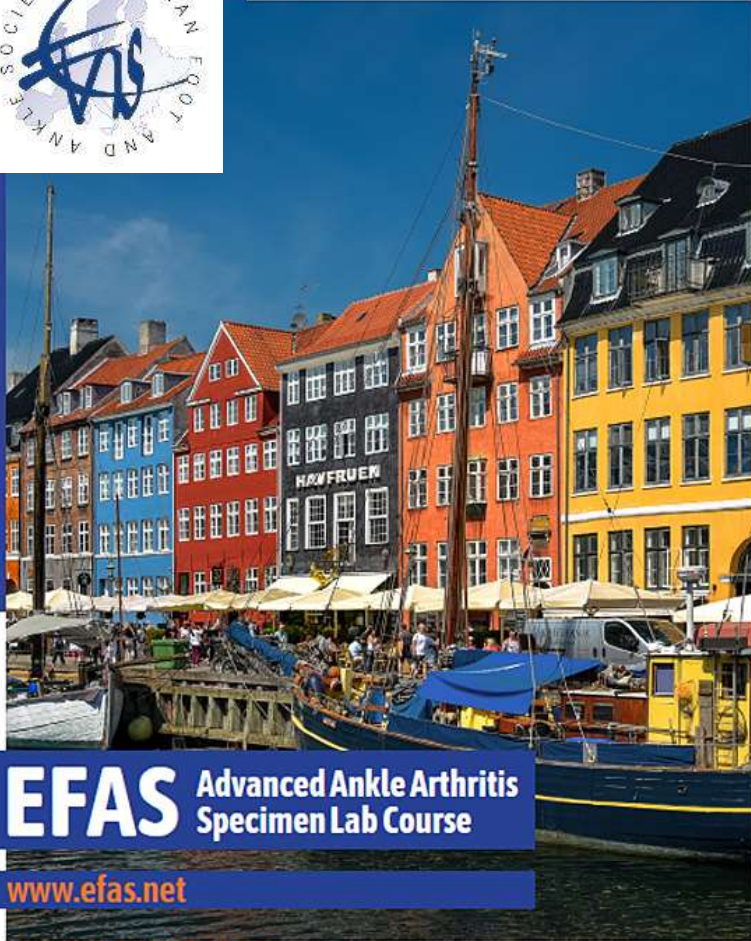




COPENHAGEN / DENMARK



**EFAS** Advanced Ankle Arthritis  
Specimen Lab Course

[www.efas.net](http://www.efas.net)

**05-06 MAY 2022**

European Foot & Ankle Society

University of Copenhagen, The PANUM Institute  
Department of Anatomy, Blegdamsvej 3B, Copenhagen, 2200, Denmark



# Chirurgie de la CHEVILLE et Infection

## Infections in Ankle Arthroplasty

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# INTRODUCTION

## Prosthetic-Joint Infections ( PJI) in ANKLE Arthroplasty = “high grade” complication

- Adverse outcome
- Prolonged Hospital stay
- Higher Cost
- Literature ?

FOOT & ANKLE INTERNATIONAL  
Copyright © 2009 by the American Orthopaedic Foot & Ankle Society  
DOI: 10.3113/FAL2009.0945

*Glazebrook MA - Foot Ankle int 2009*

*22 studies - 12.4% failure at 64 mo*

### **Evidence-Based Classification of Complications in Total Ankle Arthroplasty**

Mark A. Glazebrook, PhD, MD, FRCS(C); Kory Arseneault, BSc; Michael Dunbar, MD, PhD, FFCS(C)  
*Halifax, Canada*

#### **ABSTRACT**

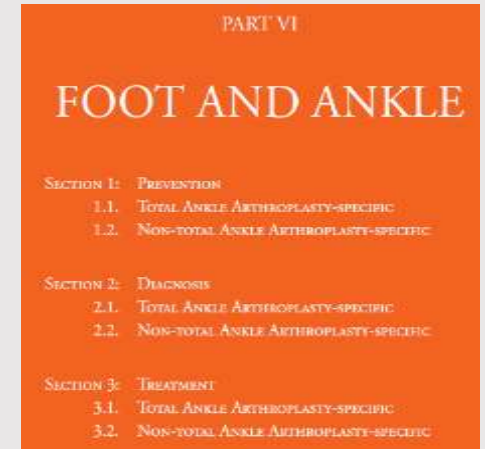
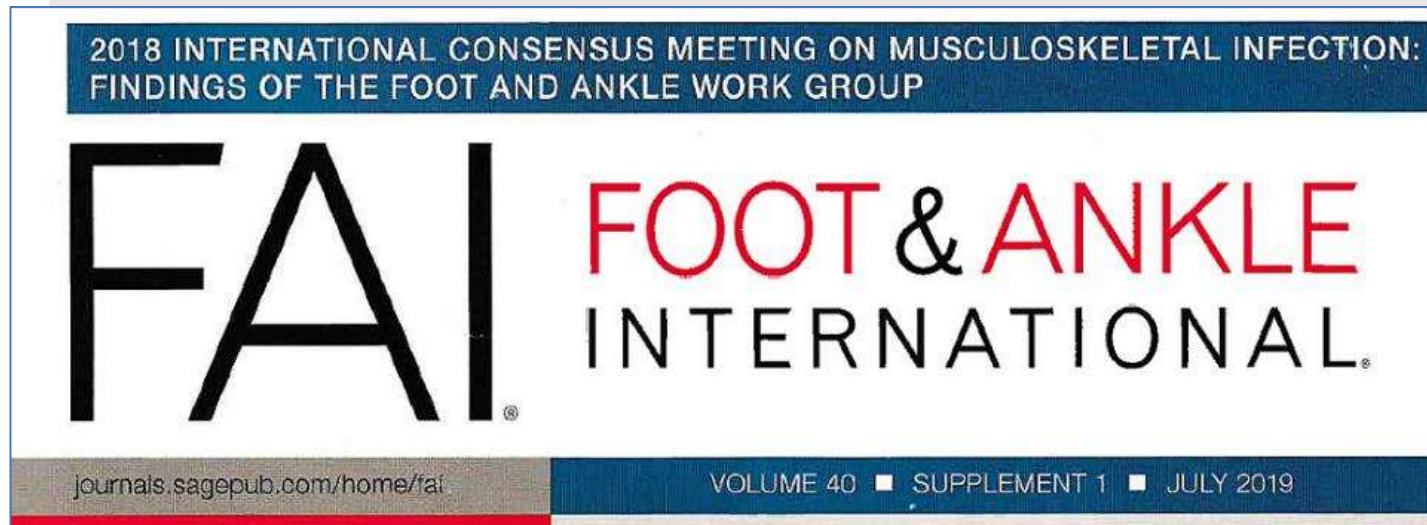
*Background:* Total ankle arthroplasty (TAA) has become a viable treatment for end-stage ankle arthrosis. Current literature on survival rates and complications of TAA consist of

Level of Evidence: III, Systematic Review of Level III and IV Studies

Key Words: Ankle; Arthroplasty; Replacement; Complications; Classification; Survival



# LITERATURE



European Review for Medical and Pharmacological Sciences | 2019; 23(2 Suppl.): 159-172

## Trends in surgical management of the infected total ankle arthroplasty

A. MAZZOTTI, G. GERACI, A. PANCIERA, F. PERNA, N. STEFANINI, F. PILLA,  
A. RUFFILLI, C. FALDINI

1<sup>st</sup> Orthopaedic and Traumatologic Clinic, IRCSS Istituto Ortopedico Rizzoli, Bologna, Italy

## 32 papers – 152 infected TAA

### *Primary treatment :*

- ✓ Irrigation-debridement 17.8%
- ✓ Revision TAR 47.4%
- ✓ Arthrodesis 19.7%
- ✓ Spacer arthroplasty 7.9%
- ✓ Amputation 5.9%



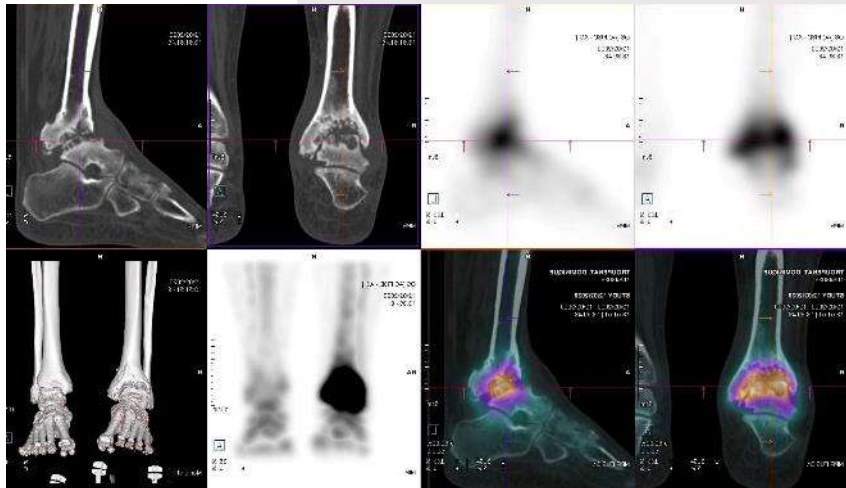


# Our experience

**C. Triffault-Fillit** (*infectiologue*) – **F. Ewald** (*mémoire DIU – Avril 2022*)

**2015 to sept 2021 - Serie of 235 TAR (Salto Talaris and/or XT)**

- **9 Infection post TAR** (*3 from other center*)
  - ✓ **5 Irrigation- Debridement** – retention of TAA (*FU 28 mo*)
  - ✓ **4 two-stage exchange TAA** (*FU 14mo*)



- **5 TAR following septic arthritis history** (*FU 16 mo*)
  - ✓ 3 one-stage TAA
  - ✓ 2 two-stage TAA

**No infection recurrence – No TAR revision**

**AOFAS (/100) :  $78 \pm 14$     EFAS (European score/24) :  $17 \pm 5$     VAS  $1.9 \pm 1.4$**



# Incidence of PJI (prosthetic joint infections)

- Total knee / Hip : 3 %
  
- **Total Ankle :**
  - ✓ *Superficial infections 0 % to 14.7%*
  - ✓ *Deep infections 0.8 % to 6.9 %*
  - ✓ **Primary TAA : 0% - 2.5%**
  - ✓ **Revision TAA : 4.7 %**



Problem literature  
THP/TKP

- **Younger patient population**
- **Previous Surgeries**
- **Tenuous soft tissue envelope**

**Specific difficulties in  
treating infected TAR**

Obtain Mechanical  
Stability

Adequate Soft  
Tissue Coverage

**Eradicate  
infection**

Restore Comfort

Maintain function

# Choices of treatment



*MAZZOTI 2019 -32 papers – 152 infected TAA*

- Irrigation-debridment 17.8%
- Revision TAR 47.4%
- Arthrodesis 19.7%
- Spacer arthroplasty 7.9%
- Amputation 5.9%

- ☐ TAA retention
- ☐ Irrigation and Aggressive debridement
- ☐ Removal of TAA in **one or two- stages**
  - 2 stage procedure with AB impregnated spacer
    - ✓ **Fusion**
    - ✓ **Revision Arthroplasty**
  - **Definitive Spacer**
  - One stage fusion with circular frame ...
  - **Amputation**



# DIAGNOSIS

## Definitions : what are we talking about ?

### Type of infection

- **Acute infection**

- Cellulitis
- Wound dehiscence

- **Late Chronic Infection**

- Infection free period
- Sinus tract
- 3 months of index Surgery

- **Hematogenous Infection**

- Infection free period
- Documented remote source

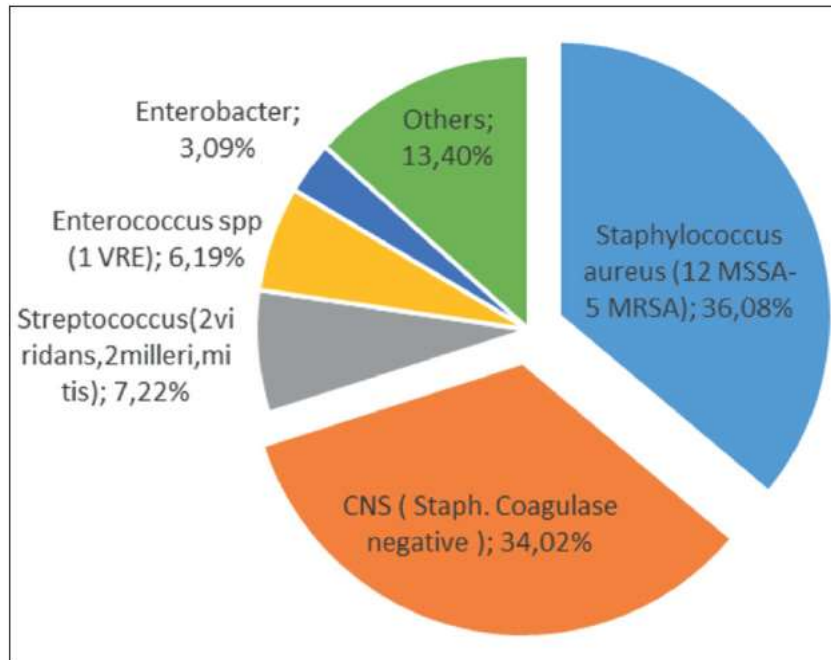




# Causative GERMS

**Higher proportion of gram-positive micro-organisms (91%) compared to TKP/THP**

*Possible Concern = Younger patients : Higher risk of CA-MSSA*



MAZZOTTI 2019

1. Staphylococcus aureus Methicillin -sensitive (MSSA)
2. Coagulase Negative Staphylococci (CNS)
3. Group B streptococcus
4. *Streptococcus milleri*
5. *Streptococcus viridans*
6. *Pseudomona aeruginosa*

**Polymicrobial infection (10.9%)**



# RISK FACTORS

## Comorbidities leading to wound healing problems

### Proven :

1. Inflammatory Disease
2. Number of previous surgeries
3. Peripheral Vascular Disease
4. Prior TAR
5. BMI < 19
6. Age < 65 Y
7. Hepatitis C

### Uncertain :

- Smoking
- Diabetes
- Low functional pre-operative Scores
- BMI > 30

*ALTHOFF . Patient-related risk factor for PJI: an analysis of 6977 TAA. J Foot Ankle surg 2018*

*KESSLER . Risk factor for periprosthetic ankle joint infection. J Bone Joint Surg Am 2012*

*PATTON . Infected TAA : risk factors and treatment option. FootAnkle Int 2015*

*RAIKEN. Risk factors for incision-healing complications following TAA. J Bone Joint Surg AM 2010*



# RISK FACTORS

## ☐ Prior Cortico-Steroids injection

- Implantation 3 months after injection

**Authors:** Ilker Uçkay, Christopher Hirose, Mathieu Assal

**QUESTION 2:** Does intra-articular injection of the ankle with corticosteroids increase the risk of subsequent periprosthetic joint infection (PJI) following total ankle arthroplasty (TAA)?  
If so, how long after a prior intra-articular injection can TAA be safely performed?

---

**RECOMMENDATION:** Every Intra-articular injection of the ankle is an invasive procedure associated with potential healthcare-associated infections, including periprosthetic joint infection (PJI) following TAA. Based on the limited current literature, the ideal timing for elective TAA after corticosteroid injection for the symptomatic native ankle joint is unknown. The consensus workgroup recommends that at least three months pass after corticosteroid injection and prior to performing TAA.

**LEVEL OF EVIDENCE:** Limited

**DELEGATE VOTE:** Agree: 92%, Disagree: 8%, Abstain: 0% (Super Majority, Strong Consensus)



# Prior Septic arthritis or osteomyelitis

- Infection assessment
- History/ physical examination
- Serology
- aspiration of joint
- In doubt : deep cultures

Per-op : deep cultures and cleaning

**BAUER . Arthroplasty following a septic arthritis history: a 53 cases series. Orthop Traumatol Surg Res 2010**

- ✓ 31 knees – 22 hips. FU 5 yrs
- ✓ **Two-stage ( for 30 evolutive septic arthritis) : 87% sepsis control**
- ✓ **One -stage ( for 23 quiescent septic arthritis) : 95% sepsis control**

**SHI . Total Ankle Arthroplasty following prior infection about Ankle. FAI 2015**

- ✓ 22 pts. Interval between infection-TAA 8.8 yrs
- ✓ **One-stage TAA. FU 29 mo**
- ✓ **No re-infection**
- ✓ Improved outcomes in pain and function

## Example of two-stage TAA after septic osteoarthritis



55 yrs old man

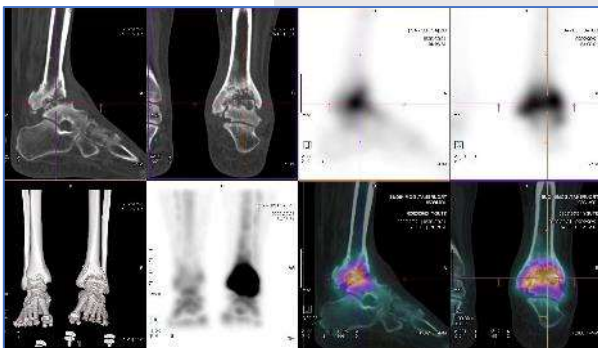
- Pilon tibial fract  
+ PO wound dehiscence



- Two-stage TAA  
(April – August 2020)  
*PMMA palacos Genta spacer*



- 2 yr FU  
**ROM 15°-0-40°**  
**AOFAS 95 / 100**







# HISTORY

- Surgery
  - ✓ Time of Index Surgery
  - ✓ Duration Surgery
  
  - ✓ Wound Drainage
  - ✓ Wound Dehiscence
  - ✓ Post-operative AB treatment
  
- Comorbidities
  
- Raisons for Hematogenous Event
  - ✓ Dental Care
  - ✓ Catheter Chamber



# CLINICAL PRESENTATION

## *Depends on*

- Virulence
- Inoculation Method
- Duration of Infection

## General Presentations

- Pain and limping with walking
- **Inflammatory Pain**
- Pain mobilization TT and ST joint
- **Rubor, Dolor**
- Joint effusion
- **Sinus Tract**

High Level of Suspicion

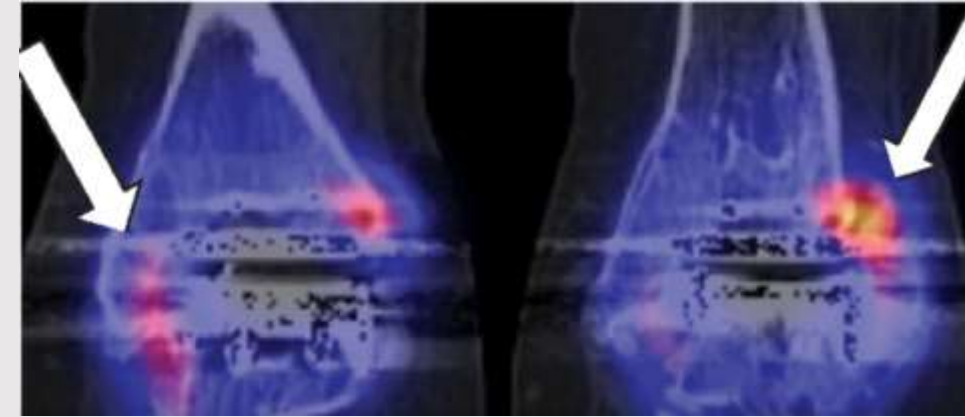


# CLINICAL PRESENTATION



## Acute Infection

- **High Fever**, Toxemia
- Severe Pain, Joint Effusion
- **Increased Skin Temperature**
- Wound Drainage



## Chronic Infection

- **Pain**
- Joint effusion
- Non Systemic signs of infection
- **Sinus Tract**



## Delayed presentation

- **Aseptic Loosening**

# When to Aspirate of possible Infected Joint ?

Authors: Milena M. Plöeger, Amiethab Aiyer

**QUESTION 4:** What are the indications for aspiration of a possibly infected total ankle arthroplasty (TAA)?

**RECOMMENDATION:** Whenever a periprosthetic joint infection (PJI) of a TAA is clinically possible or suspected, especially when elevated erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) levels exist, and in correspondence to the literature on PJI in total hip and knee arthroplasties, joint aspiration is indicated.

**LEVEL OF EVIDENCE:** Consensus

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

- **Positive Clinical Signs**
- **CRP/ESR Elevation**
- **High Index of Suspicion**

- ✓ **Sterile Conditions**
- ✓ **Antero Medial Portal**
- ✓ **UltraSound guidance ?**

- Culture, gram stain
- WBC, Neutrophil Count
- Biomarkers
  - ✓ Leucocyte Esterase
  - ✓ Alpha-Defensin

# DIAGNOSIS CRITERIA

*Defined by Musculoskeletal Infection Society. Modified by the international Consensus group PIJ 2014*

**TABLE 1. Diagnostic criteria of periprosthetic joint infection according to the International Consensus Group on Periprosthetic Joint Infection**

Major Criteria		
<ul style="list-style-type: none"> <li>Identification of 2 positive periprosthetic cultures with phenotypically identical microorganisms OR</li> <li>Presence of a sinus tract communicating with the joint</li> </ul>		
Minor Criteria		
<ul style="list-style-type: none"> <li>Elevated serum CRP AND elevated ESR</li> <li>Elevated synovial fluid WBC count OR ++ change on leukocyte esterase test strip</li> <li>Elevated synovial fluid PMN%</li> <li>Positive histologic analysis of periprosthetic tissue</li> <li>A single positive culture</li> </ul>		
Threshold Levels for minor criteria for PJI		
Criterion	Acute PJI	Chronic PJI
ESR (mm/h)	Not helpful with no defined threshold	30
CRP (mg/L)	100	10
Synovial WBC count (cells/ µl)	10,000	3000
Synovial PMN %	90	80
Leukocyte esterase	+ OR ++	+ OR ++
Histologic analysis of tissue	> 5 neutrophils per HPF (x 400) in 5 HPF	

**One Major Criterium**

**3 to 5 Minor Criteria**

- Probe the sinus
- Same micro-organism in 2 pre or intra-operative cultures
- Acute inflammation on histopathological examination
- Visible pus surrounding the joint

CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; PMN%, polymorphonuclear neutrophil percentage; WBC, white blood cell count; HPF, high-powered field; PJI, periprosthetic joint infection, mm/h, millimeters per hour; µl, microliters. (Adapted with permission [2].)





# Imaging

## Not Specific

- US and MRI : *localization of abscess*
- CT scan : *osteolysis*
- SPECT-CT + leucocytes





# Histopathological examination ++

- Acute inflammation
- Acute osteitis signs
- Chronic osteitis signs

## PCR testing

Authors: Khaled Emara, Amiethab Aiyer, Ryan Rogero

**QUESTION 8:** What is the role of molecular techniques for detection of pathogen deoxyribonucleic acid (DNA) (polymerase chain reaction (PCR) or next-generation sequencing) in patients with infected total ankle arthroplasty (TAA)?

**RECOMMENDATION:** Molecular techniques, particularly next-generation sequencing and the Ibis T5000 technology, have the potential to be used as an important adjunct in the diagnosis of bacterial infection following TAA, although sufficient clinical evidence is lacking.

**LEVEL OF EVIDENCE:** Limited

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

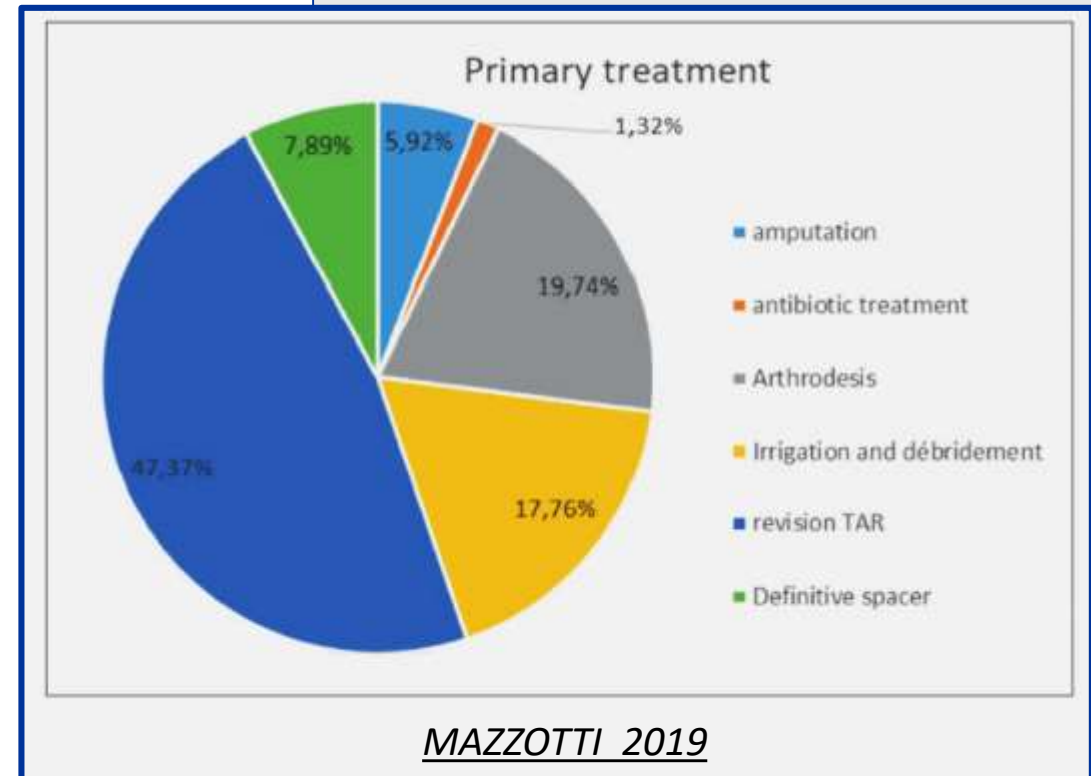
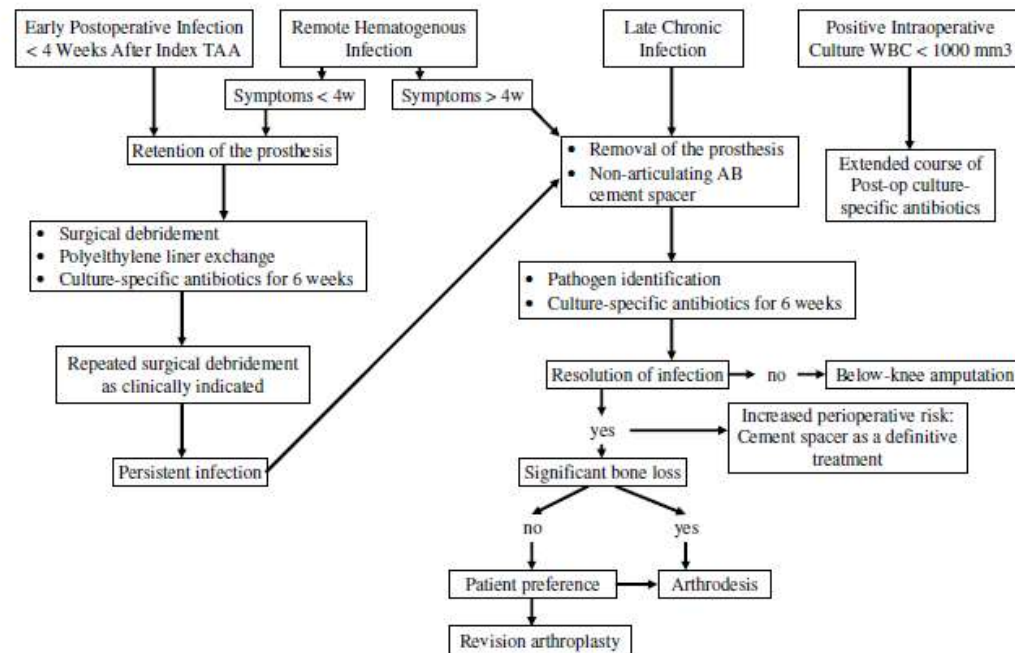
- No clinical Data
- Expensive
- Availability ?
- Could be important adjunct in the diagnosis of bacterial infection

# TREATMENT

Authors: Steven Raikin, Selene Parekh, Elizabeth McDonald

**QUESTION 1:** What is the treatment “algorithm” for an infected total ankle arthroplasty (TAA)?

**RECOMMENDATION:** The treatment of an Infected TAA is largely dictated by the acuity of the infection. The following treatment algorithm modified for TAA is recommended [1].

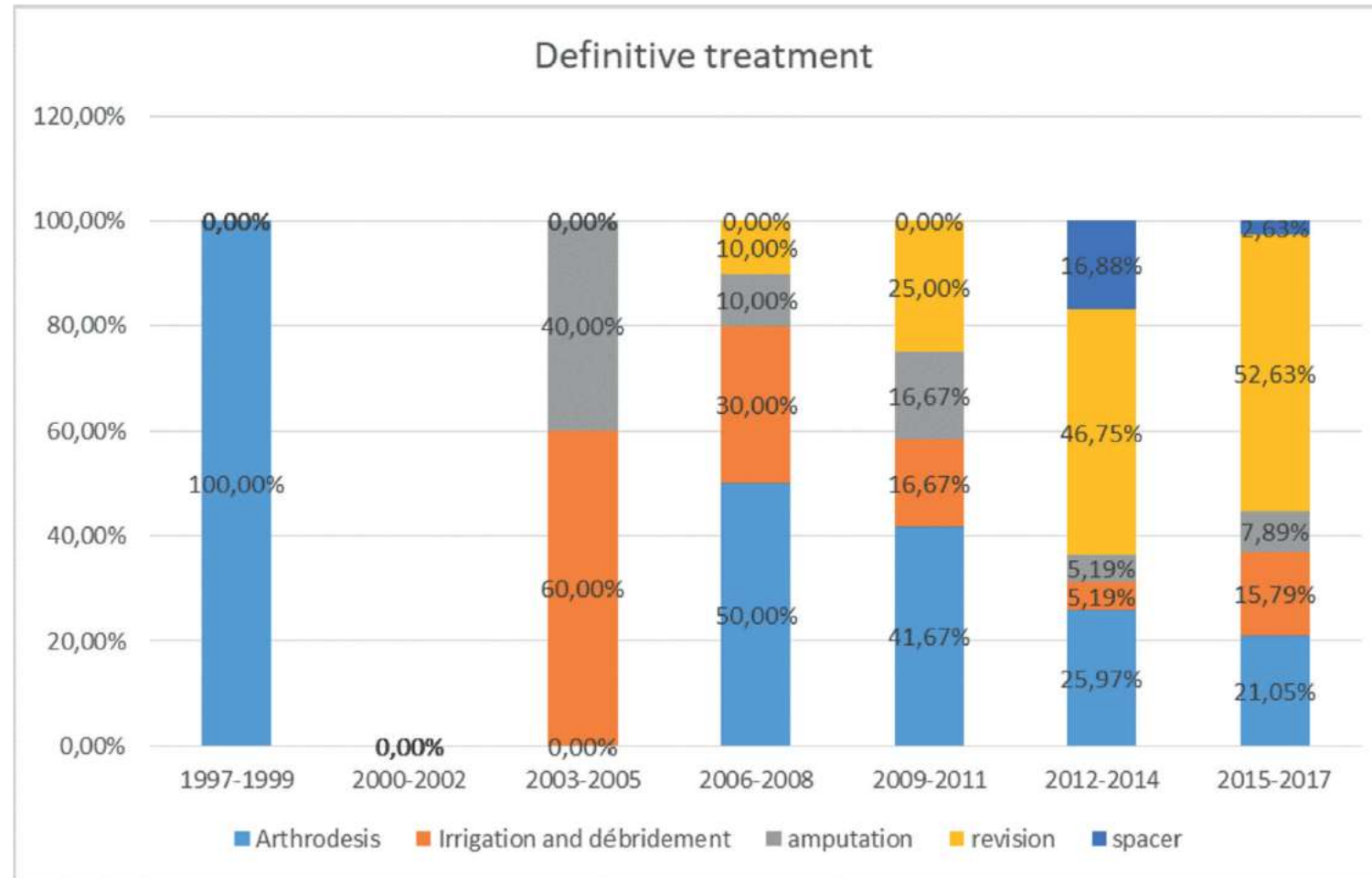


**LEVEL OF EVIDENCE:** Limited

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)



## evolution of surgical practices during the last 20 years !



MAZZOTTI 2019



# EARLY post-operative infection

Early Postoperative Infection  
< 4 Weeks After Index TAA

Retention of the prosthesis

- Surgical debridement
- Polyethylene liner exchange
- Culture-specific antibiotics for 6 weeks

Repeated surgical debridement  
as clinically indicated

Persistent infection

*MAZZOTTI 2019 – review*

## Irrigation + Debridement

27 cases (17.8%)

- Infection healing 48.2%
- Good functional outcome 30%

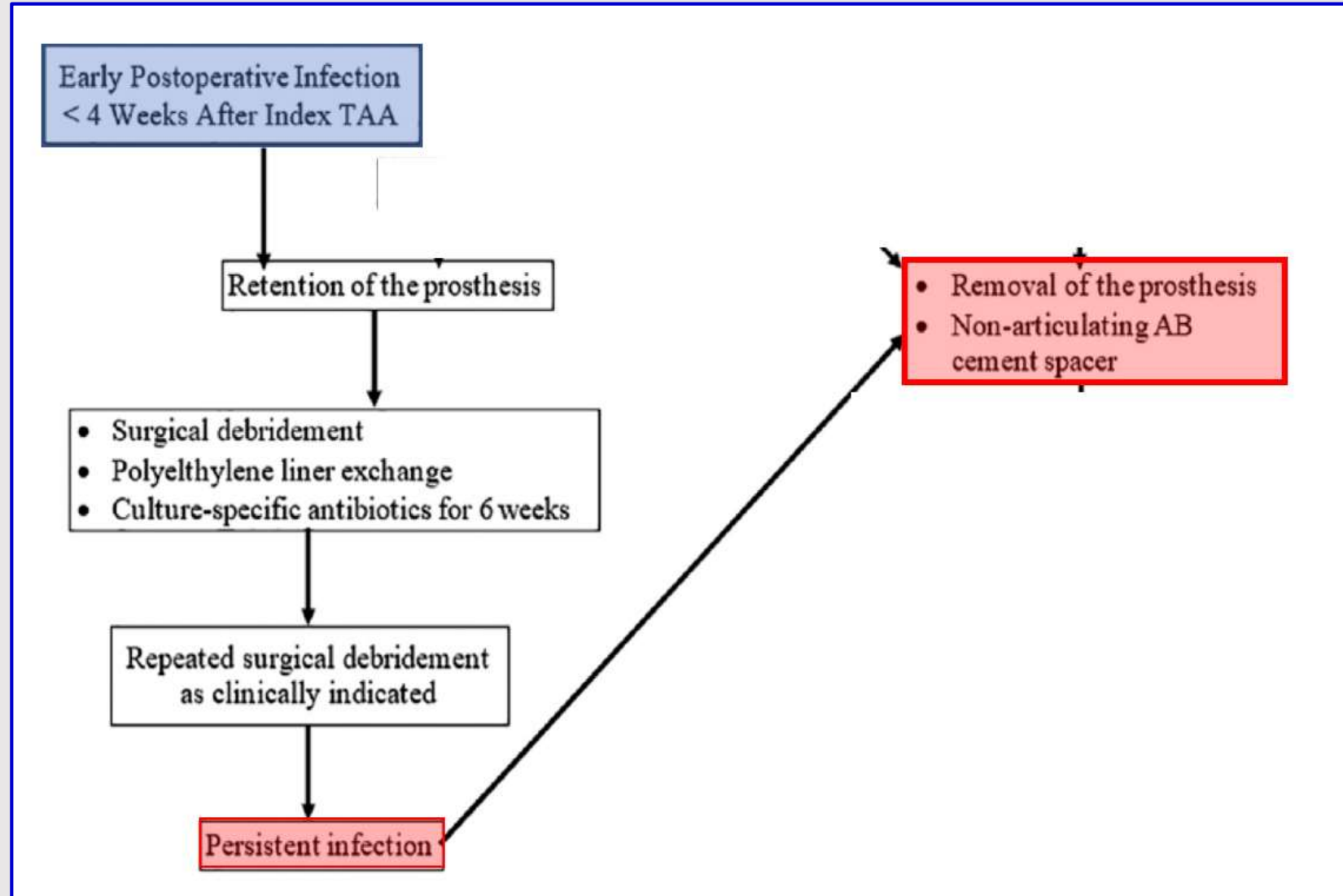
Author	Number of TAA Infections	Number of Attempted DAIR	Remission
Kessler et al. [1]	34	21	14/21 (67%)
Ferrao et al. [2]	6	0	6/6 (100%)
Myerson et al. [3]	19	4	All DAIR patients developed later infection and failed
Patton et al. [4]	29	5	Unknown for DAIR

TAA, total ankle arthroplasty; DAIR, debridement, antibiotics and implant retention





# Early post-operative infection





# One-stage versus Two-stage revision

Authors: Kent Ellington, Thomas B. Bemenderfer

**QUESTION 7:** What are the indications for one-stage versus two-stage exchange arthroplasty in management of the infected total ankle arthroplasty (TAA)?

**RECOMMENDATION:** Two-stage exchange arthroplasty is recommended in the majority of cases following infected TAA. One-stage arthroplasty is only indicated in a limited patient population with acute infection, preoperatively identified low-virulence organisms and low-risk patient factors.

**LEVEL OF EVIDENCE:** Consensus

**DELEGATE VOTE:** Agree: 92%, Disagree: 8%, Abstain: 0% (Super Majority, Strong Consensus)

TABLE 1. Indications for one- versus two-stage exchange for infected TAA

Treatment Type	Indications
One-stage Exchange Arthroplasty	No sinus tract or exposed hardware Healthy patient and soft tissue No prolonged antibiotic use No significant bone loss requiring bone graft Low-virulence Organism with good antibiotic sensitivity

## One Stage Revision: *Limited Indications*

1. Acute infections
2. Acute Hematogenous infection
3. Preoperatively identified low virulence organisms
4. Low risk patients factors
5. No sinus tract or exposed hardware
6. No prolonged AB use
7. No significant bone loss (*bone graft, stability*)

# One-stage versus Two-stage revision

## Two-stage Exchange Arthroplasty

**Sepsis.** Patients with systemic manifestations of infection

**No Cultured Organism.** High suspicion for infection but no organism has been identified

**Antibiotic-resistant Organism.** Preoperative cultures identifying difficult to treat and antibiotic-resistant organisms

**High-risk Patient Factors.**

- a. Presence of a sinus tract or exposed hardware
- b. Immunocompromised
- c. Inadequate and non-viable soft tissue coverage
- d. Need to utilize higher order reconstructive techniques (bone graft, augmentation, soft-tissue flaps)

## Two- Stage Revision : *in the majority of cases*

1. Sepsis

2. No cultured organism

3. AB resistant organism

4. High risk patient

- ✓ Sinus tract, exposed hardware
- ✓ Immunocompromised
- ✓ Inadequate and nonviable sort tissue coverage
- ✓ higher-order reconstructive

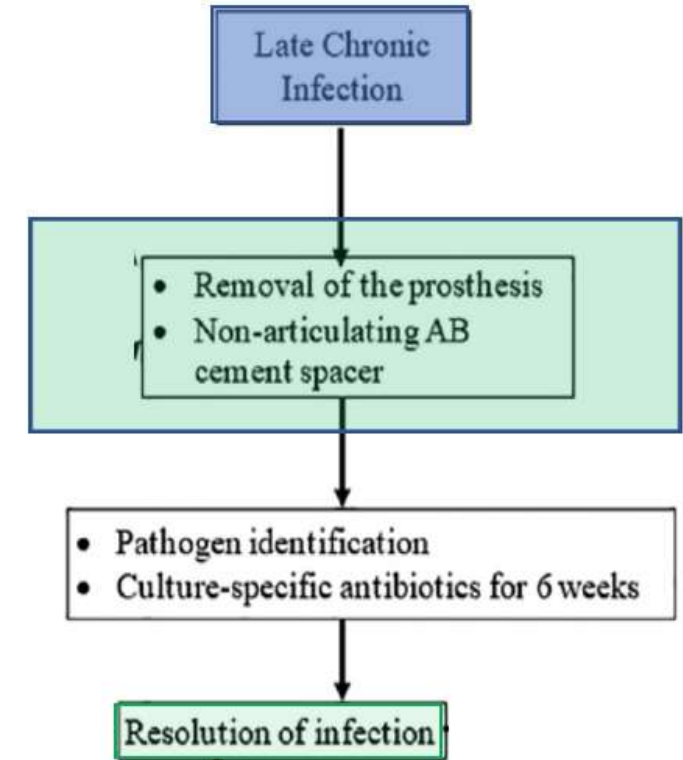


# LATE infection

## Two- Stage revision

### Considerations

- **Significant bone loss**
- Patient morbidity, disability
- **Difficult reconstruction**
- Prolonged recovery and disability
- Poorer outcome
- Higher rates and risk of subsequent infection
- Potential failure
- Amputation





# Late infection

## Clinical, biological and radiological Resolution of Infection

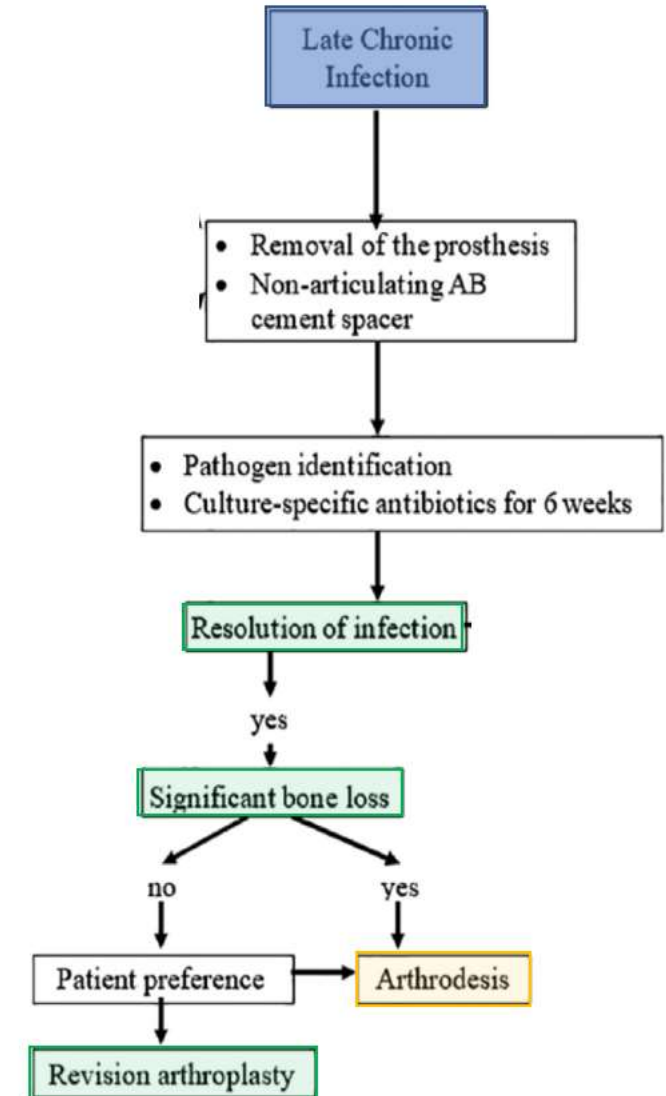
- ESR and CRP > 40 % decline from base line value
  - ✓ Improved pathogen control
  - ✓ Decreased overall biological burden.
  - ✓ Serum D-dimer ? ( increase sensitivity and specificity)
- **Well healed wound**
- Lack of erythema.
- Synovial fluid biomarkers ?

*MAZZOTTI 2019 – review*

## Revision TAA

72 cases (47.4%)

- **Infection healing 79.2%**
- **Good functional outcome 54.2%**





## Example of two-stage TAA after late infection

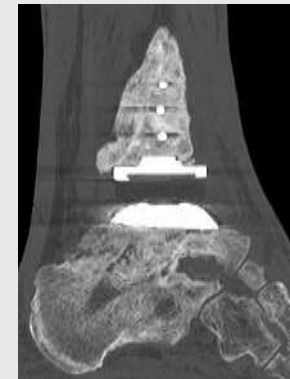
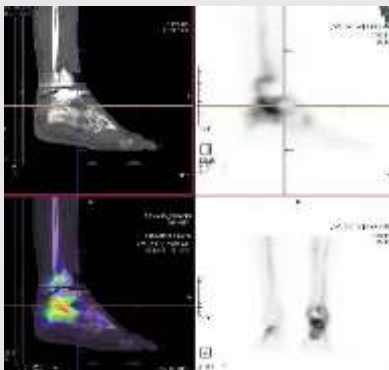
72 yrs old man

- Ankle + ST OA  
TAA (Talaris+XT) + ST fusion

- 5 mo:  
late sinus tract – no pain  
AOFAS 81  
osteolysis +++

- Two-stage TAA  
(Feb-April 2021)  
PMMA Genta+Vanco spacer  
*Enterobacter cloacae*

- 1.5 yr FU  
ROM 10°-0-40°  
AOFAS 90 /100





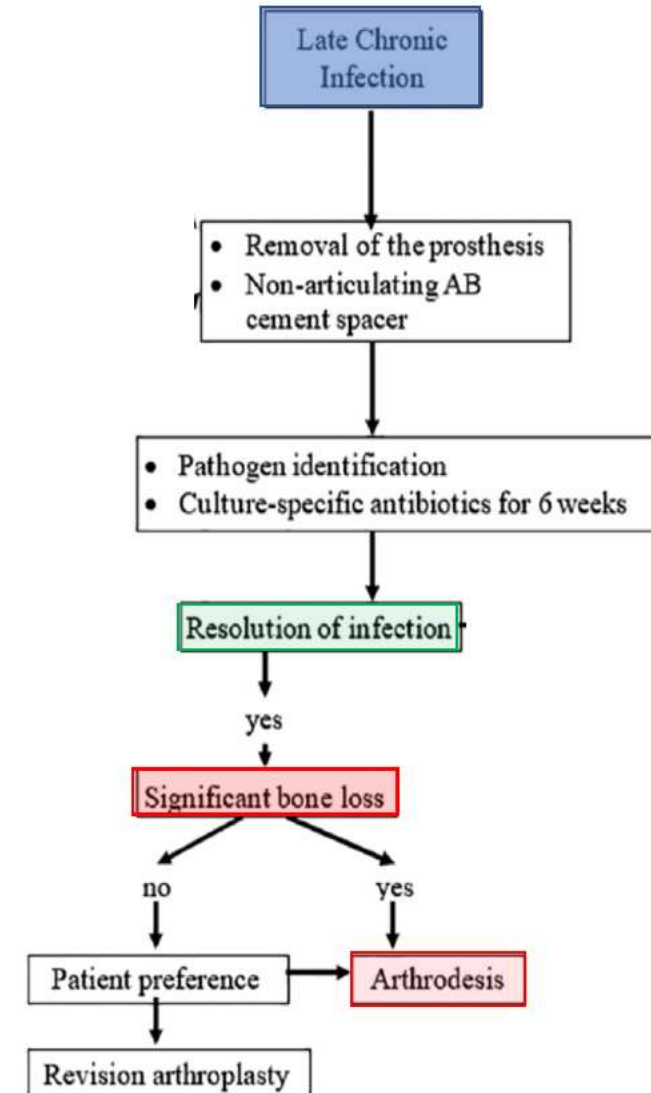
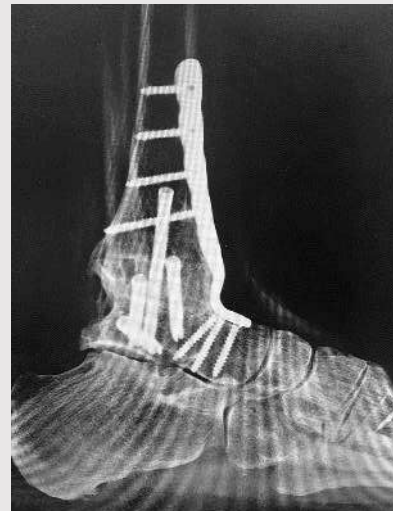
# Late infection

MAZZOTTI 2019 – review

## ARTHRODESIS

30 cases (19.7%)

- Infection healing 96 %
- Fusion 80%
- Good functional outcome 40 %





# Late infection

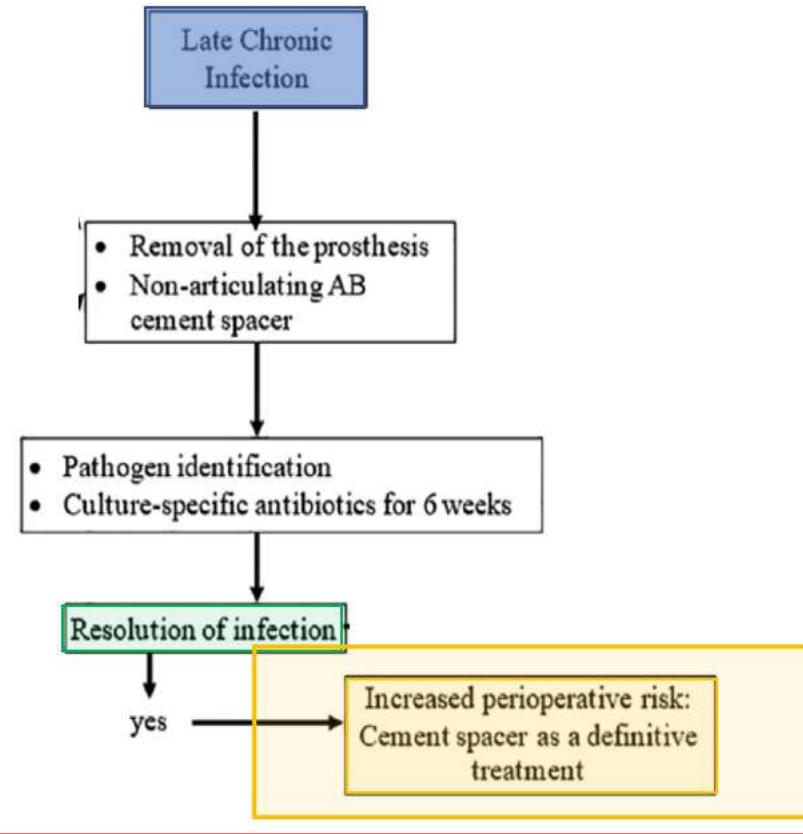
## Ferrao P - Foot Ankle int 2012 - 9 pts - FU 20.1 mo Cement Spacer as Definitive Management for Postoperative Ankle Infection

Paulo Ferrao, FCS(Ortho), SA; Mark S. Myerson, MD; John M. Schuberth, DPM; Michael J. McCourt, DPM  
Baltimore, MD; San Francisco, CA

### ABSTRACT

**Background:** Postoperative infection can be a devastating complication of ankle replacement and arthrodesis surgery. Management consists of eradication of the infection and either, revision of the initial surgery or some form of salvage procedure. There are instances however when the patient is asymptomatic, medically unfit, or the local tissue is too tenuous to warrant performing additional surgery. We conducted a retrospective review of the outcome of the use of an antibiotic impregnated cement spacer as the definitive procedure in this kind of patient. **Methods:** There were nine patients with post operative deep ankle infection following surgery who did not undergo subsequent revision surgery. The initial surgeries were either total ankle replacement (TAR) ( $n = 6$ ) or ankle arthrodesis ( $n = 3$ ). The indications for the retention of the cement spacer were patients who were asymptomatic following insertion of the cement spacer, did not desire further surgery, or were medically unfit for further surgery. The patients all underwent removal of hardware or implants, debridement, and insertion of an antibiotic impregnated cement spacer. Six weeks of intravenous antibiotics were administered according to culture sensitivity results. Patients were followed up closely for complications (wound dehiscence, spacer migration, bone loss), resolution of infection, functionality, and satisfaction. **Results:** The average time of cement spacer retention was 20.1 months, ranging from 6 to 62 months. The most common infecting organisms were Staph. Aureus ( $n = 3$ ) and Staph. Epidermidis ( $n = 3$ ). One patient had wound complications, possibly due to the proximity of the cement spacer to the anterior skin surface. One patient had a repeat infection at 52 months. The most common co-morbidities were rheumatoid arthritis ( $n = 3$ ) and diabetes ( $n = 2$ ). At final followup, seven

patients still had a retained cement spacer and two had subsequent below knee amputations (BKA) performed as a result of delayed complications. Review of the X-rays revealed two patients with loosening and migration of the cement spacer. No patients had signs of excessive bone loss. All patients with a retained antibiotic cement spacer were mobile and able to perform basic activities of daily living with minimal discomfort. **Conclusion:** The long-term use of antibiotic impregnated cement spacers following postoperative ankle infection is a reasonable option in the low demand patient with surgical or medical co-morbidities.



MAZZOTTI 2019 – review

**SPACER arthroplasty = definitive ttt**

12 cases (7.9%)

CNO : subluxation, loosening





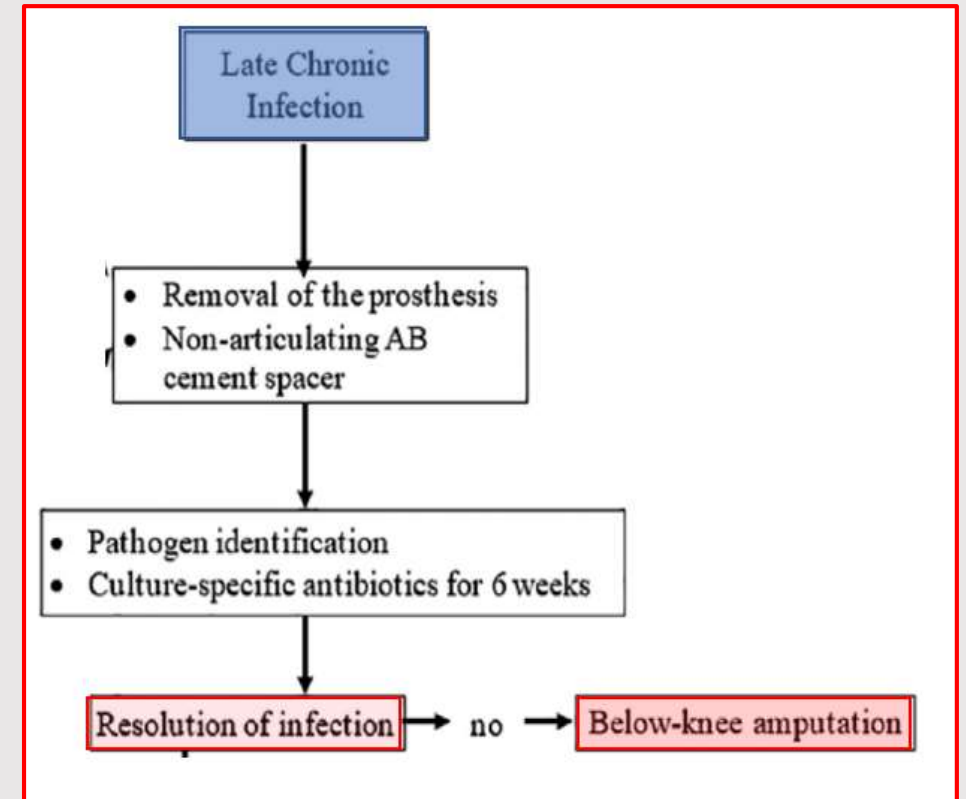
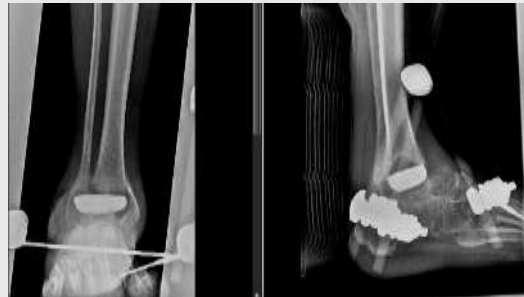
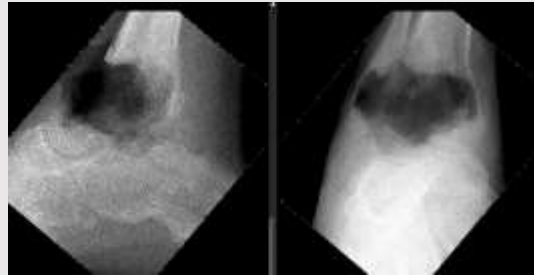
# Late infection

MAZZOTTI 2019 – review

## AMPUTATION

9 cases (5.9 %)

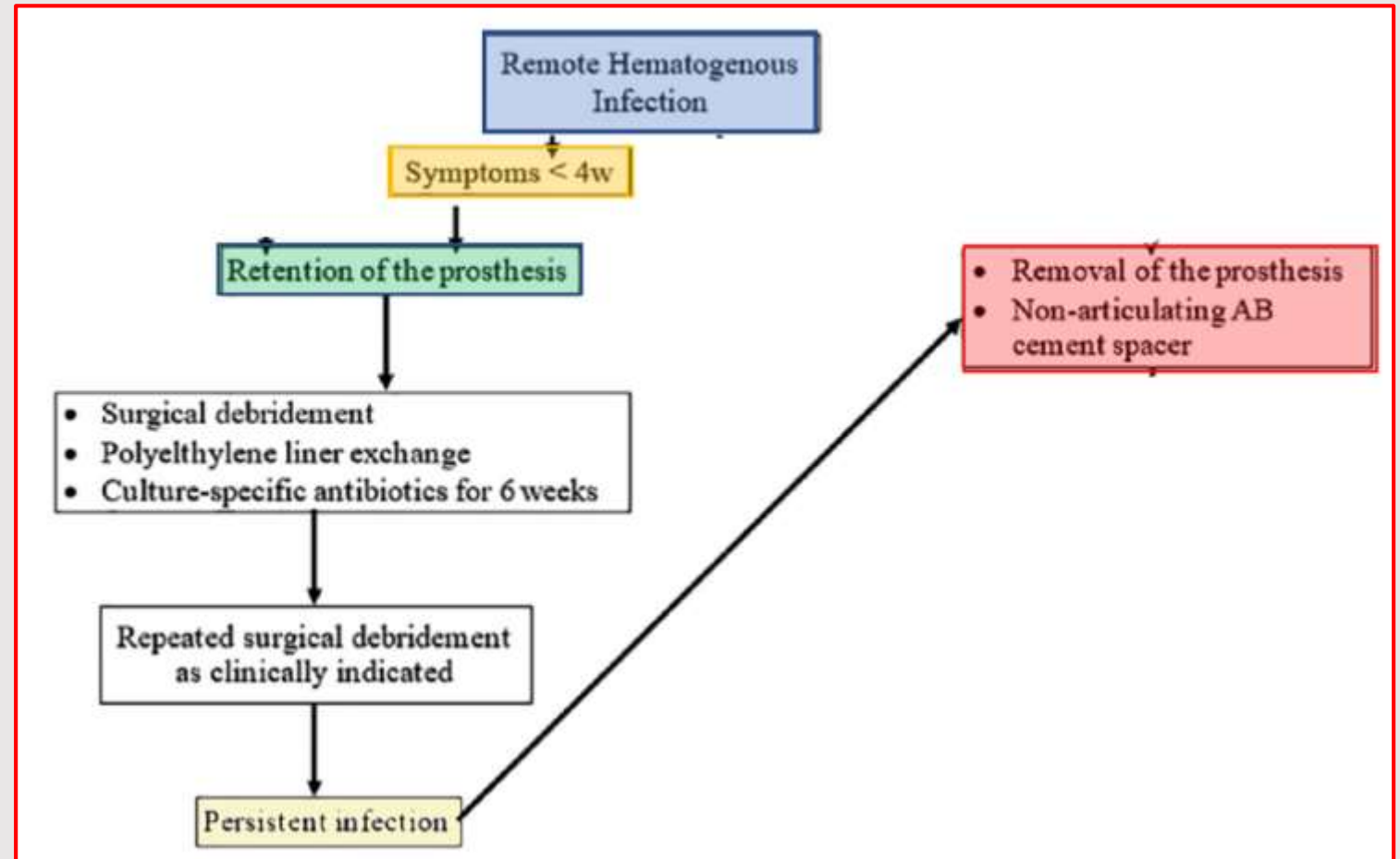
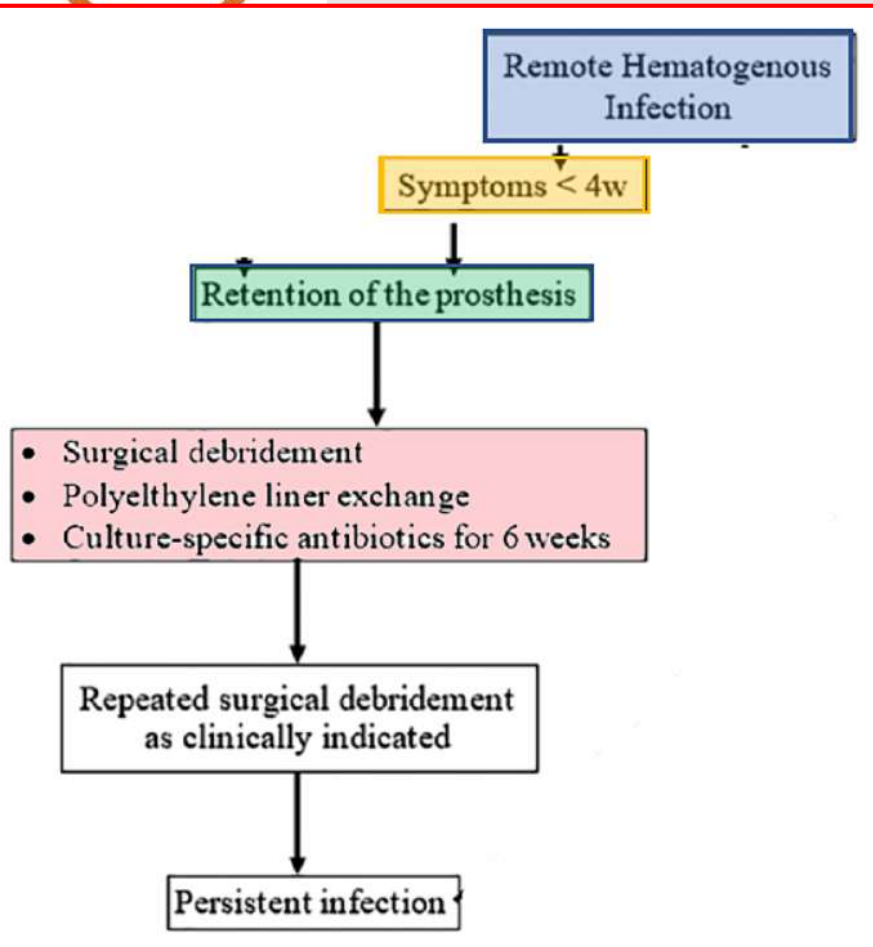
due to soft tissue loss, chronic pain  
systemic condition, persistent infection





# HEMATOGENOUS infection

## ■ Symptoms < 4 Weeks





## Example of Hematogenous infection



- 81 yrs old man
- OA on laxity + equinus  
TAA sept 2016



- 1 yr FU: AOFAS 90

- 15 mo: pain-swelling-rubor  
(history of dental care few mo earlier)

**Irrigation-Debridement-PE Exchange**

*Streptococcus mitis oralis*



- Suppressive AB : amoxicilline 3g**

- 5 yr FU

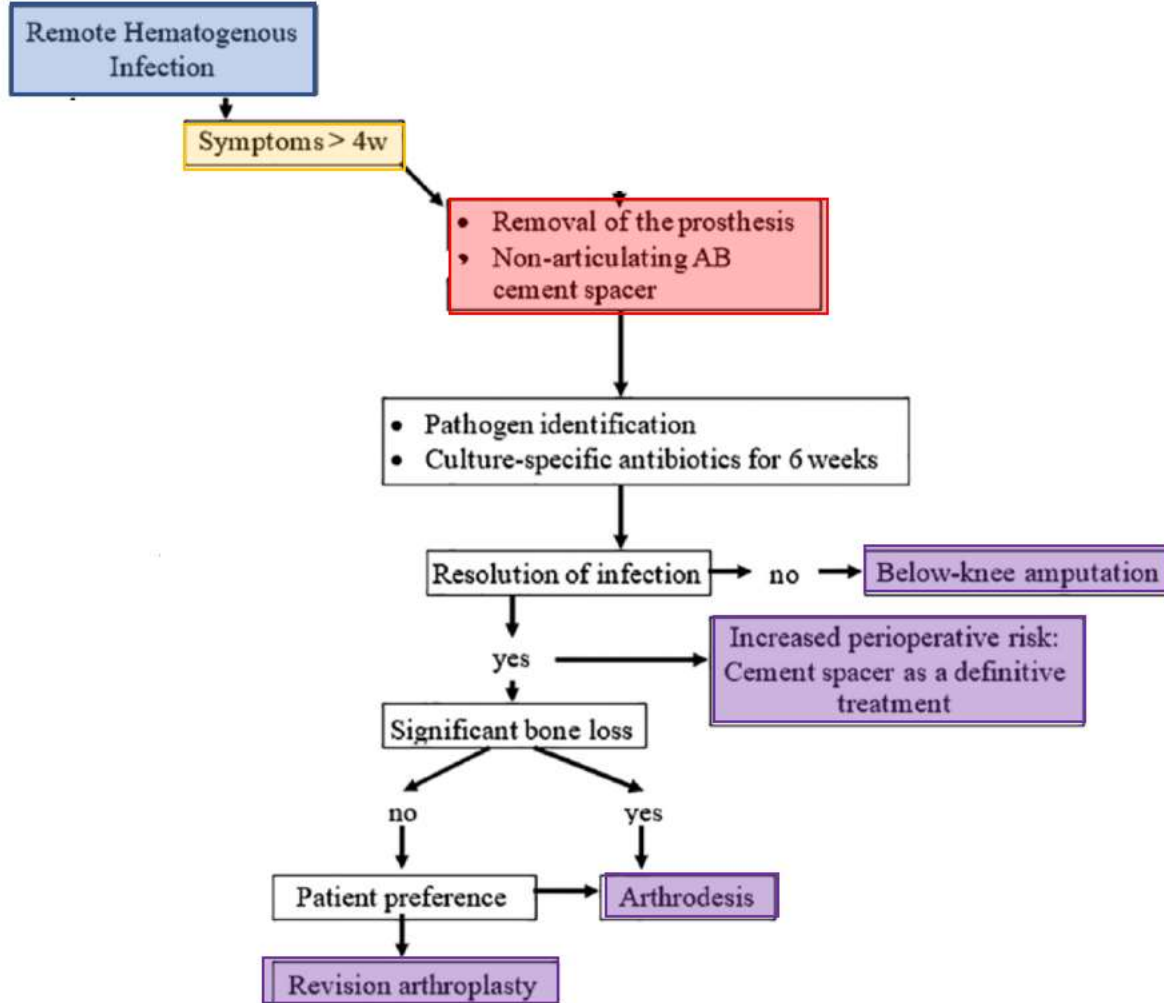
ROM 10°- 0 -30°

AOFAS 77 /100



# HEMATOGENOUS infection

- Symptoms > 4 Weeks



**Two-stage revision**



# SUPPRESSIVE ANTIBIOTICS in PJI ?

Author: Selene Parekh

**QUESTION 3:** Is there a role for suppressive antibiotics in patients with perioperative joint infection (PJI) of total ankle arthroplasty (TAA) who have undergone surgical treatment?

**RECOMMENDATION:** Culture-directed antibiotic therapy is recommended for patients undergoing surgical treatment of Infected TAA. Routine administration of suppressive antibiotics in patients with an ankle prosthesis in place is not warranted; however, in certain clinical circumstances, this may be of benefit.

**LEVEL OF EVIDENCE:** Consensus

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

## Administration of routine suppressive antibiotic therapy after PJI surgical management

- **Not warranted**
  - ✓ Cost
  - ✓ Systemic adverse effects
  - ✓ Potential emergence of antimicrobial resistance
- **Maybe benefit in certain circumstances**
  - ✓ Extensive comorbidities
  - ✓ Resistant organism
  - ✓ Complex infection

# Example of Irrigation-debridement-suppressive AB after Late infection

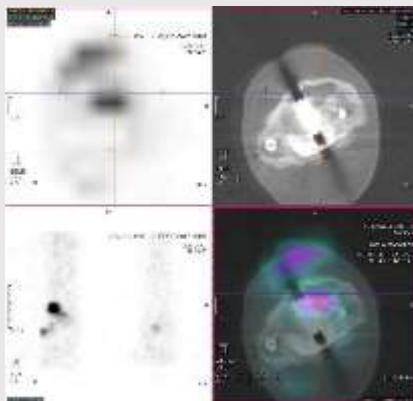
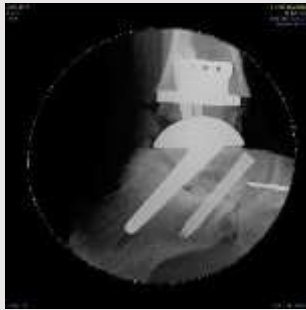
51 yr-old man

## Severe Hemophilia B

Bilat TAA+ST fusion

- Sept 2019 – left side surgery  
PO severe wound dehiscence (3mo)  
IV AB 3 wks  
*Polymicrobial (SA – SC – Enterobacter)*

- 1 yr: no pain – sinus tract  
Irrigation – PE Exchange  
Debridment (osteolysis cementing)  
*Enterobacter cloacae*
- Suppressive AB : cotrimoxazole forte 2/j
- 2 yr FU  
ROM 10°-0-30°  
AOFAS 100







# PREVENTION

## ☐ PRE-operative

- **Smoking cessation**
- **Glycemic Control**
- **BMI optimization**
- Managing immune-modulating comorbidities (RA, chronic lung disease, peripheral vascular disease)
- Screening *s aureus* ? *Some evidence younger patients CA-MRSA*
- Foot bath ?



## ☐ Immediate Pre-operative

- **Prophylactic antibiotics**
  - ✓ Timing ? ( no difference 60-15 or < 15 )
  - ✓ If surgery exceeds half life time (2h) 2<sup>nd</sup> D
  - ✓ No longer than 24 H

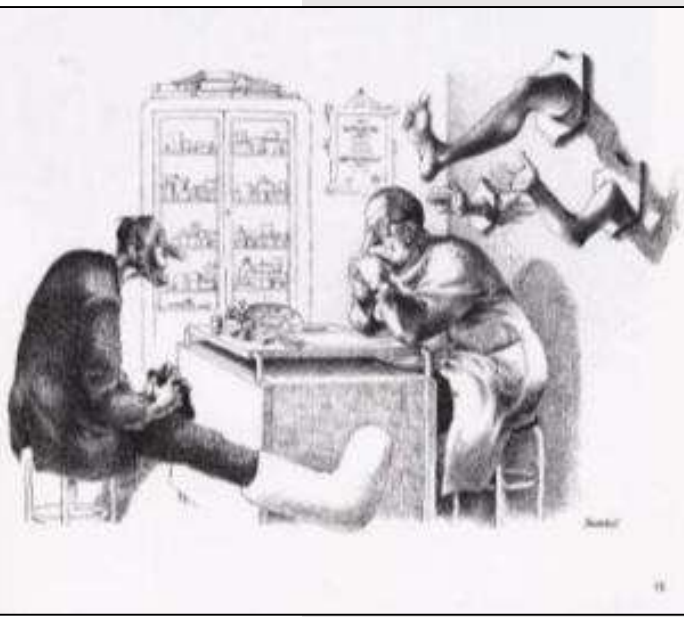
## ☐ PER-operative

- Alcohol and betadine based solution
- **Planning surgical incision site**
- Reducing Foot traffic
- Efficient ventilation system
- **Core temperature >36°**

## ☐ Immediate POST-operative

- **Drainage** wound dressing
- Meticulous wrap protocol
- **Post operative cast** until wound healing





*Thank you for  
your attention*



La persévérance,  
c'est ce qui rend l'impossible possible,  
le possible probable  
et le probable réalisé

*Robert Half*

**Perseverance**  
is what makes the impossible possible  
the possible likely  
and the likely real