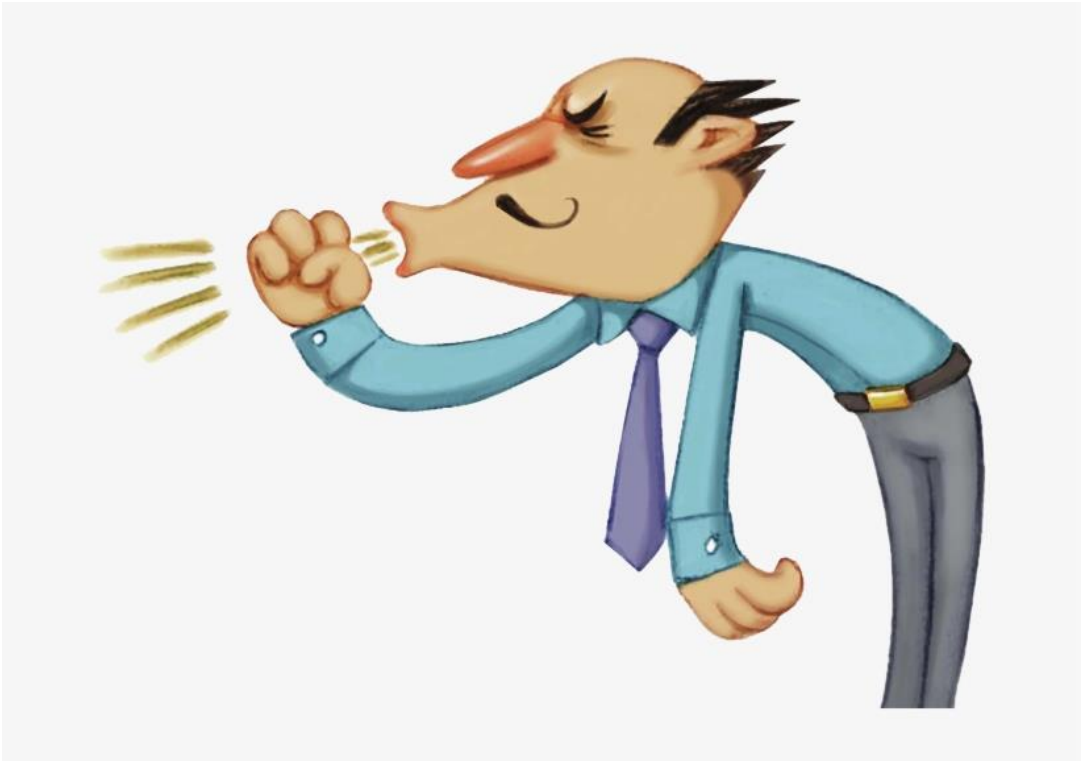


Respiratory infections

Tereza Kopecká

I believe this is the most important topic.
Do you agree?

- Yes or no?

Pneumonia!

- The world leading cause of death in kids under 5
- The most common cause of hospital admission for US adults
- Frequent complication (of virtually anything)

Golden rules

Previously healthy patients rarely die of common cold.

Bed rest, NSAID and symptomatic treatment is an adequate treatment.

If you think you really should treat them more, examine first!

Empirical treatment is an exception, not a rule.

When examine? 1/2

Request a test means *ask a question*.

Valid questions:

- Is there an indication for ATB treatment?
- Is an epidemiologically significant agent present?

When examine? 2/2

Monitoring of seriously ill people

„Getting more data“ in a hospital setting

(if you really don‘t know)

(YES!) The patient first!

Remember that…

By requesting a test

you ask a question.

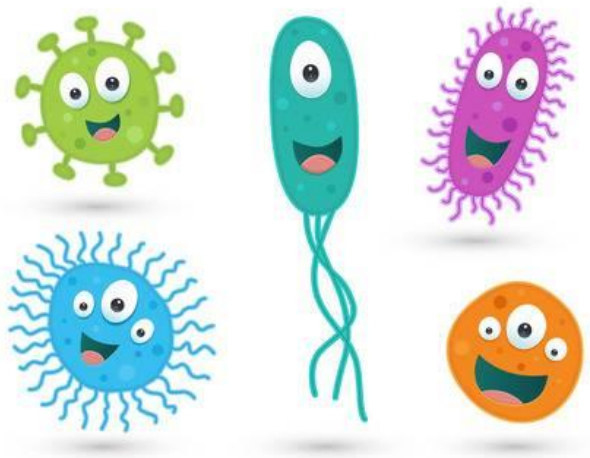
You must know

what to expect

and how to react!

Never request tests that wouldn‘t influence your decision.

A bacterium or a virus?



Bacterium

- Local symptoms
- Spaces
- Per continuitatem
- High fever
- Higher CRP
- 1 lymph node

Virus

- Overall symptoms
- Entire mucous membranes
- Remote systems
- Mild fever
- Lower CRP
- Multiple nodes

Nothing is absolute.

„Viral“ is not the same as „mild“.

But...

ATB are useless until a secondary infection occurs.

Any serious infection?

You need a blood culture.

- Pneumonia
- Lung abscess
- Empyema
- etc.

Other specimens?

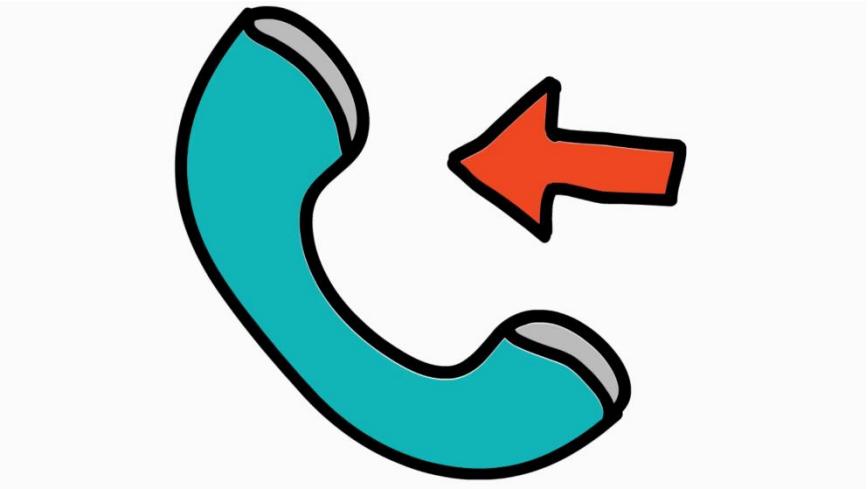
- Swabs (throat, nose, ear)
  - Watch out the technique!
- Liquids (sputum, BAL, pus)
- Tissues (debris, tonsils…)
- <u>If possible, take a liquid!</u>

What do we need?

- Swab sets
  - Dry
  - Transport medium (Amies)
- Tubes, syringes (catch the liquid)
- A little bit of rudeness – careful technique has poor results!

What to do when you are not sure about the specimens?

- Laboratory manual
  (it really exists)



- Call the lab and ask questions!

(better than discovering America for the 2nd time)

Positive results?

- Not all the bacteria found in the specimens should be eliminated by antibiotics.

- Think of the natural microbiome.

Never treat a paper, always treat a patient!

When treat?

- Always look for a link between the results and patient‘s condition.
- If it‘s weak, don‘t treat. Rather observe and/or repeat the tests. **Document your decision!**
- Always ask yourself if the patient really needs antibiotics. **Benefit is not enough.**
- Positive results about viral infections are rather informative. Antiviral therapy is a specialized issue. **Consult an expert!**

Who are the „harmless“ inhabitants of the upper respiratory tract?

- *Streptococcus viridans*
- *Neisseria* sp. (except NEGO, NEME)
- *Staphylococcus* CN (non-aureus)
- *Corynebacterium* sp. (non-diphteriae)
- Food bacteria - Enterobacteriaceae
- Other bacteria and viruses, yeasts…

„It-depends“-like bacteria

- *Streptococcus pyogenes*
- *Branhamella catarrhalis*
- *Staphylococcus aureus*
- *Haemophilus influenzae*
- *Streptococcus pneumoniae*
- …

- Colonization / infection!

What is always wrong?

- MRSA
- *Corynebacterium diphteriae*
- *Bordetella pertussis*
- *Mycobacterium tuberculosis*

  (but they need specialized tests!)

(*Burkholderia mallei, Francisella tularensis*…)

Don‘t overestimate „wide normal“ results!

Sputum: cells matter

- A valid specimen of ill sputum contains big amount of cylindric cells / leukocytes
- If obtained naturally (cough), it‘s always contaminated by oral flora.
- Massive culture of possible causative agent of pneumonia must be taken into account, if the specimen is valid.

Examples: interpretation of a swab

- Throat: *Branhamella catarrhalis*.
  - Would you treat?
  - If there is a severe acute bronchitis or pneumonia, YES
  - If there is only a sore throat, no need. (only benefit)

- Nose: *Staphylococcus aureus*.
  - Would you treat? No symptoms.
  - No! Only MRSA screening. (not even any benefit)

Is it free from bacteria?

- Primarily sterile specimens: OK!
- Regions with natural microbiome:
  - Poor specimen – you know nothing
  - Previous ATB treatment: OK!
- If you are sure there is a bacterial infection…
  - Take another specimen
  - Think about species that are hard to cultivate

Clinical case

- Male patient, 84 years
- Shortness of breath
- Chest pain
- Dry cough
- Fever 39,0°C
- Confusedness
- No sputum, throat swab culture: *Klebsiella pneumoniae*, NO ATB TESTED
- Auscultation: suspect pneumonia
- X-ray: pneumonia
- CRP: 250 nmol/l

And now, what?

- Empirical treatment with ATB?
- Request antibiotic sensitivity testing of *K. pneumoniae*?
- Another test?

What about urine?

- Urine gives us two important points about lung infections:
  - *S. pneumoniae* antigen
  - *Legionella* sp. antigen
- Results: P-, L+
- With the onset of expectoration a specimen of sputum was taken, BCYE agar cultivation was positive – *L. pneumophila*.
- Treatment with clindamycin successful.

What‘s the message?

1. Don‘t stop at the first traffic light.
2. Don‘t rely on taxonomical names.

Klebsiella pneumoniae is not a typical causative agent of community pneumonia, just like *Haemophilus influenzae* is not the causative agent of the flu.

What to remember about pneumonia?

- It really kills. Easily. **Do auscultations**.
- Chest X-ray, urine pneumococcal antigen, sputum cultivation and CRP/PCT/FW must be done in all suspect cases!
- Clinical suspection?
  - Fever, shortness of breath, cough, chest pain
  - Auscultation: foam, snow cracking
- There‘s a huge difference between community and hospital acquired pneumonia!

Agents of community pneumonia

- *S. pneumoniae*
- *E. coli*
- Influenza virus
- *H. influenzae*
- *B. catarrhalis*
- *M. pneumoniae*
- *…*

Treatment of community pneumonia

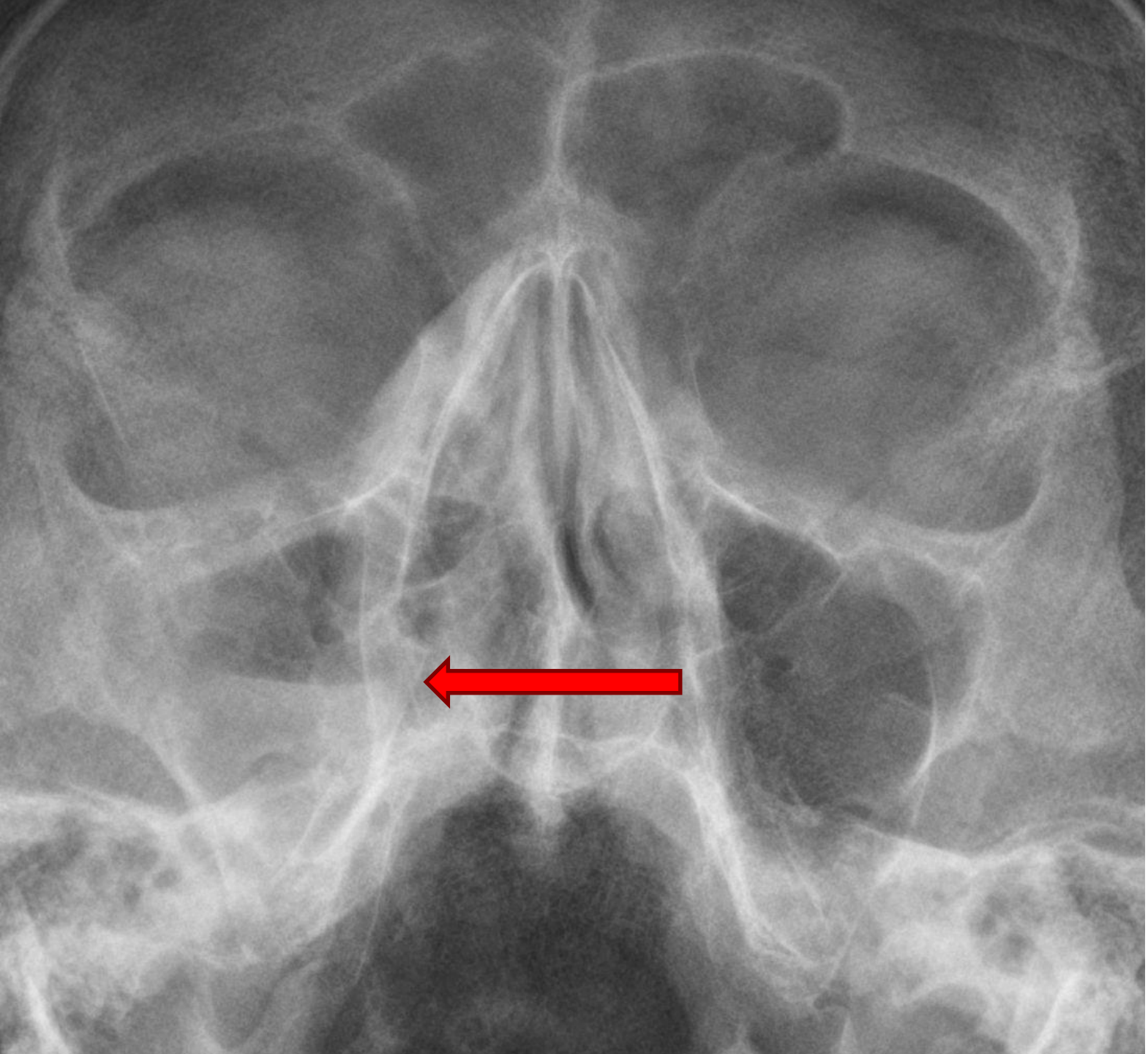
- Don‘t try to „cover all the agents“.
- Amoxicillin is fully sufficient.
- The species not covered by AMX are self-limited in otherwise healthy patients.
- Use clindamycin in case of a REAL allergy.
- Always ask about „allergy“ (some patients interpret poor effect or yeast infection as allergy).

Hospital-acquired pneumonia

- Different agents – usually bacteria (PSAE, STAU, MRSA, Enterobacteriaceae, BUCE)
- Different antibiotic sensitivity (MDR)
- Different clinical appearance (discreet)
- Different treatment (higher classes of ATB)
- Different risks (high mortality – 30%)
- Different results

Sinusitis

- All the sinuses are naturally drained into the nasal cavity
- If an infection causes swelling of the mucous membrane, the aperture diminishes, the mucus gets stuck in the sinus and suppurates (with the presence of bacteria)
- Typically viral + bacterial cause (STPN, HAIN)
- No swabs, only puncture



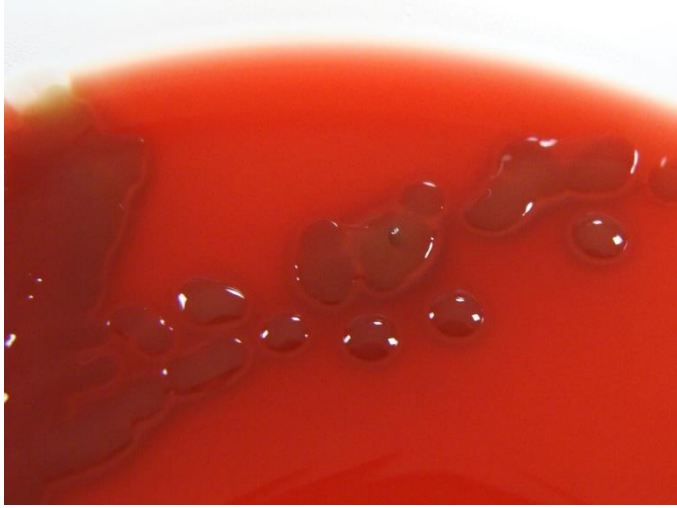
Otitis media acuta

- Similar situation – swelling of the mucous membrane due to viral infection of the nasopharnyx
- The Eustachian tube goes obstructed, the air in the middle-ear cavity absorbs and negative pressure causes irritation of the eardrum
- Secretion of fluid and subsequent bacterial inflammation
- Suppurative otitis with fever = ATB (AMC/CLI)

S. pyogenes

- Typical agent of suppurative infections
- **Tonsillitis** (very painful!), suppurative rhinitis (green), sinusitis
- Rheumatic fever and glomerulonephritis
- Treatment: **V-PNC**, amoxicillin (NOT clavulanate)
  (REAL allergy: CLA, CLI, AZI)
- If discovered accidentally, no treatment

Streptococcus pneumoniae (Pneumococcus)

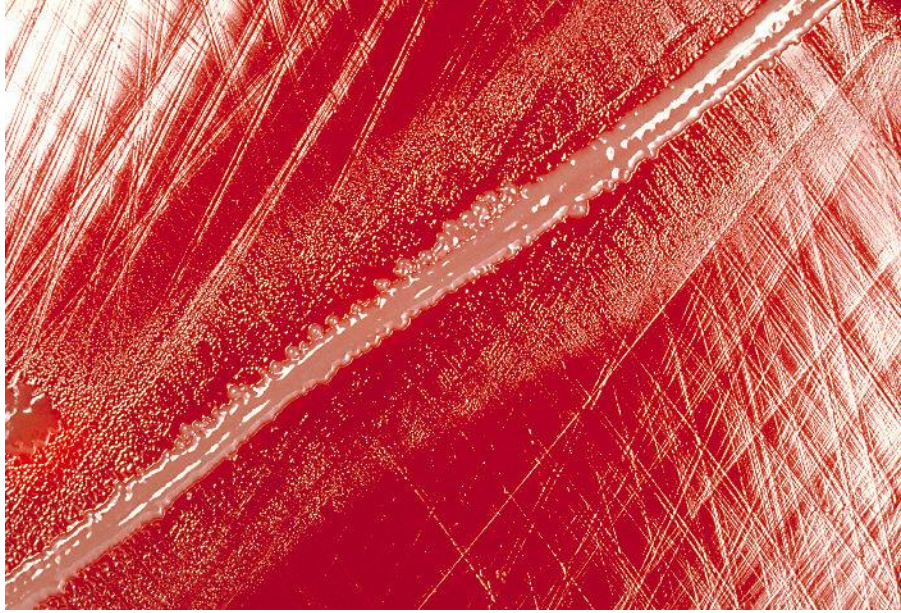


- Rhinitis to community pneumonia
- Treatment depends!

- Upper respiratory tract infections: V-PNC, amoxicillin (REAL allergy: CLA, CLI for bones)

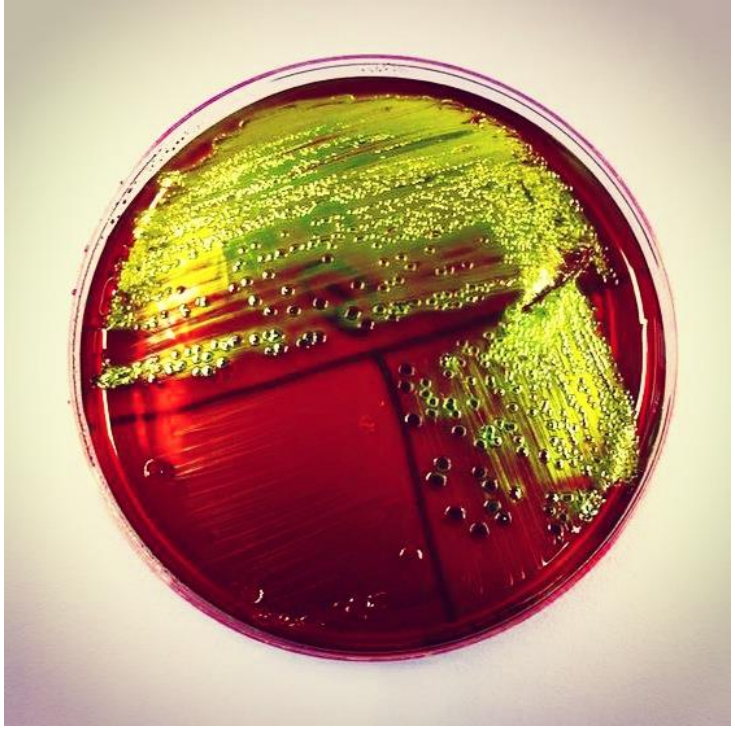
- Typical agent of community pneumonia – AMX
- Invasive serotypes – vaccines accessible. Support!

Haemophilus influenzae



- Tiny gram-negative rods
- Demanding, uneasy
- Needs NAD and hemin, but has no haemolysins
- Satellitism – growth on blood agar in close proximity to *S. aureus* (which posseses strong haemolysins)
- Chocolate agar - no chocolate

E. coli



- Neonates! and elderly
- Normal microbiome of the gut
- ALWAYS request cultivation and antibiotic sensitivity test!

(serious resistance is spreading over Europe)

Other bacteria

- *S. aureus*
- *B. catarrhalis*
- *M. pneumoniae*
- *L. pneumophila*
- *M. tuberculosis*
- …

Viruses

- Rhinoviruses
- Coronaviruses
- Adenoviruses
- Influenza / parainfluenza
- RS virus
- Coxsackie virus
- …

A special disease...

Bronchiolitis, usually caused by RS-virus (respiratory syncytitial virus) – can be deadly for **babies**

- ATB are useless
- Supportive treatment, oxygen
- Examine! Epidemiological risk!!! (such as the Flu)

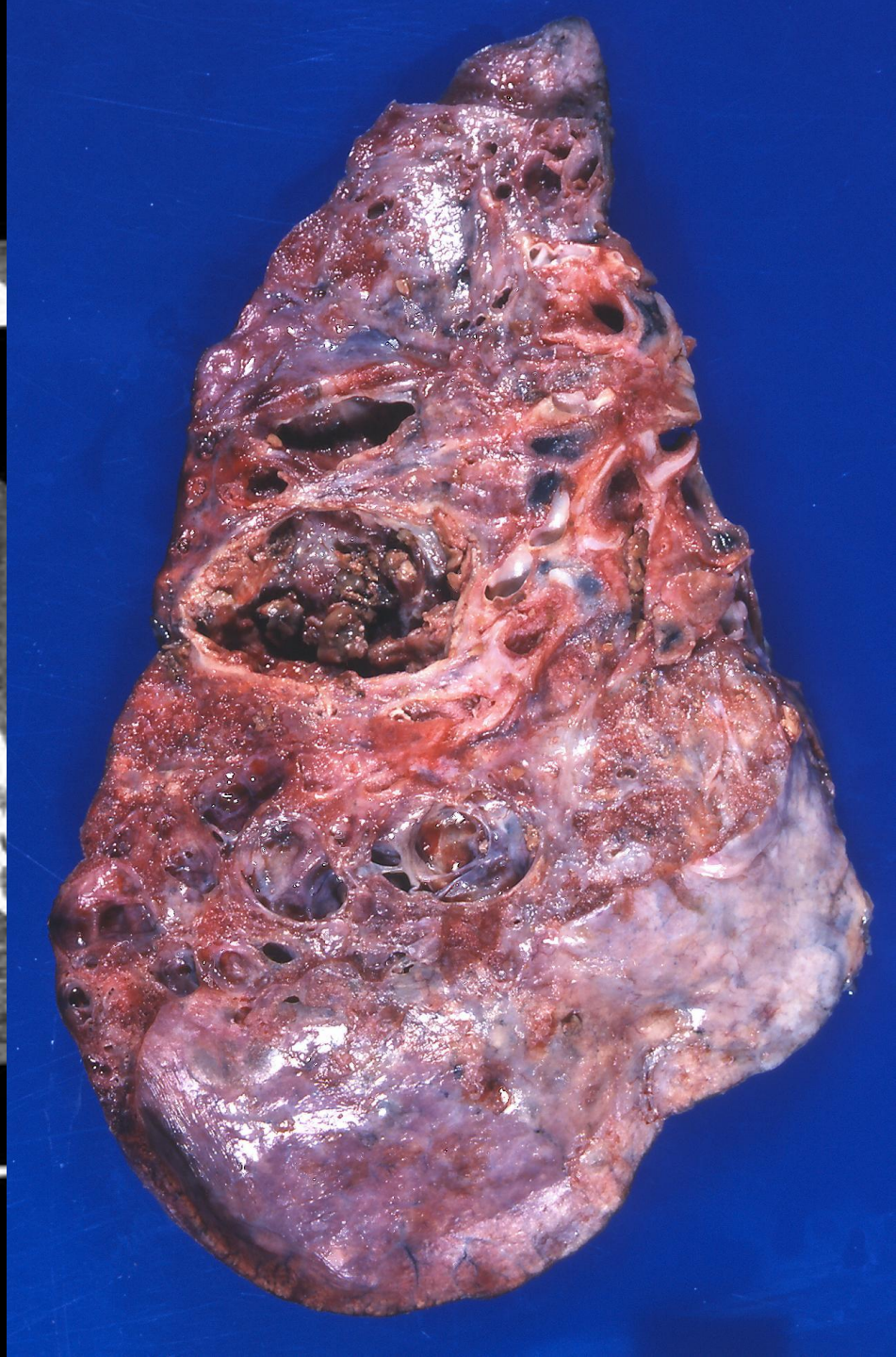
Fungi

- *Candida* sp.
- *Aspergillus* sp.
- Mucorales
- *Pneumocystis jirovecii*
- …

Aspergillus sp.

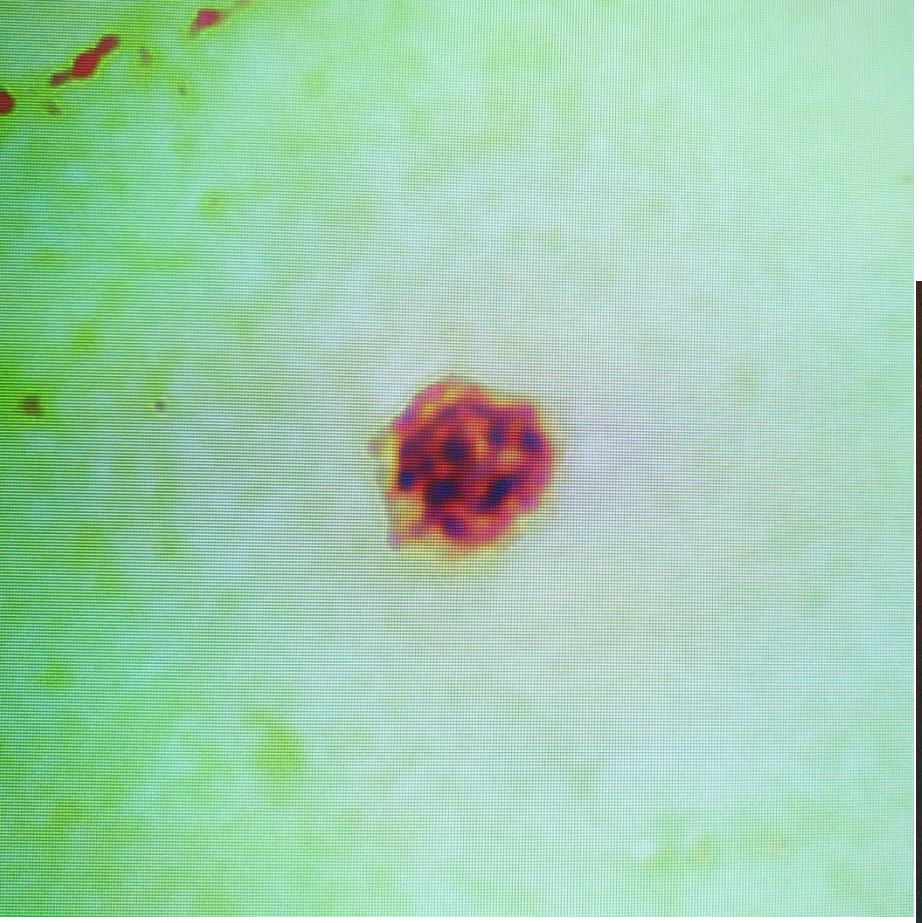
- Extrinsic allergic alveolitis
  - Colonization – allergic inflammation
- Aspergillloma
  - Localised lesion – cavity with a „fungus ball“
- External otitis and sinusitis
  - Moulds like to settle down in pre-formed cavities


[R]
[P]



Pneumocystis jirovecii

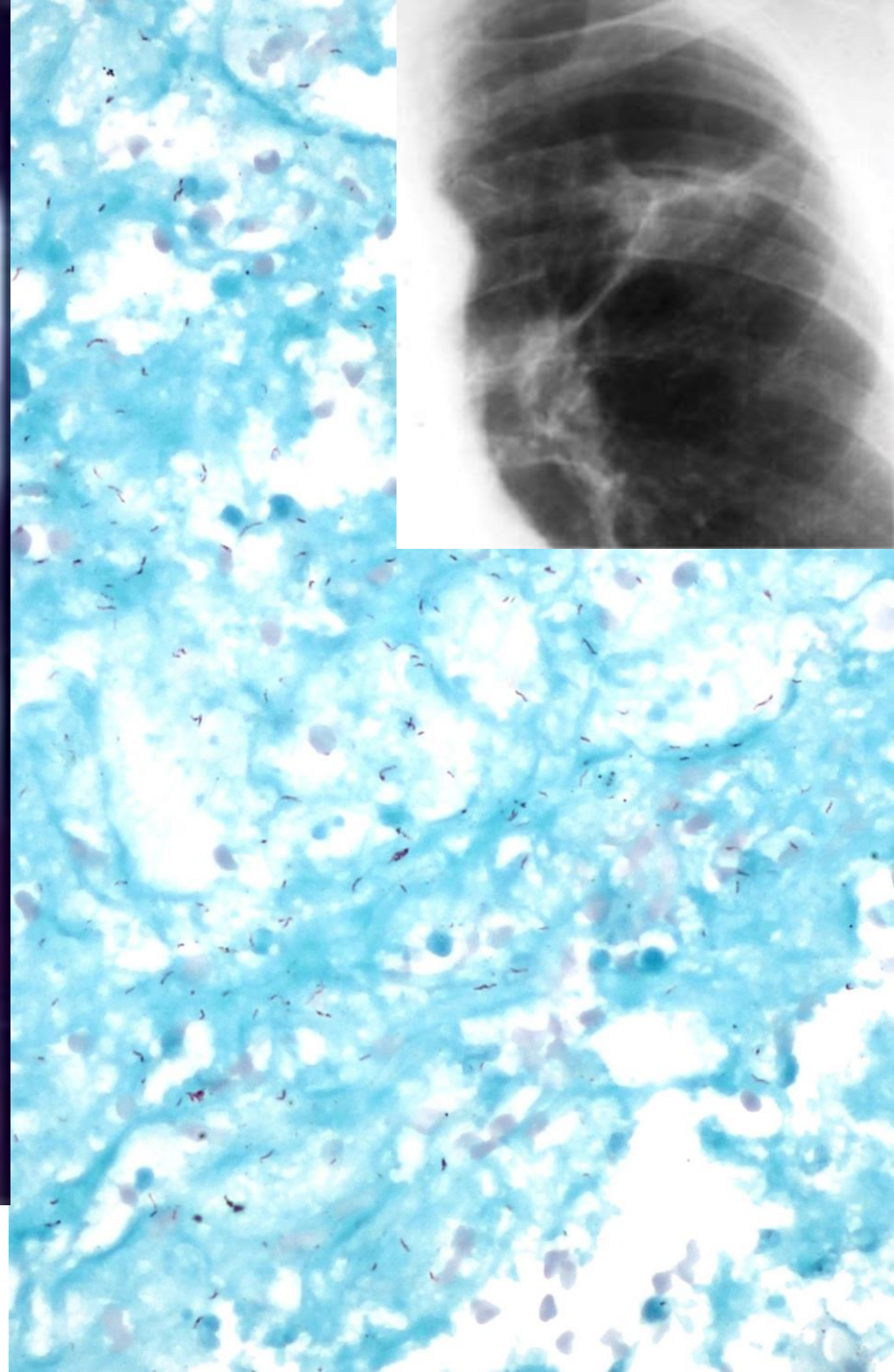
- Pneumonia in immunocompromised people
  - HIV +
  - Newborns
  - Terminal
  - Oncology patients
- Used to be considered a parasite
- Cultivation impossible – only microscopy and molecular methods
  - Staining sec Giemsa, toluidin blue, immunofluorescence



M. tuberculosis

- Vaccination is not mandatory right now – protection is not complete, but it helps to prefer granulomatous inflammation from caseous necrosis

  (+ Protects from basilar meningitis)
- Primary complex = focus + lymph node
- Apical pneumonia
- Caverns, calcified lymph nodes…

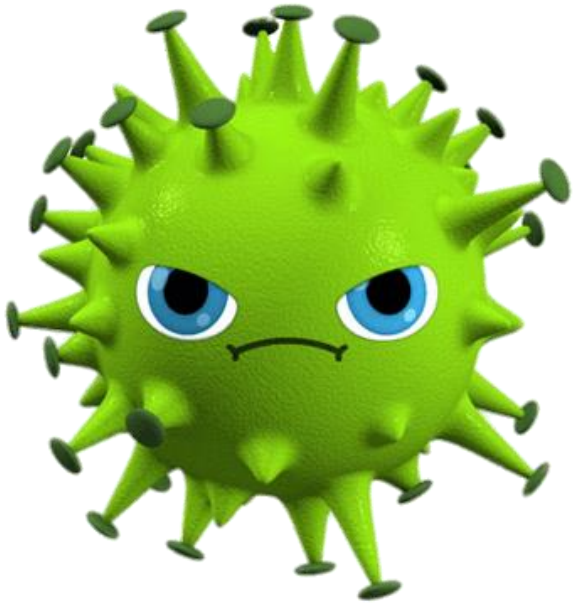


Upper

- „Common cold“ – V, (B)
- Rhinitis – V, B, (M)
- Tonsilitis – B, V
- Pharyngitis – V, (B)
- Nasopharyngitis – V, (B)
- Sinusitis – (V), B, M
- Otitis externa – B, M
- Otitis media – typically mixed infection

Lower

- Tracheitis – V, (B)
- Tracheobronchitis – V, B
- Bronchitis – V, B
- Bronchiolitis - V
- Pneumonia – B, V, T
- Pleuropneumonia – B, T
- Empyema – B, T
- …



Past Future: Diphtheria

- *Corynebacterium diphtheriae*
- Vaccinated (hexavaccine), but still possible
- Pseudomembranaceous tonsilitis + myocarditis
- Suffocation, heart failure, swollen („bull“)neck
- Toxigenic strains emerge due to phages
- Treatment: V-PNC (CLI)

Do your best to support vaccination.

Past Future: Whooping cough

Bordetella pertussis

- Vaccinated (hexavaccine), but present (re-vaccinate!)
- Catarrhal stage (upper r.t. infection)
- Paroxysmal stage (toxigenic)
- Desperate torturing cough, choking, apnoea, brain bleeding
- We can cultivate it, but you have to request it in advance (special medium – Bordet-Gengou)
- Treatment: CLI / COT

Only one word to describe this baby:

<u>Helplessness</u>

What was the message?

- Your interpretation?
- Your questions?
- Your ideas?
- Your suggestions?
- Your degree.

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By Basem Abbas Al Ubaidi - (2018). "The Radiological Diagnosis of Pulmonary Tuberculosis (TB) in Primary Care". Journal of Family Medicine and Disease Prevention 4 (1). DOI:10.23937/2469-5793/1510073. ISSN 24695793., CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=71246334