JARROHLIK INFEKSIYALARINING ETIOLOGIK TUZILMASI VA ANTIBIOTIKLARGA CHIDAMLI MIKROORGANIZMLARNI ANIQLASH TIZIMINI TAKOMILLASHTIRISH

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Annotatsiya. Jarrohlik infeksiyalari zamonaviy tibbiyotda bemorlarning davolanish jarayonini murakkablashtiruvchi, operatsiyadan keyingi asoratlar va o'lim ko'rsatkichlarining oshishiga sabab bo'luvchi dolzarb muammolardan biridir. Ushbu maqolada jarrohlik infeksiyalarini keltirib chiqaruvchi asosiy patogen mikroorganizmlarning etiologik tuzilmasi, ularning antibiotiklarga chidamlilik xususiyatlari hamda mikrobiologik diagnostika usullarini takomillashtirish masalalari yoritilgan. Tadqiqotda zamonaviy bakteriologik usullar, antibiotik sezuvchanligini aniqlash metodlari, molekulyar-genetik diagnostika texnologiyalari va infeksion nazorat tizimining ahamiyati tahlil qilingan. Antibiotik rezistent mikroorganizmlarni erta aniqlash jarrohlik infeksiyalarining samarali profilaktikasi va davolash strategiyalarini ishlab chiqishda muhim ahamiyat kasb etadi.[1,5]

Kalit so'zlar: jarrohlik infeksiyalari, etiologik tuzilma, antibiotik rezistentligi, mikrobiologik monitoring, patogen mikroorganizmlar, bakterial diagnostika, antibiotik sezuvchanligi, infeksion nazorat.

IMPROVEMENT OF THE SYSTEM FOR IDENTIFYING THE ETIOLOGICAL STRUCTURE OF SURGICAL INFECTIONS AND ANTIBIOTIC-RESISTANT MICROORGANISMS

Abstract. Surgical infections remain one of the major challenges in modern healthcare, contributing to postoperative complications, prolonged hospitalization, and increased morbidity and mortality among patients. This article examines the etiological structure of surgical infections, the prevalence of antibiotic-resistant

microorganisms, and approaches to improving microbiological diagnostic systems. The study analyzes modern bacteriological methods, antimicrobial susceptibility testing, molecular genetic diagnostic technologies, and the role of infection control systems in clinical practice. Early detection of antibiotic-resistant pathogens is essential for developing effective prevention and treatment strategies for surgical infections and reducing the spread of antimicrobial resistance.[1,5]

Keywords: surgical infections, etiological structure, antibiotic resistance, microbiological monitoring, pathogenic microorganisms, bacterial diagnosis, antimicrobial susceptibility testing, infection control.

СОВЕРШЕНСТВОВАНИЕ СИСТЕМЫ ОПРЕДЕЛЕНИЯ ЭТИОЛОГИЧЕСКОЙ СТРУКТУРЫ ХИРУРГИЧЕСКИХ ИНФЕКЦИЙ И АНТИБИОТИКОРЕЗИСТЕНТНЫХ МИКРООРГАНИЗМОВ

Аннотация. Хирургические инфекции являются одной из актуальных проблем современной медицины, поскольку они приводят к развитию послеоперационных осложнений, увеличению сроков госпитализации и повышению риска неблагоприятных исходов у пациентов. В статье рассмотрены этиологическая структура хирургических инфекций, распространенность антибиотикорезистентных микроорганизмов и современные подходы к совершенствованию микробиологической диагностики. Проанализированы методы бактериологического исследования, определения чувствительности микроорганизмов к антибиотикам, молекулярно-генетические технологии диагностики и значение системы инфекционного контроля. Раннее выявление устойчивых патогенов имеет важное значение для разработки эффективных профилактических и лечебных мероприятий при хирургических инфекциях.[1,5]

Ключевые слова: хирургические инфекции, этиологическая структура, антибиотикорезистентность, микробиологический мониторинг, патогенные микроорганизмы, бактериологическая диагностика, чувствительность к антибиотикам, инфекционный контроль.

Relevance of the Topic. Surgical infections represent one of the most important problems in modern healthcare due to their significant impact on postoperative outcomes, patient safety, and healthcare costs. The increasing prevalence of antibiotic-resistant microorganisms has complicated the treatment of surgical infections and reduced the effectiveness of commonly used antimicrobial therapies. Pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and other opportunistic microorganisms are increasingly associated with multidrug resistance, creating serious challenges for clinicians.

The improvement of microbiological monitoring systems is essential for the timely identification of causative microorganisms, determination of their antibiotic susceptibility profiles, and selection of effective antimicrobial treatment strategies. Modern diagnostic approaches, including rapid microbiological identification methods, molecular genetic technologies, and continuous surveillance of antibiotic resistance patterns, play a crucial role in preventing the spread of resistant strains. Therefore, studying the etiological structure of surgical infections and developing improved systems for detecting antibiotic-resistant microorganisms is highly relevant for modern surgery and infection control. Effective microbiological monitoring can contribute to reducing postoperative complications, optimizing antibiotic therapy, improving patient outcomes, and limiting the global spread of antimicrobial resistance.[2,4]

Main Part. Surgical infections are complex pathological conditions caused by the penetration and multiplication of pathogenic microorganisms in tissues after surgical interventions or due to traumatic injuries. The etiological structure of these infections is constantly changing due to the widespread use of antibiotics, increasing antimicrobial resistance, and changes in hospital microbial ecology. Therefore, continuous microbiological monitoring is essential for identifying the dominant pathogens and developing effective treatment and prevention strategies.

The most common causative agents of surgical infections include both Gram-positive and Gram-negative microorganisms. Among Gram-positive bacteria, *Staphylococcus aureus*, including methicillin-resistant *S. aureus* (MRSA), and *Enterococcus* species are frequently detected. Gram-negative pathogens such as *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii* are also important causes of postoperative wound infections. These microorganisms are characterized by their ability to form biofilms, survive in hospital environments, and acquire resistance genes.[3,5]

One of the major challenges in the management of surgical infections is the rapid increase in antibiotic-resistant microorganisms. The development of resistance occurs through various mechanisms, including enzymatic inactivation of antibiotics, modification of target sites, changes in bacterial cell membrane permeability, and active efflux of antimicrobial agents. The emergence of multidrug-resistant strains significantly limits therapeutic options and increases the risk of severe complications.

Modern microbiological monitoring includes several diagnostic stages: collection of clinical samples from infected wounds, microbiological cultivation, identification of microorganisms, and determination of antibiotic susceptibility. Traditional culture-based methods remain important; however, they require considerable time. Therefore, rapid diagnostic technologies such as polymerase chain reaction (PCR), matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS), and automated identification systems are increasingly used in clinical practice.

Antimicrobial susceptibility testing plays a key role in selecting effective therapy. Methods such as disk diffusion, broth microdilution, and automated susceptibility testing systems allow clinicians to determine the sensitivity profile of isolated microorganisms. Regular analysis of antibiotic resistance patterns helps to develop local antimicrobial stewardship programs and optimize empirical antibiotic therapy.[4,5]

The implementation of molecular genetic methods has significantly improved the detection of resistance genes, including genes responsible for methicillin resistance, extended-spectrum beta-lactamase (ESBL) production, and carbapenem resistance. These technologies enable rapid identification of highly resistant pathogens and allow timely implementation of infection control measures. In addition, effective infection prevention requires continuous surveillance of hospital microorganisms, strict adherence to aseptic and antiseptic principles, proper sterilization procedures, and rational antibiotic use. A comprehensive microbiological monitoring system combining classical laboratory methods, advanced molecular diagnostics, and epidemiological surveillance provides an opportunity to reduce the incidence of surgical infections and improve treatment outcomes.

Thus, the identification of the etiological structure of surgical infections and improvement of antibiotic-resistant microorganism detection systems are essential components of modern surgery. These approaches contribute to personalized antimicrobial therapy, prevention of postoperative complications, and reduction of the global burden of antimicrobial resistance.

Materials and Methods. The study was based on the analysis of scientific literature and clinical microbiological data related to surgical infections and antibiotic-resistant microorganisms. Modern scientific publications, clinical guidelines, and research results from international databases were reviewed to evaluate the current state of microbiological monitoring systems.

The research materials included clinical samples obtained from patients with surgical infections, such as wound exudates, pus, tissue samples, and postoperative material. Microbiological investigations involved isolation and identification of pathogenic microorganisms using classical bacteriological methods, including culture on selective and differential nutrient media.[5,6]

The antibiotic susceptibility of isolated microorganisms was assessed using standard antimicrobial susceptibility testing methods, including the disk diffusion

method, minimum inhibitory concentration (MIC) determination, and automated identification systems. The resistance profiles of clinically significant pathogens were analyzed according to international standards.

Modern molecular diagnostic approaches, including polymerase chain reaction (PCR) and detection of specific antibiotic resistance genes, were considered for rapid identification of multidrug-resistant microorganisms. The obtained data were analyzed using descriptive and comparative statistical methods to determine the prevalence of major pathogens, their antimicrobial resistance patterns, and the effectiveness of microbiological monitoring approaches.

The study also evaluated the role of infection control measures, antimicrobial stewardship programs, and continuous microbiological surveillance in reducing the spread of resistant microorganisms in surgical departments. The integration of laboratory diagnostics and epidemiological monitoring was considered as an important strategy for improving the management of surgical infections.[7,8]

Conclusion. Surgical infections remain a significant challenge in modern medicine due to the increasing prevalence of antibiotic-resistant microorganisms and the complexity of their treatment. The analysis of the etiological structure of surgical infections demonstrates that both Gram-positive and Gram-negative pathogens play an important role in the development of postoperative complications, with multidrug-resistant strains becoming increasingly common.

The improvement of microbiological monitoring systems, including rapid identification methods, antimicrobial susceptibility testing, and molecular genetic diagnostics, provides an opportunity for early detection of resistant microorganisms and selection of effective antimicrobial therapy. Continuous surveillance of pathogen distribution and antibiotic resistance patterns is essential for optimizing treatment strategies and preventing the spread of resistant strains.

The implementation of comprehensive infection control programs, rational antibiotic use, and modern microbiological diagnostic technologies can significantly reduce the incidence of surgical infections, improve patient outcomes,

and decrease the risk of postoperative complications. Further development of integrated microbiological monitoring systems is necessary to ensure effective prevention and management of surgical infections in clinical practice.[9,10]

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