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Agents of nosocomial infections

Definition of nosocomial infections (NIs)

Nosocomial (hospital-acquired) infections =

= infections occurring in connection with the stay in a medical institution (as opposed to community-acquired infections)

At least 5 % patients !

Exogenous NIs:

source = other patients, environment, personnel

vector = mostly personnel's unwashed hands

Endogenous NIs:

source = the patient himself/herself

Consequences of NIs

Higher mortality (†) – almost 40 % higher (a conservative estimate in this country is hundreds unnecessary deaths per year)

Longer (by weeks) and more expensive hospitalization (by tens of thousands, even more CZK per case)

Economic losses circa 1.5 billions CZK/year

Additional ATB therapy (both higher costs and toxicity)

Patients themselves = source for others

More than 1/3 of NIs can be prevented!

Main types of NIs

1. Urinary tract infections in catheterized patients – up to 40 % of all NIs
2. Respiratory tract infections – about 20 %
   - Early ventilator-associated pneumonia
   - Late ventilator-associated pneumonia
   - Aspiration pneumonia
   - Other respiratory infections
3. Purulent infections of surgical wounds – about 20 %
4. Blood-stream infections (sepsis by inserted intravenous catheters) – at least 15 %

http://www.astrographics.com

Etiology of nosocomial UTIs

Escherichia coli	25 %
other enteric bacteria	20 %
enterococci	15 %
Pseudomonas aeruginosa	10 %
other G– nonfermenting rods	10 %
yeasts	5 %

Etiology of respiratory NIs – I

Early VAP:

Staphylococcus aureus	**25 %**
Streptococcus pneumoniae	**20 %**
Haemophilus influenzae	**15 %**
enteric bacteria	**10 %**
other aerobically growing bacteria	**5 %**
anaerobes	**1 %**

(monomicrobial etiology, agents originate in community)

Etiology of respiratory NIs – II

Late VAP:

Gram–negative nonfermenting rods (***P. aeruginosa, Acinetobacter baumannii***)	**40 %**
enteric bacteria (**klebsiellae, *E. coli*, enterobacters**)	**30 %**
staphylococci (**mainly *S. aureus***)	**20 %**
yeasts	**5 %**

(some cases have polymicrobial etiology, agents are of hospital origin)

Etiology of surgical wounds suppuration

(depends on the terrain of the surgery)

Staphylococcus aureus

coagulase-negative staphylococci

Streptococcus pyogenes

enteric bacteria (*E. coli*)

bacteroids, prevotellae, peptostreptococci

Gram-negative non-fermenting rods

Clostridium perfringens

Etiology of sepsis by inserted i.v. catheter

coagulase-negative staphylococci (>50 %) – because of biofilm

enterococci – because of cephalosporins

Staphylococcus aureus

enteric bacteria (*E. coli*, klebsiellae)

Pseudomonas aeruginosa

***Acinetobacter* spp.**

***Candida* spp.**

Etiology of nosocomial viral infections

influenza virus – mainly infants and older patients

RSV – newborns and suckling infants

adenoviruses – ophthalmologic wards

other respiratory viruses

CMV – after cytotoxic treatment

rubella virus – children (vaccination available now)

rotaviruses – mainly children

VHB – higher risk in longer hospitalization

HIV – in developing countries mostly

Predisposition to NIs

Age – both extremes of age

Treatment – cytotoxic drugs, steroids, ATB

Underlying diseases

- hepatic disease
- diabetes mellitus
- cancer
- renal failure
- skin disorders
- neutropenia

Trauma – incl. surgery and i.v. catheters

Prevention of NIs – I

Four main strategies:

1. **Excluding sources of infection from the hospital environment**
2. **Breaking the chain of infection from source to the host**
3. **Improving the host's resistance to infection**
4. **Investigating hospital infection**

Prevention of NIs – II

1. Exclusion of infection sources

- Sterile instruments, dressings, medicaments and intravenous fluids
- Using only blood screened for infectious agents
- Clean linen, uncontaminated food
- Preventing contact with infected staff – both acutely ill or carriers of pathogens

Prevention of NIs – III

2. Breaking the chain of infection

- **Facilities**
  - ventilation systems & air flow (air-conditioning: legionellae, building work: aspergilli)
  - water systems (in particular warm water: legionellae)
  - patient isolation
    - to protect a particularly susceptible patient
    - to prevent the spread of pathogens from a patient to others
- **People**
  - facilitation of aseptic behavior of staff
  - the most important is effective hand washing

Prevention of NIs – IV

3. Improving the host's resistance

- **Immunization**
  - influenza (older patients)
  - pneumococcal infections (before transplantation or splenectomy)
  - VHB (in seronegative persons before hemodialysis)
  - varicella (zoster Ig in immunocompromised exposed to VZV)

- **Appropriate ATB prophylaxis**
  - in „dirty" surgery
  - In „super-clean" surgery (orthopaedics, neurosurgery)

- **Reducing the risk of postoperative infection**
  - correct operating technique
  - care of invasive devices and intravenous fluids
  - correct nursing techniques (prevention of pressure sores) and active physiotherapy

Prevention of NIs – V

4. Investigating hospital infections

- **Surveillance** (= regular monitoring) – allows early recognition of any change in the number or type of hospital infection
- **Investigation of outbreaks** from epidemiological and microbiological point of view
- **Establishment and monitoring of procedures** designed to prevent infection

Plague

The gouache Raving (1899) by Czech painter and drawer Felix Jenewein (1857-1905) belongs to the seven-part cycle Plague

Felix Jenewein: Plague – Outbreak of Infection

Felix Jenewein: Plague – Burials

Felix Jenewein: Plague – Stoning of a Physician to Death

Felix Jenewein: Plague – Raving

Felix Jenewein: Plague – Repentance

Felix Jenewein: Plague – Reconciliation


MERRY CHRISTMAS