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Evaluation of Metabolic Syndrome in Patients with Chronic Low Back Pain: Using the Fourth Korea National Health and Nutrition Examination Survey Data

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The aim of this study was to investigate the frequency of the metabolic syndrome in patients with chronic lower back pain in Korea and to evaluate the differences in clinical characteristics in chronic lower back pain patients with and without metabolic syndrome. This was a cross-sectional study using data from the fourth Korea National Health and Nutrition Examination Survey (KNHANES IV) 2008. The sample consisted of 1085 participants with chronic lower back pain. The diagnosis of metabolic syndrome was made according to the criteria of the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) and the Korean Society for the Study of Obesity. The prevalence of metabolic syndrome among chronic lower back pain patients was 36.2% (30.2% male, 38.6% female). According to our results, female sex, advanced age, and high BMI were risk factors for metabolic syndrome. These results from a representative sample show that metabolic syndrome is common in chronic lower back pain patients in Korea. Clinicians managing chronic lower back pain should consider the risk factors for metabolic syndrome.

Key Words: *Low back pain; Metabolic syndrome; Nutrition surveys*

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INTRODUCTION

Metabolic syndrome is a complicated metabolic disease that includes abdominal obesity, hypertension, insulin resistance or glucose intolerance, and dyslipoproteinemia.[1] The prevalence of this syndrome has increased with obesity worldwide.[2]

Metabolic syndrome is closely related to several other diseases linked to obesity, and low back pain is one of those. In previous studies, obesity was a direct risk factor of low back pain,[3-5] and degenerative arthritis due to obesity was shown to reduce physical activities indirectly, causing an increase in serum lipid concentrations leading to arteriosclerosis, and to cause low back pain.[6] For these reasons, evaluation of metabolic syndrome is important in the treatment of patients with chronic low back pain. Although the relationship between metabolic syndrome and other diseases, such as cardiovascular diseases,[7] diabetes,[8] bipolar disorder,[9] reflux esophagitis,[10] ischemic stroke,[11] polycystic ovary syndrome,[12] and hypogonadism,[13] has been studied, the relationship between metabolic syndrome and chronic low back pain has rarely been studied inside and outside the country.

The aim of this study was therefore to investigate the prevalence of metabolic syndrome in patients having chronic low back pain and to evaluate the differences between patients with or without metabolic syndrome. The study was based on the results and surveys of the fourth session of the Korea National Health and Nutrition Examination Survey (KNHANES), which was performed in a household sample selected from the population in Korea in 2008.

MATERIALS AND METHODS

1. Subjects

The study population was selected from among a total sample population of 9744 who participated in a health interview during the fourth session of KNHANES in the second year (Jan 2008-Dec 2008). In this study, a patient hav-

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ing chronic low back pain was defined as one who replied that his or her back was 'painful more than three months for a recent year' on the item about low back pain. A total of 1085 subjects (11.1%) were finally selected.

2. Methods

Metabolic syndrome was diagnosed when the patient had three of five items according to the recommendation of the U.S. National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III)[14] and the Korean Society for the Study of Obesity[15] as follows:

i) Waist circumference of more than 90 cm (male) or 85 cm (female)
ii) Systolic blood pressure more than 130 mmHg or diastolic blood pressure more than 85 mmHg or a response of 'yes' for a hypertension diagnosis
iii) Fasting plasma glucose of more than 100 mg/dl or a response of 'yes' for a diabetes diagnosis
iv) Triglycerides more than 150 mg/dl
v) HDL cholesterol less than 40 mg/dl (male) or 50 mg/dl (female)

In a physical examination, waist measurement was performed in the narrowest part between the lower thorax and the iliac crest. For measuring BMI, the height and weight were measured after the patient took off his or her shoes and while wearing a thin gown. Blood pressure was measured three times in 5-minute intervals and the second and third values were added and then divided in half. Fasting plasma glucose was measured by sampling the blood in the morning after the patient had fasted for 12 hours. Various clinical tests were performed by the two institutes and different values for HDL cholesterol owing to different analysis methods and equipment between the two institutes were used.

On items about regular exercise among the questions concerning life habits, intense physical activities meant more than 20 minutes three times weekly and moderate physical activities or walking meant more than 30 minutes five times per week. Items about smoking consisted of to smoke, to quit smoking, and not applicable. Drinking was classified into less than once a month, 1-4 times a month, and more than twice a week.

3. Statistical analysis

SAS version 9.2 was used for statistical analysis. The significance level was a p-value < 0.05. For each factor, continuous variables were analyzed by t-test and categorical variables were analyzed by chi-square test.

RESULTS

1. Features of patients having chronic low back pain (Table 1)

Among the entire subjects, 1,085 subjects reported chronic low back pain, including 305 males and 780 females. The average age was 58.4±16.3 years in the males and 59.2±16.1 years in the females. In addition, the prevalence of hypertension was 38.7% in the males and 46.7% in the females; thus, women showed a higher prevalence. On the contrary, the prevalence of diabetes was 37.0% in the males and 33.7% in the females; thus, men showed higher prevalence. The rate of subjects having metabolic syndrome was 30.2% in the males and 38.6% in the females. It was significantly higher in females.

2. Comparison by metabolic syndrome in male patients having chronic low back pain (Table 2)

Among 305 male patients having chronic low back pain, 92 patients (30.2%) had metabolic syndrome. The average was 61.5±13.1 years in the patients having metabolic syndrome, which was significantly higher than the age of 57.0± 17.4 years of the patients without metabolic syndrome. BMI, which showed obesity, was 22.5±2.7 in the patients without metabolic syndrome, but it was higher, 24.8±2.5, in the patients having metabolic syndrome. Waist measurement, systolic and diastolic blood pressure, fasting plasma glucose, triglycerides, and total cholesterol were significantly higher in the patients having metabolic syndrome. HDL was significantly lower in those patients. The

TABLE 1. Characteristics of the study population

Characteristics	Men	Women	p value
No. of subjects	305	780	
Age (years)	58.4 (16.3)	59.2 (16.1)	0.471
Body mass index (kg/m^2)	23.2 (2.8)	24.0 (3.4)	<0.001
Waist circumference (cm)	84.1 (8.5)	82.8 (10.2)	0.042
Systolic blood pressure (SBP, mmHg)	118.8 (16.4)	120.1 (19.3)	0.234
Diastolic blood pressure (DBP, mmHg)	73.8 (10.3)	73.2 (11.0)	0.387
Fasting plasma glucose (mg/dl)	98.7 (19.8)	99.1 (29.0)	0.840
Total cholesterol (mg/dl)	179.5 (34.0)	194.2 (36.7)	<0.001
Triglyceride (mg/dl)	155.7 (128.0)	133.4 (93.4)	0.007
HDL cholesterol (mg/dl)	44.3 (10.2)	47.7 (11.0)	<0.001
Hypertension (%)	38.7	46.7	0.017
Diabetes (%)	37.0	33.7	0.312
Metabolic syndrome (MS) (%)	30.2	38.6	0.009

HDL: high-density lipoprotein.

TABLE 2. Differences in the clinical characteristics of patients with and without metabolic syndrome (men)

Characteristics		Patients with metabolic syndrome	Patients without metabolic syndrome	p value
No. of subjects		92	213	
Age (years)		61.5 (13.1)	57.0 (17.4)	0.014
Body mass index (kg/m^2)		24.8 (2.5)	22.5 (2.7)	<0.001
Waist circumference (cm)		90.2 (6.5)	81.4 (7.9)	<0.001
Systolic blood pressure (SBP, mmHg)		124.9 (13.9)	116.1 (16.6)	<0.001
Diastolic blood pressure (DBP, mmHg)		78.3 (9.9)	71.9 (10.0)	<0.001
Fasting plasma glucose (mg/dl)		108.9 (23.7)	94.1 (15.8)	<0.001
Total cholesterol (mg/dl)		186.6 (35.5)	176.3 (32.9)	0.016
Triglyceride (mg/dl)		230.8 (167.3)	121.8 (86.9)	<0.001
HDL cholesterol (mg/dl)		38.6 (7.5)	46.9 (10.2)	<0.001
Hypertension (%)		66.3	26.8	<0.001
Diabetes (%)		71.7	21.5	<0.001
Regular exercise (%)		63.0	67.9	0.408
Smoking status	Current smoker	28	91	
	Ex-smoker	50	86	0.069
	Nonsmoker	14	35	
Drinking frequency	<1 time per month	34	91	
	1-4 times per month	20	56	0.110
	≥2 times per week	31	47	

HDL: high-density lipoprotein.

TABLE 3. Differences in the clinical characteristics of patients with and without metabolic syndrome (women)

Characteristics		Patients with metabolic syndrome	Patients without metabolic syndrome	p value
No. of subjects		301	479	
Age (years)		65.2 (10.9)	55.4 (17.6)	<0.001
Body mass index (kg/m^2)		25.9 (3.1)	22.8 (3.0)	<0.001
Waist circumference (cm)		89.4 (8.2)	78.6 (9.0)	<0.001
Systolic blood pressure (SBP, mmHg)		128.9 (17.0)	114.6 (18.6)	<0.001
Diastolic blood pressure (DBP, mmHg)		76.7 (10.4)	71.0 (10.9)	<0.001
Fasting plasma glucose (mg/dl)		110.5 (41.7)	91.3 (9.6)	<0.001
Total cholesterol (mg/dl)		202.4 (37.2)	188.6 (32.3)	<0.001
Triglyceride (mg/dl)		183.9 (112.5)	99.3 (56.5)	<0.001
HDL cholesterol (mg/dl)		42.6 (8.3)	51.2 (11.3)	<0.001
Hypertension (%)		76.4	28.0	<0.001
Diabetes (%)		62.8	14.1	<0.001
Regular exercise (%)		58.7	62.8	0.254
Smoking status	Current smoker	12	31	
	Ex-smoker	12	33	0.068
	Nonsmoker	277	415	
Drinking frequency	<1 time per month	17	32	
	1-4 times per month	38	117	0.003
	≥2 times per week	137	201	

HDL: high-density lipoprotein.

prevalence of hypertension and diabetes was 66.3% and 71.7%, respectively, in the patients having metabolic syndrome. Those were vastly higher than the 26.8% and 21.5% in the patients without metabolic syndrome. In the comparison of life habits, exercise, smoking, and drinking frequency were not significantly different from the frequencies in the group without metabolic syndrome.

3. Comparison by metabolic syndrome in female patients having chronic low back pain (Table 3)

In 780 female patients having chronic low back pain, 301 patients (38.6%) had metabolic syndrome and the rate was higher than in males. The average age was 65.2±10.9 years in the patients having metabolic syndrome, which was significantly higher than the age of 55.4±17.6 years of the pa-

tients without metabolic syndrome. BMI was 25.9±3.1 in the patients having metabolic syndrome, which was higher than the 22.8±3.0 of the patients without metabolic syndrome, the same as for the males. Waist measurement, systolic and diastolic blood pressure, fasting plasma glucose, triglycerides, and total cholesterol were significantly higher in the patients having metabolic syndrome. HDL was also significantly lower in those patients. The prevalence of hypertension and diabetes was 76.4% and 62.8%, respectively, in the patients having metabolic syndrome, which was higher than in the patients without metabolic syndrome. On items concerning life habits, exercise and smoking were not significantly different from the habits of the group without metabolic syndrome, but drinking frequency was significantly higher in the patients having metabolic syndrome.

DISCUSSION

The prevalence of metabolic syndrome in patients having chronic low back pain was 30.2% in males and 38.6% in females. This was higher than the 21.6% (1998) and 21.4% (2001)[16] according to the application of the APC-WC standards in the nation in the past. The rate of patients having metabolic syndrome was high among females, which agrees with previous results in other Asian areas.[17,18]

In patients having chronic low back pain, when the age of the two groups with or without metabolic syndrome was compared, the average age of the patients having metabolic syndrome was higher. The difference in females was particularly large, which might have been caused by the increased prevalence of abdominal obesity with weight increases related to hormonal changes after menopause, which might increase the prevalence of metabolic syndrome.[14]

BMI, waist measurement, blood pressure, fasting plasma glucose, total cholesterol, and triglycerides were higher and HDL was lower in the patients having metabolic syndrome. This result could be predicted according to the diagnostic standards for metabolic syndrome. In addition, the prevalence of hypertension and diabetes was higher in the patients having metabolic syndrome.

Factors related to life habits, such as regular exercise, smoking, and drinking frequency, were compared. Drinking frequency and the prevalence of metabolic syndrome were significantly higher in the female group with chronic low back pain but other factors were not related. This result partly agrees with previous studies of the relationship between drinking habits and the prevalence of metabolic syndrome.[19]

Metabolic syndrome occurs with risk factors for several cardiovascular diseases owing to abdominal obesity and insulin resistance. An increase of adipose tissues causes blood free fatty acids to rise and to express insulin resistance in insulin-sensitive organs, such as liver, muscle, and pancreas.[1,20] This is closely related to TNF-α, which is an inflammatory adipokine. In addition, TNF-α is known to be important in patients with low back pain,[21,22] and it was reported that TNF-α blockers have been used for the treatment of lower back pain.[23,24] Therefore, the relationship between low back pain and metabolic syndrome needs to be studied.

Some limitations were found in this study. First, it was impossible to determine cause and effect in the interpretation of data because this was a cross-sectional study. Second, self-recording methods were used to define patients with chronic low back pain, which thus might not be accurate. Third, the prevalence of metabolic syndrome in patients with chronic low back pain in our study seemed to be higher than the actual incidence because of the mean age of the subjects. Fourth, a univariate analysis was provided to evaluate the factors associated with metabolic syndrome instead of a multivariate analysis. However, this study was performed in a nation as a sample, so this result could be representative despite the limitations. In addition, this study could indicate various views by which to approach low back pain patients concerning the relationship between low back pain and metabolic syndrome.

According to this study, the prevalence of metabolic syndrome was higher in patients having chronic low back pain who were female, who were of an advanced age, and who had a high BMI. Hereafter, in the treatment of patients having chronic low back pain, factors related to metabolic syndrome should be evaluated.

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