

Nosocomial Infections

CLS 212: Medical Microbiology

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Types of Infection

- **Hospital Acquired Infections (Nosocomial):**
Infections that are acquired in hospitals or any other health care facilities.
- **Community Acquired Infections:**
Infections that are acquired outside of health care facilities.

CDC Definition

According to the CDC (Centers for Disease Control and Prevention):

- **Community Acquired Infections** are any infections present or incubated at the time of hospital admission.
- **Nosocomial Infections** are all hospital associated infections including infections that happen within 14 days of hospital discharge.

Nosocomial Infections

Nosocomial comes from the **Greek** word *nosokomeion* meaning hospital (*nosos* = disease, *komeo* = to take care of).

- This type of infection is also known as a **Healthcare Associated Infections (HAI)**.
- Nosocomial infections are widespread. They are important contributors to morbidity and mortality worldwide.

Incidence of Nosocomial Infections

In USA:

Over **2 million** infections resulting in **250,000 deaths annually**. About **5-10%** of hospitalized patients acquire nosocomial infections.

In UK:

About **443,166** cases of NI were reported in 2004.

In KSA:

About **189,676** cases of NI were reported in 2004.

(as reported by www.cureresearch.com)

Pathogens Most Commonly Associated with Nosocomial Infections

The following seven bacteria are the most common causes of nosocomial infections:

Gram Positive Bacteria

- *Staphylococcus aureus*.
- *Coagulase-negative Staphylococci (CNS)*.
- *Enterococcus spp.*

Gram Negative Bacteria

- *Escherichia coli (E. coli)*.
- *Pseudomonas aeruginosa*
- *Enterobacter spp.*
- *Klebsiella spp.*

Pathogens Most Commonly Associated with Nosocomial Infections

Viruses

- Herpes simplex virus (HSV)
- Cytomegalovirus (CMV)
- Hepatitis B & Hepatitis C
- HIV

Fungi

- Candida spp.
- Aspergillus spp.

Resistant Pathogens

- About 70% of nosocomial infections involve drug-resistant bacteria (**VRE: Vancomycin Resistant Enterococcus**, **MRSA: Methicillin Resistant S. aureus**, **MRSE: Methicillin Resistant S. epidermidis** , and **MDRTB: Multi-Drug Resistant Mycobacterium Tb**), which are common in hospitals and nursing homes as a result of the many antimicrobial agents that are used there.
- Drug resistant microbes can be other than bacteria like: viruses (HIV), fungi (*Candida spp.*), or protozoa (malaria).

Source of Pathogens

- Colonized or infected patients.
- Health care workers/visitors.
- Ventilating system.
- Water.
- Medical devices.

Routes of Transmission of Infection

A susceptible host and appropriate inoculum of infecting microorganism with an appropriate route of transmission contributed in majority of cases



Air-borne Route

- ❖ From respiratory tract via talking, coughing, sneezing.
- ❖ From the skin by natural shedding of the skin scales during wound dressing or bed making.
- ❖ From aerosols from equipment, respiratory apparatus, air-conditioning plants.



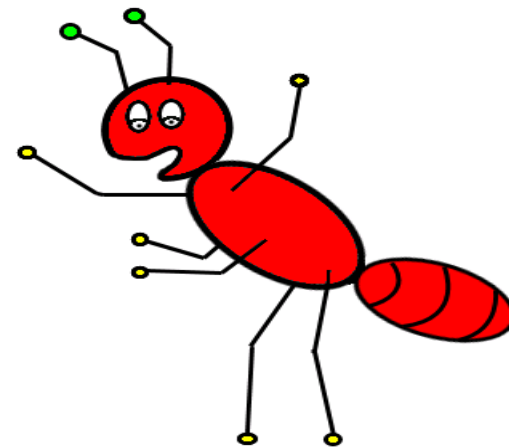
Contact Spread

- ❖ In direct contact spread from person to person.
- ❖ By indirect contact spread via contaminated hands or equipment.
- ❖ Clothing of staff.
- ❖ Instruments contaminated with hands of the operator may introduce organisms.



Food-borne Spread

- ❖ From hospital kitchen, or in special diets, infant feeds, or commercial supplies.
- ❖ Mechanical vectors flies, cockroaches or insects, or rodents act as carriers of infection.



Blood-borne Spread

- ❖ The accidental transmission of infections as HIV, HBV, and HCV by needle stick injuries is documented.
- ❖ Syphilis and malaria a concern in high prevalence areas.



Self Infections and Cross infections

- ❖ Lower bowel surgery.
- ❖ Although some of the pathogens that cause nosocomial infections come from the external environment, most come from the patients themselves **i.e. normal flora.**
- ❖ Cross infection between patients occur due to spread of Staphylococcus or coli forms



Most Common Types of Nosocomial Infections

1. Urinary tract infections (UTIs).
2. Surgical wound infections.
3. Lower respiratory tract infections mainly pneumonia.
4. Septicemia: bloodstream infections.
5. Antibiotic associated diarrhea (AAD) and Pseudomembranous colitis (PMC) which are caused by *Clostridium difficile* (normal flora of the colon).

CDC Reports

- National Nosocomial Infections Surveillance (NNIS) system, data from 1990–2002, conducted by the CDC. And data from the National Hospital Discharge Survey and the American Hospital Association Survey (for 2000):
- **The estimated number of HAIs in US hospitals was approximately 1.7 million:**
 - ✓ 33,269 HAIs among newborns in high-risk nurseries
 - ✓ 19,059 among newborns in well-baby nurseries
 - ✓ 417,946 among adults and children in ICUs
 - ✓ 1,266,851 among adults and children outside of ICUs.
- **The estimated deaths associated with HAIs in US hospitals were 98,987:**
35,967 were for pneumonia, 30,665 for bloodstream infections, 13,088 for urinary tract infections, 8,205 for surgical site infections, and 11,062 for infections of other sites.

Patients Most Likely to Develop Nosocomial Infections

- Immunocompromised patients.
- Elderly patients.
- Women in labor and delivery.
- Premature infants and newborns.
- Surgical and burn patients.
- Diabetic and cancer patients.
- Patients on steroids, chemotherapy, or radiation.
- Patients who are paralyzed or are undergoing renal dialysis or catheterization.
- Patients who are hospitalized for a long time.

Major Factors Causing Nosocomial Infections

1. Increase number of drug resistant pathogens (due to misuse of antibiotics).



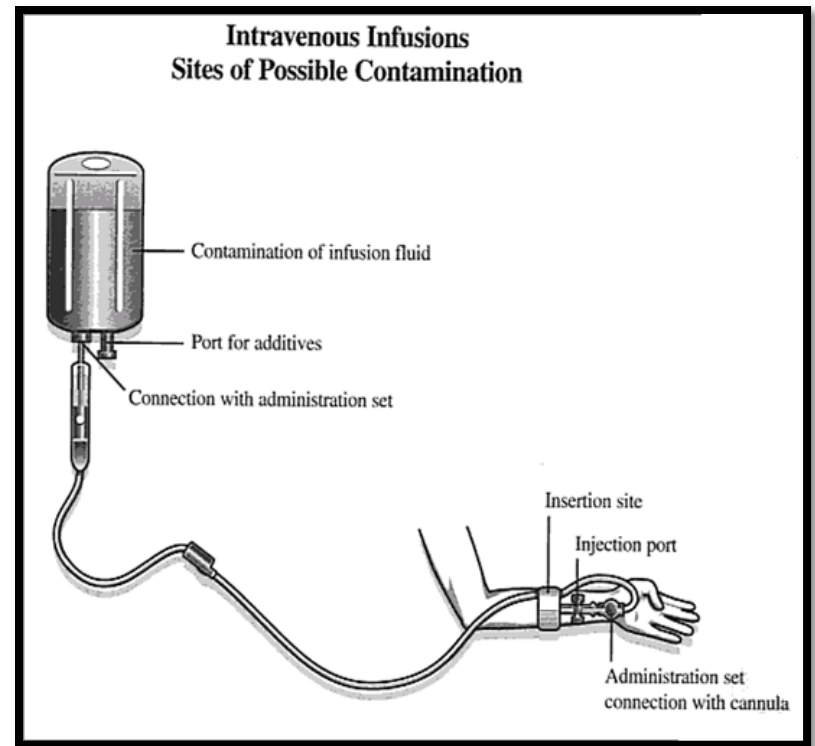
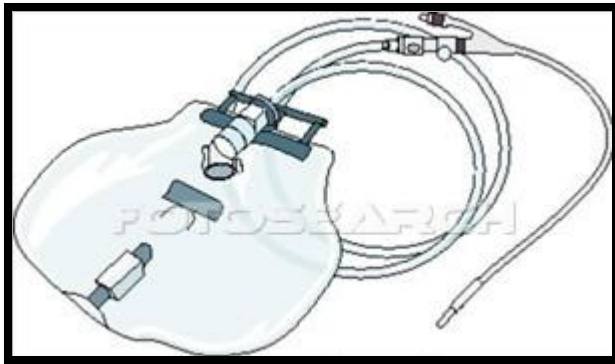
Major Factors Causing Nosocomial Infections

2. Increase number of immunocompromised patients.



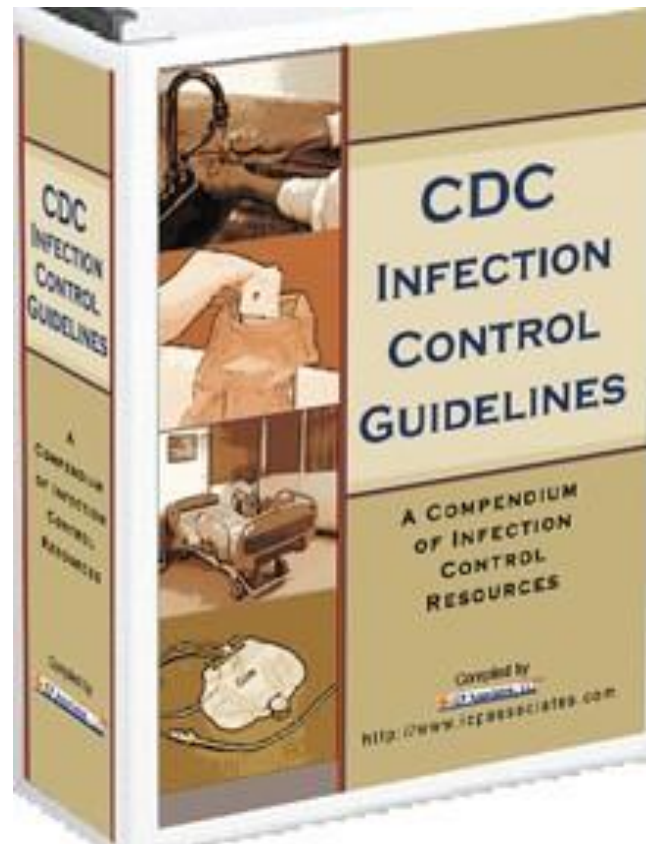
Major Factors Causing Nosocomial Infections

3. The performance of invasive medical and therapeutic procedures (vascular and urinary catheter or anything that crosses protective barriers).



Major Factors Causing Nosocomial Infections

4. Not following infection control guidelines.



Other Factors Contributing to Nosocomial Infections

- Increase use of prosthetic devices.
- Increase number of organ transplant procedures including xenotransplantation.
- Overcrowding of the healthcare facilities and shortage of staff.

What can we do??



Prevention and Control

The basic responsibility of any good hospital remain with establishment of good infection control guidelines, which can always be achieved with:

1. An infection control committee.
2. An Infection control team.

Functions of the Infection Control Department:

- To do surveillance and infection monitoring of hygiene practices.
- Educate the Medical and Paramedical staff on policies relating to prevention of infection, and safe procedures.

Infection Control Guidelines to Minimize Nosocomial Infections

Hand Hygiene

Hands are the most common vehicle of transmission of organisms



Six stage handwashing technique



1. Palm to palm



2. Backs of hands



3. Interdigital spaces



4. Fingertips



5. Thumbs and wrists



6. Nails

Personal Protective Equipment

Wearing protective measures when needed:

- **Gloves.**
- **Masks.**
- **Gowns.**



Disinfection and Sterilization Techniques

- All equipments, instruments, and hospital facilities should be kept sterile at all times.
- Use of disposable syringes, needles, catheters and drainage bags then proper disposal of them.
- Disinfection of surgical instruments, crockery, walls, floors, and furniture by appropriate chemicals.
- Basic cleaning, waste disposal, and laundry should be carried out regularly.

Isolating Infectious Patients

- Isolation of the source of infection to protect the susceptible or immunocompromised.
- It needs a highly disciplined approach by all staff to ensure that none of the barriers to transmission are breached.



Air filtration

In some critical situations such as bone marrow transplant units, where air borne contamination with environmental fungal spores is a problem the efficiency of an air filtration may be increased and laminar airflow maintained as barrier around the patient.

Surveillance and Role of Microbiology Laboratories

The detection and identification of hospital infection incidents or outbreaks rely on the laboratory data that alert the infection control team to unusual cluster of infection, called as *“alert organism”* system.

Practical Teaching to Staff

- Infection Control Guidelines Handbook should be present in each department.
- Seminars and workshops should be conducted on a regular bases.
- An annual report on the most common isolated nosocomial infection microbes should be done and circulated.



Welcome to the hospital!

Bugs are waiting for you!!!

