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THE RELATIONSHIPS AMONG PAIN, DEPRESSION AND PHYSICAL ACTIVITY IN PATIENTS WITH HEART FAILURE

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Abstract

Introduction—Increasing patients' physical activity levels holds many opportunities to facilitate health and well-being among those with heart failure (HF) by improving HF symptoms and decreasing depression and pain. Given low exercise participation rates, an essential first step to increase exercise rates is to evaluate how pain and depression may further influence engagement in exercise programs. Aims: To describe the level of physical activity and exercise that HF patients with depression achieve and to investigate the relationships among pain, depression, total activity time and sitting time.

Methods—In this correlational cross-sectional study we analyzed data from 61 participants with depression and Class II-IV HF.

Results and Conclusion—The total time spent being active was less than 1 hour per day. Depressed HF patients have much lower physical activity levels than the general public.

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Decreasing sitting time and increasing light activity levels hold promise to improve pain and depression symptoms.

Keywords

heart failure; depression; pain; physical activity

Introduction

Approximately 67% of HF patients experience chronic non-cardiac pain that further complicates their disease management.¹ Comorbid depression is estimated to impact 22 to 42% of HF patients and poses additional threats to effective pain management.² When depression is combined with HF and pain, patients are even less able to follow recommendations, treatment plans, and self-care behaviors, and length of time to treat chronic pain and depression is extended.³ Increasing physical activity levels among patients with heart failure (HF) and depression holds many opportunities to facilitate health and well-being by improving HF, pain and depression symptoms.⁴ However, Butchart reports that only 23% of HF patients reported using exercise as a pain management strategy.⁵ The majority (70%) use rest or sedentary activities to decrease their pain. Sedentary activities exacerbate HF and depression problems further, as increased muscle wasting occurs when daily physical activity decreases.¹

Chronic pain and depression often occur together.^{3,6} A considerable body of literature supports the coexistence and bi-directional relationship between chronic pain and depression that demands concurrent treatment to achieve optimal outcomes for each condition.^{3,6-9} However, little attention has been paid to this relationship in HF patients who are at much higher risk for adverse health outcomes. Given low exercise participation rates and the many barriers that discourage exercise, an essential first step is to assess current physical activity levels and examine how pain and depression may further influence engagement in exercise programs.¹⁰ The purpose of this paper is to describe self-reported physical activity and exercise levels of depressed HF patients, and to determine the relationships of pain intensity, pain interference, total activity time, and sitting time with depression.

Methods

This analysis uses cross-sectional data as a secondary analysis from a larger clinical trial that was enrolling 219 participants. This study complies with the Declaration of Helsinki, the institutional review board at a Midwestern university approved the protocol, and informed consent was obtained from participants. Inclusion criteria that were used in this analysis include the following: age 55+, diagnosis of HF, a score of 10+ on the Beck Depression Inventory, and a score of ≥ 70 on the physical impairment subscale of the Rand Medical Outcomes Study. Exclusion criteria included currently participating in psychotherapy, other significant psychiatric diagnoses, suicidal ideation, cognitive impairment, awaiting transplant, residence in a long term care facility, or significant hearing impairment.

Instruments/Measures

The International Physical Activity Questionnaire (IPAQ) is an internationally used, open-access instrument that has well-defined scoring protocols for rating physical activity levels as both a continuous variable and categorical variable.¹¹ The instructions direct participants to only count physical activities that are at least ten minutes in length. Compared to other self-report physical activity measures the IPAQ has been shown to have equally acceptable validity (0.33) for assessing different domains of exercise and physical activity.¹² Reliability is reported to be acceptable ($\alpha = 0.81$).¹³

The Beck Depression Inventory (BDI-II) was used to assess level of depression. The BDI-II contains 21 questions that are scored on a scale of 0 to 3 for a total score range of 0 to 63. The inventory has well-established cut-points related to depression severity (mild=10–20, moderate=21–30, and severe>30), and a score of 10 is widely accepted for screening.¹⁴

The Brief Pain Inventory Short Form (BPI-SF) was used to assess pain intensity and interference. The BPI-SF assesses intensity of pain, and extent that pain interferes with social and physical function.¹⁵ Scores for the 4 intensity items and 7 interference items are averaged to derive a single score value each for pain intensity and pain interference. The 15-item BPI-SF has shown consistent validity and reliability for many conditions.

The Charlson Comorbidity Index was used to evaluate the effects of comorbidities based on the International Classification of Diseases diagnostic codes. Each comorbidity has an associated weight, based on the adjusted risk of mortality or resource use. The sum of all the weights results in a single comorbidity score for a patient, with higher scores indicating greater comorbidity burden.¹⁶ Charlson scores presented here are in addition to HF.

A demographic and health related questionnaire was used to collect data on age, sex, race, ethnicity, marital status, income level, health insurance for medical expenses, employment status, education level, veteran status, smoking status, and antidepressant use. NYHA classification was assessed from medical record review.

Statistical Analyses

Data were analyzed using SAS (version 9.3, SAS Institute Inc., Cary, NC). Continuous data were summarized as means and standard deviations for variables that were normally distributed, and medians and interquartile ranges for variables that were not normally distributed. Categorical data were summarized as frequencies. Participants' time spent sitting, in low, moderate and vigorous activities were summarized in minutes. Pairwise relationships between time spent performing physical activities (total activity time) and pain (intensity and interference) among depressed HF participants were examined. Due to the level of skewness in the data, Spearman correlations were used to examine relationships among continuous variables in regression models.

Regression analyses were conducted to determine which demographic and health-related variables were most influential in predicting pain intensity, pain interference, depression, total activity time and sitting time. Demographic and health-related variables were summarized, categorized and used in the model selection analyses with the final model

chosen by Akaike information criterion (AIC). AIC is a measure of penalized fit which takes into account the amount of variability explained and penalizes for each additional parameter in the model.¹⁷ This helps determine the set of predictors that adequately describe the data while keeping the model as parsimonious as possible. The modeling method provides a means for unbiased model selection because AIC looks at model fit, not significance levels.

To further explore the relationships each key variable was used as the dependent variable in the regression analysis. Multiple linear regression was performed with pain interference, intensity, depression and total activity time. To meet the normality assumption, only those reporting pain were included for pain interference and intensity variables. Depression level and total activity time was log transformed. Sitting time was dichotomized (<8 hours a day or ≥ 8) analyzed using logistic regression.

Results

A total of 61 HF participants completed the IPAQ and BPI-SF questionnaires. The sample characteristics are displayed in Table 1. The participants had a mean age of 67 (S.D. 8.8), male (75%), white (92%), non-Hispanic (95%), married (53%), had an NYHA classification of III (60%), and had a moderate level of depression symptoms (48%). A summary of variables from the BPI-SF, IPAQ, and BDI-II can be found in Table 2. The pain scores were moderate with a median pain intensity score of 4.0 and median pain interference score of 4.4 (both on a 0–10 scale). A median of 365 minutes per week was spent performing any physical activity. A median of 60 minutes per week was spent performing light physical activity. A median of 210 minutes a week was spent performing moderate activities.

Five different regression models were developed and tested for the following variables: pain intensity and pain interference with those participants who reported pain, total activity time, depression, and sitting time (Table 3). For the pain intensity analysis, patients in NYHA classification of III-IV were more likely to report higher levels of pain compared to those with a NYHA category II ($p = 0.054$). In the pain interference analysis, women were more likely to have higher pain interference than men ($p = 0.02$). In the depression analysis, only sitting time was chosen, and that model was not statistically significant ($p = 0.0595$). In the total activity time analysis only minutes sitting was found to be statistically significant ($p < 0.001$). In sitting time analysis, age and NYHA were statistically significant ($p = 0.004$ and $p = 0.003$ respectively). For every year increase in age, the odds of being the higher sitting time group are estimated to increase by 18% controlling for all the other variables in the model. Those participants who were in NYHA class III-IV were estimated to have 20 times higher odds of being in the higher sitting time group than those in the NYHA class II.

Discussion

Depressed HF participants reported less than an hour/day of being physically active. Alosco reported that depression was an independent predictor of low physical activity levels in HF, with 587 minutes per day spent being sedentary,¹⁸ which is higher than the median sitting time of 420 minutes per day we report. Moderate activity was 8 minutes/day, which is lower than the median of 210 minutes per week (30 minutes/day) in this study.¹⁸ An explanation

for the differences might be due to the type of measurement. Johansson found accelerometers counted higher levels of light intensity activity, and lower levels of moderate activity than was self-reported, suggesting participants felt they were “working” at a higher intensity than the objective measure reported.^{19,20}

Depressed HF patients would be expected to spend less time being active. However, the difference of 52 minutes/day in this sample compared to reports of 6.1 to 7.2 hours/day in the general population,^{19,21} indicates how inactive depressed HF patients are. Light activity levels were very low (median of 1 hour/week) when compared with the general population of 2.8 to 3 hours/day.^{19,21} Moderate intensity activity was also very low with a median time of 30 minutes/day compared with 2.1 hours/day.²¹

Sitting time in this study (7 hours/day) was higher than reported for adults in the general population (4.7 hours/day) but consistent with trends that adults spend more time sitting as they age.²² The related finding that minutes sitting was the only predictor chosen in AIC model for depression, provides support for activity engagement and is consistent other studies that report an association between sitting time and depression.²³ Sitting time is an important public health concern as research consistently shows increased sitting produces worse health outcomes even in those who exercise regularly.²³ At the same time, decreasing sitting time by as little as one hour/day has the potential to decrease risk of mortality by five percent,²⁴ suggesting that interventions to reduce sitting time may have additional important outcomes in all sedentary populations.

Our results indicating that gender is a significant predictor of pain interference in those with HF and depression, with women reporting higher levels of pain interference supports similar pain findings in other populations.^{25–27} Although there is debate about sex differences in pain within the scientific community, women appear to be more sensitive to pain than men.²⁶ In turn, special consideration of pain experiences among women with HF and depression is needed in clinical practice.

Limitations

The generalizability of this data to other populations is limited by the small sample size and lack of minority participation. Self-reported measures of physical activity may lead to over estimating the actual amount of time spent exercising²⁰ and may have been complicated by HF symptoms in this population. The description of moderate activity being, “physical activities make you breathe somewhat harder than normal” may have been misleading.

Conclusion

Discussion of current levels of activities is an important starting point in HF care and treatment, for making small but meaningful changes that may enhance symptom management. Further research is needed to determine how best to increase time spent being active while decreasing sitting time, and how much of an increase is necessary to have a meaningful decrease in pain and depressive symptoms in this population.

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Clinical Pearls

1. Clinicians need to assess general activity and sitting time
2. Develop a plan with small changes to increase activity
3. Follow up with patients to reassess activity levels

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Table 1

Demographic and Health Characteristics

Demographics and Health Characteristics	Total Sample N (%)
Gender	N=61
Male	46 (75%)
Female	15 (25%)
Race	N=61
White	56 (92%)
African American	2 (3%)
Other	3 (5%)
Ethnic	N=61
Hispanic	3 (5%)
Non-Hispanic	58 (95%)
Marital Status	N=61
Single	29 (47%)
Significant other/Married	33 (53%)
Charlson Scores (not including HF)	N=59
Mean	5.37
Standard deviation	2.289
NYHA Classification ¹	N=61
Stage II	20 (33%)
Stage III	37 (60%)
Stage IV	4 (7%)
Yearly Household Income Level	N=59
<\$10,000–\$20,000	32 (54%)
\$20,001–\$50,000	18 (31%)
\$50,001–\$85,000	9 (15%)
Smoking status	N=61
Ever smoked	42 (69%)
Never smoked	19 (31%)
Current smoker	6 (10%)
Antidepressant use	N=52
Yes	21 (40%)
No	31 (60%)
Health insurance	N=61
Yes	52 (85%)

Demographics and Health Characteristics	Total Sample N (%)
No	9 (15%)
Employment status	N=61
Employed	16 (27%)
Unemployed/Retired	45 (73%)
Education level	N=61
Less than High School, High School or GED ² Certification	24 (39%)
Some college or more	37 (61%)
Depression Categories based on Beck Depression Inventory-II Scores	N=61
Low/Mild (10–20)	22 (36%)
Moderate (21–30)	29 (48%)
Severe (31+)	10 (16%)

¹New York Heart Association Classification of Heart Failure

²General Education Development

Table 2

Summary of Pain, Activity and Depression Levels

Variable	N	Mean	Standard deviation	Median	Interquartile range	Range
Pain intensity (0–10)	61	3.78	2.68	4	1.75–6.25	0–9.5
Pain interference (0–10)	61	3.94	3.275	4.42	0–6.7	0–9.5
Total time spent active (10 minutes bouts or more)	61	668	1179	365	85–700	0–8363
Light activity, minutes	41 [*]	276	825	60	0–180	0–6030
Moderate activity, minutes	52 ^{**}	344	443	210	40–460	0–2333
Vigorous activity, minutes	9 ^{***}	48	180	0	0–0	0–1260
Sitting time	61	492	216	420	360–660	155–960
Beck Depression Inventory – II Score	61	21	7.9	20	16–25	10–43

^{*} 19 out of 61 participants reported not engaging in light activity;^{**} 9 out of 61 participants reported not engaging in moderate activity;^{***} 51 out of 61 participants reported not engaging in vigorous activity.

Table 3

Regression Models

<u>Outcome Variable</u>	N	P-value	Parameter Estimate	R ²
<u>Pain Intensity</u>	44			0.141
Total activity time		0.505	0.001	
Gender		0.159	−0.900	
NYHA ^I		0.054	−1.140	
<u>Pain interference</u>	44			0.184
Depression score		0.123	0.076	
Gender		0.025 *	0.809	
<u>Total activity time</u> **	57			0.297
Minutes sitting		0.001 *	−1.267	
Charlson comorbidity index		0.072	0.557	
Education		0.060	0.630	
<u>Depression (BDI)</u> **	61			0.059
Minutes sitting		0.060	0.183	
<u>Sitting time</u> ***	57			N/A
Age		0.004 *	0.167	
NYHA ^I		0.003 *	1.498	
Total activity time		0.101	0.001	
Pain interference		0.066	−0.258	

* Statistically significant (p .05);

** Log transformed;

*** Logistic regression;

^I New York Heart Association Classification of Heart Failure. Variables not underlined were chosen using Akaike information criterion.