Cognitive Impairment in Heart Failure

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Heart failure is reaching epidemic proportions in the United States, causing a constellation of disabling symptoms. Cognitive impairment in people with heart failure may be more common than previously known with multiple etiologies from both the disease process and the treatment. Exemplars from a research study are used to illustrate the perspective of heart failure patients. Given the critical importance of memory deficits on patient education, potential nursing interventions to address the issue of cognitive impairment are described.

Keywords: Cognitive impairment, Heart failure, Memory.

Nearly 5 million people in the United States are living with heart failure (HF), with an estimated 550,000 new cases per year. An astounding $27.9 billion in direct and indirect costs is projected for 2005. Described as approaching epidemic proportions for HF treatment in the United States, HF is the only major cardiovascular condition still on the rise despite 30 years of advances in pharmacological and technologic discoveries. Almost half of the patients with HF are readmitted to the hospital within 6 months of discharge, with an average cost of $12,400 per admission.

A wide range of disabling symptoms, such as breathlessness/dyspnea, cognitive deficits, extreme fatigue, and edema, have been reported that greatly affect quality of life for people with HF. The complexity of self-care management needed by patients and families is an ongoing challenge and requires a myriad of thoughtful activities, including symptom analysis and interpretation, medication regimen management, health-promoting activities, and dietary adjustments. Multiple studies have reported major problems with compliance with medical treatment recommendations, particularly sodium restriction, smoking and alcohol cessation, and accurate medication regimens. One of the most difficult aspects of self-management is maintaining a low-sodium diet as part of a daily regimen. Successful therapeutic management depends heavily on the ability of the HF patient to actually understand the medication and diet regimen.

Cognitive impairment has received less attention as a symptom in HF than dyspnea and fatigue. One group of researchers studied 23 patients with HF (mean age of 60). Their spouses reported that some HF patients had severe, continuing cognitive impairment, including problems with concentration, memory, and attention. Other researchers evaluated 42 patients (mean age, 75) and found cognitive impairments in 28.6% of the sample and concluded that it was “relatively common” in this population. Still others reported that 35% of hospitalized HF patients (n = 526/1,511) in a large, multisite study had cognitive impairments. The purpose of this article is to discuss multiple etiologies of cognitive impairment in HF, to provide some exemplars of this symptom from a research study of people living with HF, and to suggest possible nursing interventions to address the issue.
Cognitive impairment has been reported in both HF and aging in general, and may affect the patient’s ability to integrate educational opportunities. Because most people with HF are elderly, the confounding effects of age on cognitive impairment need consideration in a discussion of etiologies. Although normal aging is not automatically associated with cognitive impairment, estimates of up to 17% of people age 65 and older do experience some degree of mild to moderate cognitive impairment, manifesting in memory problems, that is not considered as dementia. At about age 55, the prevalence of HF rises significantly in men from 1.8% of the population to 5.8%, and in women from 1.5% to 2.3%. Recently, researchers reported that cognitive impairment was 1.96 times greater in subjects with HF than in the general population 65 years and older (n = 1,075), independent of all other variables examined, including age, gender, education, diabetes, hypertension, smoking, alcohol consumption, systolic and diastolic blood pressure, geriatric depression score, and diabetes. Other investigators have reported cognitive difficulties in this population, including forgetfulness, attention, memory problems, decreased concentration, decreased attention, slower reaction time, and decreased concentration.

The precise origin of cognitive impairment in HF is thought to stem from a lack of an effective cardiac output to the brain, which alters oxygen and nutrient supply, increasing the risk for cognitive deterioration. Decreased cerebral perfusion (hypoperfusion) leads to a progressive loss of neurocognitive processes, causing neurobehavioral problems. This cerebral ischemic state is due to chronic or intermittent hypoperfusion and represents 1 of 2 leading theories about the etiology of cognitive impairment in HF. Low-output states, causing systemic hypotension with a decreased ejection fraction, are particularly seen in people with systolic HF. Gray matter loss was reported in 9 end-stage HF patients using T1-weighted magnetic resonance imaging, and was speculated that it most likely resulted from ischemia association with perfusion defects.

The role of brain blood flow as a link between HF and cognitive impairment is complex and has been the subject of considerable study. Cacciatore et al postulated a link between worsening HF and systolic blood pressure changes. As HF progresses and systolic blood pressure decreases, inhibitory input from arterial receptors decreases, and excitatory input increases with a subsequent increase of sympathetic activity. Sympathetic activation leads to an increase in heart rate, which represents one of the most important adaptive mechanisms for maintaining the pumping function of the heart during HF. Hypertension also qualifies as a risk factor for cognitive impairment, which may seem to contradict the findings about hypotension; however, either can be antecedent. Hypotension may be considered an index of HF severity and likely characterizes the most compromised patients.

The second leading theory about etiology of cognitive impairment focuses on cardiac mural emboli or multiple small emboli that travel from the heart to the brain causing areas of cerebral infarction. In addition, endothelial abnormalities in the brain, especially in small vessels, may contribute to the brain pathology.

Other explanations for at least some portion of cognitive impairment in HF have been proposed (see Figure 1). It is not the purpose of this article to discuss these in detail. Cognitive impairment may stem from the following: (1) medication use patterns; (2) effects of a wide range of pharmaceuticals; (3) anemia and low albumin levels; (4) electrolyte disturbances, including potassium and sodium; (5) sleep disorders common in both aging and HF; (6) estrogen levels in women; (7) thyroid disturbances commonly seen in HF; (8) depression; (9) fluid overload; (10) nutritional deficits including dehydration; (11) hyperglycemia; and (12) cardiac arrhythmias. Current drug therapies for HF (digitalis, diuretics, angiotensin-converting enzyme inhibitors, beta blockers, and calcium antagonists) are also known to influence cognitive function in some individuals.

Older people are particularly vulnerable to sleep disturbances because of age-related changes in the sleep cycle, such as lighter sleep with frequent awakenings, and overall sleep quality. Some patients report poor sleep outcomes of impaired memory and lack of ability to focus during the day. Increased mortality has been associated with excessive daytime sleepiness. Sedative-hypnotic drugs are often used to treat perceived insomnia and counter the effects of fatigue and cognitive impairment commonly felt with loss of sleep. However, serious adverse effects due to age-related physiological changes in body composition and drug metabolism can lead to accumulation and toxicity of sedative-hypnotic drugs.
drugs, as well as falls, delirium, slower reaction time, and impairment of memory and information processing. Depressed elderly people frequently report the inability to concentrate, loss of appetite, sleep problems, and low energy—all things that can be corrected if the depression can be resolved.30

Sleep apnea has been reported in HF patients.31 This condition is underdiagnosed in the US population in general and has recently been scrutinized for its high incidence in the HF population.32,33 Estimates are that as many as 40% to 50% of people with HF may also have some form of sleep disordered breathing, thus confounding the effects of cognitive impairment from multiple etiologies.34-36 Sleep disordered breathing broadly encompasses obstructive sleep apnea (upper airway instability causes mechanical obstruction to breathing) and central sleep apnea (absence of ventilatory effort), which have been found in people with HF.36

**MEMORY PHYSIOLOGY**

According to Guyton and Hall,37(p672) “memories are caused by changes in the sensitivity of synaptic transmission between neurons as a result of previous neural activity.” These changes, called memory traces, cause new or facilitated pathways to develop through the neural circuits of the brain, primarily in the cerebral cortex. Once established, the traces can be reactivated by the thinking mind to reproduce the memories.37

**Older Terminology**

Traditionally, nurses learned about categories as short-term, intermediate, and long-term memory. Short-term memory typically lasts for a few seconds to a few minutes at a time, lasting only as long as the person continues to think about the information, as a telephone number or fact. There is a speculation that this might occur because of a temporary memory trace through a circuit of reverberating neurons, although the precise mechanism is unknown. For short-term memory to be converted into long-term memory, it must become “consolidated”—the chemical, physical, and anatomic changes in the synapses must occur.37 The process requires 5 to 10 minutes for minimal consolidation and 1 hour or more for strong consolidation. A variety of psychological studies have demonstrated that rehearsal of the same information again and again in the mind accelerates and potentiates the degree of transfer of short-term memory into long-term memory, and thus, accelerates consolidation.37 The brain has a natural tendency to rehearse newly found information, especially data that catch the mind’s attention. The important features of sensory experiences become progressively more fixed in memory stores. A person who is wide awake can consolidate memories far better than a person who is in a state of mental fatigue. Codification of memories occurs—new memories are stored with old ones after the brain compares the data for similarities and differences.37

How long does the learning of new content for self-care last in one’s memory? There is hypothetical conjecture that patient and family education only lasts for a few weeks, stored only in intermediate long-term memory. Intermediate long-term memory may last from minutes to several weeks. Either habituation (insignificant response) or facilitation (pathway to memory storage up to weeks) can occur.37 Long-term memory seems to result from actual structural changes in the brain, instead of chemical changes alone. For example, electron microscope photos from invertebrate animals demonstrate multiple physical structural changes in the synapses during development of long-term memory traces. Within minutes after a memory training session is begun, a beginning increase in the number of neurotransmitter substance release sites in the terminal has been found with electron micrographs.37-39

**Contemporary Terminology**

Newer and more sophisticated terminology about memory is slowly making its way into recent literature used by clinicians. Perceptions about memory, including the concepts of “short-term” and “long-term,” have evolved to a more refined understanding and improved classification systems.40 A new way of looking at memory is to think in terms of “memory systems,” which are ways that the brain processes information that will be available for use at some later time. Different neuroanatomic structures have been identified.

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**Figure 1.** Etiologies of cognitive impairment in heart failure.
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that are related to different memory systems.⁴⁰ Some systems are associated with conscious awareness on the part of the person (called explicit) and can be consciously recalled (called declarative). Other memory systems are expressed with a change in behavior (implicit) and are typically unconscious (nondeclarative).⁴⁰ Four types of memory systems have been described (see Table 1). These memory classification systems provide a theoretical framework for the development of psychosocial interventions. The interventions may then target 1 or more of these types of memory systems as outcomes amenable to change.

These memory classification systems provide a theoretical framework for the development of psychosocial interventions.

SPOKEN BY PEOPLE LIVING WITH HEART FAILURE

In a recent study of people living with HF, researchers explored their perceptions of problems with memory and cognitive impairment. Eleven community-dwelling participants (8 men, 3 women; mean age, 74; range, 46-78 years) who were diagnosed with New York Heart Association (NYHA) Class II-IV HF described their experiences. The interviews were audiotaped and transcribed as spoken. The content was analyzed using the constant comparative technique.⁴¹,⁴² Questions used to probe for memory issues included the following: “Is your memory ever a problem?” “Do you think your memory affects how you manage your heart failure?” “Do you have a symptom of decreased attention span, confusion, or memory loss?” Of the 11 subjects, 8 described some cognitive impairment or memory concerns they felt or were reported by their spouses.

One subject, a man in his 70s, seemed to have some difficulty in answering the questions about memory and expressed an awareness of repeating himself in conversations and of difficulty of tuning into social settings. He described a feeling of confusion on many occasions: “That’s a good question. I don’t, you know, sometimes you seem to want to say I don’t think so. And I still want to say that, but I’m not sure. I think I do sometimes. Don’t really care what they’re saying or what’s going on or you know, sitting there more and I’m in a semi-daze. I try to stay alert and I think I do. But I’ve got enough sense to know that I’m not always getting it. You know that you can feel enough difference. I don’t know if you know what I’m trying to say. I catch myself when you’re out mixing with your own peers and a whole bunch of folks. But you know that you’re losing things because you catch yourself repeating and asking... It has nothing to do with age.” Here, he acknowledged recognition of the problem and also expressed his concern about whether others were aware of his cognitive limitations.

Participants described both harmful and positive issues related to their cognitive impairments. The youngest participant in the study, a 46-year-old woman, reported that she had overdosed on medications as a result of her memory deficits. She noted: “I do forget sometimes. So I had to get me one of those seven-day pill bottles and so I was kind of embarrassed that I had to do that. Because I’m so young. But I did get one of those and that helped me a lot because one day I took..."
too much.” Another subject described using his cognitive impairment as a positive tool as a result of understanding that there was a reason for it to happen in people with HF: “To a certain extent. It makes me more aware. I’m a little keener, I think now and I listen to my body and pick up on things so my memory—it helps me to stay on top of things.” Recognition and acceptance of memory problems was used to put more attention to trying to remember things.

Quite commonly, however, it was the spouse who was more aware of the cognitive impairment on a day-to-day basis. For example, when the interviewer asked the participant who was a Hispanic man in his 50s, “Do you have a decreased attention span, confusion, or memory loss?” the participant turned to his wife and asked: “How about that?” His wife answered: “Yes. Yes.” The subject responded: “I don’t think so—do you think my memory’s uh, worse than it used to be?” Again, his wife answered: “Oh, yes!” To this, the subject acknowledged, “Well, I guess it is. But I don’t, yeah, I don’t know that it’s in conjunction with my heart but yeah. Yeah, I write down things quicker.” (laughter). Another participant responded similarly to the question, “Is your memory a real problem?” He answered: “My wife thinks it is but (laughter). She should be here listening to this. You might have some corrections. You’d have some corrections.” When asked, “Do you think your memory affects how you manage your condition?” he responded “No. No. I mean, let’s put it this way. I mean, I do lists of things that I have to do. But that’s because I’m very organized. But then all considering, you know, that’s because I’ve been sick for many years and I…the house because and my job and I pay the bills. Well, yeah, I do have a list. I mean, I write a list of things but I think lots of people do that. I was going to say I do it. If I don’t write it down it doesn’t get done. Yeah, I mean, I uh, and its mostly for deadlines. You know. Monday I’m going to do this and Tuesday, I’m going to do this, and my wife, you know, that is not to do on Wednesday, I am planning to do that on Wednesday (Uh-huh). But it gives us something to work from.” Here, the participant described his effective use of external memory strategies, as lists and calendars, to help him remember important facts.

One man in his 70s spoke of his excellent but past memory, where he maintained a career by remembering streets and locations for delivery of furniture. He noted: “And I had things on my mind all the time, you know, and I kept going and then when I got sick and I could not work no more. I used to know all the streets all over town. I’d tell the driver now you go down the highway going west and you’ll come to a little turn in the road and there will be a sign that will say this and that. That’s where you turn right there for Mrs. So and So’s house. And I’d say you just go on up there and I left them these directions and I’d route out the trucks. I’d route them out.”

**CAN WE IMPROVE COGNITIVE FUNCTION BY MEMORY ENHANCEMENT?**

No research studies about interventions for memory enhancement in people with HF were found in a literature search; however, many studies of community-dwelling elderly have been reported. A meta-analysis of the effectiveness of memory training and pre-to-posttest gains on episodic memory tasks in healthy subjects 60 years and older was reported, with 33 studies retrieved. The results indicated that the elderly benefited more from mnemonic training than either control or placebo treatments—mnemonics are memory aids, such as short rhymes, phrases, or other mental techniques for making information easier to memorize. Other results included the following: even in old age, memory remains plastic (plasticity = the range of intraindividual differences); and performance gains were largest in subjects who were younger, when pretraining was provided, when training was carried out in groups, or when the sessions were relatively short. Researchers reported that longer sessions were less effective, which was attributed to fatigue—the median duration of sessions reported in the meta-analysis was 1.5 hours (range, 20 minutes to 2.5 hours).

McDougall has conducted several memory intervention studies for older adults. Dellefield and McDougall reported an intervention testing the effects of a 2-week, four 1-hour session group intervention with 74 older adults designed to increase metamemory and memory performance and to evaluate the influence of depression on memory self-efficacy. Content focused on attitudes toward memory and aging, as well as information on how memory works and changes with age. The intervention significantly increased both memory self-efficacy and memory performance. In addition, the treatment group’s perceptions of control in memory-demanding situations were strengthened, and their perception of negative changes in memory over time was diminished. As expected, individuals with depression had significantly lower metamemory scores than nondepressed subjects, but no difference was found in memory performance. At a 2-week postintervention follow-up, subjects receiving the intervention maintained their improved memory beliefs, whereas the control group showed a significant decline.

More recently, McDougall conducted a memory enhancement research study for community-dwelling older adults aimed at improving everyday memory.
The 8 intervention sessions lasted for 1.5 hours and focused on strategy training. The typical participant was 82 years old. Those individuals with heart disease made the largest gains in memory performance, in particular, on the prospective (future intention) memory item to remember an appointment. There were 16 individuals in this group from an assisted living facility and 5 had heart disease.

**IMPLICATIONS FOR PRACTICE IN ACUTE AND CRITICAL CARE SETTINGS**

All patients with HF should be screened for the presence of cognitive impairment and depression. These assessments can take the form of asking systematic questions to the patient and family members to ascertain any difficulties in memory, concentration, attention, and solving problems. In the early stages of HF, cognitive impairment may be intermittent or subtle and not easily recognized. Thus, routine, periodic screening may be needed to detect it and address it as soon as possible.

Many practitioners are integrating reliable and valid instruments for routine screening of cognitive impairment into clinical settings. Some of the instruments reported in the literature include the Mini-Mental Status Examination, the Draw-a-Clock Test, the Global Deterioration Rating Scale, the Metamemory in Adulthood Questionnaire, and the Geriatric Depression Scale. Informative comparisons of some of the valid and reliable measures of cognitive function are reported by several researchers.

Sensitivity to the implications of cognitive impairment is an important part of nursing care of patients with HF, regardless of the setting of care. In acute and critical care settings, however, it is particularly significant because of the patient’s need for understanding in order to give informed consent for procedures and for understanding the meaning of vital communication about health, at home care, and the full range of treatment choices. Patients may be unaware of their own memory deficits, thus, including the family in all patient teaching is essential. A low Mini-Mental Status Examination score predicted nonparticipation in an intervention; thus, a recognition of the role of potential memory impairment as a component of cognitive function is needed. A knowledge of possible causes of cognitive impairment should prompt a wide search of these possible etiologies and determine if any can be resolved with treatment adjustments. Among patients with abnormal laboratory findings on admission, restoration of hemoglobin levels, potassium, and normal glucose during the hospital stay was associated with improved cognitive ability at discharge. Providing support and careful referrals including psychological testing may be needed.

**CONCLUSIONS/SUMMARY**

Because of the high incidence of HF, most nurses are likely to encounter patients in their practice. Recognition of the incidence of potential cognitive impairment in this population is necessary to provide more holistic care. Clinicians need to use evidence-based assessment instruments to routinely screen for it as part of HF care. Strategies to evaluate possible solutions should be part of the treatment plan. Many people with HF have been found to have poor self-care abilities; thus, a recognition of the role of potential memory impairment as a component of cognitive function is needed. A knowledge of possible causes of cognitive impairment should prompt a wide search of these possible etiologies and determine if any can be resolved with treatment adjustments. Among patients with abnormal laboratory findings on admission, restoration of hemoglobin levels, potassium, and normal glucose during the hospital stay was associated with improved cognitive ability at discharge. Providing support and careful referrals including psychological testing may be needed.

**Acknowledgments**

Funding was received from the Dean’s Research Award grant (Dean Dolores Sands), and The Center for Health Promotion and Disease Prevention Research in Under-served Populations (NIH/NINR grant #5P30NRO5051, Dr. Alexa Stuifbergen, PI), the University of Texas at Austin School of Nursing, Austin, Texas.

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