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Original research article

Chronic Rhinosinusitis and Coronary Heart Disease: A Hospital based Study

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Abstract

Background: Chronic inflammation is associated with accelerated atherosclerosis, endothelial dysfunction (ED), and cardiovascular diseases. Because chronic rhinosinusitis (CRS) is an inflammatory disease, it may be associated with the development of ED and accelerated atherosclerosis.

Objective: To investigate the relationship between CRS and carotid intima-media thickness (CIMT), flow-mediated dilation (FMD) of the brachial artery, and microalbuminuria.

Materials and Methods: This cross-sectional study included 38 patients with CRS and 29 healthy controls. In addition to measuring spot urine albumin-creatinine ratios, FMD of the brachial artery and CIMT were assessed noninvasively.

Results: Patients with CRS had lower FMD scores ($p = 0.031$), higher CIMT scores ($p = 0.005$), and a higher urinary albumin-creatinine ratio ($p = 0.036$) compared with healthy controls. In a multivariate analysis, CIMT and FMD were independently associated with the presence of CRS. However, the relationship between urinary albumin and creatinine, and the presence of CRS was no longer observed.

Conclusions: CRS is associated with ED and atherosclerosis, as indicated by decreased FMD and increased CIMT in patients with CRS. Further studies are necessary to identify the exact pathophysiologic mechanisms responsible for our findings.

Keywords: Chronic rhinosinusitis, Coronary heart disease

Introduction

Chronic rhinosinusitis (CRS) is a well-known heterogeneous disorder due to its potentially infectious status along with long-term inflammation of the paranasal sinuses and the lining of the nasal passages, which lasts for 12 consecutive weeks or longer [1-4]. Although the definite pathophysiological mechanism is not clear, recent studies have postulated bacterial infections with biofilm [3-6] or fungal colonization [3,7-9] as the pathophysiological mechanisms. Progressive inflammation and the biofilm can stimulate neutrophils, mononuclear cells, and

type 2 T helpercells to release cytokines into the bloodstream and may cause acute myocardial infarction (AMI) and apoplexy [8]. Complications of CRS not only contribute to systemic disease but also decrease the quality of life and economically impact life [10,11]. Coronary heart disease (CHD) is a crucial public health problem across developed countries worldwide [12]. A recent study hasshown that patients with CRS were at a higher risk of AMI occurrence in the 6-year follow-up [13]. However, whether the incidence of cardiovascular complications increased in untreated CRS remains unclear.

Materials and Methods

This study was carried out in Banas Medical College and Research Institute , Palanpur from Oct 2021 to May 2022. We included patients without CRS as healthy controls. We excluded patients with any chronic diseases, including hypertension, diabetes mellitus, chronic kidney disease, coronary artery disease, and cerebrovascular and peripheral arterial diseases. In addition, subjects who used any kind of medication that may influence endo- thelial functions (*i.e.,* polyvitamins, antihypertensive drugs, and st- atins) were excluded. Patients who were active tobacco smokers or alcohol consumers were also excluded

Results

In all, 67 patients were enrolled in this study: 29 were men, 38 had CRS, and 29 were controls. The demographic, laboratory, and hemo- dynamic parameters among the patients are compared in Table 1. In the linear regression analysis to predict FMD, only the presence of CRS was an independent predictor of FMD (Table 2). Similarly, in the linear regression analysis of CIMT, age and the presence of CRS were independent predictors of CIMT (Table 3). None of the parameters were predictors of the urinary albumin-creatinine ratio. The albumin-creatinine ratio and CIMT values were signifi- cantly higher in patients with CRS than in controls (Fig. 1). However, the FMD values were significantly lower in patients with CRS com- pared with the controls (Fig. 2).

Table 1: The comparison of demographic, laboratory, and hemodynamic parameters between patients with and patients without sinusitis

	Patients with Sinusitis	Patients without Sinusitis	p
Age, mean (SD), y	44.1 ± 14.9	48.3 ± 9.0	0.208*
No. men/women	21/17	8/21	0.023#
BMI, mean (SD), kg/m^2	27.9 ± 4.6	27.8 ± 4.5	0.971*
Office systolic BP, mean (SD), mm Hg	124.7 ± 11.2	125.0 ± 11.6	0.933§
Office diastolic BP, mean (SD), mm Hg	80.7 ± 5.5	77.6 ± 7.8	0.079§
Fasting blood glucose level, mean (SD), mg/dL	98.2 ± 31.0	99.8 ± 17.4	0.444*
Urea concentration, mean (SD), mg/dL	29.1 ± 8.7	27.6 ± 10.5	0.262*
Serum creatinine level, mean (SD), mg/dL	0.77 ± 0.14	0.77 ± 0.20	0.358*
Sodium level, mean (SD), mg/dL	139.3 ± 1.94	137.8 ± 2.14	0.005§
Potassium level, mean (SD), mg/dL	4.48 ± 0.33	4.42 ± 0.34	0.462§
Uric acid level, mean (SD), mg/dL	5.32 ± 1.16	4.70 ± 1.05	0.028*
CKD-EPI, mean (SD)	102.3 ± 16.5	97.9 ± 16.6	0.291*
Total protein level, mean (SD), g/dL	7.30 ± 0.39	7.26 ± 0.37	0.719§
Albumin level, mean (SD), g/dL	4.35 ± 0.42	4.60 ± 1.98	0.004§
Total cholesterol level, mean (SD), mg/dL	208.0 ± 55.4	201.1 ± 42.8	0.968*
LDL cholesterol level, mean (SD), mg/dL	126.1 ± 46.1	122.0 ± 35.9	0.809*
HDL cholesterol level, mean (SD), mg/dL	45.0 ± 12.4	51.8 ± 16.4	0.099*
Triglyceride level, mean (SD), mg/dL	165.2 ± 79.4	159.0 ± 113.4	0.297*
Hemoglobin level, mean (SD), g/dL	13.88 ± 1.45	13.82 ± 1.06	0.854§

Hs-CRP level, mean (SD), mg/L	1.0 ± 0.53	0.69 ± 0.15	0.064*
Urinary albumin-creatinine ratio, mean (SD), mg/g	20.4 ± 23.0	11.5 ± 9.7	0.036*
FMD, mean (SD), %	10.7 ± 1.22	11.4 ± 1.36	0.031*
Left carotid intima-media thickness, mean (SD), mm	0.71 ± 0.23	0.56 ± 0.17	0.005*

SD = standard deviation; BMI = body mass index; BP = blood pressure; CKD-EPI = Chronic Kidney Disease Epidemiology Collaboration; HDL = high density lipoprotein; LDL = low density lipoprotein; Hs-CRP = high sensitive C-reactive protein; FMD = flow-mediated dilation.

Table 2: Linear regression analysis performed to investigate the factors that predict flow-mediated dilation (FMD- square root)

	B	β	CI	p
Sex	—0.015	—0.037	—0.115 to 0.085	0.770
Age	—0.001	—0.059	—0.006 to 0.004	0.724
BMI	—0.002	—0.042	—0.012 to 0.009	0.729
Hs-CRP	0.049	0.109	—0.071 to 0.169	0.417
Presence of CRS	—0.138	—0.349	—0.032 to —0.244	0.012

FMD- square root = flow-mediated dilation square root; CI = condition index; BMI = body mass index; Hs-CRP = high sensitive C-reactive protein; CRS = chronic rhinosinusitis

Table 3 Linear regression analysis performed to investigate the factors that predict the carotid-intima media thickness (CIMT- square root)

	B	β	CI	p
Sex	—0.014	—0.056	—0.067 to 0.038	0.581
Age	0.004	0.429	0.002–0.007	0.002
BMI	0.004	0.159	—0.001 to 0.010	0.108
Hs-CRP	0.008	0.028	—0.054 to 0.071	0.793
Presence of CRS	0.105	0.407	0.049–0.160	<0.0001

CIMT-square root = carotid-intima media thickness square root; CI =condition index; BMI = body mass index; Hs-CRP = high sensitive C-reactive protein; CRS = chronic rhinosinusitis

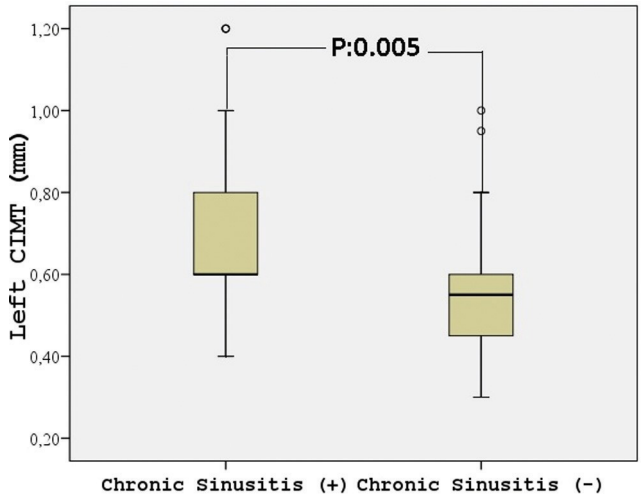

Figure 1: Carotid intima-media thickness was higher in patients with chronic rhinosinusitis compared with patients without chronic rhinosinusitis.

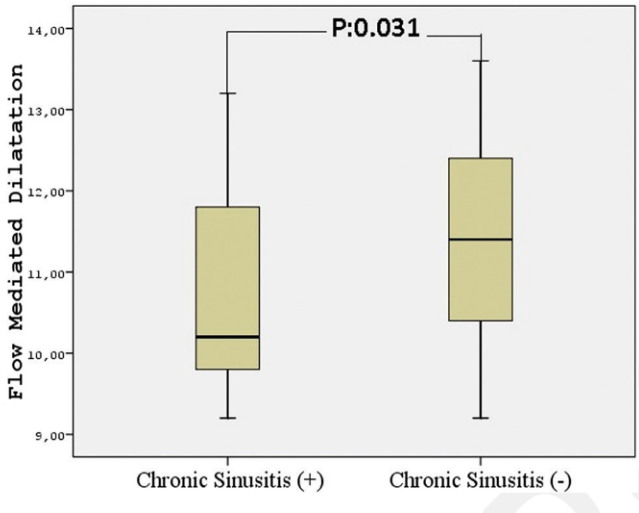

Figure 2: Flow-mediated dilation was lower in patients with chronic rhinosinusitis compared with patients without chronic rhinosinusitis

Discussion

In univariate analyses, patients with CRS had lower FMDs than patients without CRS, but patients with CRS had higher CIMTs and urinary albumin-creatinine ratios than did healthy controls. In mul- tivariate analyses, CIMT and FMD were independently associated with the presence of CRS. However, a relationship was not observed between the urinary albumin-creatinine ratio and the presence of CRS. These data were novel and, to the best of our knowledge, have not been reported in other published works.CRS is a common health problem. There is recent evidence that CRS may be an inflammatory disease, with ongoing inflammation respon- sible for its associated symptoms[14,15]Chronic inflammation is respon- sible for several pathologies, including atherosclerosis, ED, and CVD.[16-19] Increased urinary protein and/or albumin excretion has long been considered a risk factor for kidney disease and CVD, and ED is associated with chronic inflammation.[20] Similarly, in this study, the presence of CRS was associated with decreased FMD and increased CIMT. Our study's end points of ED, urinary protein excretion, and CIMT were strong predictors of cardiovascular outcome. ED can be described as a systemic pathologic state of the endothelium and results from an imbalance between vasodilator and vasoconstrictor substances produced by (or acting on) the endothelium.[21]ED is important because it is related and/or contributes to several disease processes, including hypertension, coronary artery disease, hypercho- lesterolemia, diabetes, septic shock, and Behcet disease. In addition, it can result from environmental factors, such as smoking and exposure to air pollution.[22,23] Furthermore, ED has been linked to mortality in patients with chronic heart failure.[24] CIMT is another important parameter related to cardiovascular outcomes. CIMT is a measurement of the thickness of the tunica intima and the media, the innermost two layers of the wall of the carotid artery. It is used to detect the presence of atherosclerotic disease in humans and, contentiously, to track the regression, arrest, or progression of atherosclerosis. Thus, it is considered a marker of atherosclerosis. In a meta-analysis, CIMT was demonstrated to be predictive of future cardiovascular events.[25] This is why several guidelines recommend using CIMT for risk stratification.[26,27] In this study, we examined the relationship between the urinary albumin-creatinine ratio and the presence of CRS. The albumin-cre- atinine ratio is a calculated value of the level of urine albumin. In patients with an abnormally high permeability for albumin in the glomerulus,

microalbuminuria can occur. Microalbuminuria is asso- ciated with ED, chronic kidney disease, diabetes, hypertension, and even mortality.[28] In light of this, we examined the relationship be- tween all of the abovementioned cardiovascular risk markers and the presence of CRS. Although a cause-and-effect relationship could not be drawn, the presence of CRS was related to FMD and CIMT. Our study was important not only due to these novel findings but also because it provided a basis for the investigation of the underlying. It is important to note the limitations associated with this study. First, a cause-and-effect relationship cannot be determined from our results. Second, measurements were taken only once. Third, our sample size was relatively small. However, the patients we included were not on any medications before the start of the study and did not have any chronic diseases. We recommend that these results be validated by using other patient populations, *e.g.,* a population of patients with hypertension or with chronic kidney disease

Conclusion

CRS is a threatening disease that affects the patient's quality of life and exerts an economic burden on the government. Although it is well known that long-term inflammatory conditions lead to the activation of immune cells and the release of cytokines, the exact mechanism is not fully understood. Our study showed that CRS was significantly associated with CHD. Our study also found that women with CRS are more likely to develop CHD than men, and aggressive surgical treatment seems to be protective; although, there was no statistically significant difference in the incidence of CHD. Patients with CRS may be more alert to their cardiovascular conditions

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