Clinical Microbiology

Lectures - dentistry studies 2016
Agents of respiratory diseases

Part One
Importance of respiratory infections

• The most important/frequent infections in GP‘s office (respiratory tract = an ideal incubator)

• Big economic impact on the economics in general and on the health care in particular

• Often produce outbreaks and epidemics

• 75 % (and even more in children) are caused by viruses
Where is RTI localized?

- clinical symptomatology + specific agents

- It is necessary to distinguish:
  - upper respiratory tract (URT) infections (+ adjacent organs infections)
  - lower respiratory tract (LRT) infections (infections of lower respiratory ways + pneumonias)
URT infections and infections of adjacent organs

- infections of nose a nasopharynx
- infections of oropharynx incl. tonsillae
- infections of paranasal sinuses
- otitis media
- conjunctivitis
LRT infections and lung infections

Infections of LRT

- infection of epiglottis
- infection of larynx and trachea
- infection of bronchi
- infection of bronchioli

- infections of lungs
Common flora in respiratory ways

• i.e. bacteria typically found in respiratory tract of a healthy person

• **Nasal cavity:** usually *Staph. epidermidis*, less often sterile, coryneform rods, *Staph. aureus*, pneumococci

• **Pharynx:** always neisseriae and streptococci *(viridans group)*, usually haemophili, rarely pneumococci, meningococci, enterobacteriae, yeasts

• **LRW:** sterile, clinical materials from these sites are often contaminated by URW flora
**Rhinitis/nasopharyngitis - ETIOLOGY**

- **Viruses** – the most common - „common cold“:
  - more than 50 % rhinoviruses
  - coronaviruses
  - other respiratory viruses (NOT flu!)
- **Bacteria:**
  - Acute infections: usually secondary
    - *Staphylococcus aureus, Haemophilus influenzae, Streptococcus pneumoniae, Moraxella catarrhalis*
  - Chronic infections:
    - *Klebsiella ozaenae, Kl. rhinoscleromatis*
Rhinitis/nasopharyngitis - TREATMENT

• Viral etiology - does NOT need antibiotic treatment and bacteriological examination

• If necessary (pus full of polymorphonuclears, high CRP levels → markers of bacterial infection) treatment based on the result of bacteriological examination

• Topical treatment - carriers of epidemiologically important pathogens - e.g. MRSA – mupirocin (Bactroban)
Infectious rhinitis VS. allergic/vasomotoric rhinitis

http://www.bupa.co.uk/health_information/asp/direct_news/general_health/rhinitis_240706.asp

http://www.drgreene.org/body.cfm?xyzpdqabc=0&id=21&action=detail&ref=1285
Sinusitis/otitis media – ETIOLOGY I

• Acute sinusitis and otitis usually started by respiratory viruses, *M. pneumoniae* (myringitis)

• Secondary pyogenic inflammations:
  *S. pneumoniae, H. influenzae type b, Moraxella catarrhalis, Staph. aureus, Str. group A, OR even anaerobes* (genus *Bacteroides, Prevotella, Porphyromonas...*)

Complications: mastoiditis, purulent meningitis
Sinusitis/otitis media – ETIOLOGY II

- **Sinusitis maxillaris chronica**, **sinusitis frontalis chronica:** *Staph. aureus*, genus *Peptostreptococcus*

- **Otitis media chronica:** *Pseudomonas aeruginosa*, *Proteus mirabilis*
**Sinusitis/otitis media - EXAMINATION + TREATMENT**

- **Relevant specimen** – only a **punctate** from the middle ear or paranasal sinus; NOT nasal, ear swabs (contaminants)

- **Sinusitis** ATB treatment ONLY in **painful sinusitis**, with teathache, headache, fever, lasting at least a week, eventually neuralgia of N. Trigeminus

- **Otitis media** ATB when inflammation (pain, red colour, fever) and anti-inflammatory treatment not sufficient

- e.g. Aminopenicillin or 1st gen. cephalosporin
Sinusitis acuta

Frontal sinus

Ethmoid sinus

Maxillary sinus

Sinusitis
Otitis media

- Causative agents
- as in sinusitis

http://www.otol.uic.edu/research/microto/Microtoscopy/acute1.htm

http://www.medem.com/medLB/article_detaillb.cfm?article_ID=ZZZPMV6D1AC&sub_cat=544
Conjunctivitis - ETIOLOGY

- Usually **viral**, accompanies acute URT infections/
  adenovirus, enterovirus - hemorrhagic conjunctivitis, HSV - herpetic keratoconjunctivitis

- **Bacterial**
  a. **Acute:**
    supplicative conjunctivitis: *S. pneumoniae, S. aureus*
    inclusion conjunct.: *C. trachomatis D – K*
  b. **Chronic:** *S. aureus, C. trachomatis A – C (trachoma)*

- **Allergic, mechanic** (allien body)

- **Usually topical** treatment
Oropharyngeal infections - ETIOLOGY

- **Acute tonsillitis and pharyngitis:**
  usually viral (rhinoviruses, coronaviruses, adenoviruses, EBV – inf. mononucleosis, coxsackieviruses – herpangina)

**Most important bacterial:** *S. pyogenes* (= β- haemol. streptococcus group A)

- **Other bacterial:** streptococci group C, F, G, pneumococci, *H. influenzae?*, *N. meningitidis?*,

- **Rare, but important:** *Corynebacterium diphtheriae*, *Neisseria gonorrhoeae*
Oropharyngeal infections - TREATMENT

- Throat swab recommended in all cases, incl. „typical tonsilitis“

- *Streptococcus pyogenes* - penicillin still the best!

- Macrolides, e.g. clarithromycin in allergic patients only (resistance, worse effect)

- Determination of CRP level (marker of a bacterial infection)
Tonsilopharyngitis

http://medicine.ucsd.edu/Clinicalimg/Head-Pharyngitis.htm

Viral tonsilopharyngitis

http://upload.wikimedia.org/wikipedia/commons/thumb/b/b1/Pharyngitis.jpg/250px-Pharyngitis.jpg
Purulent bacterial tonsilitis

http://www.meddean.luc.edu/lumen/MedEd/medicine/PULMONAR/diseases/pul43b.htm
Epiglottitis


de.wikipedia.org/wiki/Epiglottitis

George Washington died of epiglottitis
Epiglottitis

• Serious disease – medical emergency
  The child could suffocate!

• *Haemophilus influenzae* type b („Hib“)

- vaccination
Laryngitis and tracheitis

- **Respiratory viruses (other than in nasopharyngitis):** parainfluenza/influenza A viruses & RSV

Treatment symptomatic - antibiotics NOT recommended

- **Bacterial:** *Chlamydophila pneumoniae, Mycoplasma pneumoniae*, secondary: *S. aureus* and *Haemophilus influenzae*, laryngotracheitis pseudomembranosa (croup): *Corynebacterium diphtheriae*

- Throat swab is useless, except for chronical situations.
Laryngitis acuta

I've lost my voice. Is it contagious?
Bronchitis - ETIOLOGY

• **Acute bronchitis:**
  
  influenza, parainfluenza, adenoviruses, RSV

**Bacterial - secondary:** pneumococci, haemofili, stafylococci, moraxellae

**Bacterial - primary:** *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, *Bordetella pertussis*

• **Chronic bronchitis** *(cystic fibrosis):*
  
  *Pseudomonas aeruginosa*, *Burholderia cepacia*
Bronchitis acuta

http://www.yourlunghealth.org/lung_disease/copd/nutshell/index.cfm

http://www.lhsc.on.ca/resptherapy/students/patho/brnchit5.htm
Bronchiolitis

• **Isolated bronchiolitis in newborns and infants only:**

*Pneumovirus* (= RSV)

*Metapneumovirus*

Pneumonia

www.medicine.com/pneumonia/article.htm
Types of pneumoniae

• **Acute – community-acquired pneumoniae CAP**
  - in originally healthy
    • adults
    • children
  - in debilitated persons
  - after a contact with animals (e.g. *Pasteurella multocida*, *Coxiella burnetii* - Q-fever, *Chlamydophila psittaci* - psittacosis)

• **Acute – nosocomial pneumoniae**
  - ventilator-associated
    a) early
    b) late
  - others

• **Subacute and chronic pneumoniae**
**Pneumoniae – ETIOLOGY I**

**Acute, community-acquired, in healthy adults**

- **bronchopneumonia and lobar pneumonia:**
  - *Streptococcus pneumoniae*
  - *Staph. aureus*
  - *Haemophilus influenzae* type b

- **atypical pneumonia:**
  - *Mycoplasma pneumoniae*
  - *Chlamydia pneumoniae*
  - *Influenza A virus*
Pneumoniae – ETIOLOGY II

• Acute, community-acquired, in debilitated individuals:
  – pneumococci, staphylococci, haemofili
  – *Klebsiella pneumoniae* (alcoholics)
  – *Legionella pneumophila*

• In more serious immunodeficiency:
  – *Pneumocystis jirovecii*
  – CMV
  – atypical mycobacteria
  – *Nocardia asteroides*
  – aspergilli, candidae
Pneumoniae – ETIOLOGY III

Acute, nosocomial:

- Ventilator-associated pneumonia - VAP:
  - **early** (up to the 4th day of hospitalization):
    - sensitive community strains
  - **late** (from the 5th day):
    - resistant hospital strains

- Others
  - viruses (RSV, CMV)
  - Legionella
Pneumoniae – ETIOLOGY IV

- Subacute and chronic:
  - aspiration pneumonia and lung abscesses
    - *Prevotella melaninogenica*
    - *Bacteroides fragilis*
    - peptococci and peptostreptococci
  - lung tuberculosis and mycobacterioses
    - *Mycobacterium tuberculosis*
    - *Mycobacterium bovis*
    - atypical mycobacteria
Pneumonia

Bronchopneumonia

See the inhomogenous shadow in the lower and middle lobes of the right lung
Lobar and lobular pneumonia
Lung infections - EXAMINATION

- Clinical examination and chest X-ray, differentiation classical × atypical pneumonia

- Classical pneumoniae - sputum is useful, blood for blood culture, S. pneumoniae Ag in urine

- Atypical pneumoniae - serology - mycoplasma and chlamydophila (+ „viral screen“).

- Hospital pneumoniae also Legionella examination – Ag in urine
Bronchitis and pneumonia - TREATMENT

• **CAP amoxicilin**, (eventually according to a causative agent and antibiotic susceptibility)

• **Atypical pneumoniae tetracyclins or (esp. in children < 8) macrolides.**

• **Combination therapy**

• **Hospital infections - susceptibility test - resistances!**

• **In TB usually combination of drugs**
Gerrit Dou (1613 - 1675)
The Physician