator back-translated the text into English.

Any discrepancies between the original and translated versions were reviewed and corrected.

Four patients with PD were interviewed and tested for the pretest of the translated version.

Through this process, the final version of the K-SCOPA-Cog was obtained (Supplement 1).

3) Statistical analysis

We used the Shapiro–Wilk test for normality of the MOCA-K, K-MMSE, and SCOPA-Cog data. The reliability and validity analyses were performed separately for each domain. To evaluate reliability, we investigated internal consistency using Cronbach's alpha coefficient, which was considered acceptable when the alpha value was 0.7 or higher. We also used test-retest methods for intra-rater reliability and obtained intraclass correlation coefficients (ICC). An ICC>0.70 for total measurement scores was taken as the criterion of acceptable stability. The interval between the test and retest was 10–14 days minimize memory or practical effects. Concurrent validity assesses the degree of a measurement tool corresponding to that of an established scale measured simultaneously. To assess concurrent validity, the correlation between the SCOPA-Cog and other scales was obtained using Spearman rank correlation coefficients (rs), and nonparametric partial correlation coefficient adjusting for potential confounding variables such as age, disease duration, and education period. To compare two correlation coefficients, Fisher's r to z transformation method. We also investigated the association between age, disease duration, years of education, and H&Y stage, which have been reported as independent predictors of SCOPA-Cog.[13]

Results

 In total, 129 patients with PD (63, female 66 women) were enrolled in this study. The mean Unified Parkinson's Disease Rating Scale part 3 and H&Y stage were 19.76 ±11.19 and 2.11±0.61, respectively. The mean age and education period of participants was 66.62±8.94 and 3.01±1.71 years, respectively. The mean K-MMSE and MOCA-K scores were 26.84±3.74 and 22.63±5.05, respectively.

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The mean total SCOPA-Cog score was 22.40±6.95 (mean±SD), and histogram analysis

revealed normal distribution. Using the D'Agostino-Pearson test for testing normality, the

results showed that SCOPA-Cog followed a normal distribution (p=0.262), whereas K-

MMSE and MOCA-K did not (p<0.001, p<0.002, respectively) (Figure 1).

Table 1 presents the results of the reliability and concurrent validity of the SCOPA-Cog.

The Cronbach's α coefficient for total SCOPA-Cog was 0.797, and the range of each

domain was from 0.512 to 0.628. The ICC for the intra-rater reliability of all items and

domains was 0.887, ranging from 0.719 to 0.902.

Spearman's rank correlation analysis showed that the SCOPA-Cog was significantly

correlated with the K-MMSE (r=0.546, p<0.001) and MOCA-K (r=0.683, p<0.001) score.

However, the correlation of K-MMSE and MOCA-K did not significantly differ (r-to-z

transformation p=0.078). Among the demographic data, only age was associated with the

SCOPA-Cog scores (r=-0.264, p<0.002); however, years of education (r=0.064, p=0.471),

disease duration (r=-0.142, p=0.112), and H&Y stage (r=0.044, p=0.635) were not.

Discussion

In this study, we translated the SCOPA-Cog into Korean and demonstrated its reliability

and validity. Cognitive screening tests are essential for the diagnosis of PDD and PD-MCI,

and the SCOPA-Cog is the recommended tool in such conditions.

Cronbach's α coefficient of the total K-SCOPA-Cog was 0.797, which indicate excellent

internal consistency. However, Cronbach's α coefficient for each domain did not reach a

satisfactory level. This findings aligns with similar results observed in previous reports of

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other version of SCOPA-cog[14] Given that the total score of the SCOPA-cog is usually used

than domain score as a screening tool, the relatively lower Cronbach's α coefficient are

deemed to be a limitation inherent in SCOPA-cog.

The ICC for all 10 items showed high values, ranging above 0.7, indicating good intra-rater

reliability. In the domain-specific analysis, all domains showed statistical significance, with

the memory domain exhibiting the highest reliability. This result is also in accordance with a

previous report in which the ICC of the original SCOPA-Cog total score was 0.78.[15]

In this study, patients with moderate-to-severe dementia were excluded; therefore, only

those with mild-to-moderate cognitive dysfunction (MMSE score >20) were enrolled.

Therefore, in the data quality analysis, the K-MMSE showed a ceiling effect with a median

value of 28 points. However, the distribution of SCOPA-Cog differed from that of the K-

MMSE and MOCA-K, showing a non-normal distribution. Consistent with previous results,

these findings suggest that the SCOPA-Cog can be used as a screening tool for early stage of

cognitive dysfunction in PD.[8]

In the results of concurrent validity, the MOCA-K and K-MMSE showed significant

correlation with SCOPA-Cog. It has been reported that the MOCA-K is the most suitable

screening tool for cognitive dysfunction in PD.[16] The SCOPA-Cog consist of a domain for

executive function that is more similar to the MOCA than to the MMSE. Cognitive

dysfunction in PD is usually prominent in executive function rather than in memory or

language functions. However, our results revealed that the correlation with SCOPA-cog did

not significantly differ between K-MMSE and MOCA-K. It might be due to selection bias

arising from enrollment of patient with mild cognitive dysfunction according to inclusion

criteria.

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This study has several limitations. First, we did not compare the PD-MCI, PDD, and control groups. Therefore, we could not obtain clinometric properties or cut-off scores for screening. Second, because only patients with mild cognitive impairment were recruited, we could not investigate the validity and reliability of the scale in patients with severe dementia.

In conclusion, the K-SCOPA-Cog showed acceptable reliability and validity. It showed a normal distribution even in patients with mild cognitive dysfunction. The results of our study support the use of the SCOPA-Cog as a screening tool for cognitive dysfunction in South Korea.

Acknowledgement

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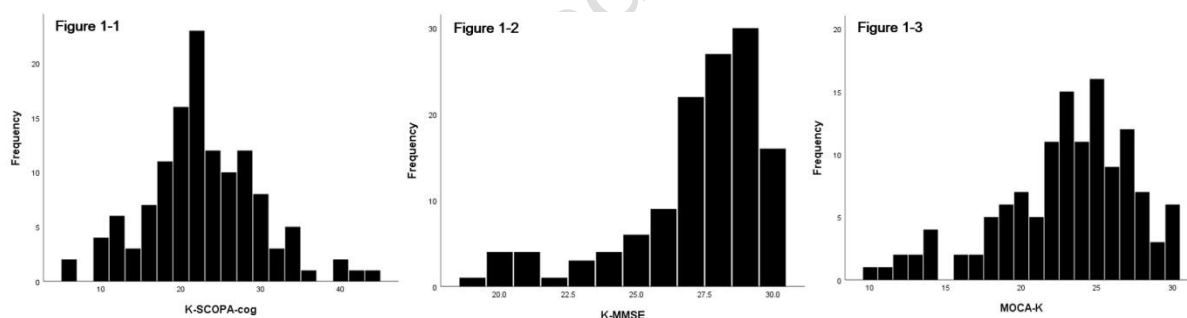
Figure 1. Histogram of the distribution of the SCOPA-Cog, K-MMSE, and MOCA-K.

In the Shapiro–Wilk test, the K-SCOPA-Cog showed a normal distribution (p=0.262);

however, the K-MMSE (p<0.001) and MOCA-K (p=0.002) showed a non-normal

distribution.

K-SCOPA-Cog: Korean version of Scales for Outcomes of Parkinson's Disease; MOCA-K:

Montreal Cognitive Assessment-Korean version; K-MMSE: Korean Mini-Mental State

Examination

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Table 1. Validity and Reliability of the K-SCOPA-Cog

Domain of K-SCOPA-Cog	Reliability		Validity	
	ICC	Cronbach's α coefficient if item deleted	K-MMSE	MOCA-K
Memory	0.902**	0.628	0.463**	0.574**
Attention	0.767**	0.598	0.534**	0.580**
Executive	0.719**	0.512	0.343**	0.474**
Visuospatial	0.859**	0.589	0.361**	0.468**
Total	0.887**	0.797	0.546**	0.683**

**p<0.00

K-SCOPA-Cog: Korean version of Scales for Outcomes of Parkinson's Disease; ICC: Intraclass correlation coefficient. MOCA-K: Montreal Cognitive Assessment-Korean version K-MMSE: Korean mini-mental state examination

[1] Non-parametric partial correlation coefficients were adjusted for age, disease duration, and education period. P values were derived from Fisher's r to z transformation method.

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