

Hospital Acquired Infections (HAI) & Concepts in Infection And Prevention Control



Objectives :

- ★ Know different types of HAI and how to prevent them
- ★ Highlight the crucial importance of Hand Hygiene
- ★ Understand different types of Isolation Precautions and how to comply with them.



[Editing file](#)

Color index

Original text

Females slides

Males slides

Doctor's notes ⁴³⁸

Doctor's notes ⁴³⁹

Text book

Important

Golden notes

Extra

Hospital Acquired Infections (HAI)

General Information

- HAIs are Also known as Nosocomial infections or Health Care Associated Infections.
- Hospital-acquired infection (nosocomial infection): an infection acquired after > 48 consecutive hours of hospitalization that was not present or incubating at admission.
- Between 5% and 10% of patients admitted to hospitals acquire one or more HAI
- Causes:
 - **More serious illness**
 - Prolonged hospital stay
 - Long-term disability
 - High personal burden on patients and their families
 - High additional financial burden
 - Deaths

Estimated Rates of HAI Worldwide

- **In the developed world;** 5–10% of patients acquire one or more infections
- **In developing countries;** It can exceed 25%
- **In intensive care units;** affects about 30% of patients and the attributable mortality may reach 44%

Source of Infection

Endogenous Sources

- Related to the patient himself
- Such as the skin, nose, mouth, GI tract, vagina and airway colonisation that are normally inhabited by microorganisms (normal flora), but after admission by 48H it changes to more serious microbes, Clostridium difficile, Staphylococcus aureus (especially MRSA), vancomycin-resistant enterococci and multiresistant Gram-negative organisms are all strongly associated with healthcare contact and are an increasing problem in hospitals worldwide

Exogenous Sources

- External to the patient such as health care workers (HCW), visitors, patient care equipment, medical devices, or the healthcare environment
- The best method to prevent it is washing hands.

Types of HAI



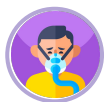
Catheter Associated Urinary Tract Infections (CAUTI)

The most common type.



Surgical site infections (SSI)

2nd most common.



Ventilator Associated Pneumonia (VAP)

3rd most common.



Central line Associated Bloodstream Infections (CLABSI)

4th most common

CAUTI

◀ Epidemiology

- Most common type of HAI: > 30%
 - Estimated > 500,000 of hospital UTIs annually
- Increased morbidity & mortality
 - Estimated 13,000 attributable deaths annually
 - Leading cause of secondary bloodstream infection with ~10% mortality through **Bacteremia via a focus**.
- Excess length of stay: 2-4 days

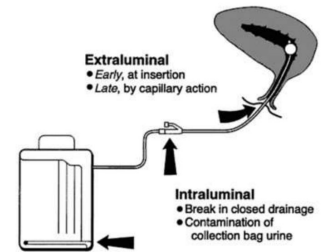
◀ Risk factors

- Advanced age
- Diabetes Mellitus
- Pregnancy
- Urolithiasis
- Severe underlying disease
- **Malnutrition**
- **Immunesuppression**

◀ Causes

1 Indwelling urinary catheter (main risk factor)

- 15-25% of hospitalized patients **have urinary catheter**
- Often placed for inappropriate indications
- Physicians frequently unaware:
 - > 50% did not monitor which patients catheterized
 - 75% did not monitor duration and/or discontinuation



2 Urinary invasive procedures (NOT the routine procedures)

◀ Pathogenesis

- **Source of microorganisms:**
 - **Endogenous:** meatal, rectal, or vaginal
 - **Exogenous;** usually via contaminated hands of HCW during catheter insertion or manipulation of the collecting system.
- Formation of biofilms (layers of bacterial colonies that develop resistance for the bacteria) by urinary pathogens is common on the surfaces of catheters and collecting systems
- Bacteria within biofilms are resistant to antimicrobials and host defenses
- **Must remove catheter for cure**

◀ Diagnostic Criteria

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

Fever (38.0C or above), urgency, frequency, dysuria, or suprapubic tenderness

Fever is important for upper UTI (kidney or ureters) but not lower why? Because sometimes in lower UTI (cystitis) you don't have fever

Positive urine culture, that is more than 10^5 CFU (colony forming unit) per ml, with no more than 2 species of microorganisms, if it's more than 2 it mean that the collection of specimen was not appropriate and there has been contamination of the specimen. **Culture should be repeated** with the proper method.



A positive culture of a urinary catheter tip is not an acceptable laboratory test to diagnose UTI

CAUTI

Prevention: CAUTI Bundle

1	Insert catheters only for appropriate indications	2	Daily revision of need of catheterization
3	Leave catheters in place only as long as needed	4	Hand hygiene
5	Ensure that only properly trained persons insert and maintain catheters	6	Maintain unobstructed urine flow by patients bed or any surroundings
7	Insert catheters using aseptic technique and sterile equipment (acute care setting)	8	Avoid catheter use for management of urinary incontinence
9	Following aseptic insertion, maintain a closed drainage system	10	Use catheters in operative patients only as necessary
11	Minimize use in all patients, particularly those at higher risk of CAUTI and mortality (Women, elderly and impaired immunity)		
12	Remove catheters ASAP postoperatively, preferably within 24 hours, unless there are appropriate indications for continued use		

Treatment

- **Catheter removal or replacement**
 - Remove if no longer necessary.
 - Replace if still necessary and present for > 2 weeks.
- Antibiotics therapy

SSI

Surgical Wound Classification

Clean	Clean-contaminated
<ul style="list-style-type: none"> ● Resp, GI, GU tracts not entered ● Uninfected, no inflammation ● Closed primarily ● Examples: lap, mastectomy, neck dissection, thyroid, vascular, hernia, splenectomy 	<ul style="list-style-type: none"> ● Resp, GI, GU tracts entered but controlled ● No unusual contamination ● Examples: Chole, SBR, Whipple, liver txp, gastric surgery, bronch, colon surgery, cholecystectomy.
Contaminated	Dirty
<ul style="list-style-type: none"> ● 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. 	<ul style="list-style-type: none"> ● 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.

SSI

◀ Epidemiology

- **Burden**
 - 17% of all HAI; second to UTI
 - 2%-5% of patients undergoing inpatient surgery
- **Mortality**
 - 3 % mortality
 - 2-11 times higher risk of death
 - 75% of deaths among patients with SSI are directly attributable to SSI
- **Morbidity**
 - long-term disabilities

◀ Causes

Inadequate antibiotic prophylaxis **before the surgery.**

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
- **Inadequate wound care**
- Poor glucose control
- Malnutrition
- Immunodeficiency
- Hypothermia
- Lack of training and supervision

Important Modifiable Risk Factors:

- Antimicrobial prophylaxis: Inappropriate choice (procedure specific), Improper timing (pre-incision dose) and Inadequate dose based on body mass index, procedures >3h
- Skin or site preparation ineffective
- Colorectal procedures; Inadequate bowel prep/antibiotics
- Inadequate wound dressing protocol
- Improper glucose control
- Colonization with preexisting microorganisms

SSI

Pathogenesis

Endogenous	Exogenous
<ul style="list-style-type: none"> • Patient flora at the operation site. <ul style="list-style-type: none"> ○ Skin ○ Mucous membrane ○ GI tract • Seeding from a distant focus of infection 	<ul style="list-style-type: none"> • Surgical Personnel (surgeon and team) <ul style="list-style-type: none"> ○ Soiled attire ○ Breaks in aseptic technique ○ Inadequate hand hygiene • O.R. physical environment and ventilation • Tools, equipment, materials brought to the operative field
Microorganisms causing SSI Important	
<ul style="list-style-type: none"> • Staphylococcus aureus (30%) • Coagulase- negative staphylococci (13.7%) • Enterococcus spp (11.2%) • Escherichia coli (9.6) • Pseudomonas aeruginosa (5.6%) • Enterobacter spp (4.2%) • Klebsiella pneumoniae (3%) • Candida spp (2%) • Klebsiella oxytoca (0.7%) • Acinetobacter baumannii (0.6%) 	

SSI Subtypes

Superficial SSI	Deep SSI
<ul style="list-style-type: none"> • Infection occurs within 30 days after the operative procedure and involves only skin and subcutaneous tissue of the incision • Purulent drainage from the superficial incision • Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision • Often Clinical diagnosis: pain or tenderness, localized swelling, redness, or heat, lack of systemic symptoms (e.g. fever, redness, inflamed skin) • A negative culture does not rule it out 	<ul style="list-style-type: none"> • Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure • Involves deep soft tissues (eg, fascial and muscle layers) of the incision • Clinically may have abscess and fever.

◀ SSI Prevention Strategies



1 **Preoperative measures: Administer antimicrobial prophylaxis in accordance with evidence based standards and guidelines**

- Administer within 30-45 minutes to incision (1-2hr for vancomycin and fluoroquinolones)
- Select appropriate agents on basis of:
 - Surgical procedure
 - Most common SSI pathogens for the procedure
 - Published recommendations
 - Consider increasing dose in obese patients and redosing in long procedures (>3h procedures)
 - Check for allergies.

2 **Nasal screen and decolonize only Staphylococcus aureus (MRSA) carriers undergoing:**

- Elective cardiac surgery
- Orthopaedic surgery
- Neurosurgery procedures with implants

If the culture is positive, use preoperative mupirocin ointment therapy known as decolonisation.

◀ SSI Prevention Bundle

- Shower night before surgery
- Skin preparation in the O.R. by alcohol-based agent
- Good glycemic control during surgery
- Normothermia should be maintained throughout surgery
- Administration of FIO₂ during surgery and after extubation
- Antimicrobial prophylaxis should be administered only when indicated:
 - Certain surgeries only
 - Single preoperative dose 30-45 min before incision
 - Topical antibiotics should not be applied to the surgical site
 - In clean and clean-contaminated surgery: No additional prophylactic antimicrobial doses should be given even in the presence of a drain

Overview

- **Central line is a line inserted in one of the major vessels that delivers essential fluids to the body**
 - Direct central line: in IJV or femoral or subclavian veins.
 - Tunneled central line: for dialysis and chemotherapy.

Definition

- Laboratory-confirmed bloodstream infection by a positive blood culture **that's not secondary to any infection.**
- Not related to an infection at another site **eg: intra abdominal infection leading to bacteremia.**
- **Develops at least after 48 hours of a central line placement**
- Infection is more common in temporary catheters inserted into the groin or jugular vein than in those in the subclavian vein. Tunnelled catheters, e.g. Hickman catheters, may also develop tunnel site infections.
- The most common site is the **femoral central lines**
Femoral has the highest risk for infection compared to other sites, because the groin area is close to the genitals and the presence of skin folds which is usually contaminated. However, it has less risk for pneumothorax and is much easier to insert.



CLABSI Microorganisms



Gram +ve cocci

- **Coagulase -ve staphylococcus¹ 35%**
Positive culture is not always significant if signs of infection are not present, this may indicate contaminated skin or inappropriate culture obtaining method
- Enterococci spp 15%
- Staphylococcus aureus 10%. coagulase +ve, including MSSA & MRSA

Candida spp.² 12%

Presence of candida in blood is very serious

Gram -ve bacilli

- Klebsiella pneumoniae 6%
- E.coli, Enterobacter spp, Pseudomonas aeruginosa (3% each)
- Acinetobacter baumannii 2%

Other 10%

Treatment

- Removal of central line (especially in cases of MDRs, candida, MRSA.) We can keep the central line in some cases of noninvasive infections (e.g. CoNS in patients with bleeding tendency) but we have to give "antibiotic lock", which are the same concept as flushing with saline but this one with antibiotics. But as a general rule you have to remove the central line. What if he needs it? Insert it in another site (Don't change the guide wires).
- 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.

1: Treated by removing the line and providing 5-7 days therapy OR in case of tunneled catheters treat empirically e.g. vancomycin with or without the use of antibiotic-containing lock therapy to the catheter for approximately 14 days. For other organisms treatment involves catheter removal, followed by 14 days of antimicrobial therapy.

2: Common cause of line infections, particularly in association with total parenteral nutrition.

◀ CLABSI Prevention Bundle

1. Prevention Guidelines During Insertion:

- Hand hygiene before wearing gloves
- Strict aseptic technique by maximal sterile barrier precautions including a full-body drape
- Use of 2% chlorhexidine skin preparations for disinfecting/ cleaning skin before insertion
- Ultrasound guidance by an experienced personnel and reduce the number of attempts
- Avoid the femoral vein if the patient is stable enough, mainly used in emergency cases (don't keep it for more than two days) prefer the subclavian vein
- Promptly remove any central line that is no longer required
- Replace central lines placed during an emergency (asepsis not assured) as soon as possible or at least within 48 hours
- Use a checklist

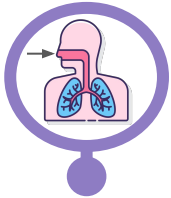
2. Prevention Guidelines During Maintenance:

- Disinfect catheter hubs injection ports, and connections before accessing line
- Replace administration sets other than sets used for lipids or blood products every 96 hours
- Assess the need for the central line daily

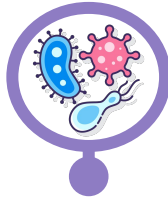
- VAP is one of the most common infections acquired by adults and children in intensive care units **that's 48 hours after intubation**
- Patients on mechanical ventilation are at risk of developing pneumonia because the normal mucociliary clearance of the respiratory tract is impaired (cannot cough). Also, positive pressure impairs the ability to clear colonization.
- Affects critically ill patients
- VAP is a cause of significant morbidity and mortality, increased utilization of healthcare resources
- The mortality attributable to VAP exceed 15%

◀ Pathogenesis and Risk Factors for VAP

The 3 common mechanisms:



Aspiration of secretions
From upper airways or GI reflux.



Colonization of the aerodigestive tract



Use of contaminated equipment (rare)

◀ VAP Prevention Bundle



1. Prevent Aspiration of Secretions:

Maintain elevation of head of bed (HOB) 30-45 degrees

- Avoid gastric over distention
- Avoid unplanned extubation and re-intubation
- Use cuffed endotracheal tube with in-line or subglottic suctioning
- Encourage early mobilization of patients with physical/occupational therapy

2. Reduce Colonization of Airway and Digestive Tract:

- Use cuffed Endotracheal Tube with inline or subglottic suctioning
 - └ Minimizes secretions above cuff; prevents contamination of lower airway.
- Avoid acid suppressive therapy for patients not at high risk for stress ulcer or stress gastritis
 - └ Increases colonization of the digestive tract.

3. Reduce Duration of Ventilation:

- Conduct "sedation vacations"
- Assess readiness to wean from vent daily
- Conduct spontaneous breathing trials

4. Prevent exposure to contaminated equipment by using closed-circuit for ventilator.

Most Frequent Sites of Infection and Their Risk Factors

URINARY TRACT INFECTIONS 34%

Most common

- **Urinary catheter CAUTI**
- **Urinary invasive procedures**
- Advanced age
- Severe underlying disease
- Urolithiasis
- Pregnancy
- Diabetes

LOWER RESPIRATORY TRACT INFECTIONS 13%

- **Mechanical ventilation**
- **Aspiration**
- **Nasogastric tube**
- Central nervous system depressants
- Antibiotics and antacids
- Prolonged healthcare facilities stay
- Malnutrition
- Advanced age
- Surgery
- Immunodeficiency

SURGICAL SITE INFECTIONS 17%

- **Inadequate antibiotic prophylaxis**
- **Incorrect surgical skin preparation**
- **Inappropriate wound care**
- Surgical intervention duration
- Type of wound
- Poor surgical asepsis
- Diabetes
- Nutrition state
- Immunodeficiency
- Lack of training and supervision

BLOOD INFECTIONS 14%

- **Vascular catheter**
- **Neonatal age**
- **Critical care**
- Severe underlying disease
- Neutropenia
- Immunodeficiency
- New invasive techniques
- Lack of training and supervision



All have a common risk factor: lack of hand hygiene¹

Prevention of Hospital Acquired Infections

Validated and standardized prevention strategies have been shown to reduce HAI

At least 50% HAI could be prevented

Most solutions are simple and not resource-demanding and can be implemented with ease by all HCW

- Hand hygiene
- Bundles²
- Compliance with isolation precautions
- Annual influenza vaccination
- Annual TB screening: TST, IGRA
- UpToDate with vaccinations: HBV Ab titre above 10, MMRV, Td



1-Other common risk factors that predispose the individual to different infections are: Uncontrolled diabetes, advanced age, chronic diseases, immunodeficiency and malnutrition.

2-Bundles of care are steps and processes that have to be implemented to prevent infections. E.g. central line bundle, includes sterilization and removing it if possible. If removal of the line isn't possible establishing a central line instead of a peripheral (femoral) one should be done.

◀ Colonization Vs Infection¹

People who carry bacteria without evidence of infection (fever, increased WBC) are colonized. We're all colonized by bacteria and it's normal, what is not normal is having MDR (Multiple drug resistance)

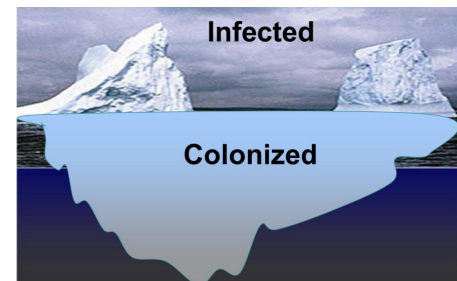
If an infection develops, it is usually from bacteria that colonize patients. Culture should be done.

Bacteria that colonize patients can be transmitted from one patient to another by hands of healthcare workers.²

Bacteria can be transmitted even if the patient is not infected.

◀ The Iceberg effect

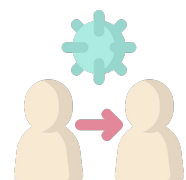
- Infected individuals don't represent the colonized ones in the community.
- Colonized patients don't show symptoms.
- The evidence of infection is symptoms such as fever, leukocytosis and raised inflammatory markers.
- Community and hospitals are full of colonized people, we just know about them if they have the infection.
- High risk patients get screening for certain organisms.
- Testing patients for COVID before admission is an example of screening.



◀ Modes of transmission

A microorganism may be spread by a single or multiple routes.

- Contact, direct or indirect
- Droplet
- Airborne
- Vector-borne (usually arthropod) and
- Common environmental sources or vehicles includes:
 - food-borne and waterborne, medications e.g., contaminated IV fluids



1- if a patient has cellulitis, and a superficial swab was taken and it was positive, we don't treat based on the swab. We don't even do skin swabs for cellulitis because they have certain indications and should be taken from **deep** areas. **Diagnosis of cellulitis is clinical because in majority of cases cultures or skin aspirate doesn't reveal a pathogen.**

2-If a patient has VRE of MRSA or CRE or pseudomonas, even if they're asymptomatic, they must be isolated as contact precaution in single a room, as they could be a source of transmission to other patients who could end up having the infection.

Hand Transmission

- Hands are the most common vehicle to transmit healthcare associated pathogens
- Transmission of microbiological organisms from one patient to another via HCW hands



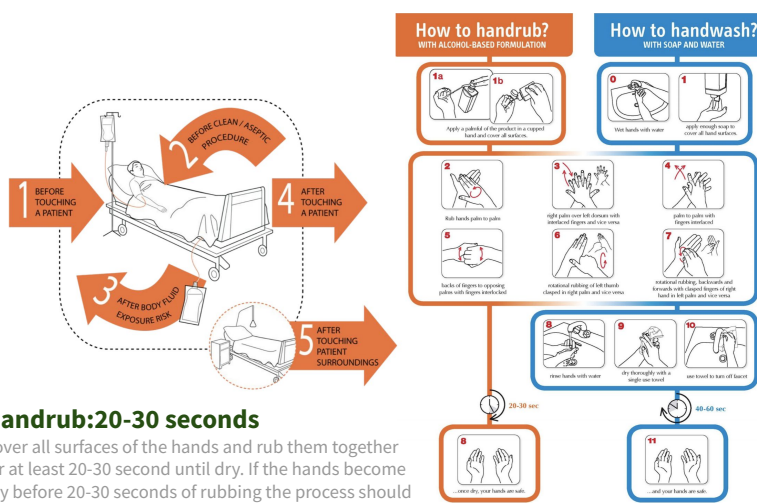
Why Should You Clean Your Hands?

- Any HCW involved in health care needs to be concerned about hand hygiene
- Other HC workers (e.g. your colleagues and seniors) hand hygiene concerns you as well
- You must perform hand hygiene to:
 - protect the patient against harmful microbes in your hands or present on your skin
 - protect yourself and the healthcare environment from harmful microbes

Bacteria Isolated Everywhere (e.g. VRE) (Vancomycin Resistant Enterococci)



Five Moments of Hand Hygiene¹ (Important)



Handrub: 20-30 seconds

Cover all surfaces of the hands and rub them together for at least 20-30 second until dry. If the hands become dry before 20-30 seconds of rubbing the process should be repeated with more hand rub

Handwash: 40-60 seconds

How to Clean Your Hands?

1. Handrubbing with alcohol-based handrub is the preferred routine method of hand hygiene if hands are not visibly soiled
2. Handwashing with soap and water – essential when hands are visibly dirty or visibly soiled (following exposure to body fluids) and after certain diseases e.g. *C. difficile*² as they are spore forming bacteria that don't get disinfected by alcohol.

Hand Hygiene and Glove Use

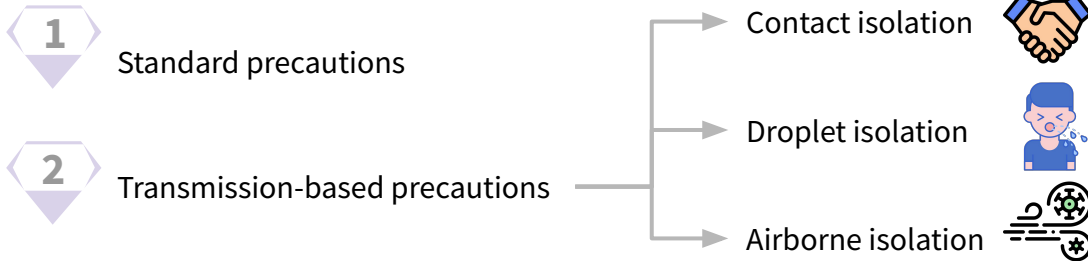
- The use of gloves does not replace the need to clean the hands and one glove is only for one patient.
- Remove gloves to perform Hand hygiene, when an indication occurs while wearing gloves
- Wear gloves only when indicated, otherwise they become a major risk for germ transmission
- Wearing gloves isn't a substitute for proper hand hygiene.

1: Decontamination with alcohol gel is equal to hand-washing with soap but hand-washing is required after any procedure that involves more than casual physical contact, or if hands are visibly soiled. Also in cases where *C. difficile* is high (e.g. a local outbreak), alcohol gel decontamination between patient contacts is inadequate as it does not kill *C. difficile* spores, and hands must be washed.

2: Caused by use of antibiotics --> Killing normal flora of the GI tract --> *C. difficile* takes over.

Types of Isolation Precautions

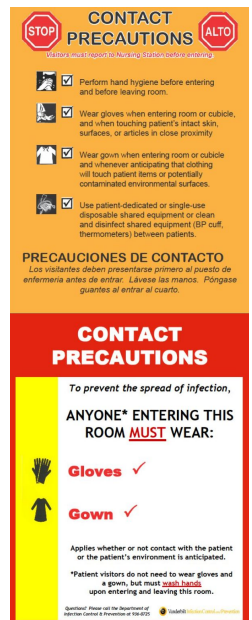
Types of Isolation Precautions



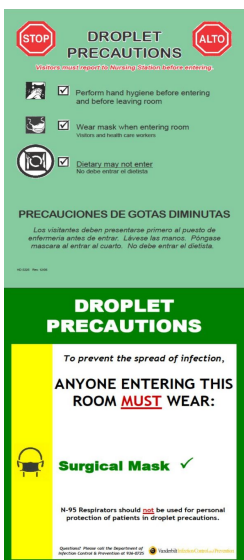
Contact Precautions

- Infections spread by direct or indirect contact with patients or patient-care environment –C. difficile, MRSA, vancomycin-resistant enterococci (VRE), extended-spectrum β-lactamases (ESBL), carbapenemase-producing Enterobacteriaceae (CRE) and MDR GNR and some viruses e.g. COVID-19.
- Limit patient movement
- Private/single room or cohort with patients with same infection
- Wear disposable gown and gloves when entering the patient room
- Remove and discard used gown and gloves **inside the patient room**
- Wash hands immediately after leaving the patient room
- Use dedicated equipment if possible (e.g., stethoscope)

(WHO): According to current evidence, COVID-19 virus is primarily transmitted between people through respiratory droplets and contact routes.



Droplet Precautions



- Reduce the risk of transmission by large particle droplets (larger than 5 μ in size)
- Requires close contact between the source person and the recipient
- Droplets usually travel 3 feet or less
- E.g. MERS-CoV, SARS-CoV-2 (non severe and no aerosol generating procedures AGP) influenza other respiratory viruses, adenovirus, RSV (Respiratory Syncytial Virus), rubella, parvovirus B19, mumps, H. influenzae, and N. meningitidis
- A private/single room or cohort with patient with active infection with same microorganism
- Use a mask when entering the room especially within 3 feet of patient
- Limit movement and transport of the patient. Use a mask on the patient if they need to be moved and follow respiratory hygiene/cough etiquette

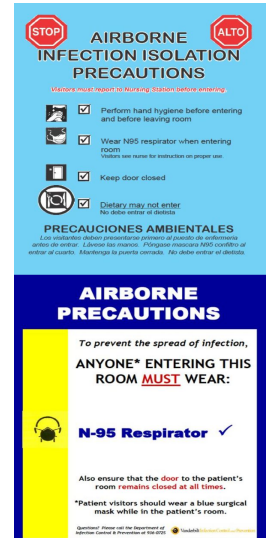
Mnemonic:
 SPIDERMAN
 S: SARS
 P: Parvovirus B19
 I: Influenza
 D: Diphtheria
 E: -
 R: Rubella + RSV
 M: Mumps + MERS
 A: Adenovirus
 N: N.meningitidis

1

Types of Isolation Precautions

Airborne Precautions Very small particles (<5µ)

- **Tuberculosis**, measles, varicella, MERS-CoV (severe), COVID-19 or AGP
- Place the patient in an **airborne infection isolation room (AIIR)**
- **Negative Pressure** (So that air moves from outside to inside) should be monitored with visible indicator
- Use of respiratory protection (e.g., fit tested N95 respirator) or powered air-purifying respirator (PAPR) when entering the room
- PAPR can be used if a HCW fails the fitting test of N95 or for bearded men who refuse to shave.
- Limit movement and transport of the patient.
- Use a mask on the patient if they need to be moved
- Keep patient room door closed, do not open anteroom door till other door closed



Summary of precautions for patients with COVID-19

Personal Protective Equipment	Close patient contact (within 2m)	Enter room but no contact with patient or environment	Cleaning room/area (Domestic staff)	Aerosol generating procedures
Gown	✓	✗	✓	✗
Surgical mask	✓	✓	✓	✗
Long sleeved disposable gown	✗	✗	✗	✓
Fit Tested N95 respirator	✗	✗	✗	✓
Eye protection (goggles, face shield)	Risk assess	✗	✗	✓
Gloves	✓	✗	✓	✓

Safe injection practices

1 Safe needle practice
Don't recap the needle, aseptic technique, discard into a sharp container.

2 Reporting of needlestick and sharp injuries to infection control department

Serologies and Vaccination

- HBSAB titre (above 10)
- VZV (Varicella)
- MMR (Measles, Mumps, Rubella)
- Td (Tetanus, Diphtheria)
- Seasonal Influenza Vaccine
- COVID-19 vaccine

Summary



Endogenous Sources



Such as the skin, nose, mouth, GI tract, or vagina that are normally inhabited by microorganisms (normal flora)

Exogenous Sources



External to the patient such as health care workers (HCW), visitors, patient care equipment, medical devices, or the healthcare environment

Source of Infection

Types of HAI

Catheter Associated UTI (CAUTI)

Causes : indwelling urinary catheters , invasive urinary procedure

Risk factors : age , DM , pregnancy , urolithiasis , severe underlying disease

Diagnostic criteria : symptomatic UTI has to meet at least 1 of the following :

- Fever (38C or above), urgency, frequency, dysuria, or suprapubic tenderness
- Positive urine culture, that is $>10^5$ CFU/ml, with no more than 2 species of microorganisms

Central line Associated Bloodstream Infections (CLABSI)

Laboratory-confirmed bloodstream infection by a positive blood culture That is not related to an infection at another site

★ Develops at least after 48h of a central line placement

The most common site is the **femoral central lines**

Treatment : removal of central line + antibiotics

Prevention : Use of 2% chlorhexidine skin preparations before insertion
+ Replace central lines placed during an emergency within 48h + US guidance + replace with new set every 96h

Surgical site infections (SSI)

Causes : Inadequate antibiotic prophylaxis , Incorrect surgical skin preparation , Inappropriate wound care

Risk factors : surgery duration , types of surgery & wound , malnutrition , immunodeficiency , poor glucose control

Surgical wound classification :

- Clean → lap, mastectomy, neck dissection, thyroid, vascular, hernia, splenectomy
- Clean-contaminated → Chole, SBR, Whipple, liver txp, gastric surgery, bronch, colon surgery.
- Contaminated → Inflamed appendix, bile spillage in chole, diverticulitis, Rectal surgery, penetrating wounds.
- Dirty → Abscess , perforated bowel, peritonitis, wound debridement.

Preoperative preventative measures :

- antimicrobial prophylaxis 30-45 min prior to surgery (1-2h for vancomycin & fluoroquinolones)
- decolonize staph aureus in cardiac , orthopedic and neuro surgeries Using preoperative mupirocin ointment therapy

Ventilator associated Pneumonia (VAP)

3 common mechanisms :

- Aspiration of secretions
- Colonization of the aerodigestive tract
- Use of contaminated equipment

Prevention :

- prevent aspiration : Maintain elevation of head of bed (HOB) 30-45 degrees
- Reduce colonization : Use cuffed endotracheal tube with subglottic suctioning
- Reduce duration of ventilation
- Prevent exposure to contaminated equipment

Lecture Quiz

Q1: A 64-year-old woman presents to the emergency room with flank pain and fever. She noted dysuria for the past 3 days. Blood and urine cultures are obtained, and she is started on intravenous ciprofloxacin. Six hours after admission, she becomes tachycardic and her blood pressure drops. Her intravenous fluid is normal saline (NS) at 100 mL/h. Her current blood pressure is 79/43 mm Hg, heart rate is 128/min, respiratory rate is 26/min, and temperature is 39.2°C (102.5°F). She seems drowsy yet uncomfortable. Extremities are warm with trace edema. What is the best next course of action?

- A. Administer IV hydrocortisone at stress dose.
- B. Begin norepinephrine infusion and titrate to mean arterial pressure greater than 65 mm Hg.
- C. Add vancomycin to her antibiotic regimen for improved gram-positive coverage.
- D. Administer a bolus of NS.
- E. Place a central venous line to monitor central venous oxygen saturation

Q2: A 48-year-old man is admitted to your service after an inhalational chemical exposure. He develops respiratory distress and requires endotracheal intubation and mechanical ventilation. Which of the following is the best way to decrease his risk of developing ventilator-acquired pneumonia?

- A. Daily interruption of sedation to assess respiratory status
- B. Nasopharyngeal rather than oropharyngeal endotracheal intubation
- C. Institution of protocol to keep bed flat during ventilation
- D. Intermittent nasopharyngeal suctioning
- E. Prophylactic broad-spectrum intravenous antibiotics

Q3: You are covering a busy hospital service at night when you are paged to evaluate a 78-year-old man with sudden onset of dyspnea. A review of the patient's chart reveals that he was diagnosed with small cell lung cancer 2 months earlier. He was subsequently treated with radiation therapy and chemotherapy. He was admitted to the hospital 3 days earlier with a suspected pathologic fracture of the right femur. He has no other known metastases. Thirty minutes ago he became acutely short of breath. Current vital signs include a heart rate of 115 beats/min, blood pressure of 92/69 mm Hg, and respiratory rate of 32/min. Oxygen saturation is 94% on 4 L of oxygen via nasal cannula. He is anxious and tachypneic, but lung sounds are clear and symmetric. The heart rhythm is regular and no murmurs are appreciated. What is the best next step in the management of this patient?

- A. Immediately administer empiric antibiotics for coverage of hospital-acquired pneumonia.
- B. Immediately administer therapeutic dose of intravenous heparin.
- C. Arrange for synchronized electrical cardioversion.
- D. Order a ventilation/perfusion (V/Q) scan of the chest.
- E. Administer a benzodiazepine.

GOOD LUCK!

*This work was originally done by **438 Medicine team:***

Team Leaders

- Raghad AlKhashan
- Mashal AbaAlkhail
- Amirah Aldakhilallah
- Nawaf Albhijan

Member : May Babaeer -رحمها الله-

- Amirah Alzahrani
- Nawaf Albhijan

Note taker : - Renad Almutawa
- Abdulaziz ALGhamdi

*Edited by **439 Medicine team:***

Team Leaders

- Shaden Alobaid
- Hamad Almousa
- Ghada Alabdi
- Naif Alsulais

Member : Sarah Alaidarous

Note taker : Norah Alasheikh &
Mohammed Alquhidan



CONTACT US THROUGH OUR EMAIL :

MEDICINE439@GMAIL.COM

اللهم ارحم مي بابعير ونجود المطيري واغفر
لهم وأنس وحشتهم ووسع قبورهم، اللهم اجعل
عيدهم في الجنة أجمل، اللهم اجعل قبورهم
روضةً من رياض الجنة، ولا تجعلها حفرةً من
حفر النار. اللهم ارحمهم رحمةً تسع السماوات
والارض، اللهم اجعل قبورهم في نور دائم لا
ينقطع واجعله في جنتك آمنًا مطمئنًا يارب
العالمين. اللهم افسح لهم في قبرورهم، مدّ
ابصارهم، وافرش قبورهم من فراش الجنة،
اللهم ارحمهم. يا الله أنت المحيي وأنت كذلك
المميت، اللهم إنا لا نعترض على قضائك
ونسألك أن تجعله نورا وضياءا على موتانا و
من يسكنون قبورهم من قبله، اللهم أرهم منازلهم
بجنتك، وأكرمهم بحسن الصحبة والعمل الصالح
الذي ارتضيته منهن في حياتهن وسرهن
وعلنهن