Clinical Investigations

Sensitivity and Specificity of a Five-Minute Cognitive Screening Test in Patients With Heart Failure

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ABSTRACT

Background: Cognitive impairment occurs in up to 80% of patients with heart failure (HF). The National Institute for Neurological Disorders and Stroke (NINDS) and the Canadian Stroke Network (CSN) recommend a 5-minute cognitive screening protocol that has yet to be psychometrically evaluated in HF populations. The aim of this study was to conduct a secondary analysis of the sensitivity and specificity of the NINDS-CSN brief cognitive screening protocol in HF patients.

Methods: The Montreal Cognitive Assessment (MoCA) was administered to 221 HF patients. The NINDS-CSN screen comprises 3 MoCA items, with lower scores indicating poorer cognitive function. Receiver operator characteristic (ROC) curves were constructed, determining the sensitivity, specificity and appropriate cutoff scores of the NINDS-CSN screen.

Results: In an HF population aged 76 ± 12 years, 136 (62%) were characterized with cognitive impairment (MoCA <26). Scores on the NINDS-CSN screen ranged from 3−11. The area under the receiver operating characteristic curve indicated good accuracy in screening for cognitive impairment (0.88; $P < .01$; 95% CI 0.83−0.92). A cutoff score of ≤9 provided 89% sensitivity and 71% specificity.

Conclusions: The NINDS-CSN protocol offers clinicians a feasible telephone method to screen for cognitive impairment in patients with HF. Future studies should include a neuropsychologic battery to more comprehensively examine the diagnostic accuracy of brief cognitive screening protocols. (*J Cardiac Fail 2016;22:99−107*)

Key Words: Heart failure, cognitive impairment, cognitive screening.

In an ageing population heart failure (HF) is the most chronic disabling illness in cardiovascular health, affecting 26 million individuals worldwide.[1,2] Not surprisingly, HF continues to be the leading medical cause of hospitalization, representing 1%−2% of all hospital admissions worldwide.[2] Most notably, despite significant improvements in HF treatments, almost 25% of recently discharged patients with HF experience a hospital readmission within 30 days.[3] These factors account for increasing direct and indirect health care costs associated with HF, which in the United States consume $20.9 billion annually.[4] Cognitive impairment is closely associated with HF and poor clinical outcomes, including poor engagement in self-care, medication nonadherence, and increased mortality.[5−8] The HF-cognition paradigm is a contentious issue, with reported prevalence rates ranging from 25%[9] to 80%.[5,10] Cognitive screening as part of routine assessment may identify

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patients who are most vulnerable to poorer health outcomes; however, greater research endeavors are required to inform clinical practice on optimal screening practices in the contemporary management of HF.[11]

There is level B evidence for cognitive screening to be recommended as best practice in the contemporary management of HF.[12] However, to date there are no recommendations on how this should be done.[13] Adding to this issue for clinicians, cognition can be considered on a continuum ranging from normal performance for age to severe impairment associated with dementia, and cognitive screening questionnaires often have differing thresholds that differentiate this spectrum of impairment.[14,15] The Vascular Cognitive Impairment Harmonisation Standards[16] were developed by representatives from The National Institute for Neurological Disorders (NINDS) and the Canadian Stroke Network (CSN) to provide consensus guidelines on cognitive screening of patients with vascular-related cognitive impairment (VCI). The pattern of cognitive impairment that is typically exhibited in VCI includes deficits in executive functioning, information processing speed, attention, working memory and language, typically resulting from neuropathology affecting the frontal and temporal lobes, hippocampus, and basal ganglia.[17] As such, cognitive screening protocols for VCI need to be sensitive to a wide range of cognitive domains implicated in the spectrum of VCI. The cognitive assessment protocols recommended by the NINDS-CSN group include a 5-minute screen composed of 3 items from the Montreal Cognitive Assessment (MoCA),[18] devised thus for use in clinical practice and large clinical studies where brevity, ease of administration, and sensitivity of the screening tool are especially important.[16]

Cognitive screening is not a formal diagnosis for cognitive impairment, but it does have an important role in alerting clinicians to patients who may warrant further neurocognitive assessment and additional support,[19] or in ruling patients as eligible to participate in research trials. The full MoCA was specifically developed to screen for mild cognitive impairment (MCI) in individuals who would otherwise perform in the normal range on the Mini Mental State Exam.[18] The MoCA assesses 6 domains that are often implicated in MCI, including memory (recall and working), visual-spatial, executive function, attention/concentration, language, and orientation (Table 1). Scores range from 0 to 30, with higher scores reflecting better cognitive performance. The suggested normal range is 26−30. In an early validation study performed on individuals who attended a memory clinic, where Alzheimer pathology was likely to predominate, the cutoff of 26 had optimal sensitivity (90%) and specificity (89%) in screening for MCI.[18] However, a cutoff of 26 may not be optimal in patients with cardiovascular disease who are at a high risk of VCI.[14] When screening for MCI in HF, and more general cardiovascular populations, MoCA cutoff scores of <24 had better sensitivity and specificity than scores <26.[14,20] Furthermore, in elderly community-dwelling

Table 1. Description and Scoring of the Montreal Cognitive Assessment

Cognitive Domain	Items	Description	Scoring	Maximum Score
Visual-spatial/executive	Trail making	Drawing lines between letters and numbers, alternating between, ascending order	1 point for correctly executed pattern	5
	Cube drawing	Replicating pictured cube	1 point for correctly drawn cube	
	Clock drawing	Drawing a clock indicating a specified time	1 point each for correctly drawn contour, numbers, and hands of clock	
Naming	Animal identification	Naming 3 animals pictured	1 point for each animal correctly identified	3
Attention	Forward, backwards digit span[C,D]	Repeating 5-number sequence normally and 3-number sequence in reverse	1 point for each sequence correctly recalled	6
	Vigilance	Tapping hand once when specified letter is heard	1 point for 0−1 incorrect taps	
	Serial 7s[A,B]	Subtracting 7s from 100, for 5 consecutive numbers	1 point for 1 correct subtraction, 2 points for 2−3 correct, 3 points for 3−4 correct	
Language	Sentence repetition	Repeating 2 different sentences	1 point for each sentence correctly recalled	3
	Fluency[N,A,C]	Naming words beginning with specified letter over 1-minute period	1 point for ≥11 words	
Abstraction	Word similarity[B,D]	Explaining commonality between 2 word pairs	1 point for each valid explanation	2
Memory	Delayed recall[N,A,B,C,D]	Recalling 5 words learned after the animal identification task	1 point for each word recalled correctly without cue	5
Orientation	Date, location identification[N]	Specifying date, month, year, day, place, and city	1 point for each item correctly identified	6

Items are presented in the order in which they are administered. The total score is the sum of all cognitive domain scores (scoring range 0−30), with an additional point for individuals with ≤12 years of formal education. A score ≥26 is considered to be normal. Symbols indicate items included in the different brief screening protocols.
[A,B,C,D,N]Item included in brief screening protocols A, B, C, and D and the National Institute of Neurological Disorders and Stroke−Canadian Stroke Network protocol, respectively.