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ОСОБЕННОСТИ ИЗМЕНЕНИЙ В СИСТЕМЕ МИКРОЦИРКУЛЯЦИИ У ДЕТЕЙ С АЛЛЕРГИЧЕСКИМ РИНИТОМ В ЗАВИСИМОСТИ ОТ ВЫРАЖЕННОСТИ ДИСФУНКЦИИ ВЕГЕТАТИВНОЙ НЕРВНОЙ СИСТЕМЫ

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Резюме. В последние годы отмечается рост распространенности аллергических болезней у детей. По степени распространенности и влиянию на здоровье и качество жизни пациентов аллергический ринит (АР) занимает первое место среди других аллергических заболеваний. В различных странах мира по разным данным страдает от 10 до 40% населения. Аллергический ринит представляет серьезную медико-социальную и экономическую проблему. Кроме того аллергический ринит, особенно с множественной сенсибилизацией и недостаточно контролируемым течением, является самостоятельным фактором риска рецидивирования респираторных инфекций и развития бронхиальной астмы, а также существенно снижает качество жизни пациентов.

АР представляет собой многофакторное заболевание, в развитии которого играют роль многие факторы. Основой патологического процесса при АР является IgE-зависимое мукозальное воспаление, реализующееся при воздействии специфических и неспецифических механизмов и имеющее Th2-характер. Вовлеченные в процесс ткани и органы определяют формирование сложных механизмов взаимодействия иммунной, микроциркуляторной и нейровегетативной систем.

Воспалительный процесс при АР характеризуется рядом особенностей, например наличием минимального персестирующего воспаления и эффектом прайминга, что в свою очередь является предрасполагающим фактором для клинического дебюта и прогрессирования АР. Микроциркуляторные механизмы имеют важное патогенетическое значение в развитии аллергического воспаления, в том числе при АР.

В зависимости от ведущего патогномоничного признака, в настоящее время принято выделять отдельные фенотипы и эндотипы АР.

Фенотип охватывает клинически значимые свойства АР, но не раскрывает детальные механизмы его развития, на основе которых можно создать персонифицированный алгоритм профилактики, лечения и прогноза.

Вегетативная нервная система обеспечивает связь организма с окружающей и внутренней средой, регулируя обмен веществ и функции органов и тканей в соответствии с изменениями этой среды, она также обеспечивает интеграцию всех органов в единое целое, являясь одной из главных адаптационных систем организма.

Во главе регуляции функционирования организма и гомеостаза стоит вегетативная нервная система, объединяющая отдельные патогенетические звенья развития заболеваний и обуславливающая структурное и функциональное единство. В связи с этим, среди причин системных изменений в ми-

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кроциркуляторном русле, которые так же отражают общие патогенетические процессы в организме, ведущее значение принадлежит нарушению нейрорегуляторных механизмов. Механизм регуляции реализуется нервно-рефлекторным путем с помощью различных нейрогуморальных факторов, сущность которых изучена в экспериментальных условиях и на сегодняшний день не подвергается сомнению.

Исследование основных показателей микроциркуляции и вегетативной нервной системы у детей с аллергическим ринитом в различном сочетании с сопутствующей патологией позволит выделить новые фенотипы АР и подобрать индивидуальный план лечения и реабилитации этих детей.

Ключевые слова: аллергический ринит, дети, микроциркуляция, капилляроскопия, вегетативная нервная система, фенотип

CLINICAL FEATURES OF CHANGES IN THE MICROCIRCULATION SYSTEM AMONG CHILDREN WITH ALLERGIC RHINITIS, DEPENDING ON THE SEVERITY OF DYSFUNCTION OF THE AUTONOMIC NERVOUS SYSTEM

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Abstract. In recent years, there has been an increase in the prevalence of allergic diseases in children. Allergic rhinitis (AR) ranks first among other allergic diseases in terms of prevalence and impact on the health and quality of life patients. In various countries of the world, according to various sources, from 10 to 40% of the population suffers. Allergic rhinitis is a serious medical, social and economic problem. In addition, allergic rhinitis, especially with multiple sensitization and insufficiently controlled course, is an independent risk factor for recurrence of respiratory infections and the development of bronchial asthma, and also significantly reduces the quality of life patients.

AR is a multifactorial disease in the development of which many factors play a role. The basis of the pathological process in AR is IgE--dependent mucosal inflammation, which is realized under the influence of specific and nonspecific mechanisms and has a Th2 character. The tissues and organs involved in the process determine the formation of complex mechanisms of interaction between the immune, microcirculatory and autonomic nervous systems.

The inflammatory process in AR is characterized by a number of features, for example, the presence of minimal persistent inflammation and the priming effect, which in turn is a predisposing factor for the clinical onset and progression of AR. Microcirculatory mechanisms are of great pathogenetic significance in the development of allergic inflammation, including in AR.

Depending on the leading pathognomonic trait, it is now customary to distinguish individual phenotypes and endotypes of AR.

The phenotype covers the clinically significant properties of AR, but does not reveal the detailed mechanisms of its development, on the basis of which a personalized algorithm for prevention, treatment and prognosis can be created.

And the autonomic nervous system is responsible for setting links between the body, ambient and internal environment through the regulation of metabolism, functioning of organs and tissues based on changes in this environment; it also provides the integration of all organs into a single whole acting as one of the main body's adaptive systems.

Since the autonomic nervous system governs the body and homeostasis uniting separate pathogenetic links of disease progression and sets the basis for structural and functional unity. In light of this, the failure of neuroregulatory mechanisms takes the lead among the causes of systemic changes in the microvasculature, which, in turn, reflects general pathogenetic processes in the body. The regulatory mechanism is implemented through nerves and reflexes by different neurohumoral factors, their nature has been studied under experimental conditions and is beyond doubt to date.

The study of the main indicators of microcirculation and the autonomic nervous system among children with allergic rhinitis in various combinations with concomitant pathology will highlight new AR phenotypes and select an individual treatment and rehabilitation plan for these children.

Keywords: allergic rhinitis, children, microcirculation, capillaroscopy, autonomic nervous system, phenotype

Introduction

Allergic rhinitis (AR) is one of the most common diseases among children [1, 8, 9]. Studying the features of the course, diagnosis and treatment of AR among children in various phenotypic variations and in different age groups allow not only to optimize approaches to treatment but also to prevent AR [6, 10].

AR is a multifactorial disease in the development of which many factors play a role. Microcirculatory mechanisms have an important pathogenetic value in the development of allergic inflammation [3, 5, 12].

At the top of the regulation of the functioning of the body is the higher nervous system, combining individual pathogenetic links in the development of diseases and causing structural and functional unity [2, 11]. Therefore, the study of the pathogenetic interaction of the microvascular bed with an imbalance of the autonomic nervous system is a promising direction in the formation of tactics for the management, monitoring and early diagnosis of children with AR, in various combinations with concomitant pathology [4, 7]. In AR, it is the concomitant pathology that determines the course of the inflammatory process and forms individual phenotypes. An imbalance in the microcirculation system and dysfunction of the autonomic nervous system is also associated with the comorbid pathology in AR, which can be used as diagnostic criteria for various forms of AR.

Materials and methods

In the clinic, 39 children with allergic rhinitis from 3 to 8 years old were examined. All children underwent assessment of the state of the microvasculature using computer capillaroscopy of the nail bed with the determination of a number of indicators (length of the arterial and venular parts of the capillaries; uneven caliber of the arterial and venular parts of the capillaries; diameter between the capillaries; diameter of the arterial and venular parts of the capillaries; distance between the arterial and venular parts of the capillaries ; extent of the perivascular zone). The state of the autonomic nervous system was assessed by the results of conducting heart rate variability for 3 minutes using the Kardiovisor-6C hardware complex (Medical Computer Systems LLC, Russia).

All children were divided into 2 groups: group 1 – 20 children with AR in combination with herpetic infection and/or pathogenic microflora in nasopharyngeal swabs exceeding 106 and group 2 – 19 children with AR. Groups were comparable by age. The control group (C gr.) Included 25 practically healthy children assigned to I-II health groups and not having a disease for 2 months before the study. The results were processed using the SPSS 14.0 software (SPSS Lab., USA).

Results and discussion

When conducting capillaroscopy among children with AR, morphological changes in the microvasculature were revealed in the form of an increase in the number of microvessels per unit of the observed area, changes in the shape and presence of vascular microcomplexes formed from several adjacent capillaries, in contrast to children from C gr., where the vessels were clearly oriented and ordered ($p < 0.05$). The revealed changes were more pronounced among children of gr. 2 – Microaneurysms and extravasases were often determined.

Among children with AR, in comparison with C gr., changes in the parameters of the microvasculature were determined, such as the expansion of the venular part of the capillaries (49.3±2.7 μm and 41.6±2.5 μm, respectively; $p < 0,05$), a decrease in the length of the arterial part of the capillary (children with AR – 180.5±10.3 μm, C gr. – 197.91±5.49 μm; $p < 0.05$), an increase in the length of the perivascular zone less than 90 μm, in C gr. – 99.6±7.3 μm. Moreover, among children with concomitant pathology, these changes were less pronounced. Changes in microcapillaries among children of gr. 2 are characterized as uniform and smooth, as expressed throughout the capillary, while among children gr. 1 changes were intermittent and expressed in individual sections of the capillaries. The tendency to homogeneous expansion and dilatation of the arterial section of the capillary caused a decrease in the distance between the adducting and outlet parts of the capillaries (children with AR – 12.8±1.3 μm, C gr – 15.9±5.0 μm; $p > 0.05$) Presumably, these changes are compensatory in nature and may be associated with a violation of the regulatory influence of the autonomic nervous system.

When assessing the results of heart rate variability among children with AR, significant changes were revealed in comparison with healthy children, in particular, the indicator reflecting long-term components and circadian rhythms (SDNN) was the highest (gr. 1 – 43.5±2.5, gr. 2 – 37.4±3.1, C gr. – 31.2±2.7, $p < 0.05$), the RMSSD indicator reflecting the activity of the parasympathetic link was more elevated among children from gr. 2 (45.3±3.8), compared with children from gr. 1 (38.2±2.5) and C gr. (28.8±4.5). All children with AR showed a slight decrease in the spectrum of low-frequency (LF) and increased high-frequency (HF) components $p > 0.05$ but the ratio of LF/HF had a clear tendency to decrease in both groups of children with AR (children with AR – 3,11±0.82, healthy children – 4.03±0.69). The determination of the IS indicator (stress index), which determines the degree of dominance of central regulation mechanisms over autonomous ones, revealed a sharp decrease in this indicator of gr. 1 190.5±20.7 than in gr. 2 and C gr., respectively 240.5±15.4 and 303.9±20.8, $p < 0.05$.

Conclusion

As we see, all children with AR have changes in the microvasculature, which vary depending on the concomitant pathology. Among these children, reactive changes in autonomic regulatory systems are observed toward an increase in the dominance of central regulation mechanisms and the predominance of parasympathetic tone. Children with AR with concomitant pathology do not show a pronounced parasympathetic effect, unlike children with AR and children without concomitant pathology, which should be taken into account when drawing up a plan for personalized treatment and rehabilitation. Evaluation of the microcirculation system by direct capillaroscopy is a non-invasive and effective diagnostic method, as well as economically attractive, which is sufficient reason to include it in the recommendations for the diagnosis of AR phenotypes.

References

1. Akdis C.A., Hellings P.W., Agache I. Global atlas of allergic rhinitis and chronic rhinosinusitis. Zurich, Switzerland: European Academy of Allergy and Clinical Immunology, 2015. 422 p.
2. Akselrod S. Components of heart rate variability: basis studies. *Heart Rate Variability, 1995, № 12, pp. 147-163.*
3. Berezhansky P.V., Berezhanskaya Yu.S. Modern features of the pathogenesis of bronchial asthma and the contribution of microcirculation in the development of chronic allergic pathology. Materials of international scientific-practical conference "Modern strategies and technologies for the prevention, diagnosis, treatment and rehabilitation of patients of different ages suffering from chronic non-infectious whitening", 2018, pp. 113-126.
4. Berezhansky P.V., Turchaninov S.O. A method for diagnosing the state of the capillary bed in various diseases in children. Acoustic-optical and radar methods for measuring and processing information: materials of the 12th International Scientific and Technical Conference, 2019, pp.104-106.
5. Korzheva I.Iu., Iakovlev V.N., Mumladze R. B., Rozikov Iu.Sh., Duvanskiĭ V.A. Blood microcirculation disorder in patients with microcirculation study. *Allergy Rhinol. (Providence), 2018, Vol. 9, pp. 1-9.*
6. Lee E., Hong S.J. Phenotypes of allergic diseases in children and their application in clinical situations. *Korean J. Pediatr., 2019, Vol. 62, no. 9, pp. 325-333.*
7. Ozsutcu M., Ozkaya E., Demir A., Erenberk U., Sogut A., Dundaroz R. Pupillometric assessment of autonomic nervous system in children with allergic rhinitis. *Med. Princ. Pract., 2013, Vol. 22, no. 5, pp. 444-448.*
8. Roberts G., Xatzipsalti M., Borrego LM, Custovic A., Halken S., Hellings P.W., Papadopoulos N.G., Rotiroti G., Scadding G., Timmermans F., Valovirta E. Paediatric rhinitis: position paper of the European Academy of Allergy and Clinical Immunology. *Allergy, 2013, Vol. 68, pp. 1102-1116.*
9. Tataurshchikova N. Rational pharmacotherapy in cases of mucosal immunity pathologies among patients suffering from allergic rhinitis. *Bulletin of Otorhinolaryngology, 2013, no. 5, pp. 93-97.* (In Russ.)
10. Tataurschikova N.S. Features of allergic inflammation in the assessment of phenotypes of allergic rhinitis. *Farmateka, 2018, no. 1, pp. 12-15.* (In Russ.)
11. Undem B.J., Taylor-Clark T. Mechanisms underlying the neuronal-based symptoms of allergy. *J. Allergy Clin. Immunol., 2014, Vol. 6, pp.1521-1534.*
12. Wiernsperger N., Rapin J.R. Microvascular diseases: is a new era coming? *Cardiovasc. Hematol. Agents Med. Chem., 2012, Vol. 6, pp. 167-183.*

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