



# *Staphylococcus aureus* bacteremia

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# Case

- Male, 82 y
- Admission ER (by ambulance)
  - 3 days diarrhea, N+V+
  - 3 'shocks' from ICD
  - ECG AF, V respons rate 150/min
  - At ER spontaneous resinusalisation (only treatment at ER was 1L 'Plasmalyte' IV)
- transfer cardiology ward, monitoring
  - D: gastro-enteritis, hypovolemia, with secondary rapid AF
  - VT vs inappropriate shock on AF

# Medical history

- AHT, Hypercholesterolemia
- Hypothyroidism (post-op)
- 2004: VF, cardiogenic shock
  - MI (infero-lateral), PTCA RCA (LVEF 50%)
  - Post-ACS syncope: inducible VT/VF: ICD implantation
- 2007 prox RCA dissection
  - BMS

# Medical history (continued)

- Appendectomy
- Nephrolithiasis (ESWL)
- THP '96 (L)
- Partial thyroidectomy '98 (polynodular, euthyroid, goitre/ 'nodules')  
→ follicular adenoma
- Shoulder prosthesis '06 (L)
- Cataract (L&R) '13

# During the admission

- 38,5°C at admission cardiology ward
  - Blood cultures neg.
  - Feces culture : *Campylobacter sp.*
- Clinical improvement without AB
- Stop IV rehydration after 24h
- D5 again fever
  - Cubital redness, pain, swelling
  - Generalised urticarial rash

# Staphylococcal septicemia

- Blood culture *staphylococcus sp.*
- Echo: thrombophlebitis (precubital veins)
- Flucloxacilline 3x 2g IV
- Dermatologist
  - Urticarial rash in the setting of the infection
  - Local treatment with potassiumpermanganate

# *Staphylococcus Aureus* !

- D7: again fever
- Bloodcultures *staph. aureus* (MSSA)
- 1st ID consultation (by telephone)
  - 4x 1g flucloxacillin
  - Control bloodcultures, TEE
- 2nd blood cultures + *staph. aureus* (at 48h h under IV flucloxacillin...)
- TEE – (at D10)

- D8: pain left shoulder
- D9: again inappropriate shock, again AF
- 2nd consult ID
  - TEE !
  - 6x 2g (+HC under 4x 1g), minimally 2 weeks
- Pain shoulder:
  - Rx prosthesis OK
  - Echo synovial thickening
  - CT : hypodensity >2mm (cement ~ bone (glenoid))



- Echo at D 22 synovial thickening, minimal fluid intra-articular
- Consult ortho:
  - Maybe loosening, no need for immediate action or puncture
  - ambulant follow-up in 2 weeks
- Treated with IV flucloxacillin in total 14 days

# 2 weeks later

## Consultation orthopedics

- More and more pain
- No fever
- Punction:
  - Clear fluid
  - Culture + *Staph. Aureus* (MSSA)
  - Bone scintigraphy



# Bacterial Basics

- Gram stain: + clusters = staphylococci (no differentiation)
  - DD 'non-pathogens' : Micrococcus, Stomatococcus, Peptostreptococcus, Pediococcus, and Aerococcus species
- Coagulase test differentiates between *Staph. aureus* & other staphylococci
  - Coagulase – staphylococci
  - Coagulase + staphylococci SA
    - MSSA
    - MRSA
      - Health-care associated MRSA  
Hospital onset  
Community onset
      - Community associated MRSA



# Epidemiology

- Mortality rates 20-40%
- MRSA > MSSA
  - Hazard ratio 1,8
- Treatment failure is common
  - Death 30d, persistence of bacteremia after 10d vancomycine, recurrence within 60 days
  - MRSA >MSSA
  - MIC > 1,5 mg/L

Comparison of mortality risk associated with bacteremia due to methicillin-resistant and methicillin-susceptible *Staphylococcus aureus*. Shurland S, Zhan M, Bradham DD, Roghmann MC *Infect Control Hosp Epidemiol.* 2007;28(3):273.

Relationship between vancomycin MIC and failure among patients with methicillin-resistant *Staphylococcus aureus* bacteremia treated with vancomycin. Lodise TP, Graves J, Evans A, Graffunder E, Helmecke M, Lomaestro BM, Stellrecht K *Antimicrob Agents Chemother.* 2008;52(9):3315.

# Clinical approach: history

- Portal of entry ?
  - Recent SSTI
  - Indwelling prosthetic devices
    - IV catheters, orthopedic hardware, cardiac devices
- Metastatic infection ?
  - Bone/joint pain
  - Protracted fever
  - Abdominal pain (left upper quadrant, spleen)
  - Costo-vertebral angle (renal infarction)
  - headache

# Clinical approach: clinical exam

- Cardiac murmur
- Emboli skin, digits, conjunctivae, fundi
- Focal neurological deficit
- Serial bedside examination ..
  
- ID consultation !

Bacteremic *Staphylococcus aureus* spondylitis. Jensen AG, Espersen F, Skinhøj P, Frimodt-Møller N *Arch Intern Med*. 1998;158(5):509.

Telephone consultation cannot replace bedside infectious disease consultation in the management of *Staphylococcus aureus* bacteremia.

Forsblom E, Ruotsalainen E, Ollgren J, Järvinen A *Clin Infect Dis*. 2013;56(4):527.

# Diagnostic evaluation

- Infective endocarditis 25-32%  
→ Higher rate with MSSA than MRSA
- All patients should undergo echocardiography
- TTE vs TEE ?  
→ Most sensitive 5-7 days after onset of bacteremia

*Staphylococcus aureus* bacteremia and endocarditis: the Grady Memorial Hospital experience with methicillin-sensitive *S aureus* and methicillin-resistant *S aureus* bacteremia. Abraham J, Mansour C, Veledar E, Khan B, Lerakis S *Am Heart J*. 2004;147(3):536.



# Always!?

- Persistent blood culture despite AB
- Unknown duration
- CV material
- Predisposing valve abnormality
- Absence of removable source
- Hemodialysis
- Spinal infection
- Peripheral stigmata IE

Use of a simple criteria set for guiding echocardiography in nosocomial *Staphylococcus aureus* bacteremia. Kaasch AJ, Fowler VG Jr, Rieg S, Peyerl-Hoffmann G, Birkholz H, Hellmich M, Kern WV, Seifert H  
*Clin Infect Dis.* 2011;53(1):1.

# Never say never (and never say always)

- Nosocomial acquisition of bacteremia
- Sterile follow-up blood cultures within four days after the initial positive culture
- No permanent intracardiac device
- No hemodialysis dependence
- No clinical signs of endocarditis or secondary foci of infection

# Imaging ?

- Depending on clinical suspicion
- CT scan thorax or abdomen
  - Renal, splenic infarction
  - Psoas abces
- MRI brain (headache or IE)

# Treatment

- Source control !
  - Removal of catheter
  - Absces? surgical drainage
- Empirical coverage of MRSA
  - Vancomycine 30 mg/kg/d
  - (daptomycine alternative)
- Deescalate to beta-lactam if MSSA
- Role for combination AB ?

The empirical combination of vancomycin and a  $\beta$ -lactam for Staphylococcal bacteremia. McConeghy KW, Bleasdale SC, Rodvold KA *Clin Infect Dis*. 2013;57(12):1760.

# Methicilline susceptible SA

- Penicilline ? (4 milj. q4h)
- Flucloxacilline 2g q6h
- Alternative cefazoline 2g q8h
- NO Vancomycine
- Synergism with aminoglycoside?
  - in vitro (and experimental models of endocarditis)
  - evidence for clinically significant benefit is minimal

Initial low-dose gentamicin for *Staphylococcus aureus* bacteremia and endocarditis is nephrotoxic.  
Cosgrove SE, Vigliani GA, Fowler VG Jr, Abrutyn E, Corey GR, Levine DP, Rupp ME, Chambers HF, Karchmer AW, Boucher HW  
*Clin Infect Dis.* 2009;48(6):713.

# Methicilline resistant SA

- Vancomycine 30 mg/kg/d
- Check MIC (E-test)
  - $\leq 1,5$  mg/L OK
  - $\geq 2,0$  mg/L not OK
- 'salvage' linezolid ?
- No evidence for combination (aminoglycoside or rifampicine) when absence of prosthetic device

Clinical practice guidelines by the infectious diseases society of america for the treatment of methicillin-resistant *Staphylococcus aureus* infections in adults and children. Liu C, Bayer A, Cosgrove SE, Daum RS, Fridkin SK, Gorwitz RJ, Kaplan SL, Karchmer AW, Levine DP, Murray BE, J Rybak M, Talan DA, Chambers HF, Infectious Diseases Society of America *Clin Infect Dis*. 2011;52(3):e18.

# Follow-up cultures

- Repeat until documented clearance
- Failure to clear within 48h ?
  - Appropriate AB and dosing?
  - Susceptibility data
  - Clinical evaluation (occult focus?)

# Duration

- Removable source
  - 14d (from the first – bloodculture)
  - Afebrile within 48 h
  - Controle culture neg. (2 to 4 days after initiation of AB)
  - No localizing complaints attributable to metastatic staphylococcal infection.
  - No valvular abnormalities predisposing to endocarditis.
  - No indwelling devices (prosthetic heart valves or vascular grafts)



# Duration : deep foci

- Infective endocarditis: 42d
- Cardiac device infection
  - Limited to pocket or SC tissue: 14 d
  - 50% have associated endocarditis
- Osteomyelitis  $\geq 42$  d
- Prosthetic joint infection ?
- Septic arthritis 14d IV +  $\geq 14$ d PO?
- Meningitis 14d
- Pneumonia 14d (21d?)

# What about our patient?

- Revision in 2 stages
- 2x more than 1 month hospitalised
- After second stage lost to follow-up..
- Contacted by telephone: OK

