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STREPTOCOCCUS PNEUMONIAE - THE FACTOR OF ETIOLOGY IN STUDYING THE MUCOSA OF NOSE MICROFLORA IN CHILDREN

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Abstract

Currently inflammatory diseases of the nasal mucosa and paranasal sinuses are more common among the pathology of the ear, throat, nose (ENT), especially in young children. An important role is played by a representative of the opportunistic microflora- *S. pneumoniae*. Based on the mechanisms of realization of pathogenic properties of opportunistic microorganisms, it is important to note that the establishment of markers of the pathogenic state would allow us to assess their role in the development of diseases.

The aim of the study was to analyze the monitoring of the frequency of detection of pneumococcus from nasal smear samples.

Materials and methods. Our retrospective analysis included data from the results of bacteriological examination of samples from the nasal mucosa of children under 14 years of age, patients of the city infectious diseases hospital of Shymkent for the period 2015-2019. The sample for quantitative evaluation of identified pneumococcal strains was based on monthly registration of the frequency of their isolation. To isolate the culture, blood and chocolate agars (BA and CHOC) were used, and the cups were incubated at 37 °C in an atmosphere of 5% CO2.

Results. In total, 9158 samples of nasal smears from children were examined by the culture method, 99 strains of pneumococci were detected and identified by the quantitative method, which amounted to 1.1%. The analysis of the results of pneumococcal seeding from nasal mucosal smears by month for 5 years allowed us to assess quarterly discharge, when in every three months the key indicator was only one of the highest proportion of pneumococcal discharge: 1q.-1.6%, 2q. -1.0%, 3q. -0.8% and the highest level was achieved in the 4th quarter-2.4% of cases.

Conclusions. Thus, the year-round isolation of pneumococci was established, with "permanent" increases in detection, which did not allow us to judge the stability of pneumococcal etiology in the incidence of ENT pathology. A retrospective analysis of the 5-year period in terms of the frequency of bacteriological isolation of pneumococci revealed only 2019. as an indicator for monitoring pneumococcal infections among children.

Keywords: *pneumococcus, nasal mucosa, microbial landscape, microbiological monitoring.*

Резюме

STREPTOCOCCUS PNEUMONIAE - ФАКТОР ЭТИОЛОГИИ ПРИ ИЗУЧЕНИИ СЛИЗИСТОЙ МИКРОФЛОРЫ НОСА В ДЕТСКОЙ ПОПУЛЯЦИИ

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Воспалительные заболевания слизистой оболочки носа и носовых пазух в сегодняшнее время является более распространенными среди ЛОР-патологии, особенно у детей младшего возраста. Хотя и за большую половину бактериальных риносинуситов ответственны *S.aureus*, немаловажную роль играет и представитель условно-патогенной микрофлоры - *S.pneumoniae*. Основываясь на механизмы реализации болезнетворных свойств условно-патогенных микроорганизмов, важно отметить, что установление маркеров патогенного состояния позволило бы оценить их роль в развитии заболеваний.

Целью исследования являлся анализ мониторирования частоты обнаружения пневмококка из образцов мазков из носа.

Материалы и методы. Проведенный нами ретроспективный анализ включал данные результатов бактериологического исследования образцов из слизистой оболочки пазух носа детей до 14 лет, получавших стационарное лечение в городской инфекционной больнице г. Шымкент за период 2015-2019гг. Выборка для количественной оценки идентифицированных штаммов пневмококков основывалась на помесячной регистрации частоты их выделения. Для изоляции культуры использовались кровяной и шоколадный агары (КА и ША), инкубация чашек проводилась при 37 °С в атмосфере 5%-ного СО2.

Результаты. Всего культуральным методом было обследовано 9158 образцов мазков детей, количественным методом обнаружены и идентифицированы 99 штаммов пневмококков, составивших 1,1%. Проведенный нами анализ суммированных результатов высеваемости пневмококка из образцов мазков СОПН по месяцам за 5 лет позволили провести оценку поквартального выделения, когда в каждые три месяца ключевым оказался - лишь один показатель наибольшего удельного веса выделения пневмококка: 1кв.-1,6%, 2-й квартал-1,0%, 3-й квартал -0,8% и самый высокий уровень был достигнут в 4-м квартале - 2,4% случаев.

Выводы. Таким образом, установлено круглогодичное выделение пневмококков, с «перманентными» подъемами обнаружения, что не позволяло судить о стабильности пневмококковой этиологии при заболеваемости ЛОР патологии. Ретроспективный анализ 5-ти летнего периода по частоте бактериологического выделения пневмококков позволил выявить лишь 2019г. как показательный при осуществлении мониторинга за пневмококковыми инфекциями в детской популяции.

Ключевые слова: *пневмококк, слизистая оболочка пазух носа, микробный пейзаж, микробиологический мониторинг.*

Түйіндеме

STREPTOCOCCUS PNEUMONIAE – БҰЛ БАЛАЛАР ПОПУЛЯЦИЯСЫНЫҢ МҰРЫН ШЫРЫШТЫ ҚАБЫҒЫНЫҢ МИКРОФЛОРАСЫН ЗЕРТТЕУДЕГІ ЭТИОЛОГИЯ ФАКТОРЫ

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Мұрын мен синустарының шырышты қабығының қабыну аурулары қазіргі кезде ЛОР патологиялары арасында, әсіресе жас балаларда, жиі кездеседі. Бактериялық риносинуситтердің көп жартысына *S. aureus* жауапты болса да, шартты патогендік микрофлораның өкілі – *S. pneumoniae* маңызды рөл атқарады. Шартты патогендік микроорганизмдердің патогендік қасиеттерін жүзеге асыру механизмдеріне сүйене отырып, патогендік жағдайдың маркерлерін белгілеу, олардың аурулардың дамуындағы рөлін бағалауға мүмкіндік беретінін атап өткен жөн.

Зерттеудің мақсаты мұрын жағындыларының үлгілерінен пневмококкты анықтау жиілігінің мониторингін талдау болды.

Материалдар мен әдістер. Біз жүргізген ретроспективті талдау 2015-2019 жылдар аралығында Шымкент қаласының қалалық жұқпалы аурулар ауруханасында стационарлық ем алған 14 жасқа дейінгі балалардың мұрын

қуысы шырышты қабығының үлгілерін бактериологиялық зерттеу нәтижелерінің деректерін қамтыды. Дақылды оқшаулау үшін қанды және шоколадты агарлар (ҚА және ША) қолданылды, шыныаяқтарды инкубациялау 5% CO2 атмосферасында 37 °C температурада жүргізілді.

Нәтижелері. Культуральды әдіспен балалардың мұрын жағындыларының 9158 үлгісі зерттелді, оның ішінде пневмококктардың 1,1% құрайтын 99 штаммы сандық әдіспен анықталып сәйкестендірілді. Мұрын қуысы шырышты қабығының жағындысынан пневмококктың бөлінуін 5 жылдың жиынтық нәтижелерін талдау әр тоқсанды бағалауға мүмкндік ашты. Сонда әр 3 айда көріністі мағына беретін ең үлкен үлес салмағы бар бір ғана көрсеткіші: 1-тоқсан -1,6%, 2-тоқсан-1,0%, 3-тоқсан -0,8% және ең жоғары деңгейде 4-ші тоқсанда - 2,4% болды.

Тұжырымдар. Осылайша, пневмококктардың жыл бойы оқшауланауы анықталды, бұл ЛОР патологиясының ауруы кезінде пневмококкты этиологияның тұрақтылығын бағалауға мүмкіндік бермеді. Балалар популяциясындағы пневмококк инфекцияларына мониторинг жүргізу кезінде пневмококктардың бактериологиялық бөліну жиілігі бойынша 5 жылдық кезеңнің ретроспективті талдауы тек 2019 жылы ғана көріністі болуы анықталды.

Түйінді сөздер: *пневмококк, мұрын қуысы шырышты қабығы, микробтық пейзаж, микробиологиялық мониторинг*

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In the structure of acute otorhinolaryngological morbidity in Russia, the pathology of the nose and paranasal sinuses leads (79.4%) [24]. According to the St. Petersburg Research Institute ear, throat, nose and speech, over a 5-year period, an increase in the proportion of inflammatory diseases of the paranasal sinuses among children and adults was revealed by 0.35%, acute and chronic middle purulent otitis - by 0.13%, inflammatory pathology of the pharynx and larynx - by 1.31% [28]. Inflammation of the mucous membrane of the nasal cavity and paranasal sinuses in humans is an urgent problem [18, 14]. Studies of the microbial landscape of foci of infection of ENT organs showed the largest share among opportunistic microorganisms was *S. epidermidis* (26.0%), followed by *Enterococcus* (14.4%), *S.haemolyticus* (12.3%) [17].

Through the respiratory system, as you know, the most important form of human communication with the environment is carried out, which does not stop throughout life [23], and the upper respiratory tract carries a high microbial load, that is, the mucous membrane is the first to resist the action of various environmental factors, including the invasion of foreign living beings. Inflammatory diseases of the ENT organs are among the most common. The upper respiratory tract (URT) is anatomically and physiologically adapted for the deposition of microorganisms from the inhaled air [25], so acute rhinitis is an inflammation of the nasal mucosa. Viral or bacterial infection (streptococci and staphylococci), acting on the mucous membrane of the nasal cavity, cause its inflammatory changes [1]. Bacterial rhinosinusitis by its etiology is caused by fastidious types of microbes: *Streptococcus pneumoniae* and *Haemophilus influenza* [9,10,13,12]. However, it should be remembered that *S. pneumoniae* is isolated from the respiratory tract in 20–40% of healthy children (colonization of children with pneumococcus occurs in the first 2 years of life) and in 10–20% of healthy adults [22], that is, differentiation of each episode is required. The role of staphylococci that cause inflammatory diseases of the nasal mucosa and paranasal sinuses, represented mainly by *Staphylococcus aureus (S. aureus)*, is also quite large, accounting for 77% of all crops, with the likelihood of being responsible for the most severe cases of hospital (nosocomial) sinusitis [21].

Recent years have been marked by successes in reducing the incidence of classic infections, which, however, have led to an increase in the proportion of diseases caused by representatives of normal human microflora [29, 30, 7], i.e. conditionally pathogenic microorganisms. Commensal - *S. pneumoniae* (*Streptococcus pneumoniae, Pneumococcus*), which is a natural inhabitant of the human respiratory system with localization mainly in the nasal cavity, pharynx, bronchopulmonary apparatus and other organs, is a striking representative of in assessing the microflora of the upper respiratory tract, and is potentially clinically significant. Based on the mechanisms of the realization of pathogenic properties, it is important to note that the establishment of markers of a pathogenic state would make it possible to advance in assessing their role in the development of diseases [19]. Isolation of streptococci (including pneumococci) does not always indicate their involvement in pathology, because quite often a person is a healthy carrier of the pathogen [26]. Since an important component of the assessment of carriage was the borderline state between normal and pathology, it is still quite relevant to use an

integrated approach to diagnosis, including bacteriological research and / or express diagnostics and serological monitoring [20].

Pneumococcal infections are not included in the competence of the Committee for Sanitary and Epidemiological Surveillance of the Republic of Kazakhstan, which maintain official records and supervise the epidemiological features of the course of epidemic processes of various infectious upper respiratory diseases, which causes the lack of objective and complete information on the spread of this infection in the country. At the same time, the fact of the priority of monitoring the problem of effective diagnostics of pneumococcal infections, aimed at regional and republican health systems, is also indisputable.

Summarizing the above it can be considered appropriate for carrying out tracking frequency allocation *S.pneumoniae* genus *Streptococcus group A*, which possess alpha hemolytic activity and examining biological properties isolates from patients in the pediatrics. The facts of the detection of pneumococci, as the most important etiopathogenetic agent, in the development of inflammatory concomitants and its complications, should be perceived as having the greatest prognostic value in vaccine prevention.

The aim of this work was to analyze a retrospective 5-year monitoring of the frequency of detection of nasopharyngeal pneumococcal isolated from infectious hospital patients among the pediatric population.

Materials and methods. We carried out a retrospective analysis for the period 2015-2019, the material for bacteriological examination was samples from the nasal mucosa, taken from children under 14 years old, who were in hospital. Material from the nasopharynx was taken with a sterile posterior pharyngeal cotton swab, which was carefully inserted through the nasal opening into the nasopharynx. The material under study was inoculated on solid nutrient medium, using standard techniques to obtain the growth of individual colonies of microorganisms, which were then sifted out in order to isolate a pure culture of the pathogen. Certain types of bacteria were isolated using elective (selective) media that inhibit the growth of unwanted microorganisms or contain substances that stimulate the growth of certain pathogenic microbes. Isolated clinical strains on nutrient medium microorganisms were identified with the definition of their species or type [11].

Subject to the analysis, isolated clinical isolates from samples of nasopharyngeal swabs of children, patients of the "City Infectious Diseases Hospital" of Shymkent at the age of 14 years inclusive, hospitalized with diseases of the upper respiratory tract. The sample for the quantitative assessment of the identified strains of pneumococci was based on monthly registration of the frequency of their isolation. For isolation of culture used blood and chocolate agars (BA and CHOC) incubation of plates was carried out at 37 ° C in an atmosphere of 5% CO2. Desiccators with a candle were used to create the required concentration of CO2 (the method is easy to perform and low cost). Another method of sowing in 38% of cases, we carried out the primary sowing on nutrient media by Gold's quantitative method. As the etiologically significant (threshold) concentration was taken only for those types of microorganisms that were isolated from the mucous membrane of the nasal cavity in an amount of 104 CFU in 1 ml and above [2, 5, 4]. Differentiation and identification of pneumococci was carried out, initially, on the basis of the morphology of microbial cells and colonies on plate media, the results of Gram staining. Subsequently, the pre-patent was successfully used, developed by the department: "Microbiology, Virology and General Immunology" KazMUCE [3].

This study was conducted on the initiative of the department staff, without financial support from external organizations. The topic of the study was not approved by the Ethical Council because the study was conducted based on the summarized results of the analysis of the bacteriological study of patients. In this regard, informed consent of patients was not required. The management of the City Clinical Infectious Diseases Hospital of the Shymkent is familiar with the progress of the study and does not object to the coverage of the results in the open press.

Results. In total, 9158 samples of nasopharyngeal swabs from children were examined by the cultural method, 99 strains of pneumococci were detected and identified by the quantitative method, which amounted to 1.1%. More than 220 native smears studied by us by the microscopic method showed the informative to their detailed viewing (at least 10 fields of view), allowing us to determine tentatively, further tactics for selecting nutrient medium for isolation and cultivation, according to the key distinctive features of morphology, increasing the chances of isolating the desired pneumococci. With the help of microscopic studies, episodes of isolation of microbes in vitro were increased based on the study of: morphology of cells and their components, size and location [8]. Comparison of indicators of the microbiocenosis of the nasal cavity with the features of the course of the inflammatory disease, according to some researchers, can show that the severity of the pathological process depends on the degree of negative changes in microbiological indicators [6], and the bacterial factor remains one of the leading causes of the development of pathological processes in the paranasal sinuses [16].

Our analysis of the summarized results of sowing pneumococcus from swabs of the nasal mucosa by months for 5 years (2015-2019) in Shymkent, in absolute terms, turned out to be ambiguous. A dynamic increase in the number of samples was established in the 2nd quarter (April, May and July - from 662, 691, 855, respectively) and the 4th quarter (September, October, November: from 631, 657, 781, respectively), which testified to the constant stability of the workload laboratory work.

As shown in Figure №1, presented aggregated value of detection of pneumococcal isolates from samples of nasal mucosa, allowed to assess quarterly allocation, when in every three months turned out to be the key - just one indicator of the highest specific gravity separation pneumococcus: Q1 - 1.6%, Q2 - 1.0%, Q3 - 0.8% and the highest level was achieved in Q4 - 2.4% of cases. There is an obvious ambiguity in registration: in the 1st quarter, negative dynamics was observed, i.e. decrease by more than 3 times (i.e. from 1.6% to 0.5); similarly in the III quarter, when, starting from 0.8% (July), the isolation of pneumococci decreased to 0.5% in August, and in September it stopped at the same level.

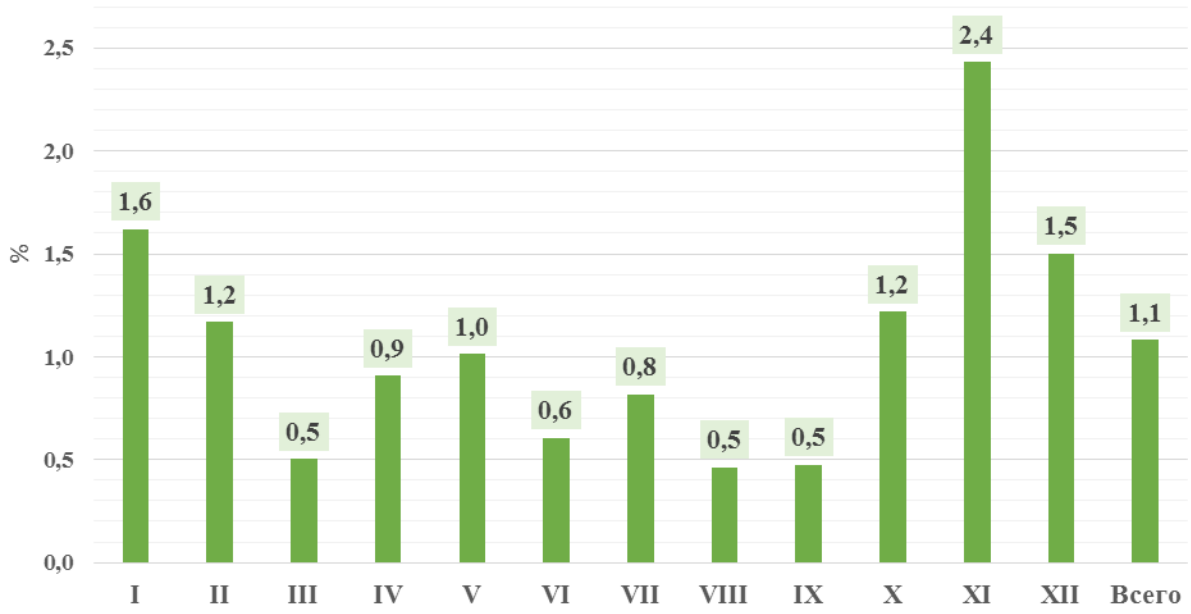
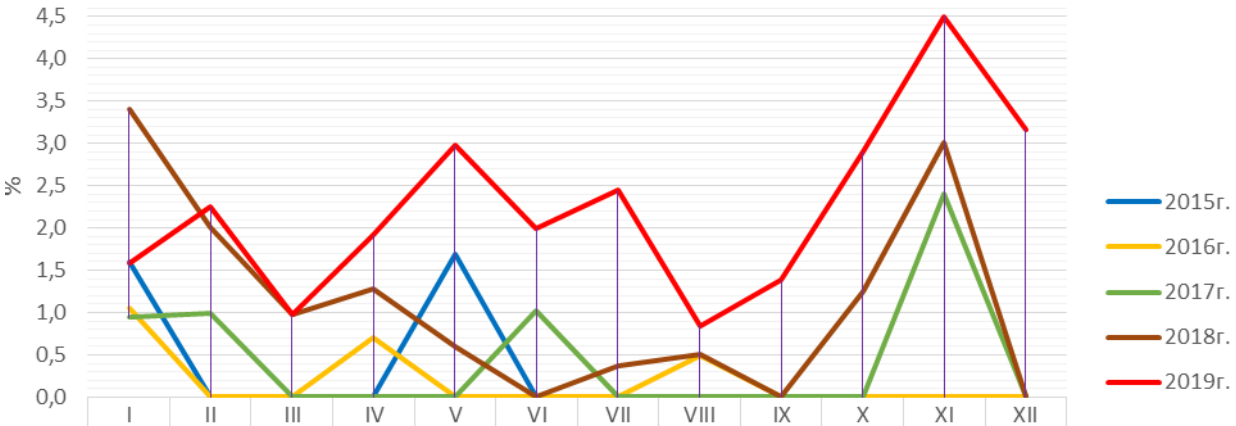


Figure 1. Monthly dynamics for a 5-year period (2015-2019) of the summarized percentage of pneumococcus discharge from the nose by among the pediatric population.

More positive can be interpreted our results obtained, although with distinctive features, in the form of a wave-like curve. Increased values were recorded in the second quarter, starting from 0.9% (April), rising to 1% (May), and then a sharp decline to 0.6% (June). The characteristics of the IV-th quarter made it possible to track the rise from 1.2% (October) twice to 2.4% (November), and then a decline by 1.6 times to 1.5%.

Discussion. Summarizing the combined indicators analyzed by us for a 5-year period, a year-round isolation was established, however, with "permanent" increases in the detection of pneumococci, which did not allow judging the stability of pneumococcal etiology in the incidence of ENT pathology (based on isolation by a bacteriological method). Thus, year-round, though less than one per cent of the allocation, evidence of prevalence at any time of the year, despite the short-wave-like curves in II-m (spring, summer) and IV-th quarter (winter). Such rises are tantamount to epidemic outbreaks of infectious diseases [27], Russian scientists say.

A fairly informative stage of our work was a dynamic analysis of the indicators of each year, out of five studies. In particular, guided by the only sign - registration of detected cases of pneumococcal etiology by bacteriological method, we found it useful to conduct a comparative analysis on the basis of the annual results for the 5-year period (2015-2019gg) infectious ENT - morbidity, reduced to a definition of what is shown in figure №2.



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2015г.	1,6	0,0	0,0	0,0	1,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2016г.	1,1	0,0	0,0	0,7	0,0	0,0	0,0	0,5	0,0	0,0	0,0	0,0
2017г.	0,9	1,0	0,0	0,0	0,0	1,0	0,0	0,0	0,0	0,0	2,4	0,0
2018г.	3,4	2,0	1,0	1,3	0,6	0,0	0,4	0,5	0,0	1,3	3,0	0,0
2019г.	1,6	2,2	1,0	1,9	3,0	2,0	2,4	0,8	1,4	2,9	4,5	3,2

Figure 2. Isolation of pneumococcus from the mucous membrane of the nasal cavity by months among the pediatric population, in the context of 2015-2019 in Shymkent.

As can be seen in Figure 2, a comparative analysis of the mucous membrane of the nasal cavity showed that from 5-year monitoring for the first three years from 2015-2017, distinctive features were identified in the form of formed curves. The difference was that:

- in 2015, isolation were detected in the first 2 quarters: only once - in January 1.6% and the second time a single peak was recorded in May - 1.7%;
- in 2016, detection in cases accounted for three quarters, though isolation was detected only in one stage: 1.1% January, April and August -0.7% -0.5%;
- in 2017, similarly, registration fell on three quarters, but also once: 1st quarter - January - 0.9%, February -1%, 2nd quarter - June - 1.0% and, then only in the 4th quarter, the rise was registered in November to 2.4%.

A distinctive feature of monthly monitoring for pneumococci isolated from the mucous membrane of the nasal cavity in 2018 was that the evaluation criterion revealed the frequency of pneumococcal isolation, which allows one to judge, for example, only according to the data of the 1st quarter on a decreasing curve - from January 3.4%, February 2.0% and in March -1.0%. According to the results of the 2nd quarter, it was revealed that only April (1.3%) and May (0.6%) months were successful, with the exception of June. The results of the isolation of pneumococci in the 3rd quarter showed decreasing activity: that is, only in July (0.4%) and August (0.5%), against the background of zero, according to the values of September. Typical for the 4th quarter, the resulting ascending percentage of allocation in October amounted to 1.3%, and by November the increase was 2.3 times, amounting to 3.0%, although again against the background of zero values in December.

The most productive, in terms of bacteriological isolation of pneumococci, over a 5-year period, turned out to be only 2019. The main difference in 2019 was that it was possible to evaluate the monitoring in full, that is, for 12 months when the results of the isolation of clinical strains of pneumococci were registered every month. It is gratifying to note that in 75% (3/4 months) a wave-like curve of pneumococcal excretion was recorded: in the first quarter, starting in January from 1.6%, having risen to 2.2% by February, there was a decrease by March - 1.0%. In the second quarter, an increase with a peak of 3.0% was recorded in May, followed by a 1.5-fold decline to 2.0% in June, while the initial value corresponded to 1.9% in April. In the 4th quarter of 2019, starting from a value of 2.9% of pneumococcal excretion in October, the peak value reached -4.5% in November, that is, an increase was observed 1.6 times, although by December, 1.4 times, it was again noted decline to 3.2% of bacteriological isolation of pneumococci. Interpretation of the facts of detection of etiopathogens, by definition, is an invaluable find in the clinical assessment of the " picture" of ENT disease and treatment correction. After all, the paranasal sinuses and the middle ear cavity in healthy people are usually sterile, which is regulated primarily by the effective work of the mucociliary apparatus, while the multiplication of bacteria (including pneumococcus) can cause the development of an inflammatory disease (for example, acute sinusitis). At the same time, the microbial landscape of the nasal mucosa, even with minimal deviations, can be an indicator of dysbiotic disorders, reported Kolenchukova O.A. (2013), conclusions were drawn based on the unusual appearance of microbial habitat. A connection has been drawn between the not quite usual localization of gram-negative bacteria that can lead to the development of an inflammatory process, remembering that bacteria have a pronounced sensitizing activity [15]. This statement is quite applicable in our studies, in relation to the detection of pneumococci, potentially dangerous pathogens of diseases of the nasal mucosa.

So, guided by the results of a 5-year retrospective analysis to study the monthly dynamics of the incidence of pneumococcal nature in the pediatric population, we obtained only 20% of the necessary information on the frequency of pneumococcal isolation. Meanwhile, the results for 2019 made it possible to justify the advisability of regular monitoring for the subsequent detection of the causes in order to develop preventive measures in relation to the time of risk of pneumococcal infection. The variety of reasons affecting the dynamics of monitoring for the release of pneumococcus can be divided into 3 groups, reported Slobodenyuk A.V. with coauthors (2015). That is, when assessing the epidemic process, these are: permanent causes throughout the year that form the level of year-round morbidity, which represents the minimum indicators of sporadic morbidity characteristic of a certain territory. Periodically intensifying reasons in the monthly dynamics of the epidemiological process determine the seasonal rise. The third type of causative factors causing irregular increases in incidence, which can occur at any time of the year. These rises are tantamount to epidemic outbreaks of infectious diseases [27].

Thus, the monthly dynamic changes that we established for 2019 on the bacteriological isolation of pneumococci isolated from the nasal mucosa made it possible to determine their regional seasonality - in the winter-spring and autumn periods, accompanied by the activation of the occurrence of ENT diseases of pneumococcal genesis.

Conclusions:

- ❖ Analysis of the summarized values for a 5-year period of detection of pneumococcal isolates from samples of the nasal mucosa, according to the principle of quarterly assessment, made it possible to reveal that only one indicator of the highest specific gravity was recorded during the quarter, which makes it possible to substantiate the need for a detailed study of unidentified causes, as well as stability of values that varied from 0.8% to 2.4%;
- ❖ A retrospective analysis of a 5-year period (2015-2019) in terms of the frequency of bacteriological isolation of pneumococci made it possible to identify only one 2019 as indicative when monitoring the pediatric population; the resulting 75% (3/4 months) recorded wave-like curves of pneumococcal isolation with a characteristic activation: in the 1st quarter with an increase in excretion by February to 2.2%, in the 2nd quarter the peak value of 3.0% was recorded in May, and in In the 4th quarter, the peak was in November -4.5%, that is, with an increase of 1.6 times;

Contribution of the authors:

Baimuratova M. - scientific Director, the developer of the project, a synthesis of the material;

Tugulbayeva A. - statistical data processing with the creation of diagrams, summing up the results, conclusions;

Abdul Basit Ateel - English translation

Tiesova-Berdalina R. - quantitative calculation, processing of primary material;

Abdusalamova Z. - correction of the primary material with the head (Baimuratova M.);

Jumatova U. - collection and processing of fresh literary sources;

Ryskulova A. - analysis and selection of special retrospective sources;

Kul'zhanova K. - provision of primary material.

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References:

1. *Алексеев Б.* Осторожно: Коварные вирусы // Директор. 2015. №10 (196). С.62-63.

2. *Байжомартов М.С., Семенова В.А., Баймуратова М.А., Стеценко О.Г. и др.* Лабораторная диагностика бактериальных пневмоний. Метод. рекомендации. – Алма-Ата, 1987. 32с.,

3. Баймуратова М.А., Воронина В.Э., Кошжанова Р. Ж., Орынбаева Ж.У. Предварительный патент Республики Казахстан № 19106 «Способ идентификации стрептококков». // Бюллетень РК «Промышленная собственность». 2008. № 2. С. 83.

4. *Баймуратова М.А., Воронина В.Э., Уйхимбаева Р.У.* К вопросу идентификации «оральных» стрептококков // Вестник КНМУ им. С. Асфендиярова. Часть 1. «Вопросы теоретической и профилактической медицины». 2007. С. 18-19.

5. *Баймуратова М.А.* Микробиологическая диагностика и изучение некоторых вопросов морфогенеза неспецифических заболеваний легких. Канд. дисс. Алматы, 1991. – 229с.

6. *Батуро А.П., Романенко Э.Е., Леонова А.Ю., Ярцева А.С., Савеливич Е.Л., Мокроносва М.А.* Доминирование Staphylococcus aureus в микробиоценозе полости носа у детей и взрослых с инфекционным аллергическим ринитом // *Журнал микробиологии, эпидемиологии и иммунобиологии.* 2015. 1:72-74.

7. *Беляев И.А., Беляев А.М.* Анализ экологических показателей микрофлоры носоглотки и их влияние на носительство инвазивных форм Streptococcus pneumonia // Медицина и экология. 2017. 1. С.78-89.

8. *Бутвиловский В.Э. [и др.].* Медицинская биология: учебно-методическое пособие для студентов медицинского факультета иностранных учащихся по специальности «Лечебное дело» – 2-е изд., испр. – Минск: БГМУ, 2019 – 216 с.

9. *Геппе Н.А., Кондюрина Е.Г., Дронов И.А., Малахов А.Б.* Антибактериальная терапия при респираторных инфекциях у детей в амбулаторных условиях: проблемы и пути решения // Русский медицинский журнал. 2014. №14. С. 1060,

10. *Дронов И.А.* Антибактериальная терапия при острых заболеваниях верхних дыхательных путей у детей // Эффективная фармакотерапия, Педиатрия. Спецвыпуск. 2012. С.61-64.,

11. *Есаулов А.С., Митрофанова Н.Н., Мельников В.Л.* Бактериологический метод лабораторной диагностики: учеб. Пособие. − Пенза: Изд-во ПГУ, 2015. – С.73-76.

12. *Заплатников А.Л.,* Гирина А.А., Короид Н.В., Коровина Н.А. и др. Рациональный выбор стартовой антибактериальной терапии инфекций органов дыхания у детей // Клиническая и неотложная педиатрия. 2015. №1. С. 25-29.

13. *Козлов Р.С., Голуб А.В.* Респираторные фторхинолоны в амбулаторной клинической практике. Медицинский совет. 2015. №11. С.18–23;

14. *Коленчукова О.А., Смирнова С.В., Савченко А.А.* Микробиоценоз слизистой оболочки носа и риносинуситы: монография. 2011. 179 с.

15. *Коленчукова О.А.* Функциональная и метаболическая активность клеток иммунной системы в патогенезе аллергического риносинусита. – Докт. диссерт. Новосибирск. 2013. – 37с.

16. *Коленчукова О.А.* Характеристика микробиоценоза слизистой оболочки носа при остром бактериальном риносинусите // Вестник оториноларингологии. 2017. 82(5): 28-31.

17. *Кривопалов А.А., Рязанцев С.В., Шервашидзе С.В., Щербук А.Ю.* Особенности микробиоты ЛОР-органов и этиотропной антибиотикотерапии при воспалительных заболеваниях и осложнениях // РМЖ. Медицинское обозрение. Болезни дыхательных путей. Оториноларингология. 2018. Т.4. №3 (II). С.82-86.

18. *Круглова Д.А.* Материалы всероссийского научного форума студентов с международным участием «Студенческая наука – 2020». Том 3, Спецвыпуск 2020. С.472-473.

19. *Мельников В.Г.* К вопросу о болезнетворности условно-патогенных микроорганизмов // Тихоокеанский медицинский журнал, 2010, № 3. С.15-18

20. *Новосад Е.В., Бевза С.Л., Обольская Н.М., Шамшева О.В., Белименко В.В.* Носительство β-гемолитического стрептококка группы А у детей: проблема дифференциальной диагностики // Детские инфекции. 2018. 17(2):52-57.

21. *Овчинников А.Ю., Панякина М.А.* Положительный опыт комплексного консервативного лечения острого и хронического гайморита в стадии обострения // Эффективная фармакотерапия: пульмонология и оториноларингология. 2010. №2. С. 84-92.

22. *Пальчун В.Т.* Оториноларингология (национальное руководство краткое издание). – Москва. 2014. Издательская группа «ГЭОТАР-Медиа. С.15.

23. *Пискунов Г.З., Пискунов С.З.* Клиническая ринология — 3-е изд., доп. — Москва: ООО «Медицинское информационное агентство», 2017. — 750 с.

24. *Скрябина Л.Ю.* Особенности патологии ЛОР-органов у лиц молодого возраста. Канд. диссерт. Москва. 2013. 290с.

25. *Теплов А.В., Климова И.И., Субботин А.В., Арефьева Е.Г.* Хроническое воспаление и микрофлора ЛОР-органов у больных с рассеянным склерозом //

Бюллетень сибирской медицины, 2009. № 3 (2),. С.43-48

26. *Эпидемиологический надзор и профилактика стрептококковой (группы А) инфекции*. МУ 3.1.1885-04; 04.03.2004.

27. Эпидемиологический анализ: учебное пособие /А.В. Слободенюк, А.А. Косова, Р.Н. Ан. - Екатеринбург: изд. ГБОУ ВПО УГМУ Минздрава России, 2015. – 36 с.

28. *Янов Ю.К., Кривопалов А.А., Щербук Ю.А. и др.* Эпидемиология ото- и риносинусогенных внутричерепных осложнений в Российской Федерации // Российский нейрохирургический журнал им. проф. А.Л. Поленова. 2015. №7. С.31–33

29. *Brook I.* Microbiology of chronic rhinosi-nusitis // Eur. J. Clin. Microbiol. Infect. Dis. 2016. V. 35 (7). P. 1059-1068,

30. Chin V.K., Lee T.Y., Rusliza B. Dissecting Candida albicans Infection from the Perspective of C. albicans Viru-lence and Omics Approaches on Host-Pathogen Interaction: A Review // Int. J. Mol. Sci. 2016. V. 17(10). pii: E1643.

References:

1. Alekseev B. Ostorozhno: Kovarnye virusy. [Caution: Insidious viruses]. *Direktor* [Director]. 2015. №10 (196)] P.2-63 [in Russian]

2. Bajzhomartov M.S. Semenova V.A., Bajmuratova M.A., Stecenko O.G. i dr Laboratornaya diagnostika bakterial'nykh pnevmonii [Laboratory diagnostics of bacterial pneumonia]. *Metod. rekomendatsii* [Methodological recommendations]. Alma-Ata, 1987 P.32. [in Russian]

3. Bajmuratova M.A., Voronina V.Je., Koshzhanova R.Zh., Orynbaeva Zh.U. Predvaritel'nyi patent Respubliki Kazahstan № 19106 «Sposob identifikatsii streptokokkov». [Preliminary patent of the Republic of Kazakhstan No. 19106 "Method of identification of streptococci»]. *Byulleten' RK «Promyshlennaya sobstvennost'»* [Bulletin of the Republic of Kazakhstan "Industrial Property"]. 2008. №2. P. 83. [in Russian]

4. Bajmuratova M.A., Voronina V.Je., Ujhimbaeva R.U. K voprosu identifikatsii «oral'nykh» streptokokkov [On the identification of "oral" streptococci]. *Vestnik KNMU im. S. Asfendiyarova. Chast' 1. «Voprosy teoreticheskoi i profilakticheskoi meditsiny»* [Journal Bulletin of Kaznmu named after S. Asfendiyarov-part1 "Questions of theoretical and preventive medicine"]. 2007. P.18-19. [in Russian]

5. Bajmuratova M.A. *Mikrobiologicheskaya diagnostika i izuchenie nekotorykh voprosov morfogeneza nespecificheskikh zabolevanii legkikh* [Microbiological diagnosis and study of some issues of morphogenesis of non-specific lung diseases]. Kand. diss. [Candidate dissertation]. Almaty, 1991. – P.29. [in Russian]

6. Baturo A.P., Romanenko Je.E., Leonova A.Ju., Jarceva A.S., Savelivich E.L., Mokronosva M.A. Dominirovanie Staphylococcus aureus v mikrobiotsenoze polosti nosa u detei i vzroslykh s infektsionnym allergicheskim rinitom [Dominance of Staphylococcus aureus in the microbiocenosis of the nasal cavity in children and adults with infectious allergic rhinitis]. *Mikrobiologii, epidemiologii i immunobiologii* [Microbiology, Epidemiology, and Immunobiology]. 2015;1. P.72-74. [in Russian]

7. Beljaev I.A., Beljaev A.M. Analiz ekologicheskikh pokazatelei mikroflory nosoglotki i ikh vliyanie na nositel'stvo invazivnykh form Streptococcus pneumoniae [Analysis of environmental indicators of the nasopharyngeal microflora and their impact on the carrier of invasive forms of Streptococcus pneumoniae]. *Meditsina i Ekologiya* [Medicine and Ecology]. 2017;1. P.78-89. [in Russian]

8. Butvilovskij V.Je. [i dr.*]. Meditsinskaya biologiya* [Medical biology]. Uchebno-metodicheskoe posobie dlya studentov medicinskogo fakul'teta inostrannykh uchashhihsya po spetsial'nosti «Lechebnoe delo» – 2-e izd., ispr. – Minsk : BGMU, 2019. P.216. [in Russian]

9. Geppe N.A., Kondjurina E.G., Dronov I.A., Malahov A.B. Antibakterial'naya terapiya pri respiratornykh infekciyakh u detei v ambulatornykh usloviyakh: problemy i puti resheniya [Antibacterial therapy for respiratory infections in children on an outpatient basis: problems and solutions]. *Russkii meditsinskii zhurnal* [Russian Medical Journal]. 2014. №14. P.1060. [in Russian]

10. Dronov I.A. Antibakterial'naya terapiya pri ostrykh zabolevaniyakh verkhnikh dyhatel'nykh putei u detei [Antibacterial therapy for acute diseases of the upper respiratory tract in children]. *Eeffektivnaya farmakoterapiya, Pediatriya. Spets.vypusk* [Effective pharmacotherapy, Pediatrics. Special Issue]. 2012. P.61-64. [in Russian]

11. Esaulov A.S., Mitrofanova N.N., Mel'nikov V.L. *Bakteriologicheskii metod laboratornoi diagnostiki: ucheb. Posobie* [Bacteriological method of laboratory diagnostics: textbook]. Penza: Izd-vo PGU, 2015. P.73-76. [in Russian]

12. Zaplatnikov A.L., Girina A.A., Koroid N.V., Korovina N.A., i dr. Ratsional'nyi vybor startovoi antibakterial'noi terapii infektsii organov dykhaniya u detei» [Rational choice of starting antibacterial therapy for respiratory infections in children»]. *Klinicheskaya i neotlozhnaya pediatriya* [Journal of Clinical and emergency pediatrics] 2015. №1. P.25-29. [in Russian]

13. Kozlov R.S., Golub A.V. Respiratornye ftorkhinolony v ambulatornoi klinicheskoi praktike [Respiratory fluoroquinolones in outpatient clinical practice]. *Meditsinskii sovet* [Medical Council] 2015. №11. P.18–23. [in Russian]

14. Kolenchukova O.A., Smirnova S.V., Savchenko A.A. *Mikrobiotsenoz slizistoi obolochki nosa i rinosinusity: monografiya* [Microbiocenosis of the nasal mucosa and rhinosinusitis: monograph]. 2011. P.179. [in Russian]

15. Kolenchukova O.A. *Funktsional'naya i metabolicheskaya aktivnost' kletok immunnoi sistemy v patogeneze allergicheskogo rinosinusita. Dokt. Dissert.* [Functional and metabolic activity of immune system cells in the pathogenesis of allergic rhinosinusitis. Doct. Dissert.] Novosibirsk. 2013. P.37. [in Russian]

16. Kolenchukova O.A. – Kharakteristika mikrobiotsenoza slizistoi obolochki nosa pri ostrom bakterial'nom rinosinusite [Characteristics of the microbiocenosis of the nasal mucosa in acute bacterial rhinosinusitis]. *Vestnik otorinolaringologii* [Bulletin of Otorhinolaryngology] 2017; 82(5). P28-31. [in Russian]

17. KrivopalovA.A., Rjazancev S.V., Shervashidze S.V., Shherbuk A.Ju. Osobennosti mikrobioty LOR-organov i etiotropnoi antibiotikoterapii pri vospalitel'nykh zabolevaniyakh i oslozhneniyakh [Features of the microbiota of ENT organs and etiotropic antibiotic therapy in

inflammatory diseases and complications.]. *RMZh. Meditsinskoe obozrenie. Bolezni dykhatel'nykh putei*. Otorinolaringologiya [Russian Medical Journal. Medical review. Diseases of the respiratory tract. Otorhinolaryngology] 2018. T.4. №3 (II). P.82-86. [in Russian]

18. Kruglova D.A. *Materialy vserossiiskogo nauchnogo foruma studentov s mezhdunarodnym uchastiem «Studencheskaya nauka – 2020»* [Materials of the All-Russian scientific forum of students with international participation " Student Science-2020»] – tom 3 Specvypusk 2020. P.472-473. [in Russian]

19. Mel'nikov V.G. – K voprosu o boleznetvornosti uslovno-patogennykh mikroorganizmov [On the question of the pathogenicity of conditionally pathogenic microorganisms]. *Tikhookeanskii meditsinskii zhurnal* [Pacific Medical Journal], 2010, № 3. P.15-18. [in Russian]

20. Novosad E.V., Bevza S.L., Obol'skaja N.M., Shamsheva O.V., Belimenko V.V. Nositel'stvo β-gemoliticheskogo streptokokka gruppy A u detei: problema differentsial'noi diagnostiki [Carriage of group A beta-hemolytic streptococcus in children: the problem of differential diagnosis.]. *Detskie infektsii* [Journal of Children's Infections] 2018; 17(2). P.52-57. [in Russian]

21. Ovchinnikov A.Ju., Panjakina M.A. Polozhitel'nyj opyt kompleksnogo konservativnogo lecheniya ostrogo i khronicheskogo gaimorita v stadii obostreniya [Positive experience of complex conservative treatment of acute and chronic sinusitis in the acute stage]. *Effektivnaya farmakoterapiya: pul'monologiya i otorinolaringologiya* [Effective pharmacotherapy: pulmonology and otorhinolaryngology]. 2010. №2. P.84-92. [in Russian]

22. Pal'chun V.T. *Otorinolaringologiya* [Otorhinolaryngology] (natsional'noe rukovodstvo kratkoe izdanie [national guide short edition] Moskva. 2014. Izdatel'skaya gruppa «GJeOTAR-Media. P.15. [in Russian]

23. Piskunov G.Z., Piskunov S.Z. *Klinicheskaya rinologiya.* 3-e izd., dop. [Clinical Rhinology— textbook, 3rd ed., supplement] Moskva: OOO «Meditsinskoe informatsionnoe agentstvo», 2017. P.750. [in Russian]

24. Skrjabina L.Ju. *Osobennosti patologii LOR-organov u lits molodogo vozrasta* [Features of pathology of ENT organs in young people] Kand.dissertat. [Cand. Dissert.] Moskva. 2013. P.290. [in Russian]

25. Teplov A.V., Klimova I.I., Subbotin A.V., Aref'eva E.G. Khronicheskoe vospalenie i mikroflora LOR-organov u bol'nykh s rasseyannym sklerozom [Chronic inflammation and microflora of ENT organs in patients with multiple sclerosis]. *Byulleten' sibirskoi meditsiny* [Journal Bulletin of Siberian Medicine], № 3 (2), 2009. P.43- 48. [in Russian]

26. Epidemiologicheskii nadzor i profilaktika streptokokkovoi (gruppy A) infektsii [Epidemiological surveillance and prevention of streptococcal (group A) infection.]. *Methodological guidelines.* 3.1.1885-04; 04.03.2004. [in Russian]

27. Epidemiologicheskii analiz: uchebnoe posobie [Epidemiological analysis: a textbook] A.V. Slobodenjuk, A.A. Kosova, R.N. An. - Ekaterinburg: izd. GBOU VPO UGMU Minzdrava Rossii, 2015. P.36. [in Russian]

28. Janov Ju.K., Krivopalov A.A., Shherbuk Ju.A. i dr. Epidemiologija oto- i rinosinusogennyh vnutricherepnyh oslozhnenij v Rossijskoj Federacii [Epidemiology of otorhinosinusogenic intracranial complications in the Russian Federation]. *Rossiiskii neirokhirurgicheskii zhurnal im. prof. A.L. Polenova* [Russian Neurosurgical Journal named after prof. A. L. Polenov]. 2015. №7. P.31–33. [in Russian]

29. Brook I. Microbiology of chronic rhinosi-nusitis. *Eur. J. Clin. Microbiol. Infect. Dis.* 2016. V. 35 (7). P. 1059-1068.

30. Chin V.K., Lee T.Y., Rusliza B. Dissecting Candida albicans Infection from the Perspective of C. albicans Virulence and Omics Approaches on Host-Pathogen Interaction: A Review. *Int. J. Mol. Sci.* 2016. V. 17(10). pii: E1643.

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