MEDICINE

432 Team

55 Health Care Associated Infections

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Objectives

Not given ☹

Health Care-associated Infection (HCAI):

- Was referred to as "nosocomial" or "hospital infection". But it has changed to HCAI because patients aren't all hospitalized. They can come to the nursing care, dressing changes, come for dialysis then go back home.
- An infection occurring in a patient during the process of care in a hospital or other health-care facility which was not present or incubating at the time of admission.
- This includes infections acquired in the health-care facility but appearing after discharge.

Health care associated infections:

Localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent or its toxin.

Clostridium difficile colitis is an example of toxin mediated health care infection, and it's due to a toxin produced by the bacteria (clostridium difficile).

Colonization: The presence of microorganisms in:

- Skin; the commonest site.
- Mucus membranes.
- Open wounds.
- Excretions or secretions.

But are not causing adverse clinical signs or symptoms

Estimated rates of HCAI worldwide:

1- In the developed world: 5–10% of patients acquire one or more infections

2- In developing countries: can exceed 25%

3- In intensive care units about 30% of patients and the attributable mortality may reach 44%.

Work in Rural area (Females slide)

- A quarter (25%) of operations done in a well-equipped rural hospital in Tanzania are linked to surgical-site infections.
- Millions of cases of hepatitis B annually are caused by unsafe injection practices.
- The burden is likely to be huge.

The deaths and illnesses that result are largely preventable

HCAI can cause:

- More serious illness (Increased morbidity).
- Patients stay longer in a health-care facility.
- Long-term disability.
- Excess deaths.
- High additional financial burden.
- High personal costs on patients.

Source of infection:

1] Endogenous sources are body sites, such as the skin, nose, mouth, gastrointestinal (GI) tract, or vagina that are normally inhabited by microorganisms.

2] Exogenous sources are those external to the patient, such as patient care personnel, visitors, patient care equipment, medical devices, or the health care environment.

Mode of transmission:

1- Contact.

- Direct contact: contact with an infected person.
- Indirect contact: contact with contaminated surfaces touched by the infected person.

2) Airborne - "aerosols" tiny infected particles from an infected person released when they cough or sneeze which can be breathed (e.g. Pulmonary Tuberculosis) Airborne is lighter than droplet and it's less than 5 micrometers.

3) Consuming contaminated food/water.

4) Blood exposures.

Types of healthcare associated infections: the most important

- Catheter-associated urinary tract infections. (most common)
- Bloodstream infections
- Ventilator-associated pneumonia.
- Surgical site infections

1- URINARY TRACT INFECTIONS 30% caused by:

1- Invasive urinary procedures.
2- Urinary catheter (Catheter associated UTIs):

- Most common type of HCAIs (>30%), ">560,000" nosocomial UTIs annually.
- among UTIs acquired in the hospital, approximately 75% are Associated with a urinary catheter
- The most important risk factor for developing a catheter associated UTI (CAUTI) is prolonged use of the urinary catheter.
- Therefore, catheters should only be used for appropriate indications and should be removed as soon as they are no longer needed.
- Increased morbidity & mortality; 13,000 deaths annually, and leading cause for secondary bacteremia with 10% mortality.
- Increased length of stay 2-4 days
- Increased costs.

- Urinary Catheter Use: (females slide)
  - 15-25% of hospitalized patients
  - Often placed for inappropriate indications
  - Physicians frequently unaware
  - In a recent survey of U.S. hospitals:
    - > 50% did not monitor which patients catheterized
    - 75% did not monitor duration and/or discontinuation.

- Source of CAUTI:
  - Endogenous; meatal, rectal or vaginal colonization. (most common)
  - Exogenous; contaminated hand of personnel.

–Extraluminal contamination may occur early, by direct inoculation when the catheter is inserted, or later, by organisms ascending from the perineum by capillary action in the thin mucous film contiguous to the external catheter surface. Intraluminal contamination occurs by reflux of microorganisms gaining access to the catheter lumen from failure of closed drainage or contamination of urine in the collection bag.
-Studies suggest that the extraluminal route may be of greater relative importance in women because of the short urethra and its close proximity to the anus

- Pathogenesis of CAUTI:
  - Formation of biofilms by pathogens on the surface of catheter (bacteria within biofilms)
  - Resistant to antimicrobial and host defense

- Diagnosis of UTI: (1 criteria of the following)
  - Fever, urgency, frequency, dysuria.
  - Positive urine culture (105 microorganism/cc of urine) with no more than 2 species of organisms.
  - Patient has a positive urine culture that is more than 10^5 microorganisms per cc of urine with no more than 2 species of microorganisms.
  - A positive culture of a urinary catheter tip is not an acceptable laboratory test to diagnose a urinary tract Infection.

Core Prevention Strategies

- Insert catheters only for appropriate indications.
- Leave catheters in place only as long as needed.
- Ensure that only properly trained persons insert and maintain catheters.
- Insert catheters using aseptic technique and sterile equipment (acute care setting).
- Following aseptic insertion, maintain a closed drainage system.
- Maintain unobstructed urine flow.
- Hand hygiene.

Specific recommendations (females slide- doctor went through them briefly)

Insert catheters only for appropriate indications

- Minimize use in all patients, particularly those at higher risk of CAUTI and mortality :
- Women, elderly, impaired immunity
- Avoid use for management of incontinence
- Use catheters in operative patients only as necessary.
- Remove catheters ASAP postoperatively, preferably within 24 hours, unless there are appropriate indications for continued use
- Among UTIs acquired in the hospital, approximately 75% are associated with a urinary catheter
- The most important risk factor for developing a catheter-associated UTI (CAUTI) is prolonged use of the urinary catheter. Therefore, catheters should only be used for appropriate indications and should be removed as soon as they are no longer needed.

-Change catheter every 2-3 weeks. If silicon catheter then it can stay up to 2-3 months but once you see signs of infection remove it

-Never lift the bag or place it above the bladder level it can reflux the urine back to the bladder causing cystitis and from there up to the kidneys (pyelonephritis)

2- SURGICAL SITE INFECTIONS 17%

- 2-5 % of patients undergoing inpatient surgeries.
- 3% mortality, with 2-11 times higher risk of death.
- Morbidity long term disabilities
- Most important risk factors:
  - Inadequate antibiotic prophylaxis.
  - Incorrect surgical skin preparation.
  - Inappropriate wound care
  - Immunocompromised patients.

Others: Surgical intervention duration
Type of wound
Poor surgical asepsis
Diabetes
Nutritional state
Immunodeficiency
Lack of training and supervision

- Types:

1-Superficial incisional surgical (SIP or SIS) site infection: Infection occurs within 30 days after the operative procedure and involves only skin and subcutaneous tissue of the incision.

- Diagnosis: pus or purulent drainage, organisms isolated from site of the incision and culture, pain, tenderness, swelling and redness.
- A culture-negative finding does not meet this criterion.

2-Deep incisional surgical site infection (more serious):

- 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 and involves deep soft tissues (eg, fascial and muscle layers) of the incision.

- Source of infection:

- Endogenous; flora on skin, mucus membranes, GI tract (e.g. colon surgery) or seeding from distant focus of infection.
- Exogenous; personnel, equipment, environment.

- Pathogens causing SSI:

- Staphylococcus aureus. (30%)
- Coagulase negative staphylococci. (13.7%)
- Enterococcus spp. (11.2%)
- *Escherichia coli.* (9.6%)

Pseudomonas aeruginosa, Enterobacter spp, Candida spp. Klebsiella oxytoca, Acinetobacter baumannii.

-U can get an ecoli pneumonia from HAI because the fecal matter can be in the skin
-HAI bugs differ from community acquired bugs they can be more resistant and more virulent
-MRSA>> resists all other types of antibiotics. Treat by giving vancomycin
-our bodies don't resist these drugs cause we are not hospitalized unlike admitted patients where they start developing resistance against almost all effective drugs

-Preventive measures: Modifiable risk factors

- Antimicrobial prophylaxis
  - Inappropriate choice
  - Improper timing (pre-incision dose)
  - Inadequate dose based on BMI.
- Skin or site preparation ineffective.
- Colorectal procedures.
- Inadequate wound dressing.
- Improper glucose control.

-Preoperative Measures:

Administer antimicrobial prophylaxis in accordance with evidence based standards and guidelines

- Administer <u>within 1 hour prior to incision</u>
  - 2hr for vancomycin and fluoroquinolones
- Select appropriate agents on basis of
  - Surgical procedure
  - Most common SSI pathogens for the procedure
  - Published recommendations

-Prevention strategies (female's slide- doctor didn't mention it)

- Nasal screen and decolonize only
  Staphylococcus aureus carriers undergoing
  1) Elective cardiac
  2) Orthopaedic
  3) Neurosurgery procedures with implants.

  USING: Preoperative mupirocin therapy

3- Central Line-associated Bloodstream Infection

Laboratory confirmed blood stream infection: must meet 1 at least of the following:
Recognized pathogen: cultured from 1 or more blood cultures and is not related to an infection at another site with one of the following;
Fever, chills, hypotension which is not related to other source of infection at another site.

Common skin contaminant:

- Coag negative staph (gram positive cocci)
- Corynebacterium (gram positive rods)
- Propionibacterium acnes (anaerobic gram positive rods)
- Bacillus species (anaerobic gram positive rods)

- Is cultured from 2 or more blood cultures drawn on separate occasions.

Blood infections (14%):

Risk factors:

- Vascular catheter
- Neonatal age
- Critical care
- Immunocompromised

Advices about blood infections:

- For clinicians:

- Promptly removes unnecessary central lines.
- Follow proper insertion practices.

- For facilities

- Train staff.
- Ensure efficient access to hand hygiene.
- Monitoring everything in the ICU.

Lower respiratory tract infections (13%):

Risk factors:

- Mechanical ventilation.
- Aspiration.
- Nasogastric tube.
- Patients on antibiotic (kills normal flora then other pathogens grow) or antacids (Lower acidity ⍰growth of bacteria)
- Advanced age.

VAP is one of the most common infections acquired by adults and children in intensive care units.

Pneumonia is the most frequently reported infection in intensive care unit patients, predominantly in mechanically ventilated individuals.

Mechanisms by which VAP develops:

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

Transmission of multidrug-resistant/marker organisms:

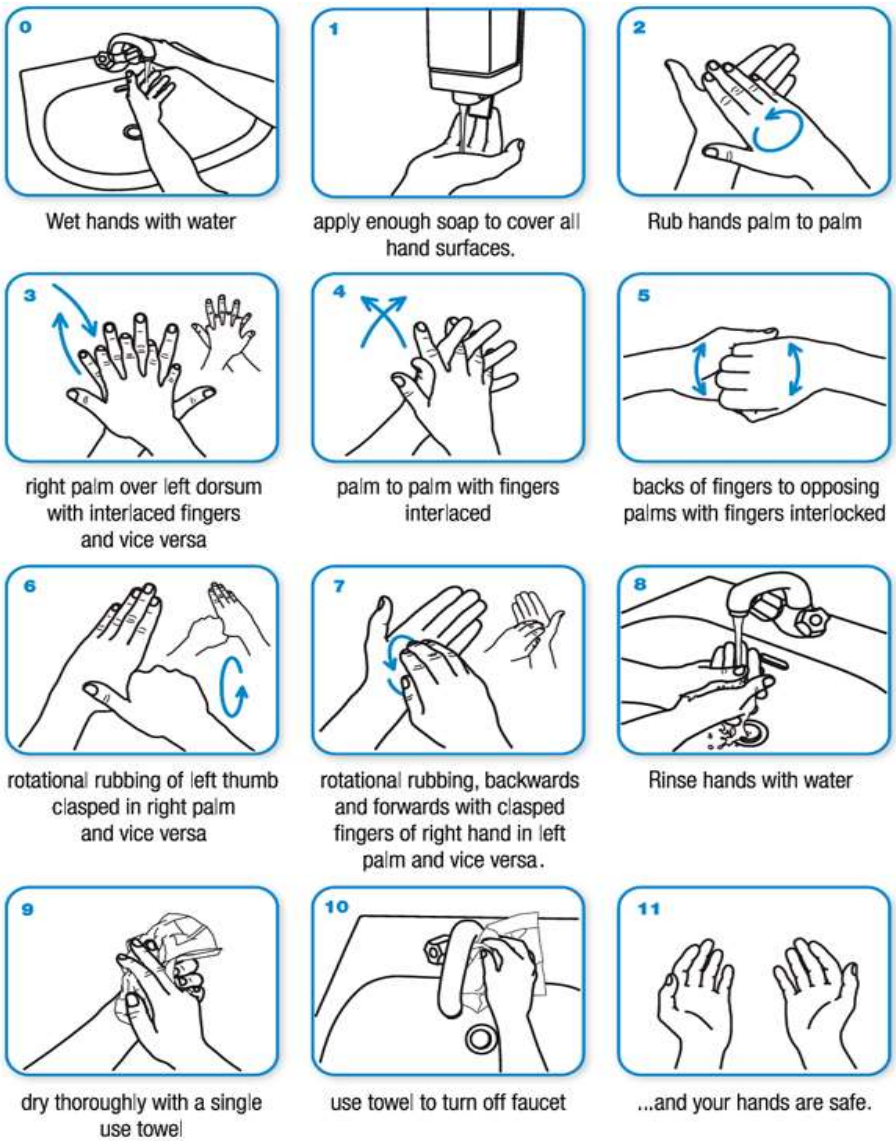
1. MRSA: Staphylococcus aureus is common cause of healthcare associated infections.
   - Most common cause of:
   a. surgical site infections(30%)
   b. ventilator associated pneumonia (24%)
2. VRE
3. Tuberculosis (MDR).
4. Aspergillus in immunocompromised patient
5. Clostridium difficile : causes colitis

Prevention of Healthcare Associated Infections:

- At least 50% of HCAI could be prevented.
- Most solutions are simple and not resource-demanding and can be implemented in developed, as well as in transitional and developing countries.
- Hands are the most common vehicle to transmit health careassociated pathogens.
- Transmission of health care-associated pathogens from one patien to another via health-care workers' hands requires strict hand hygiene.
- Handrubbing with alcohol-based handrub is the preferred routine method of hand hygiene if hands are not visibly soiled. This takes only 20–30 seconds.

To effectively reduce the growth of germs on hands, handrubbing must be performed by following all of the illustrated steps.

Handwashing with soap and water – essential when when hands are visibly dirty or visibly soiled (following visible exposure to body fluids)handwashing must last 40–60 seconds.



You must perform hand hygiene to:

- Protect the patient against harmful germs carried on your hands or present on his/her own skin

- Protect yourself and the health-care environment from harmful germs

SUMMARY

Types of healthcare associated infections:

- Catheter-associated urinary tract infections 30%.
  - Invasive urinary procedures.
  - Urinary catheter
- Bloodstream infections
- Ventilator-associated pneumonia.
- Surgical site infections 17%.
  - Superficial incisional surgical site infection.
  - Deep incisional surgical site infection