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FREQUENCY OF DETECTION OF STAPHYLOCOCCUS AUREUS ISOLATES IN VARIOUS CLINICAL MATERIALS FROM PATIENTS WITH PURULENT-INFLAMMATORY DISEASES IN NON-INFECTIOUS CLINICS

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Aim of the study. To study the frequency of isolation of *Staphylococcus aureus* from clinical biomaterials of patients with purulent-inflammatory diseases for the period from 2018 to 2022 according to the microbiological laboratory of JSC «National Scientific Medical Center», Astana.

Materials and methods. A prospective microbiological study of the microbial landscape isolated from clinical samples of inpatients with purulent-inflammatory processes was carried out. Isolation and identification of strains was carried out on the basis of the microbiological laboratory of JSC «National Scientific Medical Center», Astana.

Results and discussion. According to the microbiological laboratory of JSC «National Scientific Medical Center», during the period of bacteriological studies of clinical materials from patients with purulent-inflammatory diseases of various localization and from other materials used in medical institutions, from 2018 to 2022, a total of 961 strains of *Staphylococcus aureus* were isolated. When studying the dynamics of growth or decrease in the number over the years, it can be noted that for all the periods of study, we noted the most significant increase in the release of the amount of *Staphylococcus aureus* only from samples taken from the throat – 57.4%. In second place in terms of the frequency of *Staphylococcus aureus* discharge is a wound – 15%, in third place urine – 6.13%, followed by a nasal smear – 3.64% and sputum – 2.49%, respectively.

Conclusion. Thus, one of the dominant pathogens in purulent-inflammatory diseases is *Staphylococcus aureus* and the main clinical biomaterial according to the frequency of detection during bacteriological examination of patients taken from non-infectious clinics from 2018 to 2022, according to the microbiological laboratory of JSC «NSMC» there was a throat smear, which accounted for 57.4%, then wound – 15% and urine – 6.13%. In the remaining biomaterials, the detection of *Staphylococcus aureus* was insignificant

Key words: purulent-inflammatory diseases; *Staphylococcus aureus*; bacteriological studies; biomaterials

INTRODUCTION

Despite the rapid development of medicine, the problem of purulent-inflammatory diseases caused by *Staphylococcus aureus* has not yet lost its significance and still remains relevant. Apparently, this is due to the peculiarities of the biological properties of the pathogen (resistance to environmental factors, variability, multiresistance to many antibiotics used). Most healthy people are carriers of this microorganism and, when immunity is weakened, these microorganisms can cause various purulent-inflammatory diseases, are one of the causes of mortality in patients and

increase the duration of treatment in hospitals, which requires further study.

Purulent-inflammatory diseases (PID) caused by *Staphylococcus aureus* represent a serious medical problem that requires careful study. Colonization by *Staphylococcus aureus* is an important factor in infections caused by this organism. Among the niches of staphylococcal colonization are the nose, skin, intestinal tract, and recently the throat has also become relevant [4]. Infectious diseases are the second leading cause of death worldwide; *Staphylococcus aureus* (*S. aureus*) is a very common human pathogen that can

cause a variety of infectious diseases such as skin and soft tissue infections, endocarditis, osteomyelitis, bacteremia and fatal pneumonia [1, 3, 7, 11].

Despite continued advances in medical and surgical procedures, staphylococci remain the major gram-positive bacterial pathogens causing a wide range of diseases, especially in patients requiring the use of indwelling catheters and prostheses implanted temporarily or for long periods of time [2, 8]. Although according to the literature there is a lot of information about *Staphylococcus aureus* as a pathogenic microorganism that is often found in gastrointestinal infections of various organs and systems, there is not enough data on the dynamics of excretion from clinical samples obtained from patients from non-infectious clinics by year.

The aim of this work was to study the frequency of *Staphylococcus aureus* inoculation from clinical biomaterials of patients with purulent-inflammatory diseases for the period from 2018 to 2022 according to the microbiological laboratory of JSC «National Scientific Medical Center», Astana.

MATERIALS AND METHODS

A prospective microbiological study of the microbial landscape isolated from clinical samples of inpatients with purulent-inflammatory processes was carried out. Isolation and identification of strains was carried out on the basis of the microbiological laboratory of JSC «National Scientific Medical Center» (NSMC), Astana.

Collection of study material. Biomaterial from these patients was subjected to microbiological examination. Clinical material was collected and transported to the microbiological laboratory according to methodological recommendations.

Sample cultivation. Quantitative analysis of the studied material was carried out using nutrient media (blood agar, Endo medium, yolk-salt agar, Candida agar, Viburnum agar). The crops were cultivated for 24 hours at 37°C; Candida agar plates were cultivated for 5 days at 22°C.

Identification of isolates. According to methodological recommendations, morphological and cultural properties, Gram staining, oxidase and catalase tests, and an indole formation test were studied to identify isolates. The final identification of the isolated pure cultures of microorganisms was carried out on a microbiological analyzer «Vitek 2 – Compact» (bioMérieux, Marcy l'Etoile, France).

Statistical processing. Statistical processing of the obtained data was carried out using Microsoft Excel, the average value and the error of the average were determined, dynamic changes were determined by the linear regression method. Differences in mean values were considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

Analysis of data from various biomaterials from which *Staphylococcus aureus* was isolated during the study period showed that in 2018, out of 192 *Staphylococcus aureus* isolates, the largest amount was isolated from the throat – 69 (35.9%), then from the wound – 35 (18.2%), from urine – 21 (10.9%), from a nasal swab – 16 (8.3%), sputum – 12 (6.25), conjunctiva – 7 (3.64%), epicestoma – 9 (4.68), nephrostomy – 4 (2.0%), umbilical cord – 3 (1.56%), pleural cavity – 3 (1.56%), TBD catheter – 2 (1.04%), bronchial lavage water – 1 (0.5%), urinary catheter – 1 (0.5%). It should be noted that staphylococci were not isolated from the following materials studied: CVC, C-channel, tracheostomy, catheter, and blood for sterility, abdominal cavity and jugular catheter.

During the period of 2019, a total of 145 strains of *Staphylococcus aureus* were isolated, of which large quantities were also isolated from the nasopharynx – 69 (47.5%), urine – 18 (12.4%), wounds – 17 (11.7%), blood for sterility – 7 (4.82%), sputum – 6 (4.13%), nasal smear, epicestoma – 6 (4.13%), nephrostomy – 4 (2.75%), conjunctiva – 3 (2.06%), TBD catheter, urinary catheter, drainage – 2 (1.37%), other materials: umbilical cord, endotracheal tube, tracheal sacker tip one at a time (0.68%). In general, *Staphylococcus aureus* was not isolated from an ear smear, bronchial lavage water, C-channel, CVC, tracheostomy, pleural cavity, or jugular catheter.

In 2020, the studied materials from which there were 142 *Staphylococcus aureus* isolates were as follows: from the throat – 72 (50.7%), wounds – 25 (17.6%), umbilical cord – 10 (7.04%), nasal swab – 7 (4.92%), conjunctiva – 6 (4.22%), urine – 5 (3.52%), ear smear, blood for sterility – 3 (2.11%), nephrostomy, catheter from solid waste, pleural cavity – 2 (1.4%), sacker tip from the trachea – 1 (0.7%), epicestoma – 1 (0.7%), CVC – 1 (0.7%). Staphylococci were not detected in the following materials tested, such as bronchial lavage water, tracheostomy, endotracheal tube, urinary catheter, subclavian catheter, abdominal cavity, and kidney stone.

According to bacteriological studies for the period 2021, out of 264 *Staphylococcus aureus* isolates was also isolated from the throat – 195 (73.8%), then from the wound – 35 (13.2%), urine – 8 (3.03%), bronchial washings, conjunctiva, nasal swab – 4 (1.51%), catheter – 3 (1.13%), sputum, TBD catheter, blood for sterility, ear swab – 2 (0.75%), then pleural cavity, abdominal cavity, abscess one at a time (0.37%). There were no discharges of *Staphylococcus aureus* from the drainage, umbilical cord, or aspirate.

The largest number *Staphylococcus aureus* isolates were from pharynx – 147 (67.4%), wounds – 33 (15.1%), catheter from TBD, blood for sterility, conjunctiva 4 (1.83%), bronchial lavage water, ear swab 3 each (1.37%), nasal swab, exudate, abscess,

Table 1 – Frequency of *Staphylococcus aureus* isolation according to JSC «NSMC» data in patients with purulent-inflammatory diseases for the period 2018-2022

Year	2018	2019	2020	2021	2022	Total
Samples	n %M ± m	n %M ± m	n %M ± m	n %M ± m	n %M ± m	n %M ± m
Mucus	n = 12 6.25 ± 1.74	n = 6 4.13 ± 1.65	n = 2 1.40 ± 0.98	n = 2 0.75 ± 0.52	n = 2 0.91 ± 0.64	n = 24 2, 49 ± 0.5
Nasopharynx	n = 69 35.9 ± 3.46	n = 69 47.5 ± 4.14	n = 72 50.7 ± 4.19	n = 195 73.8 ± 2.70	n = 147 67.4 ± 3.17	n = 552 57.4 ± 1.5 9
Nasal swab	n = 16 8.33 ± 1.99	n = 6 4.13 ± 1.65	n = 7 4.92 ± 1.81	n = 4 1.51 ± 0.74	n = 2 0.91 ± 0.64	n = 35 3.64 ± 0.6
Urine	n = 21 10.9 ± 2.24	n = 18 12.4 ± 2.73	n = 5 3.52 ± 1.54	n = 8 3.03 ± 1.05	n = 7 3.21 ± 1.19	n = 59 6.13 ± 3.07
Wound	n = 35 18.2 ± 2.78	n = 17 11.7 ± 2.66	n = 25 17.6 ± 3.19	n = 35 13.2 ± 2.08	n = 33 15.1 ± 2.42	n = 145 15 ± 1.14
Umbilical cord	n = 3 1.5 ± 0.87	n = 1 0.68 ± 0.67	n = 10 7.04 ± 2.14	0	n = 1 0.45 ± 0.44	n = 15 1.56 ± 0.3 8

sputum 2 each (0.91%), abdominal cavity, umbilical cord, CVC one each (0.45%).

Thus, according to the microbiological laboratory of JSC «NSMC», during the period of bacteriological studies of clinical materials from purulent-inflammatory diseases of various localizations and from other materials used in medical institutions from 2018 to 2022, a total of 961 strains of *Staphylococcus aureus* were isolated. When studying the dynamics of growth or decline in the number over the years, the following can be noted that over all periods of study, were noted the most significant increase in the isolation of the amount of *Staphylococcus aureus* only from samples taken from the throat – 57.4% (Table 1). In second place in the frequency of isolation of *Staphylococcus aureus* is the wound – 15% and in third place is urine – 6.13%, followed by a nasal swab - 3.64% and sputum – 2.49%, respectively.

The isolation of *Staphylococcus aureus* from other studied biomaterials, such as sputum, conjunctiva, smears from the ear, nose, urine, nephrostomy, pleural cavity, epistome, blood for sterility showed its detection in insignificant quantities during the study period over the years.

The results of our research on isolation frequency of *Staphylococcus aureus* according to JSC «NSMC» data in patients with purulent-inflammatory diseases for the period 2018-2022 (Figure 1) showed that over the past decades the number of *Staphylococcus aureus* secretions from the pharynx had increased, which is confirmed by data from foreign authors [4, 5].

From our research on frequency of *Staphylococcus aureus* isolation, second place belonged to wounds, which is consistent with the data of foreign researchers, as according to D. Santosaningsih [9] *Staphylococcus*

aureus from the studied 567 outpatients with wound infections of the skin and soft tissues was isolated in 257 (45.3%) patients. According to our data, *Staphylococcus aureus* in the wound was found in 15% cases.

Studies of bacterial isolates from patient urine samples with urinary tract infections by C. M. M. Prasada Rao et al. [6] found that the most common isolates were *Staphylococcus saprophyticus* (20%), *Staphylococcus aureus* (28%) and *Escherichia coli* (24.6%). According to our research *Staphylococcus aureus* was detected in urine in 6.13% cases.

The results of frequency analysis of *Staphylococcus aureus* isolation from various clinical biomaterials showed a significant increase in inoculability *Staphylococcus aureus* isolates from the pharynx, the percentage of isolation of which was 57.4%, as well as its slight increase in isolation during bacteriological examination over the years from such clinical biomaterials as a wound, urine, nasal swab and sputum. The percentage of excretion was 57.4%, followed by biomaterial from the wound – 15%, then biomaterial from the nose – 3.64% and sputum – 2.49%.

CONCLUSION

Thus, one of the dominant pathogens in PID is *Staphylococcus aureus* and the main clinical biomaterial according to the frequency of detection during bacteriological examination of patients taken from non-infectious clinics from 2018 to 2022, according to the microbiological laboratory of JSC «NSMC» there was a throat smear, which accounted for – 57.4%, then wound – 15% and urine – 6.13%. The isolation of *Staphylococcus aureus* from other biomaterials were insignificant.

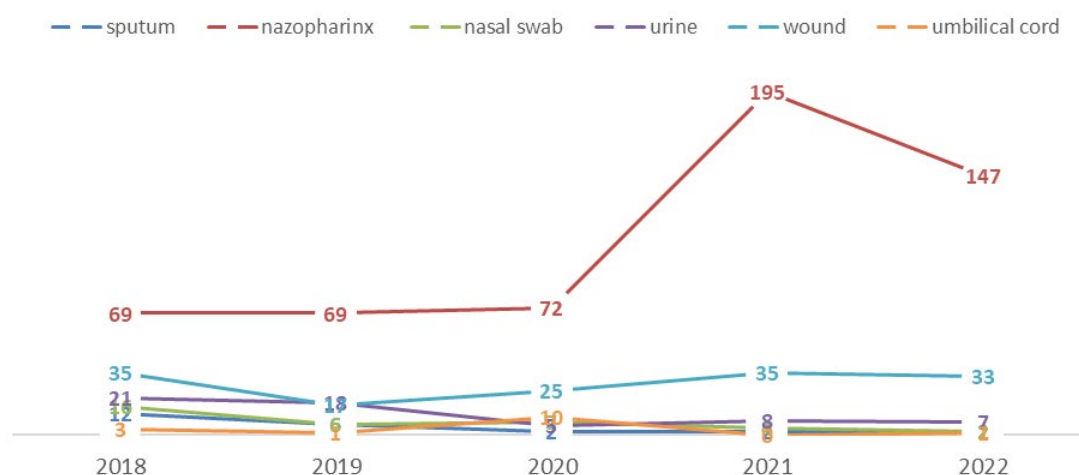


Figure 1 – Dynamics of *Staphylococcus aureus* isolation according to JSC «NSMC» data in patients with purulent-inflammatory diseases for the period 2018-2022

Authors' contributions:

A. M. Utegenova, B. S. Urekeshov – concept and design of the study.

N. M. Bissenova, M. U. Dusmagambetov – collection and analysis of the material.

A. M. Utegenova, B. S. Urekeshov – statistical processing and text writing.

N. M. Bissenova, G. O. Ilderbayeva – editing.

Conflict of interest. No conflict of interest has been declared.

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ЧАСТОТА ОБНАРУЖЕНИЯ ИЗОЛЯТОВ STAPHYLOCOCCUS AUREUS В РАЗЛИЧНЫХ КЛИНИЧЕСКИХ МАТЕРИАЛАХ ОТ БОЛЬНЫХ С ГНОЙНО-ВОСПАЛИТЕЛЬНЫМИ ЗАБОЛЕВАНИЯМИ В НЕИНФЕКЦИОННЫХ КЛИНИКАХ

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Цель исследования. Изучение частоты высеваемости Staphylococcus aureus от клинических биоматериалов больных с гнойно-воспалительными заболеваниями за период с 2018 по 2022 год по данным микробиологической лаборатории АО «Национальный научный медицинский центр» (г. Астана).

Материалы и методы. Проведено проспективное микробиологическое исследование микробного пейзажа клинических образцов, выделенных у стационарных пациентов с гнойно-воспалительными процессами. Выделение и идентификация штаммов проводились на базе микробиологической лаборатории АО «Национальный научный медицинский центр» (г. Астана).

Результаты и обсуждение. По данным микробиологической лаборатории АО «ННМЦ» за период проведенных бактериологических исследований клинических материалов от больных с гнойно-воспалительными заболеваниями различной локализации и других материалов, используемых в лечебном учреждении с 2018 по 2022 год, всего был выделен 961 штамм Staphylococcus aureus. При изучении

Клиническая медицина

динамики роста или снижения количества по годам можно отметить, что за все периоды изучения самое значительное увеличение выделения количества *Staphylococcus aureus* было отмечено только из образцов, взятых из зева, – 57,4%, на втором месте по частоте выделения находится рана – 15%, на третьем месте моча – 6,13%, далее следуют мазок из носа – 3,64% и мокрота – 2,49%.

Выводы. Таким образом, одним из доминирующих возбудителей при гнойно-воспалительных заболеваниях является *Staphylococcus aureus*. Основным клиническим биоматериалом по частоте обнаружения при бактериологическом исследовании образцов, взятых у пациентов неинфекционных клиник с 2018 по 2022 год, был мазок из зева, на долю которого приходилось 57,4%, затем следовали рана (15%) и моча (6,13%). В остальных биоматериалах обнаружение *Staphylococcus aureus* было незначительным.

Ключевые слова: гнойно-воспалительные заболевания; *Staphylococcus aureus*; бактериологические исследования; биоматериалы

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ИНФЕКЦИЯЛЫҚ ЕМЕС КЛИНИКАЛАРДА ІРІНДІ ҚАБЫНУ АУРУЛАРЫ БАР НАУҚАСТАРДАН *STAPHYLOCOCCUS AUREUS* ИЗОЛЯТТАРЫН ӘРТҮРЛІ КЛИНИКАЛЫҚ МАТЕРИАЛДАРДА АНЫҚТАУ ЖИІЛІГІ

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Зерттеудің мақсаты. Астана қаласы, «Ұлттық ғылыми медициналық орталық» АҚ микробиологиялық зертханасының деректері бойынша 2018 жылдан 2022 жылға дейінгі кезеңде іріңді-қабыну аурулары бар науқастардың клиникалық биоматериалдарынан *Staphylococcus aureus* кездесу жиілігін зерделеу.

Материалдар мен әдістер. Іріңді-қабыну процестері бар стационарлық пациенттердің клиникалық үлгілерінен бөлініп алынған микробтарына проспективті микробиологиялық зерттеу жүргізілді. Штамдарды бөліп алу және идентификациялау «Ұлттық ғылыми медициналық орталық» АҚ микробиологиялық зертханасының базасында, Астана қаласында жүргізілді.

Нәтижелер және талқылау. «Ұлттық ғылыми медициналық орталық» АҚ микробиологиялық зертханасының деректері бойынша 2018 жылдан 2022 жылға дейін емдеу мекемелерінде қолданылатын әртүрлі орналасуына байланысты іріңді-қабыну аурулары бар клиникалық материалдарға және басқа медициналық материалдарға жүргізілген бактериологиялық зерттеулер кезеңінде барлығы 961 алтын стафилококк штаммы бөлінді. Жылдар бойынша өсу немесе санның төмендеу динамикасын зерделеу кезінде мынаны атап өтуге болады: зерттеудің барлық кезеңдерінде біз тек жұтқыншақтан алынған үлгілерден мөлшерін *Staphylococcus aureus* бөліуінің айқын өсуін байқадық – 57,4%. *Staphylococcus aureus* анықталуының жиілігі бойынша екінші орында жара – 15% және үшінші орында зәр – 6,13%, содан кейін мұрын қуысынан алынған жағындысы – тиісінше 3,64% және қақырық – 2,49% құрады.

Қорытынды. Осылайша, 2018 жылдан 2022 жылға дейін «Ұлттық ғылыми медициналық орталық» АҚ микробиологиялық зертханасының мәліметтері бойынша іріңді қабыну аурулары кезінде басым қоздырғыштардың бірі *Staphylococcus aureus* және пациенттерден алынған инфекциялық емес клиникада бактериологиялық зерттеу кезінде анықтау жиілігі бойынша негізгі клиникалық биоматериал араннан алынған жағынды – 57,4% құрады, содан кейін жара – 15% және зәр – 6,13% болып табылады. Басқа биоматериалдарда *Staphylococcus aureus* анықталуы шамалы болды.

Кілт сөздер: іріңді-қабыну аурулары; бактериологиялық зерттеулер; *Staphylococcus aureus*; биоматериалдар