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Local Sympathetic System Dysfunction in Patients with Acute Allergic Rhinitis; an Electrophysiological study of Local Sympathetic Skin Responses Test

Akut Allerjik Rinitli Hastalarda Lokal Sempatik Sistem Disfonksiyonunu Gösteren Lokal Sempatik Deri Yanıtları Testi'nin Elektrofizyolojik Çalışması

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Abstract

Introduction: In this study, we aimed to investigate sympathetic nervous system functions by local sympathetic skin responses of the nasal septum in patients with acute allergic rhinitis.

Material and Methods: Eighty-five patients who were diagnosed as acute allergic rhinitis according to medical history and otorhinolaryngological examination with positive allergy evaluations via skin prick testing and 50 healthy subjects were included to the study. Sympathetic skin responses of the nasal septum were recorded in patients and in the control groups, and sympathetic skin response latencies and amplitudes were compared between groups.

Results: The mean value of sympathetic skin response latencies was significantly longer in the patient group than that of the control group ($p<0.001$). In addition, mean value of sympathetic skin response amplitudes was significantly lower in the patient group than the control group ($p<0.001$).

Conclusion: Our study is the first which electrophysiologically evaluated the local sympathetic nervous functions that shows objective evidence of local sympathetic nervous system dysfunction. This way to access local sympathetic nervous system dysfunction would be helpful in deciding patients' treatment.

Keywords: Acute allergic rhinitis, sympathetic skin responses, sympathetic nervous system

Öz

Giriş: Bu çalışmada akut allerjik rinitli hastalarda, nazal septumun lokal sempatik deri yanıtlarına bakarak, sempatik sinir sistemi fonksiyonunun araştırılması amaçlanmıştır.

Gereç ve Yöntemler: Çalışmaya tıbbi öykü, yapılan otolaringolojik muayene ve deri prick testi sonucunda pozitif allerji değerlendirmesi olan 85 hasta ile 50 sağlıklı kontrol alındı. Sempatik deri yanıtları hem hasta hem de kontrol gruplarından nazal septumdan kayıtla bakılmış olup, gruplar arası sempatik deri yanıtları latans ve amplitüdleri karşılaştırılmıştır.

Bulgular: Sempatik deri yanıtları latansının ortalama değerleri, hasta grupta kontrol gruba göre anlamlı şekilde uzun saptanmıştır ($p<0,001$). Ayrıca sempatik deri yanıtları amplitüdlerinin ortalama değerleri hasta grupta, kontrol gruba göre anlamlı derecede düşük saptanmıştır. ($p<0,001$).

Sonuç: Çalışmamız, lokal sempatik sinir sistemi disfonksiyonunun objektif kanıtını gösteren lokal sempatik sinir fonksiyonlarını elektrofizyolojik olarak değerlendiren ilk çalışmadır. Lokal sempatik sinir sistemi disfonksiyonunun bu yolla değerlendirilmesi, hastanın tedavi seçiminde etkili olacaktır.

Anahtar Kelimeler: Akut allerjik rinit, sempatik deri yanıtları, sempatik sinir sistemi

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Introduction

Allergic rhinitis (AR) is one of the most common allergic diseases. AR is usually defined as inflammatory disorder but another pathology that may contribute AR is nasal hyper-responsiveness.[1] The effect of neural mechanisms on nasal hyper-responsiveness is still not known but some studies points out the role of autonomic nervous system (ANS) dysfunction in AR.[1,2] In addition, it is reported that sensory nerves may play a role in nasal hypersensitivity.[2] ANS dysfunction has been described in patients with non-

allergic rhinitis (NAR) and AR, but the evaluations of autonomic tests were performed by systemic autonomic tests before.[2,3] Ozkaya et al. evaluated ANS testing by measuring sympathetic skin response (SRR) and heart rate (R-R) interval variation (RRIV) in children with perennial AR and they reported that SSR test results were not significantly different between patient and control groups, but they evaluated systemic SSR.[4] In this study we aimed to investigate sympathetic nervous system functions by local SSR of the nasal septum in patients with acute AR.

Material and Methods

Patients

This study was approved by the Ethical Committee of Pamukkale University (PAU). Patients who consented to participate in the study were recruited from the PAU Hospital Otorhinolaryngology and Allergy Clinic. The patients who were diagnosed as acute AR according to medical history and otorhinolaryngological examination with positive allergy evaluations via skin prick testing were included to the study. The patients with sinus infection in the previous four months, physical findings such as mucous membrane swelling and thickening on endoscopic sinonasal examination were excluded. In addition, patients who had been medically treated for acute rhinosinusitis, nasal polyposis, and neoplasms in the last three months were excluded. All subjects underwent a complete physical and endoscopic examination and a detailed medical history with special attention given to sinonasal/allergy signs and symptoms was taken. Severity of clinical symptoms was evaluated according to classification of Bousquet and ARIA Workshop Group[5] and the patients were additionally classified as patients with mild or moderate-severe allergic rhinitis.

The control group consisted of voluntary subjects of our medical stuff. The subjects younger than 16 or older than 65, smokers, subjects with a history of cardiovascular disease, diabetes mellitus, neurological disease, and rhinological problems were excluded from the study.

SSR test

The SSR was carried out according to the Technical Standards of the International of Clinical Neurophysiology.[6] Patients were examined in a quiet room and disposable electrodes were used for each patient and control subjects. The SSR test was performed by a computerized EMG system (Medelec/Teca Premier Plus, England) with standard disposable electromyographic surface electrode. Active electrode was placed on nasal septum and reference electrode was places on the skin over the zygomatic arch to make standardization for all subjects. We preferred to use zygomatic arch as the place of reference electrode, because this area is 4 or 5 cm around the active electrode which is a preferred area in the previous studies, not mobile, hairless, just above the bone tissue like dorsum of the hand or foot, sooth, abraded non-glabrous skin site. Only two SSR test for performed for all subjects to avoid irritation or discomfort of the study. Two consecutive electrical stimuli with 150V intensity and 100μ second duration were applied to the left median nerve at the wrist. The input sensitivity was 200 μV/ division and time base was 5 seconds. The latency and amplitude (peak to peak) of the two responses were measured and mean value of the two responses was recorded for each subject.

Statistics

Descriptive studies were used to evaluate patients' characteristics. We used *t*-test to compare continuous parametric vales and Chi-Square test to compare nonparametric values between groups. A p-value < 0.05 was considered to indicate statistical significance.

Results

After the selection of patients and control groups a total of 85 patients with the diagnosis AR and a total of 50 healthy subjects were included the study. Mean age of the patients was 31.1±12.6 years and the mean age of the control group was 34.1±11.4. The difference was insignificant (p = 0.189). The ratio of the males was 36.4% in the patient group 36.0% in the control group and the difference was insignificant (p=0.956).

Table 1 shows the compared parameters (SSR latency and amplitude) of SSR test between groups. The mean value of SSR latencies was significantly longer in the patient group (1.93±0.70s) than the control group (1.09±0.46s) (p<0.001). In addition, mean value of SSR amplitudes was significantly lower in the patient group (3.66±0.86 mV) than the control group (4.24±0.56 mV) (p<0.001).

There were 13 patients (15.3%) with mild AR whereas 72 patients (84.7%) had severe AR. The mean value of SSR latencies was longer in the patient with moderate-severe AR (1.96±0.67s) than the patients with mild

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Table 1. Results of SSR test and p values in patient and control groups

SSR Test	Patients	Controls	p value
Latency (mean value)	1.93±0.70s	1.09±0.46s	<0.001
Amplitude (mean value)	3.66±0.86 mV	4.24±0.56 mV	<0.001

AR (1.8±0.86s) but the difference was not significant (p=0.449). The mean value of SSR amplitudes was higher with moderate-severe AR (3.71±0.79 mV) than the patients with mild AR (3.38±1.17 mV) but the difference was not significant (p=0.203).

Figure 1 shows a typical local SSR test of a patient and a healthy subject.

Discussion

To our knowledge this is the first study to assess local SSR for evaluation of patients with AR. Our results showed that SSR of the nasal septum is disturbed in acute AR and this indicates existence of a local sympathetic nervous system (SNS) dysfunction. The adrenergic fibers of the SNS control vasoconstriction of the mucosa.[3,4] So, dysfunction of SNS, which has been objectively shown in our study, is the one of the causes of vasodilatation and nasal congestion in patients with acute AR.

It has been found that central nervous system, especially the SNS, plays an important role in the clinical symptoms of allergic diseases.[7] The results of our study showed that there is a local sympathetic dysfunction in patients with acute AR. As AR is a multifactorial disease with different predisposing factors, to perform practical tests which give objective results about the pathogenesis of the disease would be helpful in deciding patients' treatment.

It is reported that decreased sympathetic tone results in a pro-inflammatory reaction in immune mediated diseases.[8] In addition, Jordan et al. pointed a possible neurological participation in the development of the allergic late-phase inflammation and consequent hyperresponsiveness of the nasal mucosa.[9] Our results showed a local SNS dysfunction in patients with acute AR, but we evaluated patients who are on the acute phase of the disease. To evaluate the patients after the treatment and to evaluate the patients who are diagnosed as chronic allergic rhinitis would give more informative knowledge about the mechanism of allergic rhinitis.

Relation between neurological systems and nasal symptoms was also evaluated in patients with migraine and allergic rhinosinusitis by Bellamy et al. The results of their study showed increased trigeminal and parasympathetic nerve activity in patients with migraine and allergic rhinosinusitis.[10] It is known that neuronal reflexes play a

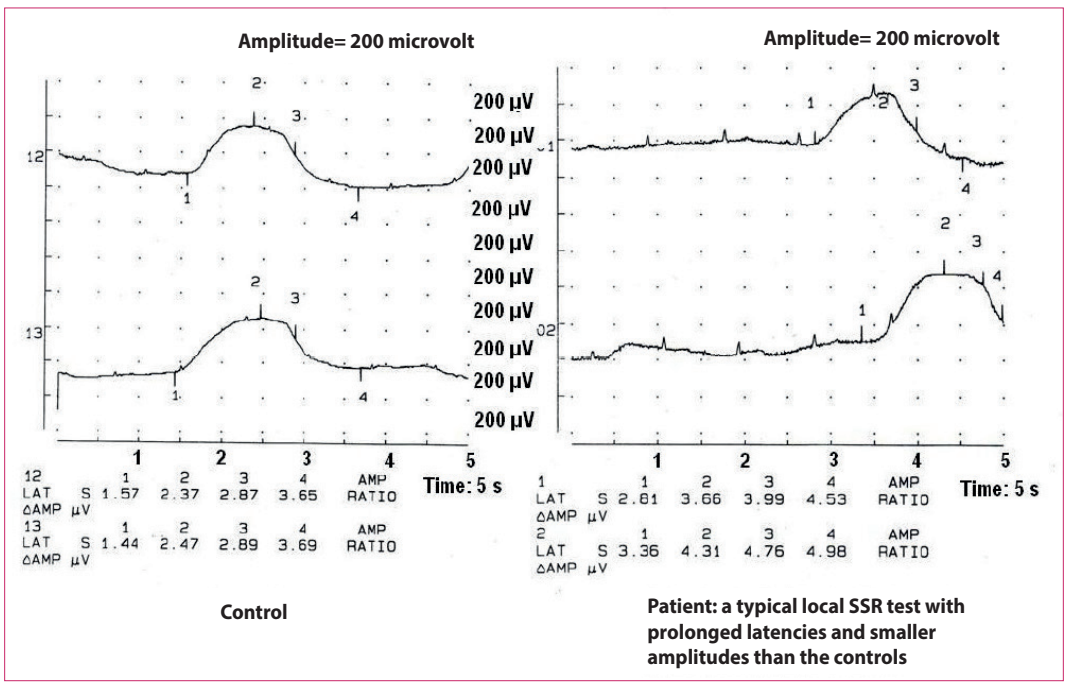

Figure 1. Demonstration of a local SSR test results of a patient and a healthy subject.

role in the allergic response[11] and the results of our study showed a local SNS dysfunction which plays an integral role in the pathogenesis of allergic rhinitis.

Patients suffering from allergic or vasomotor rhinitis usually show nasal mucosal hyperaemia, engorgement, hyperrhinorrhoea and obstruction of the nasal airway.[12] All of the patients included to our study were examined by an otorhinolaryngologist and 84.7% of the patients had been diagnosed as moderate-severe acute AR, but both SSR latencies and SSR amplitudes were not significantly different in patients with moderate-severe acute AR than the patients with mild acute AR. This result would be attributed to the small number of patients with mild acute AR in our study. The small number of patients with mild acute AR in our study would be due to relatively mild complaints of patients with mild acute AR, because they do not prefer to see a doctor.

Nasal congestion found to be related more to a withdrawal of sympathetic discharge than to an overactivity of the parasympathetic nerves.[12] So to evaluate ANS separately like sympathetic and parasympathetic systems would help an otorhinolaryngologist in the management of the patients with acute AR. To choose drugs acting on alpha-adrenergic mechanisms would be rational in patients with objective evidence of local SNS dysfunction.

In conclusion, according to knowledge of the literature, it is known that ANS dysfunction may be found in patients with acute AR, but our study is the first study which electrophysiologically evaluated local sympathetic functions. Our results showed objective evidence of local SNS dysfunction, by the way it would be helpful in deciding patients' treatment with simple and accessible tests. However further studies in different patient groups like chronic allergic rhinitis would give additional knowledge about the pathogenesis of allergic rhinitis.

Ethics Committee Approval: This study was approved by the Ethical Committee of Pamukkale University (PAU)

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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