Depression in Patients With Heart Failure: Prevalence, Pathophysiological Mechanisms, and Treatment

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PRIME POINTS

- Depression is a common comorbid condition in patients with heart failure.
- Biological, psychological, and social aspects of morbidity and mortality in heart failure can be integrated in a holistic model.
- Four major pathophysiological changes occur both in patients with depression and in patients with heart failure.
- Detect depression in patients with heart failure by using a symptom inventory and then an interview to confirm the results.

As treatment of cardiovascular diseases improves and the population ages, the incidence and prevalence of heart failure are increasing. More than 5 million patients in the United States are living with heart failure, and 550,000 new cases are diagnosed each year. The estimated prevalence of depression is 100 cases per 1000 persons in the population more than 65 years old. Strong evidence links depression to increased morbidity and mortality in patients with coronary heart disease, the underlying cause of half of the cases of heart failure. Depression is associated with mortality in outpatients, inpatients, and hospitalized patients who have heart failure. The association of depression with mortality in these patients is independent of anxiety and social isolation. In a sample of patients (N=153) enrolled in the Sudden Cardiac Death in Heart Failure Trial, depression (P=.02, hazard ratio = 2.2) was an independent predictor of mortality after controls for significant demographic and clinical predictors of mortality, anxiety, social support, and treatment group. On the basis of analysis via the Cox proportional hazards model, patients with mild depression were 2.2 times as likely to die as those who were not depressed. Mortality due to all causes was 12% for patients with depression and 9% for others.

In this article, we describe a holistic model for cardiovascular health and apply it to depression in heart failure, summarize the pathophysiological changes in depression that may contribute to increased morbidity and mortality of patients with heart failure, and review the growing literature on the prevalence of depression in patients with heart failure. We also discuss assessment of depression in patients with heart...
failure and implications for nursing practice. Future research is proposed.

**Biopsychosocial Holistic Model of Cardiovascular Health**

Thomas et al.\(^{11,19-22}\) have proposed a holistic model of cardiovascular health in which biological, psychological, and social realms interact within each person and are integrated into health (Figure 1). Health interacts with factors in each realm to affect all other realms. Acute and chronic shifts in each realm affect health status, and health status affects biological, social, and psychological factors. Psychosocial factors either promote health by moderating pathological processes or promote disease by enhancing the processes. In the psychological realm, depression, anxiety, and life stress diminish health.\(^{11,11}\) In the social realm, social support and pet ownership promote health.\(^{21,23-25}\) Social and psychological factors affect the biological factors. Depression alters levels of cortisol, catecholamines, and cytokines; autonomic neurocardiac regulation; and factors that influence cardiovascular functioning. The holistic model provides the basis for a dynamic interactive approach to the assessment and treatment of depression in patients with heart failure.

**Impact of Pathophysiological Changes in Depression on Heart Failure**

Examination of the physiology of depression in patients with heart failure illustrates the integration of physiological and psychological factors in cardiovascular health. Depression causes physiological changes that are associated with increased morbidity and mortality in patients with heart failure.\(^{21}\) Four pathological patterns that occur in depressed patients correspond to the pathogenesis of heart failure: neurohormonal activation,\(^{26,27}\) hypercoagulability,\(^{26,27}\) autonomic neurocardiac dysfunction,\(^{26,27}\) and cytokine release\(^{27}\) (Figure 2). These pathophysiological changes are thought to mediate the increased risk for cardiac events in people who are depressed and the subsequent poor prognosis if such events occur.\(^{27,29}\)

**Neurohormonal Activation**

Endogenous neurohormones are activated in patients with heart failure as a result of increased left ventricular filling pressure that stimulates the activation of norepinephrine, renin-angiotensin-aldosterone, vasopressin, and endothelin 1. Activation of these systems results in both vasoconstriction and volume expansion.\(^{28,30,31}\)

Patients with depression experience increased activation of the nervous system via hyperreactivity of the hypothalamic-pituitary-adrenal axis, leading to increased release of cortisol into the bloodstream.\(^{26,27}\) Elevated levels of serum cortisol cause high blood pressure, high levels of blood lipids, insulin resistance, and abdominal obesity.\(^{26,27}\) Over time, these factors have a long-term deleterious effect.

Hyperactivity of the hypothalamic-pituitary-adrenal axis also mediates hyperreactivity of the sympathetic nervous system as indicated by elevated plasma levels of norepinephrine and increased catecholamine

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Evidence supports a relationship between mortality and increased levels of catecholamines, most likely a result of a decrease in the number of β₁-adrenergic receptor sites, decreased sensitivity to adrenergic stimulation, inadequate myocardial remodeling, myocardial toxic effects, and increased tendency for ventricular arrhythmias. Additional research is needed to determine if catecholamine levels are elevated in patients with heart failure who are depressed.

Both hypercortisolism and increased norepinephrine levels increase blood coagulation. Hypercortisolism causes increases in the levels of factor VIII and von Willebrand factor and a decrease in fibrinolysis. Elevated norepinephrine levels are associated with increased coagulation and fibrinolysis.

Hypercoagulability
Increased platelet aggregation in cardiac patients who are depressed increases their vulnerability to thrombus formation, myocardial infarction, and stroke. Evidence of the effects of coagulation abnormalities in patients with heart failure is inconclusive. Abnormalities in platelet function in patients with untreated depression may cause platelet aggregation, leading to thrombus formation. Patients with depression have increases in the number of platelet receptors for serotonin 5-HT₂A. Even though the relationship between these receptors and platelet activation is not known, platelet reactivity is reduced in patients treated with selective serotonin reuptake inhibitors (SSRIs), one type of antidepressant. Additional research is needed to determine the relationship between depression, platelets, and outcomes for patients with heart failure.

**Figure 2** Schematic model of the pathophysiological changes in depression and heart failure. † indicates increase; ‡ indicates decrease.
Autonomic Neurocardiac Dysfunction

Changes in autonomic neurocardiac regulation occur both in patients with depression and in patients with heart failure. In heart failure and depression, patients experience increased sympathetic activity as well as decreased parasympathetic activity. In the healthy heart, the parasympathetic nervous system works as a homeostatic mechanism to balance sympathetic cardiac stimulation. Because of decreased parasympathetic activity in depression and heart failure, patients with these conditions are more likely to experience cardiac arrhythmias than are patients with other abnormalities. Heart rate variability, a measure of beat-to-beat alterations in heart rate, is used to measure autonomic neurocardiac dysfunction. The time domain measure of heart rate variability, which is the standard deviation of all normal-to-normal R-to-R intervals in a 24-hour period, strongly reflects circadian rhythms, as well as neuroendocrine rhythms, activity, and other factors. The normal standard deviation is greater than 100 milliseconds. Reduced heart rate variability correlates with reduced parasympathetic activity or decreased vagal tone and with increased mortality. Depression is associated with reduced heart rate variability in patients with heart failure.

Cytokine Cascade

Cytokines are low-molecular-weight proteins that function as chemical communicators within and between cells. Although all of the mechanisms of actions of cytokines are not yet conclusively established, evidence indicates that these proteins are critical components in the immune response. According to their role in the immune response and inflammation, cytokines are categorized as proinflammatory or anti-inflammatory. The unique receptors for cytokines promote or inhibit the activities of these proteins. Cytokine inhibitors decrease potential tissue injuries by limiting a prolonged inflammatory response. Proinflammatory cytokines include interleukin 1 (IL-1), IL-6, and tumor necrosis factor α (TNF-α). Levels of IL-1, IL-6, and TNF-α are elevated in patients with heart failure.

Three mechanisms are proposed to explain the actions of proinflammatory cytokines in heart failure. The first possibility is that cytokines are activated in response to the myocardial injury that triggers heart failure. The second possibility is that the heart is the source of TNF-α. This increase in TNF-α triggers a secondary activation of the immune system by triggering the hypothalamic-pituitary-adrenal axis and thereby increasing levels of corticosteroids. The third possibility is that the decreased cardiac output in heart failure causes underperfusion of systemic tissues and leads to the elaboration of TNF-α. Edema of the gut wall allows translocation of endotoxin, which in turn induces cytokine production.

Serum levels of IL-1, IL-6, and TNF-α are elevated in patients with major depression. Elevation in cytokines produces inflammation. The end result of the inflammation is left ventricular remodeling, contractile dysfunction, and uncoupling of myocardial β-adrenergic receptors. TNF-α increases pulmonary vascular permeability and pulmonary edema and produces myocardial necrosis.

Clinical Features Common to Both Depression and Heart Failure

The overlapping signs and symptoms of depression and heart failure make the diagnosis of depression in patients with heart failure challenging. It is often unclear whether a patient’s signs and symptoms indicate heart failure or heart failure with depression.

The essential feature required for the diagnosis of depression, according to the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV), the most recently published criteria for the diagnosis of psychiatric disorders, is a period of at least 2 weeks with depressed mood or a loss of interest in pleasurable activities (Table 1). A person with heart failure often has both of these symptoms because of the decreased cardiac output that accompanies heart failure. Decreased cardiac output leads to poor physical functioning. Poor physical function is associated with depressed mood and loss of interest, particularly in younger patients. Once this criterion is met, the diagnosis of clinical depression depends on the presence of 7 additional signs and symptoms. The presence of any 4 of them is required for a diagnosis of major depression and any 3 of them for a diagnosis of minor depression. Lack of appetite and weight loss in patients with heart failure may be a consequence of decreased mesenteric circulation and diminished ability to absorb nutrients. Weight gain is a
consequence of water retention in heart failure. Hypersomnia, or sleeping for prolonged periods during the day, may also occur in patients with heart failure as a consequence of compromised cardiac output and low energy levels. Fatigue or loss of energy is a core symptom of both depression and heart failure. Patients with heart failure often report restlessness or insomnia at night caused by shortness of breath, orthopnea (degree of shortness of breath when lying flat), and paroxysmal nocturnal dyspnea (being awakened from sleep by shortness of breath). In a study by Redeker, when demographics, comorbid conditions, and physical function were controlled for, differences in depression between patients with heart failure and a control group of members of the community were explained by sleep disturbances, fatigue, and excessive daytime sleepiness. Feelings of worthlessness, trouble concentrating, and thoughts of dying can be caused by the poor general quality of life that often accompanies progressive heart failure.

Assessment of Depression in Patients With Heart Failure

The 2 major challenges in evaluating depression in patients with heart failure are the setting in which the assessment is conducted and the variety of methods and tools used to measure depression. Depression in patients with heart failure is assessed in either the hospital or the outpatient setting. When patients with heart failure are hospitalized, the purpose is to address acute exacerbations of the signs and symptoms of heart failure. The pathological changes that occur as a result of the episodes that lead to hospitalization can increase the signs and symptoms of depression. Once the heart failure is under control, the depressive signs and symptoms may abate. Assessment of depression in patients with heart failure is more reliable in outpatients whose signs and symptoms of heart failure are more stable.

Two basic methods are used to assess depression: structured diagnostic interviews conducted by trained clinicians and symptom inventory self-reports by patients. Diagnostic interviews are designed to categorize individuals as meeting or not meeting the DSM-IV criteria for major and minor depression. Diagnostic interviews must be conducted by trained mental health professionals, including nurses with appropriate training, who are unfamiliar to the patient. In face-to-face interviews, the level of depression may be underestimated because patients are reluctant to admit to symptoms of depression. Structured diagnostic interviews are time and personnel intensive.

The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) and the Diagnostic Interview Schedule (DIS) are the 2 interviews used most often to detect major depression. The SCID-I is a semistructured questionnaire designed to provide reliable and valid detection of psychiatric disorders, including mood and anxiety disorders. The SCID-I takes 45 to 90 minutes to complete. The interrater reliability and test-retest reliability (k statistic) for major depressive disorder were 0.80 and 0.61, respectively, for the patients’ edition. The DIS is the fully structured questionnaire designed to provide reliable and valid detection of psychiatric disorders on the basis of

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Table 1 Criteria for major depression

<table>
<thead>
<tr>
<th>One of the following 2 symptoms:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depressed mood (feeling sad or low)</td>
</tr>
<tr>
<td>2. Loss of interest or pleasure in nearly all activities</td>
</tr>
</tbody>
</table>

PLUS 4 additional signs/symptoms from the following:

| 3. Significant loss of appetite or weight loss or gain |
| 4. Insomnia or hypersomnia |
| 5. Psychomotor agitation or retardation |
| 6. Fatigue or loss of energy |
| 7. Feelings of worthlessness or guilt |
| 8. Impaired thinking or concentration; indecisiveness |
| 9. Suicidal thoughts/thoughts of death |

Signs/symptoms must last at least 2 weeks

Signs/symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning

Signs/symptoms are not due to the effects of drugs or general medical condition

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a Data from American Psychiatric Association.
b Also common in patients with heart failure.
c Information in McCance and Huether.
d Information in Redeker.
e Information in Juenger et al.
f Information in Hobbs et al.
the DSM-IV. The DIS takes 90 to 120 minutes to administer. With the SCID-I as a clinical standard, the sensitivity and specificity were 0.25 and 0.98, respectively. Interrater reliabilities (κ statistic) of SCID-I for major depressive episode, suicidal ideation, and suicide attempts were 0.67, 0.76, and 0.80, respectively.

Self-report symptom inventories provide quantification of the number and severity of depressive symptoms a person is experiencing during a specified time in relation to the continuum of possible symptom experience. The scores indicate the relative strength of the symptoms. Thresholds for symptom severity indicate categories of strength of the symptoms, for example mild, moderate, or severe. A familiar clinician often asks a patient to complete a depression symptom inventory. The inventory approach allows patients some confidentiality and privacy as they answer questions about their emotional states. Self-report symptom inventories are less expensive than diagnostic interviews because the former take less clinician time and can be self-administered.

A summary of the self-report symptom inventories used to assess depression in studies of patients with heart failure is included in Table 2. It includes the name, use, number of items contained, the possible range of scores, and information about reliability and validity for each tool. The tools most commonly used to assess depression in patients with heart failure are the Geriatric Depression Scale, Center for Epidemiological Studies Depression Scale, Beck Depression Inventory and Beck Depression Inventory II, and the Zung Self-rating Depression Scale. The number of items on these scales ranges from 20 to 30. The scales are all written at an easy reading level, and each one takes less than 5 minutes to administer. All of these tools have good reliability and validity. Scales with fewer items, such as the Hospital Anxiety and Depression Scale, have lower sensitivity and specificity, indicating that they are less good for classifying patients correctly as depressed (false-positives) and incorrectly as not depressed (false-negatives). The Geriatric Depression Scale is slightly longer than the other tools and is specifically tailored for the older population in which heart failure is most common.

The appropriate instrument to use to assess depression depends on the purpose and context of the assessment. The gold standard for diagnosing major depression in the community or in nonpsychiatric patients is screening with a self-report inventory followed by an interview to confirm the diagnosis. Symptom inventories are useful to examine the relative strength of symptoms of depression, especially in patients who have depressive symptoms that are not severe enough to constitute a psychiatric disorder. Symptom inventories are particularly useful for examining changes in depressive symptoms during the course of an individual’s life and the effectiveness of interventions for reducing depression.

Prevalence of Depression in Patients With Heart Failure

Increased awareness of the potential role of depression in morbidity and mortality related to heart failure has led to assessment of the prevalence of depression among patients with heart failure. In a 2003 review of depression and heart failure, 8 articles, 5 on hospitalized patients and 3 on outpatients, provided data on the prevalence of depression among patients with heart failure. Now, 14 additional articles substantiate the evidence of the high prevalence of depression in patients with heart failure.

The prevalence of depression in patients with heart failure varies considerably from study to study. The wide range, 77.5% to 13%, reflects both the assessment settings and the tools used. Table 3 summarizes the 22 recent studies that provide prevalence of depression in patients with heart failure. The table includes the setting in which depression was assessed; the size, sex, and age of the sample population; the tool or tools used for assessment; and the prevalence of depression. Studies in which depression was assessed via chart review are not included; this method is unreliable because of inconsistent assessment, reporting, and documentation. In the 12 studies of hospitalized patients with heart failure, depression was assessed solely with self-report symptom inventories in 7, solely with interviews in 1, and with both self-report symptom inventories and interviews in 4. Prevalence of depression in studies in which symptom inventories were used ranged from 77.5% with the Geriatric Depression Scale to 22.6% with the Medical Outcome Study Depression Questionnaire. Interviews with hospitalized patients resulted in a prevalence of 36% with the DIS or the DIS and SCID-I to 13.9% with the DIS after screening with the Beck Depression Inventory.
In the 10 studies of outpatients with heart failure, depression was assessed solely with symptom inventories in 9,13,14,17,87,104-106,108,109 and solely with interviews in 1,107. The prevalence of depression in studies in which symptom inventories were used ranged from 48% with the Beck Depression Inventory57 to 13% with the Zung Self-rating Depression Scale.14 Interviews resulted in prevalences of 29% with the Primary Care Evaluation of Mental Disorders tool107 and 14% with the SCID-I.108 Outpatients had lower prevalence of depression compared to inpatients.

Table 2 Summary of the characteristics of the tools used to assess depression in studies of patients with heart failure.

<table>
<thead>
<tr>
<th>Scale sources</th>
<th>Characteristics</th>
<th>Reliability</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use</td>
<td>Method</td>
<td>Items</td>
</tr>
<tr>
<td>BDI69-72</td>
<td>Id/S</td>
<td>Self</td>
<td>21</td>
</tr>
<tr>
<td>BDI-II73-75</td>
<td>Id/S</td>
<td>Self</td>
<td>21</td>
</tr>
<tr>
<td>CES-D55,70,72,78</td>
<td>Id/S</td>
<td>Self /INTW</td>
<td>20</td>
</tr>
<tr>
<td>GDS55,77,79</td>
<td>Id/S</td>
<td>Self</td>
<td>30</td>
</tr>
<tr>
<td>HADS56,60-62</td>
<td>Id/S</td>
<td>Self</td>
<td>7</td>
</tr>
<tr>
<td>HAMD63-66</td>
<td>Id/S</td>
<td>INTW</td>
<td>17</td>
</tr>
<tr>
<td>MOS-D87,88</td>
<td>Id/S</td>
<td>Self</td>
<td>8</td>
</tr>
<tr>
<td>PRIME-MD5,60-61</td>
<td>Id</td>
<td>INTW</td>
<td>27</td>
</tr>
<tr>
<td>SDS72,82,83</td>
<td>Id/S</td>
<td>Self</td>
<td>20</td>
</tr>
</tbody>
</table>

Abbreviations: BDI, Beck Depression Inventory; BDI-II, Beck Depression Inventory, Version II; CDS, Cardiac Depression Scale; CES-D, Center for Epidemiological Studies Depression Scale; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th edition; GDS, Geriatric Depression Scale; HADS, Hospital Anxiety and Depression Scale (depression component only); HAMDS, Hamilton Depression Rating Scale; Id/S, identification of patients who are depressed/scale indicating relative severity of depressive symptoms; INTW, interview; MADRS, Montgomery-Asberg Depression Rating Scale; MCS, Mental Component Score of SF-36 Health Survey; MOS-D, Medical Outcome Study, Depression Scale; PHQ-9, Patient Health Questionnaire 9; PRIME-MD, Primary Care Evaluation of Mental Disorders (depression only); SDS, Zung Self-rating Depression Scale; STAI, State-Trait Anxiety Inventory (State and Trait scales).

a Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) and the Diagnostic Interview Schedule (DIS) are not included in the table because they do not contain items or produce scores.
b Cut point, scores greater than this number indicate depression in sensitivity and specificity analysis; when 2 scores are given, not depressed is less than the lower score and depressed is greater than the higher score.
c No score = diagnostic categories result.
d Major depression/minor depression.
e Mean of 10 samples from 7 articles.
f Revised BDI.
depression than did inpatients, and interviews resulted in fewer diagnoses of depression in patients with heart failure than did symptom inventories.

Women are 1.7 times as likely as men to experience significant depression in their lifetimes110; however, most studies of depression in patients with heart failure do not provide separate data for men and women. In the single study67 that did, in outpatients with heart failure, 64% of the women and 44% of the men were depressed. The percentages of men and women who were included in studies of depression in patients with heart failure were examined to evaluate the effect of sex on the prevalence of depression. In the 2 studies with the highest proportion of men, prevalence of depression assessed with checklists ranged from 36%13 to 42%.105 Major depression was diagnosed by using the SCID-I in 14% of heart failure outpatients in a sample that was 83% men.105 The prevalence of depression in men and women with heart failure was similar. These data suggest that men with heart failure are more likely to become depressed than are men in the general population.

### Treatment of Depression in Patients With Heart Failure

Although depression is a common comorbid condition in patients with heart failure, treatment of depression in patients with heart failure has not been specifically examined in any large clinical trial. The National Institute of Mental Health is currently funding a phase 2 clinical trial, Antidepressant Medication Treatment for Depression in Individuals With Chronic Heart

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**Table 3** Summary of characteristics of patients with heart failure included in studies of the prevalence of depression among patients with heart failure and of the tools used to assess depression in each study.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population</th>
<th>Sample</th>
<th>Male, %</th>
<th>Age, mean, y</th>
<th>Tool</th>
<th>% Depressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freedland et al94 1991</td>
<td>Hospitalized</td>
<td>60</td>
<td>43.3</td>
<td>78.4</td>
<td>DIS</td>
<td>17</td>
</tr>
<tr>
<td>Fraticelli et al96 1996</td>
<td>Hospitalized</td>
<td>50</td>
<td>50</td>
<td>77</td>
<td>GDS</td>
<td>54.2</td>
</tr>
<tr>
<td>Koenig98 1998</td>
<td>Hospitalized</td>
<td>107</td>
<td>47.7</td>
<td>55.1</td>
<td>CES-D, DIS, HAM-D</td>
<td>58</td>
</tr>
<tr>
<td>Friedman and Griffin99 2001</td>
<td>Hospitalized</td>
<td>170</td>
<td>51.2</td>
<td>72.7</td>
<td>CES-D</td>
<td>30</td>
</tr>
<tr>
<td>Jiang et al57 2001</td>
<td>Hospitalized</td>
<td>331</td>
<td>26.5</td>
<td>63.7</td>
<td>BDI and DIS</td>
<td>35.3/13.9</td>
</tr>
<tr>
<td>Vaccarino et al95 2001</td>
<td>Hospitalized</td>
<td>391</td>
<td>56.0</td>
<td></td>
<td>GDS</td>
<td>77.5</td>
</tr>
<tr>
<td>Tsay and Chao96 2002</td>
<td>Hospitalized</td>
<td>100</td>
<td>61</td>
<td>65.4</td>
<td>GDS</td>
<td>70.0</td>
</tr>
<tr>
<td>De Geest et al97 2003</td>
<td>Hospitalized</td>
<td>109</td>
<td>47</td>
<td>80</td>
<td>GDS</td>
<td>43</td>
</tr>
<tr>
<td>Freedland et al98 2003</td>
<td>Hospitalized</td>
<td>682</td>
<td>47.7</td>
<td>66</td>
<td>BDI and DIS</td>
<td>51/36</td>
</tr>
<tr>
<td>Fulop et al99 2003</td>
<td>Hospitalized</td>
<td>203</td>
<td>76.8</td>
<td>76.8</td>
<td>GDS and SCID-I/NP</td>
<td>36.0</td>
</tr>
<tr>
<td>Jünger et al100 2005</td>
<td>Hospitalized</td>
<td>209</td>
<td>86.1</td>
<td>55</td>
<td>HADS</td>
<td>30.1</td>
</tr>
<tr>
<td>Rumsfeld et al101 2005</td>
<td>Hospitalized</td>
<td>634</td>
<td>64.5</td>
<td>64.5</td>
<td>MOS-D</td>
<td>22.6</td>
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<tr>
<td>Havranek et al102 1999</td>
<td>Hospitalized</td>
<td>45</td>
<td>68.9</td>
<td>54</td>
<td>CES-D</td>
<td>24.4</td>
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<tr>
<td>Murberg et al103 1998</td>
<td>Outpatient</td>
<td>119</td>
<td>71.4</td>
<td>66</td>
<td>SDS</td>
<td>13</td>
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<tr>
<td>Skotzko et al104 2000</td>
<td>Outpatient</td>
<td>33</td>
<td>90.9</td>
<td>65.4</td>
<td>CES-D</td>
<td>42</td>
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<tr>
<td>Steptoe et al105 2000</td>
<td>Outpatient</td>
<td>60</td>
<td>66.7</td>
<td>47</td>
<td>HADS</td>
<td>22</td>
</tr>
<tr>
<td>Rumsfeld et al106 2003</td>
<td>Outpatient</td>
<td>460</td>
<td>75</td>
<td></td>
<td>MOS-D</td>
<td>30</td>
</tr>
<tr>
<td>Gottlieb et al107 2004</td>
<td>Outpatient</td>
<td>155</td>
<td>78.7</td>
<td>64</td>
<td>BDI</td>
<td>48</td>
</tr>
<tr>
<td>Sullivan et al108 2004</td>
<td>Outpatient</td>
<td>142</td>
<td>77.5</td>
<td>53.2</td>
<td>PRIME-MD</td>
<td>29</td>
</tr>
<tr>
<td>Haworth et al109 2005</td>
<td>Outpatient</td>
<td>100</td>
<td>83</td>
<td>67</td>
<td>SCID-I</td>
<td>14.0</td>
</tr>
<tr>
<td>Westlake et al110 2005</td>
<td>Outpatient</td>
<td>200</td>
<td>84</td>
<td>57</td>
<td>BDI</td>
<td>47.5</td>
</tr>
<tr>
<td>Friedmann et al111 2006</td>
<td>Outpatient</td>
<td>153</td>
<td>89.9</td>
<td>60.6</td>
<td>BDI-II</td>
<td>36</td>
</tr>
</tbody>
</table>

Abbreviations: BDI, Beck Depression Inventory; BDI-II, Beck Depression Inventory, Version II; CES-D, Center for Epidemiological Studies Depression Scale; DIS, Diagnostic Interview Schedule; GDS, Geriatric Depression Scale; HADS, Hospital Anxiety and Depression Scale (depression component only); HAM-D, Hamilton Depression Scale; MOS-D, Medical Outcome Study, Depression Scale; PRIME-MD, Primary Care Evaluation of Mental Disorders (depression only); SCID-I/NP, Structured Clinical Interview for DSM-III-R, Nonpatient Edition; SDS, Zung Self-rating Depression Scale.
Failure, to examine the use of the SSRI sertraline to reduce depression and to examine the effect of the drug on mortality and secondary cardiac incidents in patients with heart failure.\textsuperscript{111}

Other nonpharmacological treatments of depression in patients with heart failure are promising. Exercise is widely accepted as helpful in relieving depression and improves functional ability and quality of life.\textsuperscript{63,112-114} In one study,\textsuperscript{115} the combination of biofeedback and relaxation decreased depression in patients with heart failure. Although exercise and biofeedback-relaxation are promising as interventions to decrease symptoms in patients with heart failure, their effectiveness in patients with heart failure who also have depression has not been addressed in clinical trials. Because the safety of pharmacological agents in the treatment of depression in patients with heart failure remains uncertain, nurse researchers should consider examining the efficacy of non-drug alternatives such of yoga, which has shown promise in reducing risk factors associated with cardiovascular disease\textsuperscript{106} and in alleviating depression.\textsuperscript{117,118}

Electroconvulsive therapy is often used when patients with ischemic heart disease experience life-threatening depression.\textsuperscript{109} This therapy may be unsuitable for use in patients with heart failure because it often is followed by a period of bradycardia and hypotension and then sinus tachycardia and elevated blood pressure and even dysrhythmias.\textsuperscript{109,120} Research is needed to evaluate the risks and benefits of electroconvulsive therapy in patients with heart failure and depression.

Healthcare providers must rely on evidence from trials of treatment of depression after myocardial infarction to treat depression in patients with heart failure; and those results are inconclusive. In large clinical trials, antidepressant medication reduced depression, but not morbidity or mortality. In the Sertraline Antidepressant Heart Attack Randomized Trial (SADHART), sertraline had no adverse effects on left ventricular ejection fraction and fewer adverse cardiovascular events than did a placebo in patients (N=369) hospitalized for acute myocardial infarction or unstable angina.\textsuperscript{121} More recently, in the Canadian Cardiac Randomized Evaluation of Antidepressant and Psychotherapy Efficacy (CREATE) trial,\textsuperscript{122} in patients with coronary artery disease (N=284), treatment with citalopram, an SSRI, for 12 weeks significantly reduced depression more than a placebo did; short-term psychotherapy had no benefit. In the Enhancing Recovery in Coronary Artery Disease (ENRICHED) clinical trial,\textsuperscript{123} cognitive behavioral therapy, supplemented with an SSRI when indicated, decreased depression significantly but did not alter cardiovascular morbidity or mortality in patients after myocardial infarction (N=2481).

Tricyclic antidepressants and SSRIs have been tested in cardiac patients and are the most commonly prescribed antidepressants in this population. Providers may be reluctant to prescribe antidepressants because the drugs have significant side effects and may interact with other medications. These concerns deserve serious consideration. Although possibly more effective than the SSRIs in relieving depression, tricyclic antidepressants can cause increased heart rate,\textsuperscript{124} orthostatic hypotension, conduction abnormalities, and hypertension.\textsuperscript{124,126} Nelson et al\textsuperscript{127} compared the SSRI paroxetine to the tricyclic antidepressant nortriptyline in patients with ischemic heart disease. Although depression scores improved in both groups, more patients in the nortriptyline group discontinued their antidepressant because of adverse events. In several studies with small sample sizes, SSRIs were modestly effective in relieving depression in patients with acute coronary syndrome\textsuperscript{128,129} but interacted with medications that used the cytochrome P450 pathway, thereby increasing the actions of those drugs.\textsuperscript{130} For example, administration of an SSRI to a patient taking coumadin elevated the patient’s international normalized ratio, increasing the likelihood of a bleeding episode.

**Nursing Implications**

**Assessment**

Nurses who care for patients with heart failure in critical care settings can benefit from an understanding of depression, its physiological basis, its contribution to the signs and symptoms of heart failure, and its role in the inability of depressed patients with heart failure to adhere to treatment. This knowledge will help nurses understand the importance of looking for depression as a contributor to hospitalization in patients with heart failure and the possibility that treatment of depression is necessary for the control of the signs and symptoms of heart failure. The signs and symptoms of heart failure can mask the signs and
symptoms of depression. The shared physiological changes in depression and heart failure potentiate the progression of both diseases. Optimal treatment of heart failure in patients with significant depressive symptoms may not lead to improvement in the signs and symptoms of heart failure unless the depression is also treated.

All patients with heart failure should be screened for depression. Asking patients to complete a self-report symptom inventory and scoring it are a simple, reliable, and valid way to assess depressive symptoms. The Beck Depression Inventory II, Center for Epidemiological Studies Depression Scale, Geriatric Depression Scale, and the Zung Self-rating Depression Scale are all appropriate for use in patients with heart failure. Patients who give answers indicative of suicidal ideation, for example, “I would like to kill myself,” or “I would kill myself if I had the chance,” on the Beck Depression Inventory II require immediate referral to mental health services. Patients with assessment scores indicative of depression should be referred to a mental health counselor for further evaluation with a clinical interview and/or services. The risk from unnecessarily referring a patient to a mental health counselor is minimal compared with the potential to help patients whose heart failure hides their depression.131

Numerous studies document an association between depression and poor compliance with medical regimens and poor health outcomes.132 Improvement in depressive symptoms can also improve medication compliance in cardiac patients, including those without clinical depression.131 Caregivers of patients with heart failure also may experience depression.134 Their depression may affect their ability to help patients with heart failure comply with medical treatment. Depression in the caregivers of patients with heart failure has been associated with increased hospitalizations of the patients.135

Social Support
Social support provided by nurses may help alleviate depressive symptoms and improve quality of life in patients with heart failure who have such symptoms. A lack of social support is correlated with higher depression and low remission of depression in patients with heart failure.136 Among cardiac outpatients, social support is inversely related to depressive symptoms.15,136 In a study of 887 patients with acute myocardial infarction, social support intervention led to improvement in depressive symptoms; decreased depressive symptoms were associated with decreased mortality of depressed cardiac patients with high distress.6 Nurses can apply this information to provide social support for hospitalized patients with heart failure. Nurses can educate the families of depressed patients with heart failure about the importance of social support for these patients. Awareness of the connection between social support and its impact on depression will encourage nurses to assess their patients for adequate social support and assist in providing avenues of increased social support such as cardiac support groups.

Patient and Family Education
Patients and their families may lack an understanding of the diagnosis of depression, its underlying physiological mechanisms, and the interrelationship between depression and heart failure. It is therefore important for patients and their families to understand the common physiological causes of depression in patients with heart failure in layman’s terms and that symptoms of depression are due to physiological changes and do not necessarily constitute mental incompetence.137 Patients and their family members also require education about the options for treating depression, side effects of the options, the duration of treatment required for treatment benefits to begin, the possibility that a series of different treatments may be required to obtain effective relief of depression, and the improvement in quality of life that accompanies improvement in depression.138

Areas for Nursing Research
Nursing literature on the care of patients with heart failure focuses primarily on psychosocial aspects.139-141 Interventions involving goal setting and education significantly improve quality of life in patients with heart failure.142,143 The effect of depression on the quality of life of patients with heart failure has not been examined. Randomized trials on the efficacy of a variety of nondrug interventions, including exercise, yoga, counseling, stress management, and patient and family support and education are needed to guide nursing care of depressed patients with heart failure.

Conclusion
Increasing evidence supports depression as a frequent comorbid condition in patients with heart failure. Nurses using a holistic
model to understand the integration of mind and body into health status can improve the assessment and treatment of patients with heart failure who are depressed. Detection of clinical depression in patients with heart failure requires screening with a self-report symptom inventory followed by a structured interview to confirm and validate the diagnosis. Even subclinical depression, indicated by elevated scores on the symptom inventories, affects health outcomes. The major pathophysiological changes that occur in both depression and heart failure have potential deleterious effects on the heart. The most effective treatment for depression in patients with heart failure has not been established. Depression is associated with poor compliance with medical regimens. Treatment of depression improves both depression and compliance. Research is needed to determine which treatment is most effective and whether the treatment of depression will improve morbidity and mortality in patients with heart failure and depression.  

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