Features of the clinical course and treatment of anaphylaxis in children in the Ryazan region according to survey data

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Annotation

Anaphylaxis is a life-threatening systemic hypersensitivity reaction with the rapid development of critical changes in hemodynamics and /or disorders of the respiratory system, which can lead to death. Despite the trend towards the spread of anaphylaxis among children, there are difficulties in monitoring statistical data, since there is no generally accepted cipher "Anaphylaxis" in the ICD-10, and designations from allergic urticaria to anaphylactic shock appear as a diagnosis. Epidemiological studies on anaphylaxis in the Russian Federation are isolated, so the assessment of data from each region is relevant.

Objective: to study the clinical features and medical care for anaphylaxis in children of the Ryazan region in real clinical practice.

Materials and methods: A retrospective analysis of medical documentation was carried out in 300 children who had suffered an "acute allergic reaction" over the past 5 years, followed by a telephone survey of patients' parents about the disease, and based on the clinical criteria for the diagnosis of anaphylaxis presented by the World Organization of Allergists (WAO) in 2020 and in the Federal Clinical Guidelines for the Diagnosis and Treatment of anaphylaxis, 57 patients were selected for anaphylactic shock of the Russian Federation in 2022, whose data were compared in a spreadsheet and analyzed using SPSS V24.0, including descriptive statistics.

Results: It was revealed that the average age of first—time anaphylaxis is 3.5 years. Clinical manifestations from the skin and mucous membranes were present in 67.2% of patients, symptoms from the respiratory system in 11.8% of cases. The leading trigger for the occurrence of anaphylaxis in children is the nutritional factor (n = 27 (40%), ($\chi^2 = 4.56$; p = 0.033)). In 29% of cases, the causally significant allergen remained unknown. The most common drugs in the treatment of anaphylaxis in real clinical practice were glucocorticosteroids (n = 48 (84.2%)) and antihistamines of the first and second generation (n = 47 (82.5%)). The frequency of epinephrine use was only 3 cases (5%).

Conclusion: The epidemiological study of anaphylaxis in the Ryazan region was a pilot project for our region. It showed difficulties both in the organization and in the interpretation of the data obtained. According to preliminary results, food allergy is a frequent trigger of anaphylaxis in children of the Ryazan region. Regional studies of anaphylaxis in children in real clinical practice make it possible to identify not only the features of this urgent pathology, but also to note the problems of providing primary medical care in order to improve it. Further study of population models of anaphylaxis, apparently, should be based on the creation of a unified questionnaire of the pediatric community, following the example of the ISAAC questionnaires or the creation of registers, which will more accurately help determine the true prevalence of anaphylaxis, determine the need to identify anaphylactogenic relevant molecules in the pediatric population, and improve the provision of assistance to children with these conditions.

Keywords: anaphylaxis, allergic reaction, children, adrenaline, food allergy.

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Особенности клинического течения и терапии анафилаксии у детей в Рязанской области по данным опроса

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Аннотация

Анафилаксия — это жизнеугрожающая системная реакция гиперчувствительности с быстрым развитием критических изменений гемодинамики и (или) нарушениями со стороны дыхательной системы, которая может привести к летальному исходу. Несмотря на тенденцию к распространению анафилаксии среди детей, существуют затруднения в мониторинге статистических данных, так как в МКБ-10 нет общепринятого шифра «Анафилаксия», а в качестве диагноза фигурируют обозначения от аллергической крапивницы до анафилактического шока. Эпидемиологические исследования по анафилаксии в Российской Федерации единичные, поэтому оценка данных каждого региона является актуальным.

Цель работы: изучить клинические особенности и оказание медицинской помощи при анафилаксии у детей Рязанской области в реальной клинической практике.

Материалы и методы. Проведен ретроспективный анализ медицинской документации у 300 детей перенесших «острую аллергическую реакцию» за последние 5 лет с последующим телефонным опросом родителей пациентов о перенесенном заболевании с помощью адаптированной анкеты, и на основании клинических критериев диагностики анафилаксии, представленных Всемирной организацией аллергологов (WAO) в 2020 году и в Федеральных клинических рекомендациях по диагностике и лечению анафилаксии, анафилактического шока РФ 2022 года, отобрано 57 пациентов.

Результаты. Было выявлено, что средний возраст впервые возникшей анафилаксии у детей от 2 до 6 лет составляет 3,5 года. Клинические проявления со стороны кожи и слизистых оболочек присутствовали у 67,2% пациентов, симптомы со стороны дыхательной системы в 11,8% случаев. Ведущим триггером возникновения анафилаксии у детей является пищевой фактор (n = 27 (40%), ($\chi^2 = 4{,}56$; p = 0,033)). В 29% случаев причинно-значимый аллерген остался неизвестным. Наиболее распространенными препаратами в лечении анафилаксии в реальной клинической практике оказались глюкокортикостероиды (n = 48, (84,2%)) и антигистаминные препаратов первого и второго поколения (n = 47 (82,5%)). Частота применения адреналина составила всего 3 случая (5%).

Заключение. Проведенное эпидемиологическое исследование анафилаксии в Рязанской области явилось пилотным проектом для нашего региона. Оно показало сложности как в организации, так и в трактовке полученных данных. По предварительным результатам пищевая аллергия является частым триггером анафилаксии у детей Рязанской области. Региональные исследования анафилаксии у детей в реальной клинической практике позволяют выявить не только особенности этой ургентной патологии, но и отметить проблемы оказания первичной медицинской помощи с целью ее совершенствования. Дальнейшее изучение популяционных моделей анафилаксии, по-видимому, должно строиться на создании единой анкеты педиатрического сообщества, по примеру опросников ISAAC или создания регистров, что более точно поможет определить

истинную распространенность анафилаксии, определить потребность в определении анафилактогенных релевантных молекул в детской популяции, улучшить оказание помощи детям при этих состояниях.
Ключевые слова: анафилаксия, аллергическая реакция, дети, адреналин, пищевая аллергия.

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Anaphylaxis is defined as a severe life-threatening systemic immediate hypersensitivity reaction with a rapid onset and life-threatening airway and circulation problems usually but not always associated with skin and mucosal changes. These are the most commonly used definitions, presented in national clinical guidelines and positional articles of EAACI (European Academy of Allergy and Clinical Immunology) and WAO (World Allergy Organization) [1, 2].

The diagnosis of anaphylaxis is based primarily on a detailed episode history, including information on all exposures and events in the hours leading up to onset of symptoms, for instance, physical activity, taking drugs, infectious disease, stress, journey or other violations of the daily routine. The key to diagnosis is pattern recognition: the sudden appearance of characteristic symptoms and signs within a few minutes or hours after exposure to known or potential triggers, often followed by their rapid progression within a few hours.

Clinical criteria for diagnosing anaphylaxis are currently used to make a diagnosis, proposed and recommended by the World Allergy Organization (WAO) in 2020 [3]. Based on them, anaphylaxis if highly probable under any of the following two criteria (Table 1).

The absence of generally accepted encryption for this nosology introduces a certain level of complexity in evaluating real epidemiological indicators of anaphylaxis. The identification of cases using systems of medical coding, such as ICD-10, is a common general methodological approach, though is prone to misclassification as there is no generally accepted code for anaphylaxis, which can appear under other diagnoses: allergic urticaria (L50.0), unspecified

Table 1. **Clinical criteria for anaphylaxis (World allergy organization anaphylaxis guidance, 2020)**
Таблица 1. **Клинические критерии анафилаксии (World allergy organization anaphylaxis guidance, 2020 г.)**

Criterion	Characteristics of symptoms
1	Acute onset of the disease (from a few minutes to a few hours) with simultaneous lesion of the skin, mucous membrane or both (e.g., generalized urticaria, itching and hyperemia, swelling of the lips, tongue, uvula) and combined with one of the following symptoms: A. Respiratory disorders (e.g., shortness of breath, rales-bronchospasm, stridor, PEF decrease, hypoxemia); B. Blood pressure reduction or accompanying symptoms of target organ dysfunction (e.g., hypotension (collapse), fainting, urinary incontinence); C. Severe gastrointestinal symptoms (e.g., severe spastic abdominal pain, repeated vomiting), especially after exposure to non-food allergens.
2	Acute onset of the disease in the form of hypotension* or bronchospasm or a lesion of the larynx** after exposure to a known or highly suspected allergen*** for this patient (from a minute to a few hours****), even in the absence of typical skin lesions.

* Hypotension is defined as a decrease in systolic blood pressure more than 30 % of this person's baseline (infants and children under 10: systolic BP less than (70 mmHg + [2 × age in years]), adults and children over 10: systolic BP less than < 90 mmHg).
** Larynx-related symptoms include stridor, voice changes, odynophagia, symptoms of lower respiratory tract, should not be caused by common inhalant allergens or food allergens, which are believed to cause "inhaled" reactions in no ingestion.
*** An allergen is defined as a substance (usually protein), capable of triggering an immune response that may lead to an allergic reaction. Most allergens act via IgE-mediated pathways or by direct activation of mast cells.
**** Most allergic reactions develop rapidly, however, delayed response with onset from 10 hours after ingestion may occur for some food allergens (e.g., alfa-Gal) or be secondary to immunotherapy.

urticaria (L50.9), angioedema (T78.3), unspecified anaphylactic shock (T78.2), anaphylactic shock due to adverse food reaction (T78.0), anaphylactic shock due to adverse exposure to the right medication or the drug, administered properly (T88.6) that leads to difficulty in monitoring epidemiological data on anaphylaxis [4].

Therefore, unlike most allergic or hypersensitive states, such as asthma or rhinitis, epidemiological data on anaphylaxis worldwide remain scarce, which makes it difficult for comparable morbidity statistics [5, 6]. They can vary greatly, depending on information gathering and statistical processing, but in general demonstrate increased incidence of anaphylaxis [5, 7, 8, 9].

In recent years there has been an increasing interest in epidemiology of anaphylaxis due to a growth trend in this pathology in most developed countries all over the world over the past three decades. According to published data, the number of hospitalizations for anaphylaxis have increased in Great Britain, the USA, Canada and Australia. For instance, European data point to incidence rates of anaphylaxis from all causes in the range from 1,5 to 7,9 per 100 000 people a year, however, 0,3 % (95 % CI 0,1–0,5) of population are estimated to experience anaphylaxis at some point in life [10, 11, 12]. In Great Britain the number of hospitalizations for anaphylaxis has increased by 615 % over the 20-year period; similar data were provided by Australian researches [13]. According to emergency inpatient evaluation in hospitals of the USA, 1 in 3000 people suffers from anaphylactic reaction [14, 15]. American research for the period 2005– 2014 describes an increased incidence of anaphylaxis in all age groups, while the maximum increase was in a patient group aged 5–17 [14, 12]. A recent systematic review Wang et al shows an increase incidence of anaphylaxis among children, noting that the morbidity rate of anaphylaxis varies around the world from 1 to 761 incidents per 100 000 children a year [16].

Mortality from anaphylactic reactions in all age groups is from 0,5 to 1 % of cases per 1 million people a year [18]. Food anaphylaxis is the cause of death in 0,06 % of cases per 100 000 children aged 0–15 years a year [19].

There are currently several studies on epidemiology of anaphylaxis in the regions, published in the Russian Federation, but there are no presented systematic data on the incidence of anaphylaxis in the country [2, 10, 20, 14]. The most known ones, which are given in updated Federal clinical guidelines of the Russian Federation, show that the incidence of AS in Kazan in 2012 was 0,37 per 10 000 people and mortality was up to 1 % [10].

Therefore, the study of regional particularities of anaphylaxis in the Russian Federation is relevant.

OBJECTIVE OF OUR STUDY: to study clinical features and provide medical care for anaphylaxis in children of the Ryazan region in real clinical practice.

MATERIALS AND METHODS

It was an open retrospective study.

The first stage included a retrospective analysis of medical records: the history of a child development (112/y form) and discharge summary (027/y form) of children aged 0-18, living in the territory of the Ryazan region and undergoing “an acute allergic reaction with the code МКБ-10 (allergic urticaria (L50.0), unspecified urticaria (L50.9), angioedema (T78.3), unspecified anaphylactic shock (T78.2), anaphylactic shock due to an adverse food reaction (T78.0), anaphylactic shock due to adverse exposure to the right medication or a drug, administered properly (T88.6)) in the anamnesis from January, 2017 to December, 2022. For collecting documentation and identifying incidence, we contacted City Children’s Clinics № 1, 2, 3, 6, 7 in Ryazan and the Ryazan regions via regional pediatricians.

The data were collected with oral voluntary consent from children and their legal representatives. In all the tables of statistical processing, except the primary one, the interviewees are presented under serial numbers. The telephone survey was carried out on the basic questions to determine compliance with the clinical criteria for anaphylaxis diagnosis if at least one of the two criteria coincided, provided by the World Allergy Organization (WAO) in 2020, the child was chosen for further participation in the study [3]. The survey was conducted in the form of a telephone questionnaire based on the adapted one (Appendix 1).

SPSS V24.0 package was used for statistical processing, including descriptive statistics. To describe quantitative indicators of the studied data Me median was used in the range, the lower boundary of which is the first quartile Q_1, and the upper boundary — the third quartile Q_3 in the Me format [Q_1; Q_3]. The study considered only independent data

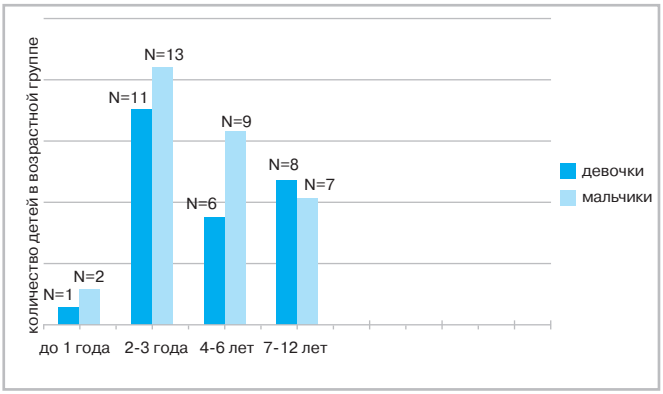

Fig. 1. **Age and sex structure of children in the Ryazan region**
Рис. 1. **Возрастно-половая структура детей Рязанской области**

groups. The statistical significance of different values for binary and nominal indicators were determined using parametric criterion χ_2. The level of statistical significance was $p < 0,05$.

RESULTS AND DISCUSSION

The Ryazan region consists of 4 city districts and 25 municipal regions [21]. The study involved all city children's clinics of Ryazan city and areas of the Ryazan region. According to preliminary estimates as of January, 1, 2022 the child population under 18 was 194,400 people.

The vast majority of children live in Ryazan city — 73,3 %, in rural areas— 26,7 % [22].

The scope of the study amounted to 300 children with a diagnosed acute allergic reaction from January 2017 to December 2022, of which 57 children aged 7 months — 12 years (19 %) met the clinical criteria of anaphylaxis by phone survey. Of these, 48 children (84,2 %) were city dwellers, 9 (15,8 %) lived in rural areas. The answers of children's parents to the telephone survey were analyzed statistically.

Evaluating regional epidemiology of anaphylaxis in the age aspect, it is possible to note the minimum age of the onset of anaphylaxis, which is 7 months, the maximum one is 12 years. Median (Me) age of anaphylaxis onset is 3,5 [2; 6] years. Gender has no impact on the onset of anaphylaxis symptom as there are 29 boys (50,9 %) and 28 girls (49,1 %), though, according to published data, a higher incidence of anaphylaxis can be traced among male patients aged 10 that disappears after this age [4, 14, 23]. However, there are very few works on the assessment of gender differences in the onset and development of anaphylactic reactions (Fig. 1).

Evaluating clinical syndromes of anaphylaxis by the description in medical records and the answers, given by our patient, we identified lesions of skin and mucous membranes (n = 45) in 67,2 %. Disorders of the respiratory system were the next in the incidence (n = 8 (11,8 %), ($\chi_2 = 38,2$; $p < 0,001$)), followed by gastrointestinal (n = 7 (10,3 %) and cardiovascular (n = 2 (2,9 %)) manifestations. Urticaria was the most common symptom (n = 47 (69,1 %) from the skin, laryngospasm and bronchospasm — from the respiratory system (n = 7 (10,8 %)). Combination of signs of skin and respiratory system lesion prevailed (n = 5 (7,5 %)).

Analyzing comorbidity of allergic diseases in children, undergoing anaphylaxis, we noted that it was a debut of clinical manifestations (n = 39,

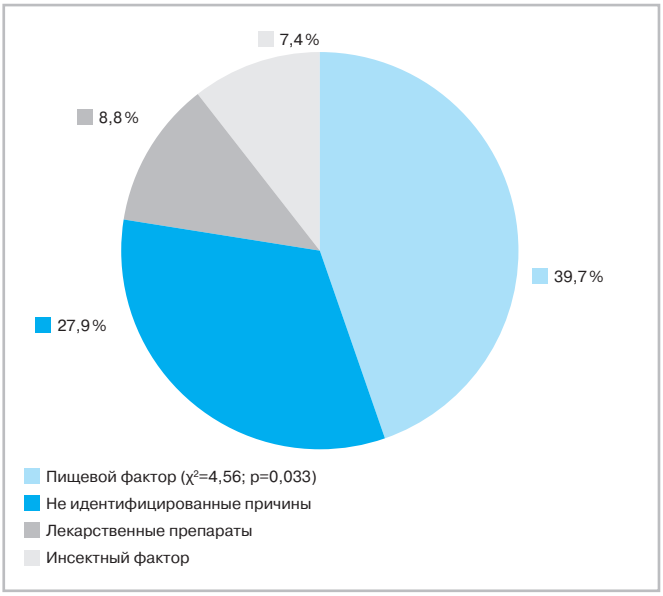

Fig. 2. **A causally significant factor in the development of anaphylaxis in children of the Ryazan region**
Рис. 2. **Причинно-значимый фактор в развитии анафилаксии у детей Рязанской области**

(57,4 %)). Atopic dermatitis was found in 8 children (11,85 %), allergic rhinitis (n = 5 (7,4 %), bronchial asthma (n = 1 (1,5 %), gastrointestinal diseases (n = 1 (1,5 %), chronic urticaria (n = 1 (1,5 %)).

The prevalence of anaphylaxis in children depends on a causally significant trigger and the age of patients under consideration. According to published data, food allergy is one of the most common causes of anaphylaxis in general and in the pediatric population in particular, it is the cause of 30–50 % of all cases of anaphylactic reactions in the general population and 81 % of cases of anaphylaxis in children [17, 24, 25, 26]. According to Russian authors, patients die from anaphylaxis on food allergens 6-7 times as often as from insect bites. In about one-third of cases among hospitalized with anaphylaxis, the reason of severe reactions is food products [2, 10, 20, 27]. Our work evaluated triggers of anaphylaxis according to anamnestic data in the medical records, parents' responses to the telephone survey and recorded the predominance of anaphylactic reactions, associated with food (n = 27 (39,7 %), (χ_2 = 4,56; p = 0,033)). Drugs take the second place after food among the known causes in children (n = 6 (8,8 %)). This trigger plays a leading role by the adolescent period that correlates with the literature data [24]. Following are insect bites — about 7,4 % of polled. And the survey method could not identify a provoking factor in 27,9 % of cases (Fig. 2).

The most common food triggers of anaphylaxis were presumably products, containing cow's milk protein (63 %), followed by fish or seafood (21 %) and nuts (7 %). Food triggers were most widespread in children under 6 (83 %), while drugs (30 %) and insect bites (28 %) were more common in the age group of 7-12 years.

According to modern care protocols and guidelines in anaphylaxis, adrenaline is the first line drug treatment [1, 2, 3]. However, according to our data, its use was recorded only in 5 % of cases in real clinic practice, and according to the literature, the use of adrenaline is described in 25 % of cases of acute allergic reactions in Europe, 44 % in Japan, 49,6 % in the USA, 46 % in Portugal and 9,3 % in Beijing [28]. In most cases glucocorticoids were used — 48 patients

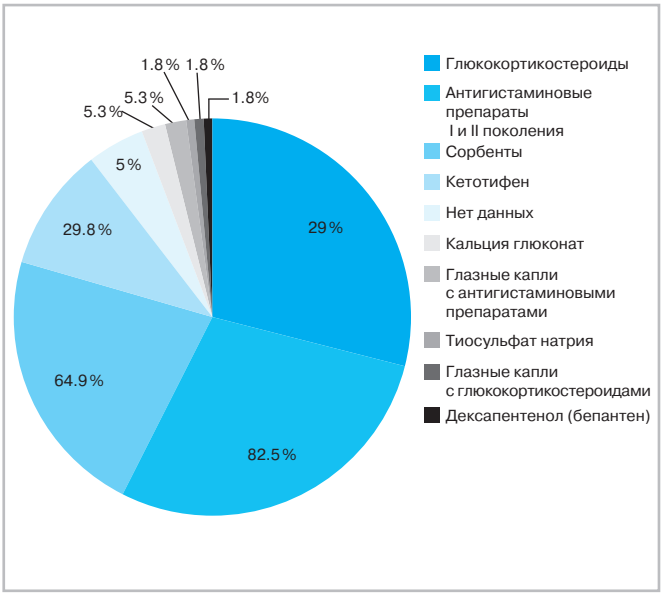

Fig. 3. **The volume of therapy when providing care to children with anaphylaxis in real clinical practice**
Рис. 3. **Объем терапии при оказании помощи детям с анафилаксией в реальной клинической практике**

(84,2 %) that is much higher than the use of adrenaline, followed by antihistamines of I and II generation and drugs, which are not listed in the FCG of the Russian Federation in assisting children with acute allergic reactions and anaphylaxis in general (Fig. 3).

Analyzing the scope of the therapy, it can be assumed that adrenaline administration might have been delayed due to the absence of signs of hypotension as many histories did not provide data of blood pressure monitoring. Besides, an accurate blood pressure measurement in young children is challenging in real clinical practice. Prospective study, carried out by Chinese researchers, showed that blood pressure measurement in children under 5 in the emergency room may be inaccurate due to the effect of fear and anxiety [28]. Literary sources name three main causes of low use of adrenaline. First, it is failure to recognize and diagnose anaphylaxis. Online survey of 7822 Medscape users showed that only 49 % of doctors were able to properly identify and diagnose food anaphylaxis, suggesting that inadequate identification and diagnostics affects the use of adrenaline [29]. Second, spontaneous anaphylaxis remission also influences on the rate of adrenaline administration [28]. Third, there is a lack of knowledge about adrenaline that further affects its use [30]. Since the delay or failure of adrenaline administration might be associated with a fatal reaction, medical personnel should certainly receive further training in recognizing and treating anaphylaxis.

CONCLUSION. The epidemiological study of anaphylaxis in the Ryazan region was a pilot project for our region. It showed difficulties both in the organization and interpretation of the data obtained. According to preliminary results, food allergy is a frequent trigger of anaphylaxis in children of the Ryazan region. Regional studies of anaphylaxis in children in real clinical practice make it possible to identify not only the features of this urgent pathology, but also to note the problems of providing primary medical care in order to improve it. Further study of population models of anaphylaxis, apparently, should be based on the creation of a unified questionnaire of the pediatric community, following the example of the ISAAC questionnaire or the creation of registers, which will help more accurately determine the true prevalence of anaphylaxis, determine the need to identify anaphylactogenic relevant molecules in the pediatric population, and improve the provision of assistance to children with these conditions.

APPENDIX 1

Anaphylaxis is a severe acute allergic reaction, including manifestations on the part of 2 or more systems and leading to a life-threatening condition. For studying the incidence of anaphylaxis in the Ryazan region, please fill out your doctor's questionnaire.

1) How old are you? (your child)

2) Gender of your child:
   - o Male
   - o Female

3) The name of the school/ preschool institution, which your child attends?

4) Does your child suffer from anaphylaxis (allergic shock)?

5) Do you know if there are other children, suffering from anaphylaxis, in the school/ kindergarten, which your child attends?

6) If yes: who gave you information about the other children, suffering from anaphylaxis?
   - o Teacher
   - o Parent Committee
   - o Headmaster
   - o Own child
   - o Other parents

7) When did your child experience anaphylactic reaction for the first time?
   - o 6
   - o 12
   - o 18
   - o More than 24 months ago

8) How often does your child experience anaphylactic reactions?
   - o once
   - o 5–2 times
   - o More than 5 times

9) Where does your child have anaphylactic reactions? (more than one answer is possible)
   - o At home
   - o In the kindergarten/school
   - o At the restaurant/cafe
   - o At friends'/relatives'
   - o On vacation
   - o In public places
   - o In the hospital (except diagnostic provocations)
   - o Other_____

10) What are the first symptoms of anaphylactic reactions (multiple choice is possible):
   - o Headache
   - o Fever
   - o Tingling in the mouth
   - o Abdominal pain
   - o Diarrhea
   - o Cough
   - o Dizziness
   - o Fainting
   - o Itching
   - o Urticaria
   - o Swelling of the throat (larynx, neck)
   - o Vomiting
   - o Feeling short of breath/dyspnea
   - o Difficulty breathing
   - o Chills/trembling in the body
   - o Cardiac arrest
   - o Swollen face
   - o Redness
   - o Nausea
   - o Abdominal cramps
   - o Trips
   - o Apnea
   - o Sleepiness
   - o Fear/ panic
   - o Other_____

11) What was the reason?
   - o Food (which?)
   - o Peanut
   - o Wheat
   - o Soy
   - o Egg
   - o Nuts
   - o Milk
   - o Fruits
   - o Other _____

12) Who was the first one to face/treat anaphylactic reaction?
   - o Parent
   - o Family doctor
   - o Outpatient treatment in a polyclinic
   - o Teacher

- Pediatrician
- Hospital
- Emergency doctor
- Accident and Emergency

13) Which type of treatment was administered?
- Prescription of emergency drugs
- Call of a doctor
- Intravenous drip
- Call for ambulance
- Oxygen insufflation
- Lying position
- Nothing

14) What treatment was prescribed?
- Administration of adrenaline
- Antihistamines
- Glucocorticosteroids
- Inhaled salbutamol/Berodual/ Pulmicort
- Other _____

15) Did your child get the emergency kit?
- Yes
- No

16) If yeas, what did the kit contain?
- Administration of adrenaline
- Antihistamines, which ones?
- Glucocorticosteroids, which ones?
- Inhaler, used in asthma (β_2-agonist), which one?
- I don't know
- Other _____

17) Were you taught how to use the emergency kit?
- Yes, I was
- Yes, I was shown how to use the kit
- Yes, we were trained on a mannequin; by the video; visually
- No

18) Have you ever had to use the kit to assist in an emergency situation?
- Yes
- No

19) If you were taught, who provided training?
- Ambulance doctor
- Pharmacist
- Nutritionist
- By myself (how?)
- Doctor in a hospital
- Friends/family
- Allergist
- Nurse
- Patient organization
- Other _____

20) Did your child receive a special emergency document/certificate?
- Yes (Who gave it?)
- No

21) Does your child wear a medical alert bracelet?
- Yes
- No
- Other _____

22) Have you informed the school/kindergarten about allergy?
- Yes, the teacher
- Headmaster
- No, nobody

REFERENCES/ ЛИТЕРАТУРА

1 Muraro A, Worm M, Alviani C, et al; European Academy of Allergy and Clinical Immunology, Food Allergy, Anaphylaxis Guidelines Group. EAACI guidelines: Anaphylaxis (2021 update). Allergy. 2022 Feb; 77 (2): 357–377. https://doi.org/10.1111/all.15032. Epub 2021 Sep 1. PMID: 34343358.

2 Федеральные клинические рекомендации по диагностике и лечению анафилаксии, анафилактического шока. 2022 г. [Электронный ресурс]. Одобрены Научно-практическим советом МЗ РФ. Разработчики КР: Российская ассоциация аллергологов и клинических иммунологов, Общероссийская общественная организация «Федерация анестезиологов и реаниматологов». Режим доступа: https://raaci.ru/dat/pdf/allergic_shock_2022.pdf. [Federal clinical guidelines for the diagnosis and treatment of anaphylaxis and anaphylactic shock. 2022. [Electronic resource]. Approved by the Scientific and Practical Council of the Ministry of Health of the Russian Federation. Developers of the CD: Russian Association of Allergists and Clinical Immunologists, All-Russian public organization “Federation of Anesthesiologists and Reanimatologists”, https://raaci.ru/dat/pdf/allergic_shock_2022.pdf. (In Russ.)]

3 World Allergy Organization Anaphylaxis Guidance, 2020 г. Published: October 30, 2020. https://doi.org/10.1016/j.waojou.2020.100472.

4 Пампура АН, Есакова НВ. Анафилаксия у детей: проблемы и пути их решения. Российский вестник перинатологии и педиатрии. 2020; 65 (3): 5–10. [Pampura AN, Esakova NV. Anaphylaxis in children: problems and ways to solve them. Russian Bulletin of Perinatology and Pediatrics. 2020; 65 (3): 5–10. (In Russ.)]. https://doi.org/10.21508/1027-4065-2020-65-3-5-10.

5 Tanno LK, Calderon MA, Goldberg BJ, Akdis CA, Papadopoulos NG, Demoly P. Categorization of allergic disorders in the new World Health Organization International Classification of Diseases. Clin Transl Allergy. 2014; 4: 42. https://doi.org/10.1186/2045-7022-4-42.

6 Tanno LK, Ganem F, Demoly P, Toscano CM, Bierrenbach AL. Undernotification of anaphylaxis deaths in Brazil due to difficult coding under the ICD-10. Allergy. 2012; 67: 783–789. https://doi.org/10.1111/j.1398-9995.2012.02829.x. — DOI — PubMed.

7 Ansotegui IJ, Sánchez-Borges M, Cardona V. Current trends in prevalence and mortality of anaphylaxis. CurrTreatOptionsAllergy. 2016; 3: 205. doi: 10.1007/s40521-016-0094-0. — DOI.

8 Tanno LK, Ganem F, Demoly P, Toscano CM, Bierrenbach AL. Undernotification of anaphylaxis deaths in Brazil due to difficult coding under the ICD-10. Allergy. 2012; 67: 783–789. https://doi.org/10.1111/j.1398-9995.2012.02829.x. — DOI — PubMed.

9 Tejedor Alonso MA, Moro Moro M, Múgica García MV. Epidemiology of anaphylaxis. Clin Exp Allergy. 2015; 45 (6): 1027–1039. https://doi.org/10.1111/cea.12418. — DOI — PubMed.

10 Ильина НИ, Заболотских ИБ, Астафьева НГ и др. Анафилактический шок. Клинические рекомендации Ассоциации аллергологов и клинических иммунологов и Общероссийской общественной организации «Федерация анестезиологов и реаниматологов». Вестник интенсивной терапии имени А. И. Салтанова. 2020; 3: 15–26. [Anaphylactic shock. Clinical recommendations of the Association of Allergists and Clinical Immunologists and the All-Russian public organization “Federation of Anesthesiologists and Reanimatologists. Bulletin of Intensive Care named after A. I. Saltanov. 2020; 3: 15–26. (In Russ.)]

11 Panesar SS, Javad S, de Silva D, Nwaru BI, Hickstein L, Muraro A, Roberts G, Worm M, Bilò MB, Cardona V, Dubois AEJ, DunnGalvin A, Eigenmann P, Fernandez-Rivas M, Halken S, Lack G, Niggemann B, Santos AF, Vlieg-Boerstra BJ, Zolkipli ZQ, Sheikh A, on behalf of the EAACI Food Allergy and Anaphylaxis Group The epidemiology of anaphylaxis in Europe: a systematic review. Allergy. 2013; 68: 1353–1361. https://doi.org/10.1111/all.12272. — DOI — PubMed.

12 Atanaskovic-Markovic M, Gomes E, Cernadas JR, du Toit G, Kidon M et al. Diagnosis and management of drug-induced anaphylaxis in children: An EAACI position paper. Pediatr Allergy Immunol. 2019; 30 (3): 269–276.

13 Weber HK, Bassett GL, Hollingsworth LK, Gan WW, Rose S, Lim J, Pryor SJ. Presentation of pediatric anaphylaxis emergency departments in regional/remote Australia. J Pediatrician Children’s Health. August 2022; 58 (8): 1407–1413. https://doi.org/10.1111/JPC.16006. Epub 2022 May 4. PMID: 35506702; PMCID: PMC9542789.

14 Пампура АН, Есакова НВ. Анафилаксия у детей. М.: ИД «Медпрактика-М», 2020. 368 с. ISBN 978-5-98803-436-0. [Pampura AN, Esakova NV. Anaphylaxis in children. M.: Publishing House “Medpraktika-M”, 2020. 368 p. (In Russ.)]

15 Wood R, Camargo C, Lieberman P, et al. Anaphylaxis in America: The prevalence and characteristics of anaphylaxis in the United States. J. Allergy and Clinical Immunology. 2014; 133 (2): 461–467. https://doi.org/10.1016/j.jaci.2013.08.016.

16 Wang Y, Koplin JJ, Ho MHK, Wong WHS, Allen KJ. Increasing hospital presentations for anaphylaxis in the pediatric population in Hong Kong. J Allergy Clin Immunol Pract. 2018; 6 (3): 1050.e2–1052.e2.

17 Muraro A, Roberts G, Worm M, Bilo et al on behalf of EAACI Food Allergy and Anaphylaxis Guidelines Group Anaphylaxis: guidelines from the European Academy of Allergy and Clinical Immunology. Allergy. 2014 — PubMed.

18 Turner PJ, Campbell DE, Motosue MS, Campbell RL Global Trends in Anaphylaxis Epidemiology and Clinical Implications. J Allergy Clin Immunol Pract. 2019; S2213— 2198(19): 30967–30965. https://doi.org/10.1016/j.jaip.2019.11.027.

19 Soar J, Pumphrey R, Cant A, et al. Emergency treatment of anaphylactic reactions — Guidelines for healthcare providers. Resuscitation. 2008; 77 (2): 157–169. https://doi.org/10.1016/j.resuscitation.2008.02.001.

20 Лепешкова ТС, Бельтюков ЕК, Царькова СА. Пищевая анафилаксия у детей. Аллергология и иммунология в педиатрии. 2020; 1 (60): 26–43. doi:10.24411/2500-1175-2020-10002. [Lepeshkova TS, Beltyukov EK, Tsarkova SA. Food anaphylaxis in children. Allergology and immunology in pediatrics. 2020; 1 (60): 26–43. (In Russ.)] https://doi.org/10.24411/2500-1175-2020-10002.

21 Главное управление МЧС России по Рязанской области. Электронный ресурс: https://62.mchs.gov.ru/ Последнее обращение от 04.12.2023. [Main Directorate of the Ministry of Emergency Situations of Russia for the Ryazan region. Electronic resource: https://62.mchs.gov.ru/ (In Russ.)]

22 Территориальный орган Федеральной службы государственной статистики по Рязанской области. Электронный ресурс: https://62.rosstat.gov.ru/. Последнее обращение от 04.12.2023. [Territorial body of the Federal State Statistics Service for the Ryazan region. Electronic resource: https://62.rosstat.gov.ru/(In Russ.)]

23 Ramsey NB, Guffey D, Anagnostou K, Coleman NE, Davis C.M. Epidemiology of Anaphylaxis in Critically Ill Children in the United States and Canada. J Allergy Clin Immunol Pract. 2019; 7 (7): 2241–2249. https://doi.org/10.1016/j.jaip.2019.04.025.

24 Новиков ДК, Аляхнович НС, Выхристенко ЛР и другие. Аллергия: инновации представлений, диагностики, лечения и подготовки врачей. Медицинские новости. 2020; 4 (307): 4–14. [Novikov DK, Alyakhnovich NS, Vykhristenko LR and others. Allergy: innovations in presentation, diagnosis, treatment and training of doctors. Medical news. 2020; 4 (307): 4–14. (In Russ.)]

25 Muraro A, Halken S, Arshad SH, Beyer K, Dubois AE, Du Toit G et al. EAACI food allergy and anaphylaxis guidelines. Primary prevention of food allergy. Allergy. 2014; 69: 590–601. https://doi.org/10.1111/all.12398.

26 Ramsey NB, Guffey D, Anagnostou K, Coleman NE, Davis CM Epidemiology of Anaphylaxis in Critically Ill Children in the United States and Canada. J Allergy Clin Immunol Pract. 2019; 7 (7): 2241–2249. https://doi.org/10.1016/j.jaip.2019.04.025.

27 Астафьева НГ, Гамова ИВ, Кобзев ДЮ и др. Пищевая анафилаксия: проблемы пациента, врача и общества. Аллергология и иммунология. Эффективная фармакотерапия. 2016; 6: 38–49. [Astafyeva NG, Gamova IV, Kobzev DY et al. Food anaphylaxis: problems of the patient, doctor and society. Allergology and immunology. Effective pharmacotherapy. 2016; 6: 38–49. (In Russ.)]

28 Su Y, Wen J, Zhang H, Zou Z, Cai Y, Zhang C. Clinical Characteristics of Anaphylaxis in Children Aged 0-16 Years in Xi'an, China. Int Arch Allergy Immunol. 2023; 184 (3): 220–227. https://doi.org/10.1159/000527497. Epub 2022 Dec 14. PMID: 36516810; PMCID: PMC10015755.

29 Wang J, Young MC, Nowak-Węgrzyn A. International survey of knowledge of food-induced anaphylaxis. Pediatr Allergy Immunol. 2014 Nov; 25 (7): 644–650. https://doi.org/10.1111/pai.12284. Epub 2014 Oct 16. PMID: 25263184; PMCID: PMC4302004.

30 Prince BT, Mikhail I, Stukus DR. Underuse of epinephrine for the treatment of anaphylaxis missed opportunities. J Asthma Allergy. 2018; 11: 143–151.

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Elena V. Stezhkina, Anna I. Agapova — development of research design, participation in research, analysis of results, statistical processing and interpretation of data, writing an article.

Natalya A. Belykh — editing the text of the article.

Darya I. Suleymanova, Anastasia N. Belyaeva — material collecting, filling out information forms.

ВКЛАД АВТОРОВ В РАБОТУ

Стежкина Е. В., Агапова А. И. — разработка дизайна исследования, участие в проведении исследования, анализ результатов, статистическая обработка и интерпретация данных, написание статьи.

Белых Н. А. — редактирование текста статьи.

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