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Atsuhiko Ota[*] Nobufumi Yasuda[†] Kazuya Kawai[‡]

Katsutoshi Tanioka[**] Yoshinori Doi[††]

Hiroshi Ohara[‡‡] Yuichiro Ono[§]

[*]Departments of Public Health, Kochi Medical School,

[†]Departments of Public Health, Kochi Medical School,

[‡]Section of Cardiovascular Medicine, Chikamori Hospital,

[**]Departments of Medicine and Geriatrics, Kochi Medical School,

[††]Departments of Medicine and Geriatrics, Kochi Medical School,

[‡‡]Departments of Public Health, Kochi Medical School,

[§]Department of Public Health, Fujita Health University School of Medicine,

Smoking Cessation after Discharge among Japanese Patients with Established Ischemic Heart Disease: A Prospective Cohort Study*

Atsuhiko Ota, Nobufumi Yasuda, Kazuya Kawai, Katsutoshi Tanioka, Yoshinori Doi, Hiroshi Ohara, and Yuichiro Ono

Abstract

In this prospective cohort study for Japanese patients with established ischemic heart disease (IHD), the authors investigated the rate of success of smoking cessation 3 months after hospital discharge and its related factors. The subjects included 90 current smokers admitted for IHD. A total of 58 subjects (64%) had quit smoking for 3 months after being discharged. In comparison with subjects with acute myocardial infarction, those with stable angina (SA) showed a significantly lower frequency of smoking cessation (relative risk of resuming smoking (95% confidence interval):2.06 (1.09, 3.92), p=0.036). This relationship remained significant even after controlling for sex, age, and scores of the Fagerstrom Test for Nicotine Dependence (adjusted odds ratio:3.39 (1.01, 11.37), p=0.048). However, it became insignificant when hospital admission followed by emergency medical service (EMS) care was additionally adjusted (adjusted odds ratio:2.48 (0.36, 16.97), p=0.356). The smoking cessation rate in this study was identical to that observed in studies conducted in Japan prior to the recent social changes with regard to tobacco use. SA still appears to be a risk factor for smoking resumption after discharge. Experiencing EMS care would be an intermediate variable in this relationship.

KEYWORDS: ischemic heart disease, smoking, prospective cohort study, Japan

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Original Article

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Atsuhiko Ota[a,b]*, Nobufumi Yasuda[a], Kazuya Kawai[c], Katsutoshi Tanioka[d], Yoshinori Doi[d], Hiroshi Ohara[a], and Yuichiro Ono[b]

Departments of [a]Public Health and [d]Medicine and Geriatrics, Kochi Medical School, Nankoku, Kochi 783–8505, Japan, [b]Department of Public Health, Fujita Health University School of Medicine, Toyoake, Aichi 470–1192, Japan, and [c]Section of Cardiovascular Medicine, Chikamori Hospital, Kochi 780–8522, Japan

In this prospective cohort study for Japanese patients with established ischemic heart disease (IHD), the authors investigated the rate of success of smoking cessation 3 months after hospital discharge and its related factors. The subjects included 90 current smokers admitted for IHD. A total of 58 subjects (64%) had quit smoking for 3 months after being discharged. In comparison with subjects with acute myocardial infarction, those with stable angina (SA) showed a significantly lower frequency of smoking cessation (relative risk of resuming smoking (95% confidence interval): 2.06 (1.09, 3.92), $p=0.036$). This relationship remained significant even after controlling for sex, age, and scores of the Fagerstrom Test for Nicotine Dependence (adjusted odds ratio: 3.39 (1.01, 11.37), $p=0.048$). However, it became insignificant when hospital admission followed by emergency medical service (EMS) care was additionally adjusted (adjusted odds ratio: 2.48 (0.36, 16.97), $p=0.356$). The smoking cessation rate in this study was identical to that observed in studies conducted in Japan prior to the recent social changes with regard to tobacco use. SA still appears to be a risk factor for smoking resumption after discharge. Experiencing EMS care would be an intermediate variable in this relationship.

Key words: ischemic heart disease, smoking, prospective cohort study, Japan

In Japan, the in-hospital mortality rate among patients with acute myocardial infarction (AMI) is currently calculated to be less than 10% [1–3]. Very few patients with angina die in the hospital. Consequently, preventive approaches against recurrence and deterioration are crucial for patients with ischemic heart disease (IHD), *i.e.*, myocardial infarction and angina. For this purpose, the cessation of smoking is essential for all IHD patients [4]. Meta-analysis reports have demonstrated that the benefits of smoking cessation in established IHD patients are extended life expectancy and decreased onset of cardiac events [5–7].

It has been reported that 26%—66% of IHD inpatients resume smoking within 3 months to 1 year after hospital discharge [8–14]. The varied results can be attributed to differences in patient characteristics among the studies. On the other hand, it has been

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*Corresponding author. Phone:+81–562–93–2453; Fax:+81–562–93–3079
E-mail:ohtaa@fujita-hu.ac.jp (A. Ota)

reported that the prevalence of smoking in some countries diminishes after introducing amendments to health policies with regard to tobacco such as an increase in the price of tobacco products, the introduction of warning labels on such product packages, and restrictions on smoking in public places [15]. Japan has made some significant changes with regard to health policies concerning tobacco use for these years. Cigarette taxes have increased by approximately 25% over the past 5 years, according to a report by the Ministry of Finance (http://www.mof.go.jp/jouhou/syuzei/siryou/128. htm; accessed Oct. 23, 2007). In accordance with the World Health Organization Framework Convention on Tobacco Control (WHO-FCTC) [16, 17], warnings pertaining to the harmful effects of smoking have been printed on all tobacco packages since 2005. The Health Promotion Law (HPL), which was the first legislation to define and control passive smoking in public places, was enforced in 2003 [16]. Therefore, comparing past and present trends in the smoking status of IHD patients after hospital discharge is a worthwhile exercise.

Review reports have suggested that smoking cessation interventions increase the number of IHD patients who successfully quit smoking by as much as 50% [5, 18]. Further improvements must be undertaken so that all established IHD patients quit smoking [4]. For this purpose, it is worthwhile to elucidate the characteristics of IHD patients who have difficulty in achieving smoking cessation. However, previous studies examining the relationships between smoking cessation and sex, age, prehospitalization smoking habits, and clinical findings have revealed mixed results [8, 9, 11–14, 19–21]. Further, only a few such studies have been carried out in Japan [12, 13].

In this prospective cohort study, the authors examined the rate of success of smoking abstinence for 3 months after hospital discharge and whether sex, age, prehospitalization smoking habits, and clinical findings were related to the smoking status of Japanese IHD inpatients.

Subjects and Methods

Subjects. The subjects were recruited at a general hospital in Kochi, Japan, from April 2005 to August 2006. The inclusion criteria for the study were admission for AMI, unstable angina (UA), or stable angina (SA) and a declaration of daily smoking by the inpatient. Medical doctors and nurses in the hospital explained the study protocol to eligible inpatients before obtaining written informed consent. A total of 100 inpatients participated in this study. Information regarding smoking status after discharge was not obtained from 10 (nonfollowed) participants for the following reasons: 1 patient expired within 3 months of hospital discharge, and 9 patients could not be contacted due to a change in residence. The remaining 90 patients were regarded as the subjects of the study.

No standardized support program for smoking cessation was set for the present study. The subjects were given verbal instructions for smoking cessation by the medical doctors and nurses; these instructions were occasionally accompanied by leaflets. The doctors and nurses exercised their discretion with regard to determining the content and frequency of the instructions during the hospitalization.

Study variables. Sex, age, and the clinical findings of the patients were compiled from medical records. The clinical findings included past IHD history, diagnosis (AMI, UA, or SA), the number of diseased coronary arteries, peak creatine phosphokinase (CPK) levels, the instances of hospital admission followed by emergency medical service (EMS) care, the length of hospitalization, subjective symptoms at the time of admission (chest pain and dyspnea), the Killip classification [22] at the time of admission, and the performance of percutaneous coronary intervention (PCI) [23] or coronary artery bypass grafting (CABG) [24]. The patients were diagnosed by cardiologists certified by the Japanese Circulation Society. A diseased coronary artery was defined as one exhibiting stenosis of 75% or greater as determined by coronary angiography. Data on the Killip classification and peak CPK levels were obtained only from participants with AMI.

In order to obtain information on prehospitalization smoking habits, the nurses interviewed the subjects as soon as their condition stabilized. The subjects were questioned regarding the number of cigarettes smoked per day, the number of years of smoking, and the degree of nicotine dependence. The degree of nicotine dependence was evaluated using 2 self-reported questionnaires: the Fagerstrom Test for

Nicotine Dependence [25] and the Tobacco Dependence Screener [26]. For both questionnaires, a greater score implies a heavier dependence. Smoking cessation guidance was not provided when collecting the information; therefore, the subjects provided a frank declaration of their smoking history.

To determine the smoking status 3 months after hospital discharge, one of the authors (A. O.) telephoned the subjects and inquired whether they had abstained from smoking. The subjects who replied affirmatively were considered as abstainers. The others were regarded as nonabstainers.

Ethics. The present study was carried out in accordance with the approval of the Ethical Committees of the hospital at which the present study was performed and Kochi Medical School.

Statistical analysis. The subjects' baseline characteristics were compared with their diagnoses using the chi-square test and one-way analysis of variance. The difference in the baseline characteristics was investigated between the subjects and the nonfollowed participants using Fisher's exact test and the *t*-test. The relationships between the smoking status 3 months after hospital discharge and sex, age, prehospitalization smoking habits, and clinical findings were evaluated based on the relative risk of resuming smoking or differences in the mean value of each baseline characteristic between abstainers and nonabstainers. For the variables that showed an association with the smoking status after discharge, multiple logistic regression analysis was performed to control possible confounders. The level of significance was 0.05 (2-tailed) for all tests. Calculations were performed using SPSS® 13.0J for Windows (SPSS Japan Inc., Tokyo, Japan).

Results

The baseline characteristics of the subjects are summarized in Table 1. Compared with subjects with AMI or UA, SA subjects exhibited the following features: fewer arteries with stenosis, fewer instances of admission followed by EMS care, a shorter duration of hospitalization, and a lower frequency of chest pain complaints at the time of admission; further, a fewer number of SA subjects compared with the AMI or UA patients underwent PCI or CABG. There were no significant differences in any of the baseline variables between the subjects and the nonfollowed participants (data not shown).

Of the 90 subjects, 64% abstained from smoking for 3 months after discharge.

Table 2 indicates the relationship between the smoking status after hospital discharge and sex, age, prehospitalization smoking habits, and clinical findings. In comparison with the subjects with AMI, those with SA showed a significantly lower frequency of smoking cessation. The negative relationship between admission followed by EMS care and smoking resumption after discharge showed borderline significance. The other variables revealed no significant relationship with smoking status after discharge.

The results of multiple logistic regression analysis are given in Table 3. The relationship between SA and resuming smoking after discharge was significant even after controlling for sex, age, and the FTND score. However, it became insignificant when admission followed by EMS care was additionally adjusted.

Discussion

The smoking cessation rate observed in the present study resembles that observed in 2 previous Japanese studies. A Japanese prospective cohort study found that 66% of IHD inpatients quit smoking for 6 months after discharge [12]. Another study reported that 74% of AMI inpatients remained abstinent for 3 months after hospital discharge [13]. Previous studies indicated that patients with SA showed a lower frequency of smoking cessation than those with AMI or UA [11, 14, 19]; this result was also obtained in the present study. However, the results of this study were based on patients from just 1 hospital. Multiinstitutional surveys are indispensable in order to generalize the findings of the present study. Furthermore, based on the present findings, we cannot conclude whether the recent changes in Japanese health policies with regard to tobacco use, as mentioned in the Introduction, modified the smoking behaviors of the subjects, as the effect of such changes on each subject was not assessed. By referring to previous reports indicating a possible relationship between health policies and the prevalence of smoking [15], researchers need to establish absolute methods to evaluate the impact of health policies on individuals. This would help in future investigations

Table 1 Baseline characteristics of the subjects: comparison with the diagnosis at the time of admission

Variables [Frequency (%) or mean (SD)]	AMI (N=55)	UA (N=20)	SA (N=15)	$p^{a)}$
Sex: Male	49 (89%)	18 (90%)	14 (93%)	0.889
Age	62.4 (10.9)	63.3 (9.4)	64.2 (5.6)	0.801
No. of cigarettes smoked per day				
10 or less	12 (22%)	5 (25%)	7 (47%)	
11–20	18 (33%)	5 (25%)	1 (7%)	
				0.138
21–30	16 (29%)	6 (30%)	7 (47%)	
31 or more	9 (16%)	4 (20%)	0 (0%)	
No. of years of smoking	42.6 (11.8)	42.7 (11.3)	46.1 (5.5)	0.535
Score of nicotine dependence				
FTND	5.5 (2.6)	5.5 (2.4)	6.1 (2.2)	0.707
TDS	6.0 (2.4)	5.9 (3.0)	6.9 (2.4)	0.465
Positive past history of IHD	10 (18%)	7 (35%)	6 (40%)	0.125
No. of diseased coronary arteries				
0	1 (2%)	4 (20%)	5 (33%)	
1	29 (53%)	8 (40%)	6 (40%)	
				0.027
2	17 (31%)	5 (25%)	3 (20%)	
3	8 (15%)	3 (15%)	1 (7%)	
Peak CPK (IU/l)[b)]	2,701 (2,522)			
Admission followed by EMS care	53 (97%)	15 (75%)	1 (7%)	< 0.001
No. of hospitalization days	17.7 (7.0)	8.1 (5.7)	7.2 (8.9)	< 0.001
Suffering chest pain at admission	43 (78%)	15 (75%)	6 (40%)	0.014
Suffering dyspnea at admission	9 (16%)	2 (10%)	2 (13%)	0.779
Killip classification at admission [b)]				
1	52 (95%)			
2	2 (4%)			
3	0 (0%)			
4	1 (2%)			
Taking PCI or CABG	51 (93%)	17 (85%)	8 (53%)	0.001

[a)] Calculated using the chi-square test or one-way analysis of variance.

[b)] Data were obtained only from subjects with AMI (n=55).

AMI, acute myocardial infarction; UA, unstable angina: SA, stable angina; FTND, Fagerstrom Test for Nicotine Dependence; TDS, Tobacco Dependence Screener; IHD, ischemic heart disease; CPK, creatine phosphokinase; EMS, emergency medical service; PCI, percutaneous coronary intervention ; CABG, coronary artery bypass grafting.

to comprehensively clarify correlates of smoking behavior among established IHD patients.

In comparison with the subjects with AMI, those with SA quit smoking less frequently. This result is concordant with those from previous studies in Western countries [11, 14, 19].

Scholte op Reimer *et al.* [14] have pointed out the possibility that AMI patients are keener than patients who have only experienced nonfatal ischemic episodes to realize the seriousness of their disease and are more willing to accept recommendations for lifestyle changes. Based on the present results of multiple logistic regression analysis, the authors supposed that experiencing EMS care could contribute toward this difference. In this study, admission followed by EMS care was associated with both the diagnosis and smoking resumption after discharge. Thus, admission followed by EMS care was entered in the multiple logistic regression analysis. An intermediate variable is epidemiologically defined as one that causes variation in the dependent variable and is caused to vary by the independent variables [27]. The results of multiple logistic regression analysis suggested that taking EMS care is an intermediate variable in the relationship between diagnosis and the smoking status after discharge.

Table 2 Relationship between smoking status 3 months after hospital discharge and sex, age, prehospitalization smoking habits, and clinical findings (N=90)

Variables		Frequency (%) or mean (SD)		Relative risk or difference (95% confidence interval)[a]	p [b]
		Nonabstainers (N = 32)	Abstainers (N = 58)		
Sex	Female	3 (33%)	6 (67%)	1.00 [c]	
	Male	29 (36%)	52 (64%)	1.07 (0.33, 3.46)	1.000
Age		63.0 (9.6)	62.8 (10.0)	0.16 (−4.16, 4.48)	0.942
No. of cigarettes smoked per day	10 or less	4 (31%)	9 (69%)	1.00 [c]	
	11–20	11 (38%)	18 (62%)	1.23 (0.42, 3.65)	0.739
	21–30	6 (25%)	18 (75%)	0.81 (0.24, 2.70)	1.000
	31 or more	11 (46%)	13 (54%)	1.49 (0.51, 4.35)	0.491
No. of years of smoking		42.4 (11.3)	43.6 (10.7)	−1.26 (−6.03, 3.50)	0.599
Score of nicotine dependence	FTND	6.0 (2.3)	5.3 (2.5)	0.70 (−0.38, 1.78)	0.199
	TDS	6.6 (2.4)	5.9 (2.6)	0.71 (−0.39, 1.81)	0.200
Past history of IHD	Negative	22 (37%)	45 (63%)	1.00 [c]	
	Positive	10 (43%)	13 (57%)	1.32 (0.71, 2.48)	0.450
Diagnosis	AMI	16 (29%)	39 (71%)	1.00 [c]	
	UA	7 (35%)	13 (65%)	1.20 (0.56, 2.61)	0.778
	SA	9 (60%)	6 (40%)	2.06 (1.09, 3.92)	0.036
No. of diseased coronary arteries	0	3 (30%)	7 (70%)	1.00 [c]	
	1	15 (35%)	28 (65%)	1.25 (0.28, 5.55)	1.000
	2	10 (40%)	15 (60%)	1.56 (0.32, 7.49)	0.709
	3	4 (33%)	8 (67%)	1.17 (0.19, 7.12)	1.000
Peak CPK (IU/l) [d]		2,107 (2,203)	2,945 (2,630)	−837.7 (−2336.0, 660.7)	0.267
Admission followed by EMS care	Not applicable	11 (52%)	10 (48%)	1.00 [c]	
	Applicable	21 (30%)	48 (69%)	0.58 (0.29, 1.16)	0.075
No. of hospitalization days		12.6 (9.2)	14.5 (8.2)	−1.82 (−5.57, 1.92)	0.336
Chest pain at admission	Not suffering	8 (31%)	18 (69%)	1.00 [c]	
	Suffering	24 (37%)	40 (63%)	1.22 (0.57, 2.61)	0.631
Dyspnea at admission	Not suffering	28 (36%)	49 (64%)	1.00 [c]	
	Suffering	4 (31%)	9 (69%)	0.85 (0.35, 2.07)	0.765
Killip classification at admission [d]	1	16 (31%)	36 (69%)	uncalculated	
	2–4	0 (0%)	3 (100%)		
PCI or CABG	Not taken	3 (21%)	11 (79%)	1.00 [c]	
	Taken	29 (38%)	47(62%)	1.78 (0.55, 5.72)	0.362

[a] The relative risk of resuming smoking and the difference in the mean values between abstainers and nonabstainers are calculated for categorical and continuous variables, respectively.
[b] Calculated with Fisher's exact test or *t*-test.
[c] Reference
[d] Data were obtained only from the subjects with AMI (n = 55).
FTND, Fagerstrom Test for Nicotine Dependence; TDS, Tobacco Dependence Screener; IHD, ischemic heart disease; AMI, acute myocardial infarction; UA, unstable angina; SA, stable angina; CPK, creatine phosphokinase; EMS, emergency medical service; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting.

It could be possible that the relationship between SA and smoking resumption after discharge merely reflected the heterogeneity of the nature of smoking cessation support during the hospitalization. No standardized support program for smoking cessation was prepared for this study. Moreover, determining the content and frequency of support for smoking cessation was left exclusively to the discretion of the medical doctors and nurses who were in charge of the subjects. Consequently, the instructions for smoking cessation during the hospitalization might differ between subjects. Compared to the subjects with SA,

Table 3 Relationship between diagnosis at admission and smoking 3 months after hospital discharge: adjusted odds ratio, 95% confidence interval (CI), and p-value

Diagnosis	Model 1		Model 2		Model 3	
	Adjusted odds ratio (95% CI)	*p*	Adjusted odds ratio (95% CI)	*p*	Adjusted odds ratio (95% CI)	*p*
AMI	1.00 [a)]		1.00 [a)]		1.00 [a)]	
UA	1.30 (0.44, 3.88)	0.635	1.33 (0.44, 4.00)	0.611	1.24 (0.39, 3.94)	0.722
SA	3.58 (1.09, 11.80)	0.036	3.39 (1.01, 11.37)	0.048	2.48 (0.36, 16.97)	0.356

Note. Adjusted factors: sex and age in Model 1; sex, age, and scores of the Fagerstrom Test for Nicotine Dependence (FTND) in Model 2; sex, age, the FTND scores, and hospital admission followed by emergency medical service care in Model 3.
[a)] Reference
AMI, acute myocardial infarction; UA, unstable angina; SA, stable angina.

those with AMI might be provided with stricter and more frequent instructions to quit smoking; this approach could lead to higher smoking cessation rates among the subjects with AMI. However, it was not evaluated in this study whether there were any differences in the smoking cessation instructions between subjects. Hence, the authors could not investigate further.

The authors discuss here whether the smoking status after discharge was correctly assessed in this study. Self-reported smoking status is generally thought to be reliable [28, 29]. On the other hand, in a survey by Ockene *et al.* [10], 30%—40% of IHD patients who self-reported smoking cessation after discharge were judged to be smokers by the estimation of saliva cotinine, a metabolite of nicotine. Therefore, it is possible that the smoking cessation rate was overestimated in the present study.

Certain limitations in the present study should be taken into account while interpreting the results. The sample size in this study may not be large enough to detect the effects of sex, age, and prehospitalization smoking habits on smoking behaviors after discharge. Certain unexamined factors in this study, *e.g.*, genetic factors, could have a greater impact than the above-mentioned factors on the smoking behaviors of patients after discharge. Because nicotine induces dopamine release in the dopaminergic reward pathway [30], recent studies have examined the relationship of pharmacogenetic factors such as polymorphisms in the dopamine-D2 receptor with nicotine dependence and smoking behavior [31–33]. To our knowledge, there is no study that has examined the genetic effects on smoking behavior among IHD patients. Such studies would aid in advancing support for smoking cessation among these patients.

It is imperative that IHD patients permanently quit smoking. Determining the long-term smoking cessation rate and its associated factors among patients with established IHD are problems that remain unresolved.

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