Received: 07 December 2024 / Accepted: 15 February 2025 / Published online: 28 February 2025

DOI 10.34689/SH.2025.27.1.011

UDC 616.98:371:378-057.875

ANALYSIS OF THE MICROFLORA ON DATES OF THE BACTERIOLOGICAL LABORATORY

Saule B. Maukayeva[1], https://orcid.org/0000-0002-2679-6399

Nazym K. Kudaibergenova[1], https://orcid.org/0000-0002-6165-7677

Assemgul K. Merimgaliyeva[2], https://orcid.org/0009-0005-7767-1093

Aliya M. Agybayeva[2], https://orcid.org/0009-0004-2962-069X

Gauhar T. Abzalkhanova[2], https://orcid.org/0009-0009-4513-5869

Ainash S. Orazalina[1], http://orcid.org/0000-0003-4594-0138

Oxana A. Yurkovskaya[1], https://orcid.org/0000-0002-6251-5574

Maiya V. Goremykina[1], https://orcid.org/0000-0002-5433-7771

Kamila A. Zeinolla[1], https://orcid.org/0009-0008-3958-7896

Almira K. Akhmetova[1], https://orcid.org/0000-0002-8938-3401

[1] NCJSC «Semey Medical University», Semey, Republic of Kazakhstan;.

[2] «Regional Center of Phthisiopulmonology and Infectious Diseases» of the Abai Regional Health Department, Semey, Republic of Kazakhstan.

Abstract

Introduction. Bacteriological laboratories play a key role in the diagnosis of infectious diseases, the study of pathogenic microorganisms, and the development of prevention methods. Close collaboration between clinical microbiologists and attending physicians is necessary to optimize microbiological research. This article discusses the main areas of work of the bacteriological laboratory, diagnostic methods, and the role of laboratories in the fight against infectious diseases.

The purpose of the study. To analyze the structure and properties of pathogens isolated from the patients' material and the choice of drugs for initial empirical antimicrobial therapy.

Research materials and methods. A retrospective continuous copying of research results from the journals of the bacteriological laboratory of the Center for Phthisiopulmonology and Infectious Diseases in Semey for 2024. Identification of pathogens obtained from various patient materials was carried out in accordance with the regulatory documents governing the work of bacteriological laboratories. Sensitivity to antimicrobial drugs was determined by the disco diffusion method. Statistical processing was carried out in the Excel program.

The results of the study. In total, 37790 analyzes from 31689 individuals were performed in the bacteriological laboratory of Semey in 2024. The main areas of the laboratory's work were the isolation of salmonella, shigella, opportunistic pathogenic flora, pathogenic staphylococcus, feces for dysbiosis, pathogens of droplet infections (meningococcal infection, diphtheria, pertussis), blood tests, biomaterial studies for pathogenic flora, serological studies. In intestinal infections, pathogenic flora, conditionally pathogenic flora, pathogenic staphylococcus, and stool examination for dysbiosis were determined. Of airborne infections, studies were conducted on meningococcal infection, whooping cough and diphtheria. Blood tests for hemoculture and striality were carried out in the laboratory. The laboratory also conducted studies of various biomaterials for pathogenic flora: eyes, ENT organs, wounds, breast milk, genitals, urine, sputum, cadaverous material. The analysis of the microbial landscape revealed that bacteria from the genera of Streptococcus, Staphylococcus, Candida, Escherichia coli, etc. were most often isolated. The bacteriological laboratory performs serological studies.

Conclusions. The work of specialists in microbiological laboratories plays a crucial role in the effective prevention and control of infections, since the identification of the pathogen allows doctors to prescribe treatment in a timely and effective manner and thereby prevent the spread of infections.

Keywords: *bacteriological laboratory, pathogens, infectious diseases.*

For citation: Maukayeva S.B., Kudaibergenova N.K., Merimgaliyeva A.K., Agybayeva A.M., Abzalkhanova G.T., Orazalina A.S., Yurkovskaya O.A., Goremykina M.V., Zeinolla K.A., Akhmetova A.K. Analysis of the microflora on dates of the bacteriological laboratory // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2025. Vol.27 (1), pp. 89-99. *doi 10.34689/SH.2025.27.1.011*

Резюме

АНАЛИЗ МИКРОФЛОРЫ ПО ДАННЫМ БАКТЕРИОЛОГИЧЕСКОЙ ЛАБОРАТОРИИ

Сауле Б. Маукаева[1], https://orcid.org/0000-0002-2679-6399

Назым К. Кудайбергенова[1], https://orcid.org/0000-0002-6165-7677

Асемгуль К. Меримгалиева[2], https://orcid.org/0009-0005-7767-1093

Алия М. Агыбаева[2], https://orcid.org/0009-0004-2962-069X
Гаухар Т. Абзалханова[2], https://orcid.org/0009-0009-4513-5869
Айнаш С. Оразалина[1], http://orcid.org/0000-0003-4594-0138
Оксана А. Юрковская[1], https://orcid.org/0000-0002-6251-5574
Майя В. Горемыкина[1], https://orcid.org/0000-0002-5433-7771
Камила А. Зейнолла[1], https://orcid.org/0009-0008-3958-7896
Альмира К. Ахметова[1], https://orcid.org/0000-0002-8938-3401

[1] НАО «Медицинский университет Семей», г. Семей, Республика Казахстан;
[2] «Областной центр фтизиопульмонологии и инфекционных заболеваний» Управления здравоохранения области Абай, г. Семей, Республика Казахстан.

Введение. Бактериологические лаборатории играют ключевую роль в диагностике инфекционных заболеваний, исследовании патогенных микроорганизмов и разработке методов профилактики. Для оптимизации микробиологических исследований необходимо тесное взаимодействие между клиническими микробиологами и лечащими врачами. В этой статье рассматриваются основные направления работы бактериологической лаборатории, методы диагностики и роль лабораторий в борьбе с инфекционными болезнями.

Цель исследования. Провести анализ структуры и свойств возбудителей, выделяемых из материала больных и выбор препаратов для стартовой эмпирической антимикробной терапии.

Материал и методы исследования. Проведена ретроспективная сплошная выкопировка результатов исследований из журналов бактериологической лаборатории Центра фтизиопульмонологии и инфекционных болезней г. Семей за 2024 год. Идентификацию возбудителей, полученных из различного материала больных, проводили согласно нормативным документам, регламентирующим работу бактериологических лабораторий. Определение чувствительности к антимикробным препаратам осуществлялось диско-диффузионным методом. Статистическая обработка проводилась в программе Excel.

Результаты исследования. Всего за 2024 год по бактериологической лаборатории г. Семей было выполнено 37790 анализов от 31689 лиц. Основными направлениями работы лаборатории были выделение сальмонеллы, шигеллы, условно-патогенной флоры, патогенного стафилококка, кал на дисбактериоз, возбудителей капельных инфекций (менингококковая инфекция, дифтерия, коклюш), исследования крови, исследования биоматериала на патогенную флору, серологические исследования. При кишечных инфекциях определяли патогенную флору, условно патогенную флору, патогенный стафилококк и исследование кала на дисбактериоз. Из воздушно-капельных инфекций исследования проводили на менингококковую инфекцию, коклюш и дифтерию. В лаборатории были проведены исследования крови на гемокультуру и стерильность. Также в лаборатории провели исследования различного биоматериала на патогенную флору: глаза, ЛОР органы, раны, грудное молоко, половые органы, моча, мокрота, трупный материал. При анализе микробного пейзажа выявлено, что чаще всего выделяли бактерии из семейства Streptococcus, Staphylococcus, Candida, Escherichia coli и др. Бактериологическая лаборатория также выполняет серологические исследования.

Выводы. Работа специалистов в микробиологических лабораториях играет решающую роль в эффективной профилактике инфекций и борьбе с ними, так как определение возбудителя позволяет врачам своевременно и эффективно назначить лечение и тем самым предовратить распространение инфекций.

Ключевые слова: *бактериологическая лаборатория, возбудители, инфекционные болезни.*

Для цитирования: *Маукаева С.Б., Кудайбергенова Н.К., Меримгалиева А.К., Агыбаева А.М., Абзалханова Г.Т., Оразалина А.С., Юрковская О.А., Горемыкина М.В., Зейнолла К.А., Ахметова А.К.* Анализ микрофлоры по данным бактериологической лаборатории // Наука и Здравоохранение. 2025. Vol.27 (1), С. 89-99. *doi 10.34689/SH.2025.27.1.011*

Түйіндеме

БАКТЕРИОЛОГИЯЛЫҚ ЗЕРТХАНАНЫҢ МӘЛІМЕТТЕРІ БОЙЫНША МИКРОФЛОРАНЫ ТАЛДАУ

Сауле Б. Маукаева[1], https://orcid.org/0000-0002-2679-6399
Назым К. Кудайбергенова[1], https://orcid.org/0000-0002-6165-7677
Асемгуль К. Меримгалиева[2], https://orcid.org/0009-0005-7767-1093
Алия М. Агыбаева[2], https://orcid.org/0009-0004-2962-069X
Гаухар Т. Абзалханова[2], https://orcid.org/0009-0009-4513-5869
Айнаш С. Оразалина[1], http://orcid.org/0000-0003-4594-0138
Оксана А. Юрковская[1], https://orcid.org/0000-0002-6251-5574
Майя В. Горемыкина[1], https://orcid.org/0000-0002-5433-7771
Камила А. Зейнолла[1], https://orcid.org/0009-0008-3958-7896
Альмира К. Ахметова[1], https://orcid.org/0000-0002-8938-3401

[1] «Семей медицина университеті» КеАҚ, Семей қ., Қазақстан Республикасы;
[2] Абай облысы денсаулық сақтау басқармасының «Облыстық фтизиопульмонология және жұқпалы аурулар орталығы», Семей қ., Қазақстан Республикасы

Кіріспе. Бактериологиялық зертханалар жұқпалы ауруларды диагностикалауда, патогендік микроорганизмдерды зерттеуде және алдын алу әдістерін әзірлеуде шешуші рөл атқарады. Микробиологиялық зерттеулерді оңтайландыру үшін клиникалық микробиологтар мен емдеуші дәрігерлер арасында тығыз өзара әрекеттесу қажет. Бұл мақалада бактериологиялық зертхана жұмысының негізгі бағыттары, диагностика әдістері және жұқпалы аурулармен күресудегі зертханалардың рөлі қарастырылады.

Зерттеудің мақсаты. Науқастардың материалынан бөлінетін қоздырғыштардың құрылымы мен қасиеттеріне талдау жүргізу және таңдау бастапқы эмпирикалық микробқа қарсы терапияға арналған препараттар.

Зерттеу материалы мен әдістері. 2024 жылы Семей қ. фтизиопульмонология және жұқпалы аурулар Орталығының бактериологиялық зертханасының журналдарынан зерттеу нәтижелерін ретроспективті үздіксіз көшірме жасалды. Науқастарының әртүрлі материалдарынан алынған қоздырғыштарды сәйкестендіру бактериологиялық зертханалардың жұмысын реттейтін нормативтік құжаттарға сәйкес жүргізілді. Микробқа қарсы препараттарға сезімталдықты анықтау диско-диффузия әдісімен жүзеге асырылды. Статистикалық өңдеу Excel бағдарламасында жүргізілді**.**

Зерттеу нәтижелері. 2024 жылы Семей қаласының бактериологиялық зертханасында 31689 адамнан 37790 талдау жасалды. Зертхана жұмысының негізгі бағыттары – сальмонелла, шигелла, шартты-патогенді флора, патогенді стафилококк бөлінуі, дисбактериозға нәжіс, тамшы инфекцияларының қоздырғыштары (менингококк инфекциясы, дифтерия, көкжөтел), қан анализі, патогендік флораға биоматериалды зерттеу, серологиялық зерттеу. Ішек инфекцияларында патогендік флора, шартты патогендік флора, патогендік стафилококк және дисбактериозға нәжісті зерттеу анықталды. Ауа-тамшы инфекцияларына зерттеулер менингококк инфекциясына, көкжөтелге және дифтерияға жүргізілді. Зертханада гемокультура мен стерильділікке қан анализі жүргізілді. Сондай-ақ, зертханада патогендік флораға арналған әртүрлі биоматериалдарға зерттеулер жүргізілді: көз, ЛОР мүшелері, жаралар, емшек сүті, жыныс мүшелері, зәр, қақырық, мәйіт материалы. Микробтық пейзажды талдау кезінде Streptococcus, Staphylococcus, Candida, Escherichia coli және т.б. тұқымдасынан бактериялар жиі бөлінді. Бактериологиялық зертханада сонымен қатар серологиялық зерттеулер жүргізеді.

Қорытындылар. Микробиологиялық зертханалардағы мамандардың жұмысы инфекциялардың тиімді алдын алуда және олармен күресуде шешуші рөл атқарады, өйткені қоздырғышты анықтау дәрігерлерге емдеуді уақтылы және тиімді тағайындауға және осылайша инфекциялардың таралуын болдырмауға мүмкіндік береді.

Түйінді сөздер: *бактериологиялық зертхана, қоздырғыштар, жұқпалы аурулар.*

Дәйексөз үшін: *Маукаева С.Б., Кудайбергенова Н.К., Меримгалиева А.К., Агыбаева А.М., Абзалханова Г.Т., Оразалина А.С., Юрковская О.А., Горемыкина М.В., Зейнолла К.А., Ахметова А.К.* Бактериологиялық зертхананың мәліметтері бойынша микрофлораны талдау // Ғылым және Денсаулық сақтау. 2025. Vol.27 (1), Б. 89-99. *doi 10.34689/SH.2025.27.1.011*

Introduction

Bacteriological laboratories are an integral part of the healthcare system and scientific research. They play a key role in the diagnosis of infectious diseases, the study of pathogenic microorganisms, and the development of prevention methods [1,3,4,6,14].

A bacteriological laboratory is a type of microbiological laboratory in which bacteriological research is carried out. Bacteriological laboratories can be scientific, industrial, medical, veterinary, etc. Medical bacteriological laboratories as independent structural units are organized at sanitary and epidemiological stations (SES) (sanitary and bacteriological laboratories), in infectious diseases hospitals, general type hospitals, some specialized hospitals (for example, in tuberculosis, rheumatology, skin and venereology) and in polyclinics (clinical bacteriological laboratories). Bacteriological laboratories at the SES examine environmental objects for general bacterial contamination, as well as infection with conditionally pathogenic and pathogenic microflora: air, water, soil, food; they examine organized groups and individuals for carriers of pathogenic bacteria of the intestinal group, corynebacteria diphtheria, whooping cough, paracoccus, meningococcus.

The work of the microbiological laboratory in conjunction with other departments of the SES has a specific task - improving the environment and reducing the incidence of diseases in the population. Bacteriological laboratories at medical and preventive institutions perform the tests necessary to establish and clarify the diagnosis of an infectious disease, contributing to the correct choice of specific treatment and determining the time of discharge of the patient from the infectious diseases hospital. The subject of research in bacteriological laboratories are: secretions from the human body: urine, feces, sputum, pus, as well as blood, cerebrospinal fluid and cadaveric material; environmental objects: water, air, soil, food, flushing from inventory items, hands, etc. [2,13,16].

The bacteriological laboratory conducts research on isolation, identification, and determination of antibiotic sensitivity of pathogenic and conditionally pathogenic microorganisms isolated from various biomaterials. The most common resistant bacteria are Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus and Streptococcus pneumoniae, followed by Salmonella spp. The only way out today is the rational use of antibiotics already available in our arsenal, which will not only keep the growth of resistance of microorganisms to them, but also increase the effectiveness of the treatment of infectious diseases [8,18].

To optimize microbiological research, it is necessary close interaction between clinical microbiologists and attending physicians

This article discusses the main areas of work of the bacteriological laboratory, diagnostic methods, and the role of laboratories in the fight against infectious diseases.

Aim. To analyze the structure and properties of pathogens isolated from the patients' material and the choice of drugs for initial empirical antimicrobial therapy.

Research materials and methods. A retrospective continuous copying of research results from the journals of the bacteriological laboratory of the Center for Phthisiopulmonology and Infectious Diseases in Semey for 2024 was carried out to identify pathogens obtained from various patient materials (feces, wound discharge, pharynx and nose, sputum, urine, vagina, etc.) in Semey. The study used an AutoMic-i600 microbiological analyzer.The management of this clinic is familiar with the progress of the research. There are no objections to the further publication of the research results in the open press. The identification of bacteria was carried out in accordance with the regulatory documents governing the work of bacteriological laboratories. Sensitivity to antimicrobial drugs was determined by the disco diffusion method. Descriptive statistics were used for the analysis in this article. Statistical processing was carried out in the Excel program.

The research topic was approved at the meeting of the Ethics Committee of the NCJSC «Semey Medical University» (Protocol No. 3 dated 02/25/2024).

Informed consent of patients to participate in the study is not required, since data obtained as part of regular laboratory diagnostics were used.

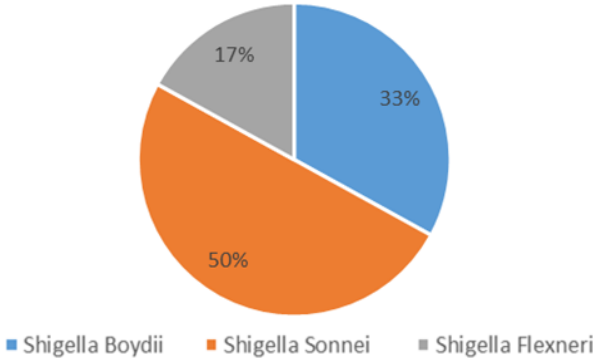
Research results

In total, 37790 analyzes from 31689 individuals were performed in the bacteriological laboratory of Semey in 2024. The main areas of the laboratory's work were the isolation of salmonella, shigella, opportunistic pathogenic flora, pathogenic staphylococcus, feces for dysbiosis, pathogens of droplet infections (meningococcal infection, diphtheria, pertussis), blood tests, biomaterial studies for pathogenic flora, serological studies. The sensitivity of microbes to antibiotics is also being determined in the laboratory.

In intestinal infections, pathogenic flora, conditionally pathogenic flora, pathogenic staphylococcus, and stool examination for dysbiosis were determined. 18,012 analyses (48%) on pathogenic flora were performed.

4,310 (11%) Salmonella tests were performed on These dates 3,937 individuals, of which 70 (1.6%) from 47 patients were positive. Salmonella enteritidis was detected in all patients from the landscape of isolated cultures. This culture is usually detected in feces [11,17].

13,702 (36%) analyses from 12,976 individuals were conducted for Shigella, of which 12 (0.09%) from 10 patients were positive. In the landscape of the isolated cultures, Shigella Boydii was isolated – 4 (33%) from 3 individuals, Shigella Sonnei - 6 analyzes (50%) from 5 individuals, Shigella Flexneri 2A – 2 analyzes (17%) from two individuals (Figure 1).



As can be seen from Figure 1, Shigella Sonnei prevails, followed by Shigella Boydii and Shigella Flexneri 2A closes. This distribution is usually seen in patients with dysentery [5].

2,148 (6%) tests were performed on conditionally pathogenic microflora (CPF) from 296 individuals, of which pathogens were isolated from feces in 1,691 (79%) analyses from 193 individuals, and 457 (21%) from 103 patients from gastric lavage. 140 analyses were confirmed, of which Proteus Vulgaris – 5 (4%), Proteus Mirabilis – 5 (4%), Enterobakter – 9 (6%), Citrobakter – 10 (7%), Staphylococcus Aureus – 33 (24%), Klebsiella – 76 (54%), Pseudomonas Aerugynosae – 2 (1%) (Figure 2).

As can be seen from Figure 2, more than half were Klebsiella, one third were Staphylococcus Aureus, and to a lesser extent the remaining pathogens. The same picture is observed in other study [12].

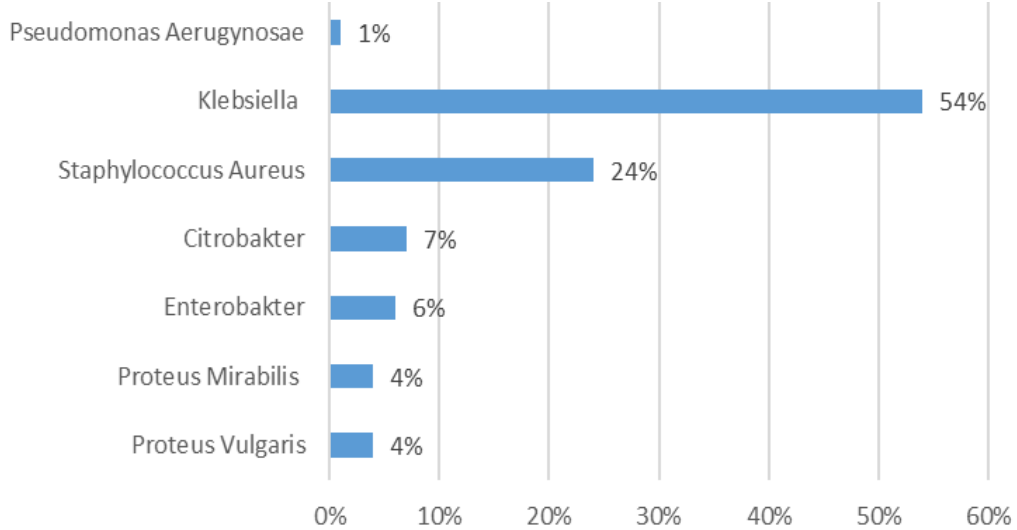


Figure 2. Microbial landscape of CPF.

3 stool tests from 2 individuals for pathogenic staphylococcus were performed, of which 2 tests from 2 individuals came out positive.

244 tests were performed on dysbiosis from 243 individuals, dysbiosis was detected in 208 cases from 203 individuals [2].

Of airborne infections, studies were conducted on meningococcal infection, whooping cough and diphtheria. A total of 5,309 (14%) were conducted analyses from 2,769 individuals. 513 (10%) tests from 391 people were conducted for meningococcal infection, 428 (8%) tests from 194 people for whooping cough, and 4,368 (82%) tests from 2,184 people for diphtheria. All the tests were negative.

The laboratory conducted 443 (1%) blood tests from 443 people, including 141 blood culture tests and 303 sterility tests [7]. 4 sterility tests were positive: Stapyilococcus epidermidis, Klebsiella pneumonia, Stapyilococcus hominis, Abiotrophia defective.

The laboratory also conducted studies of various biomaterials for pathogenic flora: eyes, ENT organs, wounds, breast milk, genitals, urine, sputum, cadaveric material (Table 1).

Table 1. **Landscape of isolated cultures from biomaterial.**

	Eyes	ENT	Wounds	Breast milk	Genitals	Urine	Sputum	Cadaveric material	Total
1	2	3	4	5	6	7	8	9	10
Number of tests	585/295	2024/1946	165/156	11/6	587/587	1596/1596	6277/6277	162/30	11407/10893
Number of positive tests	153/91	1358/1233	54/50	3/2	281/261	375/374	5307/4592	105/17	7647/6629
Staphylococcus aureus	37/22	322/296	6/3	3/2	15/15	4/4	346/247	13/1	476/591
Staphylococcus epidermidis	90/51	4/4	3/3		23/23				120/81
Staphylococcus gallinarum							1/1		1/1
Staphylococcus haemolyticus	4/2				2/2	1/1			7/5
Staphylococcus lugdunensis	2/1								2/1
Staphylococcus hominis	2/1								2/1
Staphylococcus sciuri					1/1				1/1
Staphylococcus lentus		2/2							2/2
Staphylococcus simulans							2/2		2/2
Streptococcus pneumoniae		37/37					1293/1286		1330/1323
Staphylococcus haemolyticus		119/118	2/2		6/6	3/3	847/845	2/2	973/975
Streptococcus pyogenes	4/2	297/291	4/4		14/14	1/1	909/907	8/2	1237/1221
Streptococcus sanguinis		68/67	1/1		1/1		241/236		311/305
Streptococcus suis		4/4			1/1		14/14		19/19
Streptococcus mitis		7/7	1/0				65/65		73/72
Streptococcus uberis	1/1	107/107	1/1		8/8	3/3	347/344		467/467
Streptococcus mutans		15/14					29/27		44/41
Streptococcus thoraltentis		8/8					14/14		22/22
Streptococcus anginosus						1/1	3/3		4/4
Streptococcus gordonii							2/2		2/2
Streptococcus hyantestinalis		14/13					41/38		55/51

Continuation of the Table 1

1	2	3	4	5	6	7	8	9	10
Streptococcus salivarus		1/1					16/16		17/17
Streptococcus ovalis		1/1					16/16		17/17
Streptococcus parasanguines							1/1		1/1
Streptococcus hominis	3/2								3/2
Streptococcus caprae	1/1				1/1				2/2
Streptococcus pluranimalibm						1/1			1/1
Streptococcus disgalactia							1/1		1/1
Streptococcus vestibularis							1/1		1/1
Streptococcus perosus							1/1		1/1
Streptococcus galatyticus							1/1		1/1
Streptococcus intermedius		1/1							1/1
Enterococcus faecalis	4/4		2/2		29/28	11/11			46/45
Enterococcus faecium			2/1		2/2	6/6			10/9
Enterococcus cassielilarum					1/1				1/1
Enterococcus galinarum	2/1								2/1
Escherichia coli	2/2		22/22		84/84	198/198		9/1	315/307
Escherichia hermannii			2/2		2/2	8/2			12/12
Enterobakter					2/2	4/4			6/6
Enterobacter cloacae			2/2		5/5	7/7	1/1		15/15
Enterobakter aminigensis		1/1				2/2			3/3
Enterobakter Brevis						1/1			1/1
Citrobakter						1/1			1/1
Citrobacter broakii			1/1			2/2			3/3
Citrobakter freuindii					1/1				1/1
Citrobakter malonaticus						1/1			1/1
Klebsiella		1/1				1/1			2/2
Klebsiella pneumoniae		45/43	5/5		9/9	45/44	65/56	37/8	206/165
Klebsiella oxitocae		1/1					1/1		2/2
Klebsiella aerogenes		6/6	1/1		5/5	3/3	4/2	4/1	23/18
Pseudomonas aeruginosa		5/5	3/3		1/1	17/17	54/47	1/0	81/73

Continuation of the Table 1

1	2	3	4	5	6	7	8	9	10
Pseudomonas luteola							1/1		1/1
Pseudomonas putida						1/1			1/1
Pseudomonas mendocina							1/1		1/1
Proteus vulgaris						7/7		5/1	12/8
Proteus mirabilis	1/1		1/1		4/4	17/17	2/2		25/25
Proteus penneri						1/1			1/1
Proteus morganii						1/1			1/1
Salmonella enteritidis			1/1						1/1
Shigella Sonnei						1/1			1/1
Prevotella intermedia		1/1	1/1		1/1	2/2			5/5
Candida		117/79			25/17		390/133	4/0	536/229
Candida albicans		99/66	1/0		14/9		313/115	7/0	434/190
Candida lusitaniae		4/3					10/2		14/5
Candida krusei		17/13			8/2		68/30		93/45
Candida thopicalis		3/3					13/4		16/7
Candida dublinensis		25/18					47/11	7/1	79/30
Candida guilermondii		1/1					6/2		7/3
Candida parapsilosus		5/4					11/8		16/12
Candida glabrata		2/2			3/3		14/8		19/13
Candida kefur		3/0					4/1		7/1
Candida auris		3/3					12/6		15/9
Candida pseudothopicalis							4/3		4/3
Candida norvegensis							1/0		1/0
Candida pelliculosa							1/0		1/0
Плесень							2/0	4/0	6/0
Abiothofiae detectiva		10/10					74/74		84/84
Actinomycis naeslundii		2/2					5/5		7/7
Actinomycis lucrii							2/2		2/2
Acinetobacter colcaoceticus			1/1		9/9	10/10	1/0	4/1	25/21
Acinetobacter Baumanii			1/1		1/1	6/6	2/2		10/10
Burkholderia ceracia					2/2	3/3	1/1		6/6
Hellicoccus kunsii							3/3		3/3
Lecteria adecurbroxylata						1/1	1/1		2/2

Continuation of the Table 1

Cronobacter malonaticus					1/1	1/1			2/2
Stenotrophomonas maltophini						2/2			2/2
Serratia plymutica							1/1		1/1
Gemella sanguinis							1/1		1/1
Providencia rettgerii						1/1			1/1

As can be seen from Table 1, a total of 11,407 (30%) of 10,893 individuals were executed. 7,647 (67%) tests from 6,629 individuals turned out to be positive. The analysis of microflora, depending on the material, showed the following picture. The number of eye tests was 585, positive – 153 (26%), the flora was mainly represented by Staphylococcus epidermidis and Staphylococcus aureus. The number of tests with ENT organs was 2,024, positive – 1,358 (67%). The most common were Staphylococcus aureus, Streptococcus pyogenes, Staphylococcus haemolyticus, Streptococcus uberis, and Candida. These dates are confirmed by study of other authors [15]. There were 165 tests from wound, 54 of them were positive (33%). Escherichia coli appeared among the pathogens [9,10]. Breast milk was studied from 11 people, positive 3 (27%) assays (Staphylococcus aureus). Genital seeding was 587 people, which is 281 (48%) - a positive result. The microbes Candida and Escherichia coli evolved. The urine of 1,596 individuals was studied, with 375 (23%) positive tests. Escherichia coli dominated the analyses. Sputum culture was performed by 6,277 people, and a positive result was obtained in 5,307 (85%) cases. Among the microbes were Streptococcus pneumoniae, Streptococcus pyogenes, Staphylococcus haemolyticus, Streptococcus uberis and Staphylococcus aureus. 162 tests of sheets of cadaveric material were studied, and positive result was in 105 (65%). Klebsiella pneumoniae prevailed.

The analysis of the microbial landscape revealed Streptococcus pneumoniae (1330), Streptococcus pyogenes (1237), Staphylococcus haemolyticus (973), Candida (536), Staphylococcus aureus (476), Streptococcus uberis (467), Candida albicans (434), Escherichia coli (315) and others.

The bacteriological laboratory performs serological studies (passive hemagglutination reaction (PHAR), agglutination reaction (AR)). A total of 205 (0.5%) tests were conducted from 129 individuals, including PHAR with Salmonella diagnosticum (101), PHAR with Vi antigen (2), PHAR with Shigella diagnosticum (52), PHAR with Tularemia antigen (2), AR with pertussis/paracoccussis (48) antigen from 24 individuals. No positive titers were found.

The sensitivity of various pathogens to antibiotics was determined in the laboratory. The sensitivity of Streptococcus pneumoniae to antibiotics Gentamycin, Vancomycin, Linezolid, Penicillin, Moxifloxacin, Ceftoroline, Erythromycin, Clindamycin, Daptomycin was determined. Resistance of the pathogen was observed to Ampicillin, Tetracycline, Ciprofloxacin, Trimethoprim, Rifampin. Sensitivity and resistance to antibiotics were determined in Staphylococcus aureus. The pathogen was sensitive to the following antibiotics: Gentamycin, Ciprofloxacin, Nitrofurantoin, Teicoplanin, Vancomycin. Resistance to the microbe was revealed to Ampicillin, Penicillin, Oxacillin. Klebsiella pneumoniae was sensitive to Imipenem, Minocyline, Amikacin, Pipercallin and resistant to Nitrofurantoin, Trimethoprim, Cefazolin, Tobramycin.

Discussion

Data about the structure of the microflora are varied in different hospitals. In dynamic in Saratov multidisciplinary hospital structure of pathogens may change, but some microorganisms remain dominant. These include Staphylococcus aureus in the nose and pharynx, Escherichia coli and Staphylococcus aureus in the wound materials, Streptococcus pneumoniae and Candida in the sputum, Escherichia coli in the cervical canal.

Analyze of the resistance of Staphylococcus aureus to antibacterial drugs (ABD) revealed the increase in resistance to Ceftriaxone, Oxacillin. Regarding resistance of Proteus has increased to Ampicillin. At the same time, the resistance of Staphylococcus haemolyticus to macrolides and aminoglycazides decreased. The isolated Enterobacter strains proved to be resistant to Ampicillin (and Amoxicillin/clavulanate, respectively) in 100% of cases. No Vancomycin-resistant strains have been identified. Regarding Staphylococcus epidermidis resistance to antibacterial drugs has significantly decreased. Analyze of the resistance of Escherichia coli to antibacterial drugs detected that 100% of the strains are not sensitive to unprotected Aminopenicillins (due to the production of b-lactamases). The resistance of Escherichia coli to Cephalosporins has increased, which causes the ineffectiveness of therapy. The isolated strains of Pseudomonas aeruginosa are resistant to anti-pseudomonas preparations (Ciprofloxacin, Ceftazidime). The resistance of enterococci to antimicrobial drugs is growing. Regarding the resistance of fungi of the genus Candida to Nystatin revealed [19].

The structure of the microflora isolated from biomaterial of patients in different departments of Hanoi National Hospital of pediatrics revealed the following data. A total of 140 biomaterials from 74 patients hospitalized in the anesthesiology and intensive care unit, infectious diseases department, and gastroenterology department were tested. In biomaterial of patients treated in anesthesiology and intensive care unit Enterobacteriaceae (38,5%) prevailed, in infectious hospital Gram-negative non-fermenting bacteria (46,5%) presented, in gastroenterology department Gram-positive microbes (39,3%) presented.

The structure of the microflora of the hospital, according to the selected hospital environment, gram-positive flora prevailed (60.2% in anesthesiology and intensive care unit

and 50,7% - in infectious diseases department). A wide range of Enterobacteriaceae and Gram-negative non-fermenting microbes with wide spectrum of resistance were found in National Hospital of pediatrics [20].

Bacteriological laboratory of the Center for Phthisiopulmonology and Infectious Diseases in Semey revealed a predominance of Streptococcus pneumoniae, Streptococcus pyogenes, Staphylococcus haemolyticus, Candida, Staphylococcus aureus, Streptococcus uberis, Candida albicans, Escherichia coli.

The sensitivity of Streptococcus pneumoniae to antibiotics Gentamycin, Vancomycin, Linezolid, Penicillin, Moxifloxacin, Ceftoroline, Erythromycin, Clindamycin, Daptomycin was determined. Resistance of the pathogen was observed to Ampicillin, Tetracycline, Ciprofloxacin, Trimethoprim, Rifampin. Staphylococcus aureus was sensitive to Gentamycin, Ciprofloxacin, resistant to Ampicillin, Penicillin. Klebsiella pneumoniae was susceptible to Imipinem, Minocyline and resistant to Nitrofurantoin, Trimethoprim. The sensitivity of Candida to Fluconazole, Micafungin and resistance to Voriconazole was determined.

The dates of bacteriological laboratory of the Center for Phthisiopulmonology and Infectious Diseases in Semey reflect the general situation with microflora and resistance to antibacterial drugs in the world. The Atomic-i600 microbiological analyzer allows accurate and fast testing of various biological samples, which significantly increases the reliability and speed of obtaining results.

Conclusions

Thus, the work of specialists in microbiological laboratories plays a crucial role in the effective prevention and control of infections, since the identification of the pathogen allows doctors to prescribe treatment in a timely and effective manner and thereby prevent the spread of infections.

Despite the successes, bacteriological laboratories face a number of challenges. One of the main ones is the growth of antibiotic-resistant strains. This is due to the frequent and improper use of antibiotics, as well as the lack of awareness among patients about the importance of following doctors' prescriptions. Another important problem is the shortage of qualified personnel in the laboratories. In this regard, it is necessary to raise the level of training of specialists, introduce new educational programs, and provide laboratories with modern equipment. In our study, AutoMic-i600 was used to analyze microbial strains, which ensured high data accuracy and increased the efficiency of sample processing.

The work of a bacteriological laboratory is a complex, multifaceted process that includes diagnosis, monitoring, scientific research and prevention of infectious diseases. With the development of new technologies and diagnostic methods, the role of the bacteriological laboratory in healthcare continues to grow. It is important to continue investing in the education of specialists and the development of laboratory facilities in order to improve the quality of diagnosis and treatment of infectious diseases.

The systematic introduction of new technologies and research methods into the work of bacteriological laboratories contributes to improving infection control and improving public health.

Conflict of Interest. *The authors declare that they have no conflict of interest.*

Contribution of authors. *All authors were equally involved in the writing of this article.*

Funding: *No funding was provided.*

Literature:

1. *Акимкин В.Г., Творогова М.Г.* Лабораторная диагностика инфекционных болезней – М.: ФБУН ЦНИИ Эпидемиологии, 2020. 480 с.

2. Броновец И.Н. Дисбактериоз кишечника: диагностика, профилактика и лечение. Медицинские новости. 2016. №11. С. 56-58.

3. Быков В.О. Принципы диагностики вирусных инфекций. - Изд: Феникс, 2023. 399 с.

4. *Воробьев А.А, Быков А.С., Зверев В.В.* Атлас по медицинской микробиологии, вирусологии и иммунологии. 3-е изд., перераб. и доп. Изд: 2022. 272 с.

5. Джамалудинов Ю.А., Позднякова О.Ю. Микробиологический пейзаж мокроты и содержание бактериальных иммуноглобулинов у пациентов с неконтролируемой бронхиальной астмой. Международный журнал экспериментального образования. 2014.№ 8 (часть 3). С. 67-68.

6. Донецкая Э.Г.-А. Клиническая микробиология: Руководство для специалистов клинической лабораторной диагностики. — М.: ГЭОТАР-Медиа, 2011. 480 с.

7. Каргальцева Н.М., Кочеровец В.И., Миронов А.Ю., Борисова О.Ю. Метод получения гемокультуры при диагностике инфекции кровотока. Клиническая лабораторная диагностика. 2020; 65 (3): 185-190. DOI: http://dx.doi.org/10.18821m69-2084-2020-65-3-185-190

8. Карпищенко А.И., Андреев В.А. Медицинская лабораторная диагностика. Программы и алгоритмы. Руководство для врачей. — М.: ГЭОТАР-Медиа, 2023. 976 с.

9. Кичин В.В. Особенности микробного пейзажа хронических ран мягких тканей // Журнал МедиАль, 2019. № 1 (23). С. 22-24.

10. *Кичин В.В., Романов И.Н., Шахов А.В.* Влияние микробного фактора на результаты лечения хронических ран мягких тканей. Вятский медицинский вестник, 2018. № 4 (60). С. 25-29.

11. *Ковалев Е.В., Ерганова Е.Г., Ненадская С.А., Родионова М.М., Леоненко Н.В., Мирошниченко Г.А., Карлов А.В., Буря Е.Ю., Носкова О.А., Дорофеева И.К., Водяницкая С.Ю.* Результаты эпидемиологического анализа заболеваемости сальмонеллезной инфекцией в Ростовской области в современных условиях. Медицинский вестник Юга России. 2024;15(2):117-125. https://doi.org/10.21886/2219-8075-2024-15-2-117-125

12. *Кулиева З.М., Гасанов А.И., Рустамова Л.И., Исрафилбекова И.Б., Мухтаров М.М., Мамедова М.Н.* Микробный пейзаж кишечника у амбулаторных пациентов с острыми кишечными инфекциями. Казанский медицинский журнал. 2018. Т. 99. №3. С. 401-404. doi:10.17816/KMJ2018-401

13. *Лабинская А.С., Блинкова Л.П., Ещина А.С.* Частная медицинская микробиология с техникой микробиологических исследований. СПб.: Лань, 2022. 608 с.

14. *Литусов Н.В.* Методы исследования в медицинской бактериологии. Электронное учебное пособие. – Екатеринбург: Изд-во УГМУ, 2021. – 232 с.

15. *Лопатин А.С., Иванченко О.А., Гаврилов П.П., и др.* Микробный пейзаж верхнечелюстных пазух и среднего носового хода при хроническом риносинусите. Российская ринология. 2013;21(4):4-8.

16. *Малова Е.С., Балмасова И.П., Царев В.Н.* Специальные методы лабораторной диагностики инфекционных заболеваний. – Изд: Практическая медицина, 2019. 80 с.

17. *Мамарасулова Н.И.* Пейзаж сальмонелл, выделенных от больных за 10 лет. Экономика и социум, № 11-1 (126), 2024, С. 974-979.

18. Приказ МЗ РК №758 от 28.09.2015 г. об утверждение «Положения о деятельности организаций и (или) структурных подразделений организаций здравоохранения, осуществляющих лабораторную диагностику, а также объем и виды проводимых ими исследований». URL: https://adilet.zan.kz/rus/docs/V1500012207 (Дата обращения: 28.11.2024)

19. *Aristanova L.S., Buldakova M.V., Shuvalov S.D., Akhmedov V.K., Akhmedov I.K., Korova M.B.* On the example of the bacteriological laboratory of bacteriological monitoring. Bulletin of Medical Internet conferences 2019. 9th edition. No.11, P.535-537.

20. *Kataeva L.V., Rebeshchenko A.P., Stepanova T.F., Posoiiuznykh O.V., Le Thanh Hai , Le Thi Minh Huong* Patients' microflora comparative characteristics of different departments at the National Hospital of Pediatrics in Hanoi, Vietnam. Public Health and Life Environment – PH&LE. 2019. (3):43-48. (In Russ.)

References: [1-18]

1. Akimkin V.G., Tvorogova M.G. *Laboratornaja diagnostika infekcionnyh boleznej* [Laboratory diagnostics of infectious diseases] – M.: FBUN CNII Jepidemiologii, 2020. 480 p. [in Russian]

2. Bronovec I.N. *Disbakterioz kishechnika: diagnostika, profilaktika i lechenie* [Intestinal dysbiosis: diagnosis, prevention and treatment]. *Meditsinskie novosti* [Medical news]. 2016. №11. pp. 56-58. [in Russian]

3. Bykov V.O. *Principy diagnostiki virusnyh infekcij* [Principles of diagnosis of viral infections]. - Izd: Feniks, 2023. 399 p. [in Russian]

4. Vorob'ev A.A, Bykov A.S., Zverev V.V. *Atlas po medicinskoj mikrobiologii, virusologii i immunologii. 3-e izd., pererab. i dop.* [Atlas of Medical Microbiology, Virology and Immunology] – Izd: 2022. 272 p. [in Russian]

5. Dzhamaludinov Ju.A., Pozdnjakova O.Ju. *Mikrobiologicheskii peizazh mokroty i soderzhanie bakterial'nykh immunoglobulinov u patsientov s nekontroliruemoi bronkhial'noi astmoi* [Microbiological landscape of sputum and the content of bacterial immunoglobulins in patients with uncontrolled bronchial asthma]. *Mezhdunarodnyi zhurnal eksperimental'nogo obrazovaniya* [International Journal of Experimental Education]. 2014. № 8 (chast' 3). pp. 67-68. [in Russian]

6. Doneckaja Je.G.-A. *Klinicheskaja mikrobiologija: Rukovodstvo dlja specialistov klinicheskoj laboratornoj diagnostiki* [Clinical microbiology: A guide for specialists in clinical laboratory diagnostics]. — M.: GJeOTAR-Media, 2011. 480 p. [in Russian]

7. Kargal'ceva N. M., Kocherovec V. I., Mironov A. Ju., Borisova O. Ju. *Metod polucheniya gemokul'tury pri diagnostike infektsii krovotoka* [A method for obtaining hemoculture in the diagnosis of bloodstream infection]. *Klinicheskaya laboratornya diagnostika* [Clinical laboratory diagnostics]. 2020. 65 (3): 185-190. DOI: http://dx.doi.org/10.18821m69-2084-2020-65-3-185-190 [in Russian]

8. Karpishhenko A.I., Andreev V.A. *Medicinskaja laboratornaja diagnostika. Programmy i algoritmy. Rukovodstvo dlja vrachej* [Medical laboratory diagnostics. Programs and algorithms. A guide for doctors]. — M.: GJeOTAR-Media, 2023. 976 p. [in Russian]

9. Kichin V.V. *Osobennosti mikrobnogo peizazha khronicheskikh ran myagkikh tkanei* [Features of the microbial landscape of chronic soft tissue wounds]. *Zhurnal MediAl'* [Medial Journal], 2019. № 1 (23). pp. 22-24. [in Russian]

10. Kichin V.V., Romanov I.N., Shahov A.V. *Vliyanie mikrobnogo faktora na rezul'taty lecheniya khronicheskikh ran myagkih tkanei* [The influence of the microbial factor on the results of treatment of chronic soft tissue wounds]. *Vyatskii meditsinskii vestnik* [Vyatka Medical Bulletin]. 2018. № 4 (60). pp. 25-29. [in Russian]

11. Kovalev E.V., Erganova E.G., Nenadskaja S.A., Rodionova M.M., Leonenko N.V., Miroshnichenko G.A., Karlov A.V., Burja E.Ju., Noskova O.A., Dorofeeva I.K., Vodjanickaja S.Ju. *Rezul'taty epidemiologicheskogo analiza zabolevaemosti sal'monelleznoi infektsiei v Rostovsko oblasti v sovremennykh usloviyak* [Results of an epidemiological analysis of the incidence of salmonella infection in the Rostov region in modern conditions]. *Medicinskii vestnik Yuga Rossii* [Medical Bulletin of the South of Russia]. 2024, 15(2):117-125. https://doi.org/10.21886/2219-8075-2024-15-2-117-125 [in Russian]

12. Kulieva Z.M., Gasanov A.I., Rustamova L.I., Israfilbekova I.B., Muhtarov M.M., Mamedova M.N. *Mikrobnyi peizazh kishechnika u ambulatornykh patsientov s ostrymi kishechnymi infektsiyami* [The microbial landscape of the intestine in outpatient patients with acute intestinal infections]. *Kazanskii meditsinskii zhurnal* [Kazan Medical Journal]. 2018. T. 99. №3. C. 401-404. doi: 10.17816/KMJ2018-401[in Russian]

13. Labinskaja A.S., Blinkova L.P., Eshhina A.S. *Chastnaya medicinskaya mikrobiologiya s tekhnikoi mikrobiologicheskikh issledovanii* [Private medical microbiology with microbiological research techniques] — SPb.: Lan', 2022. 608 p.[in Russian]

14. Litusov N.V. Metody issledovanija v medicinskoj bakteriologii. Jelektronnoe uchebnoe posobie [Research methods in medical bacteriology] — Ekaterinburg: Izd-vo UGMU, 2021. – 232 p. [in Russian]

15. Lopatin A.S., Ivanchenko O.A., Gavrilov P.P., i dr. *Mikrobnyi peizazh verkhnechelyustnykh pazukh i srednego nosovogo khoda pri khronicheskom rinosinusite* [Microbial landscape of the maxillary sinuses and the middle nasal passage in chronic rhinosinusitis]. *Rossiiskaya rinologiya* [Russian rhinology] . 2013;21(4):4 8. [in Russian]

16. Malova E.S., Balmasova I.P., Carev V.N. *Special'nye metody laboratornoj diagnostiki infekcionnyh zabolevanij* [Special methods of laboratory diagnostics of infectious diseases]. – *Izd: Prakticheskaja medicina* [Practical Medicine], 2019. 80 p. [in Russian]

17. Mamarasulova N.I. *Pejzazh sal'monell, vydelennyh ot bol'nyh za 10 let* [Landscape of salmonella isolated from patients over 10 years]. *Jekonomika i socium* [Economics and Society], № 11-1 (126), 2024, pp. 974-979. [in Russian]

18. Prikaz MZ PK №758 ot 28.09.2015 g. ob utverzhdenie *«Polozheniya o deyatel'nosti organizatsii i (ili) strukturnykh podrazdelenii organizatsij zdravookhraneniya, osushhestvlyayushhikh laboratornuyu diagnostiku, a takzhe obyem i vidy provodimykh imi issledovanii»* [Regulations on the activities of organizations and (or) structural divisions of healthcare organizations engaged in laboratory diagnostics, as well as the scope and types of research conducted by them]. URL: https://adilet.zan.kz/rus/docs/V1500012207 (Date of request: 28.11.2024) [in Russian]

Information about the authors:

Maukayeva Saule Boranbayevna - Candidate of Medical Sciences, Associate Professor of the Department of Infectious Diseases, Dermatovenerology and Immunology, NCJSC "Semey Medical University", phone: 8 705 529 66 75, e-mail: solly66@mail.ru, https://orcid.org/0000-0002-2679-6399, Semey, Kazakhstan;

Kudaibergenova Nazym Konyrovna - Candidate of Medical Sciences, Associate Professor of the Department of Infectious Diseases, Dermatovenerology and Immunology, NCJSC "Semey Medical University", phone: 8 705 188 0836, e-mail: nazym.kudaibergenova@smu.edu.kz, https://orcid.org/0000-0002-2679-6399, Semey, Kazakhstan;

Merimgaliyeva Asemgul Kabdulovna - Head of the bacteriological laboratory of the «Regional Center of Phthisiopulmonology and Infectious Diseases» of the Abai Regional Health Department, Semey, Republic of Kazakhstan, https://orcid.org/0009-0005-7767-1093, e-mail: merimgalieva@inbox.ru, phone: +77772735626;

Agybayeva Aliya Mubarakovna - Doctor of the bacteriological laboratory of the «Regional Center of Phthisiopulmonology and Infectious Diseases» of the Abai Regional Health Department, Semey, Republic of Kazakhstan, https://orcid.org/0009-0004-2962-069X, e-mail: agybayeva68@inbox.ru, phone: +77757567841;

Abzalkhanova Gauhar Toleugazinovna - Doctor of the bacteriological laboratory of the «Regional Center of Phthisiopulmonology and Infectious Diseases» of the Abai Regional Health Department, Semey, Republic of Kazakhstan, https://orcid.org/0009-0009-4513-5869, e-mail: tleugazinovna@inbox.ru, phone: +77757991561;

Orazalina Ainash Saparovna – Candidate of Biological Sciences, Associate Professor, Head of the Department of Molecular Biology and Medical Genetics named after Academician of the National Academy of Sciences of the Republic of Kazakhstan T.K. Raisov, Semey Medical University, 103 Abay St., Semey, Republic of Kazakhstan; https://orcid.org/0000-0003-4594-0138; e-mail: ainash.orazalina@smu.edu.kz; +7-777-235-47-72;

Yurkovskaya Oxana - Associate Professor of the Department of General Medical Practice, NCJSC “Semey Medical University”, Semey, Republic of Kazakhstan; oksana.yurkovskaya@smu.edu.kz ; https://orcid.org/0000-0002-6251-5574; +77779860822;

Goremykina Maya Valentinovna - Candidate of Medical Sciences, Associate Professor, Department of Internal Medicine and Rheumatology, NJSC «Semey Medical University», 103 Abay street, Semey, 071400, Kazakhstan; Email: maya.goremykina@smu.edu.kz; phone number: +7 (777) 390 8234; https://orcid.org/0000-0002-5433-7771

Zeinolla Kamila Akylzhanovna - resident in the specialty "Clinical laboratory diagnostics", NCJSC "Semey Medical University", phone: +77779810695, e-mail: kamila.shaidollaeva@mail.ru, https://orcid.org/0009-0008-3958-7896, Semey, Kazakhstan;

Akhmetova Almira Kalikapasovna - Candidate of Medical Sciences, Acting Professor of the Department of Infectious Diseases, Dermatovenerology and Immunology, NJSC "Semey Medical University", phone: 8 701 388 13 37, e-mail: almirahmetova@mail.ru, https://orcid.org/0000-0002-8938-3401, Semey, Kazakhstan.

Corresponding author:

Maukayeva Saule Boranbayevna - Candidate of Medical Sciences, Associate Professor of the Department of Infectious Diseases, Dermatovenerology and Immunology, NCJSC "Semey Medical University", Semey, Kazakhstan;
https://orcid.org/0000-0002-2679-6399,

Post address: 103 Abay Street, Semey, 071400, Republic of Kazakhstan.

e-mail: solly66@mail.ru,

phone: 8 705 529 66 75