Marital status, social support and survival after curative resection in non-small-cell lung cancer

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It has been suggested that marital status and social support are associated with survival in cases of lung cancer, and that such an association may be mediated by several factors. In this prospective cohort study, we investigated the effect of marital status and social support on survival after curative resection for non-small cell lung carcinoma (NSCLC) in Japan. From June 1996 to April 1999, a total of 238 patients with resectable NSCLC were enrolled. Marital status and social support were assessed. The presence and absence of confidants and the satisfaction level with the confidants were used as factors reflecting social support. During the follow-up period, 57 deaths from all causes were identified through January 2004. For the statistical analysis, Cox proportional hazards regression analyses were used. With regard to marital status, the multivariable adjusted hazard ratio (HR) of unmarried patients versus married patients was 0.8 (95% confidence interval, 0.3–1.8) (*P*-value = 0.53) after controlling for potential confounding factors, including age, sex, occasion of cancer diagnosis, pathological stage, smoking status, smoking status after surgery and serum albumin level. Similarly, the multivariable adjusted HR of patients without confidants versus those with confidants was 1.0 (0.5–2.2) (*P*-value = 0.90), whereas the multivariable adjusted HR of the dissatisfied-with-confidants group versus the satisfied-with-confidants group was 0.7 (0.4–1.3) (*P*-value = 0.28). The present data do not support the hypothesis that marital status and social support are associated with survival in NSCLC. (*Cancer Sci* 2006; 97: 206–213)

In recent years, many studies have suggested that the marital status and social support are associated with survival from lung cancer. Of eight prospective cohort studies that investigated the association between marital status and survival from lung cancer, four suggested that the survival rate was higher in married patients than in unmarried patients,[1–4] whereas the remaining four studies found no such association between marital status and survival.[5–8] Of the two studies conducted in patients with non-small cell lung carcinoma (NSCLC), one concluded that unmarried patients had a higher risk of death,[4] and the other found no association between marital status and survival.[8] Only one prospective cohort study until now has reported on the association between social support and survival from lung cancer;[9] this study found no association between social support and survival in cases of advanced NSCLC. Thus, there is little evidence to suggest a relationship between social support and survival from lung cancer.

It has also been suggested that the association between marital status and social support and survival is mediated by several factors. Unmarried status and poor social support have been reported to be associated with an increased frequency of unhealthy behavior (especially in relation to smoking), maladjustment to the diagnosis of cancer (especially continuation of smoking even after the diagnosis of cancer), psychological reaction (especially depression), delay in seeking treatment (more advanced stage at the first diagnosis and occasion of cancer diagnosis) and lower likelihood of receiving definitive treatment.[1,5,10–15] However, most previous studies did not consider smoking status,[1–4,6–9] continuation of smoking even after diagnosis,[1–9] delays in seeking treatment,[4,9] psychological variables[1–9] and the likelihood of receiving definitive treatment.[2–9] The present study is considered to have methodological advantages, in that in addition to the physical status, we took into account these potential confounding factors, such as smoking status, continuation of smoking even after surgery, psychological variables and delay in seeking treatment (occasion of diagnosis), for our analysis. The mechanisms by which marital status and social support influence prognosis might be clarified by examining the effects of these factors.

In the present prospective cohort study, we investigated the influence of marital status and social support on survival after curative resection in cases of NSCLC in Japan, and also the association between marital status and social support and various demographic, medical and psychological variables.

Methods

Participants

The design of the present study has been reported in detail elsewhere.[16,17] Briefly, consecutive newly diagnosed patients were invited to participate in the study after curative resection of NSCLC conducted at the Thoracic Oncology Division, National Cancer Center Hospital East, Kashiwa, Japan. The eligibility criteria were: 18 years of age or older; awareness of the diagnosis of cancer; ability to speak Japanese; standard surgical treatment (lobectomy or

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pneumonectomy with mediastinal lymph node dissection); no evidence of brain tumor by computed tomography or magnetic resonance imaging of the head; no history of previous or current chemotherapy, immunotherapy or radiation therapy; no active concomitant cancer; curative resection on the basis of pathology reports of an International Union Against Cancer disease stage pT1 to pT3, pN0/1 or pM0;[18] and no severe underlying medical condition at 1 month after surgery.

As a result, a total of 303 patients with NSCLC were enrolled in the study from June 1996 to April 1999. The study protocol was approved by the institutional review board of the National Cancer Center. Each patient was fully informed of the purpose of the study before obtaining written consent prior to participation.

Exposure data

The demographic and clinical variables assessed included the age, sex, body mass index, education level, smoking status, occasion of cancer diagnosis, type of surgery, pathological disease stage, histological type, comorbidity, and preoperative performance status as defined by the Eastern Cooperative Oncology Group. At 1 month after the surgery, smoking status after surgery, pain severity, dyspnea grade and serum albumin level were evaluated. With regard to smoking status, current smokers were defined as those who were smoking at the time of the surgery or had quit smoking only within the previous year, continuing smokers were defined as those who continued to smoke at 1 month after the surgery, and ex-smokers were defined as those who had quit smoking 1 or more years before surgery.

At 1 month after surgery, a psychiatrist interviewed the patients based on the Structured Clinical Interview for Diagnostic and Statistical Manual for Mental Disorders, Revised (DSM-III-R) criteria, to evaluate for the presence of depression during the intervening month between surgery and the interview (kappa = 0.78).[19] The diagnosis of depression was made when two or more criteria, including depressive mood or anhedonia, for major depressive episode were fulfilled. The patients' psychological states were assessed using the Profiles of Mood State (POMS) scale, a 65-item self-rating scale measuring six emotional states (tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia and confusion-bewilderment), and its summary score, the total mood disturbance (TMD) score, was estimated.[20] The validity and reliability of the Japanese version of the POMS have been confirmed in a previous study.[21]

Social support

Multiple domains have been suggested to comprise social support, including structural support (e.g. types of support networks) and functional support. Functional support is usually organized along four dimensions: instrumental, informational, belonging and emotional support. In the present study, the presence or absence of confidants and the satisfaction level with the confidants were evaluated as factors reflecting functional social support.[22,23] The psychiatrists asked the patients whether they had confided in someone or discussed their cancer with anyone during the period between the cancer diagnosis and 1 month after surgery and, if so, how many people they had confided in. Categories of confidants, such as spouse, children, parents, siblings, friends, neighbors, colleagues, physicians, nurses, priests or others, were suggested as examples to help the participants to answer the question. Finally, patients were asked how satisfied they were, overall, with their interactions with these confidants. If they had not confided in anyone, they were asked about their degree of satisfaction with that situation. The patients' responses were categorized on a scale of 1–7:1, extremely dissatisfied; 2, fairly dissatisfied; 3, slightly dissatisfied; 4, neutral; 5, somewhat satisfied; 6, fairly satisfied; and 7, extremely satisfied. The reliability of the interview ratings with regard to social support was determined by conducting a second interview at 3 months after surgery in the same cohort. The interview ratings at 1 month and 3 months after surgery with regard to the presence or absence of confidants, the number of confidants, and the level of satisfaction with the confidants were compared. The inter-rater agreement (kappa) with regard to the presence or absence of confidants was 0.518 ($P < 0.001$) at 1 month and 3 months after surgery. The correlation coefficient for the number of confidants at 1 month and 3 months after surgery was 0.714 ($P < 0.001$). The correlation coefficient for the level of satisfaction with confidants was 0.482 ($P < 0.001$) at 1 month and 3 months after surgery. The interview ratings with regard to social support status indicated moderate consistency between 1 month and 3 months after surgery. The validity of the interview ratings was determined by comparing the responses to the Social Support Questionnaire (SSQ)[24,25] of a random sample of 41 patients with various cancers. The SSQ was used to quantify the availability of and level of satisfaction with social support. We used an abbreviated six-item version, each item consisting of two parts. The first part assessed the number of individuals that the patient felt they could turn to in times of need (SSQ number; SSQN), and the second part measured the individual's perceived degree of satisfaction with the support available in that particular situation (SSQ satisfaction; SSQS). Thus, both the number of confidants and the level of satisfaction with the confidants were assessed by the SSQN and SSQS, respectively. In the present study, we used the subscales of SSQ question no. 1 ('Who can you really count on to be dependable when you need help?') for validity of the interview ratings, because this question was similar to our question. The correlation coefficient was 0.687 ($P < 0.001$) for the number of confidants and the score of the SSQN question no. 1. The correlation coefficient was 0.317 ($P = 0.044$) for the level of satisfaction with confidants and the score of the SSQS question no. 1. The interview ratings with regard to social support showed a moderate degree of consistency with the score of the SSQN question no. 1 and SSQS question no. 1.

In addition, the number of people living together with the patient and the employment status of the patient were also assessed.

Follow up

Survival of the subjects was followed up from June 1996 through January 2004. Out of the 303 subjects (189 men and 114 women) who had undergone surgery between June 1996

and April 1999 and were registered for the semistructured interviews, curative resection was confirmed by the final pathological report of the disease stage in 262 (86.5%) subjects. At the interview 1 month after surgery, three patients could not be contacted and 21 refused to participate because of their psychological or physical state or because of other reasons. As a result, a total of 238 patients (145 men and 93 women) were included in the final analysis. We observed little difference in statistical terms between the patients who participated in this study ($n = 262$) and those who were finally included for the analysis ($n = 238$). In particular, the mean ages were 62.7 and 62.4 years, and the percentage of men was 59.9% and 60.9%, respectively. Taken together, the subjects analyzed were representative of the total number of patients recruited for this study.

The person-months of follow up were counted for each subject from the date of enrollment in the study until death or the end of the study period (January 2004), whichever occurred first, and a total of 15 340 person-months (median, 71 months; range, 0–91 months) was obtained. During the follow-up period, 57 deaths from all causes were identified.

Statistical analysis

Standard descriptive statistics were used to characterize the distributions of marital status, and the presence or absence of and level of satisfaction with confidants. The marital status was categorized into married and unmarried, the latter including single, divorced and widowed patients. The utilization of confidants was categorized into presence and absence of confidants. The satisfaction level with confidants was categorized into extremely fairly satisfied, and somewhat satisfied–extremely dissatisfied. The patients' living status was classified into two categories, namely, living alone and not living alone. The employment status was divided into two categories, namely, working outside the home (full-time or part-time worker) or not working outside the home (housewife, retirement or without occupation). Intergroup comparisons of categorical and continuous variables were carried out using the χ^2-test and *t*-test, respectively. Hazard ratios (HR) were computed as the number of deaths from all causes among the subjects in each marital status and social support category versus the number of deaths from all causes among the respective reference categories (married, presence of confidants, or extremely fairly satisfied with confidants). Cox proportional-hazards regression analysis was conducted to adjust for sex, age and various demographic, medical and psychological variables using the SAS PHREG procedure in the SAS version 8.2 statistical software package (Cary, NC, USA). The assumption of proportional hazards was verified graphically. In all of the statistical evaluations, *P*-values of less than or equal to 0.05 were considered to denote significant difference. All *P*-values were two-tailed.

First, we conducted an analysis of the relationships between the exposure variables and the demographic, clinical and psychological variables. We then analyzed the unadjusted HR of survival from lung cancer for some demographic, clinical and psychological variables themselves, as follows, and adjusted for variables that had a statistically significant effect on survival in multivariate analysis. In addition to sex and age, the following variables were considered: body mass index in kg/m^2 (<24.9 or >25.0); education level (college/university or higher or not); occasion of diagnosis (mass screening or health checkup, subjective symptoms, follow-up for other diseases, or others); pathological stage (IA, IB, IIA, IIB, or IIIA); histological type (adenocarcinoma, squamous carcinoma, large or others); type of surgery (lobectomy or pneumonectomy); performance status before curative resection (0, 1 or 2); presence or absence of comorbidity (hypertension, myocardial infarction, angina pectoris, diabetes mellitus, renal diseases or liver diseases); smoking status (never-smoker, ex-smoker or current smoker); smoking status after surgery (never-smoker, ex-smoker, quit-smoker or continuing smoker); pain (none–mild or moderate–severe); dyspnea (none–mild or moderate–severe); serum albumin (>3.5 g/dL or <3.5 g/dL); presence or absence of depression at 1 month after surgery; POMS score at 1 month after surgery (continuous variables).

For the survival estimates, we analyzed both all-cause deaths (57 cases) and total cancer deaths (42 cases) or lung-disease deaths (42 cases).

Results

A total of 238 NSCLC patients were enrolled in the study (Table 1). The mean age of the subjects was 62.4 years, and the percentage of men was 60.9%. The proportions of married patients, patients with confidants and patients who were extremely fairly satisfied with their confidants were 82.4, 84.5 and 75.2%, respectively. With regard to marital status, the proportion of men was significantly lower among the unmarried patients compared with that among the married patients (Table 1). Moreover, the distribution of smoking status after surgery was also significantly different between the married and unmarried patients. There was no significant association between marital status and any other variables. In relation to the presence or absence of confidants, the distribution of the occasion of cancer diagnosis was significantly different between those with and those without confidants. There was no significant association between the presence or absence of confidants and any other variables. In terms of the level of satisfaction with confidants, the POMS subscales of TMD, depression-dejection, tension-anxiety, anger-hostility, vigor-activity and fatigue-inertia were significantly different between those who were extremely fairly satisfied and those who were somewhat satisfied–extremely dissatisfied.

In univariate Cox proportional hazards regression analyses, seven demographic or clinical variables, including age (60–69 years, and >70 years), sex (male), smoking status (ex-smoker, and current smoker), smoking status after surgery (ex-smoker, quit-smoker and continuing smoker), occasion of cancer diagnosis (follow up for other diseases), pathological stage (IIA, IIB and IIIA) and serum albumin level (<3.5 g/dL) showed statistically significant association with increased HR of lung cancer survival versus the respective reference categories (Table 2). Therefore, the multivariate analyses were conducted using those variables that had a statistically significant effect on survival.

Table 3 shows the HR of lung cancer survival according to marital status and social support. A univariable Cox proportional

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Table 1. Demographic, medical and psychological characteristics in non-small cell lung cancer patients according to marital status, the presence or absence of confidants and satisfaction level with confidants

Characteristics	Marital status			Confidants			Satisfaction level with confidants		
	Married	Unmarried	*P*-value	Presence	Absence	*P*-value	Extremely fairly satisfied	Somewhat satisfied–extremely dissatisfied	*P*-value
No. subjects	196	42		201	37		179	59	
Demographic characteristics									
Mean age in years (SD)	61.9 (9.9)	64.7 (13.0)	0.20	62.1 (10.7)	63.9 (9.9)	0.36	62.5 (10.5)	62.1 (10.8)	0.79
Sex, male (%)	65.3	40.5	0.003	59.2	70.3	0.20	60.3	62.7	0.75
Body mass index (kg/m^2)									
≥18.5	90.8	97.6	0.14	92.5	89.2	0.49	91.6	93.2	0.69
<18.5	9.2	2.4		7.5	10.8		8.4	6.8	
Duration of education (%)									
>15 years	16.3	4.8	0.052	14.9	10.8	0.51	15.1	11.9	0.54
15 years	83.7	95.2		85.1	89.2		84.9	88.1	
Smoking status (%)									
Never-smoker	34.2	40.5	0.49	36.8	27.0	0.45	37.9	27.1	0.26
Ex-smoker	25.0	16.7		22.4	29.7		23.5	23.7	
Current smoker	40.8	42.9		40.8	43.2		38.6	49.2	
Smoking status after surgery (%)									
Never-smoker	34.2	40.5	0.009	36.8	27.0	0.41	37.9	27.1	0.35
Ex-smoker	25.0	16.7		22.4	29.7		23.5	23.7	
Quit smoker	39.8	33.3		37.8	43.2		35.8	47.5	
Continued smoker	1.0	9.5		2.9	0.0		2.8	1.7	
Medical characteristics									
Occasion of diagnosis (%)									
Mass screening or health checkup	61.2	57.1	0.28	60.2	62.2	0.045	59.8	62.7	0.68
Subjective symptoms	20.9	16.7		22.4	8.1		21.8	15.3	
Follow up for other diseases	15.3	26.2		14.9	29.7		16.2	20.3	
Unknown	2.6	0.0		2.5	0.0		2.2	1.7	
Pathological stage† (%)									
IA	51.0	52.4	0.82	51.7	48.7	0.24	51.9	49.2	0.96
IB	26.0	21.4		24.9	27.0		25.7	23.7	
IIA	4.1	7.1		4.9	2.7		4.5	5.1	
IIB	14.3	16.7		15.4	10.8		13.9	16.9	
IIIA	4.6	2.4		2.9	10.8		3.9	5.1	
Histology type (%)									
Adenocarcinoma	68.4	66.7	0.42	67.2	72.9	0.31	69.3	64.4	0.58
Squamous cell carcinoma	19.9	26.2		20.4	24.3		18.9	27.1	
Large cell carcinoma	5.1	0.0		4.5	2.7		4.5	3.4	
Other	6.6	7.1		7.9	0.0		7.3	5.1	
Type of surgery (%)									
Lobectomy	94.9	100.0	0.13	95.5	97.3	0.62	94.9	98.3	0.27
Pneumonectomy	5.1	0.0		4.5	2.7		5.0	1.7	
Performance status before surgery‡ (%)									
0	68.9	71.4	0.86	67.7	78.4	0.41	68.7	71.2	0.81
1	30.6	28.6		31.8	21.6		30.7	28.8	
2	0.5	0.0		0.5	0.0		0.6	0.0	
Co-morbidity§ (%)									
Absence	62.8	47.6	0.069	61.7	51.4	0.24	59.2	62.7	0.63
Presence	37.2	52.4		38.3	48.7		40.8	37.3	
Pain (%)									
None-mild	45.4	52.4	0.41	46.8	45.9	0.93	49.2	38.9	0.17
Moderate-severe	54.6	47.6		53.2	54.1		50.8	61.0	
Dyspnea (%)									
None-mild	57.1	52.4	0.57	57.2	51.4	0.51	55.9	57.6	0.81
Moderate-severe	42.9	47.6		42.8	48.7		44.1	42.4	

Table 1. *Continued*

Characteristics	Marital status			Confidants			Satisfaction level with confidants		
	Married	Unmarried	*P*-value	Presence	Absence	*P*-value	Extremely fairly satisfied	Somewhat satisfied–extremely dissatisfied	*P*-value
Albumin (%)									
≥3.5 g/dL	91.3	95.2	0.48	92.0	91.9	0.85	92.2	91.5	0.98
<3.5 g/dL	7.1	2.4		6.5	5.4		6.2	6.8	
Unknown	1.5	2.4		1.5	2.7		1.7	1.7	
Psychological characteristics									
SCID-depression (%)									
Absence	94.9	88.1	0.099	94.0	91.9	0.62	94.4	91.5	0.43
Presence	5.1	11.9		5.9	8.1		5.6	8.5	
POMS score¶ (median, range)									
TMD (median)	13	20	0.51	16	8	0.90	12	26	0.002
TMD (range)	(–17–119)	(–10–64)		(–17–119)	(–15–93)		(–17–119)	(–15–93)	
Depression-dejection	4 (0–36)	5 (0–30)	0.18	4 (0–36)	2 (0–29)	0.96	4 (0–36)	6 (0–29)	0.020
Tension-anxiety	6 (0–26)	6 (0–18)	0.96	6 (0–26)	5 (2–20)	0.75	6 (0–26)	8 (2–20)	0.003
Anger-hostility	3 (0–30)	2 (0–16)	0.71	3 (0–30)	1 (0–25)	0.47	2 (0–22)	5 (0–30)	0.003
Vigor-activity	9 (0–26)	8 (0–22)	0.24	9 (0–22)	9 (0–26)	0.75	9 (0–26)	8 (0–26)	0.026
Fatigue-inertia	5 (0–22)	6 (0–15)	0.82	5 (0–22)	5 (0–21)	0.85	5 (0–22)	6 (0–21)	0.040
Confusion-bewilderment	6 (0–20)	6 (2–14)	0.86	6 (0–20)	5 (2–15)	0.46	6 (0–20)	6 (2–16)	0.086

†Defined by a tumor node metastasis staging system classification: International Union Againt Cancer. ‡Defined by Eastern Cooperative Oncology Group. §Hypertension, myocardiac infarction, angina pectoris, diabetes mellitus, renal diseases or liver diseases. ¶Two subjects excluded from analysis of Profiles of Mood State (POMS) score. SCID, Statistical Manual for Mental Disorders, Revised (DSM-III-R) criteria; TMD, total mood disturbance.

hazards regression analysis showed no significant association between marital status, the presence or absence of confidants and level of satisfaction with confidants, and the risk of death from all causes (Table 3). These findings remained basically unchanged even after multivariate adjustment for age, sex, occasion of cancer diagnosis, pathological stage, smoking status, smoking status after surgery and serum albumin level. With regard to marital status, the multivariable adjusted HR of unmarried patients versus married patients was 0.8 (95% confidence interval [CI], 0.3–1.8) (*P*-value = 0.53) after controlling for factors with a statistically significant effect on survival. Similarly, with regard to the presence or absence of confidants, the multivariable adjusted HR of patients without confidants versus those with confidants was 1.0 (0.5–2.2) (*P*-value = 0.90). With regard to satisfaction level with confidants, the multivariable adjusted HR of the dissatisfied group versus the satisfied group was 0.7 (0.4–1.3) (*P*-value = 0.28).

In addition, a multivariable Cox proportional hazards regression analysis showed no significant association between the patients' living status (*P*-value = 0.84), employment status (*P*-value = 0.90), number of confidants (*P* for trend = 0.89) and number of the confidant categories (*P* for trend = 0.36).

For the survival estimates, we also analyzed the total number of cancer deaths or lung-disease deaths as the endpoint. There were no significant associations between marital status and social support and the risk of total cancer deaths or lung-disease deaths (data not shown).

Discussion

In this prospective cohort study conducted in Japan, no association was found between marital status and social support and survival following complete resection of NSCLC. Thus, we concluded that marital status and social support might not influence survival in cases of NSCLC. Our study had methodological advantages over previous studies, in that we took into account potential confounding factors, such as smoking status, continued smoking after surgery, psychological variables and delay in seeking treatment (occasion of diagnosis) for the analyses. Marital status was significantly related to the sex of the patients and continuation of smoking even after surgery. The presence of confidants was significantly associated with the occasion of diagnosis. These latter factors were associated with survival in our NSCLC subjects. However, we did not find any significant association between marital status and social support and survival, and both univariate and multivariate analyses yielded consistent results. Therefore, the present study results do not support the hypothesis that the association between marital status and social support and survival may be mediated by potential confounding factors.

Previous studies have revealed that marital status is associated with smoking status and advanced stage.[1,5] Our study is the first to consider smoking status and continuation of smoking even after surgery in determining the relationship between marital status and social support and survival in patients of lung cancer. We found a significant association between

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Table 2. Results of univariate analysis for survival from non-small cell lung cancer

Characteristics	No. subjects	Person-months Median (range)	Cases	Univariate analysis	
				HR (95% CI)†	*P*-value
Demographic characteristics					
Age (years)					
≤59	82	72 (8–91)	11	1.0 (referent)	
60–69	87	69 (0–91)	23	2.2 (1.1–4.4)	0.036
70≤	69	69 (6–91)	23	2.7 (1.3–5.5)	0.007
Sex					
Female	93	72 (8–91)	12	1.0 (referent)	
Male	145	69 (0–91)	45	2.6 (1.4–4.9)	0.003
Body mass index					
≥18.5 kg/m^2	219	71 (2–91)	50	1.0 (referent)	
<18.5 kg/m^2	19	66 (0–89)	7	1.9 (0.9–4.1)	0.12
Duration of education					
>15 years	34	71 (18–88)	6	1.0 (referent)	
15 years	204	71 (0–91)	51	1.4 (0.6–3.4)	0.38
Smoking status (%)					
Never-smoker	84	73 (10–91)	9	1.0 (referent)	
Ex-smoker	56	69 (10–91)	19	3.4 (1.5–7.6)	0.002
Current smoker	98	67 (0–91)	29	3.1 (1.5–6.6)	0.003
Smoking status after surgery					
Never-smoker	84	73 (10–91)	9	1.0 (referent)	
Ex-smoker	56	69 (10–91)	19	3.4 (1.5–7.6)	0.002
Quit smoker	92	67 (2–91)	26	2.9 (1.4–6.3)	0.006
Continued smoker	6	52 (0–91)	3	6.4 (1.7–23.9)	0.005
Medical characteristics					
Occasion of diagnosis					
Mass screening or health checkup	144	72 (2–91)	28	1.0 (referent)	
Subjective symptoms	48	69 (0–89)	10	1.2 (0.6–2.5)	0.58
Follow up for other diseases	41	63 (8–89)	18	2.8 (1.6–5.1)	<0.001
Unknown	5	69 (53–91)	1	0.9 (0.1–6.9)	0.95
Pathological stage‡					
IA	122	74 (18–91)	17	1.0 (referent)	
IB	60	67 (8–91)	13	1.8 (0.9–3.6)	0.13
IIA	11	64 (18–77)	5	4.3 (1.6–11.8)	0.004
IIB	35	66 (0–91)	16	4.3 (2.2–8.6)	<0.001
IIIA	10	34 (2–74)	6	8.6 (3.4–22.0)	<0.001
Histology type					
Adenocarcinoma	162	71 (2–91)	39	1.0 (referent)	
Squamous cell carcinoma	50	68 (8–89)	13	1.1 (0.6–2.0)	0.83
Large cell carcinoma	10	61 (0–73)	4	2.3 (0.8–6.3)	0.12
Other	16	71 (16–91)	1	0.2 (0.0–1.8)	0.16
Type of surgery					
Lobectomy	228	71 (2–91)	55	1.0 (referent)	
Pneumonectomy	10	69 (0–86)	2	1.2 (0.3–4.8)	0.82
Performance status before surgery§					
0	165	72 (6–91)	36	1.0 (referent)	
1–2	73	68 (0–89)	21	1.5 (0.9–2.5)	0.15
Co-morbidity¶					
Absence	143	71 (0–91)	32	1.0 (referent)	
Presence	95	69 (2–89)	25	1.3 (0.7–2.1)	0.40
Pain					
None-mild	111	72 (0–91)	27	1.0 (referent)	
Moderate-severe	127	70 (2–91)	30	1.0 (0.6–1.7)	0.97
Dyspnea					
None-mild	134	72 (6–91)	31	1.0 (referent)	
Moderate-severe	104	69 (0–91)	26	1.1 (0.7–1.9)	0.68
Albumin					
≥3.5 g/dL	219	71 (4–91)	48	1.0 (referent)	
<3.5 g/dL	15	62 (0–73)	8	3.4 (1.6–7.2)	0.002
Unknown	4	74 (8–88)	1	1.3 (0.2–9.1)	0.82
Psychological characteristics					
SCID-Depression					
Absence	223	71 (0–91)	54	1.0 (referent)	
Presence	15	71 (27–86)	3	0.8 (0.3–2.6)	0.73
POMS score¶					
TMD	236	71 (0–91)	57	Continuous variables	0.29
Depression-dejection	236	71 (0–91)	57	Continuous variables	0.14
Tension-anxiety	236	71 (0–91)	57	Continuous variables	0.51
Anger-hostility	236	71 (0–91)	57	Continuous variables	0.12
Vigor-activity	236	71 (0–91)	57	Continuous variables	0.27
Fatigue-inertia	236	71 (0–91)	57	Continuous variables	0.33
Confusion-bewilderment	236	71 (0–91)	57	Continuous variables	0.18

†All hazard ratios (HR) are given with 95% confidence intervals (CI) in parentheses. ‡Defined by a tumor node metastasis staging system classification: International Union Againt Cancer. ‡Defined by Eastern Cooperative Oncology Group. §Hypertension, myocardiac infarction, angina pectoris, diabetes mellitus, renal diseases or liver diseases. ¶Two subjects excluded from analysis of Profiles of Mood State (POMS) score. SCID, Statistical Manual for Mental Disorders, Revised (DSM-III-R) criteria; TMD, total mood disturbance.

Table 3. Hazard ratios (HR) of cancer survival according to marital status, presence or absence of confidants and satisfaction level with confidants[†]

Characteristics	Marital status			Confidants			Satisfaction level with confidants		
	Married	Unmarried	*P*-value	Presence	Absence	*P*-value	Extremely fairly satisfied	Somewhat satisfied–extremely dissatisfied	*P*-value
No. subjects	196	42		201	37		179	59	
Person-months of follow up	70 (0–91)	73 (6–91)		71 (0–91)	65 (6–86)		71 (0–91)	67 (6–88)	
No. deaths from all causes	50	7		46	11		43	14	
Unadjusted HR	1.0 (referent)	0.6 (0.3–1.4)	0.26	1.0 (referent)	1.4 (0.7–2.7)	0.34	1.0 (referent)	1.0 (0.6–1.9)	0.96
Sex-, age-adjusted HR	1.0 (referent)	0.7 (0.3–1.6)	0.37	1.0 (referent)	1.3 (0.6–2.5)	0.50	1.0 (referent)	0.9 (0.5–1.8)	0.93
Multivariable-adjusted HR	1.0 (referent)	0.8 (0.3–1.8)	0.53	1.0 (referent)	1.0 (0.5–2.2)	0.90	1.0 (referent)	0.7 (0.4–1.3)	0.21

[†]Cox proportional hazards regression was used to adjust multivariable HR for age in years at cancer diagnosis (≤59, 60–69, ≥70), sex, smoking status (never-smoker, ex-smoker or current smoker), smoking status after surgery (never-smoker, ex-smoker, quit smoker or continued smoker), occasion of diagnosis (mass screening or health checkup, subjective symptoms, follow up for other diseases or unknown), pathological stage (IA, IB, IIA, IIB, or IIIA), and albumin.

marital status and continuation of smoking even after surgery; however, while the latter showed a significant association with survival, marital status by itself was not significantly associated with survival. The reasons for this finding are not clear, but the following may be considered. In our study, the proportion of patients who continued to smoke after surgery, which indicated poor survival, was higher among unmarried patients than among married patients (9.5% among unmarried patients vs 1.0% among married patients). However, the number of never-smokers was also higher (40.5% among unmarried patients vs 34.2% among married patients), ex-smokers (poor survival) was lower (16.7% among unmarried patients vs 25.0% among married patients), and quit-smokers (poor survival) was lower (33.3% among unmarried patients vs 39.8% among married patients) among unmarried patients than among married patients.

In relation to the psychological variables and delay in seeking treatment, there are several studies that have taken into consideration disease stage,[1–3,6–8] but none has considered psychological variables and occasion of diagnosis while determining the association between marital status and social support and survival. We evaluated these variables and found a significant association between presence of confidants and the occasion of diagnosis, which indicated influence on the survival. Moreover, the level of satisfaction with confidants showed significant association with some of the POMS subscale scores (except confusion). However, we did not found any influence of these variables on the association between marital status and social support and survival.

Goodwin *et al*.[1] reported that unmarried lung cancer patients were more likely to be diagnosed with non-local-stage disease, and were less likely to receive definitive treatment. They also found that unmarried patients still had poor survival after adjustment for stage and definitive treatment. Greenberg *et al*.[8] reported that married lung cancer patients were more likely to be treated by surgery. After adjustment for age, sex and economic and clinical characteristics, no significant association was observed between marital status and survival. According to marital status and disease stage, in our cohort, the proportion of non-local-stage disease was not significantly different between married (23.0%) and unmarried (26.2%) patients ($P = 0.65$). However, in the present study, we did not evaluate patients with advanced stages of cancer. Similarly, in relation to the likelihood of receiving definitive treatment, we did not evaluate these effects because our study subjects consisted only of patients who had undergone curative resection. If marital status and social support were associated with survival by influencing the likelihood of receiving definitive treatment and being diagnosed with non-local-stage disease, then our result on the association between marital status and social support and survival may be underestimated. Our study considered potential confounding variables, such as smoking status before and after surgery, psychological variables and occasion of diagnosis, but the size of the effect of each item that could not assessed in our study was unclear.

Our study had several limitations. First, the number of subjects ($n = 238$) and as well as deaths from cancer ($n = 57$) was small. Although we found no significant association between marital status and social support and survival from lung cancer, the analyses may not have had sufficient statistical power to detect associations between small increases or decreases in the risk of mortality. Also, we did not separate patients into men and women or unmarried patients into single, divorced or widowed because of the small sample size. Further studies are needed using larger sample sizes to clarify the prognostic effects of marital status and social support on survival according to the sex of lung cancer patients. Second, at the time of the interview conducted 1 month after the surgery ($n = 262$), three patients (1.1%) could not be contacted and 21 patients (8.0%) refused to participate because of their psychological state, physical burden or other reasons. Thus, the subjects eventually included in the analysis might have been in a better state of psychological or physical health, and

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the results might be an underestimation of the association between marital status and social support and survival in lung cancer patients. Third, we did not evaluate economical aspects of social support, including items related to welfare and insurance.

In conclusion, our data do not support the hypothesis that marital status and social support may influence survival after curative resection in NSCLC patients in Japan. Further studies are needed to clarify the prognostic effects of marital status and social support, using larger sample sizes.

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