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ORIGINAL ARTICLE

The association between serum serglycin level and coronary artery disease severity in patients with stable angina pectoris

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Abstract

Background: Serglycin plays a key role in the inflammatory status however the relationship between coronary artery disease (CAD) and serglycin is still unknown.

Aim: In this study, we aimed to investigate association of serglycin levels with CAD severity in patients with stable angina pectoris (SAP).

Methods: In total, 100 SAP patients diagnosed by coronary angiography and clinical manifestations, and 100 control subjects matched for age and sex were enrolled in this case-control study. Plasma levels of serglycin, high-sensitivity C-reactive protein (hsCRP), lipid profiles, and clinical parameters were assayed for all participants. The severity of coronary lesions was evaluated based on the SYNTAX score (SS) assessed by coronary angiography.

Results: Positively correlated with the SS ($r = 0.564$, $p < 0.001$), the plasma serglycin level in the SAP group was higher than that in the control group (11.17 ± 1.82 vs. 19.28 ± 1.88 ng/mL, $p < 0.001$). The plasma serglycin level was an independent predictor for both SAP (odds ratio [OR] 1.037, 95% confidence interval [CI] 1.020–1.054, $p < 0.001$) and a high SS (OR = 1.087, 95% CI 1.051–1.124, $p < 0.001$) in a multivariate logistic regression model. In the receiver operating characteristic curve analysis, the plasma serglycin level was found to have a better predictive value for a high SS (area under the curve [AUC] 0.858, 95% CI 0.788–0.929, $p < 0.001$) compared with hsCRP (AUC 0.665, 95% CI 0.557–0.773, $p = 0.006$; $Z = 2.94$, $p < 0.001$), with an optimal cut-off value of 17.25 ng/mL (sensitivity 94.3%, specificity 68.2%).

Conclusions: Plasma serglycin levels correlate with both the presence and severity of coronary stenosis in patients with SAP, suggesting that it could be a potential predictive marker of severe stenosis in SAP patients.

Key words: serglycin, coronary artery disease, SYNTAX score, inflammation, stable angina pectoris

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INTRODUCTION

Recent research has shown that inflammation plays a key role in coronary artery disease (CAD) and other manifestations of atherosclerosis. Immune cells dominate early atherosclerotic lesions, their effector molecules accelerate progression of the lesions, and activation of inflammation can elicit acute coronary syndromes. Atherosclerosis, the main cause of CAD, is an inflammatory disease in which immune mechanisms interact with metabolic risk factors to initiate, propagate, and activate lesions in the arterial tree [1]. Stable angina pectoris (SAP) is one of the most common subtypes of CAD, affecting approximately 54 million patients worldwide. An individual's prognosis can vary greatly, from chronic recurrent angina pectoris to acute myocardial infarction. Early and accurate identification of SAP patients with high risk is of great clinical value [2]. An increasing number of inflammatory markers and acute phase proteins have been tested in CAD, and their plasma levels have been confirmed to be correlated with different clinical characteristics and the prognosis of these patients [3]. However, there is a lack of clinically useful, highly specific biomarkers for SAP to guide treatment decisions for SAP patients.

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Serglycin is associated with intracellular proteoglycan and haematopoietic cells. Prior studies showed that some non-haematopoietic cell types also synthesise serglycin. Inflammatory cells synthesise serglycin then store it in granules to react with mediators, for instance, cytokines, chemokines, growth factors, and proteases [4, 5]. Serglycin can also participate in the formation of atheromatous lesions and atherosclerosis. It has been shown that serglycin is up-regulated by lipopolysaccharides in macrophages, tumour necrosis factor (TNF) in endothelial cells, and interleukin 1-β in smooth muscle cells [6]. Because of these findings, serglycin plays a role in the inflammatory status and in the development of vascular diseases, and we hypothesise that serglycin might be involved in CAD. Therefore, we aim to investigate the association between serglycin levels and CAD severity in patients with SAP. To the best of our knowledge, this is the first study of its kind in the literature.

METHODS

Study population

We consecutively recruited 100 CAD patients with SAP at Sivas Numune Hospital from July 2016 to March 2017 for this study. SAP was defined as chest pain typical for cardiac ischaemia on exertion or emotional stress that is relieved by rest or nitrates. The pattern of chest pain did not change within at least one month. All patients had undergone coronary angiography and had angiographically documented narrowing of at least 50% of the luminal diameter of an epicardial coronary artery. Subjects with acute myocardial infarction, systolic and diastolic heart failure, cardiomyopathies, and valvular disease were excluded. Also, in the same date range, a total of 100 age- and sex-matched controls without CAD were enrolled. They were found to be free of CAD based on no history of angina and other heart diseases as well as a normal electrocardiogram (ECG), and exercise ECG stress testing. The exclusion criteria for both groups were as follows: acute or chronic infection, definite inflammatory and immune-associated diseases, bleeding, surgery or trauma within 12 weeks prior to admission, liver or renal dysfunction, and malignancy. Patients were also excluded if they had been taking statins or any anti-inflammatory drugs. Patients received acetylsalicylic acid (ASA) before the blood samples were taken, but the dose of ASA was 100 mg/day (low dose) so the anti-inflammatory effect was small. The study protocol complied with the Declaration of Helsinki. All the participants gave written, informed consent.

The participants were diagnosed with arterial hypertension if their systolic blood pressure was ≥ 140 mmHg and/or their diastolic blood pressure was ≥ 90 mmHg. Hypertension was also diagnosed if a patient self-reported a previous diagnosis of this disease established by a physician or if any anti-hypertensive treatment was being taken at admission. Diabetes mellitus was diagnosed according to the American Diabetes Association, which include a fasting plasma glucose level ≥ 126 mg/dL, a 2-h post-load glucose level ≥ 200 mg/dL, self-report of a physician's diagnosis, and any hypoglycaemic medication taken at admission. Smokers were defined as those who regularly smoked five cigarettes or more per day, and if patients had stopped smoking for more than 10 years preceding the disease onset, they were classified as non-smokers. In addition, body mass index (BMI) was calculated as weight (kg)/height^2 (m^2). The definitions of systolic and diastolic heart failure were determined according to the 2016 European Society of Cardiology guidelines.

Coronary angiography

Selective coronary angiography was performed using a standard Judkins technique. CAD was defined as the presence of obstructive stenosis in any of the main coronary arteries, including the left main coronary artery, left anterior descending artery, left circumflex coronary artery, right coronary artery, and any of the main branches of the vascular system of more than 50% of the lumen diameter. The severity of coronary lesions was assessed by the SYNTAX score (SS), which was calculated for all patients by two experienced interventional cardiologists who were unaware of the patients' clinical or laboratory results. SS was determined for all coronary lesions with > 50% diameter stenosis in a vessel > 1.5 mm based on a SS calculator 2.1 (www.syntaxscore.com). SAP patients were divided into three subgroups: high SS (> 32; 32 patients), intermediate SS (22 < n ≤ 32; 28 patients), and low SS (≤ 22; 40 patients).

Laboratory tests

Blood samples from the patients after a fasting period of 12 h were collected into plain tubes, serum was separated after centrifugation at 4000 g for 10 min, and stored at –80°C until analysis. We obtained all the blood samples after coronary angiography in the SAP group. Complete blood count and differentials were measured from the peripheral venous blood samples obtained at admission. An automatised analyser was used to measure high-sensitivity C-reactive protein (hsCRP), total cholesterol, triglyceride, creatinine, low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C). Serglycin levels in plasma were determined by a previously described enzyme-linked immunosorbent assay [7].

Statistical analysis

All statistical analyses were performed using the SPSS 20.0 software package (SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test was used to determine data distribution patterns. Continuous variables are presented as the mean ± standard deviation or median with the 25th and 75th percentile, as appropriate. Variables with a skewed distribution were log-transformed for further statistical testing. Differences

Table 1. Baseline characteristics of the study population

Variables	Control group (n = 100)	SAP group (n = 100)	p
Demographic and clinical data:			
Men	77	74	0.542
Age [years]	51.62 ± 8.35	52.01 ± 8.75	0.264
Body mass index [kg/m^2]	24.92 ± 3.37	25.36 ± 3.74	0.260
Diabetes	18	22	0.225
Arterial hypertension	55	64	0.071
Smoking	53	51	0.771
Biochemical parameters:			
Total cholesterol [mg/dL]	251 ± 30.1	269 ± 28.8	0.639
Triglyceride [mg/dL]	188 ± 29.9	200 ± 18.8	0.415
HDL-C [mg/dL]	48 ± 8.4	32 ± 7.7	0.005
LDL-C [mg/dL]	145 ± 20.1	184 ± 31.1	0.004
NT-proBNP [pg/mL]	98 ± 8.4	101 ± 7.7	0.124
hsCRP [mg/L]	1.08 (0.62–1.76)	2.02 (1.07–3.38)	< 0.001
Serglycin [ng/mL]	11.17 ± 1.82	19.28 ± 1.88	< 0.001
Medications:			
Statins	0	0	0
Aspirin	11	15	0.296
Calcium channel blocker	20	20	0.727
ACEI/ARB	13	20	0.254
β-blocker	27	37	0.123

Data are shown as mean ± standard deviation or number. ACEI — angiotensin-converting enzyme inhibitor; ARB — angiotensin-receptor blocker; HDL-C — high-density lipoprotein cholesterol; hsCRP — high-sensitivity C-reactive protein, presented as median with 25th and 75th percentiles; LDL-C — low-density lipoprotein cholesterol; NT-proBNP — N-terminal pro B-type natriuretic peptide; SAP — stable angina pectoris

between groups were compared using the t-test or one-way ANOVA. Categorical variables are expressed as frequencies or percentages, and differences were compared with the χ^2 test or Fisher's exact test.

We calculated that enrolment of 100 patients with SAP in the study group and 100 individuals in the control group would provide a 90% power to demonstrate a significant difference ($p = 0.05$) in serglycin levels between patients with SAP and control subjects. Pearson and Spearman correlation coefficients were used to evaluate the correlations between serglycin plasma concentration and other variables, when appropriate. Subsequently, multiple linear regression analysis was performed to investigate a set of independent risk factors associated with the plasma serglycin level. Spearman correlation analysis was also used to determine the correlations between plasma serglycin levels and SSs in SAP patients. The predictive values of different clinical variables for the SAP risk and high SS (> 32) were found using the univariate and multivariate logistic regression models. Receiver operating characteristic (ROC) curves were generated to assess the diagnostic value of plasma serglycin for SAP and high SS. The maximum Youden index was used to determine the optimal cut-off values. The diagnostic values of plasma serglycin and hsCRP were compared using the Z test. A value of $p < 0.05$ was considered to indicate a statistically significant difference.

RESULTS

Baseline clinical characteristics of the study population

To investigate the relationship between plasma serglycin levels and SAP, 200 subjects were enrolled in the present study, including 100 SAP patients and 100 non-CAD controls. Because the inflammation-modulating capacity of statins has been confirmed, patients treated with statins were excluded from our study. Thus, data regarding the effects of statin use are not presented. The baseline clinical characteristics and biochemical parameters of the study population are summarised in Table 1. Age, sex, BMI, smoking status, and the presence of diabetes showed no significant difference between the SAP group and the control group. When we classified the SAP patients according to the severity of symptoms (class 1–4 angina, according to European Society of Cardiology stable coronary

Table 2. Correlations between the plasma serglycin concentration and other variables

Variables	Univariate analysis		Multivariate analysis		
	r	p	β coefficient	B (95% CI)	p
Men	0.068	0.317	–	–	–
Age	0.182	0.007	0.493	0.171–0.815	0.003
Body mass index	0.669	0.504	–	–	–
Diabetes	0.049	0.469	–	–	–
Arterial hypertension	0.245	0.111	1.324	−4.391–7.038	0.648
Smoking	0.153	0.023	6.238	0.721−11.756	0.027
Total cholesterol	−0.028	0.690	–	–	–
Triglycerides	−0.108	0.114	–	–	–
HDL-C	−0.184	0.006	−9.701	−18.953– −0.449	0.040
LDL-C	0.121	0.072	–	–	–
hsCRP	0.297	< 0.001	10.691	5.021–16.362	< 0.001
Aspirin	0.109	0.105	–	–	–
Calcium channel blocker	0.008	0.902	–	–	–
ACEI/ARB	0.039	0.569	–	–	–
β-blocker	0.129	0.056	–	–	–

ACEI — angiotensin-converting enzyme inhibitor; ARB — angiotensin-receptor blocker; CI — confidence interval; HDL-C — high-density lipoprotein cholesterol; hsCRP — high-sensitivity C-reactive protein; LDL-C — low-density lipoprotein cholesterol; OR — odds ratio

artery disease guideline), we could not find any association between CAD severity and symptom severity ($p = 0.12$). As expected, patients in the SAP group had significantly higher mean levels of plasma hsCRP, serglycin, and LDL-C and a lower mean HDL-C level compared with the control group.

Plasma serglycin concentration assessment

The plasma serglycin concentrations for all subjects ranged from 9.15 to 26.10 ng/mL with a median of 14.93 ng/mL. In the total population studied, the plasma serglycin concentration was positively correlated with age, smoking status, and the plasma hsCRP level, and negatively correlated with the plasma HDL-C level (Table 2). In covariance analysis, the plasma serglycin concentration adjusted for these possible confounding factors was still higher in the SAP group than that in the controls (11.17 ± 1.82 ng/mL vs. 19.28 ± 1.88 ng/mL, $p < 0.001$).

Correlations between plasma serglycin concentration and stable angina pectoris

To confirm the predictive value of an increased plasma serglycin level for SAP, univariate and multivariate logistic regression analyses were performed. As shown in Table 3, plasma levels of LDL-C, hsCRP and serglycin were found to be independent predictors of SAP (LDL-C: odds ratio [OR] 1.724, 95% confidence interval [CI] 1.100–2.702, $p = 0.017$; hsCRP: OR 2.908, 95% CI 1.402–6.033, $p = 0.004$; serglycin: OR 1.037, 95% CI 1.020–1.054, $p < 0.001$). To test the diagnostic value of plasma serglycin concentration for SAP, ROC curves were established. As shown in Figure 1A, the value of plasma serglycin and hsCRP levels in distinguishing patients with SAP from controls was comparable (for serglycin: area under the curve [AUC] 0.721, 95% CI 0.655–0.788, $p < 0.001$, and for hsCRP: AUC 0.698, 95% CI 0.628–0.768, $p < 0.001$, $Z = 0.46$, $p = 0.105$). The plasma serglycin concentration was of certain value in predicting SAP with a sensitivity of 63.4% and a specificity of 67.8%. The best cut-off value calculated using the Youden index was 16.72 ng/mL.

Correlations between plasma serglycin concentration and SYNTAX score

The SYNTAX score was used to assess the severity of coronary atherosclerotic lesions. SAP patients were divided into three subgroups according to angiographic findings. The baseline characteristics of these subgroups are presented in Table 4. Patients with a high SS had higher plasma serglycin levels, while those with a low or intermediate SS had the lowest serglycin levels (low SS subgroup ≤ 22; 13.17 ± 2.83 ng/mL, intermediate SS subgroup 22 < n ≤ 32; 14.22 ± 2.45 ng/mL, high SS subgroup > 32: 20.68 ± 3.98 ng/mL). To further investigate the association between plasma serglycin concentrations and coronary severity, Spearman analysis was performed. As shown in Figure 2, there was a significant positive correlation between plasma serglycin levels and SS in patients with SAP ($n = 100$, $r = 0.564$, $p < 0.001$). Additionally, we performed univariate analysis between the SAP patients with high SS (> 32)

Table 3. Univariate and multivariate logistic regression analyses of risk factors and laboratory parameters to identify independent predictors of stable angina pectoris

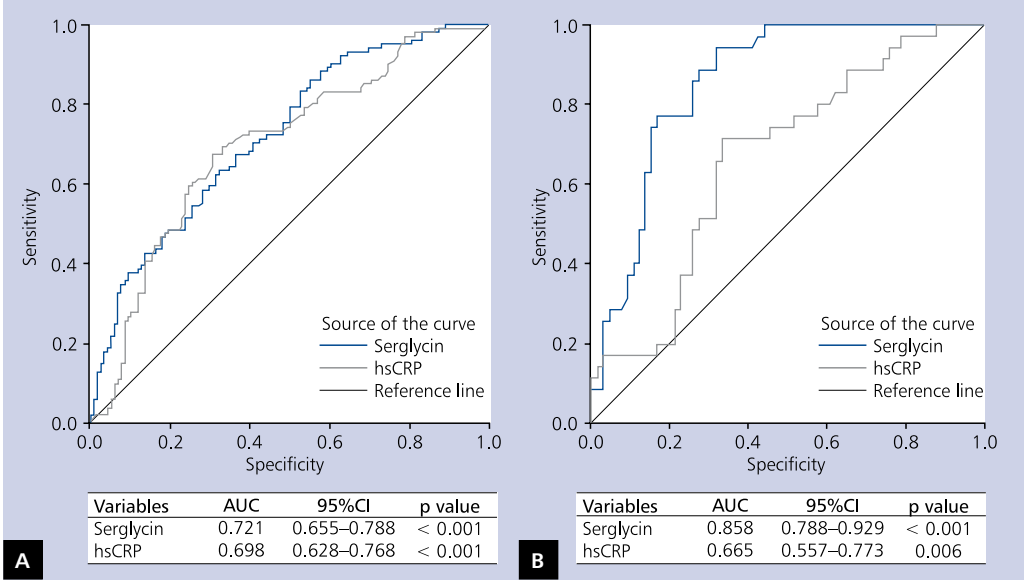
Variables	OR	95% CI	P
Univariate analysis			
Men	1.201	0.678–2.130	0.530
Age	0.978	0.948–1.009	0.164
BMI	1.036	0.961–1.117	0.356
Diabetes	1.597	0.807–3.163	0.179
Arterial hypertension	2.787	1.595–4.870	< 0.001
Smoking	1.113	0.655–1.891	0.693
Total cholesterol	1.089	0.771–1.540	0.628
Triglyceride	1.073	0.817–1.408	0.613
HDL-C	0.256	0.097–0.677	0.006
LDL-C	1.742	1.161–2.615	0.007
hsCRP	4.395	2.194–8.806	< 0.001
Serglycin	1.044	1.028–1.060	< 0.001
Aspirin	1.658	0.725–3.793	0.231
Calcium channel blocker	1.181	0.595–2.343	0.635
ACEI/ARB	1.946	0.915–4.142	0.084
β-blocker	1.889	1.049–3.404	0.034
Multivariate analysis			
LDL-C	1.724	1.100–2.702	0.017
hsCRP	2.908	1.402–6.033	0.004
Serglycin	1.037	1.020–1.054	< 0.001

ACEI — angiotensin-converting enzyme inhibitor; ARB — angiotensin--receptor blocker; BMI — body mass index; CI — confidence interval; HDL-C — high-density lipoprotein cholesterol; hsCRP — high-sensitivity C-reactive protein; LDL-C — low-density lipoprotein cholesterol; OR — odds ratio

and those with low or intermediate SS (≤ 32). Patients with high SS (> 32) were more often older and had significantly elevated plasma serglycin and hsCRP levels. Moreover, the multivariate logistic regression analysis showed that only the plasma serglycin level was shown as an independent predictor of high SS in SAP patients (OR 1.087, 95% CI 1.051–1.124, $p < 0.001$), which suggests a more severe atherosclerotic lesion. Finally, the ROC curve analysis (Fig. 1B) showed a moderate diagnostic value of plasma serglycin levels for identifying SAP patients with high SS from those with low or intermediate SS (AUC 0.858, 95% CI 0.788–0.929, $p < 0.001$), and it was better than that of plasma hsCRP levels (AUC 0.665, 95% CI 0.557–0.773, $p = 0.006$, $Z = 2.9363$, $p < 0.001$). Additionally, we found that a plasma serglycin level of 17.25 ng/mL was an effective cut-off point for differentiating SAP patients with severe atherosclerotic lesions from those without, with a sensitivity of 94.3% and a specificity of 68.2%.

DISCUSSION

Our study demonstrated that plasma serglycin levels were significantly higher in patients with SAP than in controls. An elevated plasma serglycin level was found to be an independent risk factor for both the presence of SAP and high SS. The ROC curve analysis indicated that plasma serglycin level could be a potential marker of the presence and severity of SAP; in particular, a plasma serglycin level of 17.25 ng/mL or higher identified SAP patients with high SSs with a sensitivity of 94.3% and a specificity of 68.2%. All these findings suggest that plasma serglycin levels could serve as a valuable predictor in the screening of SAP patients for more severe coronary stenosis, and these patients would greatly benefit from further



Variables	AUC	95%CI	p value
Serglycin	0.721	0.655–0.788	< 0.001
hsCRP	0.698	0.628–0.768	< 0.001

Variables	AUC	95%CI	p value
Serglycin	0.858	0.788–0.929	< 0.001
hsCRP	0.665	0.557–0.773	0.006

Figure 1. Receiver operating characteristic (ROC) curve analyses of the predictive ability of plasma serglycin levels; **A.** ROC curve analysis for stable angina pectoris; **B.** ROC curve analysis for a high SYNTAX score (≥ 32) identification; AUC — area under the curve; CI — confidence interval; hsCRP — high-sensitivity C-reactive protein

Table 4. Baseline characteristics based on SYNTAX score (SS) in stable angina pectoris (SAP) group

Variables	Low SS (≤ 22, n = 40)	Intermediate SS (22 < n ≤ 32, n = 28)	High SS (> 32, n = 32)	p
Men	25	18	20	0.129
Age [years]	52.21 ± 7.36	53.23 ± 8.84	55.69 ± 9.53	0.071
Body mass index [kg/m^2]	25.48 ± 3.55	25.88 ± 4.12	26.54 ± 3.33	0.214
Diabetes	13	9	10	0.699
Arterial hypertension	21	15	16	0.893
Smoking	22	16	18	0.684
Total cholesterol [mg/dL]	251 ± 30.1	249 ± 24.1	259 ± 30.4	0.692
Triglyceride [mg/dL]	205 ± 11.7	210 ± 9.7	215 ± 11.1	0.612
HDL-C [mg/dL]	35 ± 5.1	34 ± 4.7	32 ± 3.3	0.640
LDL-C [mg/dL]	177 ± 23.1	171 ± 19.4	188 ± 14.7	0.238
hsCRP [mg/L]	1.83 (0.96–3.62)	1.91 (0.98–3.84)	2.66 (1.67–3.55)	0.013
Serglycin [ng/mL]	13.17 ± 2.83	14.22 ± 2.45	20.68 ± 3.98	< 0.001
Statins	0	0	0	0
Aspirin	9	5	6	0.605
Calcium channel blocker	10	7	8	0.860
ACEI/ARB	9	6	7	0.948
β-blocker	17	11	13	0.619

Data are shown as mean ± standard deviation or number. ACEI — angiotensin-converting enzyme inhibitor; ARB — angiotensin-receptor blocker; HDL-C — high-density lipoprotein cholesterol; hsCRP — high-sensitivity C-reactive protein, presented as the median with 25th and 75th percentiles; LDL-C — low-density lipoprotein cholesterol

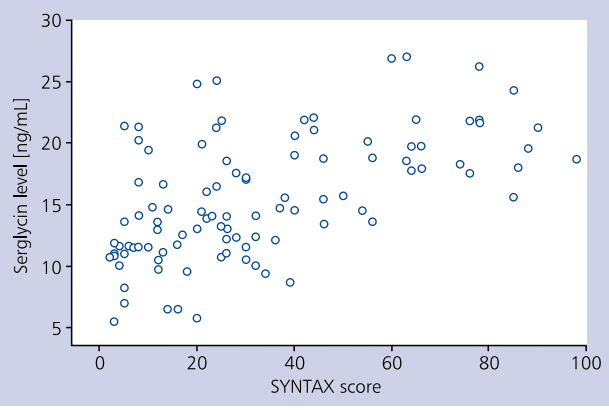


Figure 2. Correlation between the plasma serglycin level and the SYNTAX score in the stable angina pectoris (SAP) patients. There was a significantly positive correlation between the plasma serglycin level and the SYNTAX score in SAP patients (r = 0.564, p < 0.001)

examination and treatment, such as percutaneous coronary intervention and stenting.

Serglycin is a dominant intracellular proteoglycan expressed by immune cells, where it interacts with many inflammatory mediators, such as proteases, chemokines, cytokines, and growth factors [4, 5]. In a recent study serglycin was found to be among the most abundantly expressed proteins in adiposities of epicardial adipose tissue in patients with CAD. It was also demonstrated that TNF-α induces expression and secretion of serglycin in adipocytes. These observations suggest that serglycin and TNF-α contribute to the development and progression of CAD through cross-talk between macrophages and adiposities [8]. Circulating serglycin might also participate to atheromatous lesion formation [9, 10]. The biosynthesis of serglycin is up-regulated by lipopolysaccharides in macrophages [9, 10], TNF in endothelial cells, and interleukin 1b in smooth muscle cells [6]. On the other hand, Kundi et al. [11] found that serglycin was significantly higher in patients with coronary artery ectasia.

Coronary artery disease is an inflammation-mediated atherosclerotic disease [12]. Multiple inflammatory cells and mediators have been reported to help sustain and amplify pro-inflammatory signals, leading to the onset and development of atherosclerosis. Therefore, we supposed that the elevation of plasma serglycin levels in SAP patients could be the result of the chronic inflammatory status. This was supported by the positive correlation between plasma hsCRP and serglycin levels observed in the current study population. In addition to inflammation, plasma serglycin levels were also found to be positively correlated with age and smoking status, and negatively correlated with HDL-C plasma levels. Old age, smoking, and low

plasma HDL-C level were all related to high plasma serglycin levels, and after adjusting for these possible confounders, the plasma serglycin level was still associated with SAP. The ROC curve analysis further demonstrated that plasma serglycin level was an independent predictor of SAP. The SS has been used to evaluate the severity of CAD. In our study, a positive correlation between plasma serglycin levels and SS was confirmed in patients with SAP. After adjusting for other risk factors, plasma serglycin levels were still related to a high SS, indicating that the plasma serglycin concentration is an independent risk factor for the severity of SAP. In addition, the ROC curve analysis showed that plasma serglycin levels could effectively differentiate SAP patients with severe coronary stenosis from those with low or intermediate SS.

Serglycin-deficient mice have been found to have impaired haemostasis due to a defective thrombosis response [13]. It may affect atherosclerosis and the progression of CAD through its effect on growth related oncogene α (GRO-α) [14]. It has been suggested that the absence of serglycin-delivered platelet factor 4 (PF4) could prevent atherosclerotic plaque formation because PF4 is involved in atherosclerosis [15–17]. All these findings support the significant association between plasma serglycin levels and SS observed in our study. As a well-known acute phase protein in cardiovascular diseases, hsCRP has been confirmed to be of a diagnostic value in CAD and to be associated with coronary angiographic severity [18]. Our data showed that plasma serglycin levels had a similar diagnostic value to that of hsCRP levels for SAP. However, the plasma serglycin level was more powerful than the hsCRP level for identifying SAP patients with a higher SS. Interestingly, plasma serglycin levels were better at distinguishing high-SS patients from low- or intermediate-SS patients than at distinguishing SAP patients from controls. This suggests that measurement of plasma serglycin has a greater value for recognising severe coronary stenosis in patients with suspected CAD in clinical practice. Because there is a need to reduce healthcare costs and the risk of cardiovascular events in SAP patients with severe coronary stenosis, plasma serglycin levels might be a useful screening tool for clinicians. Therefore, SAP patients with significantly increased plasma serglycin levels are more inclined to receive further evaluation by coronary angiography. In our study, the severity of coronary stenosis was only evaluated by SS. The association of plaque vulnerability and serglycin requires further study with intravascular ultrasound and optical coherence tomography. Because of the strong correlation between serglycin levels and SS, future studies should evaluate plasma serglycin levels in asymptomatic CAD patients.

There are several limitations to our study. First, our sample size was small, and our subjects were obtained from a single centre. The diagnostic value of plasma serglycin level needs to be further evaluated in a large study population with standardised diagnostic tests. Second, cardiovascular events were not analysed in this study due to its cross-sectional design, and the prognostic value of plasma serglycin levels must be assessed during follow-up. On the other hand, we could not completely exclude CAD because no coronary angiography was performed in control subjects. The other limitation was analysing only one inflammatory marker (hs-CRP) to compare with serglycin.

In conclusion, our study demonstrated a significantly higher plasma serglycin level in patients with SAP compared to controls. Plasma serglycin levels were an independent risk factor of SAP and higher SS. Plasma serglycin concentrations could be measured in SAP patients to predict the severity of coronary lesions.

Conflict of interest: *none declared*

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