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Research report

Use of the Cognitive Performance Scale (CPS) to detect cognitive impairment in the acute care setting: Concurrent and predictive validity

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ABSTRACT

The Cognitive Performance Scale (CPS) was initially designed to assess cognition in long term care residents. Subsequently, the CPS has also been used among in-home, post-acute, and acute care populations even though CPS' clinimetric performance has not been studied in these settings. This study aimed to determine CPS agreement with the Mini Mental Status Exam (MMSE) and its predictive validity for institutionalization and death in a cohort ($N = 401$) of elderly medical inpatients aged 75 years and over. Medical, physical and mental status were assessed upon admission. The same day, the patient's nurse completed the CPS by interview. Follow-up data were gathered from the central billing system (nursing home stay) and proxies (death).

Cognitive impairment was present in 92 (23%) patients according to CPS (score ≥ 2). Agreement with MMSE was moderate (κ 0.52, $P < .001$). Analysis of discordant results suggested that cognitive impairment was overestimated by the CPS in dependent patients with comorbidities and depressive symptoms, and underestimated in older ones. During follow-up, subjects with abnormal CPS had increased risks of death (adjusted hazard ratio (adjHR) 1.7, 95% CI 1.0–2.8, $P = .035$) and institutionalization (adjHR 2.7, 95% CI 1.3–5.3, $P = .006$), independent of demographic, health and functional status. Interestingly, subjects with abnormal CPS were at increased risk of death only if they also had abnormal MMSE.

The CPS predicted death and institutionalization during follow-up, but correlated moderately well with the MMSE. Combining CPS and MMSE provided additional predictive information, suggesting that domains other than cognition are assessed by professionals when using the CPS in elderly medical inpatients.

1. Introduction

Cognitive impairment is common in elderly persons and is associated with adverse outcomes during, as well as after, a hospital stay [2,13,15,23,24]. Several studies have shown that detection is less than ideal in this setting, usually around 50% [1,3,14,15,27]. Better detection might improve management of patients with conditions such as dementia or delirium during their hospitalization, and contribute to preventing or delaying subsequent events, such as nursing home admission [7,10,15,20]. However, time and resource constraints are obvious barriers to implementing routine cognitive screening in the acute care setting. A simple and brief instrument, that could ideally be used by any health professional would be very useful in this setting.

The Cognitive Performance Scale (CPS) was initially developed to assess cognitive status of nursing home residents [21]. It is part of the minimum data set (MDS), the federally mandated reporting form required for reimbursement in US nursing homes. The CPS was developed using the Mini Mental Status Exam (MMSE) [8] as a criterion measure and several studies have shown good agreement between the two scales in nursing home populations [11,12,19,21,22]. The CPS has also been included in subsequent versions of the MDS developed for in-home, post-acute, as well as acute care populations [5,17,18], but the performance of the CPS in this latter setting has not been previously studied. Compared to nursing home or in-home settings, the more limited interaction between the nurses and their patients, the acuity of medical illnesses, the usual emphasis given to technical rather than observational skills, as well as difficulties in training health professionals in the busy acute care environment might all affect CPS performance [9,26].

The aim of this study was to assess the agreement between the CPS and the MMSE in a cohort of elderly medical inpatients, and to investigate the predictive validity of the CPS for nursing home admission and death, two events that have been previously asso-

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ciated with cognitive impairment in hospitalized elderly persons [10,15,20].

2. Methods

2.1. Study population

This study was performed as part of a larger investigation of the yield of comprehensive geriatric assessment in hospitalized older patients. Recruitment and methods have been previously described [4]. Briefly, eligible participants were aged 75 years and older, consecutively admitted over a 6-month period to the general internal medicine service of an academic medical center in Lausanne, Switzerland. From the original 649 patients, 135 did not meet inclusion criteria because they were discharged within 24 h of their admission ($N = 10$), previously living in a nursing home ($N = 43$), transferred from another hospital for an elective procedure ($N = 32$), or had private insurance ($N = 50$). These latter patients were not eligible because of the inability to access follow-up data on service utilization. From the 543 eligible participants, 106 patients were excluded because of unstable medical conditions ($N = 20$), aphasia or stroke ($N = 9$), terminal illness or coma ($N = 23$), inability to give a correct name and date of birth ($N = 29$), or other reasons (e.g., language barrier) ($N = 25$). Seven patients refused participation in the study, leaving a final sample of 401 patients. The University Institutional Review Board approved the study, and all patients gave written informed consent.

2.2. Baseline data collection

Within 48 h of admission, a trained research nurse interviewed the patients to collect data on demographics (age, gender), living situation (living alone or not), education (completed high school or not), and self-rated income (comfortable or not). In-hospital performance of basic activities of daily living (ADL) was obtained by asking the nurse in charge of the patient [16]. Scores range from 0 to 6, with higher scores indicating better function. Affective status was assessed using the 15-item Geriatric Depression Scale (GDS) with a cutoff of 6 or more defining the presence of depressive symptoms [25]. Main admission diagnosis and information required to calculate the Charlson's comorbidity index [6] were collected from the medical record. Finally, home care services were systematically contacted to collect data on formal and informal help received at home prior to hospitalization.

2.3. Cognitive measures and cutoff values for defining cognitive impairment

Two instruments were used to assess the cognitive status of patients at hospital admission. First, the MMSE [8] was administered during patient interview by the research nurse. Possible scores range from 0 to 30, with higher scores indicating better cognition. Patients were classified as cognitively impaired if scoring less than 24.

Second, the research nurse interviewed the ward nurse in charge of the patient at hospital admission and completed the CPS [21]. Routine CPS administration requires usually less than 3 min after some training. For the current study, the ward nurse did not receive formal training and was unaware of patient's MMSE performance. The CPS assesses patient's awakening status (comatose or not) and patient's performance in four domains: short-term memory, ability to make decisions, ability to make self-understood, and ability to eat. Scores range from 0 to 6, with higher scores indicating worse cognition. Patients can be classified in different categories according to their CPS performance. For this analysis, the usual cutoff of 2 points or more was used to define the presence of cognitive impairment at the CPS. No other part of the MDS-RAI was administered for this study.

2.4. Follow-up data collection

Participants were systematically contacted by phone at 6 months to assess mortality and living arrangement. For those who died during the study period, the exact date of death was gathered from proxies, primary care physicians, and other health professionals (in-home services, nursing home). Vital status (i.e., alive vs. dead) was determined in all subjects. Data on service utilization (i.e., length of stays in hospitals and nursing homes) were obtained from the database of the state centralized billing office. The validity of this database was previously shown to be excellent [4]. In particular, data on nursing home admissions during the 6-month follow-up period were systematically correlated with proxy information. No unknown nursing admission was detected.

2.5. Statistical analysis

Population characteristics were described using means and proportions. Comparisons between subgroups of patients were assessed using Chi-square or Fisher exact tests for categorical variables, and Student *t*-test, ANOVA, or the Kruskall–Wallis rank sum test for continuous variables. Agreement between the MMSE and the CPS was assessed using Spearman correlation coefficient and κ statistics. Analyses of discordant results between the CPS and MMSE were performed using bivariate and multivariate logistic regression. A first set aimed at identifying characteristics associated with an abnormal CPS among subjects with normal MMSE results. A second set aimed at identifying characteristics associated with a normal CPS among subjects with abnormal MMSE results.

Kaplan–Meier survival curves were plotted, and tested for differences, using the log-rank test. Risks of nursing home admission and death were estimated from bivariate and multivariate Cox proportional hazards regression, using a stepwise procedure. Selection of covariates was based on a priori hypotheses, and included age, gender, income, education, living situation, use of in-home help, admitting diagnoses, comorbidity, basic ADL performance, and depressive symptoms. Statistical significance levels for variables entering and remaining in the model were set at $P < .10$ and $P < .20$, respectively. Multivariate analyses were performed with and without the cognitive impairment variable forced into the model (no differences). Death was a censoring event in both analyses. Statistical analyses were performed using *Stata 10.0* (Stata Corp., College Station, TX).

3. Results

Baseline characteristics of the study population and comparisons between subjects with and without cognitive impairment according to CPS score are shown in Table 1. Overall, 92 (22.9%) patients were cognitively impaired using the CPS (score ≥ 2). Compared to the others, these patients were significantly older, more frequently receiving in-home services, impaired in basic ADLs, admitted after a fall, reporting depressive symptoms, and had higher comorbidity. Only the four latter characteristics remained significant in multivariate analysis (data not shown).

3.1. Agreement between CPS and MMSE

Overall, 129 (32.2%) patients were cognitively impaired using the MMSE (score < 24). Correlation with the CPS was moderate (Spearman's $\rho = -0.60$, $P < .001$), and agreement between the two instruments in defining cognitively impaired subjects was also moderate (agreement 80.8%, κ 0.52, $P < .001$). Table 2 describes the average MMSE score for each level of CPS in more detail. The MMSE score decreased steadily across increasing levels of CPS score, ranging from 26.6 in subjects with CPS score equal to zero, to 16.3 and 6.0 in those with CPS score equal to 5 and 6, respectively. Considering a score <24 at the MMSE as the criterion measure defining cognitive impairment, a cutoff score of 2 or more for the CPS would detect 72 of 129 patients with abnormal MMSEs and falsely classify as cognitively impaired 20 of the 272 with normal MMSE (sensitivity 55.8%, specificity 92.7%). When considering only severe cognitive impairment (MMSE score < 18), CPS sensitivity was higher (83.8%) but its specificity decreased to 83.2%. Compared to subjects with a normal CPS (score < 2), those with an abnormal CPS were 12.7 times as likely (95% CI 6.7–24.3, $P < .001$) to have an abnormal MMSE (score < 24), in stepwise multivariate regression analysis that controlled for age, admitting diagnosis, performance in basic ADLs, and education.

To further explore the reasons for the moderate agreement between the 2 instruments, differences in patient's characteristics among subjects with discordant classification by CPS and MMSE were investigated. Table 3 provides a detailed description of the patients classified into four categories: no cognitive impairment; impairment on CPS alone; impairment on MMSE alone; impairment on both instruments. Compared to subjects without cognitive impairment on both instrument, those impaired on CPS alone had more basic ADL dependency (adjOR 1.9, 95% CI 1.1–3.2, $P = .020$), more comorbidities (adjOR 1.7, 95% CI 1.3–2.3, $P < .001$), and were more likely to report 6 or more depressive symptoms (adjOR 4.8, 95% CI 1.6–14.0, $P = .004$) in multivariate analysis. In contrast, among subjects cognitively impaired using the MMSE, those without impairment on the CPS tended to be older (adjOR 1.1, 95% CI 1.0–1.2, $P = .054$).

3.2. Predictive performance of the CPS

Overall, 36 (9%) patients were permanently admitted to a nursing home, and 82 (20.5%) died during follow-up. Table 4 shows the