Original Article

Relation between Blood Pressure and Rhinitis in a Japanese Adolescent Population

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Recent studies have reported an association between systolic blood pressure (BP) and rhinitis. The prevalence of allergic rhinitis is 20% to 30% in Japan. The present cross-sectional study was performed to assess the relation between BP and allergic rhinitis in a sample of 2,292 male adolescent high school students who attended the annual school health examination. Of the 2,292 students (mean age, 16 years), 26.6% were considered to have allergic rhinitis based on their responses to a questionnaire, 25.1% were diagnosed with allergic rhinitis by an otolaryngologist, and 12.6% were consistently diagnosed with allergic rhinitis by both questionnaire and an otolaryngologist. There was no difference in systolic BP between subjects with and without allergic rhinitis. Diastolic BP, however, was higher in subjects without allergic rhinitis than in those with allergic rhinitis as diagnosed by questionnaire alone or by both questionnaire and an otolaryngologist. When the subjects were divided into three BP categories (normal, high normal, and hypertension) according to the criteria in the JSH 2000, the rates of allergic rhinitis were similar in the three BP categories. These findings do not confirm a relation between allergic rhinitis and systolic BP.

(*Hypertens Res* 2003; 26: 961–963)

Key Words: allergic rhinitis, blood pressure, hypertension

Introduction

Recent studies have reported an association between systolic blood pressure (SBP) and rhinitis (1, 2). It would be interesting to know more about the relation between rhinitis and blood pressure (BP), since the prevalence of both rhinitis and hypertension is approximately 25% in the general Japanese population. The aim of the present study was to assess the relation between allergic rhinitis and BP in a group of male adolescent high school students.

Methods

The study subjects were 2,292 male high school students with a mean age of 16 years (range, 15–19 years) who attended the annual school health examination performed by

the Health Center of Keio University between April 8 and 10, 2003. BP was measured with an automatic electronic sphygmomanometer (BP-103i II; Nippon Colin, Komaki, Japan) after a 5-min rest in the sitting position. We repeated BP measurement when the value of the first measurement was $\geq 140/90$ mmHg. If more than two measurements were taken, the first BP reading was used to define SBP and diastolic BP (DBP) in this study. The subjects were divided into three BP categories (normal: $< 130/75$; high normal: $130-139/75-84$; and hypertension: $\geq 140/85$ mmHg) according to the criteria in the JSH 2000 (3). Body height and weight measurements were obtained with the subjects wearing light clothing but no shoes. Body mass index (BMI: weight/height² [kg/m²]) was calculated. The diagnosis of allergic rhinitis was based on a questionnaire and an examination by an otolaryngologist. Subjects who answered “yes” to the question: “Do you have allergic rhinitis?” were considered to

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Received July 16, 2003; Accepted in revised form September 5, 2003.

Table 1. Prevalence of Allergic Rhinitis in Adolescents Defined by Questionnaire and by Examination by an Otolaryngologist

Otolaryngologist	Questionnaire (number (%))		
	No rhinitis	Rhinitis	Total
No rhinitis	1,395 (81.3)	321 (18.7)	1,716 (100)
Rhinitis	287 (49.8)	289 (50.2)	576 (100)
Total	1,682 (73.4)	610 (26.6)	2,292 (100)

Table 2. Blood Pressure (BP), Heart Rate, Height, Weight, and Body Mass Index (BMI) in Adolescents with and without Allergic Rhinitis as Defined by Questionnaire

	No rhinitis	Rhinitis	<i>p</i> value
Number	1,682	610	
Systolic BP (mmHg)	117 ± 12	117 ± 12	ns
Diastolic BP (mmHg)	62 ± 8	61 ± 8	0.013
Heart rate (beats/min)	73 ± 14	70 ± 13	< 0.0001
Height (cm)	170.7 ± 5.7	171.3 ± 5.6	0.023
Weight (kg)	61.4 ± 9.1	62.4 ± 8.4	0.027
BMI	21.0 ± 2.7	21.2 ± 2.5	ns

suffer from allergic rhinitis. Evaluation of the nose was performed by two otolaryngologists each day. An anterior rhinoscope was used to examine the interior of the nose. The weather was cloudy on April 8 and sunny on April 9 and 10. The rates of diagnosis of allergic rhinitis by the otolaryngologists were similar among the three days (27.6%, 24.3%, and 23.4%, respectively).

The present study was carried out in accordance with the Declaration of Helsinki (1981) of the World Medical Association, and the study protocol was approved by the Research Committee of the Health Center, Keio University, Tokyo. Informed consent was obtained from each subject after full explanation of the purpose, nature, and risk of all procedures used.

Statistical Analysis

All statistical analyses were performed using the StatView® program for Macintosh (version 4.5-J; SAS Institute, Cary, USA). The significance of differences between the groups was assessed by Student's two-tailed unpaired *t*-test. All data were expressed as the mean ± SD, and a *p* value of less than 0.05 was considered statistically significant.

Results

Of the 2,292 subjects, 26.6% answered affirmatively to the question about allergic rhinitis in the questionnaire, 25.1% were diagnosed with allergic rhinitis by an otolaryngologist, and 12.6% were considered to have allergic rhinitis based on

Table 3. Blood Pressure (BP), Heart Rate, Height, Weight, and Body Mass Index (BMI) in Adolescents with and without Allergic Rhinitis as Diagnosed by an Otolaryngologist

	No rhinitis	Rhinitis	<i>p</i> value
Number	1,716	576	
Systolic BP (mmHg)	117 ± 12	117 ± 12	ns
Diastolic BP (mmHg)	62 ± 8	61 ± 8	0.006
Heart rate (beats/min)	72 ± 13	72 ± 13	ns
Height (cm)	170.9 ± 5.7	170.9 ± 5.9	ns
Weight (kg)	61.7 ± 9.0	61.5 ± 8.5	ns
BMI	21.1 ± 2.7	21.1 ± 2.5	ns

Table 4. Blood Pressure (BP), Heart Rate, Height, Weight, and Body Mass Index (BMI) in Adolescents with and without Allergic Rhinitis as Defined by Both Questionnaire and an Otolaryngologist

	No rhinitis	Rhinitis	<i>p</i> value
Number	1,395	289	
Systolic BP (mmHg)	117 ± 13	117 ± 12	ns
Diastolic BP (mmHg)	62 ± 8	60 ± 8	0.004
Heart rate (beats/min)	72 ± 14	70 ± 13	0.012
Height (cm)	170.8 ± 5.7	171.3 ± 5.9	ns
Weight (kg)	61.5 ± 9.1	62.0 ± 8.0	ns
BMI	21.1 ± 2.7	21.1 ± 2.3	ns

both the questionnaire and otolaryngological examination (Table 1). There was no difference in SBP between subjects with and without allergic rhinitis as defined by the questionnaire (Table 2), as diagnosed by an otolaryngologist (Table 3), or as defined by both questionnaire and otolaryngological examination (Table 4). DBP, however, was higher in subjects without allergic rhinitis than in those with allergic rhinitis defined by the questionnaire or by both questionnaire and an otolaryngologist. There was no difference in BMI between subjects with and without allergic rhinitis. When the subjects were divided into three BP categories (normal, high normal, and hypertension) according to the criteria in the JSH 2000, the rates of allergic rhinitis were similar in the three BP categories (Tables 5 and 6).

Discussion

Our main finding in this study was that SBP did not differ between subjects with and without allergic rhinitis. DBP, however, was higher in subjects without allergic rhinitis than in those with allergic rhinitis as diagnosed by the questionnaire or by both the questionnaire and an otolaryngologist. The prevalence of allergic rhinitis in this study was similar to that in previous studies in Japan (4, 5).

Recently, Kony *et al.* reported an association between rhinitis and SBP in a population-based study of 330 men

Table 5. Prevalence of Hypertension, High Normal Blood Pressure (BP), and Normal BP in Adolescents with and without Allergic Rhinitis as Defined by Questionnaire

	Systolic BP (number (%))			Diastolic BP (number (%))		
	No rhinitis	Rhinitis	Total	No rhinitis	Rhinitis	Total
Hypertension	34 (72.3)	13 (27.7)	47 (100)	12 (80)	3 (20)	15 (100)
High normal BP	259 (73.8)	92 (26.2)	351 (100)	67 (73.6)	24 (26.4)	91 (100)
Normal BP	1,389 (73.3)	505 (26.7)	1,894 (100)	1,603 (73.3)	583 (26.7)	2,186 (100)
Total	1,682 (73.4)	610 (26.6)	2,292 (100)	1,682 (73.4)	610 (26.6)	2,292 (100)

Hypertension: $\geq 140/85$; high normal BP: 130–139/75–84; normal BP: $< 130/75$ mmHg.

Table 6. Prevalence of Hypertension, High Normal Blood Pressure (BP), and Normal BP in Adolescents with and without Allergic Rhinitis as Diagnosed by an Otolaryngologist

	Systolic BP (number (%))			Diastolic BP (number (%))		
	No rhinitis	Rhinitis	Total	No rhinitis	Rhinitis	Total
Hypertension	37 (78.7)	10 (21.3)	47 (100)	10 (66.7)	5 (33.3)	15 (100)
High normal BP	262 (74.6)	89 (25.4)	351 (100)	75 (82.4)	16 (17.6)	91 (100)
Normal BP	1,417 (74.8)	477 (25.2)	1,894 (100)	1,631 (74.6)	555 (25.4)	2,186 (100)
Total	1,716 (74.9)	576 (25.1)	2,292 (100)	1,716 (74.9)	576 (25.1)	2,292 (100)

Hypertension: $\geq 140/85$; high normal BP: 130–139/75–84; normal BP: $< 130/75$ mmHg.

aged 28–56 years (1). Although the mechanism by which allergic rhinitis contributes to high BP has not been elucidated, it may be possible that nasal congestion-induced sleep disturbance is associated with increased BP. In the present study, however, we found that subjects without allergic rhinitis had a similar SBP and a higher DBP compared with those with allergic rhinitis. Many factors, including obesity, contribute to high SBP and DBP (6, 7). In the present study, we found no difference in BMI between subjects with and without allergic rhinitis. Differences in the study populations may explain the difference in the results, since an association between rhinitis and SBP was found in men, not in women, in the study of Kony *et al.* (1).

Our study had a number of limitations that should be mentioned. The most important limitation concerns the validity of our diagnosis of allergic rhinitis. Of the 610 subjects who reported having allergic rhinitis in the questionnaire, 289 (47.4%) were diagnosed as having allergic rhinitis by an otolaryngologist. Of the 576 subjects who were diagnosed to have allergic rhinitis by an otolaryngologist, 289 (50.2%) reported having allergic rhinitis in the questionnaire. Thus, we compared the 289 subjects with allergic rhinitis and 1,395 subjects without allergic rhinitis as defined consistently by both questionnaire and an otolaryngologist. We have no measurements of serum IgE antibody. Our reliance on the first BP reading should also be mentioned. We repeated BP measurement when the value of the first measurement was $\geq 140/90$ mmHg; most of the subjects had a BP $< 140/90$ mmHg and required only one BP reading.

In conclusion, in the present study we found no difference in SBP between male high school students with and those without allergic rhinitis; DBP was slightly higher in the subjects without allergic rhinitis.

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