



Boyko-Maksimova G.¹, Tagieva F.¹ ✉, Trofimuk V.²

¹ Belarusian State Medical University, Minsk, Belarus

² LLC "LuxSmile Plus", Brest, Belarus

Antiseptics of the Skin of Medical Staff

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Contacts: faridatagieva70@gmail.com

Abstract

Purpose. To study protocols for hand skin treatment for personnel in Belarusian medical institutions and to increase awareness among medical specialists and healthcare workers.

Materials and methods. Analysis of regulatory documents, WHO recommendations, and scientific literature on hand hygiene and antiseptics.

Results. Hand hygiene compliance remains insufficient (~40%). The use of standardized protocols improves effectiveness.

Conclusion. Monitoring systems and adherence to protocols are key to preventing infections.

Keywords: hand hygiene, antiseptics, healthcare-associated infections, medical personnel, microflora, disinfection

Бойко-Максимова Г.И.¹, Тагиева Ф.Р.¹ ✉, Трофимук В.А.²

¹ Белорусский государственный медицинский университет, Минск, Беларусь

² ООО «Люкссмайл Плюс», Брест, Беларусь

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Контакты: faridatagieva70@gmail.com

Резюме

Цель. Изучить протоколы обработки кожи рук персонала в медицинских учреждениях Беларуси и повысить осведомленность медицинских специалистов и работников здравоохранения.

Материалы и методы. Анализ нормативных документов, рекомендаций ВОЗ и научной литературы по вопросам гигиены рук и антисептики.

Результаты. Соблюдение правил гигиены рук остается недостаточным (~40%). Использование стандартизированных протоколов повышает эффективность.

Заключение. Применение систем мониторинга и соблюдение протоколов являются ключевыми факторами профилактики инфекций.

Ключевые слова: гигиена рук, антисептики, инфекции, связанные с оказанием медицинской помощи, медицинский персонал, микрофлора, дезинфекция

■ INTRODUCTION

Control of healthcare-associated infections is impossible without achieving high levels of hand hygiene compliance among healthcare personnel. However, empirical data indicate that correct hand hygiene is achieved in only 40% of cases. This situation is due, in part, to a lack of infrastructure and financial resources to ensure the availability of antiseptics. Nevertheless, the use of various strategies and their combinations, based on World Health Organization (WHO) recommendations, has demonstrated a positive impact on hand hygiene compliance, as confirmed by the results of numerous studies. Hand hygiene is a primary measure for the prevention of hospital-acquired infections (HAIs) and the control of the spread of antimicrobial resistance in pathogens. Despite this, the problem of insufficient hand hygiene compliance among healthcare personnel remains unresolved. WHO studies have identified inaccuracies in hand hygiene compliance among healthcare personnel in both developed and developing countries.

■ PURPOSE

To study protocols for hand skin treatment for personnel in Belarusian medical institutions and to increase awareness among medical specialists and healthcare workers.

■ RESULTS

In the Republic of Belarus, the method of hand treatment is regulated by the Instructions for Use "Hygienic and Surgical Antisepsis of the Skin of the Hands of Medical Personnel", registration No. 113-0801 dated September 5, 2001.

The microflora that inhabits it are epidemiologically dangerous. The microbiological background of the hands is represented by the following flora:

- resident 10–20%;
- transient 80–90%;
- infectious up to 100%.

Human skin is populated by resident flora—microorganisms that are constantly present and multiply on its surface. The highest levels of colonization are found in the subungual, periungual, and interdigital spaces. These microorganisms are generally not pathogenic on intact skin, but if the skin or mucous membranes are damaged, they can initiate an infection.

Resident skin microflora provides colonization resistance by preventing the adhesion of pathogens through microbial antagonism and species competition within the skin ecosystem. The majority of resident microflora resides in the epidermis, primarily in the stratum corneum. Up to 20% of this flora resides in the deeper layers of the dermis, including sebaceous and sweat glands, as well as hair follicles. For example, *S. aureus* is found in the nose of approximately 20% of healthy individuals and very rarely colonizes

the skin of the hands. However, if the skin epithelium is damaged, especially in healthcare settings, it can be detected in healthcare personnel. Hygienic procedures such as hand washing and the use of antiseptics do not completely eliminate resident microflora but can significantly reduce its colonization.

Transient microflora are temporary microorganisms that healthcare workers acquire during their professional activities. They come into contact with infected patients or contaminated objects. Transient flora may include microorganisms such as *Escherichia coli* (*E. coli*), *Klebsiella* spp.), *Staphylococcus aureus* (*S. aureus*), and *Candida* fungi (*C. albicans*); gram-negative microorganisms are less common [2]. The longer a healthcare worker is in contact with a patient, the more transient bacteria may appear on their hands. On average, for every minute of contact, their number increases by approximately 5 colony-forming units (CFU) [2]. Sometimes these microorganisms, which can cause nosocomial infections in patients, are found only on the hands of healthcare personnel. Transient flora does not remain on the skin of the hands for long and is easily removed by regular handwashing with soap or using antiseptics.

Infectious (pathogenic) flora are microorganisms capable of causing infectious and inflammatory diseases, including nosocomial infections. Pathogenic microorganisms include, for example, *Staphylococcus aureus* (*Staphylococcus aureus*) and beta-hemolytic streptococci. They are often found in skin infections such as abscesses, whitlows (purulent inflammation of the fingers), paronychia (inflammation of the nail fold), and infectious eczema [2].

WHO offers a standardized protocol, "5 steps of hand hygiene," which enables healthcare personnel to systematically monitor hand health:

- before direct contact with the patient;
- before performing any medical procedure;
- after completion of a medical procedure or contact with biological fluids;
- after cessation of contact with the patient;
- after contact with environmental objects.

The hands of medical personnel treating dental patients in outpatient or inpatient settings are often dominated by resistant microflora—a population of microorganisms exhibiting reduced sensitivity to antiseptics. Complete elimination of this resistant microflora, typically represented by gram-negative opportunistic pathogens, is not achieved through standard hand washing or antiseptic procedures. It has been established that the highest microbial contamination occurs on the distal phalanges of the fingers, with subsequent reductions in the interdigital spaces and on the forearms [1]. Therefore, these areas require special attention during hand hygiene.

It should be noted that gloves alone do not provide absolute protection from infectious contamination for either healthcare workers or patients. Therefore, even when working with gloves, hand hygiene and antiseptic treatment remain mandatory. Gloves protect personnel from potential contamination and act as an additional barrier to prevent cross-infection. Scientific data indicate that even when gloves are used, up to 15% of cases of gram-negative microorganisms and enterococci from the patient's mouth are transferred to the hands of healthcare workers. The level of contamination of the gloves themselves is significantly higher, making it impossible to reprocess them between patients. Therefore, when antiseptic procedures are followed, changing gloves between each new patient is mandatory [1].

Hand treatment is divided into three levels:

- mechanical hand treatment (social level);
- hygienic hand treatment (hand treatment using antiseptics);
- surgical hand treatment (a special sequence of manipulations when (hand treatment followed by putting on sterile gloves)

Mechanical hand treatment

Mechanical hand washing aims to eliminate a significant portion of transient microflora from the skin (without the use of antiseptics) and remove visible contaminants. An additional objective is to decontaminate hands with spore-forming bacteria, particularly *Clostridium difficile*, in healthcare settings. It has been established that simple hand washing can reduce the number of bacterial spores by approximately 2-fold, regardless of the duration of the procedure [2]. Maintaining the integrity of the stratum corneum and maintaining the relative stability of resident microflora prevents the colonization of the skin by pathogenic microorganisms. Soap used for standard hand washing does not contain active antimicrobial agents [2]. The use of abrasive brushes and highly alkaline detergents during hand washing can lead to destruction of the stratum corneum and disruption of the species balance of resident microflora, which provokes the development of skin dysbiosis followed by colonization by gram-negative bacteria. Bar soap should not be used in healthcare settings due to its contamination and potential role as a reservoir for pathogens such as *Pseudomonas aeruginosa* or *Klebsiella pneumoniae* [2]. Liquid soap is the preferred option. Simple hand washing has a minor effect on resident microflora (average reduction of 0.32 times after 30 seconds), whereas with a washing duration of 30 seconds or more, a reduction of approximately 2 times in transient microflora is observed.

Similar hand treatment is carried out:

- after using the toilet;
- before eating or before working with food;
- before and after physical contact with the patient;
- in case of any contamination of hands.

Necessary equipment:

1. Liquid neutral soap in a dose or individual disposable Bars of soap. It's best if the soap doesn't have a strong scent. Open liquid or bar reusable non-personalized soap quickly becomes infected with microbes.
2. Disposable wipes measuring 15×15 cm, clean for blotting hands. Using a towel (even a personal one) is not advisable, because it does not have time to dry out and, in addition, is easily contaminated with microbes.

Hand sanitization rules

To ensure maximum hand cleanliness, remove all jewelry and watches before washing. This is done to allow the soap to have unimpeded contact with the entire skin surface. Handwashing consists of two sequential steps. It is believed that the initial lathering and rinsing with warm water effectively removes most germs from the skin's surface. Warm water and gentle self-massage open the skin's pores. This creates conditions for deeper cleansing during the second lathering and rinsing, which removes the germs accumulated in the open pores. Each step includes lathering and thoroughly rinsing with

warm running water. It is important to note that warm water enhances the effectiveness of soap or sanitizer, while hot water can damage the skin's natural protective oil layer. Using regular bar soap can be less hygienic, as it promotes the dispersal of bacteria from the skin, increasing the risk of infection. In addition, household soap often leaves the skin dry and irritated, unlike specialized alcohol-based antiseptics, which contain moisturizing ingredients that promote healthy skin.

Hygienic hand treatment

Hand hygiene with antiseptics aims to remove or wash away transient microorganisms from the skin. This process has a dual effect: mechanical removal of bacteria and fungi, as well as their chemical destruction with disinfectants. The history of antiseptic use in medicine began in 1847, when Ignaz Semmelweis first used chlorine water to clean hands. Modern liquid soaps used for this purpose contain biocidal components. Frequent use of antimicrobial soaps can cause skin irritation, as skin sensitivity depends on the type and composition of the cleanser. The addition of substances such as chlorhexidine or octenidine to antiseptics also affects how well the skin tolerates their irritating effects. Most antiseptics are based on alcohols such as ethanol, isopropanol, or n-propanol, or mixtures thereof. Their concentrations typically range from 60% to 95%, with higher alcohol concentrations generally providing greater antimicrobial activity. Despite this, with frequent use of various antiseptics, individual skin intolerance may occur. However, the risk of developing an allergic reaction (sensitization) to skin antiseptics is very low. Interestingly, some antiseptic gels can improve skin hydration.

Similar hand treatment is carried out:

- before putting on gloves and after removing them;
- before any physical contact with the patient;
- before and after performing invasive procedures, minor surgical manipulation;
- after contact with biological fluids (for example, emergency situations with blood);
- after using the toilet;
- before going home.

Necessary equipment:

1. Liquid dosed pH-neutral soap or individual disposable soap bars.
2. Disposable clean napkins measuring 15×15 cm.
3. Skin antiseptic.

Hand sanitization rules

Hand hygiene consists of two stages: mechanical hand cleaning and disinfection of hands with skin antiseptic. After completing the mechanical cleaning stage (double soaping and rinsing) the antiseptic is applied to the hands in an amount of at least 3 ml and Rub thoroughly into the skin until completely dry (do not wipe your hands).

If the hands were not contaminated (for example, there was no contact with the patient), then the first step is skipped and you can immediately apply the antiseptic. Each the movement is repeated at least 5 times. Hands are treated for 30 seconds – 1 minute.

Among the variety of methods for treating hand skin, there is only one method has received the qualifications of a European standard and is registered as "European Norm 1500" (EN 1500). This method is the most optimal for hygienic and surgical hand antisepsis of personnel.

Sequence of movements when treating hands EN 1500:

1. Rub one palm against the other palm in a back and forth motion.
2. Rub the back of your left hand with your right palm, then change hands.
3. Connect the fingers of one hand in the spaces between the fingers of the other, rub the inner surfaces of the fingers with upward and downward movements.
4. Interlock your fingers and rub the palm of your other hand with the back of your bent fingers.
5. Grasp the base of the left thumb between the thumb and index fingers of the right hand, using rotational friction. Repeat on the wrist. Switch hands.
6. Rub the palm of your left hand with the fingertips of your right hand in a circular motion, then change hands.

Requirements for hand treatment with an antiseptic:

- rub the antiseptic only into dry skin;
- use an adequate amount of antiseptic (avoid excess), for which it is necessary to use elbow dispensers;
- do not use napkins, sponges, tampons or other foreign objects to apply the drug;
- alternate the use of antiseptics containing active ingredients with different mechanisms of antimicrobial action;
- careful execution of the processing technique;
- observe the sequence of actions, dosage of the drug and exposure of treatment at each stage.

Surgical treatment of hand skin

The goal of surgical hand debridement is to remove transient microorganisms and significantly reduce resident microflora to levels incapable of causing infection. Traditional handwashing with antiseptic soap (chlorhexidine or povidone-iodine) is giving way to more effective methods, such as intensive rubbing of skin antiseptics. The advantages of the latter include faster onset of antimicrobial action, a broader spectrum of activity against pathogens, and the elimination of the risk of recontamination when subsequently rinsing with water.

Surgical treatment of hands is performed:

- before surgical interventions;
- before serious invasive procedures.

Necessary equipment:

1. Liquid dosed pH-neutral soap or individual disposable soap bars.
2. Napkins measuring 15×15 cm, disposable, sterile.
3. Skin antiseptic.
4. Disposable sterile surgical gloves.

Surgical hand preparation consists of three stages:

- mechanical cleaning of hands;
- hand disinfection cutaneous antiseptic;
- closing hands sterile disposable gloves.

Rules for surgical hand preparation according to EN 1500:

1. Mechanical cleaning:
 - mandatory conditions are the inclusion of forearms in the treatment for blotting Sterile wipes are used, and hand washing itself lasts at least 2 minutes;

- after drying additionally are being processed nail lodge and periungual folds with disposable sterile wooden sticks soaked in an antiseptic solution;
 - it is not necessary to use brushes. If brushes are used, then it is necessary use sterile, soft, single-use brushes or brushes that can withstand autoclaving, but brushes should only be used for treatment of periungual areas and only for the first treatment within work shift.
2. After the mechanical cleaning stage is completed, the hands are treated with antiseptic:
 - in portions of 3 ml and, without allowing it to dry, rub into the skin;
 - strictly following the sequence of movements;
 - procedure for applying skin antiseptic treatment is repeated at least twice, the total consumption of antiseptic is 10 ml, the total procedure time is 5 minutes.
 3. Sterile gloves are put on only on dry hands.

At if the duration of work in gloves is more than 3 hours, the treatment is repeated changing gloves.
 4. After removing the gloves, wipe your hands again with a napkin soaked in skin antiseptic, then wash with soap and moisturize with a softening agent cream.
- Requirements for antiseptics for treating hand skin:
- must have a broad spectrum and a sufficiently high level of antimicrobial action (bacterio-, tuberculo-, virucidal, fungicidal);
 - must have a rapid disinfecting effect (for hygienic antiseptics – 30 sec – 1 min, for surgical – 5 min);
 - there should be no skin-irritating, allergenic, or general toxic effects;
 - must have residual action;
 - should not provoke the development of resistance in microorganisms;
 - economic accessibility.

According to the requirements of the Resolution of the Ministry of Health of the Republic of Belarus dated July 5, 2017 No. 73 "On approval of the Sanitary norms and rules "Sanitary and epidemiological requirements for organizations providing medical care, including the organization and implementation of sanitary and anti-epidemic measures to prevent infectious diseases in these organizations", recognition as invalid According to certain regulations of the Ministry of Health of the Republic of Belarus, personnel must wear gloves when performing medical procedures.

Basic rules for working with gloves

Preparation for working with a patient:

- Hand hygiene comes first: Wash your hands thoroughly with soap before any contact with the patient.
 - Clean and well-groomed hands: Nails should be trimmed short and free of polish. Remove all jewelry and watches before putting on gloves.
 - Choosing the Right Gloves: Use gloves that are the right size for your needs.
 - Treatment of non-sterile gloves: If you use non-sterile gloves, treat them with 70% ethyl alcohol or another suitable antiseptic.
- Using gloves while working:
- Change after each patient: After completing work with each patient, be sure to remove used gloves and put on new ones.

- Protection against contamination: Do not allow gloves to come into contact with mucous membranes or exposed skin.
After working with gloves:
- Repeated hand hygiene: After removing gloves, be sure to wash your hands again with soap.
- Movement restrictions: Do not leave your work area while wearing gloves.
Proper storage of gloves:
- Avoid harmful influences: Store gloves away from heat sources (radiators, air conditioners), direct sunlight, UV radiation, and X-ray machines. These factors may damage the glove material.

■ CONCLUSION

Hand hygiene for healthcare personnel plays a key role in preventing the spread of infections acquired in healthcare facilities. Basic hand hygiene methods include handwashing with soap, which is effective when hands are visibly contaminated or have come into contact with disinfectants that are resistant to disinfectants. Microorganisms, such as *C. difficile* bacterial spores, and hand disinfection are essential. To improve hand hygiene compliance among healthcare personnel, it is necessary to establish or improve a system for monitoring hand hygiene compliance. It is also important to develop and implement specific metrics to assess the effectiveness of these procedures. Healthcare organizations should also foster a safe environment where employees feel comfortable reporting errors or violations without fear of reprisal. To improve compliance, it is recommended to encourage healthcare organizations to undergo accreditation. This process allows for the timely identification of deviations from established standards and suggests ways to address them.

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