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# INFECTION CONTROL IN THE CONDITIONS OF A MULTIDISCIPLINARY HOSPITAL

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# ІНФЕКЦІЙНИЙ КОНТРОЛЬ В УМОВАХ БАГАТОПРОФІЛЬНОГО СТАЦІОНАРУ

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**Summary/Резюме**

The purpose of the study is to evaluate the effectiveness of the system of infection control measures in the conditions of a multidisciplinary hospital.

The study was performed on the basis of the multidisciplinary medical center (university clinic) of the Odesa National Medical University in 2023. The results of epidemiological monitoring were analyzed (the number of postoperative infectious complications, the length of stay of patients in the hospital). In addition, an analysis of the qualitative composition of microbiocenoses of exudates obtained from drains in the early postoperative period and biofilms fixed on drains and catheters was performed. In addition, 20 employees of departments of a multidisciplinary medical center were interviewed regarding the importance of various risk factors for SSI and other types of postoperative infectious complications. Statistical processing was carried out by methods of variance analysis using Excel software (MS Office 2021, Microsoft Inc., USA).

In 62.5% of cases, confirmed SSI were registered in patients of surgical departments. The frequency of SSI in gynecological patients did not exceed 9.2% of their total number in the hospital. The studied samples are dominated by multicomponent microbial associations, consisting mainly of Str. haemolyticus, Str. epidermidis, Str. viridans, Str. Warneri, St. capitus, St. aureus, Ent. faecium, E.coli. The type of surgical intervention, its duration and the state of microbiocenoses of the patient's skin are the main factors in the success of infection control measures in a multidisciplinary hospital.

***Key words:*** *infection control, surgical site infections, microbiocenosis, forecasting*



Метою дослідження є оцінка ефективності системи заходів інфекційного контролю в умовах багатопрофільного стаціонару.

Дослідження виконане на базі багатопрофільного медичного центру (університетська клініка) Одеського національного медичного університету у 2023 р. Проаналізовані результати епідеміологічного моніторингу (кількість післяопераційних інфекційних ускладнень, тривалість перебування хворих в стаціонарі). Додатково проведений аналіз якісного складу мікробіоценозів ексудатів, одержаних по дренажах у ранньому післяопераційному періоді, та біоплівок, фіксованих на дренажах і катетерах. Додатково опитано 20 працівників відділень багатопрофільного медичного центру щодо важливості різних чинників ризику ІМХВ та інших видів післяопераційних інфекційних ускладнень. Статистична обробка проводилася методами дисперсійного аналізу за допомогою програмного забезпечення Excel (MS Office 2021, Microsoft Inc., США).

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У 62,5% випадків підтверджені ІМХВ реєструвалися у хворих хірургічних відділень. Частота ІМХВ у гінекологічних пацієнтів не перевищувала 9,2% від загального їх числа у стаціонарі. У досліджених зразках переважають мультикомпонентні мікробні асоціації, що місять переважно Str. haemoliticus, Str. epidermiditis, Str. viridans, Str. warneri, St. capitus, St. aureus, Ent. faecium, E.coli. Вид оперативного втручання, його тривалість та стан мікробіоценозів шкіри пацієнта є основними факторами успішності заходів інфекційного контролю у багатопрофільному стаціонарі.

***Ключові слова:*** *інфекційний контроль, інфекції місця хірургічного втручання, мікробіоценоз, прогнозування*

More than 230 million major surgical interventions are performed annually in the world [1, 2]. Hospital-acquired infections are serious complications that increase the risk of mortality, prolong the length of hospital stay, and increase health care costs. Even after the introduction of modern infection control technologies, the frequency of nosocomial infection is 5–10%, rising to 30% in intensive care unit patients, especially in conditions of use of invasive devices [2].

A special place in the structure of hospital infection is occupied by surgical site infections (SSI), the frequency of which, according to various researchers, ranges from 0.9% of the number of operations in the USA (NHSN 2014), to 2.6% in Italy, 2.8% in Australia (2002–13, VICNISS), 2.1% in the Republic of Korea (2010–11), to 6.1% in low-middle-income countries (WHO, 1995–2015) and 7.8% in South-East Asia (SEA) and Singapore (combined incidence from 2000 to 2012) [3-5]. According to Salmanov A.G. the frequency of MI after planned operations in Ukrainian hospitals is (28.6±1.75)% per 100 operations, after emergency operations - (26.4±1.07)% per 100 operations [6].

Recently, modern molecular genetic methods are increasingly used for the needs of epidemiological surveillance. Thus, the method of whole-genome sequencing (WGS) allows better investigation of outbreaks in hospitals [7, 8]. In recent years, the cost of using methods for sequencing isolates and primary clinical samples has decreased, and the method of polymerase chain reaction (PCR) has become routine for hospital epidemiology, which makes them available even for developing countries [7].

Traditionally, sanitary-technical, sanitary-hygienic, epidemiological, and organizational-planning measures are distinguished in the prevention of hospital infection [2]. The infection control system combines organizational, preventive, and anti-epidemic measures aimed at preventing the occurrence, spread, and reduction of the level of infectious diseases, including postoperative infections, and mortality; and economic damage from these diseases [2, 9, 10]. It is especially difficult to implement measures in the conditions of multidisciplinary treatment and prevention institutions, with a significant degree of centralization and the presence of saturated nodes of interaction of various departments and intensive traffic of patients, visitors and staff [2, 9].

The purpose of the study is to evaluate the effectiveness of the system of infection control measures in the conditions of a multidisciplinary hospital.

Material and methods. The study was carried out on the basis of the multidisciplinary medical center (university clinic) of the Odesa National Medical University in 2023. The results of epidemiological monitoring (the number of postoperative infectious complications, the length of stay of patients in the hospital) were analyzed [11]. In addition, an analysis of the qualitative composition of microbiocenoses of exudates obtained from drains in the early postoperative period and biofilms fixed on drains and catheters was performed [12]. In addition, 20 employees of departments of a multidisciplinary medical center were interviewed

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regarding the importance of various risk factors for IMHV and other types of postoperative infectious complications [13]. Statistical processing was carried out by variance analysis methods using Excel software (MS Office 2021, Microsoft Inc., USA) [14].

## The results

The number of registered cases of nosocomial infection was small (Fig. 1). They were registered mainly in surgical departments, the department of invasive diagnostics and the gynecological department.

When analyzing the qualitative microbiocenosis of exudates obtained from drains in the early postoperative period and biofilms fixed on drains and catheters, data were obtained in favor of the existence of multicomponent microbial associations, which contained mainly Str. haemolyticus, Str. epidermidis, Str. viridans, Str. Warneri, St. capitus, St. aureus, Ent. Faecium, E.coli. Klebsiella (Kl. pneumoniae, Kl. oxytoca) were much less frequently restored. In isolated cases, isolates of Acinobacter baumani, Pseudomonas studzensi et aeruginosa, Neisseria sicca, Enterococcus faecalis, Morganella morganii were determined (table 1).

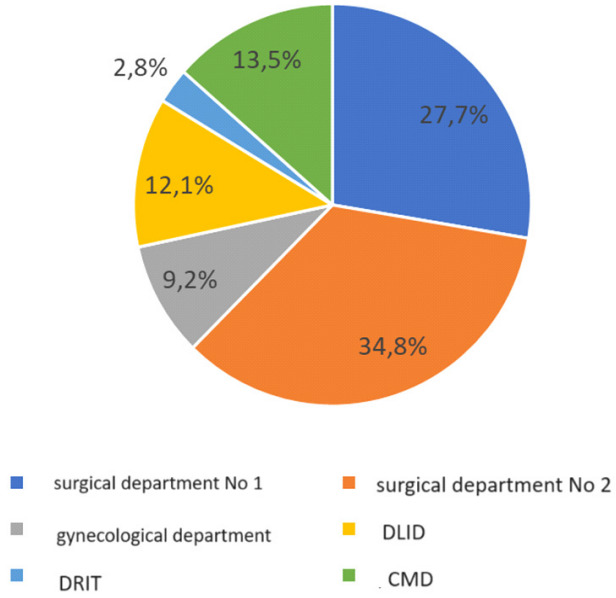


Fig. 1. Number of registered cases of nosocomial infection

As can be seen from the above, transient skin microorganisms and fecal flora prevailed in the composition of microbiocenoses. It should be noted that only streptococci were cultured in the gynecological department, and the total number of isolates was 9.2% of the total number of positive samples.

According to the results of the survey, the factors that, according to the experts, are decisive in determining the risk of IMHV and other infectious complications are highlighted (Fig. 2). This is, first of all, the type of surgical intervention, its duration, the degree of contamination of the wound and the state of microbiocenosis of the patient's skin, as well as the use of antibiotic prophylaxis. Experts paid much less attention to the nomenclature of antiseptics, the experience of the surgeon/interventionist, and the

*Table*

**Frequency of detection of various microorganisms (monitoring data)**

| Microorganisms | Frequency | |
|---|---|---|
| | Abs. | % |
| E. coli | 9 | 4,7 |
| Str. haemolyticus | 45 | 23,4 |
| Str. epidermiditis | 85 | 44,3 |
| St. aureus | 14 | 7,3 |
| Str. viridans | 2 | 1,0 |
| Str. warneri | 3 | 1,6 |
| St. capitus | 3 | 1,6 |
| Kl. oxytoca | 1 | 0,5 |
| Kl. pneumoniae | 5 | 2,6 |
| Ent. facium | 3 | 1,6 |
| Acinobacter baumani | 1 | 0,5 |
| Ps. strudzeni | 1 | 0,5 |
| Neisseria sicca | 1 | 0,5 |
| Enterococcus faecalis | 1 | 0,5 |
| Morganella morganii | 1 | 0,5 |

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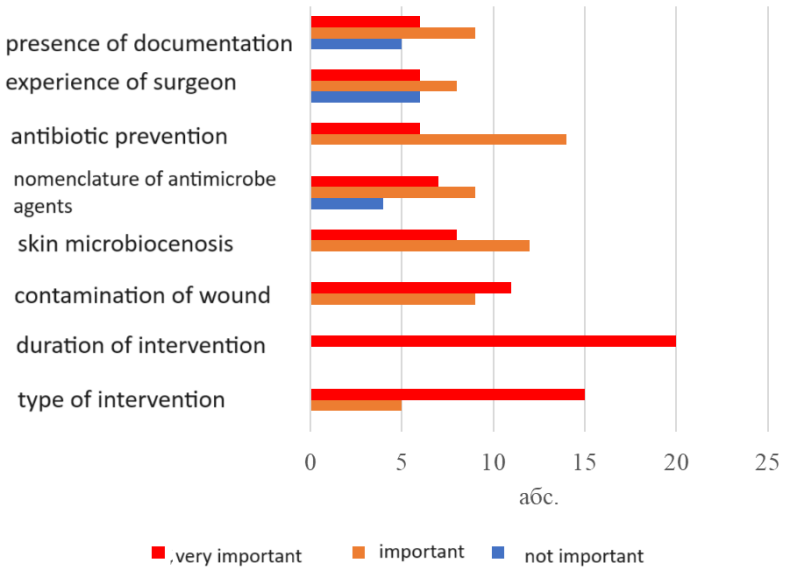


Fig. 2 The results of the Delphi survey

availability of documentation on infection control at the workplace.

The influence of surgical factors on the risk of postoperative infections is of primary importance, as they significantly affect the susceptibility of patients to infections after surgical interventions. These factors encompass various elements of the surgical process, including surgical technique and considerations related to the surgical environment, presence of foreign materials, and other critical factors.

The choice of surgical technique plays a key role in determining the risk of postoperative infections. This decision depends on the size and nature of the incisions made during surgery. Open surgical procedures, which are characterized by larger incisions, inherently create a larger wound area, potentially increasing the risk of contamination and subsequent infection. Conversely, minimally invasive procedures, such as laparoscopic or robotic surgery, have smaller incisions, which reduces tissue trauma. This reduction in tissue exposure reduces the risk of infection by minimizing potential entry points for pathogens.

The duration of surgery is inextricably linked to the potential risk of infection. Prolonged operations expose patients to long-term exposure to pathogens, which disrupts tissue perfusion. Prolonged exposure to surgical instruments, equipment, and the operating environment increases the likelihood of bacterial contamination and subsequent development of infection.

When analyzing which operations most often caused SSI it was found that laparotomic hysterectomy poses the greatest risk. Given the specificity of the contingent treated at the university clinic, there were no patients with purulent-inflammatory diseases of the pelvic organs in the studied sample, so the factors of infection may be related to the peculiarities of the skin microbiocenosis of the operated women and the level of contamination of the hospital environment.

Insertion of surgical implants, devices, or foreign materials increases the risk of infection. These foreign bodies represent surfaces where bacteria can adhere and form biofilms, challenging the immune system's ability to fight infection.

Proper sterilization of surgical instruments and maintenance of a sterile surgical environment are critical to preventing postoperative infections. Inadequate sterilization or contamination of surgical instruments creates a direct route for the transmission of pathogens into the patient's body. Strict adherence to strict sterilization protocols, thorough cleaning of instruments, and strict adherence to infection control practices are imperative to reduce this risk.

Surgical procedures that are performed as emergencies, instead of routine operations, may carry an increased risk of infections. The urgency of emergency surgery often requires less preoperative preparation, resulting in a higher risk of infection due to limited time for comprehensive sterilization and preparation procedures.

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An important element of the infection control system is the organizational measures, established practices, standard operating procedures and conditions in the medical institution that significantly affect the risk of infections after surgical procedures.

Strict adherence to infection control practices is a cornerstone in preventing healthcare-associated infections. This includes strict adherence to hand hygiene protocols, aseptic techniques, and sterile procedures. Regular and thorough hand washing by healthcare personnel is critical to minimizing the transmission of potential pathogens from person to person. Aseptic techniques ensure that the surgical environment and procedures are as free from contamination as possible, which reduces the risk of introducing harmful microorganisms during surgery. During sterile procedures, sterile gloves, gowns, surgical linen, and instruments are used to maintain a sterile field and minimize the risk of introducing pathogens into the patient's body.



Appropriate preoperative antibiotic administration, known as antimicrobial prophylaxis, is a critical preventive measure against postoperative infections. Prescribing the right antibiotics at the right time helps manage potential pathogens that may be introduced during surgery. By reducing the microbial load before the procedure, antimicrobial prophylaxis significantly reduces the risk of infection. However, it is important to follow evidence-based antibiotic recommendations to avoid the development of antibiotic resistance [2, 11].

The hospital environment can contribute to the risk of infections, especially hospital-acquired infections. Patients undergoing surgery are vulnerable to pathogens from other infected patients or contaminated surfaces in the hospital environment. Effective cleaning and disinfection of surfaces, equipment, and patient care areas is imperative to minimize the potential for cross-contamination. Isolation of patients from known infections and implementing strict infection control protocols can help contain the spread of pathogens in the hospital environment.

When ranking the factors that influenced the risk of SSI and determined the success of infection control measures, the type of surgical intervention, its duration, the degree of wound contamination and the state of the patient's skin microbiocenosis were of the greatest importance.

**Conclusions:**

1. In 62.5% of cases, confirmed SSI were registered in patients of surgical departments
2. The frequency of SSI in gynecological patients does not exceed 9.2% of the total number of them in the hospital
3. The studied samples are dominated by multicomponent microbial associations, consisting mainly of Str. haemolyticus, Str. epidermidis, Str. viridans, Str. Warneri, St. capitus, St. aureus, Ent. faecium, E.coli
4. The type of surgical intervention, its duration and the state of microbiocenoses of the patient's skin are the main factors in the success of infection control measures in a multidisciplinary hospital.

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