Urinary Incontinence and Overactive Bladder in Patients With Heart Failure

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Abbreviations and Acronyms
ACE = angiotensin-converting enzyme
BMI = body mass index
CESD-SF = Center for Epidemiologic Studies Depression Scale-Short Form
NYHA = New York Heart Association
OAB = overactive bladder
UI = urinary incontinence

Purpose: We explored the nature of the relationship between heart failure and urinary symptoms, specifically urinary incontinence and overactive bladder.

Materials and Methods: An 81-item written survey about urinary incontinence, urgency, frequency, nocturia and other symptoms was administered to hospitalized and clinic patients with heart failure. A medical records review was also conducted to determine types of medications, body mass index and documentation of the New York Heart Association Classification of heart failure.

Results: Of 408 respondents 296 (average age 62.2 years) had information about heart failure stage and urinary symptoms. Of these respondents 45% and 57% reported urinary incontinence and overactive bladder, respectively. Adjusted odds ratio for having overactive bladder over no symptoms for respondents with New York Heart Association Class III or Class IV heart failure was 2.9 (95% CI 1.344–6.250) and for higher fatigue-depression composite was 2.155 (95% CI 1.206–3.360). Adjusted odds ratio for having overactive bladder over frequency/nocturia for respondents with higher body mass index was 1.458 (95% CI 1.087–1.953) and for higher fatigue-depression composite was 1.629 (95% CI 1.038–2.550).

Conclusions: Urinary incontinence and overactive bladder are prevalent in patients with heart failure. Evidence of late stage heart failure, higher fatigue-depression composite and higher body mass index were associated with overactive bladder. Sex, age and diuretic use were not associated with urinary incontinence and overactive bladder.

Key Words: depression, diuretics, fatigue, body mass index, autonomic nervous system

Heart failure, urinary incontinence and overactive bladder are prevalent and have a significant impact on quality of life.1 Reports in the literature indicate that heart failure may affect urinary function through increased nocturnal urine production.2 In addition, pharmacological therapies for heart failure such as diuretics may exacerbate existing UI or contribute to development of new UI.3 In a study of 167,854 older adults approximately 32% of men and 41% of women with heart failure reported having UI.3 The prevalence of OAB is unknown.

Evidence exists that UI and heart failure share risk factors, i.e. older age, increased BMI, diabetes mellitus and depression.2,3 Several of these risk factors are associated with autonomic nervous system dysfunction,4,5 which has also been implicated in OAB.6
Thus, we conducted this descriptive study to explore
the relationship between heart failure and urinary
symptoms, specifically UI and OAB.

METHODS

Overview
Hospitalized and clinic patients were invited to complete a
survey about urinary symptoms from October 2005 to
August 2006. Participant medical records were also au-
dited. The study was approved by the institutional review
boards of The University of North Carolina, Presbyterian
Healthcare and Carolina HealthCare System.

Sample
All patients 20 years or older with a medical diagnosis of
heart failure were invited to participate in the study. The
sites included a 22-bed heart failure hospital unit and 2
heart failure clinics.

Protocol
On the hospital unit medical record documentation was
used to verify that a potential participant had heart fail-
ure, was older than 20 years, was not on dialysis or did not
have urinary diversion, was competent to sign a consent
form and was able to understand English. Using a stan-
dardized recruitment script a trained research assistant
invited individuals to participate. Clinic nurses recruited
eligible individuals after undergoing training regarding
human subject protection, obtaining informed consent and
administering the survey.

After written informed consent was obtained partici-
pants were given the 81-item questionnaire which took
approximately 30 minutes to complete. After its comple-
tion participants received a cash incentive ($19). Medical
records were reviewed for medications, heart failure treat-
ment and urinary symptoms. Information on BMI, func-
tional status, history of medical conditions and document-
tion of NYHA Classification of heart failure stage was
also collected.

Measures
The International Consultation on Incontinence Question-
naire-Short Form item, “How often do you leak urine?”
was used to determine the prevalence of any UI. 9 The 6
possible responses were never, about once a week or less
often, 2 to 3 times a week, about once a day, several times
a day and all the time. A response other than never was
considered an affirmative response.

Urinary symptoms, frequency and nocturia were de-
uced from International Continence Society definitions
and were measured as an affirmative response to the
questions, “Do you urinate more than 8 times in a 24-hour
period?” and “Do you frequently get up 2 or more times
during the night to go to the bathroom?” Overactive blad-
der was defined as an affirmative response to 1 or both
questions, “Do you have uncontrollable urges to urinate
that sometimes results in wetting accidents?” and “Do you
frequently have strong, sudden urges to urinate?”

The Iowa Fatigue Scale is an 11-item scale with 4
subsccales of cognitive, fatigue, energy and productivity. 9
Possible responses were not at all, a little, moderately,
quite a bit and extremely. Scores range from 11 to 55 with
a cutoff for severe fatigue of 40 or greater. For this study
item measuring productivity, “I have low output,” was
not included. During instrument development this item
causd some confusion in respondents and could have
posed a similar problem for participants in this study. 9
The criterion score for severe fatigue was set at 35 or
greater to compensate for the missing item.

The CES-D-10 is a 10-item, 4-point scale that measures
current depressive symptoms in the general public. For
the CES-D-10 scores of 10 or greater indicate probable
depression. 10 In patients with chronic illnesses scores of
15 to 30 are considered high depressive symptoms. 11

Chronic fatigue and depression are increasingly being
viewed as dysfunctions of the autonomic nervous system
and although conceptually distinct, fatigue and depres-
sion share a substantial empirical association as reflected
in the correlation of 0.73 between the fatigue and depres-
sion scores in this sample. 12, 13 To achieve a parsimonious
model and avoid problems of interpretation associated
with their high correlation a fatigue and depression com-
posite was created. This new variable was entered into the
final model, and had 3 levels of neither severe fatigue nor
probable depression, either severe fatigue or probable
depression, and both severe fatigue and probable depression.

NYHA Classification of Heart Failure
The NYHA Classification of heart failure was used by
clinicians treating study participants. Class I (mild) indi-
cates no limitation of physical activity, Class II (mild)
indicates slight limitation of physical activity, Class III
(moderate) indicates marked limitation of physical activ-
ity and Class IV (severe) indicates that an individual is
unable to perform any physical activity without discom-
fort. 14 For analytic purposes NYHA heart failure Classes
I and II were designated as early stage heart failure and
NYHA heart failure Classes III and IV were designated as
late stage heart failure.

Analytic Plan
Participants were classified into 4 mutually exclusive cat-
cogies of urinary symptoms based on responses. These
categories reflect levels of functional impact of urinary
symptoms and were ordered from highest to lowest func-
tional impact as 1) urgency or urge incontinence (OAB),
2) nonurge incontinence, 3) only frequency or only noctu-
ria and 4) no urinary symptoms.

Mantel-Haenszel tests were used to compare trends
across the 4 categories of urinary symptoms by age (in
deciles), sex, report of constipation, fatigue-depression
composite, BMI and heart failure stage. The joint effect of
the predictors on the likelihood of having OAB compared
to each of the other levels of urinary symptoms was as-
sessed by generalized logit analysis.

RESULTS

A total of 408 individuals completed the surveys and
296 respondents (72.5%) had complete information on urinary symptoms and NYHA Classifi-
cation of heart failure stage (see figures). Of these
respondents 24 provided unclear responses to uri-
nary symptoms and their data were removed from analyses. Another 88 participants had no information about NYHA heart failure stage. Most of these participants were hospitalized (93%). They were significantly younger (58 vs 62 years, t (382) = −2.53, p = 0.01) and proportionally more reported poorer health than those with known heart failure stage (79.5% vs 62%, chi-square (1, N = 383) 8.95, p = 0.003). There was no association in the total sample between whether NYHA stage was recorded and the level of OAB symptoms (chi-square Mantel-Haenszel 0.08, p = 0.78), nor was there an association among patients with early or late stage heart failure (early—chi-square Mantel-Haenszel 2.41, p = 0.12; late—chi-square Mantel-Haenszel 1.37, p = 0.24). Therefore, participants with missing information about NYHA heart failure stage were excluded from further analyses.

The majority of the remaining 296 participants were male (60.5%), married (55.7%) and white (67.9%). Average age was 62.2 years (SD 14.7, median 62, range 20 to 94). The majority (88%) were taking diuretics. Approximately 37.6% rated health as good or excellent and comorbidities were prevalent (table 1).

Parity was not associated with OAB or UI in women. There were 49 men (27%) who reported that they had been told that their prostate was enlarged, and of those men 59% reported having symptoms of OAB. UI was not associated with self-report of enlarged prostate. There were 13 men who reported having prostate surgery and 8 (61.5%) who reported having UI. Proportionally more incontinent participants had diabetes mellitus than those reporting no UI (50% vs 36%), chi-square (1, N = 296) 6.06, p = 0.01.

Proportionally fewer hospitalized participants reported excellent or good health status than did clinic participants (25% vs 44%) chi-square (1, N = 295) 9.72, p = 0.002. There were no statistically significant differences between hospitalized and clinic participants by sex, age, race, marital status, NYHA Classification of heart failure, presence of UI, urgency or frequency. However, pro-
Table 1. Characteristics of the sample

<table>
<thead>
<tr>
<th>Gender:</th>
<th>No. (%)</th>
</tr>
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<tbody>
<tr>
<td>M</td>
<td>179 (80.5)</td>
</tr>
<tr>
<td>F</td>
<td>117 (55.9)</td>
</tr>
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<table>
<thead>
<tr>
<th>Race:</th>
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<tbody>
<tr>
<td>White</td>
<td>201 (57.9)</td>
</tr>
<tr>
<td>Black</td>
<td>94 (31.8)</td>
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<tr>
<td>Other</td>
<td>1 (0.3)</td>
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<table>
<thead>
<tr>
<th>Marital status:</th>
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<tr>
<td>Single, never married</td>
<td>24 (8.1)</td>
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<tr>
<td>Single</td>
<td>107 (36.3)</td>
</tr>
<tr>
<td>Married</td>
<td>165 (55.7)</td>
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<table>
<thead>
<tr>
<th>NYHA classification of heart failure:</th>
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<tbody>
<tr>
<td>Class I</td>
<td>41 (14)</td>
</tr>
<tr>
<td>Class II</td>
<td>106 (38)</td>
</tr>
<tr>
<td>Class III</td>
<td>125 (42)</td>
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<tr>
<td>Class IV</td>
<td>24 (8)</td>
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<table>
<thead>
<tr>
<th>Self-reported health:</th>
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<tbody>
<tr>
<td>Excellent</td>
<td>9 (3.1)</td>
</tr>
<tr>
<td>Good</td>
<td>102 (34.6)</td>
</tr>
<tr>
<td>Fair</td>
<td>126 (42.7)</td>
</tr>
<tr>
<td>Poor</td>
<td>56 (19.7)</td>
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</table>

<table>
<thead>
<tr>
<th>Comorbidities:</th>
<th></th>
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<tbody>
<tr>
<td>Arthritis</td>
<td>92 (31.1)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>230 (77.1)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>98 (33.3)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>125 (42.2)</td>
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</table>

<table>
<thead>
<tr>
<th>Urinary symptoms:</th>
<th></th>
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<tbody>
<tr>
<td>Overactive bladder</td>
<td>166 (56.8)</td>
</tr>
<tr>
<td>Nonurge incontinence</td>
<td>30 (10.1)</td>
</tr>
<tr>
<td>Frequency or nocturia</td>
<td>57 (19.3)</td>
</tr>
<tr>
<td>No urinary symptoms</td>
<td>41 (13.8)</td>
</tr>
</tbody>
</table>

Bivariate Analyses

Age, diabetes mellitus and diuretic use were not associated with the level of urinary symptoms. In addition, no association of antidepressant use, ACE inhibitors, beta blockers and angiotension II receptor blockers with urinary symptoms was found. Approximately 23% were on fluid restriction, which was not associated with urinary symptoms. Few participants (8) received pharmacological treatment for urinary symptoms and all 8 had OAB.

Variables significantly associated on bivariate analyses are noted in table 2. Because so few individuals without urinary symptoms reported constipation (3) and no participant with nonurge incontinence reported constipation it was removed from the multivariate model. Constipation was reported by 23% of the overall group. A third of the participants with OAB and 18% of the participants with frequency or nocturia, respectively, also reported constipation. Although sex was not associated with urinary symptoms at the p < 0.05 level, it was added to the multivariate model because gender differences in prevalence of urinary symptoms have been noted elsewhere.

Multivariate Analyses

Adjusting for other predictors people in the late stages of heart failure (Class III or Class IV) were 2.90 times more likely to have OAB rather than no urinary symptoms compared to those in the early stages of heart failure. In addition, the adjusted odds of having OAB rather than frequency/nocturia increased with higher BMI (OR 1.458, 95% CI 1.087–1.953). The presence of probable severe fatigue or probable depression increased the odds of having OAB rather than no urinary symptoms (OR 2.155, 95% CI 1.206–3.860) or frequency/nocturia (OR 1.629, 95% CI 1.038–2.550) (table 3).

Table 2. Bivariate analyses

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistical Test</th>
<th>Critical Value</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Welch's ANOVA</td>
<td>F = 2.08</td>
<td>0.1067</td>
</tr>
<tr>
<td>BMI</td>
<td>Welch's ANOVA</td>
<td>F = 4.87</td>
<td>0.0036</td>
</tr>
<tr>
<td>Sex</td>
<td>Chi-square</td>
<td>7.3906</td>
<td>0.0015</td>
</tr>
<tr>
<td>Race (white/nonwhite)</td>
<td>Chi-square</td>
<td>5.1774</td>
<td>0.1930</td>
</tr>
<tr>
<td>Diuretic use</td>
<td>Chi-square</td>
<td>1.8038</td>
<td>0.1741</td>
</tr>
<tr>
<td>Antidepressant use</td>
<td>Chi-square</td>
<td>1.2672</td>
<td>0.5934</td>
</tr>
<tr>
<td>ACE inhibitor use</td>
<td>Chi-square</td>
<td>2.0272</td>
<td>0.5668</td>
</tr>
<tr>
<td>Beta blocker use</td>
<td>Chi-square</td>
<td>2.9889</td>
<td>0.0533</td>
</tr>
<tr>
<td>Angiotension / blocker use</td>
<td>Chi-square</td>
<td>3.5568</td>
<td>0.1950</td>
</tr>
<tr>
<td>Fluid restriction</td>
<td>Chi-square</td>
<td>2.2774</td>
<td>0.1778</td>
</tr>
<tr>
<td>Constipation</td>
<td>Chi-square</td>
<td>24.6801</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Heart failure stage (early/late)</td>
<td>Chi-square</td>
<td>10.7595</td>
<td>0.0131</td>
</tr>
<tr>
<td>Fatigue score</td>
<td>Welch's ANOVA</td>
<td>7.16</td>
<td>0.0022</td>
</tr>
<tr>
<td>CESD-SF score</td>
<td>Welch's ANOVA</td>
<td>9.66</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
Table 3. Factors associated with urinary symptoms and OAB in patients with chronic heart failure

<table>
<thead>
<tr>
<th></th>
<th>More Severe Urinary Symptoms*</th>
<th>p Value</th>
<th>Greater Likelihood of OAB</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>2,170</td>
<td>0.054</td>
<td>Not significant†</td>
<td></td>
</tr>
<tr>
<td>Higher fatigue-depression composite</td>
<td>18,281</td>
<td>&lt;0.001</td>
<td>Presence of frequency or nocturia</td>
<td>1.629 (1.038–2.560)</td>
</tr>
<tr>
<td>Late stage heart failure</td>
<td>9,542</td>
<td>0.002</td>
<td>No urinary symptoms</td>
<td>2.155 (1.206–3.860)</td>
</tr>
<tr>
<td>Higher body mass</td>
<td>9,780</td>
<td>0.021</td>
<td>Presence of frequency or nocturia</td>
<td>2.900 (1.344–6.250)</td>
</tr>
<tr>
<td>Constipation</td>
<td>15,444</td>
<td>&lt;0.001</td>
<td>Not available‡</td>
<td></td>
</tr>
</tbody>
</table>

* Mantel-Haenszel test (mean ordered level of urinary symptoms).
† Odds of OAB compared to stated level of urinary symptoms, adjusting for other factors except constipation.
‡ At the 0.05 level.
§ Estimate not available due to zero frequency in 1 level of urinary symptoms.

DISCUSSION

UI and OAB were prevalent in patients with heart failure. One limitation was that none of the urinary symptoms was verified through objective means. Because urgency is the cardinal symptom in OAB, patients who reported only nocturia or only frequency were excluded from the OAB group. Thus, OAB prevalence is likely underestimated. Another limitation was missing information of NYHA Classification of heart failure stage for 88 (23%) participants.

The median age of 62 years was younger than that of heart failure hospital admissions in the United States (ie 75 years). Younger patients with heart failure tend to be treated by cardiologists while older patients are treated by general practitioners. All the participants in this study were being treated by cardiologists. We also did not distinguish between systolic failure which is often seen in men in their 60s who have had a myocardial infarction from diastolic failure seen in people with longstanding hypertension or in the elderly. Diabetes mellitus, arthritis, chronic obstructive pulmonary disease and UI were prevalent, indicating this sample, albeit chronically young on average, had comorbidities typically associated with older age.

Few participants (14%) reported having no urinary symptoms. Of those participants 71% were in the early stages of heart failure and 88% were taking diuretics (data not shown). In addition, 57% reported OAB symptoms, which was higher than the reported OAB prevalence in 18.9% of women and 16.9% of men in their 60s. Approximately 45% of the overall sample (134) reported incontinence, and of those 69 (51%) were incontinent 2 to 3 times weekly or more often. Frequency and nocturia were also prevalent at 59% and 64%, respectively. Our findings on the prevalence of UI in patients with heart failure are higher than those reported by Bierman at 34% vs 32% in males and 62% vs 41% in females, respectively. Parity was not associated with incontinence, supporting earlier findings that the effects of parity on female incontinence decrease with age. To our knowledge this is the first report of the magnitude of OAB in patients with heart failure.

OAB may be part of a neurohormonal phenomenon that includes heart failure, fatigue, and depression. In this study 55 participants (19%) had a CESD-SF score greater than 15 indicating severe depressive symptoms and of those participants 76% reported OAB. In addition, 58 participants (20%) had an Iowa Fatigue Score of 35 or greater and of those 74% reported OAB symptoms. On multivariate analyses participants with late stage heart failure were almost 3 times as likely to have OAB as any urinary symptoms compared to those in the early stages of heart failure. In addition, individuals with probable severe fatigue and depression were more than 2 times as likely to have OAB as to have no urinary symptoms. Higher body mass index increased the odds of having OAB rather than frequency/nocturia, although the mechanism is unclear.

Emerging evidence in the fields of neurocardiology and behavioral cardiology exists that heart failure and depression share signs (ie decreased heart rate variability) and symptoms (ie low mood, fatigue), and researchers suggest they may also share the same mechanism. An association between depression and urge incontinence has been reported with depression in 60% of those who had idiopathic urge incontinence. However, the mechanism underlying this relationship is not clear. Choi et al found decreased heart rate variability in women with OAB, leading them to posit that OAB symptoms may be indicators of a disease or dysfunction in the autonomic nervous system. These findings indicate that further research is needed to better understand the relationship among heart failure, depression and OAB. Adequately powered studies that investigate the autonomic nervous system role, while controlling for the effects of heart failure treatment, comorbidities such as diabetes mellitus, and functional disability, are needed. Nocturia reported by patients with heart failure may be nocturnal
polyuria and future research using timed voided volumes could shed further light on this issue.

It is clear that patients with heart failure are affected by multiple symptoms that can have a negative impact on quality of life. OAB may be a result of comorbidities that directly or indirectly affect bladder function or diuretic use. Therefore, studies designed to follow patients with heart failure prospectively are needed to determine the mechanism and interplay of symptoms in these complex scenarios. Increasing the awareness in health care providers who treat patients with heart failure that UI and OAB are prevalent is also needed. In this study most incontinent patients (66%) did not report incontinence to a health care provider. Help seeking behavior in patients with heart failure with urgency, frequency and nocturia is not known. Using information about the occurrence, type and frequency of urinary symptoms should be an important component of heart failure treatment and management.

A voiding diary may help patients and clinicians observe patterns in the timing and volume of voids, determine the frequency of bowel movements and examine the relation of voiding and frequency to oral intake. This information can guide clinicians and patients in using behavioral interventions designed to prevent wet episodes, increase voiding intervals or decrease urgency. A 24-hour voiding diary also provides an important diagnostic measure for nocturnal polyuria. In these patients changing the timing of the administration of diuretics to earlier in the evening may reduce reports of nocturia. Other lifestyle changes include using compression stockings and elevating the legs in the afternoon. Few participants were prescribed medications for UI or OAB which may reflect concern about polypharmacy in patients with heart failure or assumptions that urinary symptoms were caused solely by diuretic therapy and that treatment would be futile. Further research is also needed to better understand help seeking and treatment practices for urinary symptoms.

CONCLUSIONS

No causal relationships can be assumed from this study. OAB was associated with late stage heart failure, fatigue, depression and high body mass index. The mechanism for the relationships among these factors must be further explored in light of emerging evidence from the fields of neurocardiology and behavioral cardiology. Urinary symptoms in patients with heart failure pose a complex challenge to clinical management. Although research is needed to determine the underlying causal mechanisms of UI and OAB, they should not be dismissed simply as unavoidable results of being female, being old or taking diuretics. In this study sex, age and diuretic use were not significantly associated with OAB. Future research should explore the relation of UI and OAB in the pathogenesis and trajectory of heart failure. Behavioral and other interventions are currently available that may improve the care and lives of current and future patients with heart failure experiencing these symptoms.

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