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Original Article

Evaluation of Oxidative Stress Biomarkers in Patients with Henoch-Schönlein Purpura

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Abstract

Introduction: Henoch-Schönlein Purpura (HSP) is a systemic vasculitic syndrome characterized by non-thrombocytopenic purpura, arthritis/arthralgia, abdominal pain, and glomerulonephritis. The pathogenesis of HSP has not been clearly identified. Oxidative damage has a role in the pathogenesis of most cases.

Aim: This study aimed to evaluate changes of oxidative stress by studying parameters like superoxide dismutase (SOD), catalase (CAT), and malondialdehyde (MDA) in an attempt to identify the role of oxidative stress in HSP from another perspective.

Materials and methods: This study enrolled 23 pediatric patients (ten girls and thirteen boys) diagnosed with HSP who were under follow-up at Sutcu Imam University School of Medicine Department of Pediatrics between 2014 and 2016 and twenty healthy children as the control group. The parents of all subjects gave informed consent to participate in the study. In the HSP group, the beginning season of the illness and the systemic involvement during follow-up were determined. Blood specimens were obtained at presentation before any treatment was started. SOD, CAT activities, and MDA values in erythrocyte and plasma samples were compared between the patient group and the healthy children.

Results: Twenty-three patients with HSP (13 males, 10 females) and 20 healthy children participated in this study. The mean age of the HSP cases was 8.21±3.78 years (range 2-16 years) and of the controls was 8.6±4.2 (range 3-14 years). The mean MDA value was 2.95±0.71 nmol/ml in the patient group and 2.67±0.66 nmol/ml in the control group (p=0.787). The mean level of the CAT enzyme was 1.32±0.35 U/g Hb in the patient group and 7.8±1.74 U/g Hb in the control group (p=0.001). The mean levels of the SOD enzyme were 3.06±0.85 U/g Hb in the patient group and 0.97±0.36 U/g Hb in the control group (p=0.001).

Conclusions: Although high MDA levels support the role of lipid peroxidation in the pathogenesis of HSP, statistical significance was not reached owing to a limited number of our patients. The reduced CAT enzyme activity is consistent with the findings of previous reports. This finding supports the notion that oxidative stress can play a role in the pathogenesis of HSP.

Keypoints: Our findings support the notion that oxidative stress can play a role in the pathogenesis of HSP.

Keywords

Henoch-Schönlein purpura, oxidative stress, pediatric

INTRODUCTION

Henoch-Schönlein Purpura (HSP) is a systemic vasculitic syndrome characterized by non-thrombocytopenic purpura, arthritis/arthralgia, abdominal pain, and glomerulonephritis.[1] The pathogenesis of HSP has not been clearly identified. Oxidative damage has a role in the pathogenesis of most cases. Increased oxidant levels and reduced antioxidant levels indicate that oxidative stress is responsible for tissue damage. During the inflammatory process in HSP, a variety of stimuli can induce the release of oxygen radicals. The role of oxidative stress and lipid peroxidation in the pathogenesis of HSP has been shown by recent studies.[2-4]

AIM

This study aimed to evaluate changes of oxidative stress by studying parameters such as superoxide dismutase (SOD), catalase (CAT), and malondialdehyde (MDA) in an attempt to identify the role of oxidative stress in HSP from another perspective.

MATERIALS AND METHODS

This study enrolled 23 pediatric patients (ten girls and thirteen boys) diagnosed with HSP who were followed up at Sutcu Imam University School of Medicine Department of Pediatrics between 2014 and 2016 and twenty healthy children as the control group. The parents of all subjects gave informed consent to participate in the study. In the HSP group, the beginning season of the illness and the systemic involvement during follow-up were determined. After the diagnosis was made, blood was collected from the oxidative stress and antioxidant parameters into purple-capped tubes with anticoagulant for MDA, SOD, and CAT. It was centrifuged at 4000 rpm for 5 minutes. Plasma samples were taken for MDA levels, and erythrocyte samples for SOD and CAT were washed with saline (SF) and placed in Eppendorf tubes for each parameter. CAT activities were determined by measuring the decrease in hydrogen peroxide concentration at 230 nm by the method of Beutler.[5] The activity of CAT was expressed as U/g Hb. The SOD activities in erythrocyte were estimated using the method described by Fridovich.[6] The absorbance at 505 nm wavelength was recorded. SOD activity was expressed as units per gram of haemoglobin (U/g Hb). Plasma MDA levels were estimated by the method of Ohkawa.[7] One milliliter of thiobarbituric acid/trichloroacetic acid was added to the plasma. The resulting product was analyzed spectrophotometrically at a wavelength of 532 nm, and the results were expressed as nmol/ml. From this standard graph, the value of the parameters (U/g Hb, nmol/ml) was calculated according to the absorbance of the samples. Other biochemistry tests were performed in the clinical biochemistry laboratory of Sutcu Imam University Health Research and Application Hospital on an autoanalyzer device.

Statistical analysis

The Mann-Whitney U-test was used to compare nonparametric continuous variables. Means were compared using non-paired Student's t-test. The level of significance was set at $p<0.05$. All patient information was analyzed with SPSS (Statistical Package for Social Science, Chicago, IL, USA) v. 17.0 software package. Ethical aspects: The Ethics Committee of Sutcu Imam University School of Medicine approved the study.

RESULTS

Twenty-three patients with HSP (13 males, 10 females) and 20 healthy children participated in this study. The mean age of the HSP cases was 8.21±3.78 years (range 2-16 years) and the mean age of the controls was 8.6±4.2 (range 3-14 years). A rise was detected in the incidence of the disease during autumn and spring. Systemic involvements were evaluated at admission and during the follow-up period. All patients (100%) had skin involvement in the form of palpable purpura. Gastrointestinal system involvement was detected in 7 (30.4%) cases; joint involvement in 13 (56.5%) cases; and kidney involvement in 4 (17.4%) cases **(Table 1).**

Table 1. Demographic data of the patients with HSP

Variables	Patients n=23	Control n=20
Age (years)	**8.2±3.8**	**8.6±4.2**
Age range (years)	2–16	3–14
Male/Female (n/n)	13/10	10/10
Presenting symptom		
- Purpura, n (%)	23 (100)	
- Gastrointestinal symptom n (%)	7 (30.4)	
- Arthralgia n (%)	13 (56.5)	
- Renal findings n (%)	4 (17.4)	

Laboratory findings showed leukocytosis in 47.8% of patients; thrombocytosis in 60.9%; increased CRP values above 5 mg/dl in 52.2%, and increased sedimentation rate above 20 mg/hour in 2 (8.7%) cases. The mean MDA value was 2.95±0.71 nmol/ml in the patient group and 2.67±0.66 nmol/ml in the control group (p=0.787). The mean level of the CAT enzyme was 1.32±0.35 U/g Hb in the patient group and 7.8±1.74 U/g Hb in the control group (p=0.001). The mean levels of the SOD enzyme were 3.06±0.85 U/g Hb in the patient group and 0.97±0.36 U/g Hb in the control group (p=0.001).

DISCUSSION

In the present study, we attempted to determine the role of oxidative stress biomarkers in the active period of HSP. Although the pathogenesis of HSP is not fully known, it is an IgA-related inflammatory disease. Immune complex deposition in small vessels activates inflammatory cells, including leukocytes, monocytes, and macrophages. As a result, reactive oxygen radicals are produced, triggering lipid peroxidation.[3] Increased levels of oxidants and decreased levels of antioxidants ultimately produce oxidative stress that damage tissues. HSP is one of the diseases in which oxidative stress is important.[3,4] In our study, the levels of oxidative stress and antioxidant parameters, namely MDA, SOD, and CAT values, were measured in the active stages of HSP and compared with those of the healthy individuals. Erdoğan et al. found a low SOD level but a high MDA level during active disease.[8] In another study[9], the MDA, a marker of lipid peroxidation, was higher in patients with HSP than in the control group consisting of healthy children. Ece et al., in a study including 29 patients with HSP, compared MDA levels in the active period of HSP with those of a control group.[10] They demonstrated a lower antioxidant capacity, arylesterase, and CAT activity in the patient group. In our study, the MDA level was 2.95±0.71 nmol/ml in the patient group and 2.67±0.66 nmol/ml in the control group. Although it was higher in the patient group than in the control group, the difference did not reach statistical significance. We believe that the lack of statistical significance resulted from a relatively low number of patients. In the presence of oxidative stress, oxygen and hydrogen are converted to hydrogen peroxide by SOD and removed by CAT. Our results, indicating a lower level of CAT in the patient groups, are in agreement with the literature reports.[10] Increased SOD activity in Behcet's disease is believed to be an indicator of free oxygen radical production.[11] Increased enzyme activity in the activation period compared to the remission period suggests that oxidative stress is higher in the disease activation than disease remission. In our study, the level of SOD enzyme was significantly higher in HSP patients than in the control group.[12,13] However, recent studies have shown the opposite, which is a lower SOD level in HSP patients. We thought that we obtained the blood samples during a period at which the enzyme is taken before being consumed by oxidative stress products. Low levels of SOD in literature reports are associated with H_2O_2 accumulation.

CONCLUSIONS

Although MDA values were found to be higher in patients with HSP than in the controls, no statistical difference was noted. We believe that although high MDA levels support the role of lipid peroxidation in the pathogenesis of HSP, statistical significance was not reached owing to the small number of our patients. Reduced CAT activity is well in agreement with the findings of previous reports. This finding supports the notion that oxidative stress can play a role in the pathogenesis of HSP.

Compliance with the Ethical Standards

All human studies have been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. All persons gave their informed consent prior to their inclusion in the study.

Conflict of interest

The authors declare that they have no conflict of interest.

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Оценка биомаркеров окислительного стресса у пациентов с пурпурой Шенлейна-Геноха

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Резюме

Введение: Пурпура Шенлейна-Геноха (ПШГ) - это синдром системного васкулита, характеризующийся нетромбоцитопенической пурпурой, артритом / артралгией, абдоминальной болью и гломерулонефритом. Патогенез ПШГ неясен. Окислительное повреждение играет роль в патогенезе большинства случаев.

Цель: Целью этого исследования было оценить изменения окислительного стресса путём изучения таких параметров, как супероксиддисмутаза (SOD), каталаза (CAT) и малоновый диальдегид (MDA), чтобы попытаться определить роль окислительного стресса в ПШГ с другой точки зрения.

Материалы и методы: В это исследование вошли 23 педиатрических пациента (десять девочек и тринадцать мальчиков) с диагнозом ПШГ, которые наблюдались в отделении педиатрии Медицинского университета имени Кахранмараша Сютчуйма в период с 2014 по 2016 год, и двадцать здоровых детей в качестве контрольной группы. Родители всех детей дали информированное согласие на участие в исследовании. В группе ПШГ определяли начало сезона заболевания и системное поражение во время последующего наблюдения. Перед началом любого лечения брали образцы крови. Значения SOD, активности CAT и MDA в образцах эритроцитов и плазмы сравнивались между группой пациентов и здоровыми детьми.

Результаты: В исследовании приняли участие 23 пациента с ПШГ (10 женского и 13 мужского пола) и 20 здоровых детей. Средний возраст пациентов с ПШГ составлял 8.21 ± 3.78 года (от 2 до 16 лет), а в контрольной группе - 8.6 ± 4.2 (от 3 до 14 лет). Среднее значение MDA составило 2.95 ± 0.71 nmol/ml в группе пациентов и 2.67 ± 0.66 nmol/ml в контрольной группе (p=0.787). Средний уровень фермента CAT составил 1.32 ± 0.35 U/g Hb в группе пациентов и 7.8 ± 1.74 U/g Hb в контрольной группе (p=0.001). Средние уровни фермента СОД составили 3.06 ± 0.85 U/g Hb в группе пациентов и 0.97 ± 0.36 U/g Hb в контрольной группе (p=0.001).

Заключение: Хотя высокие уровни MDA подтверждают роль перекисного окисления липидов в патогенезе ПШГ, статистической значимости достичь не удалось из-за ограниченного числа наших пациентов. Снижение активности фермента CAT согласуется с результатами предыдущих исследований. Эти данные подтверждают идею о том, что окислительный стресс может играть роль в патогенезе.

Ключевые моменты: Наши результаты подтверждают идею о том, что окислительный стресс мог играть роль в патогенезе ПШГ.

Ключевые слова

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