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Correlation between hs-CRP, VCAM-1, LEP levels and blood pressure variability in OSAHS patients

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ABSTRACT

This study was to explore the relationship between hs-CRP, VCAM-1, LEP and blood pressure variability in obstructive sleep apnea-hypopnea syndrome (OSAHS) patients. For this purpose, 92 OSAHS patients treated in our hospital from January 2019 to December 2022 were randomly divided into a mild group (MIG) (AHI > 5, < 20), moderate group (MOG) (AHI > 20 and not more than 40) and severe group (SEG) (AHI > 40). According to sleep AHI, they were divided into MIG (n = 28), MOG (n = 30) and SEG (n = 26). The age and sex of the patients in the study group were compared with those in the control group (COG). The serum levels of hs-CRP, VCAM-1, LEP and blood pressure variability were observed and compared. Pearson correlation test was used to analyze the correlation between hs-CRP, VCAM-1, LEP levels and blood pressure variability in patients with OSAHS. Results showed that the age, sex and BMI between each group have no difference(P>0.05), but the AHI in the study group was raised than that in the COG (P<0.05). Compared with the COG, the serum levels of hs-CRP, VCAM-1, LEP and dDBP, dSBP, nDBP and nSBPraised with the increase of the severity of the disease (P<0.05). The dDBP among MOG, MIG and SEG was no different (P>0.05). The blood pressure variability of patients with OSAHS was raised, especially at night. Pearson correlation test showed that nSBP was positively correlated with serum levels of hs-CRP, VCAM-1 and LEP, that is, blood pressure variability was positively correlated with serum levels of hs-CRP, VCAM-1 and LEP (P<0.05). In conclusion, the serum levels of hs-CRP, VCAM-1 and LEP in patients with OSAHS are raised than those in healthy subjects, and they are significantly correlated with blood pressure variability, which can be used as an important index to judge the severity of OSAHS.

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Introduction

Obstructive sleep apnea-hypopnea syndrome (OSAHS) refers to apnea and hypopnea caused by the collapse of the upper airway during sleep, mainly characterized by snoring accompanied by apnea and shallow breathing, recurrent hypoxemia, and sleep structure disorders at night, resulting in daytime drowsiness, cardio-cerebrovascular complications, and even multiple organ damage (1). It is an independent risk factor for hypertension (HTN) independent of age, sex, smoking and heart and kidney diseases, which is the main cause of secondary HTN (2). The early onset of OSAHS is not obvious, which is mainly manifested by unconscious snoring and often delayed treatment due to the lack of corresponding medical knowledge of patients and their families. With the development of the disease, the decrease of nocturnal blood oxygen saturation caused by frequent apnea and hypopnea in OSAHS patients significantly increased the incidence and mortality of cardiovascular disease (3). Patients with OSAHS lost their normal circadian rhythm of blood pressure. Blood pressure variability can be used as an important index of cardiovascular death and all-cause mortality. In order to reduce the targeted damage caused by OSAHS, early diagnosis, early detection and timely treatment of the disease is of great significance. It is reported that high-sensitivity C-reactive protein (hs-CRP), vascular cell adhesion molecule-1 (VCAM-1) and serum leptin (LEP) are closely related to the OSAHS progression (4). However, there are few reports about the relationship between it and blood pressure variability. In this study, we mainly discussed and analyzed the correlation between hs-CRP, VCAM-1, LEP levels and blood pressure variability in OSAHS patients.

Materials and Methods

General information

Based on the approval of our hospital's ethics committee, 84 patients with OSAHS treated at our hospital from January 2019 to December 2022 were randomly divided into mild group (MIG) (AHI > 5, < 20), moderate group (MOG) (AHI > 20 and no more than 40) and severe group (SEG) (AHI > 40). According to the sleep AHI, they were divided into MIG (n = 28), MOG (n = 30) and SEG (n = 26). As a control group (COG), 30 healthy individuals who underwent physical examinations at our hospital during the same period were selected.

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Inclusion criteria

Inclusion criteria included the following:
(I) meet the guidelines for diagnosis and treatment of OSAHS (5), and confirmed by polysomnography;
(II) aged between 23 and 79 years old;
(III) complete medical records and did not drop out;
(IV) all participants and their families agreed and signed consent forms;
(V) studies in this group were in line with medical ethics.

Exclusion criteria

Exclusion criteria included the following:
(I) severe mental illness, unable to cooperate with treatment;
(II) infectious diseases;
(III) acute or chronic respiratory infections such as asthma;
(IV) severe insufficiency of liver, kidney and/or heart function;
(V) anti-inflammatory drugs such as antibiotics and glucocorticoids were used within 2 months before the study.

Observation index

After admission, all the subjects fasted for more than 10 hours. 5mL was drawn from the median elbow vein blood on an empty stomach in the morning. The serum and blood cells were separated by a low-temperature and high-speed centrifuge. The supernatant was taken and frozen in cryopreservation at -80 ℃. Due to the follow-up study.

Fasting blood glucose, age, sex, smoking history, drinking history, body mass index (BMI), family history, and AHI of the two groups were compared.

Serum hs-CRP levels were measured by immune turbidimetry, while VCAM-1 and LEP levels were measured by enzyme-linked immunosorbent assay (ELISA).

Blood pressure variability detection: A sphygmomanometer was used to measure ambulatory blood pressure 24 hours a day, and average daytime diastolic blood pressure (dDBP), nocturnal mean diastolic blood pressure (nDBP), daytime mean systolic blood pressure (dSBP) and nocturnal mean systolic blood pressure (nSBP) were calculated.

Correlation analysis: Hs-CRP, VCAM-1 and LEP levels of patients with OSAHS were analyzed by Pearson correlation test.

Statistical method

The SPSS 23.0 software package was used to analyze the statistical data in this study. The counting data of gender, smoking history, drinking history and family history were all tested by χ^2 test. Hs-CRP, VCAM-1, LEP levels and other measurement data between groups were compared by single factor and multi-sample mean, and an independent sample t-test was used between the two groups. The Pearson correlation test was used to analyze the correlation. The difference was regarded as statistically significant ($P<0.05$). $^aP<0.05$ compared with the COG, $^bP<0.05$ with the MIG, $^cP<0.05$ with the MOG.

Results

Comparison of basic clinical data of all subjects

The age, sex and BMI between each group were no different ($P>0.05$), but the AHI in the study group was raised than COG ($P < 0.05$) (Table 1).

Serum hs-CRP, VCAM-1 and LEP levels were compared in each group

Compared with the COG, the serum levels of hs-CRP, VCAM-1 and LEP were raised with the increase in the severity of the disease ($P<0.05$) (Table 2).

Comparison of blood pressure variability in each group

Compared with the COG, the levels of dDBP, dSBP, nDBP and nSBP in the MIG, MOG and SEG were raised ($P<0.05$), and the levels of them were raised with the increase of the severity of the disease, but the dDBP among these groups was no difference ($P>0.05$) (Table 3).

Correlation between hs-CRP, VCAM-1, LEP levels and blood pressure variability in OSAHS patients

The blood pressure variability of patients with OSAHS

Table 1. Clinical data.

Group	Study group (n=84)	Control group (n=30)	χ^2/t	*P*
Age (year)	48.37±6.27	50.03±6.85	1.215	0.227
Gender				
Male	45 (53.57)	16 (53.33)	0.001	0.982
Female	39 (46.43)	14 (46.67)		
BMI (kg/m^2)	25.34±2.24	24.83±2.91	0.986	0.326
Fasting blood glucose (mmol/L)	4.12±1.49	3.82±1.14	1.002	0.319
Smoking history				
Yes	30 (35.71)	10 (33.33)	0.055	0.815
No	54 (64.29)	20 (16.67)		
History of drinking				
Yes	8 (9.52)	4 (13.33)	0.341	0.559
No	76 (90.48)	26 (86.67)		
Family history				
Yes	31 (36.90)	11 (36.67)	0.001	0.981
No	53 (63.10)	19 (63.33)		
AHI (time/h)	22.36±4.59	2.87±1.29	22.877	<0.001

Table 2. Serum hs-CRP, VCAM-1 and LEP levels in each group ($\bar{x}\pm s$).

Group	Number of cases	hs-CRP (mg/L)	VCAM-1 (ng/mL)	LEP (ng/mL)
COG	30	0.29±0.15	15.22±1.67	6.82±0.53
MIG	28	0.94±0.65[a]	17.92±1.11[a]	7.98±0.69[a]
MOG	30	1.77±1.56[ab]	21.59±2.52[ab]	9.93±0.85[ab]
SEG	26	2.49±1.27[abc]	24.81±2.54[abc]	12.42±0.67[abc]
F		23.11	117.81	342.82
P		<0.001	<0.001	<0.001

Table 3. Blood pressure variability in each group ($\bar{x}\pm s$).

Group	Sample	dDBP(mmHg)	dSBP(mmHg)	nDBP(mmHg)	nSBP(mmHg)
COG	30	81.48±11.55	100.71±11.34	81.76±12.67	112.49±13.66
MIG	28	98.64±13.69[a]	118.44±12.77[a]	89.32±11.36[a]	123.55±12.58[a]
MOG	30	102.45±12.68[a]	129.54±16.60[ab]	96.21±12.45[ab]	139.92±13.63[ab]
SEG	26	107.92±12.75[a]	143.95±17.03[abc]	104.92±11.44[abc]	155.36±14.44[abc]
F		23.44	44.17	18.82	53.29
P		<0.001	<0.001	<0.001	<0.001

was raised, especially at night. Pearson correlation test showed that nSBP, and blood pressure variability were positively correlated with the levels of hs-CRP, VCAM-1 and LEP (P<0.05) (Table 4).

Table 4. hs-CRP, VCAM-1, LEP levels and blood pressure variability in OSAHS patients.

Index	nSBP	
	r	*P*
hs-CRP	0.146	<0.05
VCAM-1	0.376	<0.05
LEP	0.783	<0.05

Discussion

OSAHS is a common sleep apnea disorder, mainly caused by upper respiratory tract obstruction, snoring during sleep, accompanied by respiratory apnea and shallow breathing, recurrent hypoxemia, hypercapnia, unawakened and water surface disorder at night, dry mouth, headache and daytime fatigue (6). According to statistics, its incidence in adults is 1%-5% and increases with age. OSAHS is closely related to the progression of HTN, coronary heart failure, pulmonary HTN, insulin resistance and arrhythmia. It is one of the inducements of many diseases and causes a huge economic burden to the patients' families and society. At present, the pathogenesis of OSAHS is not clear, it may be related to intermittent hypoxia, fat factor, inflammatory factor disorder and so on (7). This study explored the correlation between the levels of hs-CRP, VCAM-1, LEP and blood pressure variability in OSAHS patients.

Hs-CRP is recognized as the most valuable acute phase protein, one of the most important and sensitive indicators of nonspecific inflammation, and a part of the nonspecific immune mechanism (8). It mainly exists in serum. Under normal circumstances, its level is very low, but when stimulated by ischemia, trauma, infection and inflammation, the level of hs-CRP was raised. This study showed that the level of hs-CRP in patients with OSAHS was raised. This mainly occurs after hypoxemia, which may be closely related to the increased risk factors of HTN, or it may be the result of vascular endothelial dysfunction (9). VCAM-1 is a member of the immune protein superfamily of cell adhesion molecules. It is widely expressed on the surface of fibroblasts, bone marrow stromal cells and smooth muscle cells. It is an important pro-inflammatory mediator (10). It is reported that when the body is stimulated by inflammation, cytokines produced by the inflammatory response can induce the expression of VCAM-1 in blood vessels (11). Here, the level of VCAM-1 in OSAHS patients was raised. This may be because recurrent apnea and hypoxemia in patients with OSAHS can induce the release of tumor necrosis factor, interleukin and other factors, cause vascular endothelial cell injury and dysfunction, and significantly enhance the VCAM-1 expression in leukocytes and endothelial cells (12). LEP is a protein hormone synthesized and secreted mainly by white adipose tissue, which can regulate energy metabolism, body weight and fat distribution, and is closely related to human growth and development, blood-sucking, respiratory regulation, inflammation and the occurrence of many diseases (13). In our study, the level of LEP in patients with OSAHS was raised. This may be due to the protective response of the body to respiratory disorders and disorders of fat metabolism (14).

Blood pressure is affected by age, body weight, antihypertensive drugs and other factors. Under normal circumstances, the level of blood pressure has obvious diurnal variation, but in most patients with HTN, blood pressure can maintain a physiological circadian rhythm. sleep dipper blood pressure can be effectively adapted and daily activities are very important for the protection of cardiocerebrovascular structure and function (15). Some studies have found that 24-hour blood pressure in OSAHS patients lost its normal rhythm, and with the aggravation of the patient's condition, the trend of deviation from dipper was raised. Our study showed that OSAHS is closely related to the occurrence of HTN, and blood pressure variability can be used as an important target for the treatment of HTN. Pearson correlation test showed that blood pressure variability was positively correlated with serum levels of hs-CRP, VCAM-1 and LEP.

To sum up, the levels of serum hs-CRP, VCAM-1 and LEP in OSAHSpatients were raised than those in healthy subjects, and they were significantly correlated with blood pressure variability, which could be used as an important index to judge the severity of OSAHS.

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