

# **Session SPILF**

## **Infections sur prothèses**

### **Prise en charge clinique : actualités**



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Université Claude Bernard Lyon 1



*Hospices de Lyon*



2009

# Recommandations de pratique clinique

## *Infections ostéo-articulaires sur matériel*

### **(prothèse, implant, ostéo-synthèse)**

Niveau de preuve scientifique fourni par la littérature	Grade des recommandations
<b>Niveau 1</b> <ul style="list-style-type: none"><li>- Essais comparatifs randomisés de forte puissance</li><li>- Méta-analyse d'essais comparatifs randomisés</li><li>- Analyse de décision basée sur des études bien menées</li></ul>	<b>A</b> Preuve scientifique établie
<b>Niveau 2</b> <ul style="list-style-type: none"><li>- Essais comparatifs randomisés de faible puissance</li><li>- Études comparatives non randomisées bien menées</li><li>- Études de cohorte</li></ul>	<b>B</b> Présomption scientifique
<b>Niveau 3</b> <ul style="list-style-type: none"><li>- Études cas-témoins</li></ul> <b>Niveau 4</b> <ul style="list-style-type: none"><li>- Études comparatives comportant des biais importants</li><li>- Études rétrospectives</li><li>- Séries de cas</li></ul>	<b>C</b> Faible niveau de preuve

# Généralités



**PTG**



**PTH**

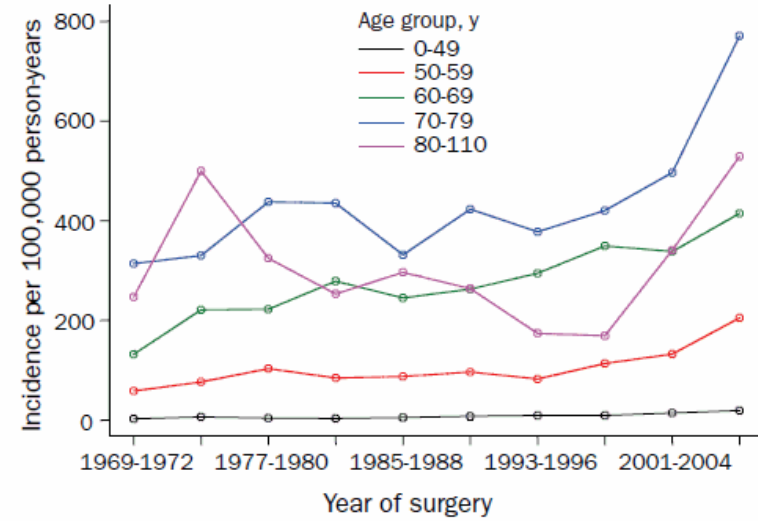
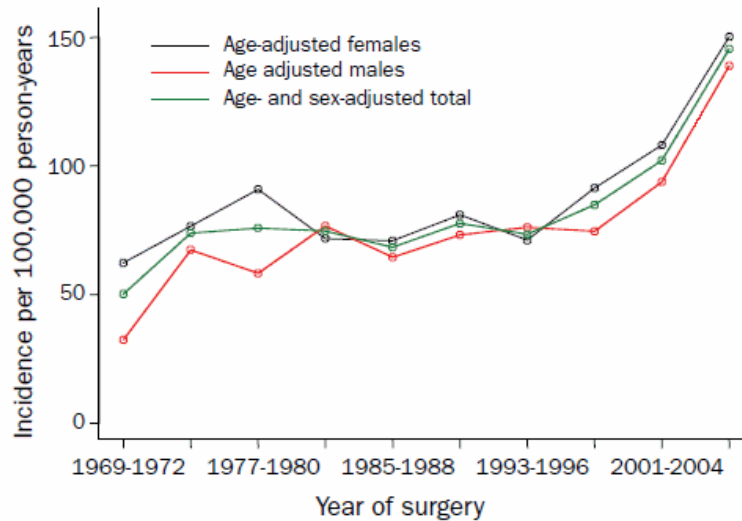


200 000 / an en France. Incidence d'un sepsis ~1%

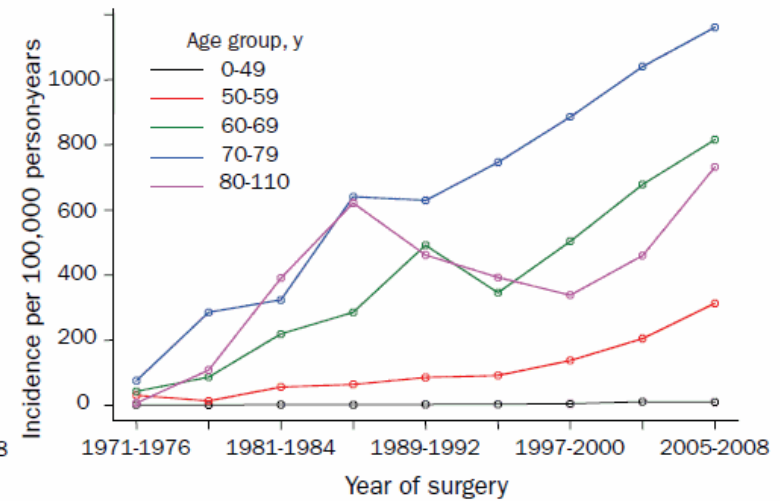
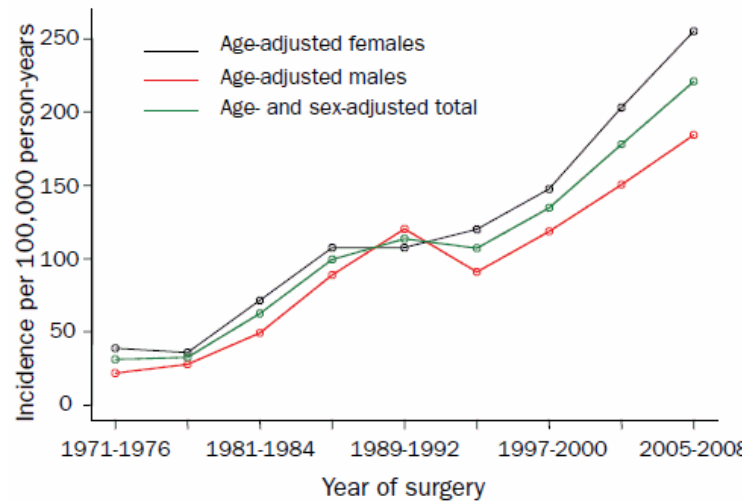
# A Population-Based Study of Trends in the Use of Total Hip and Total Knee Arthroplasty, 1969-2008

JASVINDER A. SINGH, MD, MPH; MICHAEL B. VESSELY, MD; W. SCOTT HARMSEN, MS;  
 CATHY D. SCHLECK, BS; L. JOSEPH MELTON III, MD; ROBERT L. KURLAND, MD; AND DANIEL J. BERRY, MD

**PTH**



**PTG**



# Projections of Primary and Revision Hip and Knee Arthroplasty in the United States from 2005 to 2030

J Bone Joint Surg Am. 2007;89:780-5

By Steven Kurtz, PhD, Kevin Ong, PhD, Edmund Lau, MS, Fionna Mowat, PhD, and Michael Halpern, MPH, MD, PhD

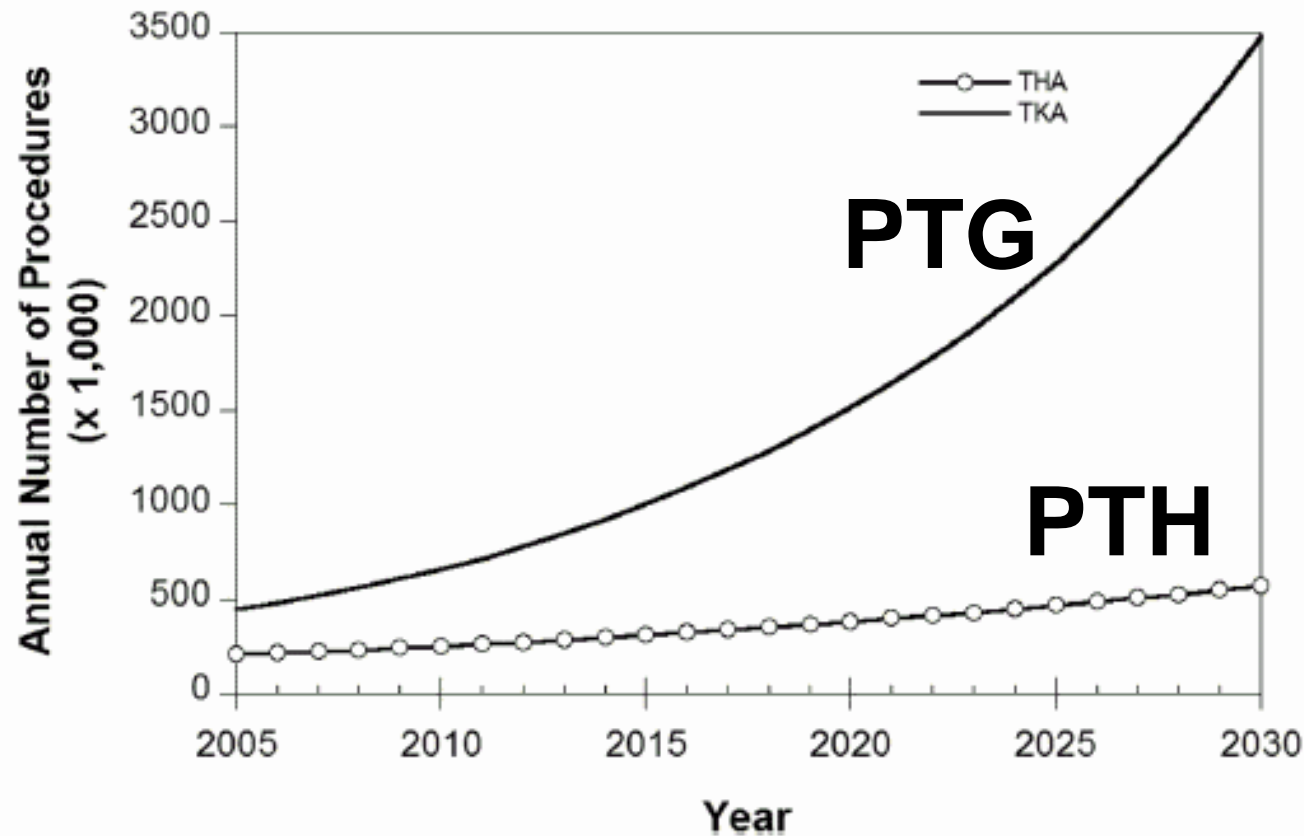


Fig. 1

The projected number of primary total hip arthroplasty (THA) and total knee arthroplasty (TKA) procedures in the United States from 2005 to 2030.

# Infection de prothèse

## Complexité !

- Infection nosocomiale (jusqu'à 1 an post-op)
- Chirurgie lourde
- Antibiothérapie prolongée (contrainte, toxicité)
- Morbidité élevée (absence d'appui, iatrogénie)
- Hospitalisation prolongée (plusieurs mois)
- Séquelles fonctionnelles (boiterie, amputation)
- Arrêt de travail prolongé
  - 50% arrêt définitif de l'activité professionnelle
  - 50% arrêt de travail de 2 ans
- Rechutes fréquentes dans certains cas (2 ans)  
**Ferry et al. *EJCMID* 2010**
- Surcoût pour la société > 50,000 USD / épisode  
**Zimmerli et al. *NEJM* 2004**

# Microbiology of 578 prosthetic joint infections seen at Mayo Clinic between 1992-1997

Microorganism	%
Coagulase-negative staphylococci	30 %
<i>S. aureus</i>	23 %
Polymicrobial	12 %
Unknown	11 %
Streptococci	9 %
Gram-negative bacilli	6 %
Anaerobes	4 %
Enterococci	3 %
Other	2 %

Steckelberg et al. Prosthetic Joint Infections,  
Infections Associated with Indwelling Medical Devices, 3rd edition, ASM Press, 2000

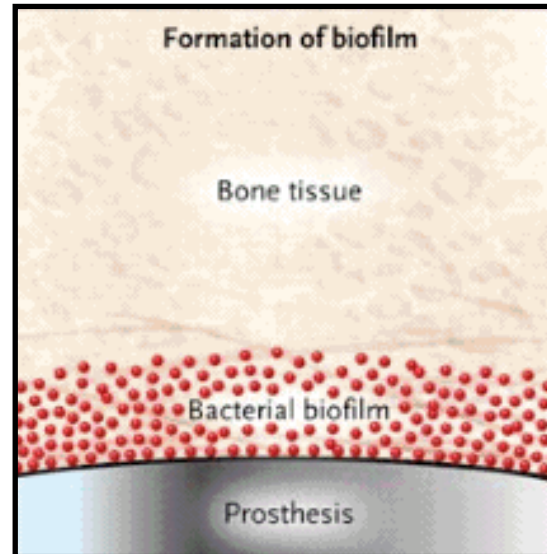
# Classification

Infection aiguë

Infection chronique



Traitement conservateur

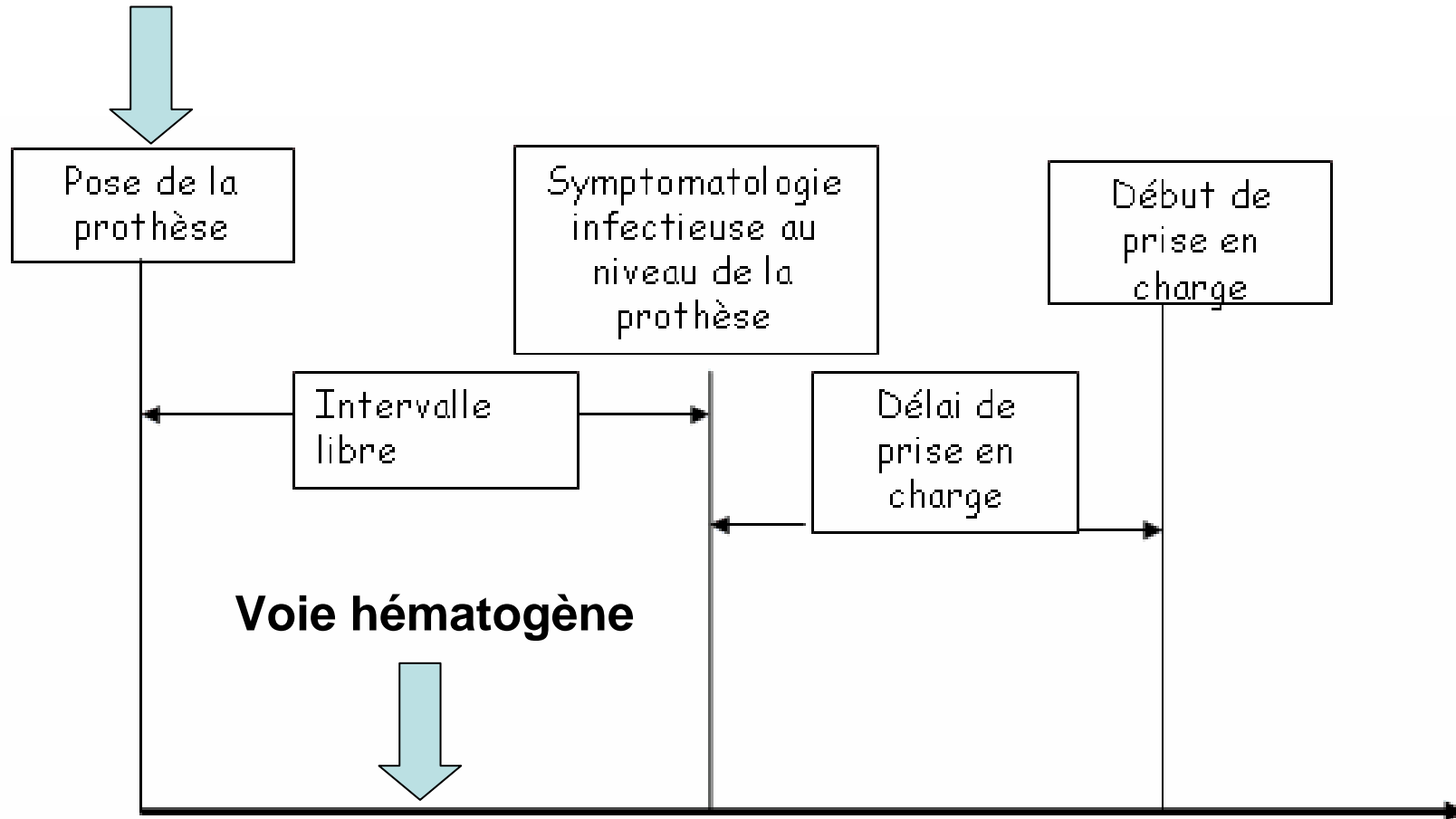


Ablation de l'implant

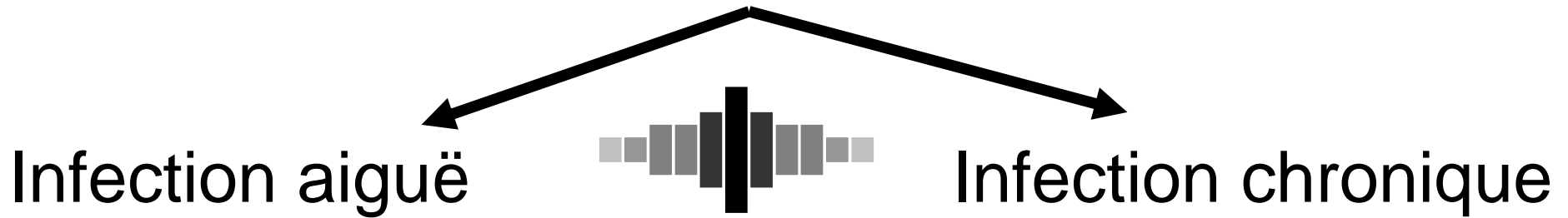


# Classification

**Inoculation  
peropératoire**



# Classification



## Pour le microbiologiste

« Avant que le biofilm ne soit formé »

## Pour le clinicien

« Guérissable avec un traitement conservateur »

## **Définition Zimmerli et al. *NEJM* 2004**

Durée des symptômes cliniques < 3 semaines

Hématogène

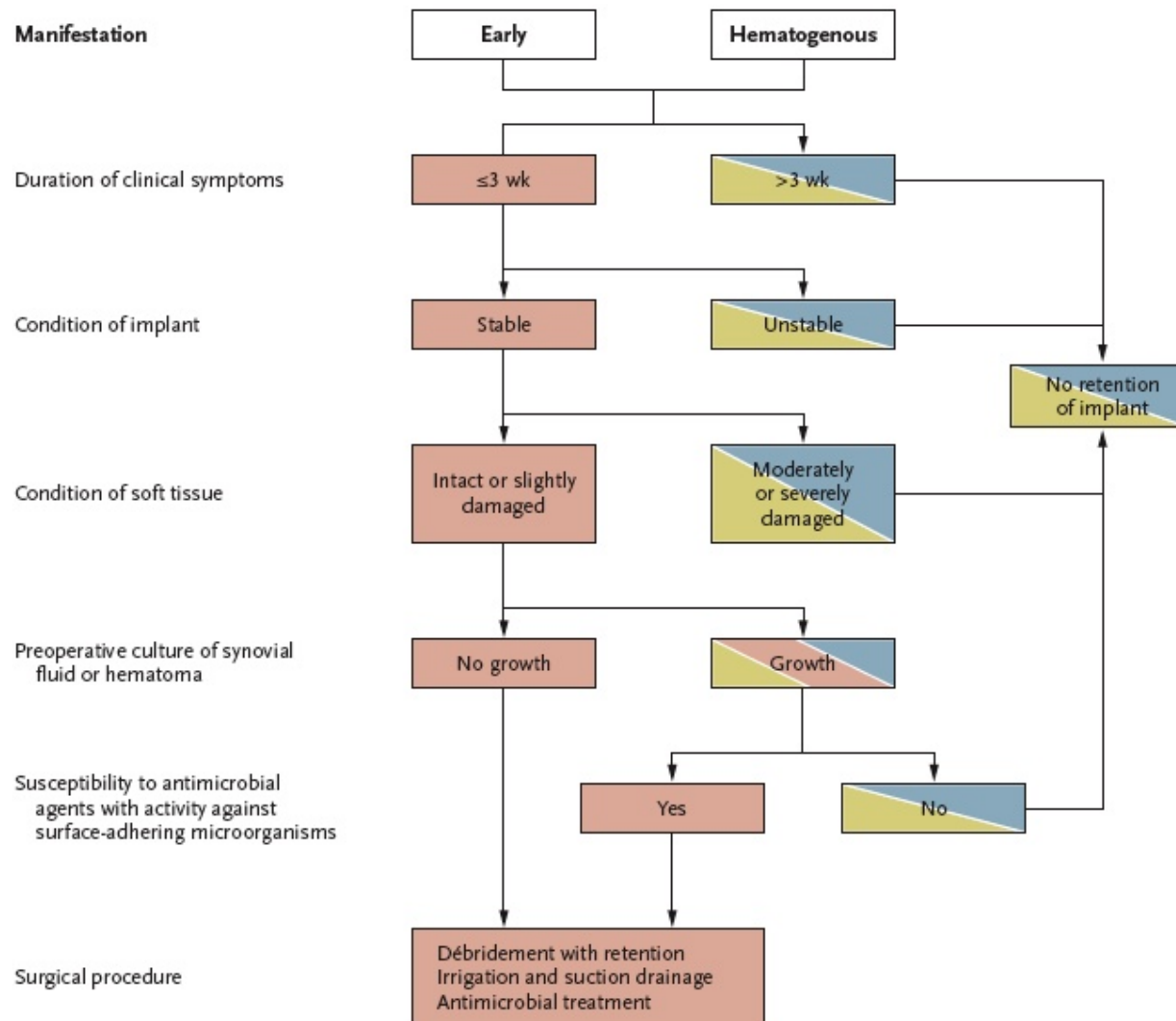
Ou

Post-opératoire précoce (<1 mois, <3 mois)

CURRENT CONCEPTS

# Prosthetic-Joint Infections

Werner Zimmerli, M.D., Andrej Trampuz, M.D., and Peter E. Ochsner, M.D.



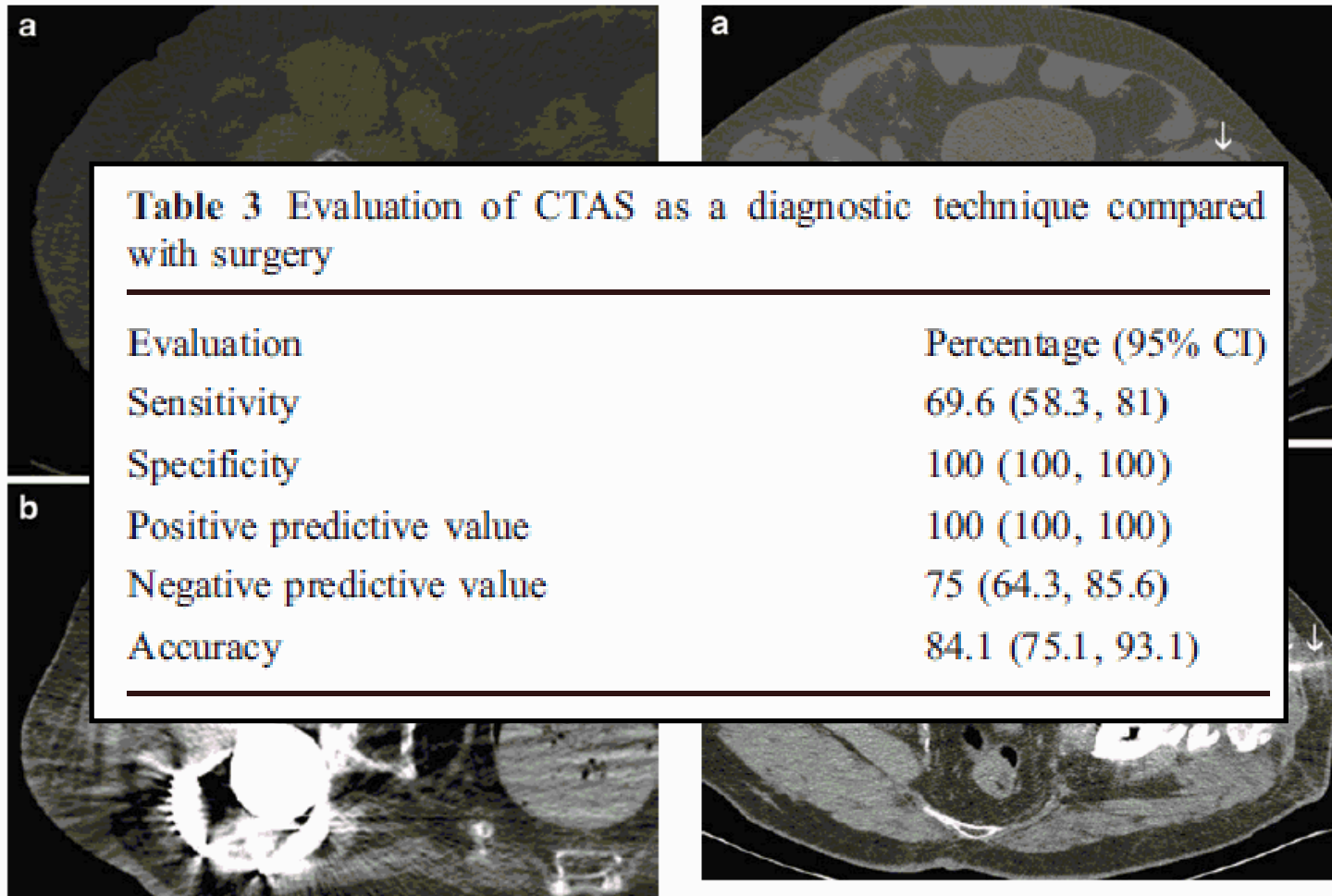
# Indication du 1 temps

- Avoir la connaissance de la bactérie
- Sensibilité aux antibiotiques
- Terrain
  - Pas de chirurgie multiple sur le site infecté
  - Risque opératoire

***Conférence de consensus SPILF 2009***

## Accuracy of CT-guided joint aspiration in patients with suspected infection status post-total hip arthroplasty

Xavier Tomas • Guillem Bori • Sebastián García • Ana Isabel García-Diez •  
Jaime Pomes • Alex Soriano • Jose Ríos • Manel Almela • Josep Mensa •  
Xavier Gallart • Juan Carlos Martínez • Josep Riba



**Table 3** Evaluation of CTAS as a diagnostic technique compared with surgery

Evaluation	Percentage (95% CI)
Sensitivity	69.6 (58.3, 81)
Specificity	100 (100, 100)
Positive predictive value	100 (100, 100)
Negative predictive value	75 (64.3, 85.6)
Accuracy	84.1 (75.1, 93.1)

# Facteurs de risque d'échec

- Polyarthrite rhumatoïde
- Diabète
- Descellement
- Durée des symptômes
- Fistule
- Infection à *S. aureus*
- Ne pas suivre les recommandations



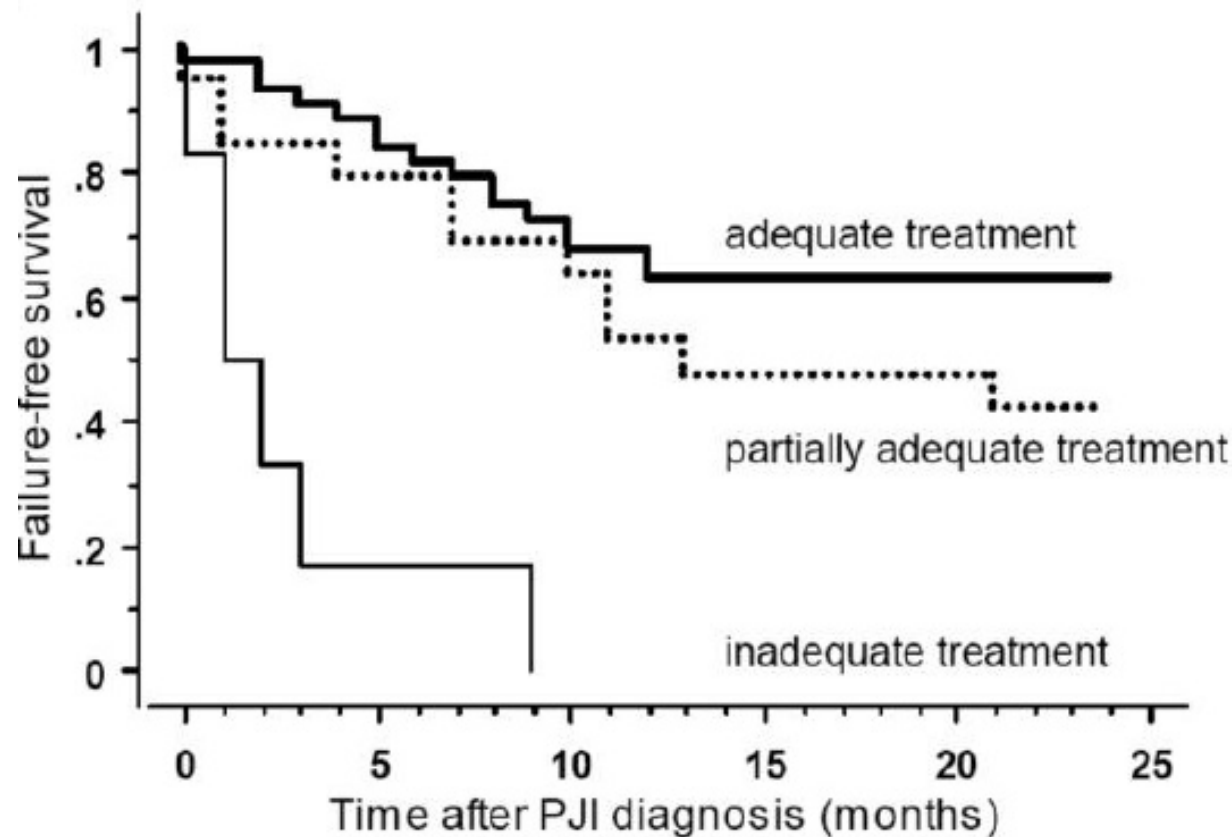
Zimmerli *NEJM* 2004, Betsch *CID* 2008, Marculescu *CID* 2006,  
Lee *J Hospit Infect* 2010

# Treatment of Joint Prosthesis Infection in Accordance with Current Recommendations Improves Outcome

Clinical Infectious Diseases 2008;46:1221-6

Belinda Y. Betsch,<sup>1</sup> Stefan Eggli,<sup>2</sup> Klaus A. Siebenrock,<sup>2</sup> Martin G. Täuber,<sup>1,3</sup> and Kathrin Mühlemann<sup>1,3</sup>

Departments of <sup>1</sup>Infectious Diseases and <sup>2</sup>Orthopedic Surgery, University Hospital Bern, and <sup>3</sup>Institute for Infectious Diseases, University of Bern, Bern, Switzerland



# Outcome of Prosthetic Joint Infections Treated with Debridement and Retention of Components

C. E. Marculescu,<sup>1</sup> E. F. Berbari,<sup>2</sup> A. D. Hanssen,<sup>3</sup> J. M. Steckelberg,<sup>2</sup> S. W. Harmsen,<sup>4</sup> J. N. Mandrekar,<sup>4</sup> and D. R. Osmon<sup>2</sup>

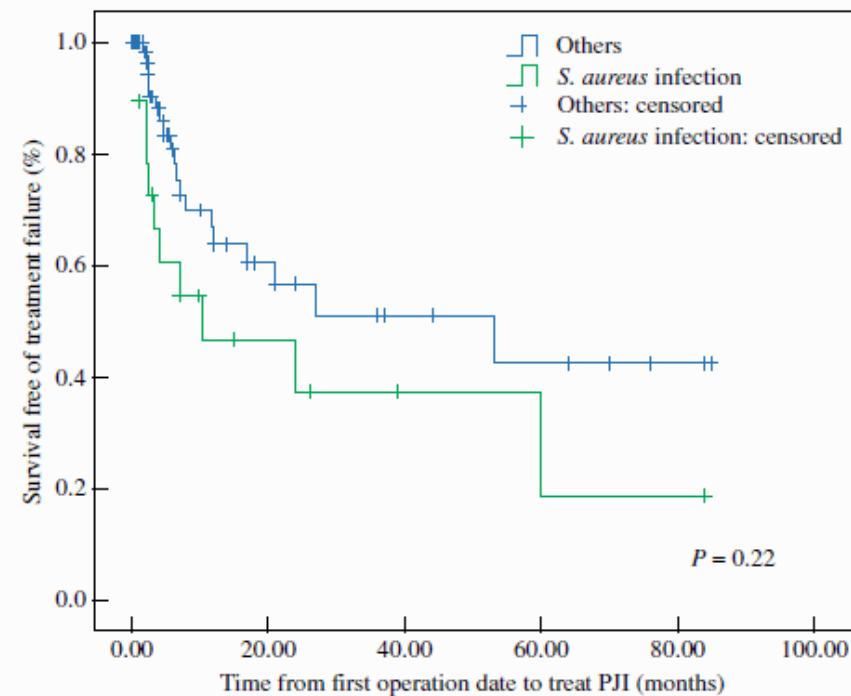
<sup>1</sup>Division of Infectious Diseases, Medical University of South Carolina, Charleston; and <sup>2</sup>Division of Infectious Disease, Department of Internal Medicine, <sup>3</sup>Department of Orthopedics, and <sup>4</sup>Department of Biostatistics, Mayo Clinic College of Medicine, Rochester, Minnesota

Clinical Infectious Diseases 2006;42:471–8

**Table 6. Univariate assessment of risk factors for treatment failure among patients with prosthetic joint infection treated with debridement and retention of prosthesis.**

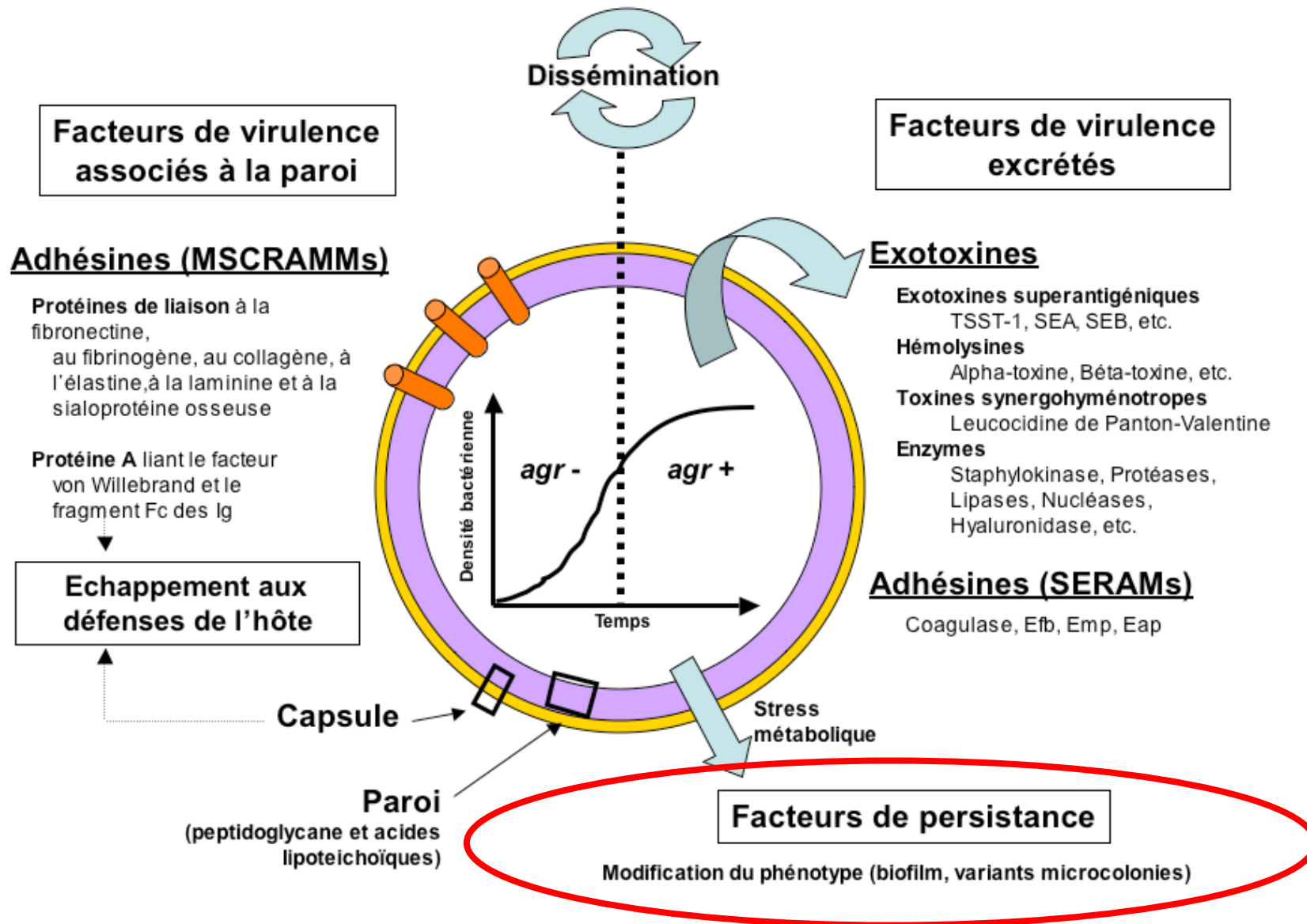
Variable	Hazard ratio (95% CI)	P
Infecting microorganism		
<i>Staphylococcus aureus</i>	5.14 (2.36–11.20)	<.00
Coagulase-negative staphylococci	0.43 (0.12–1.62)	.21
Streptococci	0.80 (0.30–2.12)	.65
Other <sup>a</sup>	1.0 (reference)	
Diabetes mellitus		
Present	1.13 (0.53–2.41)	.75
Absent	1.0 (reference)	
Sinus tract		
Present	2.85 (1.50–5.44)	.002
Absent	1.0 (reference)	
Duration of symptoms		
≥8 days	1.79 (1.04–3.09)	.04
<8 days	1.0 (reference)	
Joint age		
≥31 days	0.65 (0.25–1.65)	.36
<31 days	1.0 (reference)	
Rheumatoid arthritis		
Present	1.34 (0.42–4.34)	.61
Absent	1.0 (reference)	
Joint location		
Total knee arthroplasty	1.09 (0.63–1.89)	.75
Total hip arthroplasty	1.0 (reference)	

Lee et al. *J Hospit Infect* 2010;75:273–6



**Figure 1.** Treatment failure-free survival among 93 episodes of prosthetic joint infection (PJI).

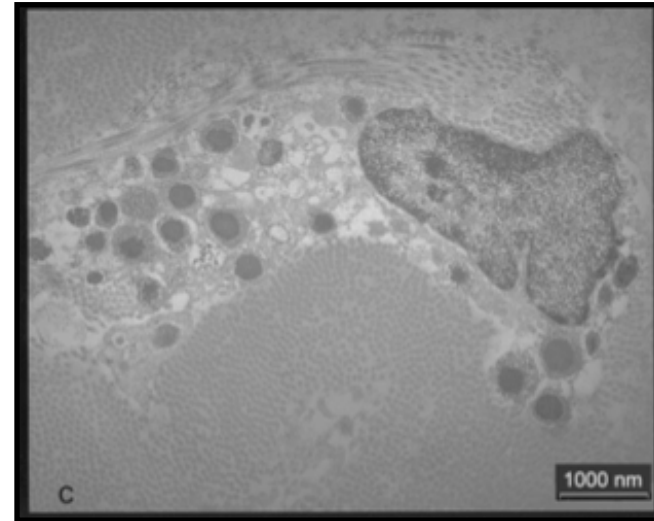
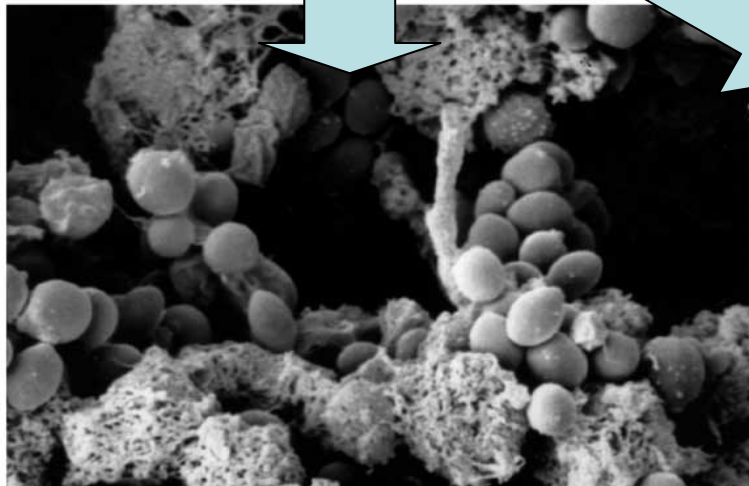
# Facteur de virulence de *S. aureus*



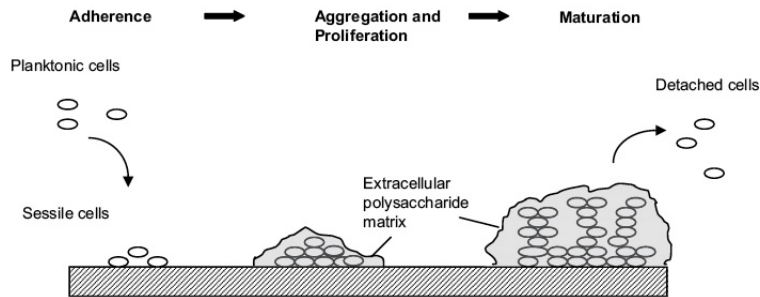
# Staphylococcus aureus Small Colony Variants in Prosthetic Joint Infection

Parham Sendi,<sup>1</sup> Markus Rohrbach,<sup>2</sup> Peter Graber,<sup>1</sup> Reno Frei,<sup>3</sup> Peter E. Ochsner,<sup>2</sup> and Werner Zimmerli<sup>1</sup>

<sup>1</sup>Unit of Infectious Diseases, Basel University Medical Clinic Liestal and <sup>2</sup>Clinic of Orthopedic Surgery, Kantonsspital, Liestal, and <sup>3</sup>Microbiology Laboratory, University Hospital Basel, Basel, Switzerland

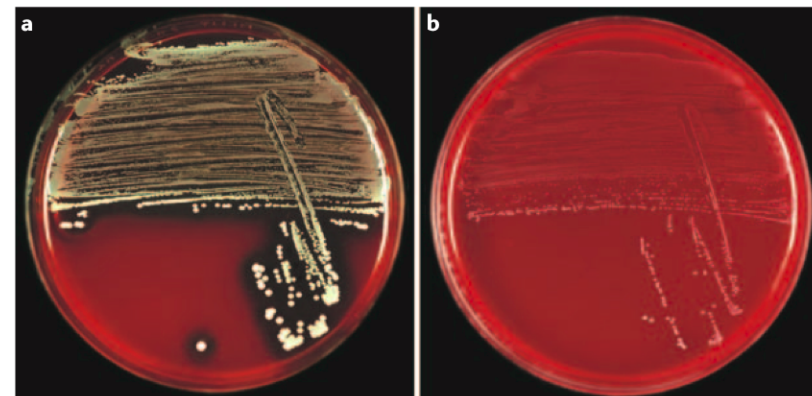


Sendi et al. *Clin Infect Dis.* 2006



Yarwood JM, *J Bacteriol* 2004

Zimmerli W, *NEJM* 2004

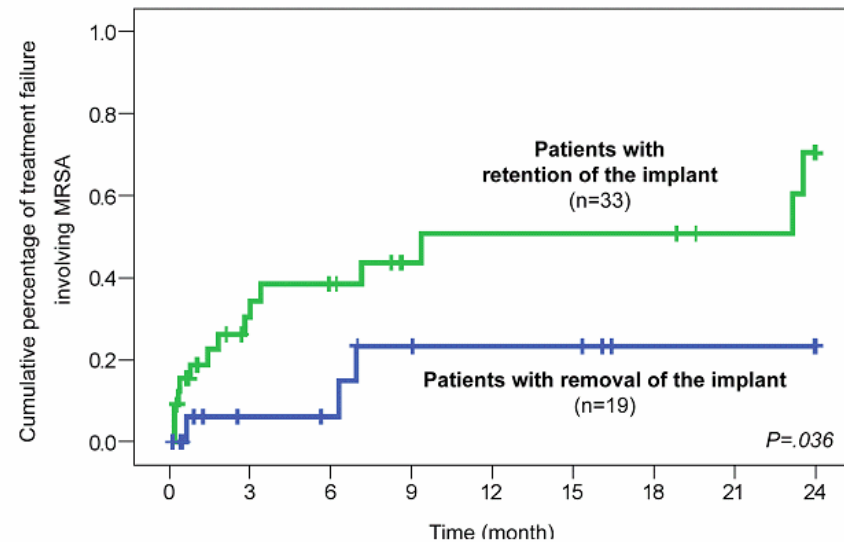


Proctor RA, *Nat Rev Microbiol* 2006

ARTICLE

# Risk factors for treatment failure in orthopedic device-related methicillin-resistant *Staphylococcus aureus* infection

T. Ferry • I. Uçkay • P. Vaudaux • P. François •  
 J. Schrenzel • S. Harbarth • F. Laurent • L. Bernard  
 F. Vandenesch • J. Etienne • P. Hoffmeyer • D. Lew



Patients with MRSA treatment failure	0	10	12	15	16	16	16	16	18
Patients lost to follow-up	0	7	9	13	14	14	17	19	22
Patients died	0	6	7	8	8	8	8	8	8
Patients at risk	52	29	24	16	14	14	11	9	4
% of lost to follow-up	0	13	17	25	27	27	32	37	42

# Periprosthetic Joint Infection

## The Economic Impact of Methicillin-Resistant Infections

Javad Parvizi, MD, FRCS,\* Ian M. Pawasarat, MA,\* Khalid A. Azzam, MD,\*  
Ashish Joshi, MD, MPH,\* Erik N. Hansen, MD,† and Kevin J. Bozic, MD, MBA†

The Journal of Arthroplasty Vol. 25 No. 6 Suppl. 1 2010

	Methicillin Resistant	Methicillin Sensitive	<i>P</i>	Methicillin Resistant/ Methicillin Sensitive Quotient
I and D				
Mean	32 720	18 734.2	.001	1.7465
SD	38 657.9	13 122.8		
n	132	92		
Resection arthroplasty				
Mean	30 387.4	23 459.5	.0199	1.2953
SD	31 719.5	19 071.1		
n	237	139		
Revision (1-stage exchanges)				
Mean	36 606.6	25 886	.033	1.4141
SD	22 005.5	19 177.5		
n	45	30		
Reimplantation				
Mean	35 022.4	26 775.7	.0105	1.3080
SD	32 473.3	13 447.9		
n	170	115		

**Staphylocoque  
sensible  
68'053 \$**

**Staphylocoque  
résistant  
107'264 \$**

# Molécules antistaphylococcique et antibiofilm

- Rifampicine
- Rifampicine
- Rifampicine
- Rifampicine.....

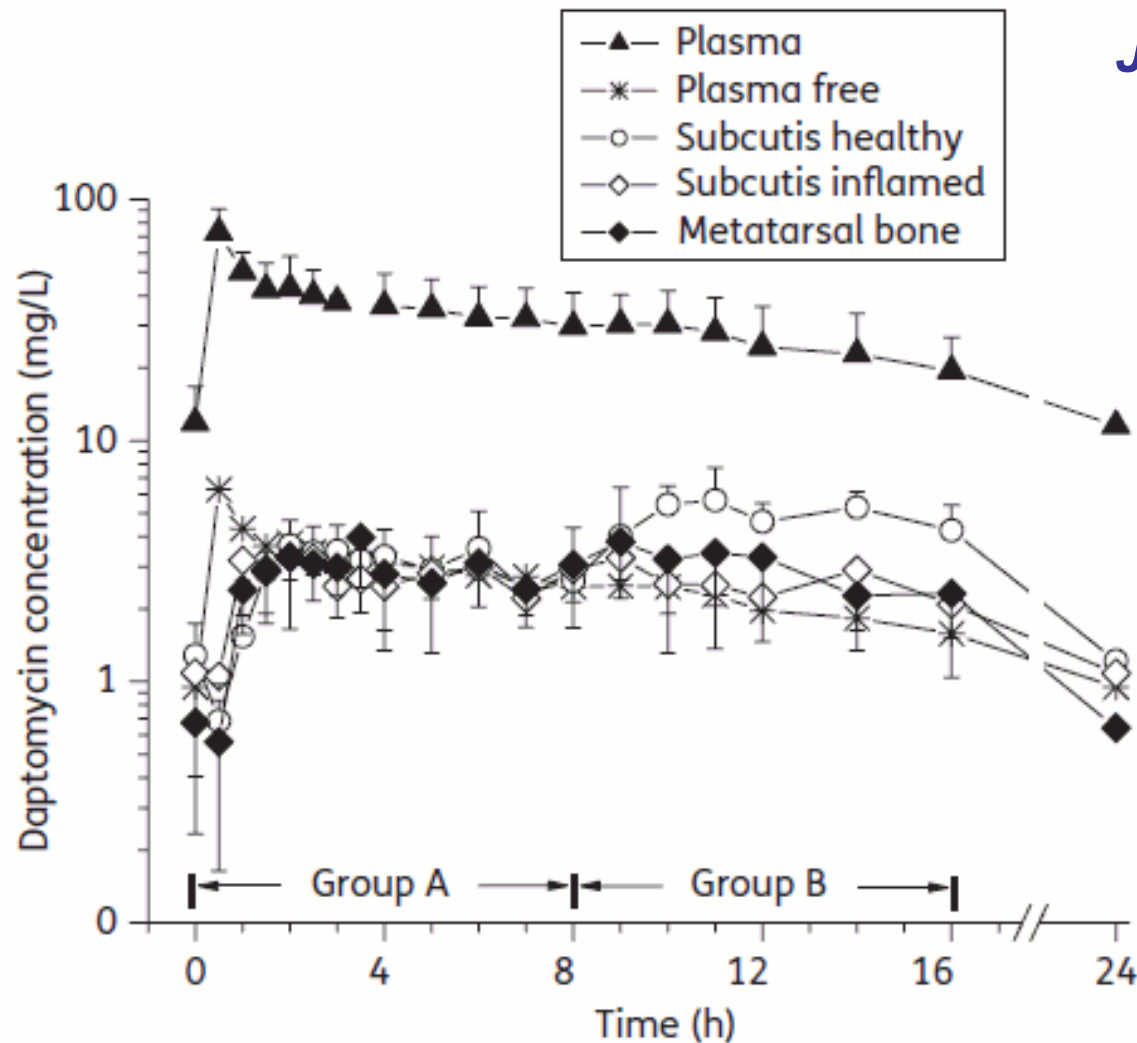
## *Oui mais :*

- jamais en monothérapie (pas avec la clindamycine!)
- interactions médicamenteuses
- à quelle dose ?

# Soft tissue and bone penetration abilities of daptomycin in diabetic patients with bacterial foot infections

Friederike Traunmüller<sup>1,2†</sup>, Michael V. Schintler<sup>1†</sup>, Julia Metzler<sup>1</sup>, Stephan Spendel<sup>1</sup>, Oliver Mauric<sup>2</sup>, Martin Popovic<sup>2,3</sup>, Karl Heinz Konz<sup>4</sup>, Erwin Scharnagl<sup>1</sup> and Christian Joukhadar<sup>1,2,5,6\*</sup>

JAC 2010



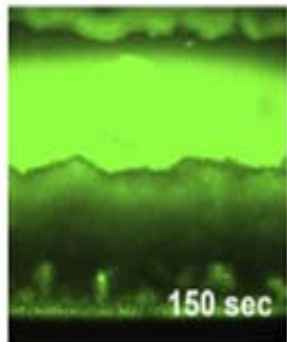
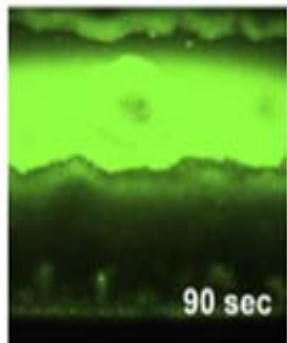
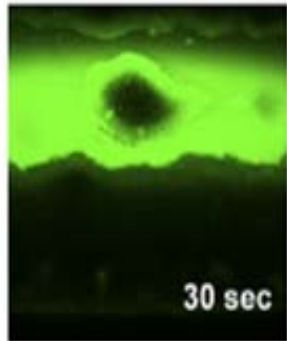
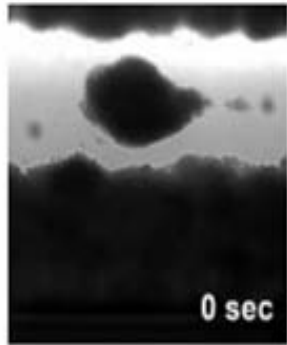
## Daptomycin Rapidly Penetrates a *Staphylococcus epidermidis* Biofilm<sup>∇†</sup>

Philip S. Stewart,<sup>1\*</sup> William M. Davison,<sup>1</sup> and Judith N. Steenbergen<sup>2</sup>

Center for Biofilm Engineering and Department of Chemical and Biological Engineering, Montana State University, Bozeman, Montana,<sup>1</sup> and Cubist Pharmaceuticals, Lexington, Massachusetts<sup>2</sup>

Received 31 December 2008/Returned for modification 4 May 2009/Accepted 13 May 2009

Fluorescently tagged daptomycin accessed the interior of *Staphylococcus epidermidis* biofilm cell clusters within minutes. The diffusion coefficient of daptomycin in the biofilm was 28% of its value in pure water. Daptomycin activity against staphylococci embedded in biofilms is unlikely to be limited by penetration of the antibiotic into the biofilm.

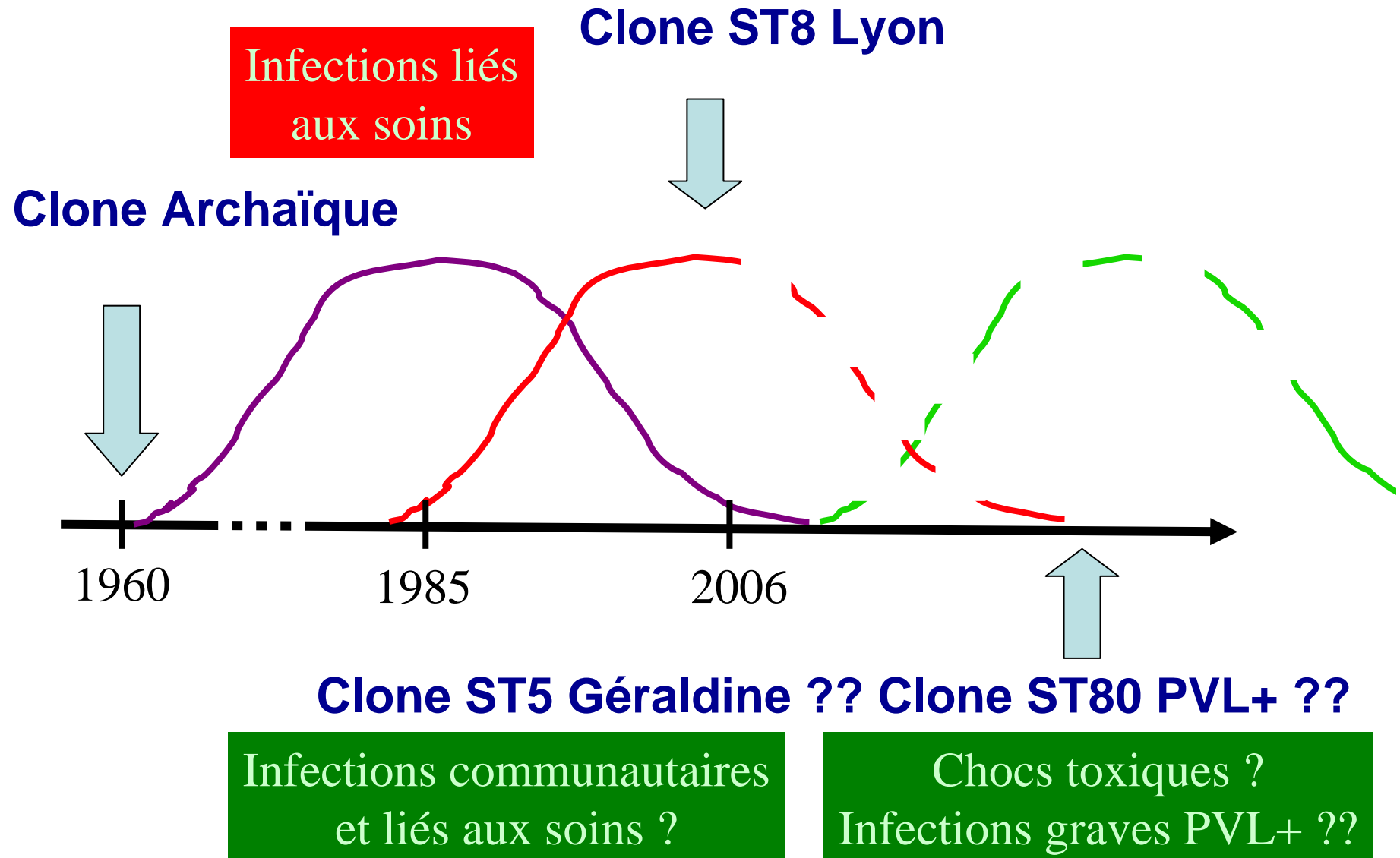


Cinétique de pénétration dans le biofilm  
Microscopie électronique confocale  
Marquage Bodipy Daptomycine

**Coeff diffusion = 28%**

**Stewart et al. AAC 2009;53:3505-7**

# L'avenir des clones MRSA en France



# Conclusion

- Conférence de consensus (SPILF 2009)
- Respect des recommandations
- Attention à *S. aureus*
  - Plus d'échec
  - Epidémiologie des clones MRSA
- Utilisation de molécules antibiofilm
  - Rifampicine
  - Daptomycine ?