Usefulness of the Japanese version of Rapid Dementia Screening Test for mild cognitive impairment in older patients with cardiovascular disease: a cross-sectional study

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ABSTRACT

BACKGROUND  Cognitive decline is common among older patients with cardiovascular disease (CVD) and can decrease their self-management abilities. However, the instruments for identifying mild cognitive impairment (MCI) are not always feasible in clinical practice. Therefore, this study evaluated whether MCI could be detected using the Japanese version of the Rapid Dementia Screening Test (RDST-J), which is a simple screening tool for identifying cognitive decline.

METHODS  This retrospective single-center study included patients who were ≥ 65 years old and hospitalized because of CVD. Patients with a pre-hospitalization diagnosis of dementia were excluded. Each patient’s cognitive function had been measured at discharge using the RDST-J and the Japanese version of the Montreal Cognitive Assessment (MoCA-J), which is a standard tool for MCI screening. The correlation between the two scores was evaluated using Spearman’s rank correlation coefficient. Receiver operating characteristic (ROC) analysis was also to evaluate whether the RDST-J could identify MCI, which was defined as a MoCA-J score of ≤ 25 points.

RESULTS  The study included 78 patients (mean age: 77.2 ± 8.9 years). The RDST-J and MoCA-J scores were strongly correlated (r = 0.835, P < 0.001). The ROC analysis revealed that an RDST-J score of ≤ 9 points provided 75.4% sensitivity and 95.2% specificity for identifying MCI, with an area under the curve of 0.899 (95% CI: 0.835–0.964). The same cut-off value was identified when excluding patients with a high probability of dementia (RDST-J score of ≤ 4 points).

CONCLUSIONS  The RDST-J may be a simple and effective tool for identifying MCI in older patients with CVD.

The long-term management of patients with cardiovascular disease (CVD) is a major concern in aging societies. Japan has the most aged society in the world and the number of Japanese patients with CVD has steadily increased. Furthermore, consistent with population aging, the age of Japanese patients hospitalized because of CVD has also steadily increased. Decreased cognitive function is a common condition among older patients with CVD, and is associated with a poor prognosis. The presence of cognitive decline increases the difficulty of self-management, and may even lead to readmission because of worsening CVD. Therefore, early detection of cognitive decline is clinically important, as it can help guide effective home-based care measures, including education of family members and deployment of healthcare resources.

Cognitive screening instruments are useful for detecting cognitive decline. The most commonly used tool is the Mini-Mental State Examination (MMSE), although it requires 10–15 min to complete and has low sensitivity for mild cognitive impairment (MCI), which is a transient stage that is associated with a high risk of developing dementia. The Montreal Cognitive Assessment (MoCA) is another tool with higher sensitivity and specificity for detecting MCI, relative to the MMSE. Although
the MoCA is useful for identifying patients who require healthcare support because of MCI, it also requires 10–15 min to complete, which may not be feasible in clinical practice. Thus, it would be useful to have easier and more rapid screening tools to identify patients with cognitive decline and ensure that they have sufficient support to manage their disease.

The Rapid Dementia Screening Test (RDST) is a psychometric screening tool that is easy to administer and can be completed in 3 min.\[11\] The Japanese version has been validated and the scores are highly correlated with the MMSE scores.\[12\] In addition, a previous study revealed that the RDST could predict the development of early-stage dementia,\[12,13\] which suggests that the RDST might be useful for identifying probable MCI. However, there are no studies regarding the association between RDST scores and MCI. Therefore, this study aimed to examine the correlation between the RDST and MoCA scores, and to identify a RDST score that might be used to identify MCI.

**METHODS**

**Study Population**

This single-center retrospective study evaluated data from patients with CVD who were admitted to Nagoya Ekisaikai Hospital (Nagoya City, Japan) between January and December of 2020. The inclusion criteria were consecutive patients who were ≥ 65 years old, participated in an inpatient rehabilitation program, and completed the RDST and MoCA as part of routine clinical practice. Patients were excluded if they were unable to answer the questionnaire because of visual or hearing impairment, if they had severe psychiatric or neurological disorders, or if they had physician-diagnosed dementia or were receiving anti-dementia drugs before admission. All patients were offered the opportunity to opt out of the study, although none had chosen to opt out at the time of the analysis. The study protocol complied with the Declaration of Helsinki and was approved by the Ethics Committee of Nagoya Ekisaikai Hospital, Japan (No.2019-043).

**Measurements of Cognitive Function**

Trained physical therapists performed routine clinical assessments immediately before hospital discharge, which included the Japanese versions of the RDST (RDST-J) and MoCA (MoCA-J).\[14\] The RDST-J includes a number-transcoding task and a supermarket task.\[12\] The number-transcoding task involves transcoding two Arabic numerals to Chinese numerals (e.g., 209 to ‘二百九’ and 4,054 to ‘四千五十四’) and transcoding two Chinese numerals to Arabic numerals (e.g., ‘六百八十一’ to 681 and ‘二千二十七’ to 2,027). Each correct answer is worth 1 point and the maximum score is 4 points. The supermarket task is a category fluency task that involves verbally listing items that can be bought in a supermarket during a one-minute period. The supermarket task is scored as 8 points (≥ 14 items correctly listed), 6 points (11–13 items), 4 points (8–10 items), 2 points (5–7 items), or 0 points (≤ 4 items). The scores for the two tasks are added and the maximum total score for the RDST-J is 12 points. A previous study has indicated that a RDST-J score of ≤ 7 points can be used to predict dementia and that dementia was strongly suspected at scores of ≤ 4 points.\[12\]

The MoCA-J assesses nine domains of cognition: (1) attention; (2) concentration; (3) executive functions; (4) memory; (5) language; (6) visuoconstructional skills; (7) conceptual thinking; (8) calculations; and (9) orientation. The maximum total score for the MoCA-J is 30 points, and a cut-off of ≤ 25 points has been used for identifying MCI (sensitivity: 93%, specificity: 87%).\[14\]

**Clinical Data**

The patients’ medical records were reviewed to collect data regarding age, sex, body mass index, principal diagnosis of CVD during the hospitalization, comorbidities, left ventricular ejection fraction, medication, and walking ability at discharge.

**Statistical Analysis**

The Shapiro-Wilk test was used to assess the normality of data distribution. Normally distributed continuous variables were reported as mean ± SD and non-normally distributed continuous variables were reported as median (interquartile range). The unpaired t-test, Mann-Whitney U test, and Pearson’s chi-squared test were used, as appropriate, to compare the characteristics between patients with and without MCI, which was defined as a MoCA-J score.
of ≤ 25 points. The correlation between the MoCA-J and RDST-J scores was assessed using Spearman’s rank correlation coefficient. Receiver operating characteristic (ROC) curve analysis was used to identify a cut-off value for using the RDST-J to identify MCI (based on a MoCA-J score of ≤ 25 points). The ROC curve was constructed by plotting sensitivity against 1–specificity, the area under the curve (AUC) was calculated, and the optimal cut-off value was identified based on the Youden index. The ROC analyses were initially performed using data from all subjects, and then repeated after excluding patients with a high probability of dementia (RDST-J score of ≤ 4 points). All statistical analyses were performed using Stata/SE software (version 15.1; StataCorp LP, College Station, TX, USA) and results were considered statistically significant at P-value < 0.05.

RESULTS

The study included 78 older patients who were hospitalized because of CVD. The patients’ characteristics are shown in Table 1. The mean age was 77.2 ± 8.9 years and 56.4% of the patients were men. Based on a MoCA-J score of ≤ 25 points, MCI was identified in 73.1% of the patients. Relative to patients without MCI, patients with MCI were significantly older (P < 0.001), had a significantly higher prevalence of heart failure before the hospitalization (P = 0.009), and were significantly more likely to need a walking device or assistance (P = 0.001).

There was a strong correlation between the MoCA-J and RDST-J scores (r = 0.835, P < 0.001) (Figure 1). Furthermore, the correlation remained strong even after excluding patients with a high probability of dementia based on a RDST score of ≤ 4 points (r = 0.791, P < 0.001).

The results of the ROC curve analysis using data from all patients are shown in Figure 2. Using the RDST-J to predict cognitive decline provided an AUC of 0.899 (95% CI: 0.835–0.964). Furthermore, even after excluding patients with a high probability of dementia, the RDST-J had good value for predicting cognitive decline (AUC = 0.878, 95% CI: 0.801–0.955). The predictive accuracies according to different cut-off points are summarized in Table 2. According to the Youden index, the optimal cut-off point for predicting cognitive decline was ≤ 9 points (sensitivity: 75.4%, specificity: 95.2%, positive predictive value: 97.7%, negative predictive value: 58.8%) and the same cut-off value was identified after excluding patients with a high probability of dementia. Relative to patients with ≥ 10 points, patients with ≤ 9 points were significantly older (79.5 ± 1.1 vs. 71.0 ± 1.8, P < 0.001), and had a relatively lower prevalence of men (45.5% vs. 70.6%, P = 0.304). Education background was not different between the groups (≥ 13 years: 15.9% vs. 17.7%, P = 0.838).

DISCUSSION

The present study revealed that the RDST-J score was highly correlated with the MoCA-J score, which is an established screening instrument for MCI. In addition, the results of the ROC curve analysis suggested that a RDST-J score of ≤ 9 points had good ability to identify MCI. Thus, despite the study’s single-center retrospective design, the results suggest that the RDST-J might be a simple and rapid tool for MCI screening among patients with CVD.

Cognitive decline is a common condition among patients with CVD, which may negatively affect their self-management ability after discharge. Furthermore, previous reports have indicated that even MCI can create self-care challenges for patients with CVD. Therefore, strategies are needed to improve access to healthcare resources and family supports for patients with declining cognitive function. The MoCA remains the standard instrument for identifying MCI, as it has better predictive accuracy than the MMSE, although the time required for this tool may be a barrier to its use in clinical practice. The present study revealed that the RDST-J and MoCA-J scores were strongly correlated, and that the RDST-J score could predict MCI. Thus, the RDST-J may be a more rapid assessment of cognitive function that can be more readily used in the clinical setting.

The RDST was originally developed as a screening tool for dementia, although our results suggest that it can also be used to identify an earlier stage of cognitive decline (i.e., MCI). Our results indicate that the optimal RDST-J score for identifying MCI...
was ≤ 9 points, which is higher than a previously reported cut-off value for identifying dementia.\textsuperscript{[11,12]} Thus, our cut-off value is likely appropriate for identifying probable MCI, although prospective studies are needed to confirm the generalizability of this result. For example, even after we excluded patients with a high probability of dementia (RDST score of ≤ 4 points), the prevalence of MCI in this study was higher than in previous reports.\textsuperscript{[19,20]} This may be related to selection bias, as we retrospectively evaluated patients underwent cognitive assessments as part of routine clinical practice. Thus, further studies are needed to confirm that a RDST-J score of ≤ 9 points can be used to accurately identify MCI.

In addition to its use during hospitalization, the RDST can be used as part of home-based care after discharge. Previous reports have demonstrated that CVD predicts future cognitive decline among middle-aged adults.\textsuperscript{[21,22]} The high prevalence of pre-
vious heart failure in our MCI group may also support the concept that CVD contributes to the progression of cognitive decline. Therefore, the cognitive status of older patients with CVD should be monitored after discharge in order to achieve early detection of declining cognitive function. The RDST is easily completed during a short period of time, without special training or tools, which may make it a valuable tool for various healthcare professionals to measure patients' cognitive function at any time and in any place. A previous report has also indicated that there is no learning effect on category fluency tasks among individuals with MCI,\(^{23}\) which suggests that the supermarket task (a category fluency task) can be repeatedly used to measure cognitive function after discharge. Nevertheless, further studies are needed to confirm that the RDST can be readily used in community settings, and whether it can detect temporal changes in cognitive status.

**LIMITATIONS**

This study has several limitations that should be discussed. Firstly, the small single-center retrospective study design is associated with a risk of selection bias. Secondly, this study did not evaluate potential confounding factors, such as sociodemographic factors and the presence of comorbidities. There is a room for examining the influences of these factors because of a limited sample size and a lack of detail sociodemographic data in this study.
although there was no difference in education background according to the RDST-J score. Thirdly, we did not consider post-discharge outcomes and it is unclear whether the RDST can predict adverse events after discharge. Last but not least, the cross-sectional design precludes an evaluation of whether the RDST-J scores respond over time to changes in cognitive function. Therefore, further studies are needed to address these issues and evaluate the generalizability of our findings.

CONCLUSIONS

In conclusion, the RDST-J is a simple instrument and its score was highly correlated with the MoCA-J score, which is a standard test for identifying MCI. Our results suggest that a RDST-J score of ≤ 9 points had good ability to identify MCI, which suggests that the RDST-J might be useful for routine cognitive assessments in both clinical practice and in the home-based setting. However, longitudinal studies are needed to evaluate whether the RDST-J scores respond to changes in cognitive status, as well as whether this tool can be used to predict adverse health outcomes after discharge.

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