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Smoking Among Women Following Heart Transplantation: Should We Be Concerned?

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Abstract

The serious detrimental effects of smoking after heart transplantation (HTX) are well established, but data that demonstrate the effects on female HTX recipients are scarce. The purpose of this study was to describe tobacco use, exposure to second hand smoke (ESHS), and health perceptions of female HTX recipients and examine relationships between these variables of interest and demographic and clinical characteristics of women following HTX. Seventy-two women (mean age, 54.3 ± 12.7 years; mean time since transplant, 5.5 ± 4.5 years) were enrolled from a single HTX center. Demographic and clinical data, tobacco use, ESHS, and health perceptions were obtained through self-report and chart reviews. Tobacco use was verified by measurement of urine cotinine levels. Twenty-four women were nonsmokers before and after HTX. Eighteen (37.5%) of the 48 women who were former smokers before HTX had returned to tobacco abuse. Only 4 of the 18 accurately reported their smoking behaviors. Forty percent of nonsmokers reported ESHS. Tobacco use and ESHS were highest among African American women. Forty percent of the sample perceived their health status as fair-poor; the remaining 60% reported good-excellent health. In a multivariate analysis, current tobacco use (odds ratio [OR], 5.20; confidence interval [CI], 3.83–9.13) and ESHS (OR, 1.82; CI, 1.17–2.82) were independent predictors of lower health perceptions. Although a majority of the female recipients who used tobacco ceased smoking before HTX, a substantial proportion demonstrated recurrent tobacco use after HTX. Our findings suggest the need for aggressive screening and risk factor interventions to promote smoking cessation before and after HTX in this unique population of female HTX recipients.

Almost 5000 heart transplantations (HTX) were done in the United States between 2006 and 2007; approximately 26% of HTX patients were women.¹ Although an increasing number of women need and receive HTX, little is known about their health risk behaviors after HTX. In the last decade, investigators have reported poorer overall outcomes in women than men,² and although both men and women have equivalent survival rates in the first year after HTX, the survival rates for women drop drastically thereafter.¹ Unfortunately, mechanisms underlying gender differences in survival are poorly understood and the effect of health risk behaviors like smoking on outcomes in women is unclear. Although the serious detrimental effects of smoking are well established in the general postheart HTX population,^{3–6} there is a paucity of research examining its impact on female HTX recipients.

Our understanding of factors that contribute to worse prognosis in women is partially attributed to the under-representation of women in studies examining the effects of smoking on HTX outcomes.⁶⁻⁹ The current study was conducted to describe tobacco use, exposure to second hand smoke (ESHS), and health perceptions of female HTX recipients. A secondary aim was to examine the association between tobacco use, ESHS, health perceptions, and women's demographic and clinical characteristics. Our investigation was guided by 3 research questions: (1) What are the prevalence rates for tobacco use and ESHS in female HTX recipients? (2) How do female HTX recipients describe their health status? and (3) What are the associations of demographic and clinical characteristics, tobacco use, and ESHS with health perceptions in women following HTX?

METHODS

Study Design and Participants

A cross sectional, correlational design was used. A convenience sample of 72 women who received follow-up care from a single-outpatient post-HTX clinic was recruited for the study. Women were eligible to participate if they received their HTX at least 1 year before enrollment but not >5 years after HTX. The ability to read, write, and speak English, and willingness to participate in the study were additional inclusion criteria. Women receiving transplants of more than 1 organ, those undergoing repeat HTX, and pediatric patients undergoing HTX were excluded.

Procedures

Institutional Review Board approval for protection of human subjects was received before study initiation. Women who expressed an interest in participating in the study signed an informed consent during their routine clinic visit and were given a battery of self-administered study instruments to complete. Questionnaire completion took approximately 10 to 15 minutes. Socio-demographic data (eg, age, race, income, education, marital status, and employment status), health history specific to heart disease, and current clinical status (eg, time since HTX, comorbidities, and medications) were obtained from patient self-reports and were verified through inpatient and outpatient medical records abstraction.

A self-report questionnaire was used to assess previous tobacco history and current smoking behaviors. The presence of other smokers in the household and ESHS was also assessed. Participants who were ESHS >1 day a week were identified as individuals at risk for exposure to the negative effects of passive smoking. Patients were asked to provide a fresh urine specimen during the clinic visit for biochemical validation of smoking status using a urine cotinine dipstick. The research assistant dipped a test strip into the cup with the urine and read and recorded the colored response that was associated with the cotinine level. Several studies support the use of urinary cotinine as a reliable and valid measure for distinguishing smokers and nonsmokers.¹⁰ A "smoker" was defined as a patient who self-reported cigarette use or demonstrated biochemical validation of tobacco exposure. A "former-smoker" was defined as a patient who self-reported a history of smoking and smoking cessation before study enrollment. A "nonsmoker" was a woman with self-reported abstinence who also had no biochemical evidence of tobacco exposure.

Health perception was measured using a single item question on of the SF-12 that reflected participants' rating of their general health as either "excellent," "very good," "good," "fair," or "poor." Appropriate concurrent and discriminant scale performance was established previously with the SF-12, a measure of health status, and quality of life.¹¹

Data Analysis

Descriptive statistics were used to provide profiles of tobacco use, ESHS, and perceived health. Differences in socio-demographic and clinical characteristics were calculated for smokers and nonsmokers using chi-square or independent *t*-tests, depending on the level of measurement. A multiple logistic regression model was used to examine the bivariate relationship of tobacco use and ESHS to overall health perceptions. Overall health perceptions were recoded into 2 comparative groups; participants who reported either “excellent” or “very good” or “good” health were compared with participants who reported “fair” or “poor” health. Criteria for entry and removal of variables were based on the likelihood ratio test with enter and remove limits set at $P \leq .05$ and $P \geq .100$, respectively. Statistical analysis was carried out using SPSS version 13 (SPSS Inc., Chicago, IL).¹²

RESULTS

Patients

Women in our sample had a mean age of 54.7 ± 12.7 years. On average they had their HTX 3.8 ± 2.5 years before study enrollment. Sixty-five percent were Caucasian, while 80% were unemployed or retired. Approximately half of the sample was married, reported an educational attainment equal to or less than a high school education, and had an annual income below US \$15,000. Smokers and nonsmokers did not differ in age, time since HTX, employment status, marital status, education, and income (Table I). Immunosuppression consisted of cyclosporine (38.9%), azathioprine (34.7%), or tacrolimus (26.4%). Prednisone-free immunosuppression was possible in 99% of the women.

Self-Reported Smoking Profiles Pre-HTX

Twenty-four (33%) of the 72 women in the sample were nonsmokers, while 48 (67%) of the women were former smokers. The average duration of pre-HTX smoking in “pack years” was 23.4 ± 5.6 years. Of those who smoked before HTX, the average time of smoking cessation before transplant was 10.3 ± 8.1 months; 20 (42%) had stopped smoking more than a year before HTX, and 28 (58%) stopped smoking less than a year before HTX. Two patients smoked up to the day before HTX.

Self-Reported Smoking Profiles and Health Perceptions Post-HTX

Of the 48 patients who stopped smoking before HTX, 18 (37.5%) had returned to tobacco abuse. Four women admitted to being a current smoker, but active smoking was confirmed in 14 additional women or 25% of the overall sample based on a urine cotinine level >500 ng/mL (ie, cotinine levels for nonsmokers ESHS are usually <300 ng/mL).¹⁰ The difference in smoking recidivism between women who stopped smoking more than a year before HTX ($n = 5$, 28%) was significantly lower than women who stopped smoking less than a year before HTX ($n = 13$, 72%, $P = .008$). Of the 54 patients who were confirmed nonsmokers at the time of the study, 22 (41%) reported ESHS post-HTX. Fifty-seven percent of the women reported good, very good, or excellent health status and the remaining 43% reported fair or poor health (Table II).

The Association Between Health Perceptions, Smoking Patterns, and Other Key Variables

Table III demonstrates the correlational matrix for the key variables of interest. Race was significantly associated with tobacco use; African American women were more likely to continue smoking and be ESHS than other race/ethnic groups. In a multivariate analysis, current tobacco use (odds ratio [OR], 5.20; confidence interval [CI], 3.83–9.13) and ESHS (OR, 1.82; CI, 1.17–2.82) were independent predictors of lower health perceptions.

DISCUSSION

Our data show that the prevalence of smoking after HTX is relatively high; almost 1 out of 5 women smoked following HTX. The rate of tobacco recidivism in this sample of 37.5% was slightly higher than the 17.6% to 32.5% reported in prior research.^{6-8,13} We found that rates of tobacco use were higher among African American women than other ethnic groups. While no previous studies have examined racial differences in smoking behaviors among women following HTX, our findings concur with studies examining racial differences in smoking behaviors pre-HTX which show that smoking among African Americans was also significantly higher compared with Hispanics and Caucasians in a sample of women with chronic heart failure.^{13,14} In a qualitative study, African American women with chronic heart failure identified high stress levels, cultural influences, financial strain, and lack of education as the reasons for the high prevalence of smoking risks in their group. They cited barriers to risk factor reduction were the time constraints placed on them by work and family, unsafe neighborhoods, lack of support from private physicians, and poor access to costly health clubs.¹⁵ Research has also shown that African Americans with chronic heart failure were less likely to receive smoking cessation counseling,^{16,17} which may partially explain our findings.

Our data also showed that smoking rates following transplant were higher among women who ceased smoking less than a year before HTX compared with women who had quit smoking more than a year before HTX. Investigators who specifically examined length of time of smoking cessation before HTX have reported that patients who have decided to stop smoking long before being considered for HTX had stronger convictions to adapt a healthier lifestyle and eliminate risks to their own health, while patients who stopped within the year before HTX did so because of worsening prognosis and desire to be placed on the transplantation wait list.^{7,18} Additional studies to examine known causes for increased recidivism among patients who stop smoking shortly before HTX are warranted to better explicate this phenomenon.

Surprisingly, we found that almost half of the nonsmokers were ESHS. Second-hand tobacco smoke is known to increase risks of acute myocardial infarction, sudden cardiac death, stroke, aortic aneurysm, and peripheral vascular disease among healthy adults secondary to both the prothrombotic and atherogenic effects of harmful chemicals and carcinogens that are released into the environment when people are smoking.¹⁹ While no studies to date confirms that ESHS increases morbidity and mortality after HTX, the known effects of tobacco on atherogenesis and increased levels of proinflammatory cytokines,²⁰⁻²² suggests increased risks for cardiac allograft vasculopathy, which represents a major prognostic factor in survival after HTX.^{23,24} Thus, total smoking cessation is the only absolute way to ensure full protection of nonsmokers against ESHS. Strategies aimed at helping family members with smoking cessation efforts are vital to facilitate the elimination of ESHS and protect the health and safety of HTX recipients from the harmful effects of tobacco.

To our knowledge, our study is the first to evaluate the relationship of smoking to perceived health status. The literature to date examining the effects of smoking has focused on clinical parameters such as development of tumors,^{3,6,17} vascular disease,⁴ vasculopathy,^{6,17} renal dysfunction,⁵ and death.^{6,17} We found that both smokers and women ESHS ranked their health status more negatively than those who were not exposed to tobacco or its byproducts. Our findings suggest that patients who smoke or who are ESHS appreciate the negative consequences of tobacco, and this perception may lead to behavioral changes, specifically smoking cessation. Data from a study conducted in Europe showed that lower perceptions of control were more significant in ex-smokers than nonsmokers, and that worse psychosocial adaptation was found among ex-smokers who ceased smoking <1 year before HTX compared with ex-smokers who stopped smoking more than a year before HTX.⁷

The negative impact of tobacco use on health perceptions and health outcomes following HTX reinforces the need for health care providers to assess smoking status and ESHS in their patients, and to begin appropriate interventions aimed at enhancing patient adherence to smoking cessation recommendations both before and after HTX. Aggressive screening protocols to identify women at risk for tobacco abuse post-HTX are of utmost importance. Increased scrutiny among African American men and women who stopped smoking shortly before HTX is warranted given the data that timing of smoking cessation influences tobacco abuse postoperatively in HTX patients.^{6,7} Interventions targeted at reducing smoking recidivism through lifestyle and behavioral changes need to be integrated into the overall management of the HTX patient. Patients at risks for recurrent smoking post-HTX need to be encouraged to attend compliance programs for tobacco avoidance.⁸ Counseling on smoking cessation is more effective when patients are given the tools to adequately help them stop smoking before HTX. To improve patient outcomes, enhance patient adherence, and promote health, interventions must not only include the health care provider and the patient, but also integrate the patient's family and significant others in the strategic planning process.

We were particularly intrigued by our findings that showed a high percentage of women who reported being a nonsmoker but who demonstrated biochemical verification of tobacco exposure. Less than a quarter of women in the sample who smoked accurately reported their smoking behaviors. In an earlier study, only half of the male and female patients who were confirmed smokers after HTX self-reported their tobacco use.⁸ Although under-reporting may be common among post-HTX patients, our data suggest that the failure to report tobacco use may be higher in women than men. This gap in communication between the health care provider and patient, along with the divergent results of self-report measures and urine cotinine tests is a cause of concern. The phenomenon of female patients returning to their smoking habits after HTX and not openly admitting it warrants further investigation. In a social context, failure of women to fulfill the societal and cultural expectations about femininity and the role of a mother and caretaker may make the admission of continued smoking more difficult for female patients. Therefore, gender specific programs and services geared toward this high-risk patient population are needed to help women feel comfortable revealing vital information to their health care providers.

Several limitations must be considered when interpreting the results from our study. As expected with prospective, cross-sectional studies, causation cannot be inferred. Our findings merely support the association between smoking and ESHS and perceptions of health status. The use of a single-item global evaluation of health perceptions, while widely accepted in the assessment of health status among populations with chronic illness,¹¹ limits our ability to compare the results of our study with other populations.^{24,25} Furthermore, data from the study were gathered in a primarily Caucasian sample from a single HTX clinic and may not generalize to the general HTX population. Lastly, we only focused on smoking and ESHS for the current study and did not examine other important health risk behaviors including alcohol use, obesity, limited physical activity, and adherence to treatment recommendation, which are also important factors that may impact participants' overall health behavior profile and consequently their perceptions of health status. Future studies that examine additional health behaviors are warranted to identify effective strategies to promote life style changes after HTX.

CONCLUSION

In conclusion, this study was a first attempt to evaluate the prevalence of tobacco use, ESHS, and health perceptions among female HTX recipients. We found that tobacco use and ESHS after HTX was fairly high in women and were associated with lower health perceptions. These results provide important information to clinicians and support the current practice of encouraging smoking cessation at the time of initial HTX evaluation. A large, multicenter study

is necessary to further evaluate this important subject. Nevertheless, our findings support the need to implement aggressive screening and multiple risk factor interventions to promote smoking cessation before and after HTX in this unique population of female recipients. Efforts to promote healthy lifestyle behaviors by aggressively promoting smoking cessation efforts and preventing ESHS after HTX may decrease morbidity and mortality among female HTX recipients, particularly related to cardiac disease.

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Table I

Demographic Characteristics of Smokers and Nonsmokers (N = 72)

CHARACTERISTIC	SMOKERS (N = 18)	NONSMOKERS (N = 54)	P VALUE
Age (y) (mean ± SD)	52.8 ± 12.7	54.9 ± 11.3	.173
# years since HTX (mean ± SD)	5.8 ± 4.8	5.2 ± 4.1	.169
Race (%)			.038
White	11 (61.1%)	36 (70.3%)	
Black	7 (38.9%)	14 (25.9%)	
Other	0 (0%)	2 (3.7%)	
Employment status (%)			.639
Employed	3 (16.7%)	12 (22.2%)	
Unemployed/retired	15 (78.9%)	42 (77.8%)	
Marital status (%)			.889
Married	10 (55.5%)	29 (53.7%)	
Not married	8 (44.5%)	25 (46.3%)	
Education			.763
≤ High school	9 (50.0%)	26 (48.1%)	
Vocational or junior college	7 (38.9%)	16 (29.7%)	
≥ College	2 (11.1%)	12 (22.2%)	
Annual income			.632
<15,000	10 (55.5%)	24 (44.4%)	
15,000–39,999	4 (22.2%)	10 (18.5%)	
≥ 40,000–49,999	4 (22.2%)	20 (37.1%)	

Abbreviation: HTX, heart transplantation.

Table II

Frequencies of Self-Reported Quality of Life Among Smokers and Nonsmokers (N = 72)

DESCRIPTOR	SMOKERS (N = 18)	NONSMOKERS (N = 54)	P VALUE
Excellent, very good, good	8 (44.5%)	34 (63.0.8%)	.032
Fair-poor	10 (55.5%)	19 (35.2%)	.034

Table III

Correlational Matrix for the Key Variables (N = 72)

	1	2	3	4	5	6
(1) Race	1.000					
(2) Marital status	-0.020	1.000				
(3) Transplant yrs	0.251	0.123	1.000			
(4) Current smoker	0.294*	0.015	0.155	1.000		
(5) ESHS	0.304*	-0.013	0.010	0.364 [†]	1.000	
(6) Perceived health	0.134	0.353 [†]	0.169	-0.265*	-0.239*	1.000

* $P < 0.05$

[†] $P < 0.001$.

Abbreviation: ESHS, exposure to second hand smoke.