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ORIGINAL ARTICLE

Comparison of hypertension management between cancer survivors and the general public

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Proper management of hypertension is important for better survival and quality of life of cancer survivors who have hypertension. We aimed to compare hypertension management between cancer survivors and the general population. A nationwide, multicenter, cross-sectional survey was administered to adult cancer patients, currently receiving treatment or follow-up, who had been diagnosed with hypertension. Comparison group was selected from among participants in the health behavior survey of the third Korean National Health and Nutrition Examination Survey. Self-reported hypertension management was surveyed, including antihypertensive medication adherence, frequency of blood pressure (BP) monitoring and perceived BP control. Multivariate logistic regression analysis was used to evaluate the relationship between cancer survivorship and each outcome measure. Compared with the general population, cancer survivors were more likely to report full adherence (92.7% *vs.* 73.0%; adjusted odds ratio (aOR) = 3.45; 95% confidence interval (CI), 2.08–5.73), more frequent BP measurement (⩾24 per year: 50.1% *vs.* 24.7%; aOR = 2.51; 95% CI, 1.83–3.46), and very good perceived BP control (60.8% *vs.* 26.2%; aOR = 4.34; 95% CI, 3.13–6.02). Cancer survivors appear to be better with antihypertensive medication adherence and BP monitoring than those without cancer, and as a result, they appear to be under better BP control. However, several methodological limitations of our study prompt further research on this issue.
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INTRODUCTION

As the survival of cancer patients improves, comorbid conditions are increasing among the major causes of death for many cancer survivors.[1] Hypertension is the most common comorbid condition in cancer survivors, with a prevalence of 20–65%.[2–4] Furthermore, it can lead to 30 ~ 50% of excess mortality from stroke and heart disease in cancer survivors,[2,3] as demonstrated in large-cohort studies in Korea[3] and the United States.[2] Therefore, proper management of hypertension is important for better survival and quality of life of cancer survivors who have hypertension.

Researchers have found that the management of hypertension is affected by various socio-demographic and clinical factors, including age, gender, race, marital status, income level, place of residence, insurance status, comorbid conditions and duration of antihypertensive medication.[5–9] According to the Health Belief Model, certain behavioral factors, such as perceived risk for the disease and perceived benefit of treatment,[10–12] could also affect the management of hypertension. Unlike hypertensive patients without cancer, cancer survivors with hypertension are more likely to consider cancer recurrence, metastasis and a second primary cancer as major health concerns, and usually require more complex care.[13] In addition, their personal cancer experiences cause cancer survivors to have different health perceptions and health behaviors.[13] Therefore, it is possible that cancer survivors have different practices regarding the management of hypertension compared with people without cancer.

Although some studies have examined the prevalence,[4,14–16] predictors[14–16] and outcomes[2,3] of hypertension in cancer survivors, little is known about the management perspective of hypertension specific to cancer survivors.[17] In the current study, we aimed to compare hypertension management, including antihypertensive medication adherence, frequency of blood pressure (BP) monitoring and perceived BP control between cancer survivors and the general population.

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METHODS

Study participants

This study was part of a national survey to examine the experiences of cancer survivors in Korea. Data were collected from cancer patients treated at the National Cancer Center and nine regional cancer centers, one in each of the nine provinces of Korea, in 2009. Cancer patients who agreed to participate were interviewed by trained interviewers at their centers of treatment. The study was approved by the Institutional Review Board of the National Cancer Center in Korea. Inclusion criteria for this study were as follows: (1) older than 18 years of age, (2) cancer diagnosis, (3) at least 4 months since diagnosis, (4) currently receiving treatment or follow-up and (5) diagnosis of hypertension at the time of survey.

Comparison group was selected from among participants in the health behavior survey of the third Korean National Health and Nutrition Examination Survey (KNHANES). KNHANES is a series of population-based, cross-sectional surveys conducted by the Korea Center for Disease Control and Prevention. It uses a stratified multistage sampling design according to geographic area, age and gender group to select a representative sample of the civilian, non-institutionalized Korean population. All participants signed a written informed consent, and the response rate was 92.7%.[18] We included people who were older than 18 years of age, had a diagnosis of hypertension at the time of the survey and who did not have cancer.

Measurements

To compare the hypertension management of cancer patients to the general population, we decided to use the same questions used in the KNHANES for cancer survivors to assess their hypertension management. The outcome measures consisted of three questionnaires in relation to the hypertension management: (1) antihypertensive medication adherence, (2) frequency of BP monitoring and (3) perceived BP control. Patients were asked about antihypertensive medication adherence by the question, 'Do you regularly take antihypertensive medication for your BP control?' Response choices were the following: (1) take it regularly at all times, (2) take it occasionally or as needed and (3) do not take it. The frequency of BP monitoring was asked with the question, 'How often do you measure your BP?' The responses were collected as number of measurements per day, week, month or year, as appropriate. Perceived BP control was asked with the question, 'How well do you think your BP is controlled?' The response choices were (1) very well controlled, (2) well controlled, (3) not well controlled and occasional high BP, (4) not well controlled and frequent high BP and (5) not well controlled at all. For the subsequent analyses, we dichotomized the responses considering the distributions.

Self-reported medication-taking behavior has been reported to be predictive of actual adherence,[19,20] to correlate well with actual BP control[21] and even to be linked with cardiovascular outcomes.[22] It has been used widely in previous clinical studies regarding adherence,[10,21–24] although there has been some criticism that it is not very sensitive[19] and there is an inconsistent report regarding the concordance with actual behaviors.[25] Frequent BP measurement at home may help to improve awareness and concordance, and thus has been shown to be effective in lowering BP.[26] Self-reported BP status has been generally reliable and correlated with actual measured data,[27] and the perception of BP control has been shown to be related to the intention for improving lifestyle.[23]

To adjust for potential confounders, we included additional demographic and clinical characteristics identified from previous studies.[5–8,10,28,29] The factors included age, gender, marital status, education, household income, employment status, health insurance status, duration of antihypertensive medication, smoking status and drinking status. Cancer stage was included as a subgroup to assess the impact of competing risks on hypertension management. The Surveillance, Epidemiology and End Results stage at cancer diagnosis was used,[30] but we restaged those with recurrence or metastasis at distant sites, as it was more relevant to our research question.

Statistical analysis

Data for baseline characteristics and hypertension management practices are presented as means ± s.d. or numbers and percentages. Both univariate and multivariate logistic regressions were conducted to evaluate the relationship between cancer survivorship and each outcome measure. Subgroup analyses were made according to cancer stage. All analyses were performed using SAS 9.1 (SAS Institute, Cary, NC, USA), and statistical significance was defined as a two-tailed P-value ≤ 0.05.

RESULTS

Characteristics of cancer survivors and the general population

Among the total of 1956 cancer patients who completed the interview process, 385 had a diagnosis of hypertension. Among 7802 participants in KNHANES, 138 were excluded because they reported a cancer diagnosis, and 1124 who had a hypertension diagnosis were included in the study as the comparison group.

The characteristics of cancer survivors and the general population are summarized in Table 1. Cancer survivors were older (65.2 *vs.* 59.9 years, $P<0.001$) and had been diagnosed with hypertension earlier (8.4 *vs.* 6.3 years, $P<0.001$) than the comparison group. Significant differences existed in gender, education, household income, employment status, health insurance status and health behaviors. Among cancer patients, lung, stomach, colorectal and breast cancer were the most common diagnoses, comprising around two-thirds of the patients, and most survivors had undergone surgery. The mean duration since cancer diagnosis was 1.87 years.

Hypertension management between cancer survivors and the general population

Of the cancer survivors, 92.7% reported taking medication regularly at all times; 73.0% of the non-cancer comparison group reported taking medication regularly at all times. The mean number of BP measurements per year was 98.6 for cancer survivors and 28.8 for the non-cancer comparison group. In addition, 60.8% of the cancer survivors and 26.2% of the non-cancer comparison group perceived their BP to be under very good control ($P<0.001$ for all parameters; Table 2).

The multiple logistic regression model adjusting for other covariates indicated that, compared with the comparison group, cancer survivors were significantly more likely to report full adherence (adjusted odds ratio (aOR) = 3.45; 95% confidence interval (CI), 2.08–5.73), BP measurements more than 24 times per year (aOR = 2.51; 95% CI, 1.83–3.46) and very good perceived BP control (aOR = 4.34; 95% CI, 3.13–6.02). Subgroup analyses by cancer stage showed that patients with *in situ* or local tumors tended to report full adherence and very good perceived BP control, although there was no statistical significance by trend analysis (Table 3).

DISCUSSION

To our knowledge, this is the first study to compare self-reported hypertension management between cancer survivors and the general population. Our results indicate that compared with the general population, cancer survivors are more likely to regularly take their antihypertensive medication, to more frequently monitor their BP and probably as a consequence, to believe their BP is under very good control.

In general, cancer survivors reported better behaviors related to hypertension management. According to the Health Belief theory, the probability that a person will take a preventive health action is a function of the perceived susceptibility to the disease, its severity and the perceived benefits and barriers related to the recommended preventive action.[10] Although it could not be determined whether cancer survivors have a perceived susceptibility specifically to hypertension, they may have an increased perception of

Table 1 Characteristics of the study participants

Characteristic	General population N (%)	Cancer survivors N (%)	P-value
Age, mean (s.d.), years	59.9 (12.2)	65.2 (8.9)	<0.001
Years since hypertension diagnosis	6.3 (7.5)	8.4 (7.7)	<0.001
Gender			
Female	631 (56.1)	188 (48.8)	
Male	493 (43.9)	197 (51.2)	0.013
Marital status			
Unmarried	361 (32.1)	86 (22.4)	<0.001
Married	762 (67.9)	298 (77.6)	
Education			
Less than high school	725 (64.5)	163 (42.3)	
High school and above	399 (35.5)	222 (57.7)	<0.001
Monthly income			
<2 million KRW	767 (68.9)	307 (79.7)	
⩾2 million KRW	347 (31.1)	87 (20.3)	<0.001
Employment status			
Not employed	568 (50.6)	129 (34.1)	
Employed	555 (49.4)	249 (65.9)	<0.001
Health insurance			
Medical aid	91 (8.1)	81 (21.1)	
National Health Insurance	1033 (91.9)	303 (78.9)	<0.001
Smoking			
Non-smoker or past smoker	884 (78.6)	350 (93.5)	
Current smoker	240 (21.4)	25 (6.5)	<0.001
Alcohol consumption			
Non-drinker or past drinker	421 (37.5)	360 (93.5)	
Current drinker	703 (62.5)	25 (6.5)	<0.001
Time since cancer diagnosis, mean (s.d.), years		1.9 (3.1)	
Cancer type			
Stomach		58 (15.1)	
Lung		49 (12.7)	
Colorectal		79 (20.5)	
Breast		54 (14.0)	
Others[a]		145 (37.7)	
SEER stage			
In situ and local		132 (37.6)	
Regional		125 (35.6)	
Distant		94 (26.8)	
Treatment received			
Surgery		284 (73.8)	
Radiotherapy		88 (22.9)	
Chemotherapy		260 (67.5)	

Abbreviations: KRW, Korean Won; SEER, Surveillance, Epidemiology and End Results.
[a]'Others' includes all other types of cancer, such as cervical, thyroid, hepatobilliary cancer, and so on.

Table 2 Hypertension management of cancer survivors compared with the general population

Parameter	General population N (%)	Cancer survivors N (%)	P-value
Antihypertensive medication adherence			
Take it regularly at all times	820 (73.0)	353 (92.7)	<0.001
Take it occasionally or as needed	55 (4.9)	9 (2.4)	
Do not take it	248 (22.1)	19 (5.0)	
Frequency of blood pressure monitoring			
Mean (s.d.), measurements per year	28.8 (82.4)	98.6 (199)	<0.001
Perceived blood pressure control			
Very well controlled	284 (26.2)	231 (60.8)	<0.001
Well controlled	585 (53.9)	131 (34.5)	
Not well controlled, and occasionally high	172 (15.9)	13 (3.4)	
Not well controlled, and frequently high	38 (3.5)	5 (1.3)	
Not well controlled at all	6 (0.6)	0 (0)	

vulnerability with respect to their health, and this perceived vulnerability may lead to stricter medication adherence and BP monitoring. In this regard, frequent BP monitoring and good adherence could be a consequence of their increased concern for their health, rather than for the specific purpose of hypertension management. Similar observations can be found with increased cancer screening practices among cancer survivors, even without specific knowledge of the risk for a second primary cancer.[13,31]

Cancer survivors were also more likely to perceive their BP as being very well controlled, compared with those in the comparison group. This may be the result of their better adherence and more frequent BP monitoring, both of which lead to better-controlled BP.[22,26] As self-reported BP status is generally reliable and correlated with actual measured data,[27] it can be assumed that hypertensive cancer survivors are usually in better control of their BP than are hypertensive patients without cancer.

Although not statistically significant, there were noticeable trends of less strict adherence and poorer perceived BP control among cancer survivors with more advanced stage cancer. People with advanced cancer may perceive their prognosis as poor and thus may be more likely to ignore the benefits of hypertension management. This would be consistent with the Health Belief model, which explains medication adherence with long-term antihypertensive therapy,[10] in that a smaller perceived benefit leads to less favorable behavior. Complexity of care for the management of advanced cancer might be another potential reason for poorer compliance.[32]

The present study should be interpreted with full knowledge of its limitations. First, the main limitations are those common to studies with a survey data set. As actual measurements of BP were not performed, persons who might not have been hypertensive at the time of the survey might have been included, while those who were not aware of their high BP might have been missed. However, it is impractical to confirm BP in this kind of design, as the diagnosis of

Table 3 Hypertension management of cancer survivors according to stage, compared with the general population

		Cancer survivors				
		By cancer stage				
Parameter	*General population*	*All*	*Local*	*Regional*	*Distant per Recurrent*	P-*trend*
Antihypertensive adherence						
Less than regular, *N* (%)	303 (27.0)	28 (7.3)	8 (6.2)	8 (6.5)	9 (9.6)	
Regular, *N* (%)	820 (73.0)	353 (92.7)	122 (93.8)	115 (93.5)	85 (90.4)	
OR (95% CI)		4.66 (4.10–7.00)	5.63 (2.72–11.66)	5.31 (2.56–11.01)	3.49 (1.73)	
Adjusted OR (95% CI)		3.45 (2.08–5.73)	5.92 (2.31–15.20)	3.66 (1.67–8.01)	2.20 (1.03–4.70)	0.172
Frequency of blood pressure monitoring						
$<$24 per year, *N* (%)	845 (75.3)	189 (49.9)	66 (50.8)	65 (52.8)	43 (46.7)	
$\geqslant$24 per year, *N* (%)	277 (24.7)	190 (50.1)	64 (49.2)	58 (47.2)	49 (53.3)	
OR (95% CI)		3.07 (2.41–3.91)	2.96 (2.04–4.28)	2.72 (1.86–3.98)	3.48 (2.26–5.35)	
Adjusted OR (95% CI)		2.51 (1.83–3.46)	2.50 (1.62–3.86)	2.25 (1.44–3.52)	2.80 (1.72–4.58)	0.822
Perceived blood pressure control						
Less than very well controlled, *N* (%)	801 (73.8)	149 (39.2)	46 (35.4)	51 (41.5)	42 (45.2)	
Very well controlled, *N* (%)	284 (26.2)	231 (60.8)	84 (64.6)	72 (58.5)	51 (54.8)	
OR (95% CI)		4.37 (3.42–5.60)	5.15 (3.51–7.56)	3.98 (2.71–5.84)	3.43 (2.23–5.27)	
Adjusted OR (95% CI)		4.34 (3.13–6.02)	5.12 (3.25–8.07)	4.12 (2.62–6.48)	3.12 (1.91–5.11)	0.079

Abbreviations: CI, confidence interval; OR, odds ratio.

hypertension and judgment of adequacy of BP control require multiple sequential BP measurements. Many large-scale studies have also used self-reporting to determine the occurrence of hypertension.

Second, the survey questions on main outcome measures limited deeper investigation and were not well validated. There are some validated measures for medication adherence, such as the Morisky Medication Adherence Scale.[33] Yet, in this study we had to use these specific questionnaires from KHANES to compare the hypertension management of cancer patients to the general population. Moreover, in previous studies other various question formats have been used for self-reported antihypertensive adherence,[20,22] and we are not aware of any validated self-reporting measures for BP monitoring behavior or perceived BP control.[23]

A third limitation is the potential for selection bias. The cancer survivors who participated in this study were recruited from a hospital sample, whereas the controls were recruited from the community. However, considering that most cancer survivors regularly visit a hospital for treatment or routine surveillance, the effect of this selection may not be significant. Indeed, an additional analysis of hypertensive cancer survivors in KNHANES revealed similar results (for example, aOR = 3.81; 95% CI, 0.90–16.18 for antihypertensive full adherence). However, we did not use the cancer survivor sample from the KNHANES data set for this comparison because of its limited sample size ($n = 37$) and lack of stage data.

Fourth, there are concerns about the accuracy of self-reports. Our previous study showed similar antihypertensive medication adherence between cancer survivors and the comparison group (84.0% *vs.* 85.6%) using the claim data set.[17] The agreement between self-reported adherence and refill adherence is reported to be only poor to fair,[9,22] and it has been suggested that these two methods reflect different dimensions of medication-taking behavior.[34] Other potential explanations would be increased awareness of non-cancer care among cancer survivors between the study period (2002 *vs.* 2009),[35,36] and insufficient adjustment of potential confounders, such as education, employment status and smoking, in the previous study.[17] Given the lack of a gold standard, the discrepancy between our two methodologically different studies underscore the need to conduct further investigations. Concurrent measurements of actual adherence and BP may be needed to examine whether cancer survivors are overestimating their adherence or BP control.[37]

Lastly, our study did not consider the physician–patient interaction, which could be a significant source of actual and perceived hypertension management.[10,38] The situation that cancer survivors face in the treatment of hypertension may be quite different from that of usual hypertensive patients without cancer. It is important to understand whether cancer survivors obtain prescriptions for their hypertension from oncologists or from primary care physicians, and how much they are informed of their BP status or encouraged to be fully adherent to medication by their physician.[39] Further study is warranted to investigate how patient–physician interaction factors affect the hypertension management and perception of cancer survivors.

Despite the above-mentioned limitations, this study is one of the few studies to evaluate hypertension management issues in cancer survivors. Cancer survivors appear to be better with antihypertensive medication adherence and BP monitoring, compared with hypertensive patients without cancer. As a result, they also appear to be under better BP control. There were trends of less strict adherence and poorer perceived BP control among cancer survivors with more advanced stage cancer. Our findings suggest the role of complexity of care and health perception in the management of hypertension in cancer survivors. However, several methodological limitations of our study prompt further research on this issue, especially with regard to the accuracy of self-reporting and patient–physician interactions in this specific population.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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