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Ameliyathanedeki Sağlık Profesyonellerinin Cerrahi El Yıkama Prosedürleri: Aseptik Ellerin Gücü
Surgical Handwashing Procedures of Health Professionals in The Operating Room: The Power of Aseptic Hands

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ÖZET

Hastane enfeksiyonları, hastanede yatış süresini uzatan, morbidite ve mortaliteyi artıran, ayrıca tedavi maliyetlerini yükselten önemli bir sağlık sorunu olarak öne çıkmaktadır. Bu enfeksiyonların yayılmasında, özellikle sağlık profesyonellerinin elleri, mikroorganizmaların hastaya geçişinde kritik bir rol oynamaktadır.Yüksek morbidite, mortalite ve tedavi maliyetleri ile sonuçlanan bu enfeksiyonlardan korunmanın en etkili yöntemlerinden biri, yeterli ve doğru el hijyeninin sağlanmasıdır. Çağdaş sağlık hizmetleri anlayışı, sağlığın korunması ve geliştirilmesine odaklanmakta olup, bu çerçevede her bireyin kişisel hijyen kurallarına uyması, sağlığının korunması açısından büyük bir öneme sahiptir. El yıkama, hastane enfeksiyonlarını önlemenin ve oranlarını azaltmanın en etkili, basit ve maliyet açısından en uygun yolu olarak kabul edilmektedir. Özellikle ameliyathanelerde hastane enfeksiyonlarının başında gelen cerrahi alan enfeksiyonu olgularını önlemek için uygun bir cerrahi el yıkama prosedürünün sürdürülmesi gerekmektedir. Ameliyathanede çalışan sağlık profesyonellerinin, el temizliğini doğru bir şekilde ve yeterince uygulaması hem meslek risklerinin azaltılmasına hem de hastane enfeksiyonlarının etkin bir şekilde kontrol altına alınmasına önemli bir katkı sağlamaktadır.

Anahtar Kelimeler: Cerrahi, El yıkama, Cerrahi ovalama, Ameliyathaneler.

ABSTRACT

Nosocomial infections stand out as an important health problem that prolongs hospitalization, increases morbidity and mortality, and increases treatment costs. In the spread of these infections, especially the hands of healthcare professionals play a critical role in the transmission of microorganisms to the patient. One of the most effective methods to prevent these infections, which result in high morbidity, mortality and treatment costs, is to ensure adequate and correct hand hygiene. The contemporary understanding of health services focuses on the protection and promotion of health, and within this framework, the compliance of each individual with personal hygiene rules is of great importance in terms of protecting their health. Hand washing is recognized as the most effective, simple and cost-effective way to prevent and reduce the rates of nosocomial infections. It is necessary to maintain an appropriate surgical handwashing procedure to prevent surgical site infection (SSI), which is the leading cause of nosocomial infections, especially in operating rooms. The correct and adequate application of hand hygiene by healthcare professionals working in the operating room contributes a important to both the reduction of occupational risks and the effective control of nosocomial infections.

Keywords: Surgery, Handwashing, Surgical scrubbing, Operating rooms

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INTRODUCTION

One of the most important threats to patient safety is nosocomial infections. Studies conducted worldwide for a long time have shown that hand hygiene is the most important tool in the control and prevention of healthcare-associated infections. Healthcare professionals, especially their hands, play a critical role in the spread of these infections (1). Microorganisms can be transmitted to the patient through the hands of healthcare professionals, which can lead to rapid spread of infections. Therefore, hand hygiene is of great importance for infection control in hospitals (2).

Considering the prevalence of nosocomial infections, SSI is among the most common cases and accounts for 20% of nosocomial infections (3). However, in the perioperative period, the hands of healthcare professionals are the most important source of microbial contamination including transient and persistent microorganisms (4). The surgical hand washing procedure of healthcare professionals in the operating room is one of the most basic and effective practices to prevent nosocomial infections by removing microorganisms from their hands. Especially for surgeons and surgical nurses in the operating room, surgical hand washing is extremely important both to ensure personal hygiene and to ensure the safety of patients (5). Inadequate hand hygiene paves the way for the spread of infections. This may pose serious threats to both the health of patients and the efficiency of healthcare services (6).

In this review, current information on surgical handwashing procedures of operating room professionals is presented. In this context, the aim of our study is to provide a guiding resource on the current situation regarding the surgical handwashing procedure, especially for healthcare professionals who work or are candidates to work in the operating room.

Natural Bacterial Flora on the Hand

In order to better understand the purpose of different hand hygiene practices, it is important to examine the skin flora. In the human body, normal bacterial skin flora varies according to anatomical regions (7). In general, two different communities of microorganisms are found on the skin and especially on the hands. One of these is the microorganisms that are permanently resident on the skin; the other is the transient microorganisms that are transmitted by external factors, i.e. contamination, for a short period of time. These two types of microorganisms are important factors to be taken into consideration in ensuring hand hygiene (8).

Persistent flora: The community of microorganisms that are resident and permanently present in the skin. These microorganisms are predominantly found in the upper layers of the skin, although some (about 10-20%) can also be found in the deeper layers of the skin. The amount of bacteria in the permanent flora is found in different densities in different parts of the body. For example, the total number of bacteria on the hands of a healthcare professional usually ranges between 3.9×104 - 4.6×106 colony forming unit (CFU). After mechanical hand washing with soap and water, there is no significant decrease in the amount of this bacterial community (9).

Characteristic members of the microorganisms in the permanent flora include coagulase negative staphylococci such as staphylococcus hominis, staphylococcus capitis, staphylococcus epidermidis, micrococcus species, propionibacterium species and corynebacterium. These microorganisms do not cause disease outside the skin and skin infections are usually limited. However, they can lead to serious infections when skin integrity is disrupted, in immunocompromised patients or in patients undergoing invasive procedures (10).

Transient flora: Microorganisms that are transmitted to the hands of healthcare professionals through patient secretions or contaminated tools and equipment and settle on the surface of the skin. These microorganisms, unlike permanent flora, are considered to be one of the main culprits of nosocomial infections. Microorganisms in the transient flora have a high disease-causing potential and are responsible for many outbreaks associated with contaminated hands of healthcare professionals (5).

Although surgical hand washing is necessary to reduce the amount of microorganisms in the permanent flora, hygienic hand washing is usually sufficient to remove transient flora. Transient flora is mostly found on the hands of healthcare professionals due to contact with the external environment and therefore regular hand hygiene plays a critical role in the control of nosocomial infections (2).

Cross Contamination of Hands

Microorganisms can be transmitted to living or non-living surfaces through the hands of healthcare professionals and hands can carry microorganisms from various sources. Sources of infection usually originate from the endogenous flora of individuals (patients, healthcare

professionals and rarely visitors) and inanimate environmental elements (healthcare equipment, patient care materials and treatment tools) (8).

Healthcare-associated pathogens are naturally present in frequently colonized areas of intact patient skin. The density of microorganisms in contactable areas can vary between 100 and 106 CFU/ml. Considering that approximately 106 skin cells are shed daily, it is understood that any inanimate surface in contact with hands can be easily contaminated. Especially staphylococcus and enterococcus species have the potential to rapidly contaminate environmental surfaces (11).

Surgical Site Infections

Hospital-acquired infections are a major problem leading to increased morbidity and mortality in many countries (12). However, SSI is a complication with the highest cost when compared with other nosocomial infections (3). Nosocomial infections observed in the operation area up to the 30th postoperative day or up to 1 year in the presence of an implant placed in the area are called SSI. SSI is an important cause of postoperative complications, prolongs hospitalization and increases treatment costs (13). Most of these infections occur when microorganisms found on the hands are transferred to the surgical field (14).

General Hand Hygiene

General hand hygiene should be practiced meticulously by all healthcare professionals. The most effective and economical method in terms of prevention of infections is to provide hand hygiene for at least 15 seconds before and after contact with the patient and in any situation where there is a risk of contact with blood and other body fluids (2). The use of gloves is not a substitute for hand hygiene and hands should be properly cleaned even after gloves are removed (4). If the hands are visibly dirty, they should be washed with non-antibacterial soap and water in accordance with the relevant guidelines, hands should be dried with disposable towels and the faucet should be turned off with a towel (15).

In hands contaminated with biological materials with high protein content such as blood and saliva, the use of alcohol-based hand antiseptics is not appropriate because oil and residues cannot be completely removed. In such cases, washing with soap and water should be preferred to ensure hand hygiene (16). Compliance with these principles is of great importance in terms of preventing the spread of infections and maintaining health standards (2).

Surgical Hand Washing

Surgical hand washing minimizes the microorganism load, especially by reducing permanent and transient flora, and reduces the risk of infection in undesirable situations such as glove perforation during surgery (5).

Surgical handwashing sink

Surgical handwashing sink should have some different criteria from other sinks. These criteria minimize the risk of infection by helping to maintain aseptic conditions (17).
Location: It should be located right next to the operating room.
Control mechanism: It should be able to be controlled by foot, knee or sensor so that hands can be used freely.
Design: It should have sufficient width and depth and should be designed to prevent splashing of water.
Intended use: It should only be used for surgical hand cleaning and should not be used for washing dirty medical instruments and equipment (18).

Water

The chemical and bacteriological characteristics of water used in healthcare facilities must comply with applicable local regulations. If the water used for hand hygiene is not of potable quality or is suspected to be contaminated, measures can be taken to minimize the risk of infection. These measures include the use of antiseptic solutions, water treatment by filtration and disinfection. Water stored and distributed under inappropriate conditions may be contaminated with human pathogens such as enteric bacteria, staphylococci, fungi and parasites and aquatic microorganisms (19).

On the other hand, the effectiveness of waterless hand antisepsis has been evaluated in some studies. In this method, which is referred to as dry fast technique, surgical hand washing procedure was performed without using water and by preferring antiseptic solutions with ingredients such as alcohol and chlorhexidine. Looking at the results of these studies, it was seen that time saving was achieved with the application of waterless hand antisepsis. Moreover, it was found to be effective in hand antisepsis by reducing the bacterial load on the hands as much as the aqueous method. Therefore, waterless hand antisepsis is also recommended in surgical hand washing (9, 10, 11, 20, 21).

Hand-arm preparation

Healthcare professionals performing surgical procedures should take certain precautions before starting the procedure to maximize the effectiveness of surgical hand antisepsis.

Operating room attire: Clothing suitable for the operating room environment, with short sleeves (allowing hands to be washed up to the elbow) should be worn, and a cap and mask should be worn (5).

Removal of jewelry: Watches, rings, bracelets and all other jewelry should be removed before starting the hand hygiene procedure. Jewelry prevents full contact of the antimicrobial agent with the skin, making it difficult to remove microorganisms (2).

Nail care: Nails should be short (no longer than the fingertip), clean and well-groomed. Nail polish should be completely removed before entering the perioperative area (before, during and after surgery). The use of artificial nails is strictly prohibited (17).

Having short nails, keeping them clean and not wearing nail polish prevents the accumulation and spread of microorganisms under the nail. Artificial nails, on the other hand, may create a suitable breeding environment for microorganisms and therefore their use is not recommended (22). These measures are of vital importance to prevent surgical site infections and to ensure patient safety (13).

Use of brushes in surgical washing

Findings in the literature show that the majority of microorganisms on the hands are found on the nails. Therefore, guidelines published worldwide and in Turkey emphasize that under the nails should be cleaned with a brush or nail cleaner during surgical hand washing (2). The use of brushes is common in the traditional surgical hand washing method. However, it has been reported that brushes increase irritation on the hand, which leads to more shedding of skin cells and may increase the number of gram-negative bacteria and candida (14).

Recent studies have shown that the number of bacteria on the hands is sufficiently reduced even when brushes are not used and many current sources do not recommend the use of brushes (6). Organizations such as AORN (Association of periOperative Registered Nurses) state that companies producing some surgical hand antisepsis products recommend the use of a soft sponge that will not disrupt tissue integrity instead of a brush (5). The World Health Organization does not recommend nail brushes because they may cause skin damage and cell shedding, but recommends the use of single-use sterile brushes if nail brushes are to be used (2).

The “Hand Washing and Hand Disinfection Guideline for Healthcare Personnel” presented by the Centers for Disease Control and Prevention (CDC) recommends brushing gently with a disposable brush, preferably with a sponge on one side and a brush on the other, paying attention to the nails and the grooves on the hand, and not brushing the skin except under the nails because skin integrity may be disrupted (16). The hand hygiene guideline established by the Ministry of Health in Turkey states that only under the nails should be cleaned by brushing before the first case of the day and brushes should be disposable (15).

Time for surgical hand washing

Studies have shown different results regarding the effectiveness of the duration of surgical hand washing. Tanner et al. showed that 5 minutes of hand washing was as effective as 10 minutes (6). Some studies conducted in Europe and Australia have shown that handwashing for 3 or 4 minutes can be as effective as 5 minutes when certain products are used (6, 24). Some studies show that there are differences between the first hand wash of the day and subsequent washes (25). The Royal Australasian College of Surgeons recommends that the first hand wash of the day should last 5 minutes and subsequent hand washes should last 3 minutes.

Hand washing time may vary according to the content of the products used. The important point here is that every point of the hands is washed correctly. Healthcare organizations should act in accordance with their own policies and procedures (26). In summary, although there are different opinions on the duration of surgical hand washing, the important thing is to ensure hand washing with the correct technique and for a sufficient time (2).

Maintaining skin integrity

Hand hygiene and skin health are especially important in healthcare settings. Healthcare professionals therefore need to pay attention to skin care. In particular, hands and forearms should be free of open wounds or compromised skin integrity. Damage to the skin may lead to the entry of microorganisms and increased risk of infection (2). If moisturizer use is necessary, appropriate selection should be made by infection control specialists. Water-based, anionic or chemical-free moisturizers compatible with the antiseptic agents used should be preferred. Moisturizers that do not damage the barrier properties of the glove used should be selected (17). Skin health is critical for the effectiveness of hand hygiene. Appropriate moisturizer use helps to maintain skin integrity and reduce the risk of infection. Healthcare organizations should determine their own policies and procedures regarding hand hygiene and skin care (2).

Surgical hand washing technique

The standard protocol for the effectiveness of surgical hand antisepsis usually includes the following steps.

Preliminary preparation: Hands and forearms are thoroughly wetted with warm water if a dry wash procedure is not to be performed. Antimicrobial soap is applied to the palm of the hand in sufficient quantity. Wash hands and forearms thoroughly in a circular motion for at least two minutes. Especially between the fingers, under the nails and thumbs are carefully cleaned (2).

Nail cleaning Dirt and debris accumulated under the nails should be removed under running water using a disposable nail cleaner (16).

Rinsing: Hands and forearms should be rinsed from fingertips to elbows (2).

Antiseptic solution application: The amount of antiseptic solution recommended by the manufacturer should be applied to the hands and forearms. Some manufacturers may recommend the use of non-irritating soft sponge (17).

Hand position: Hands should be kept up, elbows should be kept down and surgical clothes should be avoided to prevent recontamination of the fingertips during cleaning (2).

Effective scrubbing: The fingers and forearms on both hands should be cleaned by rubbing, followed by rinsing (2).

Preventing splashing: Care should be taken not to splash water on surgical clothes during washing (2).

Water conservation: If possible, unnecessary water consumption should be prevented by turning off the water when not in use.

Waste management: Used sponges should be disposed of in appropriate waste containers.

Drying: Before putting on sterile shirts and gloves, hands and forearms should be dried with sterile towels using tampon movements (2).

Hand hygiene: General hand hygiene should be practiced immediately after surgical gloves are removed (4).

Some Solutions Used in Surgical Hand Washing

Surgical hand antiseptic agents are antimicrobial agents used to minimize the risk of infection during surgical procedures. An ideal surgical hand antiseptic agent should have a broad antimicrobial spectrum, show rapid and lasting effect, should not cause skin irritation and should be easy to use (27).

Characteristics of ideal surgical hand antiseptic agents

Broad antimicrobial spectrum: It should be effective against various microorganisms including bacteria, viruses and fungi.

Rapid action: It should rapidly kill or inhibit microorganisms after application.

Lasting effect: Should provide long-lasting antimicrobial activity.

Skin tolerance: It should not cause skin irritation, dryness or allergic reactions.

Ease of use: It should be easy and quick to apply.

Cumulative effect: Efficacy should increase with repeated use.

Leaving no residue: It should not leave residues that may cause adhesion of gloves or contamination of surgical instruments (28).

Antiseptic solutions

Chlorhexidine gluconate (2-4%): Chlorhexidine gluconate is a broad-spectrum antiseptic and is effective against gram-positive and gram-negative bacteria. It is generally used in concentrations of 2-4% in surgical hand antisepsis and has a long-lasting antimicrobial effect. It prevents recontamination by showing a permanent effect on the skin (17, 27).

Povidone-iodine (7.5%): Povidone-iodine is a broad-spectrum antiseptic and is effective against bacteria, viruses and fungi. It is used in surgical hand washing at 7.5% concentrations. However, it may cause allergic reactions in some individuals and may discolor the skin (17, 27).

Alcohol-based solutions (60-80% ethanol or isopropanol): Alcohol-based antiseptics are fast-acting and broad-spectrum agents. For surgical hand antisepsis, 60-80% ethanol or isopropanol is used. Recent studies have shown that alcohol-based solutions are effective in surgical hand antisepsis and can be applied in a shorter time compared to traditional methods (6, 11, 17).

The effectiveness of antiseptics used in surgical hand washing varies according to the surgical hand washing technique and the relevant sample group. Therefore, the effectiveness of the antiseptic solutions used and the preference of one over the other is still a controversial issue (17). This information shows the diversity and efficacy of antiseptic solutions used in surgical hand washing. When deciding which solution to use, hospital protocols, surgeon's preference and available scientific data should be taken into consideration (2).

CONCLUSION

This comprehensive review emphasizes the critical role of surgical handwashing in the prevention of nosocomial infections. The basic principles of hand hygiene, microbial flora of the hand, surgical handwashing techniques and antiseptic solutions used were discussed in

detail. The study emphasized the importance of applying standard protocols to ensure the effectiveness of surgical handwashing. In particular, it was stated that factors such as hand washing time, use of brush, preservation of skin integrity and correct antiseptic solution selection are effective on the success of surgical hand antisepsis. In line with the different opinions in the literature and the recommendations in the guidelines, it was concluded that current approaches should be adopted in surgical hand washing practices. In particular, it is recommended to limit the use of brushes in nail cleaning and to prefer nail cleaners, to use moisturizers that protect skin integrity, and to consider the effectiveness of alcohol-based antiseptic solutions.

This study aims to provide healthcare professionals with comprehensive information on surgical hand washing practices and to contribute to raising infection control standards. Increasing the effectiveness of surgical hand antisepsis is of great importance in terms of ensuring patient safety and preventing nosocomial infections. Future research could focus on innovative approaches to further improve the effectiveness of surgical handwashing techniques and antiseptic solutions and find practical time-saving solutions.

Scientific Responsibility Statement

We declare that all responsibility for the scientific content of this article, including the preparation, study design, analysis and interpretation of the study design, writing of the manuscript, scientific review of its content and approval of the final version of the manuscript belongs to the authors.

Ethics Approval and Consent

As this study did not involve human participants or experimental procedures, and/or utilized publicly available data, no additional approval by an ethics committee was required.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author Contributions

MUA: Conceived the idea, conducted the literature review, and prepared the entire draft of the manuscript, including final editing.

YY: Provided textual revisions, contributed to structural organization, and reviewed the final version of the manuscript for accuracy and clarity.

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