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**Complications in Orthopaedics and Traumatology**

30-28 April 2018  
Rugoset 2018/18





# ICM 2018

## Mission


■ Improve musculoskeletal care of **patients** by preventing or better treating orthopedic infections

**IC**

**We'll come**



The English orthopedic society has announced a future program called "orthopedic infections". The program will focus on the prevention, diagnosis, and treatment of orthopedic infections. The program will be a multi-disciplinary effort involving orthopedic surgeons, infectious disease specialists, and other healthcare providers. The program will be a multi-disciplinary effort involving orthopedic surgeons, infectious disease specialists, and other healthcare providers. The program will be a multi-disciplinary effort involving orthopedic surgeons, infectious disease specialists, and other healthcare providers.





## International Consensus Group Discovery





Why bother?

## International Consensus Group Discovery


Literature is not definitive on many issues

Which of them we have to base on this evidence, if any at all


## Challenges of Generating Evidence

- To generate evidence, we need large sample sizes are needed
- 10-15,000, 22,000, 36,000




## Challenges of Generating Evidence

- Not everything we do needs "randomized, prospective studies"



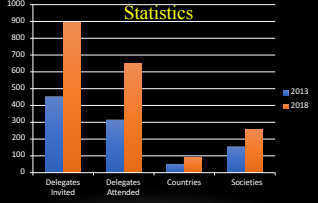


## First International Consensus on Periprosthetic Joint Infection August 1-3, 2013


Javad Parvizi MD, FRCS  
Thomas Jefferson University, Philadelphia



## ICM 2013 Statistics




Category	2013	2018
Delegates Invited	~450	~900
Delegates Attended	~300	~650
Countries	~100	~50
Societies	~150	~250








## Delegates


- 890 Delegates
- 98 Countries
- Over 200 societies
- 98 Presidents



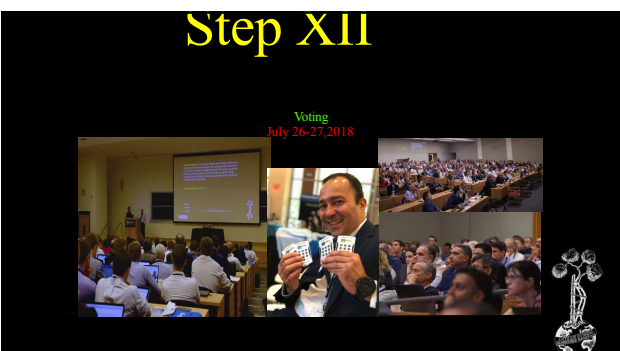
## ICM 2018 Delphi Steps

Thorsten On Skype



## Delegates

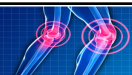



# GENERAL<sup>1</sup> ASSEMBLY

Prevention  
Host Related, Local  
Factors: Host Related,  
General Factors

Section 1:

- 1.1. Host Risk Mitigation, Local
- 1.2. Factors: Host Risk Mitigation,
- 1.3. General Factors Risk Mitigation,
- 1.4. Local Factors
- 1.5. Risk Mitigation, General
- 1.6. Factors Antimicrobials
- 1.7. (Systems) Antimicrobials
- 1.8. (Local)
- 1.9. Surgical Site Preparation
- 1.10. Operating Room, Anesthesia
- 1.11. Operating Room, Personnel
- 1.12. Operating Room,
- 1.13. Environment Operating,
- 1.14. Room, Surgical attire
- 1.15. Operating Room, Surgical
- 1.16. Field Antiseptic Irrigation
- Solution
- Operating Room, Surgical
- Technique



## ICM 2018

- Class 1: Clinically important, high evidence
- Class 2: Clinically important, low evidence
- Class 3: Clinically less important, high evidence
- Class 4: Clinically less important, low evidence

## G-9 (Former G-108) Should routine dental clearance be obtained prior to total joint arthroplasty (hip/knee/shoulder/ankle)?

RESEARCHED BY:



William V Arnold



Emad Mustapha Al-Bushra



Juan Ottolenghi



## Literature:

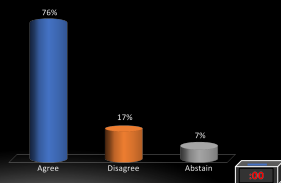
- Only one retrospective study has compared the incidence of PJI in a population of patients who underwent dental clearance prior to arthroplasty with a population of arthroplasty patients who had no such clearance.
- This latter group of patients was not a prospective matched control cohort, but rather was composed of hip fracture patients treated with non-elective arthroplasty. The conclusion of this study was that dental clearance prior to arthroplasty did not provide a significant decrease in PJI.



**Recommendation:** No. While dental pathology has been reported in a subset of patients undergoing joint arthroplasty, there are no prospective controlled studies supporting the role of pre-surgical dental clearance in reducing the rate of subsequent PJI.

Level of Evidence: Consensus

- A. Agree
- B. Disagree
- C. Abstain



## G-79 (Former G-110) Should extended (beyond 24 hours) antibiotic prophylaxis be administered to patients with surgical drain in place?

RESEARCHED BY:



Werner Zimmerli



Ed McPherson



## Literature:

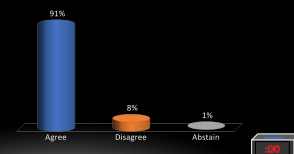
- Meta-analysis 0, Prospective/Randomized 0, Retrospective 6
- There is minimal evidence that extended antibiotics demonstrates a reduced rate of infection
- There is minimal literature that antibiotics should be administered in patients with drains



**Recommendation:** No. There is no indication for prolonged antibiotic prophylaxis regardless of the presence of surgical drains. Prolonged prophylaxis is potentially dangerous, because it increases the fraction of resistant microorganism on the skin microbiome.

Level of Evidence: Strong

- A. Agree
- B. Disagree
- C. Abstain





## G-127 (Former G-148) What is the recommended time interval that would divide acute and chronic PJI (four weeks, 90 days, etc)?

RESEARCHED BY:



Marjan Wouthuyzen-Bakker, MD



Jeppe Lange, MD



## Literature:

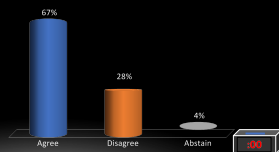
- Meta-analysis 0, Prospective/Randomized 1, Retrospective 35
- Carli et al. observed in a mouse model with a proximal tibial implant infection, using a high initial bacterial inoculum ( $3 \times 10^5$  CFU), that a biofilm is evident after 2 weeks of injection, but extends and is covered by fibrinous tissue and multiple host cells after 6 weeks.
- The majority of the proposed PJI classification schemes in literature use a wide variety in time intervals (3 weeks - 3 months), but all are based on expert opinions.
- Some clinical reports have supported the usefulness of a 3-week time interval, but others have not.



**Recommendation:** There is no evidence-based time interval that divides acute from chronic PJI. It is recommended that a time interval of 3 weeks after the onset of symptoms should be used as cut-off between acute and chronic. It is recommended, that a time interval of 3 weeks after the index arthroplasty should be applied in early post-surgical PJI when the onset of symptoms is not clear.

**Level of Evidence:** Limited

- A. Agree
- B. Disagree
- C. Abstain



## G-139 (Former G-113) Should perioperative antibiotics be withheld prior to obtaining an intra-operative aspirate and/or tissue samples for culture in suspected infected revision total joint arthroplasty cases?

RESEARCHED BY:



Natividad Benito



Robert Barrack



Giuseppe Sessa



## Literature:

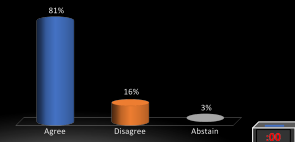
- Two randomized clinical trials, two prospective cohort studies, one systematic review of the literature, three retrospective studies.
- The literature overwhelmingly supports giving prophylactic antibiotics at the onset of the case, rather than holding them for cultures to be obtained.




**Recommendation:** Prophylactic antibiotics should not be withheld in patients undergoing revision joint arthroplasty

**Level of Evidence:** Moderate

- A. Agree
- B. Disagree
- C. Abstain








**ICM 2018**


- Class 1: Clinically important, high evidence
- Class 2: Clinically important, low evidence
- Class 3: Clinically less important, high evidence
- Class 4: Clinically less important, low evidence

**G-13 (Former G-85) How should a patient with a pre-operative urinary tract infection (UTI) be managed prior to undergoing elective joint arthroplasty?**

RESEARCHED BY:






Young-Kyun Lee      Bulent Atilla      Andrew Battenberg



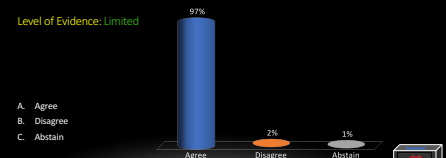
**Literature:**

- To date, there are no studies reporting on symptomatic pre-operative UTI that goes untreated prior to elective TJA, making comparison difficult
- Current data is limited to large institutional and publicly available databases; 3 demonstrated preoperative UTI as a risk while smaller retrospective studies fail to find a difference (3).




**Recommendation:** Pre-operative UTI should be treated with appropriate antibiotics prior to elective total joint arthroplasty (TJA).

Level of Evidence: Limited





Response	Percentage
Agree	97%
Disagree	2%
Abstain	1%

A. Agree  
B. Disagree  
C. Abstain




**Does screening for diabetes and glycemic control reduce the risk of SSI/PJI?**

RESEARCHED BY:





Noam Shoat      Javad Parvizi



**Literature:**

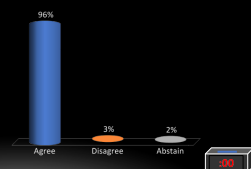
- Meta-analysis 0, Prospective/Randomized 0, Retrospective 19
- The prevalence of diabetes in patients undergoing TJA has been shown to be 20.7% (40.9% of these were undiagnosed)
- Inadequately controlled diabetes is associated with greater risk of PJI, though no studies exist that show tight control reduces this risk



**Recommendation:** The routine screening for diabetes and glycemic control has the potential to reduce the incidence of surgical site infection (SSI) and/or periprosthetic joint infection (PJI) following total joint arthroplasty (TJA).

Level of Evidence: Consensus

- A. Agree
- B. Disagree
- C. Abstain



## G-49 (Former G-74) Does the use of laminar flow in the operating room reduce the risk of subsequent SSI/PJI in patients undergoing orthopedic procedures?

RESEARCHED BY:



Arash Aalirezaei



Everth Merida



Kelly Vince



Greg Stocks



## Literature:

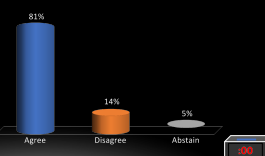
- Meta-analysis 0, Prospective/Randomized 1, Retrospective 20
- Early studies suggested LAF was effective in reducing SSI/PJI
- 6 retrospective studies found no difference in rate of SSI/PJI with use of LAF
- 3 recent studies linked use of LAF to increase in rate of SSI/PJI



**Recommendation:** Recent orthopedic literature has not demonstrated that the use of laminar flow systems (LAF) reduces surgical site infection (SSI) or periprosthetic joint infection (PJI) in orthopedic surgery. At this time, is not necessary to perform a clean orthopedic surgery procedure, including elective joint replacement surgery, in an operating theatre equipped with LAF systems.

Level of Evidence: Moderate

- A. Agree
- B. Disagree
- C. Abstain



## G-117 (Former G-77) Does the use of surgical drains increase the risk of subsequent SSI/PJI?

RESEARCHED BY:



Gregory Deirmengian, MD



Snir Heller, MD



Kier Blevins, MD



## Literature:

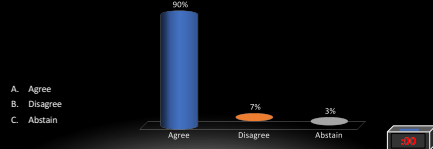
- Meta-analysis 0, Prospective/Randomized 0, Retrospective 14
- Several studies demonstrate no difference in the infection rate with the use of drains.
- Several studies reveal an increased rate of blood transfusions in patients with drains





**Recommendation:** There is no direct evidence to suggest that the use of surgical drains (for < 48 hours) leads to an increase in the rate of subsequent SSI/PJI. The use of surgical drains lead to a higher volume of blood loss and an increased need for allogeneic blood transfusion, which may indirectly increase the rate of SSI/PJI.

**Level of Evidence: Limited**



A. Agree  
B. Disagree  
C. Abstain

## HK-12 (former HK-83): Is there sufficient evidence to support the use of antibiotic-loaded cement in primary TKA or THA to reduce the risk of SSI/PJI?

RESEARCHED BY:



Yale Fillingham, MD



Sergei Oshkukov, MD



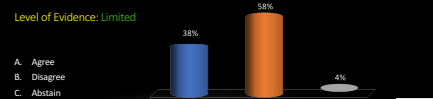
Ali Parsa, MD

## Literature:

- Meta-analysis 1, Prospective/Randomized 0, Retrospective 26
- A number of retrospective studies have correlated use of antibiotic-loaded cement with lower rates of wound infection and failure in THA and TKA, whereas others show no difference
- No evidence exists demonstrating that use of antibiotic-loaded cement reduces incident of SSI/PJI in primary hip or knee arthroplasty

**Recommendation:** There is no conclusive evidence to demonstrate that routine use of antibiotic-loaded cement in primary TKA or THA reduces the risk of subsequent SSI/PJI. Recent high level evidence and registry data has not demonstrated a reduction in SSI/PJI. Furthermore, the added cost, the potential for emergence of resistant organisms, and the potential adverse effect of antibiotics on the host provide adequate reasons to refrain from routine use of antibiotic loaded cement during primary total joint arthroplasty.

**Level of Evidence: Limited**



A. Agree  
B. Disagree  
C. Abstain

## ICM 2018

- Class 1: Clinically important, high evidence
- Class 2: Clinically important, low evidence
- Class 3: Clinically less important, high evidence
- Class 4: Clinically less important, low evidence

## HK-29 (former HK-22) Does changing the drapes during debridement, antibiotics, and implant retention affect the rate of success?

RESEARCHED BY:



Plamen Kinov MD,  
Bulgaria



Alos Zahar MD,  
Germany



Thorsten Gehrke MD,  
Germany

### Literature:

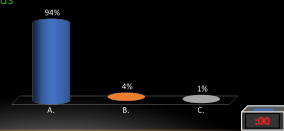
- There are no studies that assess the impact of changing the drapes during DAIR.
- After a literature review of 51 papers, only one study was identified that indirectly mentioned the use of clean draping during the surgical procedure.
- Changing the drapes during DAIR can be performed at the surgeon's discretion.



**Recommendation:** The impact and effectiveness of changing the drapes during debridement, antibiotics, and implant retention (DAIR) has not been investigated and therefore it can be performed at the surgeon's discretion.

**Level of Evidence:** Consensus

- A. Agree  
B. Disagree  
C. Abstain



### G-35 (Former G-48) Does the number of individuals in the operating room affect the rate of SSI/PJI? If so, what strategies should be implemented to reduce traffic in the operating room?

RESEARCHED BY:



Eleftherios Tsiridis



Daniel Del Gaizo



### Literature:

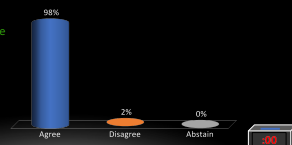
- Meta-analysis 0, Prospective/Randomized 0, Retrospective 29
- Multiple studies show an increased trend in PJI associated with high OR traffic and increased rate of door opening.
- Systemic and behavioural measures in the OR have been shown to significantly reduce the incidence of superficial PJI and a non-significant decrease in the deep PJI.



**Recommendation:** Yes. The number of individuals in the operating room (OR) and door openings (DO) during total joint arthroplasty (TJA) are correlated to the number of airborne particles in the OR. Elevated airborne particles in the OR can predispose to subsequent periprosthetic joint infection (PJI). Therefore, operating room traffic should be kept to a minimum. Multiple strategies, outlined below, should be implemented to reduce traffic in the OR during orthopaedic procedures.

**Level of Evidence:** Moderate

- A. Agree  
B. Disagree  
C. Abstain



### HK-18 (former HK-47) - Does the use of personal protection suits (space suits) influence the rate of SSI/PJI in patients undergoing joint arthroplasty?

RESEARCHED BY:



Mark Spangehl MD,  
USA



Xianlong Zhang MD,  
China



### Literature:

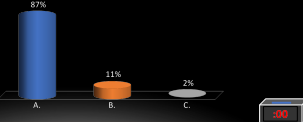
- Meta-analysis 1, Prospective/Randomized 3, Retrospective 17
- Meta-analysis of body exhaust suits (Blomgren et al.)
  - Body exhaust suits were associated with a significant reduction in deep infection rates (RR 0.11, 95% CI 0.09-0.46)



**Recommendation:** In the absence of strong evidence, we believe the use of personal protection suits (space suits) does not reduce the rate of subsequent SSI / PJI in patients undergoing joint arthroplasty.

**Level of Evidence: Moderate**

A. Agree  
B. Disagree  
C. Abstain



### HK-100 (former HK-76) Is there a role for intraoperative autoclaving and re-use of an infected prosthesis as a spacer during resection arthroplasty?

RESEARCHED BY:



Samuel Wellman MD, USA



Biagio Moretti MD, Italy

Lluís Font-Vizcarra MD, Spain

Andrew Battenberg MD, USA



### Literature:

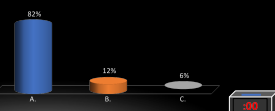
- Meta-analysis 0, Prospective/Randomized 0, Retrospective 16
- Hofmann et al. reported 44/50 patients (88%) with an autoclaved femoral component as a spacer had successful reimplantation and were infection free at latest follow-up
  - Lee et al reported 19/20 patients successfully treated in a similar study
- Only one study discussed the use of autoclaved hip components, and while they reported excellent results in 31/32 patients, information on autoclave protocol and other details were lacking



**Recommendation:** Multiple studies have demonstrated that the re-use of autoclaved prosthetic components, during knee resection arthroplasty, did not compromise the eradication of an established infection. Though a viable option, there are potential legal implications associated with the re-use of autoclaved components and a proper standard for autoclaving of these components is also not known. Re-use of autoclaved components in resection arthroplasty, particularly for the knee, may be suitable in scenarios when proper dynamic spacer components are not available or for economic considerations.

**Level of Evidence: Moderate**

A. Agree  
B. Disagree  
C. Abstain



### ICM 2018

- Class 1: Clinically important, high evidence
- Class 2: Clinically important, low evidence
- Class 3: Clinically less important, high evidence
- Class 4: Clinically less important, low evidence

## G-106 (Former G-123) What antiseptics can be used to prevent biofilm formation?

RESEARCHED BY:



Silvestre Ortega-Pena



Mark Smeltzer



Kenneth Urish



### Literature:

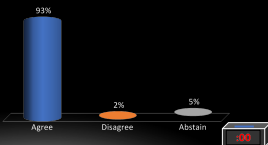
- Meta-analysis 0, Prospective/Randomized 1, Retrospective 5,
- There are minimal studies in orthopaedics and in-vivo regarding the use of antiseptic agents for biofilm formation.
- One randomized study for gingival biofilm formation
- Majority of studies are in-vitro



**Recommendation:** Although several studies have demonstrated the ability of certain antiseptic agents to prevent biofilm formation in vitro, the ability of antiseptics to provide prevention of biofilm formation in vivo is uncertain. They may have utility in the context of revision surgery due to existing infection but this issue has not been adequately studied.

Level of Evidence: Limited

- A. Agree
- B. Disagree
- C. Abstain



## HK-85 (former HK-132) What is the minimum necessary volume of irrigation solution to use in debridement, antibiotics, and implant retention treatment of acute PJI?

RESEARCHED BY:



Wayne G. Paprosky MD,  
United States of America

Evan Schwechter MD, United  
States of America



### Literature:

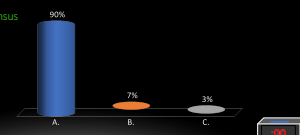
- Meta-analysis 0, Prospective/Randomized 1, Retrospective 11
- There are a small number of studies providing limited secondary data regarding the ideal volume of irrigation to be used during IJA.
  - These studies either did not take biofilms into account or did not examine volume of irrigation solution as an endpoint
- Limited evidence available indicates the presence of staphylococcal infection, elevated ASA score, or purulence are more likely to determine failure than volume of irrigation.
- Delegates performed a comprehensive systematic review of the literature relating to open DAIR treatment of acute postoperative and hematogenous hip and/or knee PJI.
  - Typically 6 to 9L of solution were used during a single DAIR treatment, with twelve of the thirteen studies utilizing up to 9L or more of irrigation solution.
- No studies currently exist directly linking the necessary volume of irrigation to use in debridement, antibiotics, and implant retention in acute PJI



**Recommendation:** We recommend that 6-9L of irrigation solution, including antiseptic solution such as dilute betadine, is used during debridement, antibiotics, and implant retention (DAIR) treatment of acute periprosthetic joint infection (PJI).

Level of Evidence: Consensus

- A. Agree
- B. Disagree
- C. Abstain



Section 1:	Prevention
1.1	Risk Related
1.2	Risk Mitigation
1.3	Antimicrobials (Systemic)
1.4	Antimicrobials (Local)
1.5	Operating Room Environment
1.6	Surgical Technique
1.7	Prosthesis Factors
1.8	Postoperative Issues
Section 2:	Diagnosis
2.1	Definitions
2.2	Algorithm
2.3	Laboratory Tests
2.4	Pathogen Isolation, Culture Related
2.5	Reimplantation
Section 3:	Pathogen Factors
Section 4:	Fungal Periprosthetic Joint Infection
4.1	Diagnosis and Treatment

- Section 5: Treatment
  - 5.1. Algorithm
  - 5.2. Debridement and Retention of Implant
  - 5.3. One-stage Exchange
  - 5.4. Two-stage Exchange: Spacer Related
  - 5.5. Two-stage Exchange
  - 5.6. Surgical Technique
  - 5.7. Prosthesis Factors
  - 5.8. Salvage
  - 5.9. Antimicrobials
  - 5.10. Antimicrobials (Two-Stage)
  - 5.11. Antimicrobial Suppression
- Section 6: Outcomes

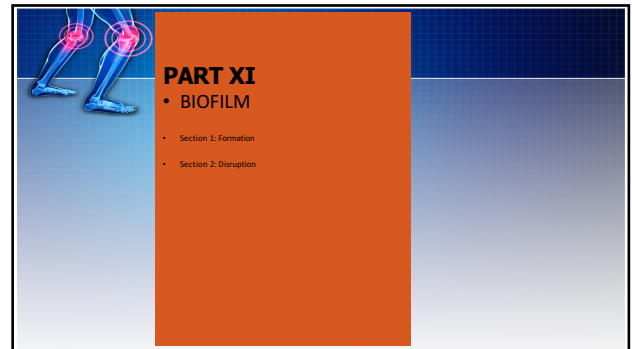
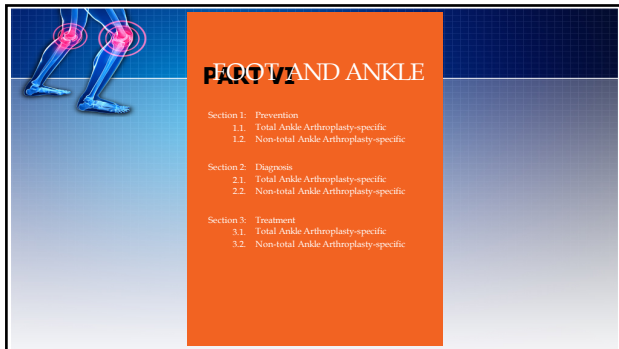
## 2.1. DIAGNOSIS: DEFINITIONS

**QUESTION:** What is the definition of a periprosthetic joint infection (PJI) of the knee and the hip? Can the same criteria be used for both joints?

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Fig. 1. New scoring based definition for **periprosthetic joint infection (PJI)**. Proceed with caution in: adverse local **tissue reaction**, crystal deposition disease, slow growing organisms. **CRP**, **C-reactive protein**; **ESR**, **erythrocyte sedimentation rate**; **LE**, **leukocyte esterase**; **PMN**, polymorphonuclear; **WBC**, white blood cell. \*For patients with inconclusive minor criteria, operative criteria can also be used to fulfill definition for PJI. †Consider further **molecular diagnostics** such as **next-generation sequencing**.

- Section 1: Prevention
  - 1.1. Antibiotics
  - 1.2. Intraoperative
  - 1.3. Patient Characteristics
  - 1.4. Skin Preparation
- Section 2: Diagnosis
  - 2.1. Culture Significance
  - 2.2. Culture Technique
  - 2.3. Diagnostic Criteria
  - 2.4. Inflammatory Markers
  - 2.5. Sampling
- Section 3: Treatment
  - 3.1. Antibiotics for Unexpected Positive Cultures
  - 3.2. Antibiotics for Periprosthetic Joint Infection
  - 3.3. Bone Graft
  - 3.4. Component Retention
  - 3.5. Implant
  - 3.6. Revision
  - 3.7. Revision







# ICM Philadelphia



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