

Nosocomial Infections

Nosocomial infections also known as hospital acquired infections are infections not present and without evidence of incubation at the time of admission to a healthcare setting.^[1] They become evident 48 hours after admission or 48 hours after patient is discharged.

Definition of nosocomial infections

- NI - not an infection contracted by health care personnel in the course of their profession - *professional infection*.
- Basic feature of NI - hospital strains have higher resistance to antimicrobials and disinfection.
- Cause of higher morbidity and mortality.

Classification of nosocomial infections

By agent:

- **Exogenous** - the agent is introduced into the organism from outside;
- **endogenous** - own infectious agent from the colonized site into another system, into a wound, into serosal cavities (Blood, during surgery, invasive procedures, immunosuppressive treatment); the etiologic agent is the microflora present in the body, which is normally non-pathogenic.

According to the epidemiological point of view:

- **non-specific** - reflect the epidemiological situation in the catchment area of the health facility or are an indicator of the hygiene level of the facility;
- **specific** - a consequence of diagnostic and therapeutic procedures, their occurrence can be influenced by asepsis, sterilization, disinfection, hygiene-epidemiological regime.

According to the affected system:

- **respiratory**;
- **catheter** - from the bloodstream;
- **urinary tract infections**;
- **gastrointestinal**;
- **wound infections**;
- **genital tract**;

Process of spreading nosocomial infections

- Existence of a source of the causative agent - Transmission of the causative agent by NI - Presence of a susceptible individual - Transmission of the causative agent by NI - Presence of a susceptible individual.

Source - Nosocomial agent

- **Patient** - his own microflora, another patient (his microflora is in saliva, on hands, in air, dust, tools, etc.).
- **Health care worker** - does not appreciate his own disease.
- **Visitor** - least serious source, control of visitors.

Forms of nosocomial infections

- **Manifest** - less dangerous, easily diagnosed and treatable.
- **Carriage** - carriers harbor and excrete infectious agents without obvious signs of disease.

Nosocomial transmission

- **Direct transmission:**
 - presence of a source of infection and a susceptible individual;
 - contact (e.g., kissing/sexual contact);
 - essentially transmission by the hands of health care personnel;
 - in newborns - eye infection (direct contact with the mucous membrane of the vagina);
 - droplet infection;
 - alimentary route - preparation of milk food in the neonatal unit.
- **Indirect transmission** depends on:
 - the ability of the microorganism to survive outside the host body;
 - the existence of a suitable medium in which the aetiological agent multiplies and with the help of which the infection is transmitted.

Most common bacterial agents of nosocomial infections

- Staphylococcus,
- Enterococcus,
- *Streptococcus pneumoniae*,
- *Clostridium difficile*,
- Enterobacteriaceae,
- *Pseudomonas aeruginosa*,
- *Helicobacter pylori*,
- *Mycobacterium species*,
- mycotic agents.

Mechanism of bacterial resistance

- ATBs have been used for more than 50 years.
- ATBs are a substantial part of all drug costs.
- Adequate application of ATBs - economics and spread of resistance.
- Emergence of resistance - most in ICU and ARO settings - multiple ATB applications.

Most important microorganisms: gram-positive bacteria

- MRSA - methicillin-resistant *Staphylococcus aureus*.
- MRSE - methicillin-resistant coagulase-negative staphylococcus aureus.
- VISA - *Staphylococcus aureus* with reduced susceptibility to vancomycin.
- PRSP - *Streptococcus pneumoniae* resistant to PNC.
- VRE - vancomycin-resistant enterococci.
- Enterococci with high resistance to aminoglycosides.

Most important microorganisms: gram-negative bacteria

- With production of broad-spectrum β -lactamases encoded plasmidally and chromosomally (ESBL).
- With resistance to carbapenems.
- With resistance to fluoroquinolones.
- With resistance to aminoglycosides.

Resistant strains of MRSA

- Identified in 1961.
- In the US, incidence increased from 2.4% in 1975 to 30-60% after 1990.
- Scandinavia - still 1% in 1990.
- Spain and France - more than 30%.
- 1990 in Central Europe - prevalence from 1.7% to 8.7%.
- England - from 3% in 1989 to 34% in 1998.
- Measures - isolation and compliance with a hygiene and epidemiological regime, including hand washing.

MRSA resistance in the Czech Republic

- Exact figures are not available;
- 70 hospitals have investigated invasive isolates under the EARSS (*European Antimicrobial Resistance Surveillance System*) project;
- MRSA incidence - 3.8% in 2000 increased to 8.8% in 2004.

Resistance is caused by

- The production of **bacterial enzymes** that disrupt or modify the structure of the ATB;
- Alteration of the **bacterial wall** - reduction of its permeability;
- **modification** of the target sites of ATBs;
- increased **excretion** of ATB from bacterial cells to prevent its intracellular accumulation.

Suppression of nosocomial infections

- Knowledge of all data and information on the emergence and spread of NN is a prerequisite;
- Data collection is integrated into the "Surveillance" programme;
- Decree 195/2005 Coll. - lists infectious diseases for which isolation in inpatient facilities is ordered and treatment is mandatory;
- Act on the Protection of Public Health and on Amendments to Certain Related Acts - 258/2000 Coll., last amended - Act No. 274/2003 Coll.

Repressive measures

- Tasks:

- eradication of an outbreak of an already established disease;
- reporting of an outbreak of NI;
- treatment of a patient with NI, isolation;
- barrier nursing care;
- search for contacts and source of infection;
- disinfection - in the outbreak area;
- increasing the immunity of susceptible patients;
- control of the measures ordered, including thorough documentation.

Nosocomial urinary tract infections

- Account for 30-40% of UTIs;
- 60-90% - association with indwelling urinary catheter;
- 10% - urological-endoscopic intervention;
- Less costly NI, but prolonged hospitalization increases cost of treatment.

Prevention

- Always use a sterile catheter;
- thorough disinfection of the periurethral area;
- hand disinfection, use of sterile gloves;
- catheter fixation - prevention of movement in the urethra.

Surgical site infection

- Third most common NI - 14-20% CDC:
- - **superficial IMCHV;**
 - **deep incisional IMCHV;**
 - **Organ/space IMCHV.**

Clinical picture of IMCHV

- Redness,
- serous secretions;
- purulent secretion from a small area of the wound;
- purulent secretion from the whole wound area, eventually its disintegration - dehiscence.

Prevention in the preoperative period

- The shortest possible hospitalization before surgery;
- Thorough bath and shower;
- for elective procedures, overtreat other infections;
- attention to shaving the surgical site;
- antibiotic prophylaxis.

Intraoperative prophylaxis

- Principles of asepsis and barrier nursing techniques;
- use of protective equipment by theatre staff;
- disposable drapes;
- disinfection of the surgical field site with proper exposure to disinfectant;
- precise surgical technique;
- minimizing the number of staff in the operating room;
- efficient ventilation and air conditioning in the operating room.

Postoperative interventions

- Cover the incision with a sterile dressing for 24-48 hours;
- principles of asepsis during dressings;
- Educate family and patient about proper wound care and symptoms of wound infection.

Respiratory tract - pneumonia

- 10-20% of all nosocomial infections;
- incidence in ICUs can be as high as 65% with mortality rate above 25%;
- prolong hospitalization;
- persons at risk are over 70 years of age.

Specific risk factors

- **Internal-** age, smoking, alcoholism, malnutrition, obesity, lung disease, severe general illness, and microbial

flora of the oropharynx.

- **External** - length of hospitalization, immunosuppression, drug administration, thoracic and abdominal surgery, tracheotomy, ET, bronchoscopy, ventilators, nebulizers.

General principles of prevention

- maintaining proper personal hygiene and hand washing
- sterilisation of hospital equipment
- providing clean and sanitary environment
- existence of infection control team
- regular, close observation of high-risk units .e.g intensive care
- development of policies on areas such as isolation, disinfection and antibiotic usage

Links

Sources

- KOLEKTIV AUTORŮ,. *Základy ošetřování nemocných*. 1. vydání. Praha : Karolinum, 2005. 145 s. ISBN 80-246-0845-6.
- MIKŠOVÁ, Z, et al. *Kapitoly z ošetrovateľskej péče I..* 2. vydání. Praha : Grada, 2006. 248 s. ISBN 80-247-1442-6.
- MIKŠOVÁ, Z, et al. *Kapitoly z ošetrovateľskej péče II..* 2. vydání. Praha : Grada, 2006. 171 s. ISBN 80-247-1443-4.
- RICHARDS, A a S EDWARDS. *Repetitorium pro zdravotní sestry*. 1. vydání. Praha : Grada, 2004. 376 s. ISBN 80-247-0932-5.
- ROZSYPALOVÁ, M a A ŠAFRÁNKOVÁ. *Ošetrovateľství I., II..* 1. vydání. Praha : Informatorium, 2002. 239 s. ISBN 80-86073-97-1.
- WORKMAN, B a C., L. BENNETT. *Klíčové dovednosti sester*. 1. vydání. Praha : Grada, 2006. 259 s. ISBN 80-247-1714-X.
- MANDAL, BK. *Lecture Notes : Infectious Diseases*. 6th edition. Wiley-Blackwell, 2004. 280 pp. ISBN 978-1-4051-0820-1.

References

1. Ayesha Mirza, MD Assistant Professor, Pediatric Infectious Diseases, University of Florida College of Medicine Jacksonville- Hospital-acquired infections. January 5th 2012 (<http://emedicine.medscape.com>)