HPIs, infection control and antibiotic use/abuse

Objectives:

1. Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.
2. Understand features/mechanism involved in developing antibiotics resistance.
3. Appreciate the challenges in the management of Hospital acquired infections.
4. Discuss the antimicrobial treatments for hospital acquired infections.
5. Define the necessary infection control guidelines.

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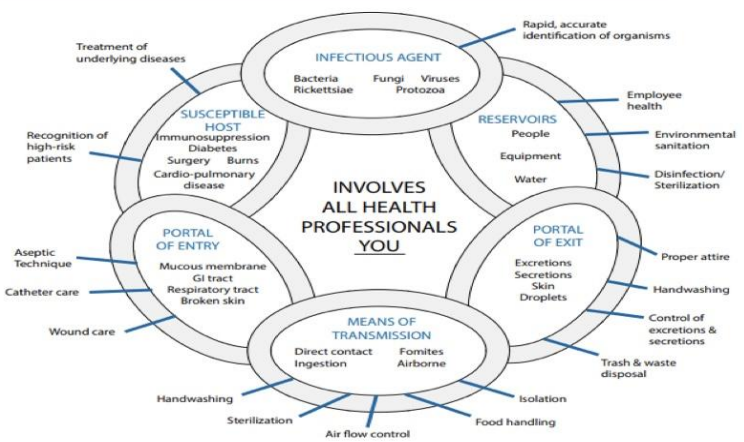
Chain of infection

Chain of infection links	Definition	Break the link
Infectious agent	These are the pathogens that cause communicable diseases. Most commonly these are bacteria, virus, fungi or parasites.	• Rapid, accurate identification of organism
Reservoir	The source of infection where the microorganism can live and thrive. This may be a: • **Person**- sexually transmitted diseases, measles, mumps, streptococcal infection, and many respiratory pathogens. • **Animal**- brucellosis (cows and pigs), anthrax (sheep), plague (rodents), trichinellosis/trichinosis (swine), tularemia (rabbits), and rabies (bats, raccoons, dogs, and other mammals). any object in the general environment, food or water. • **Environmental reservoirs**- Plants, soil, and water in the environment are also reservoirs for some infectious agents. Many fungal agents, such as those that cause histoplasmosis, live and multiply in the soil. Outbreaks of Legionnaires disease are often traced to water supplies in cooling towers and evaporative condensers, reservoirs for the causative organism Legionella pneumophila.	• Occupational Health Screening • Environmental cleaning • Equipment cleaning, disinfection and sterilization • Environmental sampling (water or air sample)
The portal of exit from the reservoir	This refers to the route by which the infectious microorganisms escape or leave the reservoir • Influenza viruses and Mycobacterium tuberculosis exit the respiratory tract. • Schistosomes through urine, cholera vibrio's in faeces. • In the case of someone with gastro-enteritis microorganisms would be transmitted in the faeces or vomit.	• Contain portal of exits e.g. dressing for open wound. • Hand hygiene • Cough Etiquette • Waste Management • Environmental control

Chain of infection *cont,*

Chain of infection links	Definition	Break the link
The mode of transmission	This describes how microorganisms are transmitted from one person or place to another. This could be via someone's hands, on an object, through the air or bodily fluid contact. • **Direct** : Direct contact or Droplet spread • **Indirect** : Airborne, Vector borne (mechanical or biologic)	• Hand hygiene • Use of personal protective equipment • Isolation precaution • Cough Etiquette • Environmental cleaning • Environmental control e.g air pressure monitoring
The portal of entry	This is how the infection enters another individual. This could be landing on a mucous membrane, being breathed in, entering via a wound, or a tube such as a catheter.	• Wear a mask/respirator • Maintain good ventilation • Isolate those with respiratory symptoms • Good respiratory hygiene/etiquette practices. • Perform good hand hygiene
The susceptible host	This describes the person who is vulnerable to infection: • Children who are very young • People who are very old • People on inadequate diets • People who are chronically ill • People receiving medical therapy such as chemotherapy or high doses of steroids • People who are already ill • People with open wounds	• Separate high-risk individuals from persons with known or potential infections • Provide nutritional supplements to persons on inadequate diets • Vaccinate against vaccine preventable diseases • Maintain proper sanitation of air and environment • Diagnose and treat underlying disease

If the chain is not broken the infectious organism is able to go on to develop disease in another person.



There are many opportunities to stop the spread of infection.

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

Hospital acquired infection

Epidemiology:

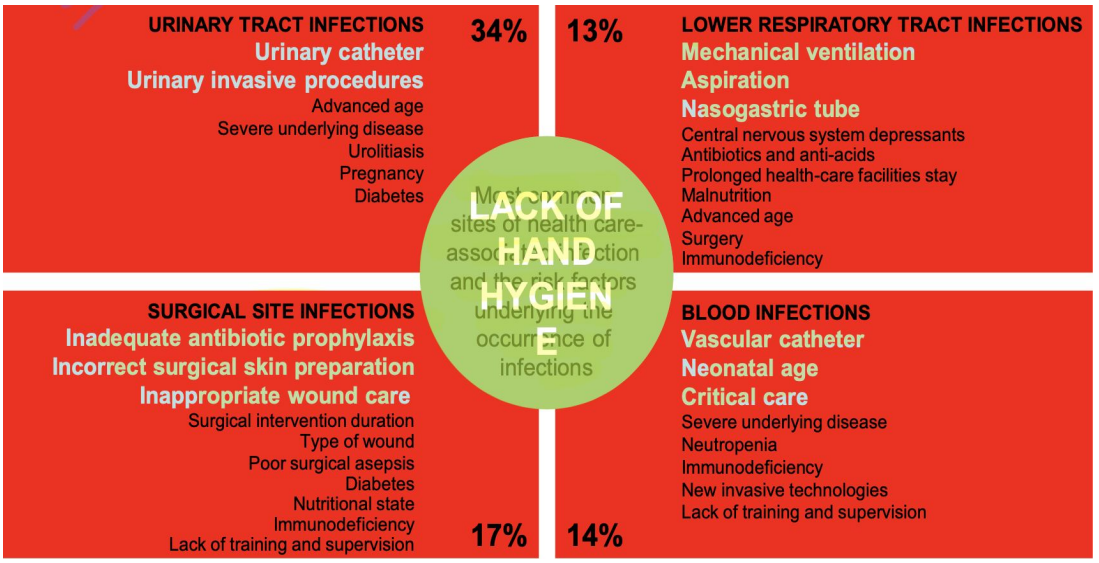
At any time, over 1.4 million people worldwide are suffering from infections acquired in hospital. Between 5% to 10% of patients admitted to hospitals acquire one or more infections.

Clinical presentation:

HAI can occur in many forms, but the most common are :

1. Catheter-Associated Urinary Tract Infections (CAUTI)
2. Surgical site infections (SSI)
3. Hospital-acquired pneumonia (HAP)
4. Catheter-Associated Bloodstream Infections (CLABSI)

Most frequent sites of infection and their risk factors:



Morbidity:

1. Causes more serious illness
2. Prolong hospital stay
3. Long-term disability
4. High additional financial burden
5. High personal burden on patients and their families
6. Deaths

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

1. Catheter-Associated Urinary Tract Infections (CAUTI)

Definition:

- **Catheter-associated UTI (CAUTI):** symptomatic UTI occurring in a patient with an indwelling urinary catheter OR within 48 hours after removal of a urinary catheter.
- **Catheter-associated asymptomatic bacteriuria(CAASB):** bacteriuria (≥ 105CFU/mL) without symptoms in a patient with an indwelling urinary catheter OR within 48 hours after removal of a urinary catheter

Epidemiology:

- CAUTIs are among the most common healthcare-associated infections > 30%, estimated > 500,000 of hospital UTIs annually. Increased morbidity & mortality, estimated 13,000 attributable deaths annually. Leading cause of secondary blood-stream infection with ~10% mortality.
- Excess length of stay: 2-4 days

Risk factors:

- Advanced age
- Severe underlying disease
- Urolithiasis
- Pregnancy
- DM

Causative organisms:

Causative organisms are likely to have antibiotic resistance. In patients with long-term catheterization (≥ 30 days), UTIs are typically polymicrobial.

Clinical features:

Symptomatic UTI must meet at least 1 of the following criteria:

- Fever (380 C or above), urgency, frequency, dysuria, or suprapubic tenderness.
- Positive urine culture, that is more than 105 CFU per ml, with no more than 2 species of microorganisms.

Diagnostic criteria:

Significant bacteriuria thresholds in catheterized patients

- CAASB: ≥ 105CFU/mL without symptoms
- CAUTI: ≥ 103CFU/mL with symptoms of UTI

Treatment:

Catheter removal or replacement:

- Remove if no longer necessary.
- Replace if still necessary and present for > 2 weeks.

Antibiotic therapy:

Guided by culture results and local resistance patterns, typically 7–14 days depending on the resolution of symptoms.

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

2. Surgical site infections (SSI)

- **Inadequate antibiotic prophylaxis**
- **Incorrect surgical skin preparation**
- **Inappropriate wound care**

Risk Factors:

- Surgery duration
- Type of surgery: clean, clean-contaminated, contaminated, dirty
- Type of wound
- Improper surgical aseptic preparation
- Poor glucose control
- Malnutrition
- Immunodeficiency
- Hypothermia
- Lack of training and supervision

Definition:

Infection arising within 30 days of a surgical procedure at the site of the surgical incision.

Epidemiology:

- 15–20% of all healthcare-associated infections
- Most common nosocomial infection among patients undergoing surgery
- Incidence: ~ 5% of all surgical wounds

Causative organisms:

- During the first 4 days (uncommon): Group A Streptococcus(GAS), C. perfringens → necrotizing fasciitis
- After 4 days; : SSI due to bacteria on the skin, in the genital tract, or in the gastrointestinal tract (e.g., S. aureus)
- > 30 days; : SSI due to indolent organisms (e.g., coagulase-negative staphylococci)

Types of surgical wounds:

Clean:

- Uninfected, no inflammation
- Resp, GI, GU tracts not entered
- Closed primarily

Examples: Ex lap, mastectomy, neck dissection, thyroid, vascular, hernia, splenectomy.

Clean-contaminated:

- Resp, GI, GU tracts entered, controlled
- No unusual contamination

Examples: Chole, SBR, Whipple, liver txp, gastric surgery, bronch, colon Surgery.

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

2. Surgical site infections (SSI)

Types of surgical wounds(con…):

Contaminated:

- Open, fresh, accidental wounds
- Major break in sterile technique
- Gross Spillage from GI tract
- Acute non-purulent inflammation

Examples: Inflamed appendix, bile spillage in chole, diverticulitis, Rectal surgery, penetrating wounds.

Dirty:

- Old traumatic wounds, devitalized tissue
- Existing infection or perforation
- Organisms present BEFORE procedure

Examples: Abscess I&D, perforated bowel, peritonitis, wound debridement, positive cultures pre-op.

Classification and clinical features:

Type of SSI	Incisional SSI		Organ/space SSI
	Superficial incisional SSI	Deep incisional SSI	
Definition	involving only the skin and subcutaneous tissue of the incision.	involving fascia and muscle layers at the site of the incision.	SSI involving any part of the body that is deeper than the fascia or muscle layers and was opened or manipulated during surgery.
Clinical features	-Purulent discharge from the incision -In some cases, postoperative fever -Tenderness, erythema, warm, and/or localized swelling.	-Purulent discharge from deep within the incision -Postoperative fever -Tenderness at the incision -Wound dehiscence -Necrotizing fasciitis: cloudy gray discharge, possible crepitus of tissue surrounding the wound	-Postoperative fever -Purulent discharge from a drain placed within the organ or space, or an abscess -Further signs depend on the organs affected

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

2. Surgical site infections (SSI)

Diagnostics:

- Leukocytosis
- Incisional SSI: wound swab for Gram stain and wound culture
- Organ/space SSI: imaging (e.g., CT, MRI)

Treatment:

-Surgical therapy:

- Suture removal, incision and drainage, regular dressings, and daily wound inspection
- Debridement is indicated for devitalized tissue.
- Delayed closure once the wound is no longer infected

-Empiric antibiotic therapy for SSI

Indications:

- Erythema and induration extending > 5 cm from the wound edge
- Fever > 38.5° C
- Heart rate > 110/min
- WBC count > 12,000 cells/mm3

Antibiotic of choice:

-SSI in a clean wound over the trunk, head and neck, or limb:

- In low risk of MRSA: cefazolin
- In high risk of MRSA and individuals with beta-lactams allergy: vancomycin, daptomycin, or linezolid

-SSI in a clean-contaminated wound or in a clean wound over the perineal region: cephalosporin PLUS metronidazole, levofloxacin PLUS metronidazole, or carbapenem

- If group A Streptococcus or C. perfringens infection is suspected: penicillin and clindamycin
- Targeted antibiotic therapy may be initiated once results of the bacterial culture are available.

Complications:

- Wound dehiscence
- Secondary hemorrhage
- Bloodstream infection → sepsis → septic shock

Prevention:

- Optimize blood glucose levels.
- Stop smoking one month before surgery.
- Delay the elective procedure until all infections, even those remote from the surgical site, are treated.
- Skin antisepsis in the operating room
- Perioperative antibiotic prophylaxis(Administer within 30-45 minutes to incision, 1-2hr for vancomycin and fluoroquinolones)

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

3. Hospital-acquired pneumonia (HAP)

Definition:

- Hospital-acquired pneumonia (HAP) or nosocomial pneumonia refers to a new episode of pneumonia occurring at least 2 days after admission to hospital.
- It is the second most common hospital-acquired infection (HAI) and the leading cause of HAI-associated death.
- The elderly are particularly at risk, as are patients in intensive care units, especially when mechanically ventilated; here, the term ventilator-associated pneumonia (VAP) is applied.
- Health-care-associated pneumonia (HCAP) refers to the development of pneumonia in a person who has spent at least 2 days in hospital within the last 90 days, or has attended a haemodialysis unit, or received intravenous antibiotics, or been resident in a nursing home or other long-term care facility.

Risk factor:

- Reduced host defences against bacteria:

Reduced immune defences (e.g. glucocorticoid treatment, diabetes, malignancy), Reduced cough reflex (e.g. post-operative), Disordered mucociliary clearance (e.g. anaesthetic agents), Bulbar or vocal cord palsy.

- Aspiration of nasopharyngeal or gastric secretions:

Immobility or reduced conscious level, Vomiting, dysphagia (N.B. stroke disease), achalasia or severe reflux, Nasogastric intubation, Bacteria introduced into lower respiratory tract, Endotracheal intubation/tracheostomy, Infected ventilators/nebulisers/bronchoscopes, Dental or sinus infection.

- Bacteraemia:

Abdominal sepsis, Intravenous cannula infection, Infected emboli.

Clinical features and investigation:

The diagnosis should be considered in any hospitalised or ventilated patient who develops purulent sputum (or endotracheal secretions), new radiological infiltrates, an otherwise unexplained increase in oxygen requirement, a core temperature > 38.3°C, and a leucocytosis or leucopenia.
The clinical features and radiographic signs are variable and non-specific, however, raising a broad differential diagnosis that includes pulmonary embolism, ARDS, pulmonary oedema, pulmonary haemorrhage and drug toxicity.
Therefore, in contrast to CAP, microbiological confirmation should be sought whenever possible. Adequate sputum samples may be difficult to obtain in the frail elderly person and physiotherapy should be considered to aid expectoration. In patients who are mechanically ventilated, bronchoscopy-directed protected brush specimens, bronchoalveolar lavage (BAL) or endotracheal aspirates may be obtained.

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

3. Hospital-acquired pneumonia (HAP)

Treatment:

- The principles of management are similar to those of CAP, focusing on adequate oxygenation, appropriate fluid balance and antibiotics.
- The organisms implicated in early-onset HAP (occurring within 4–5 days of admission) are similar to those involved in CAP. In patients who have received no previous antibiotics, co-amoxiclav or cefuroxime represents a sensible choice.
- If the patient has received a course of recent antibiotics, then piperacillin/tazobactam or a third-generation cephalosporin should be considered.
- Late-onset HAP is more often attributable to Gram-negative bacteria (e.g. Escherichia coli, Pseudomonas aeruginosa, Klebsiella spp. and Acinetobacter baumannii), Staph. aureus (including meticillin-resistant Staph. aureus (MRSA)) and anaerobes, and the choice of antibiotics ought to cover these possibilities.
- Antipseudomonal cover may be provided by a carbapenem (meropenem), an anti-pseudomonal cephalosporin or piperacillin–tazobactam.
- MRSA cover may be provided by glycopeptides such as vancomycin or linezolid.
- A. baumannii is usually sensitive to carbapenems but resistant cases may require nebulised and/or intravenous colistin.
- The choice of agents is most appropriately guided by knowledge of local patterns of microbiology and antibiotic resistance. It is sensible to commence broad-based cover, discontinuing less appropriate antibiotics as culture results become available. In the absence of good evidence, the duration of antibiotic therapy remains a matter for clinical judgement.

Prevention:

- Good hygiene is paramount, particularly with regard to hand-washing and any equipment used.
- Steps should be taken to minimise the chances of aspiration and to limit the use of stress ulcer prophylaxis with proton pump inhibitors.
- Oral antiseptic (chlorhexidine 2%) may be used to decontaminate the upper airway and some intensive care units employ selective decontamination of the digestive tract when the anticipated requirement for ventilation will exceed 48 hours.

Recognize the epidemiology, clinical presentation and morbidity of Hospital acquired infections.

4. Catheter-Associated Bloodstream Infections (CLABSI)

Definition:

- Laboratory-confirmed bloodstream infection by a positive blood culture
- Not related to an infection at another site
- Develops at least after 48 hours of a central line placement

Most common site: femoral central lines

Causative organisms:

- Staphylococci account for 70–90% of catheter infections, with coagulase-negative staphylococci more common than Staph. aureus.
- Other causes include: enterococci and Gram-negative bacilli.
- Unusual Gram-negative organisms, such as Citrobacter freundii and Pseudomonas fluorescens, raise the possibility of non-sterile infusion equipment or infusate.
- Candida spp. are a common cause of line infections, particularly in association with total parenteral nutrition.
- Non-tuberculous mycobacteria may cause tunnel infections.

Clinical features:

- Local features: swelling, pain, redness, exudates, and/or purulence at catheter insertion sites.
- Systemic features: features of sepsis (e.g., fever, hemodynamic instability, altered mental status)

Treatment:

- Removal of central line
- Antimicrobial therapy: Type and duration depends on culture results, type of organism, complicated disease.

e.g. of antibiotics used: Vancomycin, cloxacillin, cefazolin, piperacillin/ tazobactam, cefepime, ceftazidime, carbapenems, Aminoglycosides, colistin, daptomycin, echinocandins.

Prevention:

Infection prevention is a key component of the management of vascular catheters. Measures include:

- Strict attention to hand hygiene
- Optimal siting, full aseptic technique on insertion and subsequent interventions
- Skin antisepsis with chlorhexidine and isopropyl alcohol
- Daily assessment of catheter sites and daily consideration of the continuing requirement for catheterisation.
- The use of catheters impregnated with antimicrobials, such as chlorhexidine or silver, is advocated in some settings.

Understand features/mechanism involved in developing antibiotics resistance.

Antimicrobial resistance happens when germs like bacteria and fungi develop the ability to defeat the drugs designed to kill them. Resistant infections can be difficult, and sometimes impossible, to treat. Antimicrobial resistance is a naturally occurring process. However, increases in antimicrobial resistance are driven by a combination of germs exposed to antibiotics and antifungals, and the spread of those germs and their resistance mechanisms.

Mechanism of developing antibiotic resistance.

Resistance Mechanisms	Description
Restrict access of the antibiotic	Germs restrict access by changing the entryways or limiting the number of entryways. **Example:** Gram-negative bacteria have an outer layer (membrane) that protects them from their environment. These bacteria can use this membrane to selectively keep antibiotic drugs from entering.
Get rid of the antibiotic or antifungal	Germs get rid of antibiotics using pumps in their cell walls to remove antibiotic drugs that enter the cell. Example: Some *Pseudomonas aeruginosa* bacteria can produce pumps to get rid of several different important antibiotic drugs, including fluoroquinolones, beta-lactams, chloramphenicol, and trimethoprim.
Change or destroy the antibiotic	Germs change or destroy the antibiotics with enzymes, proteins that break down the drug. Example: *Klebsiella pneumoniae* bacteria produce enzymes called carbapenemases, which break down carbapenem drugs and most other beta-lactam drugs.
Change the targets for the antibiotic or antifungal	Many antibiotic drugs are designed to single out and destroy specific parts (or targets) of a bacterium. Germs change the antibiotic's target so the drug can no longer fit and do its job. Example: *Escherichia coli* bacteria with the *mcr*-1 gene can add a compound to the outside of the cell wall so that the drug colistin cannot latch onto it. *Aspergillus fumigatus* changes the *cyp1A* gene so that triazoles cannot bind to the protein.
Bypass the effects of the antibiotic	Germs develop new cell processes that avoid using the antibiotic's target. Example: Some *Staphylococcus aureus* bacteria can bypass the drug effects of trimethoprim.

Appreciate the challenges in the management of Hospital acquired infections.

Challenges in management:

- Increased number of severely ill patients and increased numbers of immunocompromised patients
- Lack of rapid diagnostics for MDR pathogens extends the length of time that patients receive suboptimal antibiotic therapy
- Growing frequency of antimicrobial-resistant pathogens

Challenges in prevention:

- Lack of compliance with hand hygiene and other infection preventive measures (e.g. endoscope)
- Limited infection prevention resources

Discuss the antimicrobial treatments for hospital acquired infections.

The approach to management may vary depending on the site of infection. The general approach to a suspected HAI is :

- ➢ Management of sepsis
- ➢ Empiric or targeted antibiotic therapy of the underlying infection
- ➢ Consult infectious disease specialists for the management of MDRO infections.
- ➢ Determine the need for PPE and follow isolation precautions as needed.

Treatment of multi resistant pathogens					
Pathogen		**Resistance**		**First-line therapy**	**Alternative therapy**
Gram-positive	MRSA	All beta-lactam antibiotics(penicillins, cephalosporins, and carbapenems) Potential resistance to: -Aminoglycosides -Macrolides -Lincosamides -Quinolones		-Vancomycin	-Linezolid -Daptomycin -Tigecycline -Ceftaroline -Doxycycline -Quinupristin/dalfopristin
	Vancomycin-resistant enterococci (VRE)	-Vancomycin (possibly also teicoplanin) Potential resistance to: -Macrolides -Most penicillins -Quinolones -Aminoglycosides -Tetracyclines		-Linezolid	-Quinupristin/dalfopristin -Tigecycline -Daptomycin
Gram-negative	ESBL pathogens (extended-spectrum β-lactamase)	-Penicillins -Cephalosporins	MDRGNB -Fluoroquinolones -Carbapenems -Third and fourth generation cephalosporins -Broad-spectrum penicillins	MDRGNB: carbapenems	In case of resistance to all four groups, consider last resort antibiotics: -Colistin -Gentamicin -Tigecycline.
	Pseudomonas aeruginosa	-Most penicillins -First, second, and third generation cephalosporins -Macrolides		MDRGNB -Piperacillin PLUS tazobactam -Certain third generation cephalosporins(e.g., ceftazidime) -Carbapenems All options can potentially be combined with an aminoglycoside	In case of resistance all four groups, give last resort antibiotics according to antibiogram: -Colistin -Polymyxin

Define the necessary infection control guidelines.

HAI prevention and control measures

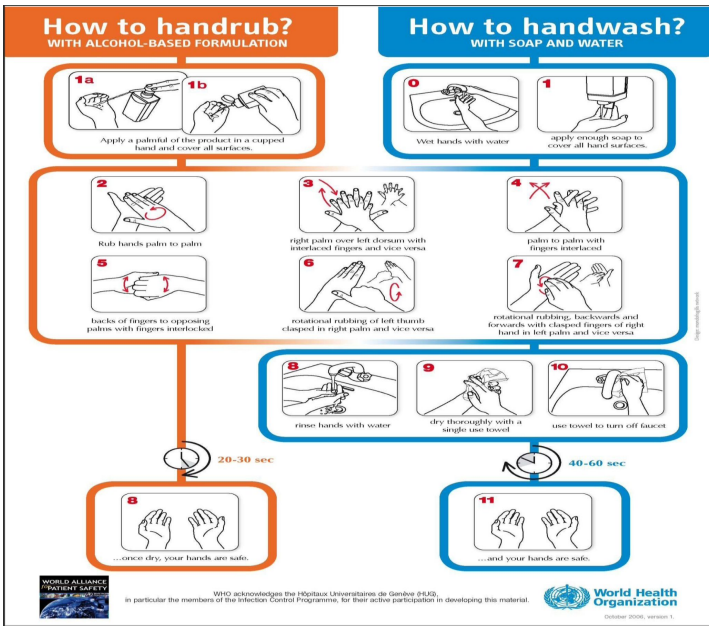
Poor infection control practice in hospitals and other healthcare environments can cause the transfer of infection from person to person. It is essential for all healthcare workers to wash or clean their hands before and after patient contact; whenever necessary, they should wear gloves, aprons and other protective equipment. This is particularly important when they are performing invasive procedures, dealing with infected wounds or manipulating indwelling devices. Care should also be taken when in contact with patients known to be colonized or infected with a resistant organism (e.g. carbapenemase-producing K. pneumoniae), those infected by communicable pathogens with high mortality (e.g. Ebola, for which high- security isolation and extreme care are mandatory), or those with diarrhoea (e.g. C. difficile infection).
Interventions that health workers should focus on to prevent and control HAIs are:

Care bundle approach

There is a set (typically 3–5) of simple actions ideally, highly evidence-based that healthcare professionals should always implement in a certain situation (e.g. inserting a urinary catheter) to minimize the risk of a negative outcome.

Hand hygiene

Hands are the most common vehicle to transmit healthcare associated pathogens. The WHO's 'Five Moments for Hand Hygiene' must be applied before and after all patient contacts, including before and after aseptic procedures, and after contact with body fluids and the patient environment. Soap and water (rather than an alcohol-based rub) should be used after visible contamination of hands and when patients are vomiting or have diarrhoea, even if gloves are used(Wear gloves only when indicated, other wise they become a major risk for germ transmission).



Define the necessary infection control guidelines.

HAI prevention and control measures

Hand hygiene *cont,*

- Healthcare-associated pathogens are most often transmitted from patient to patient through the hands of healthcare workers.
- Hand Hygiene is the single most important measure for preventing the spread of microorganisms in healthcare settings.
- Any HCW involved in health care needs to be concerned about hand hygiene. You must perform hand hygiene to protect the patient against harmful microbes in your hands or present on your skin and to protect yourself and the healthcare environment from harmful microbes.

What are our hands carrying?

1. **Resident Flora:** Microorganisms residing under the superficial cells of the stratum corneum and also found on the surface of the skin. They are deep seated, difficult to remove and associated with infection following surgery/invasive procedures. Example : Staphylococcus Epidermidis
2. **Transient Flora:** Microorganisms that colonize the superficial layers of the skin and are more amenable to removal by routine handwashing.They are transferred with ease to and from hands, important cause of cross infection and easily removed with good hand hygiene. Example : S. Aureus, E.coli.

You must perform hand wash with plain/antimicrobial soap since alcohol is not beneficial during the following situations:

- Your hands are visibly soiled (dirty).
- Hands are visibly contaminated with blood or body fluids.
- When dealing with spore forming organism e. g. Cl. difficile.
- Before eating and after using the restroom

Important tips for clean hands :

- **Fingernails:**
  Should be short, clean, and free from nail polish as it harbour micro organisms that are not easily removed during hand hygiene. Documented evidence of link between artificial nails and a Pseudomonas outbreak in a neonatal intensive care unit in the USA.

- **Jewellery:**
  No Jewellery to be worn on the hands & wrists as it become contaminated during work activities and prevent proper hand hygiene procedures .

HAND WASHING using plain soap and water or disinfectant soap, e.g., soap containing Chlorhexidine.
Timing: 40–60 seconds

HAND RUB using alcohol- based hand rub/ gels
Timing: 20–30 seconds.

HAND SCRUB antimicrobial agent with a sponge and brush or by using an alcohol-based rub.
Timing: First scrub) will take about 5 minutes and subsequent one ranging from 2-3 minutes. Attention should be taken to clean under nails.

Define the necessary infection control guidelines.

HAI prevention and control measures

Personal protective equipment

All health care worker should assess the risk of exposure to blood or body fluids or contaminated surfaces BEFORE any health care or patient-care activities. Gloves should be worn for all invasive procedures, including venesection, and contact with sterile sites, mucous membranes, bodily fluids or non-intact skin. Disposable plastic aprons should be used when there is a risk of contamination of clothing or skin; if there is a risk of extensive contamination, surgical gowns should be worn. Respiratory protection should be worn for patients with high-consequence respiratory-spread pathogens, such as avian influenza and MERS.

Aseptic technique

This should be adopted for all invasive procedures, when using and manipulating invasive devices, and when in contact with all wounds.

Urinary catheters

These should be inserted only when it is essential to do so and then removed as soon as is possible; they must be inserted using an aseptic technique. A clear care plan should be in place for longer-term catheters. Overuse or poor care of urinary catheters increases the risk of E. coli bloodstream infection.

Vascular access devices

Insert a vascular catheter only when there is a clear plan to use it; check the device daily and remove as soon as is possible. Use 2% chlorhexidine gluconate in 70% isopropyl alcohol for skin decontamination prior to insertion and to clean the access port or hub prior to use.

Adequate hydration

Dehydrated patients are at higher risk of urinary tract infections. Oral hydration is preferred to intravenous if possible (there is a lower risk of infection with an intravenous device), and patients should be encouraged to drink a variety and an adequate quantity of fluids.

Communication

This is essential when transferring patients with transmissible infections (e.g. chickenpox, MERS, and infections caused by multi and extensively drug-resistant bacteria) between admission areas, wards, hospitals and institutions, including residential and nursing homes.

Patient Care Equipment

Patient care equipment soiled with blood, body fluids in a manner that prevents transfer of microorganisms to one's, other patients and environment. Single use, disposable items must be disposed properly. Reusable items have to be been cleaned and reprocessed appropriately, prior to use on another patient based on the manufacture recommendation and the intended use.

Safe injection practices

Do not recap, bend, break or hand-multiple used needles. If recapping is required use a one handed scoop technique only. Discard the needle in sharp containers. Reporting of needle stick and sharp injuries to infection control department.

Define the necessary infection control guidelines.

HAI prevention and control measures

"Hand Hygiene and Medical Glove use"

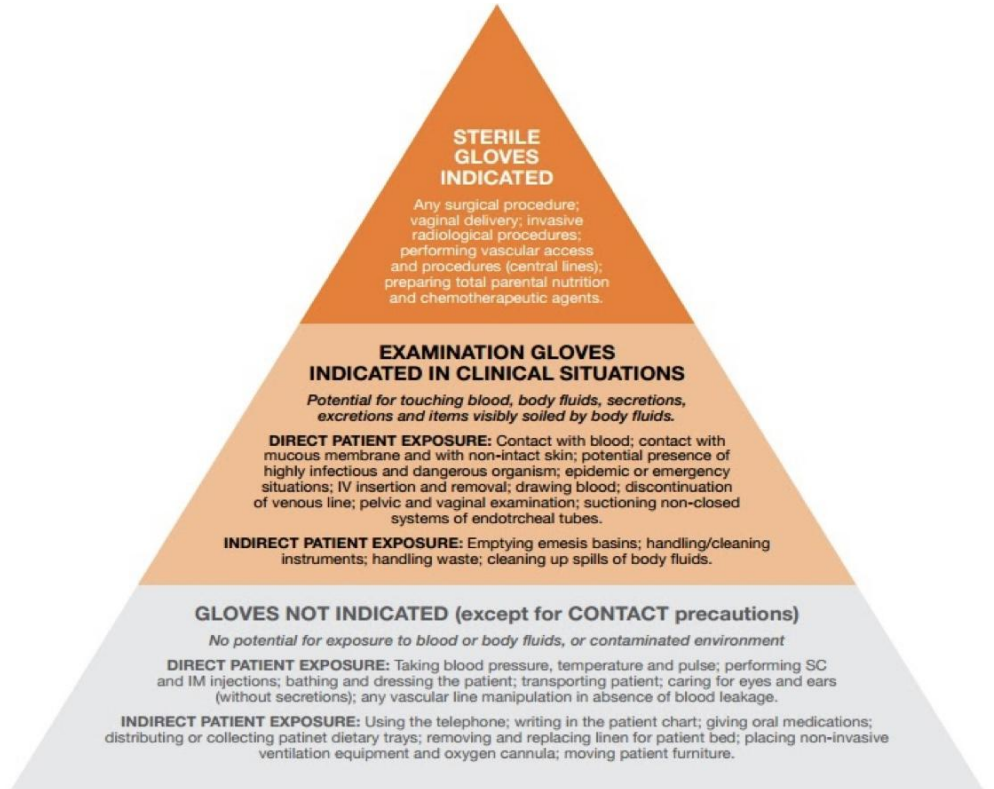
Discard gloves after each task and clean your hand –gloves may carry germs. Wear gloves only when indicating to Standard and Contact precautions, otherwise they become a major risk for germ transmission. Since gloves are not completely free from leaks and may tear, their use does not replace the need for hand hygiene. Therefore, effective hand hygiene protocols should be followed before donning gloves and after removing them.

REMINDER:

- Do not wear the same pair of gloves for the care of more one patient.
- Gloves should be put on immediately before the activity .
- Gloves must be removed after the activity.
- Should be procedure-specific, not patient-specific
- Change the gloves as soon as gloves are damaged or non-integrity is suspected

The Glove Pyramid : To aid decision making on when to wear and not wear gloves .

- Gloves must be worn according to STANDARD and CONTACT PRECAUTIONS
- The pyramid details some clinical examples in which gloves are not indicated, and others in which examination or sterile gloves are indicated.
- Hand hygiene should be performed when appropriate regardless of indication for glove use



Define the necessary infection control guidelines.

HAI prevention and control measures

Isolation

The appropriateness of isolation, if available, should be considered. Infections with a high risk to public health (e.g. Ebola and MERS) are isolated within high-security, hospital-based, negative- pressure isolation facilities using enhanced respiratory, personal protective equipment and decontamination procedures. Patients hospitalized with highly infectious respiratory-spread pathogens, such as chickenpox and measles, are isolated in negative-pressure isolation facilities. Patients with high-consequence pathogens spread by direct or indirect person- to-person contact (colonization or infection), such as C. difficile and multi-drug resistant Gram-negative bacteria, are ideally, housed in side-rooms with en suite toileting facilities and appropriate contact precautions (hand hygiene and personal protective equipment).

Types of Isolation Precautions:

1- Standard precautions:

A group of practices of infection prevention and control based on the principle that all blood, body fluids secretions, excretions (except sweat), non intact skin and mucous membrane may contain transmissible infectious agents regardless of their diagnosis. It is applied to all patients regardless of their diagnoses

Elements of Standard Precaution

1. Hand Hygiene
2. Gown
3. Mask
4. Face Protection
5. Gloves
6. Safe Injection Practices
7. Patient care equipment
8. Environmental Control
9. Textile Laundry
10. Worker Safety
11. Patient Placement Transport
12. Respiratory Hygiene
13. Infection Control Practices for Lumbar Punctures:

Use face mask during lumbar puncture, spinal/epidural anesthesia, intrathecal chemo, myelogram to prevent droplet spread of oral flora during spinal procedure.

Define the necessary infection control guidelines.

HAI prevention and control measures

Types of Isolation Precautions *cont,*

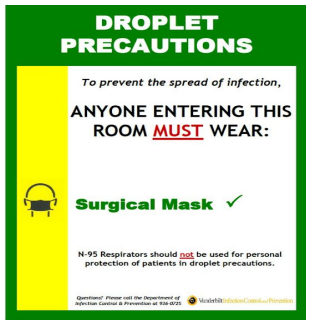
2- Transmission-based precautions:

Contact precautions:

1. Infections spread by direct or indirect contact with patients or patient-care environment (C.difficle, MRSA, VRE, ESBL, CRE and MDR GNR).
2. Limit patient movement.
3. Private/SINGLE room or cohort with patients with same infection.
4. Wear disposable gown and gloves when entering the patient room.
5. Remove and discard used gown and gloves inside the patient room.
6. Wash hands immediately after leaving the patient room.
7. Use dedicated equipment if possible(e.g.,stethoscope)

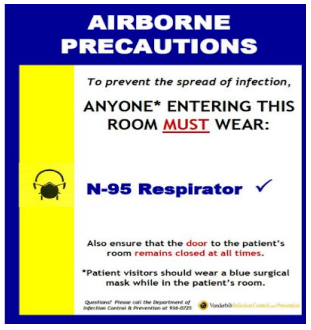
Droplet precautions:

1. Reduce the risk of transmission by large particle droplets (larger than 5 µ in size).
2. Requires close contact between the source person and the recipient.
3. Droplets usually travel 3 feet or less.
4. E.g., influenza, MERS-CoV, other respiratory viruses, rubella, parvovirus B19, mumps, H. influenzae, and N. meningitidis.
5. A private/single room or Cohort with patient with active infection with same microorganism.
6. Use a mask when entering the room especially within 3 feet of patient.
7. Limit movement and transport of the patient.
8. Use a mask on the patient if they need to be moved and follow respiratory hygiene/cough etiquette.



Airborne precautions:

1. Tuberculosis, measles, varicella, MERS-CoV (severe).
2. Place the patient in an airborne infection isolation room (AIIR).
3. Pressure should be monitored with visible indicator.
4. Use of respiratory protection (e.g., fit tested N95 respirator) or powered air-purifying respirator (PAPR) when entering the room.
5. Limit movement and transport of the patient. Use a mask on the patient if they need to be moved
6. Keep patient room door closed.



Define the necessary infection control guidelines.

HAI prevention and control measures

Types of Isolation Precautions *cont,*

2- Transmission-based precautions:

Blood Spillage Management

- ➢ Evaluate the situation and control the source. Inform others, limit the access to the spillage area and immediately clean and disinfect
- ➢ Use protective PPE
- ➢ Cover spillage with hypochlorite (presept) solution. Leave it for the appropriate contact time.
- ➢ Mop up excess with paper towels and dispose in yellow bag
- ➢ Clean the area thoroughly with detergent solution. Dispose of protective clothing into yellow bag. Do hand wash effectively.

When do we discontinue isolation ?

- Precautions is discontinued when the patients is no longer considered infectious based on clinical and/or laboratory data. After consulting IPAC.
- Keep updated about notifiable diseases and emergent diseases To protect your self and your patient

Safe injection practices :

- Safe needle practice
- Reporting of needlestick and sharp injuries to infection control department
- Needlesticks and other sharps injuries are a serious hazard in any healthcare setting. Contact with contaminated needles, scalpels, broken glass, and other sharps may expose healthcare workers to blood that contains pathogens which pose a grave, potentially lethal risk
- ELIMINATE HAZARD : Remove sharps and needles, and eliminate all unnecessary injections, workplace controls, use protective barrier between HCW and hazard as part of standard precaution

- ❖ ENGINEERING CONTROLS : Use safety syringes with a sharp injury protection feature, e.g use needles that retract, sheathe or is blunt.
- ❖ WORKPLACE CONTROLS : No re- capping of needles Placing sharp containers at eye- level Empty sharp containers when 3/4 full Plan safe handling and disposal before using them. Never pass a sharp by hand, use a neutral zone. Always report your injury
- ❖ ADMINISTRATIVE CONTROLS : Ensure appropriate training to HCW on safe handling of sharp equipment and devices Ensure HCW immunity and vaccination against blood borne disease
- ❖ PERSONAL PROTECTIVE EQUIPMENT : Use protective barrier between HCW and hazard as part of standard precaution

Serologies and Vaccination :

- HBSAB titre (above 10), VZV, MMR, Td, Seasonal Influenza Vaccine, COVID-19 vaccine.

Lecture Quiz

1:C / 2:D / 3:D

Q1: 36 Y/O man with indwelling urinary catheter for past 3 months after a motor vehicle accident, his nurse noticed the urine output to be a little turbid. He has no fever, no dysuria, no lower abdominal pain. His CBC and renal functions are normal, Urine culture grew more than 100,000 colonies of E.Coli, susceptible to all beta-lactams, fluoroquinolones and TMP-SMX. You recommend:

A. Start ceftriaxone 1 gm IV od
B. Start ciprofloxacin 500mg pp Q12h
C. Remove catheter
D. Remove catheter and start TMP-SMX 960mg po q12h

Q2:30 Y/O man underwent knee ligament tear repair 2 weeks ago; he now presents to clinic with 5 days of opening gap of surgical scar with pussy discharge. He has no fever, WBC 15, platelets 450, ESR 80, creatinine 70, culture from pus grew MRSA resistant to tetracycline TMP-SMX and clindamycin. You recommend:

A. Clindamycin 300 mg po q 8h
B. TMP-SMX 960mg po q 12h
C. Ciprofloxacin 500mg po q 12h
D. Linezolid 600mg po q 12h

Q3: 22 years old lady in ICU for past 6 months has tracheostomy for ventilation, she is on 2 L O2, with minimal sputum, has no fever, CXR normal, the RT send a sputum culture which grows Pseudomonas aeruginosa susceptible to ceftazidime, meropenem, ciprofloxacin. You recommend:

A. Ceftazidime
B. Meropenem
C. Moxifluxacin
D. Change tracheostomy tube