


Orthopaedica Belgica 2018


Appropriate use of antibiotics in Orthopaedic and Trauma surgery

Prof O Cornu – Prof JC Yombi




Interest of antibiotics in Orthopaedics

Pathogens in 90% of surgical wounds postop
 With an implant: germs needed for infection $\downarrow 10^5$
 Inoculum $10^4-10^5 \rightarrow$ Acute infection
 $10^2 \rightarrow$ Low grade infection
Bernthal et al. Plas one 2010.




	+	SSI
Staph aureus carrier	+	6.8%
Staph aureus non carrier	-	2.1%


Williams, BMJ, 11:658-662 ; 1959.
Prophylaxis reduces from 50% infection risk (3 to 5% \rightarrow < 1%)
SFAR SOFCOT Orthorisk V012011




Fleming and the penicillin



The Nobel Prize in Physiology or Medicine 1945



Sir Alexander Fleming Prize share: 1/3
 Ernst Boris Chain Prize share: 1/3
 Sir Howard Walter Florey Prize share: 1/3

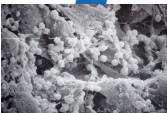



Induced antibiotic resistance

Antibiotic prophylaxis with cloxacillin and gentamycin loaded cement:
 « 2 weeks after surgery, the proportion of patients with a methicillin-resistant CNS in the groin increased from 20% preoperatively to 50% postoperatively and with a gentamycin resistant CNS from 5 to 45% »
Stefanodottir et al. Acta Orthopaedica 2013;84:87-91.


Sub lethal antibiotic treatment leads to multidrug resistance
Kohanski et al. Mol Cell 2010;37:311-320.

Implant related infection with Biofilm forming microorganisms
Naylor et al. Clin Orthop. 1990; 261:126-133.





Resistance...

Antibiotic	Introduction	First resistance
Sulfamides	1936	1940
Penicillin G	1943	1946
Streptomycin	1943	1959
Chloramphenicol	1947	1959
Tetracycline	1948	1953
Erythromycin	1952	1988
Ampicillin	1961	1973
Ciprofloxacin	1987	2006




When to use antibiotics ?



Antibiotic prophylaxis

Clean Surgery without implants / soft tissue

No antibiotics



Cliniques universitaires Saint-Luc


Antibiotic prophylaxis – particular case

B lactam ALLERGY
(10% cross allergy between penicillin and cefalosporin)

Clindamycin 600 mg IV

- ✓ Timing : induction, IV, slowly within 30 min
- ✓ Repeated if surgery > 4H00
- ✓ Repeated: 600 mg/8h00 if joint arthroplasty
- ✓ 16h00 max

But Erythromycin/Clindamycin... resistance in staph Epidermidis



Cliniques universitaires Saint-Luc


Antibiotic prophylaxis

Surgery with implants / open fracture Gustilo 1-2 (6h00)

Cefazolin 2g

- ✓ **Timing** : induction (30 minutes), slowly direct IV
- ✓ Repeated doses: half the dose/8 hours twice **when joint arthroplasty**
- ✓ 16h00 max !
- ✓ Repeated if surgery >4h00 or bleeding (cefazolin)

"Prolonged prophylaxis after the end of surgery...did not contribute to fewer SSIs in this study." -> increased bacterial resistance
van Kasteren ME et al. Clin Infect Dis. 2007;44:921-7.



Cliniques universitaires Saint-Luc

Antibiotic prophylaxis – particular case


Suspected Infection / Prior infection

Deep culture biospies **before** prophylaxis to avoid negative culture unless improved microbiological technique (sonication, PCR, ..)
Wouthuysen-Bakker et al. J Clin Microb 2017

Adapted Antibiotherapy according to:

- prior microbiological isolations
- more predictable microorganism (infection history)
- until 7 days culture results / histopathology negative or positive culture -> orientated antibiotherapy

(when all implants have been revised or infection within 3 weeks of primary surgery !)



Cliniques universitaires Saint-Luc


Antibiotic prophylaxis – particular case

MRSA carrier

Cefazolin 2g

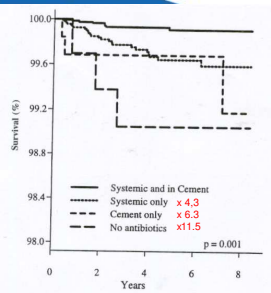
- ✓ **Timing** : induction, slowly direct IV
- ✓ Repeated doses: half the dose/8 hours twice when joint arthroplasty
- ✓ 16h00 max !
- ✓ Repeated if surgery >4h00 or bleeding (cefazolin)

Risk of MSSA infection > MRSA infection
Cefazolin more active than Vanco on MSSA



Cliniques universitaires Saint-Luc


Antibiotic prophylaxis in total hip arthroplasty



A lower overall rate of infection was seen in the gentamicin-loaded cement group, but there was a significantly higher rate of gentamicin-resistant infection
Thornes et al. JBJS 2002; 84:758-60.

found that out of the patients who had had antibiotic cement in their reconstruction, 88% had development of resistant bacteria
Hope et al. JBJS 1989; 71:851-855.

Espehaug et al. J Bone Joint Surg 1997; 79:590-5



Cliniques universitaires Saint-Luc

Local antibiotics

- Buchholz et al. 1970 and 1977
 AB syst 5.4% -> AB local 0.2%
- Josefsson G et al. 1981
 AB syst 1.6% -> AB local 0.4%
 > 2 et 5 y
- But... 1993 = 10 y
- "the use of antibiotic-impregnated cement did not contribute to fewer SSIs in this study."
van Kasteren ME et al. Clin Infect Dis. 2007;44:921-7.

13

Antibiotic prophylaxis

Open fracture Gustillo III A / B / C within 06h00

- Multiple choices : function contamination/delay >4h00

 1. Aminopenicillin+inhibitor Betalactamase (*Augmentin[®]-Amoxycylav[®]*)
 2. Idem + Gentamycin (5mg/kg/day 1x)
 3. Clindamycin+Genta (in case of allergy to penicilline)
 4. Cefalosporin 2^e generation + Gentamycin (*Cefamandol /Mandal[®] or Cefuroxim/Zinacef[®]*)
 5. Cefalosporin 2^e generation + Gentamycin + Metronidazol
 6. Cefalosporin 3^e generation+ Gentamycin (*Cefotaxim et Ceftazidim*)

Aminopenicillin+inhibitor Betalactamase (*Augmentin[®]-Amoxycylav[®]*)

 - 2g IV slowly on admission; +1g when > 2H00 surgery or important blood loss
 - 2g/6h00
 - 48h00

14

Antibiotic prophylaxis

Dentistry

• Antibiotic prophylaxis in high-risk or low-risk dental procedures did not decrease the risk of subsequent total hip or knee infection (adjusted OR, 0.9 [95% CI, 0.5-1.6] and 1.2 [95% CI, 0.7-2.2], respectively).

Berbari EF et al. Clin Infect Dis.2010;50:8-16.

30 / 100.000 implants
 29.3 / 10 millions dentistry cares

Seymour RA et al. Dent Clin N Amer.2002;46:635-651.

BUT: increased risk of hematogenous infection the first two years following joint replacement -> Amoxicillin 1 g prior to dental care ?

14

Antibiotic prophylaxis

Open fracture Gustillo III A / B / C

- Negative evolution after 72h00

 - **Surgical revision** with tissue cultures (3-6)
 - Soft tissue problem ?
 - Inadequate debridement ?

 - Resistant microorganism ?
 - Bacillus cereus
 - Enterobacter
 - MRSA

Move antibiotics to Quinolons and Glycopeptides
(if wound closed)

14

Antibiotic prophylaxis

Urinary tract Infection

Asymptomatic bacteriuria NOTHING
 (with or without catheter)
 (with or without co-morbidities)

Acute Cystitis (dipstick test +) Furadantin 100 mg 3x/d for 5 d
 Acute cystitis with co-morbidities Furadantin 100 mg 3x/d for 7 d
 (dipstick test+ and culture +) Ciprofloxacin 500 mg 2x/d for 5 d

15

Antibiotic prophylaxis

Open fracture Gustillo III A / B / C

- Negative evolution after 5 days

 - **Surgical revision** with tissue cultures (3-6)
 - Soft tissue problem ?
 - Inadequate debridement ?

 - Resistant microorganism ?
 - Pseudomonas aeruginosa
 - Acinetobacter
 - MRSA

Tazocin or Imipenem and glycopeptides
(if wound closed)

15


Antibiotic prophylaxis

Dog or cat bites

No antibiotic prophylaxis unless:




- Deep puncture wound
- Location (hand/face)
- Delay > 8h00
- Patients with risk factors (diabetes, vascular, alcohol consumption, immunosuppression, >50 yo)

-> Amoxy+clavulanic acid 3x500
 -> if allergy Doxycyclin 2x100 mg/j 48H00
 -> child < 12 yo/Pregnant:
 Erythromycin 30-50 mg/kg 4x ; max 4x1g/day




20

INFECTION?

Colonisation No Antibiotic treatment	-> localised Infection Antibiotic treatment skin and soft tissue antibiotics	-> sepsis osteomyelitis antibiotics with bone diffusion
		

Misuse of antibiotics treatment = Emerging of Multidrug resistant bacteria



22


Early postoperative infection Hematogenous infection (within 3 to 4 weeks from surgery/symptoms)

Surgical debridement ; change of unstable/Mobile implants

Cefazolin 2g/08h00 IV
 or Flucloxacillin 2g x4/j IV + Ciprofloxacin 500 3x1 PO/day
 Treatment 3 to 6 weeks (19% failure when shorter)

Adjust according to deep cultures (tissue biopsies / Liquid in Blood culture vial / NO SWAB !)
 Oral Antibiotherapy if:


- CRP < 100
- No wound drainage
- No positive blood culture or IV treatment for 2 weeks
- Oral antibiotics with high tissue penetration /bioavailability
- Bi-therapy when staphylococcus infection (Rifampicin+ciprofloxacin)



20

Take home messages

- Do not use antibiotics unless it is absolutely needed
 prophylactic use / Treatment of general septic condition
- Avoid antibiotics prior to surgery
 induces resistance and renders antibiotic prophylaxis inoperant
- Try to identify the microorganism prior to AB treatment
 deep biopsies (3-4) or joint aspiration / blood culture
 Do not rely on swabs
- Use the molecule with the adequate dose (bone penetration!)
- Use it for the appropriate delay (not too long, not too short)
- When facing a suspected infection, consider surgery prior to antibiotics!



23

Late postoperative infection (more than 3 to 4 weeks from surgery/symptoms)

Surgical debridement / Consider implant removal

Identify microorganism prior to antibiotherapy (aspiration/Biopsy)

Treatment for 3 months



21