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Care of Patients With Heart Failure

Is sleep quality related to cognition in individuals with heart failure?

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ABSTRACT

Objective: To examine how self-reported sleep quality and daytime symptoms are associated with selected domains of cognitive function among individuals with heart failure (HF).
Background: HF patients suffer from poor sleep quality and cognitive decline. The relationship between sleep and cognition has not been well documented among individuals with HF.
Methods: In this descriptive, cross-sectional study, 68 individuals with HF (male: 63%, mean age = 72 years, SD = 11) completed sleep questionnaires and a neuropsychological battery.
Results: Participant had mean Pittsburgh Sleep Quality Index score of 5.04 (SD = 2.8). Regression analyses demonstrated neither sleep quality or excessive daytime sleepiness (EDS) were related to cognitive function, but daytime dysfunction was related to lower letter fluency and attention index.
Conclusion: Contrary to some earlier reports, subjective sleep and EDS in this group of individuals was not associated with cognitive decline.

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Introduction

Heart failure (HF) is a major public health concern. It is associated with frequent hospital admissions,[1] poor quality of life,[2] a significant symptom burden,[3] high morbidity, and increased mortality.[4–6] Up to half of individuals with HF experience a decline in cognition that does not meet the criteria for dementia, but which is greater than would be expected in normal aging.[7–9] Among individuals with HF, cognitive impairment has been reported as a significant problem that may also increase morbidity and mortality by diminishing self-management skills.[5–11] Magnetic resonance imaging (MRI) studies of the brain revealed that individuals with HF present differences in the prefrontal lobe, medial temporal lobe, and hippocampus that are associated with reduced attention, memory, and executive function.[12–16] These differences in cognition and brain structure may be due to reduced cerebral blood flow arising from low cardiac output.

Cognitive impairment may also be worsened by other factors, such as older age, low education level, depression, medications, and comorbid conditions.[17,18] While researchers have studied several of these variables, the relationship between sleep problems and cognition among patients with HF is still uncertain. Cross sectional studies have documented a relationship between poor sleep quality, excessive daytime sleepiness (EDS), and cognitive function.[19–24] However, the direction of that relationship is still unclear.

Up to 70% of individuals with HF report problems with sleep[25–29] and often present with sleep-related breathing disorders (SRBD), such as obstructive sleep apnea (OSA) or central sleep apnea (CSA), insomnia, or HF-related nighttime symptoms, such as paroxysmal nocturnal dyspnea or nocturia.[28,30–32] The concept of sleep quality is multi-dimensional. The dimensions of sleep quality include the general quality of one's sleep, duration of sleep, the time required to fall asleep (sleep latency), the percent of time spent in bed asleep (sleep efficiency), disrupted sleep, and the use of sleep medication.[33] Redeker and Stein[26] found that patients with HF had significantly increased time spent awake after sleep onset, more disrupted sleep, and more daytime symptoms including EDS compared to people without HF. Another study by Redeker et al[32] found significant differences in the time spent awake after sleep onset and sleep efficiency with increasing severity of SRBD in HF patients. Also, participants' reports of sleep quality and EDS were no more common in those with SRBD than without, suggesting that the characteristics of disturbed sleep in HF are uniquely different than SRBD in the general population. In addition to SRBD, contributing factors to disturbed sleep may include aging, comorbidities, mental health, and medications.[27,28,34,35]

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In the general population, evidence from behavioral and physiological studies have shown that sleep is related to hippocampal function, i.e., memory consolidation.[24] Researchers have found that self-reported poor sleep quality is associated with reduced prefrontal cortex function, i.e., attention and executive function.[19–21] For example, Nebes et al[19] demonstrated that global sleep quality is associated with attention, executive function, and global cognition. In this study, each dimension of sleep quality affects different domains of cognitive function. They found longer sleep latency was associated with poorer global cognitive function and executive function, and higher sleep efficiency is associated with better global cognitive function and attention.

Daytime symptoms (e.g., EDS or daytime dysfunction) of disturbed sleep and sleep disorders may be related to cognitive decline as well. Sleepiness from sleep deprivation slows responses and increases errors in attention tasks in healthy adults.[22] In a population-based study of 1026 older adults, EDS was a risk factor for reduced attention and memory.[23] In individuals with HF, it is important to evaluate EDS because it is known to affect medication adherence, an essential facet of self-care.[36] However, within the HF population, limited information exists on whether daytime symptoms due to disturbed sleep influence cognitive function.

Only a few researchers have explored the relationships between sleep quality and cognition in individuals with HF and their findings have been inconsistent. Garcia et al[37] reported that 96% of older adults with HF experienced poor sleep quality as measured by the Pittsburgh Sleep Quality Index (PSQI) score, with a mean score of 15.23 (SD = 7.12). In this study, poor sleep quality was associated with reduced attention and executive function, but not memory.[37] Two other researchers examined whether specific sleep disorders were related to cognitive function. Knecht et al[38] examined 42 HF patients with SRBD and 138 HF patients without SRBD. Seventy-one percent had normal cognitive function according to the Modified Mini-Mental Status Examination. The patients with both HF and SRBD performed worse on tasks related to global cognitive function and attention as compared to HF patients without SRBD. Hjelm et al[39] examined whether or not SRBD and insomnia were associated with cognitive impairment in a sample of 137 older adults with HF. Their results indicated that 78% had normal global cognitive function according to the Mini-Mental Status Examination (MMSE) scores. Their study also showed that insomnia was associated with poor scores on global cognition, but that SRBD and EDS were not. Researchers did not explore the relationship between different dimensions of sleep quality and cognitive function.

The overall purpose of this study was to examine whether self-reported sleep quality and daytime symptoms among individuals with HF are associated with selected domains of cognitive function, specifically, attention, immediate memory, and executive function. The specific aims of this study are (1) to examine how global sleep quality and dimensions of sleep quality, such as sleep duration, sleep disturbances, sleep latency, and sleep efficiency, are related to cognitive function tests of attention, immediate memory, and executive function and (2) to examine how EDS and daytime dysfunction due to sleep disturbance are related to cognitive tests of attention, immediate memory, and executive function.

Methods

Using a descriptive, cross-sectional design, we conducted a secondary analysis of data from a larger study in which researchers documented the psychometric properties of a brief, but comprehensive neuropsychological battery in HF patients.[11,40] The original study was approved by the institutional review board.

Sample

Eighty patients with HF were recruited from a community-based, tertiary care HF clinic serving three mid-western states (Western Iowa, South Dakota, and Nebraska). Participants were age 50 or older and had a history of HF for at least six months prior to study enrollment. All participants were medically stable and had been on American Heart Association guideline-based[41] medication regimens for at least four weeks. Exclusion criteria included a) any signs of cardiovascular instability including but not limited to history of a myocardial infarction, unstable angina, coronary artery bypass surgery, percutaneous transluminal coronary angioplasty, or insertion of an implantable device including pacemaker or defibrillator within three months of study enrollment; severe renal failure defined by serum creatinine >2.5 mg per deciliter; or anemia, b) conditions known to affect cognitive function[42] including a previous diagnosis of dementia or neurological disease, such as Alzheimer's disease, Parkinson's Disease, epilepsy, or stroke; a history of substance abuse or treatment for substance abuse; aspartate aminotransferase (AST) > 40 units per liter for males or AST >72 units per liter for females, or an alkaline phosphatase (ALP) > 200 units per liter, and c) conditions that affect sleep (e.g., dysregulated sleep schedules or shift workers).

Measurements

Sleep quality

Sleep quality was measured using the PSQI. The PSQI is a self-report measure of global sleep quality. The instrument consists of 19 items that are grouped into seven subscales reflecting different dimensions of sleep, such as sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each subscale was weighted equally on a 0 to 3 scale, yielding a global score from 0 to 21. Poor sleep quality is defined as a global PSQI score ≥5. The measure has adequate internal consistency among adults (Cronbach's alpha = 0.83).[33] We reported the raw scores for sleep duration, sleep latency, sleep efficiency, and use of sleep medications subscales because they are meaningful descriptions of different dimensions of sleep quality.

EDS

The Epworth Sleepiness Scale (ESS) is a self-report questionnaire used to identify individuals with EDS.[35] Participants were asked to rate their likelihood of falling asleep during eight different daily situations. The scale covers normal to pathologic sleep propensities in particular situations (e.g., social conversation, watching TV, driving a car). Scores range from 0 to 24 with scores ≥10 indicating significant EDS. Researchers have demonstrated good construct validity and reliability of ESS in adults (Cronbach's alpha = 0.88).[43]

Dementia screening

The MMSE was used as a screening tool for dementia. MMSE scores <24 are considered to indicate dementia.[44] Using the standard cutoff point of 24, sensitivity and specificity are 98% and 89% respectively in older adults.[45]

Cognitive function

Cognitive function was measured using a comprehensive neuropsychological battery. The feasibility of using the neuropsychological battery has been documented elsewhere.[40] Briefly, the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a widely used measure of global cognitive function and five cognitive domains (immediate memory, visual/spatial

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