In the name of God

Infections Acquired in Health Care Facilities

dr.mazaherpour

Assistant professor of infectious disease of ARAKMU

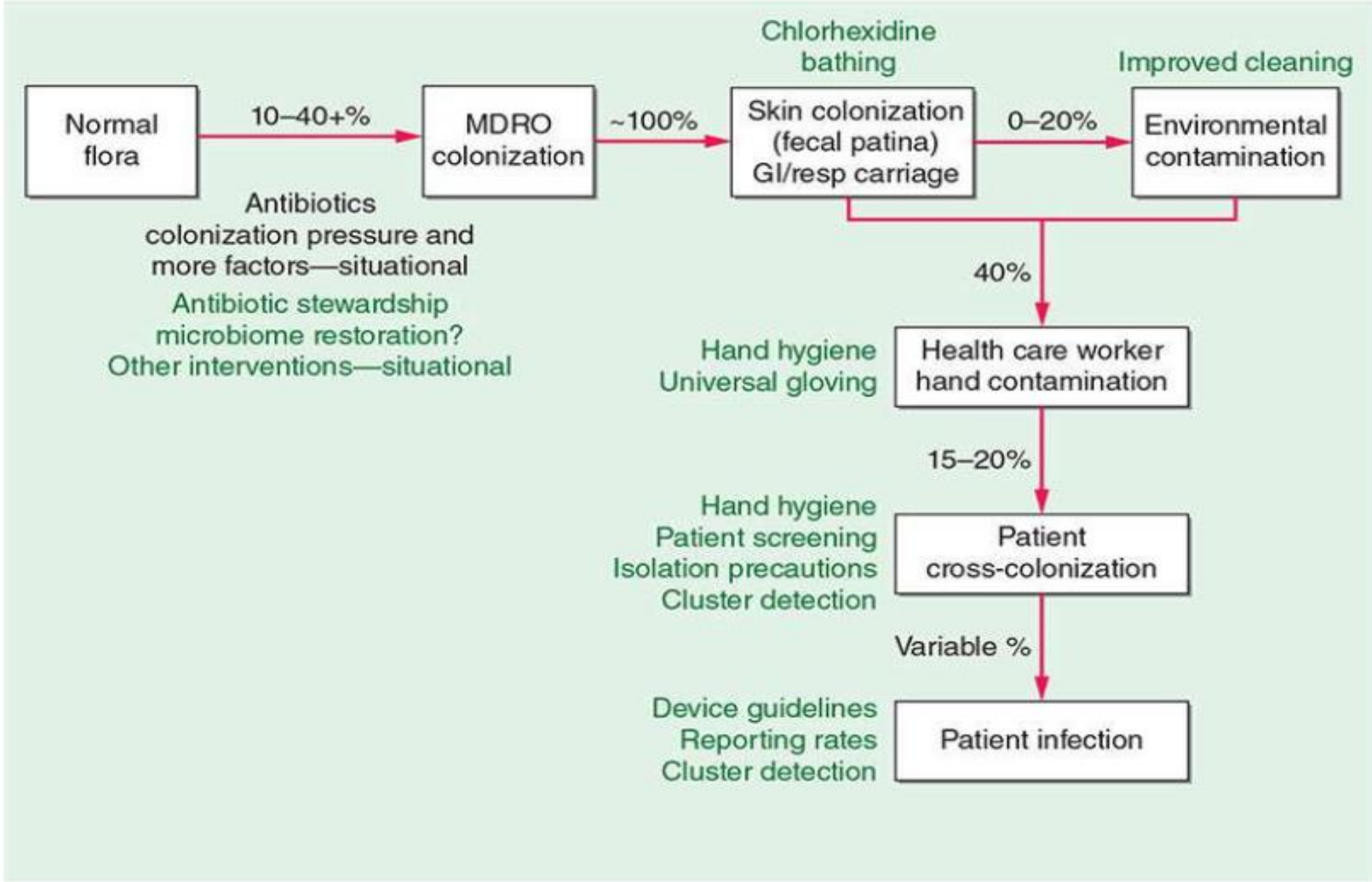
- Traditionally, infection preventionists surveyed inpatients for infections acquired in hospitals (some of which only appear after hospital discharge, i.e., community-onset, health care–associated infections)
- Nosocomial pathogens have **reservoirs**, are **transmitted** by largely predictable routes, and require **susceptible** hosts.

- Reservoirs and sources exist in the **inanimate** environment (e.g., antibiotic-resistant bacteria or *Clostridioides difficile* spores on frequently touched surfaces) and in the **animate** environment (e.g., infected or colonized patients and hospital visitors)
- The mode of transmission usually is either **cross-infection** (e.g., indirect spread from one patient to another on the inadequately cleaned hands of hospital personnel) or **autoinoculation** (e.g., aspiration of oropharyngeal flora); patient **hand** colonization with problem microbes also may contribute to self, environmental, and health care worker contamination.

- Occasionally, pathogens (e.g., group A streptococci and many respiratory viruses) are spread from person to person via large infectious **droplets** released by coughing or sneezing.
- Much less common—but often devastating in terms of epidemic risk—is true **airborne** spread of small or droplet nuclei (as in nosocomial chickenpox or measles)

- Factors that **increase** patient susceptibility include diabetes, renal insufficiency, and other comorbidities; extremes of age; abnormalities of innate defense
- Given the prominence of cross-infection, **hand hygiene** is cited as the most important preventive measure. Health care worker **adherence** to hand hygiene is historically **low**. Reasons cited include inconvenience, time pressures, and skin damage from frequent washing.

- Sinkless alcohol rubs are quick and highly effective, and their emollients may improve hand condition.
- Use of alcohol hand rubs between patient contacts is recommended for all health care workers **except** when hands are visibly soiled or after care of a patient who is part of an outbreak of infection with *C. difficile*, whose spores resist killing by alcohol. In these cases, washing with soap and running water is recommended.


Chlorhexidine bathing
Improved cleaning
Normal flora
10–40+%
MDRO colonization
~100%
Skin colonization (fecal patina) GI/resp carriage
0–20%
Environmental contamination
Antibiotics
colonization pressure and more factors—situational
Antibiotic stewardship
microbiome restoration?
Other interventions—situational
40%
Hand hygiene
Universal gloving
Health care worker hand contamination
15–20%
Hand hygiene
Patient screening
Isolation precautions
Cluster detection
Patient cross-colonization
Variable %
Device guidelines
Reporting rates
Cluster detection
Patient infection

NOSOCOMIAL AND DEVICE-RELATED INFECTIONS

- The five major nosocomial infection sites are **urinary, lower respiratory, surgical wound, bloodstream, and gastrointestinal** (mostly *C. difficile*).
- The percentage of infections due to **invasive devices**—25–50%—has **fallen** in recent years, reflecting marked improvements in the use and design of devices

Prevention of Central Venous Catheter Infections

Catheter insertion bundle

- Educate personnel about catheter insertion and care.
- Use chlorhexidine to prepare the insertion site.
- Use maximal barrier precautions and asepsis during catheter insertion.
- Consolidate insertion supplies (e.g., in an insertion kit or cart).
- Use a checklist to enhance adherence to the insertion bundle.
- Empower nurses to halt insertion if asepsis is breached.

Catheter maintenance bundle

- Cleanse patients daily with chlorhexidine.
- Maintain clean, dry dressings.
- Enforce hand hygiene among health care workers.
- Use aseptic technique when accessing transducers or vascular ports.

Ask daily: Is the catheter needed? Remove catheter if not needed or used.

Prevention of Ventilator-Associated Events

- Avoid mechanical ventilation whenever possible.
- Elevate head of bed to 30–45° to lessen aspiration risk.
- Decontaminate oropharynx regularly with chlorhexidine (controversial).
- Use aseptic care of all respiratory equipment.
- Consider using endotracheal tubes with channels for subglottic drainage of secretions.
- Give "sedation vacation" and assess readiness to extubate daily, which can shorten duration of intubation and of intensive care unit stays.
- Use deep-vein thrombosis prophylaxis (unless contraindicated).

Prevention of Surgical-Site Infections

- Choose a surgeon wisely.
- Treat *active* infections preoperatively.
- Administer prophylactic antibiotics within 1 h before surgery; discontinue within 24 h.
- Limit any hair removal to the time of surgery; use clippers or do not remove hair at all.
- Prepare surgical site with chlorhexidine-alcohol.
- Enforce operating room asepsis, e.g., minimize movement in-and-out of the room.
- Assess attention to technical surgical issues (e.g., avoiding open or prophylactic wound drains).

Prevention of Urinary Tract Infections

- Place bladder catheters only when absolutely needed (e.g., to relieve obstruction), not solely for the provider's convenience.
- Use aseptic equipment and technique for catheter insertion and urinary tract instrumentation.
- Minimize manipulation or opening of drainage systems; avoid catheter irrigation.
- Ask daily: Is the bladder catheter needed? Remove catheter if not needed.
- Use bladder scanners to avoid catheterization, e.g., for assessing urinary retention.

Prevention of Pathogen Cross-Transmission

- Cleanse hands with alcohol hand rub before and after all contacts with patients or their environments.

- **URINARY TRACT INFECTIONS** Urinary tract infections (UTIs) due to indwelling bladder catheters affect ~160,000 patients annually, which represents a **deceased** risk over the past several years, and account for ~10% of nosocomial infections; up to 3% of bacteriuric patients develop bacteremia.
- Most nosocomial UTIs have been associated with preceding **instrumentation** or **indwelling** bladder catheters, which create a 3–7% risk of infection each day

- UTIs generally are caused by pathogens that spread up the **periurethral** space from the patient's **perineum** or **gastrointestinal** tract—the most common pathogenesis in women—or via intraluminal contamination of urinary catheters
- A **condom catheter** for men without bladder obstruction may be more acceptable than an indwelling catheter and may **lessen** the risk of UTI if maintained carefully. In addition, in a multicenter trial, daily **chlorhexidine bathing** lessened UTI risk in catheterized men.

- **Older strategies** have included the use of topical meatal antimicrobial agents, drainage bag disinfectants, and anti-infective catheters, **none** of which is considered routine.
- The **most common** pathogens are *Escherichia coli*, nosocomial gram-negative bacilli, enterococci, and *Candida*.

- **PNEUMONIA** Pneumonia accounts for ~28% of nosocomial infections; with improvements in device and patient care—most importantly, lessening patient time on ventilators—ventilator-associated pneumonias (VAPs) have become less frequent and now account for only ~25–35% of all nosocomial lower respiratory tract infections.
- Most cases of bacterial nosocomial pneumonia are caused by aspiration of **endogenous** or **hospital-acquired** oropharyngeal or gastric flora.

- Nosocomial pneumonias have been associated with more **deaths** than have infections at any other body site. However, attributable mortality rates suggest that the **risk of dying** from nosocomial pneumonia is affected greatly by other **factors**, including comorbidities, inadequate antibiotic treatment, and the involvement of specific pathogens (particularly *Pseudomonas aeruginosa* or *Acinetobacter*).

- **Risk factors** for nosocomial pneumonia include those events that increase **colonization** by potential pathogens (e.g., prior antimicrobial therapy, contaminated ventilator equipment, or decreased gastric acidity); those that facilitate **aspiration** of oropharyngeal contents into the lower respiratory tract (e.g., intubation, decreased levels of consciousness, or presence of a nasogastric tube); and those that **reduce pulmonary defense** mechanisms and permit overgrowth of aspirated pathogens (e.g., chronic obstructive pulmonary disease or upper abdominal surgery).

- **early-onset** nosocomial pneumonia, which manifests within the **first 4 days** of hospitalization, is often caused by **community-acquired** pathogens such as *Streptococcus pneumoniae* and *Haemophilus* species, although some studies have challenged this view.
- **Late-onset** pneumonias commonly are due to *S. aureus, P. aeruginosa, Enterobacter* species, *Klebsiella pneumoniae*, or *Acinetobacter*.

- **SURGICAL-SITE (WOUND) INFECTIONS** Wound infections account for ∼17% of nosocomial infections. The average wound infection has an incubation period of 5–7 days longer than many postoperative stays.
- These infections usually are caused by the patient's **endogenous** or **hospital-acquired** skin and mucosal flora and occasionally are due to airborne spread of skin squames that may be shed into the wound from members of the operating-room team or environmental sources.

- True **airborne** spread of infection is **rare** in operating rooms unless there is a disseminator (e.g., of group A streptococci or staphylococci) among the **staff** or **air supply** contamination (e.g., with mold)
- In general, the common **risks** for postoperative wound infection are related to the surgeon's technical skill, the patient's underlying conditions (e.g., diabetes mellitus, obesity) or advanced age, and inappropriate timing of antibiotic prophylaxis.

- Additional **risks** include the presence of drains, prolonged preoperative hospital stays, shaving of operative sites by razor the day before surgery, and prolonged duration of surgery.
- Preoperative administration of **intranasal mupirocin** to patients colonized with *S. aureus*, preoperative **antiseptic bathing**, intra- and **postoperative oxygen** supplementation, and attention to patients' blood **glucose** levels and body **temperature** have been **controversial** because of conflicting study results, but evidence seems mostly to favor these interventions.

- The most common **pathogens** in postoperative wound infections are *S. aureus*, coagulase-negative staphylococci, and enteric and anaerobic bacteria.
- Diagnosis of infections of **prosthetic devices**, such as orthopedic implants, may be complicated when pathogens are cloistered in prosthesis-adherent **biofilms**; cultures of ***sonicates*** from explanted prosthetic joints have been more sensitive

- **INFECTIONS RELATED TO VASCULAR ACCESS AND MONITORING** Intravascular device–related bacteremias cause ~10–15% of nosocomial infections; central vascular catheters (CVCs) account for **most** of these bloodstream infections, although peripheral catheters are underappreciated as a source of nosocomial bacteremia.
- CVC infections have had estimated attributable **mortality** rates of 12–25%, an excess **length** of hospital stay of 7–15 days

- **Intrinsic** (during the manufacturing process) or **extrinsic** (on-site in a health care facility) contamination of infusate, although rare, is the most common cause of epidemic device-related bloodstream infection.
- The most common **pathogens** isolated from vascular device–associated bacteremias include coagulase-negative staphylococci, *S. aureus* (often resistant to methicillin), enterococci, nosocomial gram-negative bacilli, and *Candida*.

- Many pathogens, especially **staphylococci**, produce extracellular polysaccharide **biofilms** that facilitate attachment to catheters and provide sanctuary from antimicrobial agents
- control measures include use of a **chlorhexidine**-impregnated patch at the skin-catheter junction; application of **semitransparent** accesssite dressings (for ease of bathing and site inspection and protection of the site from secretions); **daily bathing** of ICU patients with **chlorhexidine**; **avoidance** of the **femoral** site for catheterization;

- **rotation** of peripheral catheters—an under recognized cause of staphylococcal bacteremia—to a new site at specified intervals (e.g., **every 72–96 h**) rather than as clinically indicated (a debatable recommendation that may be facilitated by use of an IV therapy team)
- The **diagnosis** is confirmed by the recovery of the same species of microorganism from peripheral-blood cultures and from semi-quantitative or quantitative cultures of the vascular catheter tip.

- Important considerations are the need for an **echocardiogram** (to evaluate the patient for endocarditis), the duration of therapy, and the need to **remove** potentially infected catheters.
- In one report, approximately **one-fourth** of patients with intravascular catheter–associated *S.aureus* bacteremia who were studied by **transesophageal** echocardiography had evidence of **endocarditis**
- When attempting to **salvage** a potentially infected catheter, some clinicians use the “antibiotic lock” technique, which may facilitate penetration of infected biofilms, in addition to systemic antimicrobial therapy

EPIDEMIC AND EMERGING PROBLEMS

- The investigation and control of nosocomial epidemics require that infection control personnel (1) develop a case **definition**, (2) **confirm** that an outbreak really exists (since apparent epidemics may actually be pseudo-outbreaks due to surveillance or laboratory artifacts), (3) review **aseptic** practices and disinfectant use, (4) determine the **extent** of the outbreak, (5) perform an **epidemiologic** investigation, which may require a case–control study to determine sources and modes of transmission.

- (6) work closely with **microbiology** personnel to culture for common sources or personnel carriers as appropriate and to provide molecular typing and (7) heighten surveillance to judge the **effect** of control measures.
- Control measures generally include reinforcing routine aseptic practices, hand hygiene, and environmental cleaning

ANTIBIOTIC-RESISTANT BACTERIA

- **SURVEILLANCE, CONTROL, AND ANTIBIOTIC AND DIAGNOSTIC STEWARDSHIP** Emerging multidrug-resistant bacteria like CRE are harbingers of a potential post antibiotic era.
- The CDC's comprehensive 2019 Antibiotic Resistance Threat Report provides the updated estimate that >2.8 million antibiotic-resistant infections occur in the United States each year, and >35,000 people die as a result.

Urgent threats

- Carbapenem-resistant *Acinetobacter*
- *Candida auris*
- *Clostridioides difficile*
- Carbapenem-resistant Enterobacteriaceae
- Drug-resistant *Neisseria gonorrhoeae*

Serious Threats

- Drug-resistant *Campylobacter*
- Drug-resistant *Candida*
- ESBL-producing Enterobacteriaceae
- Vancomycin-resistant *Enterococci* (VRE)
- Multidrug-resistant *Pseudomonas aeruginosa*
- Drug-resistant nontyphoidal *Salmonella*
- Drug-resistant *Salmonella* serotype Typhi
- Drug-resistant *Shigella*
- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Drug-resistant *Streptococcus pneumoniae*
- Drug-resistant Tuberculosis

Concerning threats

- Erythromycin-resistant group A *Streptococcus*
- Clindamycin-resistant group B *Streptococcus*

Watch list

- Azole-resistant *Aspergillus fumigatus*
- Drug-resistant *Mycoplasma genitalium*
- Drug-resistant *Bordetella pertussis*

- Control of resistance depends on **early** detection of problem pathogens ; on aggressive reinforcement of routine **asepsis**; on implementation of **barrier precautions** for all colonized and/or infected patients; on use of patient **surveillance cultures** to more fully ascertain the extent of patient colonization; on diagnostic **stewardship** to avoid overtreatment and on timely initiation of an epidemiologic investigation when rates increase.

Isolation precautions

- Transmission of infectious agents within a healthcare setting requires **three** elements: a **source** (or reservoir) of infectious agents, a **susceptible** host with a portal of entry receptive to the agent, and a **mode** of transmission for the agent
- ***Sources of infectious agents.*** Infectious agents transmitted during healthcare derive primarily from human sources but inanimate environmental sources also are implicated in transmission. Human reservoirs include patients, healthcare personnel, and household members and other visitors.

- ***Susceptible hosts.*** Host factors such as extremes of age and underlying disease (e.g., diabetes), human immunodeficiency virus/acquired immune deficiency syndrome [HIV/AIDS], malignancy, and transplants can increase susceptibility to infection as do a variety of medications that alter the normal flora
- Surgical procedures and radiation therapy impair defenses of the skin and other involved organ systems.

- ***Modes of transmission.*** The modes of transmission vary by type of organism and some infectious agents may be transmitted by more than one route: some are transmitted primarily by direct or indirect **contact**, (e.g., Herpes simplex virus [HSV], respiratory syncytial virus, Staphylococcus aureus), others by the **droplet**, (e.g., influenza virus, B. pertussis) or **airborne** routes (e.g., M. tuberculosis).

- Other infectious agents, such as **bloodborne** viruses (e.g., hepatitis B and C viruses [HBV, HCV] and HIV are transmitted rarely in healthcare settings, via percutaneous or mucous membrane exposure.

Precautions

- **Standard Precautions** are intended to be applied to the care of all patients in all healthcare settings, regardless of the suspected or confirmed presence of an infectious agent.
- Implementation of *Standard Precautions* constitutes the primary strategy for the prevention of healthcare-associated transmission of infectious agents among patients and healthcare personnel.

- Standard Precautions include a group of infection prevention practices that apply to **all patients**, regardless of suspected or confirmed infection status, in any setting in which healthcare is delivered. These include: hand hygiene; use of gloves, gown, mask, eye protection, or face shield, depending on the anticipated exposure; and safe injection practices.

- ***Contact transmission.*** The most common mode of transmission, contact transmission is divided into two subgroups: direct contact and indirect contact.
- ***Direct contact transmission.*** Direct transmission occurs when microorganisms are transferred from one infected person to another person without a contaminated intermediate object or person.
- ***Indirect contact transmission.*** Indirect transmission involves the transfer of an infectious agent through a contaminated intermediate object or person.

- Contact Precautions are intended to prevent transmission of **infectious** agents, including **epidemiologically** important microorganisms, which are spread by direct or indirect contact with the patient or the patient's environment
- The application of Contact Precautions for patients infected or colonized with **MDROs** is described

- Contact Precautions also apply where the presence of excessive **wound drainage**, **fecal incontinence**, or other **discharges** from the body suggest an increased potential for extensive environmental **contamination** and risk of **transmission**.
- A **single-patient** room is preferred for patients who require Contact Precautions. In multi-patient rooms**, ≥3 feet** spatial separation between beds is advised to reduce the opportunities for inadvertent sharing of items between the infected/colonized patient and other patients.

- Healthcare personnel caring for patients on Contact Precautions wear a **gown** and **gloves** for all interactions that may involve contact with the patient or potentially contaminated areas in the patient's environment.
- Donning PPE **upon room entry** and discarding **before** exiting the patient room is done to contain pathogens, especially those that have been implicated in transmission through **environmental contamination** (e.g., VRE, C. difficile, noroviruses and other intestinal tract pathogens; RSV)

- ***Droplet transmission.*** Droplet transmission is, technically, a form of contact transmission, and some infectious agents transmitted by the **droplet** route also may be transmitted by the **direct** and **indirect** contact routes.
- **Respiratory** droplets are generated when an infected person **coughs**, **sneezes**, or **talks** or during **procedures** such as **suctioning**, endotracheal **intubation** cough induction by chest **physiotherapy** and cardiopulmonary **resuscitation**

- the area of defined risk has been a distance of **≤3 feet** around the patient and is based on epidemiologic and simulated studies of selected infections
- Droplets traditionally have been defined as being **>5 µm** in size.
- Examples of infectious agents that are transmitted via the droplet route **include** *Bordetella pertussis*, influenza virus, adenovirus , rhinovirus, *Mycoplasma pneumoniae*, SARS associated coronavirus (SARS-CoV), group A streptococcus, and *Neisseria meningitidis*

- Droplet Precautions are intended to prevent transmission of pathogens spread through **close respiratory** or mucous membrane contact with respiratory **secretions**
- A **single patient room** is preferred for patients who require Droplet Precautions

- When a single-patient room is **not** available, consultation with infection control personnel is recommended to assess the various risks associated with other patient placement options (e.g., **cohorting**)
- Spatial separation of **≥3 feet** and drawing the **curtain** between patient beds is especially important for patients in multi-bed rooms with infections transmitted by the droplet route.

- Healthcare personnel wear a **mask** (a respirator is not necessary) for close contact with infectious patient; the mask is generally donned upon room entry. **Patients** on Droplet Precautions who must be transported **outside** of the room should wear a **mask** if tolerated

- ***Airborne transmission.*** Airborne transmission occurs by dissemination of either airborne droplet nuclei or small particles in the **respirable size** range containing infectious agents that remain infective over time and distance (e.g., spores of **Aspergillus** spp, and Mycobacterium tuberculosis).
- Infectious agents to which this applies include **Mycobacterium** tuberculosis, **rubeola** virus (**measles**), and **varicella-zoster** virus (**chickenpox**)

- In addition to AIIRs, respiratory protection with NIOSH certified **N95** or **higher** level respirator is recommended for healthcare personnel entering the AIIR to prevent acquisition of airborne infectious agents such as M. tuberculosis
- Some airborne infectious agents are derived from the **environment** and do not usually involve person-to-person transmission. **Spores** of environmental fungi (e.g., ***Aspergillus*** *spp*.) are ubiquitous in the environment and may cause disease in **immunocompromised** patients who inhale aerosolized (e.g., via construction dust) spores

- The preferred placement for patients who require Airborne Precautions is in an airborne infection **isolation** room (AIIR). An AIIR is a single-patient room that is equipped with special air handling and ventilation capacity that meet the American Institute of Architects/Facility Guidelines Institute (AIA/FGI) standards for AIIRs (i.e., monitored negative pressure relative to the surrounding area, **12** air exchanges per hour for new construction and renovation and 6 air exchanges per hour for existing facilities, air exhausted directly to the outside or recirculated through **HEPA** filtration before return)

- In settings where Airborne Precautions cannot be implemented due to limited engineering resources (e.g., physician offices), **masking** the patient, placing the patient in a **private** room (e.g., office examination room) with the door **closed**, and providing **N95** or higher level respirators or masks if respirators are not available for healthcare personnel will reduce the likelihood of airborne transmission until the patient is either transferred to a facility with an AIIR or returned to the home environment, as deemed medically appropriate.

- Whenever possible, nonimmune HCWs should **not** care for patients with **vaccine-preventable** airborne diseases (e.g., measles, chickenpox, and smallpox).
- A user-seal check (formerly called a "**fit check**") should be performed by the wearer of a respirator each time a respirator is donned to minimize air leakage around the facepiece

- Respirators are also currently recommended to be worn during the performance of **aerosol-generating procedures** (e.g., intubation, bronchoscopy, suctioning) on patients with SARS Co-V infection, avian influenza and pandemic influenza

- **Hand Hygiene**
  Hand hygiene has been cited frequently as the single most important practice to reduce the transmission of infectious agents in healthcare settings and is an essential element of Standard Precautions. The term “hand hygiene” includes both handwashing with either plain or antiseptic-containing soap and water, and use of alcohol-based products (gels, rinses, foams) that do not require the use of water.

Hand washing technique with soap and water

1

Wet hands with water

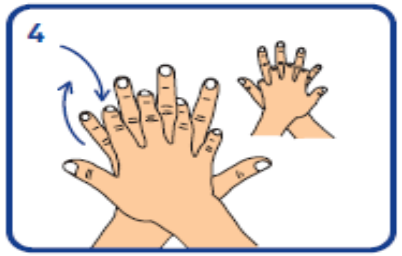
2

Apply enough soap to cover all hand surfaces

3

Rub hands palm to palm

4

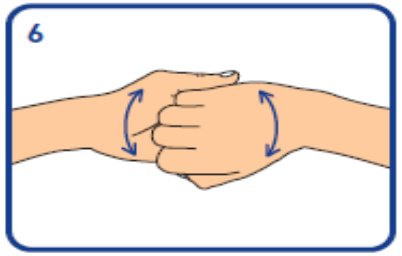


Rub back of each hand with palm of other hand with fingers interlaced

5

Rub palm to palm with fingers interlaced

6

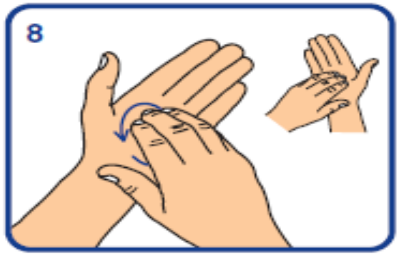


Rub with back of fingers to opposing palms with fingers interlocked

7

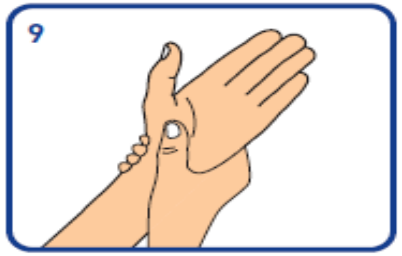
Rub each thumb clasped in opposite hand using a rotational movement

8



Rub tips of fingers in opposite palm in a circular motion

9

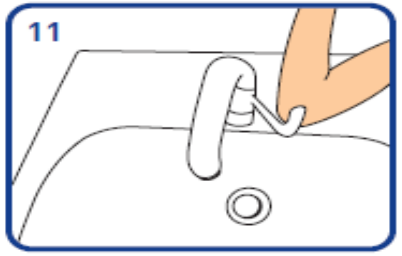


Rub each wrist with opposite hand

10

Rinse hands with water

11

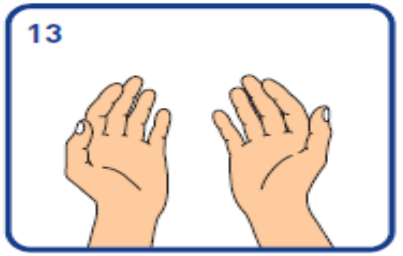


Use elbow to turn off tap
(if no elbow tap available use paper towel to turn off tap)

12

Dry thoroughly with a single-use towel

13



Hand washing should take 40-60 seconds

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World Health Organization

Adapted from World Health Organization Guidelines on Hand Hygiene in Health Care 2009

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- **Personal Protective Equipment (PPE) for Healthcare Personnel**
  PPE refers to a variety of **barriers** and **respirators** used alone or in combination to **protect** mucous membranes, airways, skin, and clothing from contact with infectious agents. The selection of PPE is based on the nature of the **patient interaction** and/or the likely **mode(s)** of transmission

- ***Gloves.*** Gloves are used to prevent contamination of healthcare personnel hands when
  1. anticipating direct contact with blood or body fluids, mucous membranes, **nonintact** skin and other potentially infectious material;
  2. having direct contact with patients who are **colonized** or **infected** with pathogens transmitted by the contact route e.g., VRE, MRSA, RSV
  3. handling or touching visibly or potentially **contaminated** patient care equipment and environmental surfaces.

- The extent to which gloves will protect healthcare personnel from transmission of **bloodborne** pathogens (e.g., HIV, HBV, HCV) following a needlestick or other pucture that penetrates the glove barrier has not been determined.
- While there is little difference in the barrier properties of unused intact gloves, studies have shown repeatedly that **vinyl** gloves have **higher failure rates** than latex or nitrile gloves when tested under simulated and actual clinical conditions. For this reason either latex or nitrile gloves are preferable for clinical procedures that require manual dexterity and/or will involve more than brief patient contact.

- ***Isolation gowns.*** Isolation gowns are used as specified by Standard and Transmission-Based Precautions, to protect the HCW's arms and exposed body areas and prevent contamination of clothing with blood, body fluids, and other potentially infectious material
- When applying Standard Precautions, an isolation gown is worn only if contact with blood or body fluid is anticipated.

- However, when **Contact** Precautions are used (i.e., to prevent transmission of an infectious agent that is not interrupted by Standard Precautions alone and that is associated with environmental contamination), donning of both gown and gloves **upon room entry** is indicated to address unintentional contact with contaminated environmental surfaces

- ***Face protection: masks, goggles, face shields.***
- ***Masks.*** Masks are used for three primary purposes in healthcare settings:
  1. placed on healthcare personnel to protect them from contact with infectious material from patients e.g., respiratory secretions and sprays of blood or body fluids, consistent with **Standard** Precautions and **Droplet** Precautions.

- 2. placed on healthcare personnel when engaged in procedures requiring sterile technique to protect patients from exposure to infectious agents carried in a healthcare worker’s mouth or nose, and
- 3. placed on coughing patients to limit potential dissemination of infectious respiratory secretions from the patient to others.

- ***Goggles, face shields*** The eye protection chosen for specific work situations (e.g., goggles or face shield) depends upon the circumstances of exposure, other PPE used, and personal vision needs.
- The role of goggles, in addition to a mask, in preventing exposure to infectious agents transmitted via respiratory droplets
- As compared with goggles, a face shield can provide protection to other facial areas in addition to the eyes. Face shields extending from chin to crown provide better face and eye protection from splashes and sprays

پيشگيري و كنترل عفونت در اتاق عمل

- در پيشگيري از عفونت ناشي از اتاق عمل توجه به سه عنوان زير به عنوان منشاء ايجاد عفونت بايد مدنظر باشد:
- الف) بيمار
- ب) پرسنل اتاق عمل
- ج) محيط اتاق عمل

- الف) در مورد بيمار بايستي مراقبتهاي قبل از عمل و آمادگي وي مدنظر باشد كه با فرآيندهاي زير قابل اعمال است
- 1 .ارزيابي از نظر وجود عفونت:

- قبل از عمل جراحي عفونتهاي ساير قسمتهاي بدن و دور از محل عمل مشخص و تحت درمان قرار گيرد و اعمال جراحي الكتيو تا حل مشكل عفونت به تأخير انداخته شود.
- كنترل قندخون در بيماران مبتلا به ديابت
- بيمار تشويق به ترك مصرف سيگار شود (بيمار حداقل ۳۰ روز قبل از عمل، از كشيدن سيگار، پيپ، قليان و جويدن تنباكو خودداري نمايد)
- از دادن محصولات خوني لازم براي بيماران دريغ نكنيد.
- وضعيت بيمار قبل از عمل از نظر هپاتيت Bو HIV (اختياري) مشخص گردد.

- ۲- دوش گرفتن با آنتي سپتيك قبل از عمل:
- لازم است بيمار شب قبل از عمل دوش گرفته و يا با مواد آنتي سپتيك حمام نمايد.
- ۳ چيدن موي محل عمل:
- موهاي محل عمل را مگر اينكه ايجاد مزاحمت براي عمل جراحي نمايد اصلاح نكنيد.
- در صورت نياز به اصلاح اين كار بلافاصله قبل از عمل و با ماشين ريش تراشي انجام گيرد.

- ۴- آماده نمودن پوست بيمار در اتاق عمل:
- قبل از آماده كردن پوست بيمار با مواد آنتي سپتيك بطور كامل محل و اطراف محل برش جراحي را شسته و تميز نماييد.
- يك مواد آنتي سپتيك مناسب براي آماده كردن پوست استفاده نماييد.
- اين مواد را به صورت دايره وار از محل عمل به طرف محيط جهت آماده كردن پوست بكار ببريد.
- حتي الامكان اقامت قبل از عمل بيمار را در بيمارستان به حداقل برسانيد.

- ۵ درمان پرسنل آلوده يا عفوني:
- پرسنل جراحي آلوده يا عفونت يافته تا زمان بهبودي از شركت در عمل ممانعت كنند.
- ۶ پيشگيري با آنتي بيوتيك قبل از عمل:
- توجه داشته باشيد دادن آنتي بيوتيك به هيچ عنوان به معني جايگزيني اقدامات مناسب كنترل عفونت در انجام جراحي نيست.
- آنتي بيوتيك را فقط در مواردي بكار ببريد كه مشخص شده است از عفونت محل عمل جلوگيري خواهد كرد.

- اولين دوز آنتي بيوتيك را در شروع جراحي تجويز كنيد.
- سطح درماني آنتي بيوتيك را در سرم و بافت محل عمل تا پايان دوره عمل و چند ساعت بعد از عمل در سطح درماني نگهداريد.
- براي عمل سزارين پرخطر آنتي بيوتيك پروفيلاكسي را بلافاصله بعد از كلامپ كردن بند ناف بكار گيريد.
- قبل از جراحي هاي انتخابي كولوركتال، با استفاده از تنقيه و مسهل، كولون را از نظر مكانيكي آماده سازيد و روز قبل از عمل از مواد ضدميكروبي خوراكي غيرقابل جذب در دوزهاي منقسم استفاده نماييد.

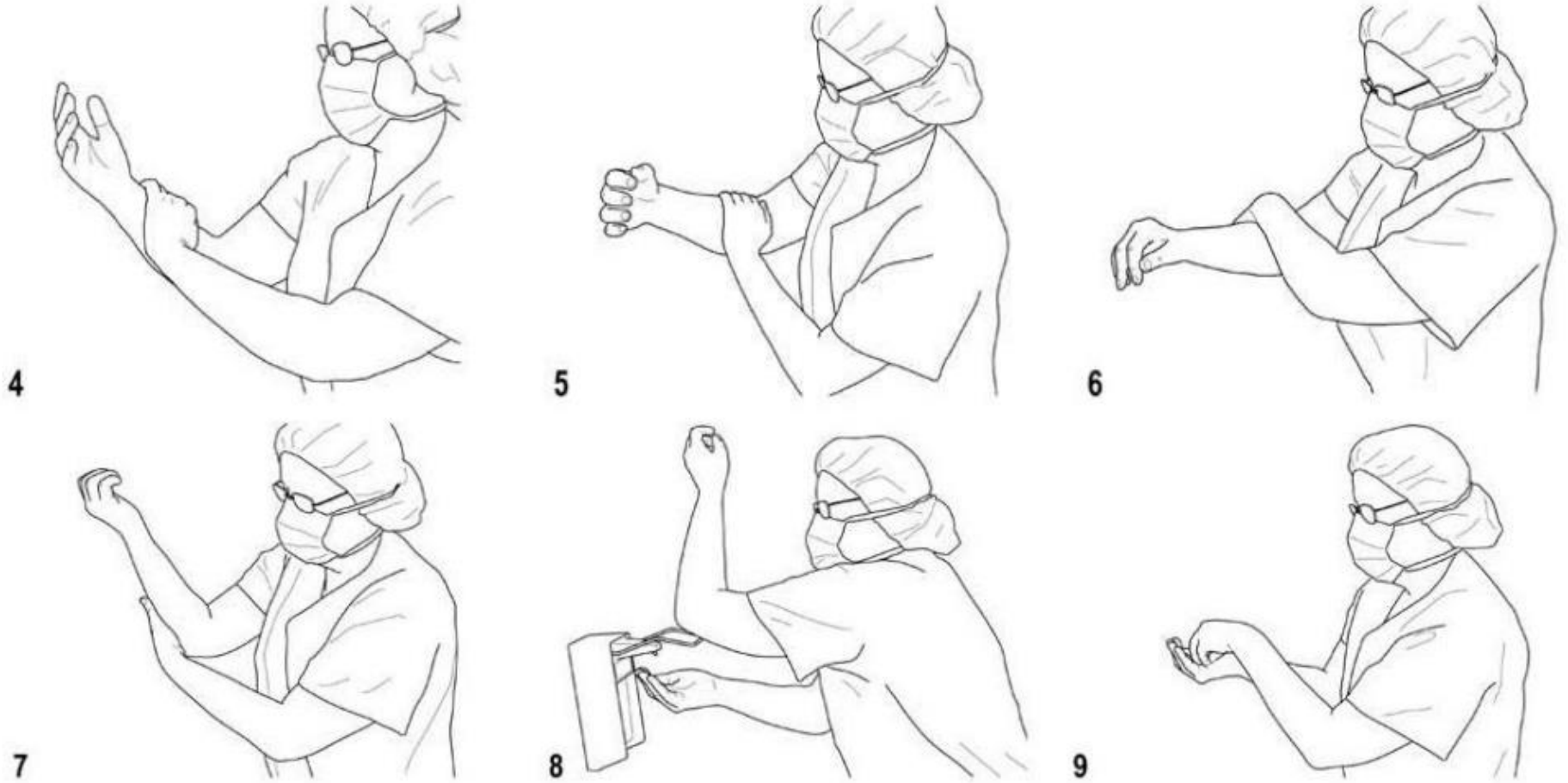
- **ب) پرسنل اتاق عمل:**
- شستشوي جراحي دست يا مالش جراحي دست (Surgical handrub) بايستي قبل از عمل توسط پرسنل اتاق عمل اجرا شود. شستشوي جراحي دست در تمام اعمال جراحي تهاجمي و نسبت براي تمام پرسنل اتاق عمل شامل پزشكان، متخصصين بيهوشي و پرستاران لازم است.

- **مراحل آماده نمودن دست جهت انجام اعمال جراحی و پروسیجرهای تهاجمی با استفاده از محلول های ضد عفونی با بنیان الکلی:**

۱. با فشردن افشانه با استفاده از آرنج دست راست خود، تقریباً ۵ میلی لیتر از ماده ضدعفونی با بنیان الکلی را در کف دست چپ خود بریزید.

۲. به منظور ضد عفونی، نوک انگشتان دست راست خود را حداقل به مدت ۵ ثانیه در مده ضدعفونی که در کف دست چپ خود ریخته اید، قرار دهید.

۳. مطابق با روش کار نمایش داده شده در تصاویر 7-٤، ماده ضد عفونی با بنیان الکلی را به مدت (۱۰ تا ۱۵ ثانیه)، با استفاده از حرکات دایره ای بر روی تمام نواحی پوست در ناحیه ساعد(خلف، قدام، طرفین) تا بازو، دست راست خود بمالید.



۸. با فشردن افشانه با استفاده از آرنج دست چپ خود، تقریباً ۵ میلی لیتر از ماده ضدعفونی با بنیان الکلی را در کف دست راست خود بریزید.

۹. به منظور ضد عفونی، نوک انگشتان دست چپ خود را حداقل به مدت ۵ ثانیه در ماده ضدعفونی که در کف دست راست خود ریخته اید، قرار دهید.

۱۰. ماده ضد عفونی با بنیان الکلی را به مدت (۱۰ تا ۱۵ ثانیه)، با استفاده از حرکات دایره ای بر روی تمام نواحی پوست در ناحیه ساعد(خلف، قدام، طرفین) تا بازوی دست چپ خود، بمالید.

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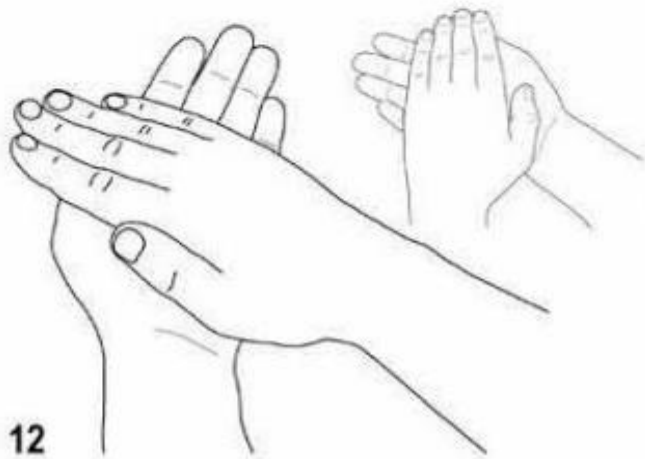

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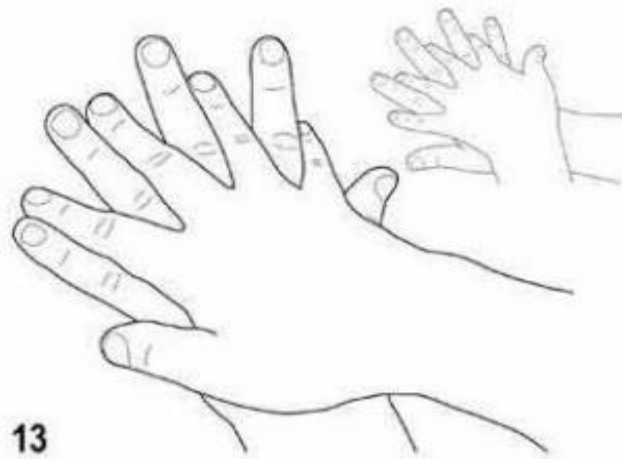

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۱۱. مطابق با روش کار نمایش داده شده در تصاویر ۱۷-۱۲، با فشردن افشانه با استفاده از آرنج دست راست خود، تقریباً ۵ میلی لیتر از ماده ضدعفونی با بنیان الکلی را در کف دست چپ خود بریزید.

۱۲. به صورت همزمان ، هر دو دست را تا ناحیه مچ دست به مدت ۲۰ تا ۳۰ ثانیه با انجام مراحل ذیل را تمیز کنید:

۱۳. کف دست راست خودرا با حرکات جلو و عقب بر روی قسمت خلفی دست چپ شامل مچ دست بمالید و بالعکس.

۱٤. کف دستان خود را در حالی که انگشتانتان در هم قفل شده است با حرکات جلو و عقب یه هم بمالید

۱۵. رویه خلفی انگشتان هر یک از دستان خود را در دست دیگر خود قفل کنید و با حرکات جلوو عقب در کف دست مقابل بمالید.

۱٦. شست هر یک از دستان در کف دست مقابل قرار داده و به هم بمالید.

۱۷. بعد از خشک شدن دست ها می توان لباس جراحی و دستکش استریل را پوشید.

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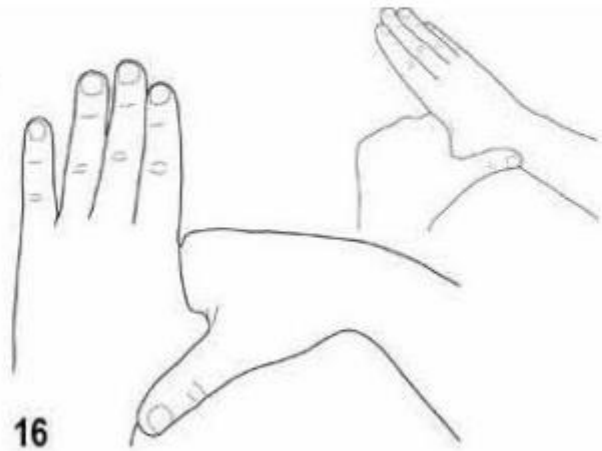

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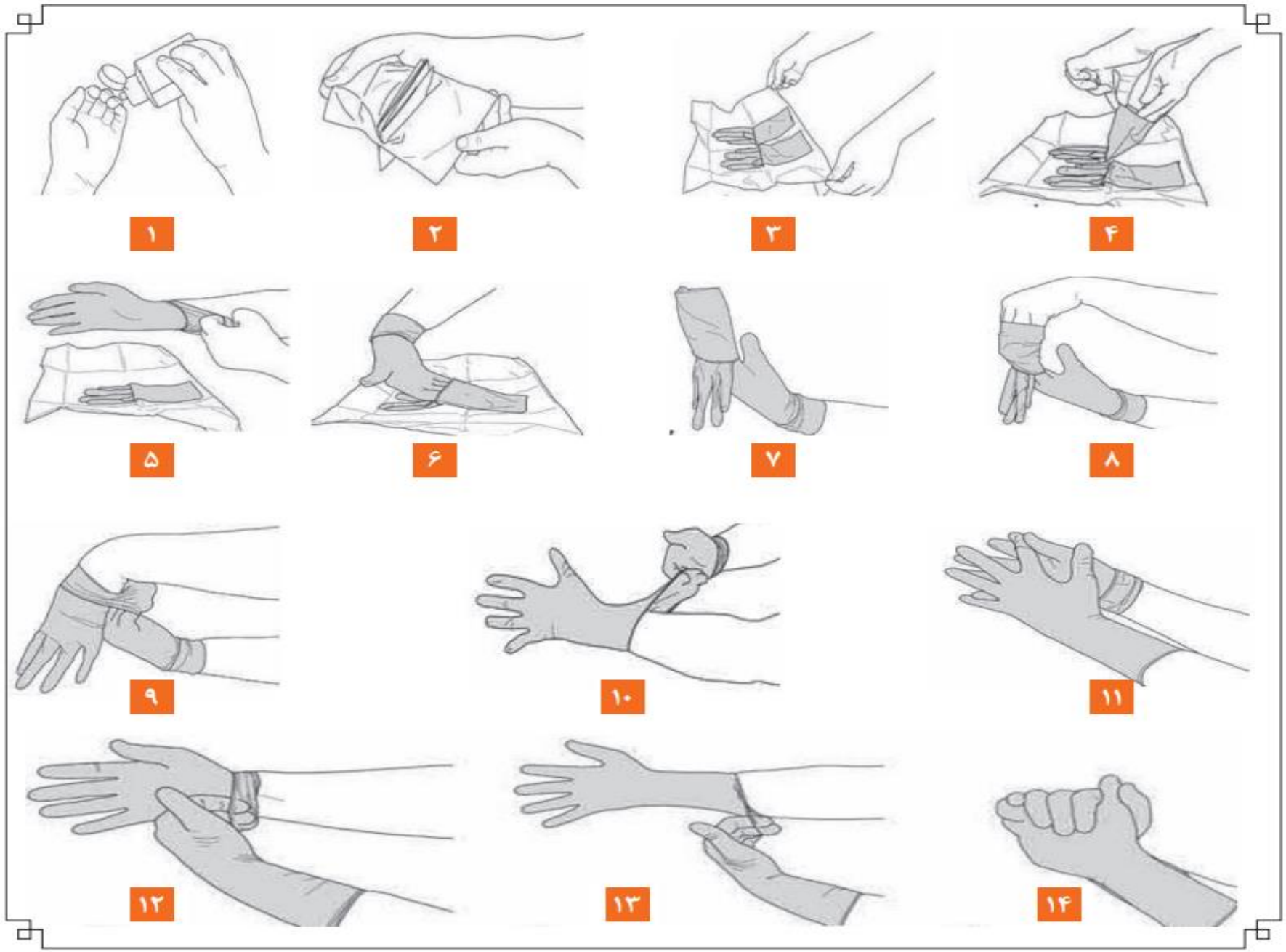
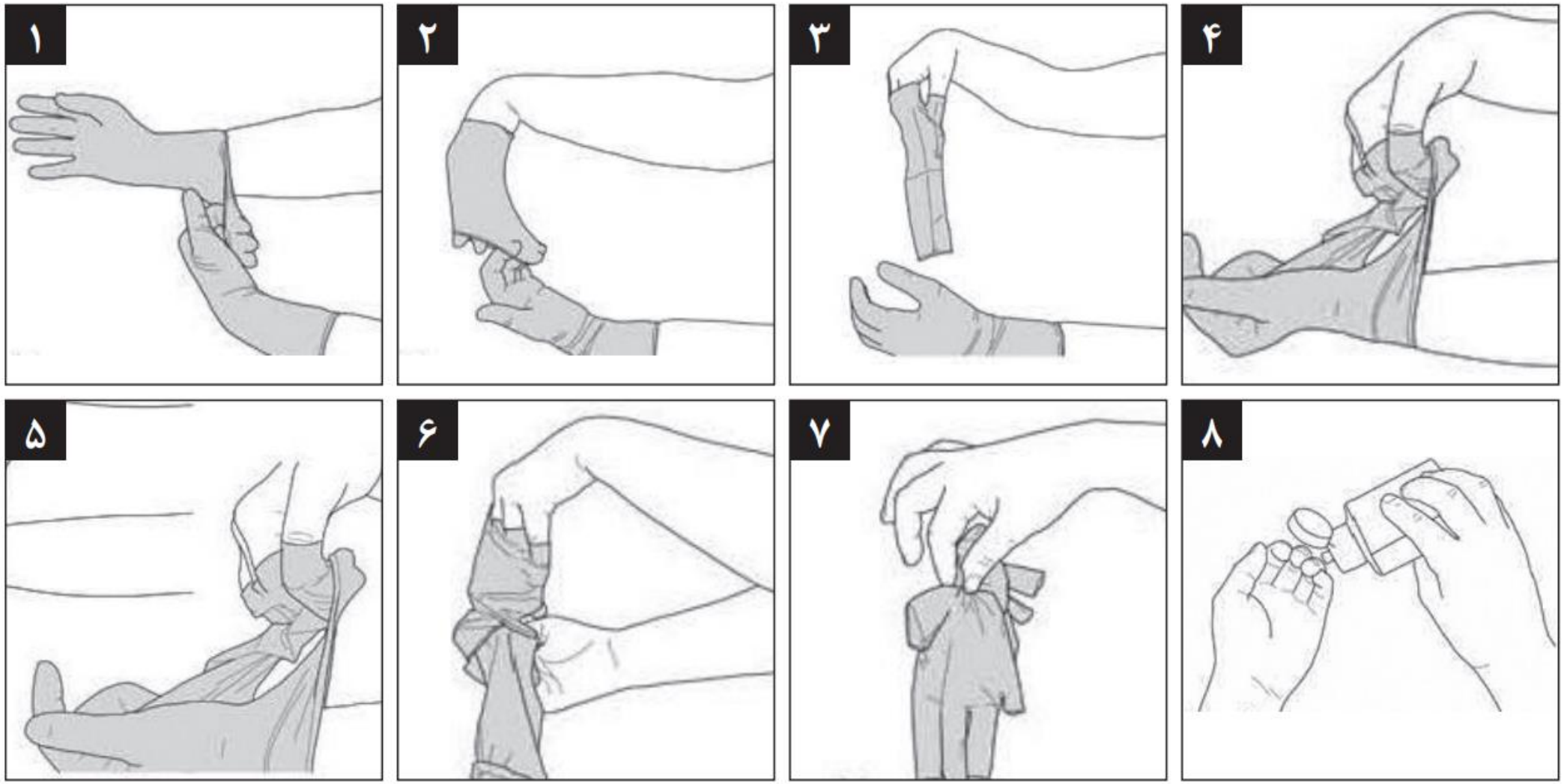
- ۲ ماسك جراحي استاندارد استفاده شود. در صورت مرطوب شدن، و در بين اعمال جراحي بايد عوض شود. ماسك را نبايد از گردن آويزان كرد و يا به جيب گذاشت و دوباره استفاده كرد. ماسكهاي با كارآيي بالا در موارد احتمال بيماري سل بايد استفاده گردد.
- تمام پرسنل اتاق عمل بايد از گان استريل استفاده نمايند.
- شان استريل براي ايجاد سدي بين فيلد جراحي و منبع بالقوه باكتري ها استفاده گردد.

- تيم جراحي بايد لباسهاي اتاق عمل شامل بلوز و شلوار پوشيده و روي آن گان بپوشند.
- كلاه مخصوص اتاق عمل بايستي استفاده گردد.
- براي پيشگيري از انتشار قطرات آلوده به چشم و بيني از محافظ چشم و صورت استفاده گردد.
- ناخن ها كوتاه شده و نبايد از ناخن مصنوعي استفاده گردد و از آويزان كردن جواهرات به دست و انگشتان و ساعد اجتناب شود.
- دستكش لاتكس استريل جراحي توسط پرسنل اتاق عمل پوشيده شود و در صورت آلودگي يا پاره شدن تعويض گردند. پوشيدن دو جفت دستكش احتمال آلودگي دست با خون يا مايعات بدن را كاهش ميدهد

تصویر شماره ۲-۲) نحوه پوشیدن دستکش استریل



تصویر شماره۴- ۲) نحوه درآوردن دستکش استریل بر اساس دستورالعمل سازمان بهداشت جهانی



- **ج - کنترل محیط اتاق عمل**
- حفظ سالمترین محیط در محل انجام عمل:
- اتاق اختصاصي براي انجام عمل جراحي و اقدامات تهاجمي با وسايل و تجهيزات استريل مشخص گردد.
- ورود پرسنل به اتاق عمل فقط محدود به پرسنل ضروري گردد.
- دما و رطوبت اتاق عمل:
- مناسب ترین میزان رطوبت ۵۵ -۵۰%
- مناسب ترین دما يك درجه سردتر از محیط خارج از اتاق عمل میباشد (۲۴ -۱۸ درجه سانتیگراد)

- تهويه اتاق عمل:
- در اتاق عمل سيستم تهويه فشار مثبت برقرار و حفظ شود.
- حداقل ۱۵ بار تعويض هوا در ساعت انجام شده و حداقل ۳ بار آن هواي تازه باشد.
- ورود كل جريان هوا از سمت سقف و خروج آن نزديك به كف زمين باشد.
- به منظور پيشگيري از عفونت زخم جراحي از اشعه ماوراي بنفش استفاده نشود.
- بجز در مواقع عبور وسايل، پرسنل و بيمار، درب هاي اتاق عمل بسته باشد.

- لوازم اتاق عمل:
- تمام وسايل بايستي براساس دستورالعملهاي منتشر شده استريل گردد.
- پاك كردن و گندزدايي سطوح محيطي:
- در مواقعي كه حين عمل جراحي، آلودگي قابل رؤيت سطوح يا تجهيزات با خون يا ساير مايعات بدن ايجاد ميشود قبل از انجام عمل جراحي بعدي از گندزدايي مناسب بيمارستاني براي تميز كردن محل آلوده استفاده كنيد.
- بعد از آخرين عمل جراحي كف اتاق عمل را با ماده گندزداي مناسب نظافت كنيد.

- به علت خطر انتقال بيماريهاي منتقله از طريق خون زباله ها بايستي با كمترين دستكاري دفع گردند.
- پنبه و گازهاي مورد استفاده در كيسه هاي آلوده درست در محل استفاده قرار داده ميشود و گازهاي آغشته به مايعات در ظروف مقاوم به مايعات قرار داده ميشود
- نمونه گيري بصورت روتين از محيط اتاق عمل توصيه نميشود. فقط تحت عنوان تحقيقات اپيدميولوژي از سطوح محيطي يا هوايي اتاق عمل نمونه ميكروبيولوژيك تهيه شود.
- در زمان كار گذاشتن وسايل داخل عروقي (كاتتر مركزي) يا كاتترهاي بيهوشي نخاعي يا اپيدورال يا در زمان توزيع و مصرف داروهاي داخل وريدي اصول آسپسي رعايت گردد.

- به بافتها به آرامي دست بزنيد، هموستاز مؤثري برقرار كنيد، نسوج مرده و جسم خارجي را به حداقل برسانيد و فضاي مرده در محل جراحي را از بين ببريد.
- در صورتي كه به نظر برسد محل جراحي به شدت آلوده است بستن پوست را در جلسه اول به تأخير بياندازيد يا محل انسزيون را باز بگذاريد تا در جلسه دوم ترميم گردد.
- اگر درناژ لازم باشد از درن ساكشن بسته استفاده كنيد. درن را در محل انسزيون جداگانه و دور از انسزيون محل عمل جراحي قرار دهيد. هر چه سريعتر درن را خارج نماييد.

- مراقبت از انسزيون بعد از عمل جراحي:
- اگر انسزيون در مرحله اول (زمان جراحي) بسته (بخيه) شده است. بعد از عمل به مدت ۲۴ تا ۴۸ ساعت از پانسمان استريل استفاده نماييد.
- قبل و بعد از تعويض پانسمان و در صورت هرگونه تماس با محل جراحي دست هاي خود را بشوييد.
- در رابطه با مراقبت صحيح از محل انسزيون علائم عفونت زخم و لزوم گزارش دهي چنين علايمي، بيمار و خانواده وي را آموزش دهيد.
- اگر نياز به تعويض پانسمان محل انسزيون باشد از روش استريل استفاده نماييد.

Thanks for your attention