Prevalence Rates of Type 2 Diabetes and Hypertension are Elevated among Middle-aged Japanese Men with Colonic Diverticulum

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Abstract

Objective: To elucidate the prevalence rate of metabolic disorders among subjects with asymptomatic colonic diverticulum.

Methods: We carried out a cross-sectional analysis of the association between colonic diverticulum and selected metabolic disorders among the male personnel of the Self-Defense Forces who underwent total colonoscopy as part of their retirement check-up (age range, 51–59 years).

Results: The prevalence rate of colonic diverticulum was 10.2% among the population studied. The scores of lifestyle factors including those of cigarette smoking and alcohol consumption were similar between the subjects with colonic diverticulum and those without it. Type 2 diabetes (21.6% vs 14.0%, $P=0.047$) and hypertension (30.9% vs 19.8%, $P=0.011$) were more prevalent among the subjects with colonic diverticulum than those without it. The prevalence rates of obesity, dyslipidemia, hyperuricemia, and impaired glucose tolerance were similar between the two groups.

Conclusion: The prevalence rates of type 2 diabetes and hypertension are elevated among the middle-aged male subjects with asymptomatic colonic diverticulum. The results may partly explain the reported association between colonic diverticulum and cardiovascular disease.

Key words: colonic diverticulum, cardiovascular risk factor, diabetes

Introduction

Colonic diverticulum is relatively common and is present among two-thirds of the elderly people in developed countries (1, 2). Although most types of colonic diverticula are clinically asymptomatic, approximately 20% of affected people manifest clinical symptoms. In addition, it is reported that subjects with colonic diverticulum show higher prevalence rate of cardiovascular disease (3, 4). The mechanism by which colonic diverticulum is associated with cardiovascular disease has not yet been elucidated. Colonic diverticulum and some metabolic disorders, however, might share a common etiology (5, 6). It is reported that the prevalence rates of impaired glucose tolerance (IGT) and hyperlipidemia are increased among patients with colonic diverticulum in the Western population (5). However, it has not been clarified whether asymptomatic diverticulum is associ-

ated with diabetes and hypertension. In this study, the association between colonic diverticulum and selected metabolic disorders was analyzed among middle-aged Japanese men (age range, 51–59 years) who belonged to the Self-Defense Forces (SDFs). The results showed that the prevalence rates of diabetes and hypertension were elevated among the subjects with asymptomatic colonic diverticulum.

Methods

Male subjects who were admitted to the SDFs Central Hospital for retirement medical check-up were enrolled in the study. Of the 974 participants, full length colonoscopy was successfully performed in 954 subjects. Of these 954 subjects, colonic diverticulum was found in 97 subjects (10.2%). Most of the colonic diverticula were found in the right side of the colon. Fasting plasma and serum samples were collected. Metabolic risk factors for atherosclerosis, including serum total cholesterol and triglyceride, and fasting plasma glucose concentrations were measured. An oral 75 g glucose tolerance test was performed except in subjects with known diabetes. Blood pressure was measured after resting in a sitting position using a mercury sphygmomanometer. Body mass index was calculated

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as $[\text{weight (kg)}]/[\text{height (m)}]^2$.

Information on individual medical history and lifestyle factors including cigarette smoking rate, physical activity frequency, and vegetable intake score was obtained using a self-completion questionnaire. Physical activity was expressed as the frequency of exercise sufficient to induce perspiration. Physical inactivity was defined as the frequency of exercise of less than once per week that induces perspiration. Daily alcohol consumption rate was calculated from the sum of the individual consumption rate of each alcohol. Frequent drinkers were defined as those whose daily alcohol consumption rate is more than 30 ml per day. Vegetable intake level was assessed by using a self-rating scale and was classified into four categories: poor intake “1”, common intake “2”, relatively rich intake “3”, and rich intake “4” (vegetable intake score) as reported previously (7).

Obesity was defined as having a body mass index of 25.0 kg/m² or more. The diagnosis of diabetes and the impaired glucose tolerance test (IGT) were carried out according to the criteria of the World Health Organization. Briefly, subjects with a fasting plasma glucose level of 7.0 mmol/l (126 mg/dl) or

more, or those with a 2 h plasma glucose level of 11.1 mmol/l (200 mg/dl) or more were considered to have diabetes. Subjects with fasting plasma glucose levels of 6.1–6.9 mmol/l (110–125 mg/dl), or those with 2 h plasma glucose levels of 7.8–11.0 mmol/l (140–199 mg/dl) were defined as subjects having IGT. The diagnoses of hypercholesterolemia, hypertriglyceridemia, and hyperuricemia were made on the basis of the subjects' medical history and laboratory findings. Subjects who had a total cholesterol concentration higher than 5.69 mmol/l (220 mg/dl) were considered hypercholesterolemic; subjects who had a triglyceride concentration higher than 1.68 mmol/l (150 mg/dl) were considered hypertriglyceridemic; subjects who had a uric acid concentration higher than 417 $\mu\text{mol/l}$ (7 mg/dl) were considered hyperuricemic. The diagnosis of hypertension was made on the basis of individual medical history or hypertension medication history using the criteria of the Seventh Report of Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (systolic blood pressure of 140 mmHg or more, or diastolic blood pressure of 90 mmHg or more). The protocol of this study was approved by the Ethics Committee of the SDFs

Table 1 Association between colonic diverticulum, lifestyle factors and metabolic parameters, and related lifestyles (mean $\pm$ SD)

	Diverticulum (–) n=857	Diverticulum (+) n=97	P value
Age, years	52.9 $\pm$ 1.0	53.0 $\pm$ 1.2	NS
Lifestyle factors			
No. of cigarettes smoked/day	10.4 $\pm$ 12.4	10.2 $\pm$ 11.9	NS
Sweating exercise, session/wk	2.28 $\pm$ 2.17	2.25 $\pm$ 2.10	NS
Alcohol consumption rate, ml/day	35.8 $\pm$ 31.6	31.3 $\pm$ 24.7	NS
Vegetable intake score	2.3 $\pm$ 0.8	2.3 $\pm$ 0.8	NS
Metabolic factors			
Body mass index, kg/m ²	23.6 $\pm$ 2.4	23.8 $\pm$ 2.4	NS
Total cholesterol, mmol/l	5.5 $\pm$ 0.9	5.6 $\pm$ 0.9	NS
Triglyceride, mmol/l	1.6 $\pm$ 0.9	1.8 $\pm$ 0.9	0.049
Uric acid, $\mu\text{mol/l}$	366 $\pm$ 72	370 $\pm$ 73	NS
Fasting plasma glucose, mmol/l	5.6 $\pm$ 0.7	5.8 $\pm$ 0.9	0.012
Systolic blood pressure, mmHg	122 $\pm$ 13	123 $\pm$ 13	NS

P values are for the “Diverticulum (–)” group.

Table 2 Association between colonic diverticulum and prevalence rates of metabolic disorders and related lifestyles

	Diverticulum (–) n=857	Diverticulum (+) n=97	P value
Lifestyle factors, %			
Current smokers	46.6	47.4	NS
Physically inactive persons	22.2	23.7	NS
Frequent drinkers	49.6	47.4	NS
Poor vegetable consumers	14.6	12.4	NS
Prevalence of metabolic disorders, %			
Obesity	27.9	28.9	NS
Hypercholesterolemia	41.0	42.3	NS
Hypertriglyceridemia	35.3	38.1	NS
Hyperuricemia	23.1	23.7	NS
Impaired glucose tolerance	22.1	22.7	NS
Type 2 diabetes	14.0	21.6	.044
Hypertension	19.8	30.9	.011

P values are for the “Diverticulum (–)” group.

Central Hospital.

Mean values and proportions between subjects with colonic diverticulum and subjects without colonic diverticulum were compared by unpaired *t* test and χ^2 test. Statistical analysis was performed using Stat View, version 5.0 (SAS Institute, Cary, NC, USA).

Results

Th number of cigarettes smoked, the frequency of exercise sufficient to induce perspiration, the daily alcohol consumption rate, and the level of vegetable intake were all similar between the subjects with colonic diverticulum and those without it (Table 1). The proportions of physically inactive persons, frequent drinkers, current smokers, poor vegetable consumers, and subjects who were obese were similar between the two groups (Table 2). The levels of serum triglyceride and fasting plasma glucose but not body mass index, total cholesterol, uric acid or systolic blood pressure were higher among the subjects with colonic diverticulum than among those without it (Table 1). The prevalence rates of type 2 diabetes and hypertension were higher among the subjects with colonic diverticulum than among those without it (Table 2). The prevalence rates of obesity, hypercholesterolemia, hypertriglyceridemia, hyperuricemia, and IGT were comparable between the two groups.

Discussion

It is reported that IGT is associated with the development of colonic diverticulum (5), and that the prevalence rate of hypertension is elevated among subjects with symptomatic (bleeding) colonic diverticulum (8) in the Western population. In accordance with the results of these previous studies, the prevalence rates of type 2 diabetes and hypertension were elevated among the subjects with colonic diverticulum in this study (Table 2). To the best of our knowledge, this is the first report that shows that the prevalence rates of type 2 diabetes and hypertension are elevated among subjects with asymptomatic colonic diverticulum.

The association between diabetes and colonic diverticulum

may partly be explained by the reported association between colonic diverticulum and cardiovascular disease (3, 4). The mechanism by which colonic diverticulum is associated with diabetes is not yet clear. It is assumed that low dietary fiber intake contributes to the development of colonic diverticulum (9, 10), type 2 diabetes (11–14), and cardiovascular disease (15–18). In this study, however, the proportion of poor vegetable consumers was similar between the subjects with colonic diverticulum and those without it.

Some lifestyles and related factors including cigarette smoking, obesity, and high alcohol intake, are reported to be correlated with the risk of type 2 diabetes. However, the prevalence rates of these lifestyle factors were similar between the subjects with colonic diverticulum and those without it. Thus, these factors do not seem to contribute much to the observed association between colonic diverticulum and type 2 diabetes. Although it is reported that the prevalence rates of colonic diverticulum and metabolic disorders are age-dependent, the confounding effects of ageing appear to be minimal, considering the narrow age range of the population studied.

Most colonic diverticula are found on the left side of the colon in the Western population (19). In contrast, most colonic diverticula are found on the right side of the colon in the Japanese population (20, 21). Most colonic diverticula were also found on the right side of the colon of the subjects in this study. Right-side diverticulum incidence is increasing steadily in Japan (21). There are lines of evidence that the etiology of right-side diverticulum in the Japanese population is similar to that of left-side diverticulum in the Western population (22). It is possible, however, that the etiologies of colonic diverticulum are different between the Japanese and Western populations. Thus, the main finding of this study does not appear to be associated with the findings of diverticulum development in the Western population.

In conclusion, the development of colonic diverticulum was associated with some metabolic disorders among middle-aged Japanese men who belonged to SDFs. The results may partly explain the reported association between colonic diverticulum and cardiovascular disease.

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