



# INTRAHOSPITAL INFECTIONS (hospital or nosocomial)



Assoc. prof. dr Biljana Popovska  
Jovičić

## *Definition of hospital infections (HI)*

- ✓ BI are clinically manifested diseases that occur in patients as a result of hospital stay or treatment, but also in staff as a result of hospital work
- ✓ 48 hours after admission and within 3 days after discharge
- ✓ BI is an infection that was not present on admission nor was the patient incubating at the time of admission
- ✓ They can be endogenous and exogenous in origin



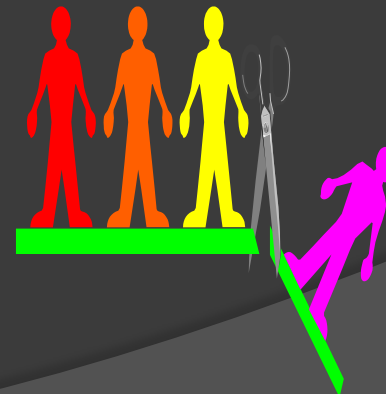
# Hospital infections - the importance

- 5-10% of hospitalized patients develop IBD
- IBD causes 100,000 deaths annually
- More than 70% of IBD pathogens are multidrug-resistant



# Nosocomial infections - consequences

- ✓ Increased morbidity and mortality
- ✓ Prolonged hospitalization (days of hospital treatment)
- ✓ Increased cost of treatment



## Patients at risk for developing BI

- ✓ Neonates, children and the elderly
- ✓ Patients with prolonged hospitalization
- ✓ Immunocompromised patients
- ✓ Patients with chronic diseases
- ✓ Patients colonized with MRM



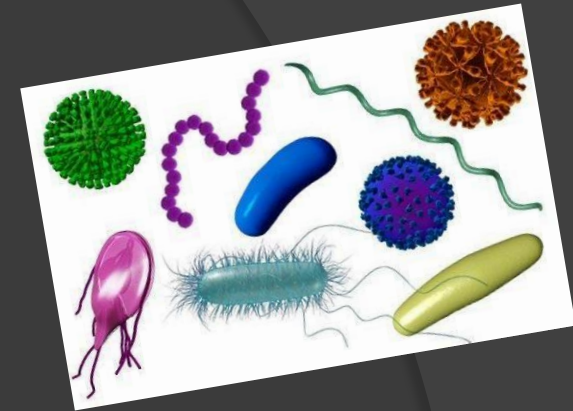
# Risk factors

- ✓ Presence of intravascular devices
- ✓ Presence of urinary catheters
- ✓ Intubation or mechanical ventilation
- ✓ Surgeries
- ✓ Presence of nasogastric tube
- ✓ Transfusions
- ✓ Parenteral nutrition

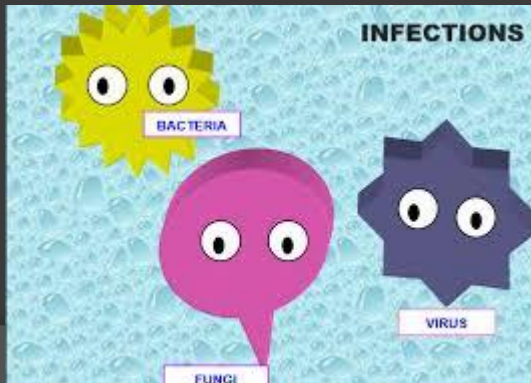




# Routes of transmission

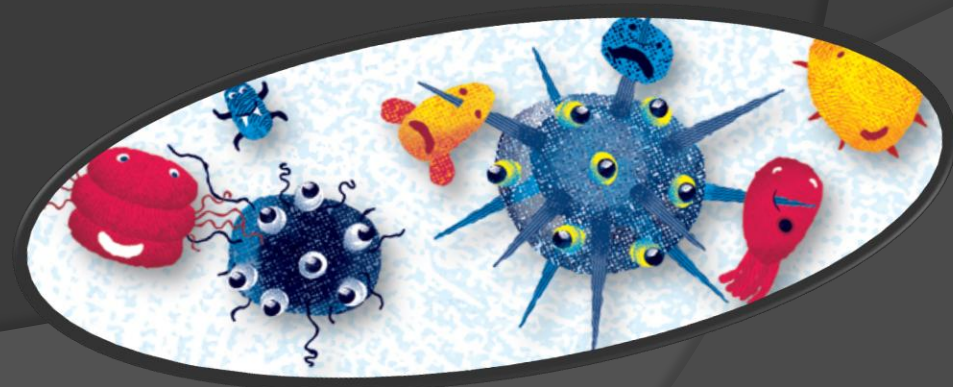
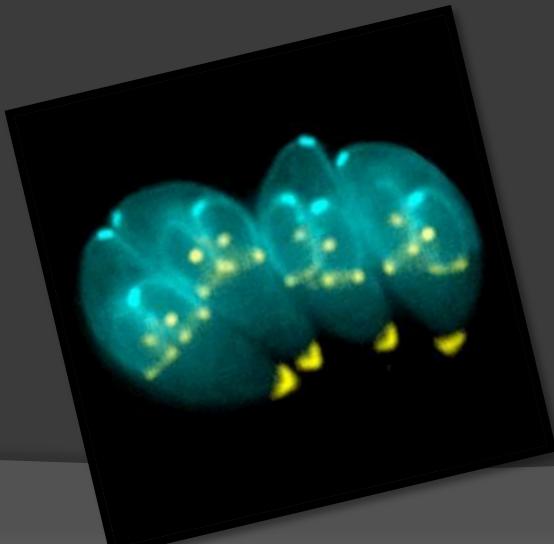
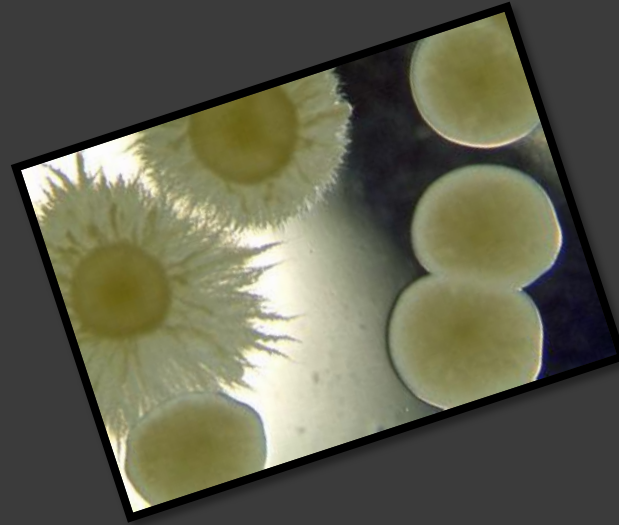


- Microorganisms are transmitted in hospitals in several ways, and the same microorganism can be transmitted in several ways:
- Contact transmission, direct and indirect
- Droplet transmission
- Airborne transmission
- Vector transmission (not specific to the hospital environment)



# Causative agents of intrahospital infections

- Bacteria
- Viruses
- Fungi
- Protozoa
- Prions





## The most important bacterial causative agents of intrahospital infections

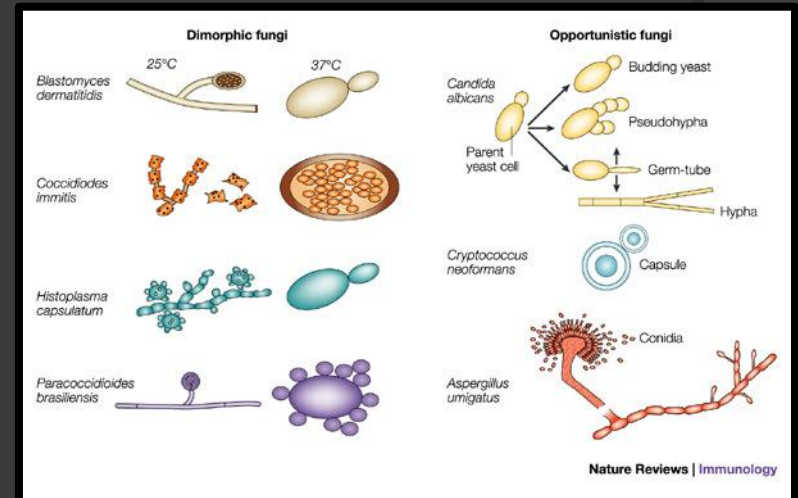
- ✓ Gram positive bacteria
  - ✓ Staphylococcus aureus
  - ✓ Enterococcus spp.
  - ✓ Coagulase negative Staphylococcus
- ✓ Gram negative bacteria
  - ✓ Escherichia coli
  - ✓ Pseudomonas aeruginosa
  - ✓ Klebsiella spp.
  - ✓ Serratia spp.
  - ✓ Acinetobacter spp.

## The most important viruses as causative agents of intrahospital infections

- ✓ Airborne
  - ✓ Influenza, VZV, Measles, Parainfluenza, Respiratory Syncytial Virus
- ✓ Fecal-oral
  - ✓ Rotavirus, Norovirus
- ✓ Direct contact
  - ✓ HSV1, HSV2, VZV
- ✓ Bloodborne viruses
  - ✓ HBV, HCV, HIV

# Fungi as causative agents of intrahospital infections

- Yeasts
- Candida spp. (*C. albicans*, *C. glabrata*, *C. krusei*, *C. tropicalis*...)
- Molds
- Aspergillus spp, Acremonium spp
- Mucorales
- Rhizopus spp



## Incidence of various nosocomial infections

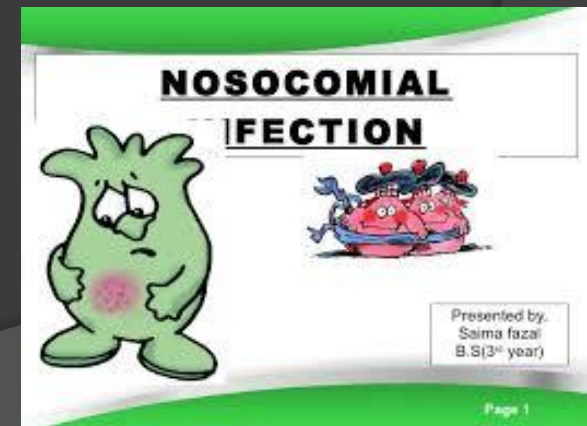
- **Urinary tract infections**
  - most often due to manipulations in the urinary tract
  - in 20-25% of patients with a urinary catheter
- **Respiratory tract infections**
  - nosocomial pneumonia is the second most common nosocomial infection
  - prolongs hospitalization of patients by 4-9 days
  - mortality ranges between 20-50%

- **Surgical wound infections**
- About 12% of surgical patients develop a surgical wound infection
- They extend the patient's hospitalization by about 6 days
- **Blood infections**
- Nosocomial blood infections (sepsis) account for about 6% of nosocomial infections
- Most nosocomial sepsis is associated with intravascular catheters

## The most important forms of resistance (multidrug-resistant microorganisms)

In hospital settings, infections are common:

- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin-resistant *Enterococcus* (VRE)
- Multidrug-resistant Gram-negative bacilli
- ESBL (extended-spectrum lactamases)
- Resistant fungi





## The most important procedures in reducing the occurrence and control of multidrug-resistant microbes

- ✓ Active surveillance of infections and recognition of antibiotic resistance patterns
- ✓ Good microbiological laboratory practice
- ✓ Effective control of antibiotic use
- ✓ Development and implementation of adequate infection control measures
- ✓ Adequate cleaning and decontamination of the hospital environment
- ✓ Education and practical training of healthcare personnel

## Methicillin-resistant *Staphylococcus aureus* (MRSA)

- *Staphylococcus aureus* causes skin and soft tissue infections, as well as systemic infections
- 30% of healthy people carry *Staphylococcus aureus* in their nose
- MRSA is the leading nosocomial pathogen worldwide (SSI, vascular/orthopedic implant infections, surgical wound infections, sepsis, pneumonia)

# Methicillin-resistant *Staphylococcus aureus* (MRSA)

## Source of infection

Patients with MRSA infection or colonization

## Route of transmission

The main route of transmission of MRSA in hospitals is from patient to patient via the hands of healthcare workers (inadequate hand washing)

In some hospitals, MRSA becomes endemic

## Vancomycin-resistant Enterococcus (VRE)

- ✓ Previous Vancomycin therapy or multiple antibiotic therapy
- ✓ Presence of permanent devices (central venous catheters, urinary catheters, drains, etc.)
- ✓ Life-threatening patients (patients in the ICU, oncology departments, etc.)
- ✓ Patients who have had intra-abdominal, thoracic, orthopedic, vascular, and urological surgeries
- ✓ Severe underlying disease or immunosuppression

## Vancomycin-resistant Enterococcus (VRE)

### Source of infection

Enterococcus faecium and Enterococcus fecalis are saprophytes in the intestinal tract (due to the use of broad-spectrum antibiotics they can become pathogenic)

### Mode of transmission

Most often from patient to patient via the hands of healthcare personnel or via contaminated patient care equipment

## Multidrug-resistant gram-negative bacteria

- Many gram-negative bacteria (*Klebsiella*, *Escherichia coli*) secrete beta-lactamase, which makes them resistant
- Risk factors
  - Presence of vascular catheters
  - Presence of urinary catheters
  - Emergency abdominal surgery
  - Existence of gastrostomy or jejunostomy tubes,
  - Longer hospital stay (especially in the ICU)
  - Previous antibiotic therapy



## Infection caused by *Clostridium difficile*

*Clostridium difficile* infection is now the most common cause of hospital-acquired diarrhea

### Clinical features

Diarrhea usually occurs 5-10 days (range: a few days to 2 months) after the start of antibiotic therapy

The most severe form of the disease is called pseudomembranous colitis

**Complications:** pancolitis, toxic megacolon, perforation, and endotoxic shock

The disease is prone to relapse (in 15-25%, within 2-4 weeks)

## Risk factors

Indiscriminate use of broad-spectrum antibiotics, especially beta-lactam antibiotics

Gastrointestinal and surgical procedures

Older age (elderly and debilitated patients)

## Source of infection

The source of infection is patients with clostridial colitis who excrete pathogens in the stool

The infection is most often spread between patients by contact (direct or indirect)

## Diagnosis

Detection of *Clostridium difficile* toxins in stool

## Treatment

Stop antibiotic therapy that has altered the intestinal microflora or switch to antibiotic therapy that is less associated with colitis

Antiperistaltic drugs (Loperamide) should be avoided

Fluid and electrolyte replacement

**Antibiotics:** Metronidazole tbl. 400 mg 3x1 10-14 days (first choice drug) or Vancomycin orally 4x125 mg 10-14 days

# Key strategic prevention measures



1. Infection prevention (vaccination, isolation, not working until the erosion heals, gloves, goggles, masks),
2. Early diagnosis and therapy (surveillance),
3. Selective use of antibiotics,
4. Prevention of transmission.

## Monitoring of hospital infections

- Every healthcare organization is obligated to monitor hospital-acquired infections!
- The main goals of hospital-acquired infection monitoring are:
- reducing the incidence of infections in hospital settings
- determining one's own infection rates
- detecting outbreaks
- comparing the incidence rates of hospital-acquired infections between healthcare institutions evaluating infection control measures



THANK YOU FOR YOUR ATTENTION!

