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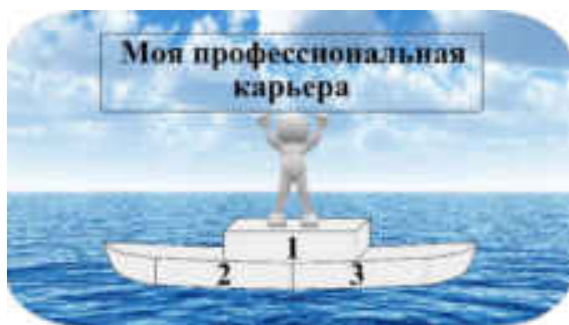


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**Международный научно-образовательный электронный журнал
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Журнал объединяет авторов на территории стран СНГ и помогает обмениваться передовыми научно-образовательными исследованиями.

Содержит научные работы отечественных и зарубежных авторов по экономическим, техническим, философским, юридическим и другим наукам.

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ФИО автора(-ов): Alimardonov G`ulom Sheraliyevich

Student of the Faculty of Medical Prevention and Public Health,

Group S24-02A. Tashkent state medical university.

Address: 100109, Tashkent City, Farabi street 2. Uzbekistan

Scientific supervisor: Masharipov Valijon Orinovich

Senior Lecturer of the Department of Microbiology, Virology and Immunology.

(PhD) Candidate of Medical Sciences. Tashkent state medical university.

Address: 100109, Tashkent City, Farabi street 2. Uzbekistan

Название публикации: «THE ROLE OF STAPHYLOCOCCI, STREPTOCOCCI, AND PSEUDOMONAS AERUGINOSA IN THE ETIOLOGY OF PURULENT INFECTIONS AND LABORATORY DIAGNOSTIC METHODS»

ABSTRACT

Purulent-inflammatory diseases are widespread infectious pathologies in modern medicine and pose a serious threat to patients' health. This article analyzes the bacteria Staphylococcus aureus, Streptococcus pyogenes, and Pseudomonas aeruginosa, which play a major role in the etiology of purulent infections. During the study, biological materials obtained from purulent wounds, abscesses, phlegmons, and surgical wounds were examined using microbiological laboratory methods. Bacteriological culture, Gram staining, biochemical tests, and antibiotic susceptibility testing were applied to determine the morphological, cultural, and pathogenic characteristics of the microorganisms. The results of the study showed that staphylococci are the most frequently occurring pathogens in purulent infections, while streptococci and Pseudomonas aeruginosa were also identified as clinically significant etiological agents. Modern laboratory diagnostics serve as an important tool for the timely detection of purulent infections and for determining effective treatment strategies.

This study further strengthened the role of microbiological investigations in clinical practice and highlighted their importance in the management of purulent-inflammatory diseases.

Keywords: *Purulent infections, Staphylococcus aureus, Streptococcus pyogenes, Pseudomonas aeruginosa, microbiological diagnostics, laboratory examination, bacteriological culture, antibiotic susceptibility*

INTRODUCTION

Purulent-inflammatory diseases are among the widely prevalent infectious pathologies in modern medicine and represent a significant medical and social challenge in clinical practice. These conditions develop in association with the skin and soft tissues, surgical wounds, burn injuries, and internal organ damage, and are often characterized by severe inflammatory processes and pus formation. Purulent infections not only exacerbate the overall condition of patients but may also prolong treatment duration, increase medical costs, and, in some cases, lead to severe complications, including the development of sepsis.

In recent years, the widespread prevalence of purulent infections has been recognized as a significant epidemiological challenge for healthcare systems. According to the World Health Organization, postoperative infections and skin–soft tissue infections constitute a substantial proportion of nosocomial infections in many countries. The risk of developing purulent infections is particularly high in patients with burn injuries, trauma, surgical interventions, or compromised immune systems. Furthermore, the emergence and dissemination of antibiotic-resistant microorganisms represent a major factor complicating the effective management and treatment of these conditions.

A variety of bacterial species are involved in the etiology of purulent-inflammatory diseases. However, in clinical practice, certain microorganisms hold particular significance as the primary causative agents of these infections. Notably, *Staphylococcus aureus* is recognized as a major pathogen responsible for numerous purulent infections of the skin and soft tissues. This bacterium plays a critical role in the development of furuncles, carbuncles, abscesses, and postoperative wound infections.

Furthermore, *Streptococcus pyogenes* also plays a significant role in the etiology of purulent infections. These microorganisms can cause inflammatory diseases of the skin and soft tissues, including phlegmon, erysipelas, and other infectious processes.

In addition, *Pseudomonas aeruginosa*, recognized as one of the key causative agents of nosocomial infections, is of particular importance in the development of purulent processes. This bacterium is especially associated with severe infections in burn wounds, surgical wounds, and immunocompromised patients. Its high resistance to antibiotics presents a major clinical challenge, highlighting the critical role of laboratory diagnostics in the accurate identification and management of these infections.

Timely detection of purulent infections and the implementation of effective therapeutic measures rely heavily on microbiological laboratory diagnostics. Bacteriological examinations enable the identification of the causative microorganisms, the study of their biological characteristics, and the assessment of their susceptibility to antibiotics.

Accordingly, the aim of this study is to analyze the clinical significance of *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa* in the etiology of purulent infections, as well as to examine the laboratory diagnostic methods employed for their identification.

The main objectives of the study are as follows::

1. To analyze the etiological factors of purulent infections;
2. To investigate the biological and pathogenic characteristics of the main pathogenic microorganisms;
3. To examine the microbiological laboratory methods used for their identification.

LITERATURE REVIEW

The study of the etiology and pathogenesis of purulent-inflammatory diseases represents one of the key areas in microbiology and clinical medicine. The pathogenic microorganisms responsible for these diseases, their biological characteristics, and

their interactions with the host organism have been extensively investigated in numerous scientific studies.

Significant research has been conducted on the biological and taxonomic characteristics of pathogenic cocci. In particular, detailed information has been provided regarding the taxonomic position, morphological, and biological features of pathogenic cocci, specifically *Staphylococcus* and *Streptococcus* species¹ [1]

These studies offer important scientific insights into the morphological structure of cocci, their pathogenicity factors, and the mechanisms by which they induce disease.

One of the bacteria playing a significant role in the etiology of purulent infections is *Staphylococcus aureus*. These microorganisms are recognized as important etiological agents in the development of numerous purulent conditions, including skin and soft tissue infections, surgical wound infections, and abscesses. Researchers have extensively studied the pathogenicity factors of staphylococci, their toxins and enzymes, as well as their resistance to antibiotics² [2].

Another important pathogenic bacterium involved in the development of purulent infections is *Streptococcus pyogenes*. This bacterium can cause inflammatory diseases of the skin and soft tissues, including phlegmon, erysipelas, and other infectious processes. The pathogenesis of streptococcal infections, their interactions with the host immune system, and the clinical manifestations of the infections have been extensively described in numerous scientific studies³ [3].

Furthermore, *Pseudomonas aeruginosa*, which is one of the significant causative agents of nosocomial infections, also plays a crucial role in the development of purulent-inflammatory processes. This bacterium is particularly notable for causing severe infections in burn wounds, surgical sites, and immunocompromised patients.

¹ Rozenbax ularni batafsil o'rgangan, F. (2022). 3.1 Patogen kokklarning taksonomik o'rni. *MIKROBIOLOGIYA, VIRUSOLOGIYA VA IMMUNOLOGIYA*, 80

² Ondusko, D. S., & Nolt, D. (2018). *Staphylococcus aureus*. *Pediatrics in review*, 39(6), 287-298.

³ Orinovich, M. (2025). A MODERN APPROACH TO THE PROBLEM OF TREATING UREAPLASMA INFECTION. *SHOKH LIBRARY*, 1(12).

The pathogenic characteristics of this microorganism, as well as its resistance to antibiotics, have been extensively discussed in contemporary scientific research⁴ [4]

Scientific literature has also extensively examined the immunological interactions between microorganisms and the human body. For instance, important information has been reported regarding the immune responses generated against bacterial antigens and the defense mechanisms against microbes⁵ [5]. These studies demonstrate the critical role of the immune system in the development and progression of infection-related processes associated with microorganisms.

Furthermore, microbiological laboratory diagnostics play a crucial role in identifying infections caused by microorganisms. Modern diagnostic methods include bacteriological examinations, cultivation of microorganisms on nutrient media, microscopic analyses, and biochemical tests. These approaches enable the determination of the etiological agents of infections and facilitate the formulation of effective treatment strategies⁶ [6].

Additionally, the state of the microbiota, the activity of the immune system, and the organism's sensitivity to bacterial antigens are also significant factors in the development of infectious diseases⁷ [7].

Thus, the analysis of scientific literature indicates that pathogenic bacteria play a crucial etiological role in the development of purulent-inflammatory diseases. Timely identification of these microorganisms and the study of their biological characteristics are of fundamental importance for developing effective diagnostic and therapeutic strategies in clinical practice.

⁴ Машарипов, В. У., Мирвалиева, Н. Р., & Абдуллаев, У. М. (2023). Местный иммунитет и специфическая сенсibilизация к антигенам бактерий у больных тонзиллитом. *Science and Education*, 4(2), 392-400.

⁵ Машарипов, В. У. (2025). АНТИОКСИДАНТНАЯ ТЕРАПИЯ В КОМПЛЕКСНОМ ЛЕЧЕНИИ КАНДИДОЗНОГО СТОМАТИТА У ВЗРОСЛЫХ. *SHOKH LIBRARY*, 1(11).

⁶ Dilshod o'g'li, A. U. (2025). QOQSHOLNING BAKTERIOLOGIK DIAGNOSTIKASI. *MILLIY IFTIXOR*, 1(3), 84-89.

⁷ Симонова, А. В. (2005). Новые подходы к оценке иммунного статуса при хронических инфекционных и воспалительных заболеваниях человека. *Материалы*, 91-92.

MATERIALS AND METHODS:

This study was conducted with the aim of identifying the primary microorganisms responsible for purulent-inflammatory diseases and investigating their microbiological characteristics. During the research, modern microbiological laboratory methods were employed to detect pathogenic microorganisms in samples obtained from biological materials.

Research Materials

For this study, biological materials were collected from patients exhibiting purulent-inflammatory processes in clinical practice. The following samples were used as research materials:

1. Exudates obtained from purulent wounds;
2. Pus samples from abscesses and phlegmons;
3. Biological materials from surgical wounds;
4. Blood and other biological fluids, when necessary.

The biological materials were collected in strict accordance with aseptic and antiseptic principles, placed into sterile containers, and transported to the microbiological laboratory. To preserve the microbiological characteristics of the samples, they were analyzed in the laboratory within a short time frame.

Microbiological Examination Methods

Classical bacteriological examination methods were employed to identify pathogenic microorganisms in the biological materials. During the study, the morphological, cultural, and biochemical characteristics of the microorganisms were investigated.

Bacteriological Culturing

Samples obtained from biological materials were inoculated onto nutrient media using a sterile bacteriological loop. General and differential-diagnostic culture media were used for the cultivation of microorganisms. The inoculated materials were incubated in a thermostat at 37 °C. After the incubation period, the morphological characteristics of the colonies were evaluated, including their shape, color, size, and hemolytic activity.

Microscopic Examination and Gram Staining Method

Microscopic examination was performed to determine the morphological structure of the isolated microorganisms. For this purpose, bacterial smears were prepared and stained using the Gram method. This technique allows for the identification of bacteria as either Gram-positive or Gram-negative, as well as the determination of their shape and arrangement. Bacteria belonging to the Gram-positive cocci group play a significant etiological role in purulent infections and exhibit characteristic morphological features under the microscope.

Identification of Microorganisms

The identification of the isolated bacteria was carried out by examining their morphological, cultural, and biochemical characteristics. Biochemical tests were employed to determine the fermentative activity of the bacteria, their ability to metabolize carbohydrates, and other metabolic properties. These tests enable precise determination of the microbial species. Particular attention was given to the detection of bacteria commonly associated with purulent infections, including *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa*.

Determination of Antibiotic Susceptibility

The antibiotic susceptibility of the isolated microorganisms was determined using the disk-diffusion method. In this technique, a bacterial suspension was inoculated onto a specialized nutrient medium, and antibiotic-impregnated disks were placed on its surface. Following incubation, the zones of growth inhibition surrounding the antibiotic disks were measured to assess the microorganisms' susceptibility to the antibiotics. This method is of critical importance in clinical practice for selecting an effective antibiotic therapy.

RESULTS:

As a result of the conducted microbiological studies, various pathogenic microorganisms were identified in biological materials obtained from patients suffering from purulent-inflammatory conditions, and their etiological roles were evaluated.

During the research, samples taken from wounds, purulent discharges, and other biological materials were examined using bacteriological methods.

Laboratory investigations revealed that a range of bacteria participate in the etiology of purulent infections. According to the study results, the primary pathogens responsible for purulent-inflammatory diseases were identified as *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa*.

Among the isolated microorganisms, staphylococci were the most frequently encountered bacteria, comprising the majority of the examined samples. These bacteria were primarily isolated from skin and soft tissue infections, surgical wounds, and abscesses. The high prevalence of staphylococci can be attributed to their resilience in the external environment and their pathogenic characteristics.

The study also confirmed that streptococci are important etiological agents of purulent infections. They were mainly observed in inflammatory processes of soft tissues, phlegmon, and other infectious conditions. Streptococcal infections were characterized by rapid development and swift progression of the inflammatory process.

Additionally, laboratory investigations identified *Pseudomonas aeruginosa* in certain cases, particularly in materials obtained from surgical wounds and burn injuries. This bacterium is recognized as a significant causative agent of nosocomial infections and is distinguished by its high resistance to antibiotics.

The overall distribution of microorganisms identified through the bacteriological investigations is presented in the following table.

Table

Microorganisms	Detected cases (%)
Staphylococcus aureus	52 %
Streptococcus pyogenes	31 %
Pseudomonas aeruginosa	17 %

Prevalence of Microorganisms

As seen from the table, the most frequently encountered microorganisms in purulent-inflammatory diseases were staphylococci, which occupied a leading position among the examined samples. Streptococci ranked second, while *Pseudomonas*

aeruginosa, although less frequently observed, was noted as a clinically significant pathogen.

The results of the antibiotic susceptibility testing of the isolated microorganisms indicated that certain bacteria exhibited varying degrees of resistance to different antibiotic agents. In particular, *Pseudomonas aeruginosa* demonstrated significant resistance to some antibiotics, which represents an important factor in selecting an appropriate treatment strategy.

Overall, the study results confirmed that staphylococci, streptococci, and *Pseudomonas aeruginosa* play a significant role in the etiology of purulent-inflammatory diseases.

DISCUSSION

The results of the study demonstrated that certain pathogenic bacteria occupy a leading role in the etiology of purulent-inflammatory diseases. The findings obtained during the research confirmed that the most frequently encountered microorganisms in purulent infections include *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa*. These results are consistent with numerous scientific studies.

According to the literature, staphylococci are considered one of the primary etiological agents of skin and soft tissue infections. Scientific investigations conducted by researchers have indicated that *Staphylococcus aureus* plays a significant role in the development of many purulent diseases⁸ [8]. Our study results also confirmed this observation, as staphylococci were the most frequently isolated microorganisms among the examined samples. This can be explained by the adaptability of staphylococci to external environmental conditions, their pathogenic factors, and their ability to produce various enzymes and toxins.

The study also revealed that streptococci occupy an important role in the etiology of purulent infections. According to the literature, streptococci play a key role in the development of soft tissue inflammatory diseases, including phlegmon and erysipelas⁹

⁸ Orinovich, M. V., Baratovna, Z. Z., Rezhametovna, M. N., Abdinasirovich, K. I., & Naurizbaevna, O. Z. (2023). Prospects and Problems of Searching for Highly Effective Drugs with Antiviral and Antimicrobial Activity.

⁹ Sheraliyev, A. (2008). UMUMIY VA QISHLOQ XO'JALIGI FITOPATOLOGIYASI. T—"Talqin, 59-62.

[9]. Our findings are consistent with these data, showing that streptococci represented a significant proportion of the examined samples. This further confirms the widespread occurrence of streptococcal infections in clinical practice.

In addition, *Pseudomonas aeruginosa* was identified in some samples during the study. In scientific literature, this bacterium is often described as one of the major causative agents of nosocomial infections¹⁰ [10]. Its high resistance to antibiotics and aggressive pathogenic properties make it one of the clinically significant microorganisms.

Moreover, the immune system plays a critical role in the interaction between microorganisms and the human body. Some studies indicate that the immune response formed against bacterial antigens is an important factor in the development of infectious processes¹¹ [11]. This shows that the progression of infectious diseases depends not only on the pathogenic properties of microorganisms but also on the immunological status of the organism.

Our study results indicate that multiple microorganisms may participate in the etiology of purulent infections. However, among them, staphylococci, streptococci, and *Pseudomonas aeruginosa* stand out as the leading etiological agents. Timely identification of these microorganisms and determination of their antibiotic susceptibility are crucial for selecting an effective treatment strategy in clinical practice.

Furthermore, the use of modern microbiological laboratory diagnostic methods significantly accelerates the process of identifying the etiological agents of infectious diseases and improves treatment efficacy. Therefore, bacteriological examinations, microscopic techniques, and biochemical tests are highly recommended for diagnosing purulent infections.

¹⁰ Машарипов, В. У. (2011). Система антимикробного иммунитета организма и уровень сенсибилизации к бактериальным антигенам при дисбиозе толстого кишечника. Автореф. дисс. к. м. н.

¹¹ Рахманова, С. С. (2017). Сравнительное изучение циркулирующих в крови антител к условно-патогенным энтеробактериям у здоровых детей и взрослых. Авиценна, (7), 11-14.

CONCLUSION

The conducted study showed that *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa* are the most important pathogenic microorganisms in the etiology of purulent-inflammatory diseases. Among the examined biological materials, staphylococci demonstrated the highest occurrence rate, while streptococci and *Pseudomonas aeruginosa* were also confirmed as clinically significant pathogens.

Modern laboratory diagnostic methods, including bacteriological culture, Gram staining, biochemical tests, and antibiotic susceptibility testing, serve as essential tools for determining the etiology of infections and selecting effective treatment strategies. The results of the study indicate that timely detection of purulent infections and investigation of the pathogenic characteristics of microorganisms significantly improve disease management and treatment effectiveness in clinical practice.

Thus, it can be concluded that microbiological laboratory investigations play a crucial role in the prevention of purulent-inflammatory diseases, optimization of treatment strategies, and the effective selection of antibiotic therapy.

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