INFECTIONS PÉRI-PROTHÈTIQUES: REVUE DE LA LITTERATURE ORTHOPÉDIQUE

PROFESSEUR CHRISTOPHE NICH
CLINIQUE CHIRURGICALE ORTHOPÉDIQUE ET TRAUMATOLOGIQUE (CCOT)
HOTEL-DIEU
NANTES

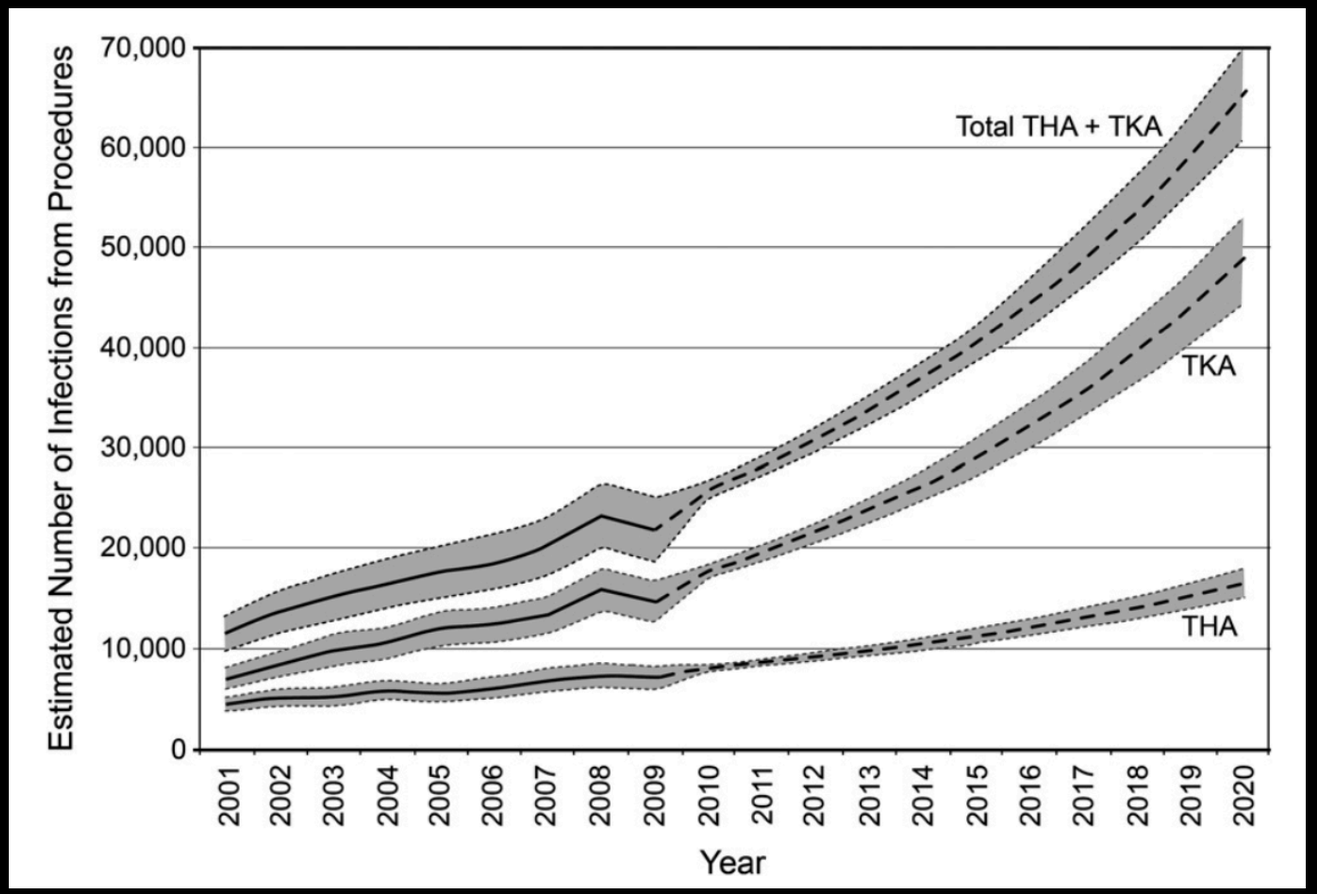
CENTRES DE RÉFÉRENCE
POUR LES INFECTIONS OSTÉO-ARTICULAIRES COMPLEXES
DU GRAND OUEST
CRIOGO

CENTRE HOSPITALIER
UNIVERSITAIRE DE NANTES

9EME JOURNEE SCIENTIFIQUE CRIOGO NANTES 29 NOVEMBRE 2019

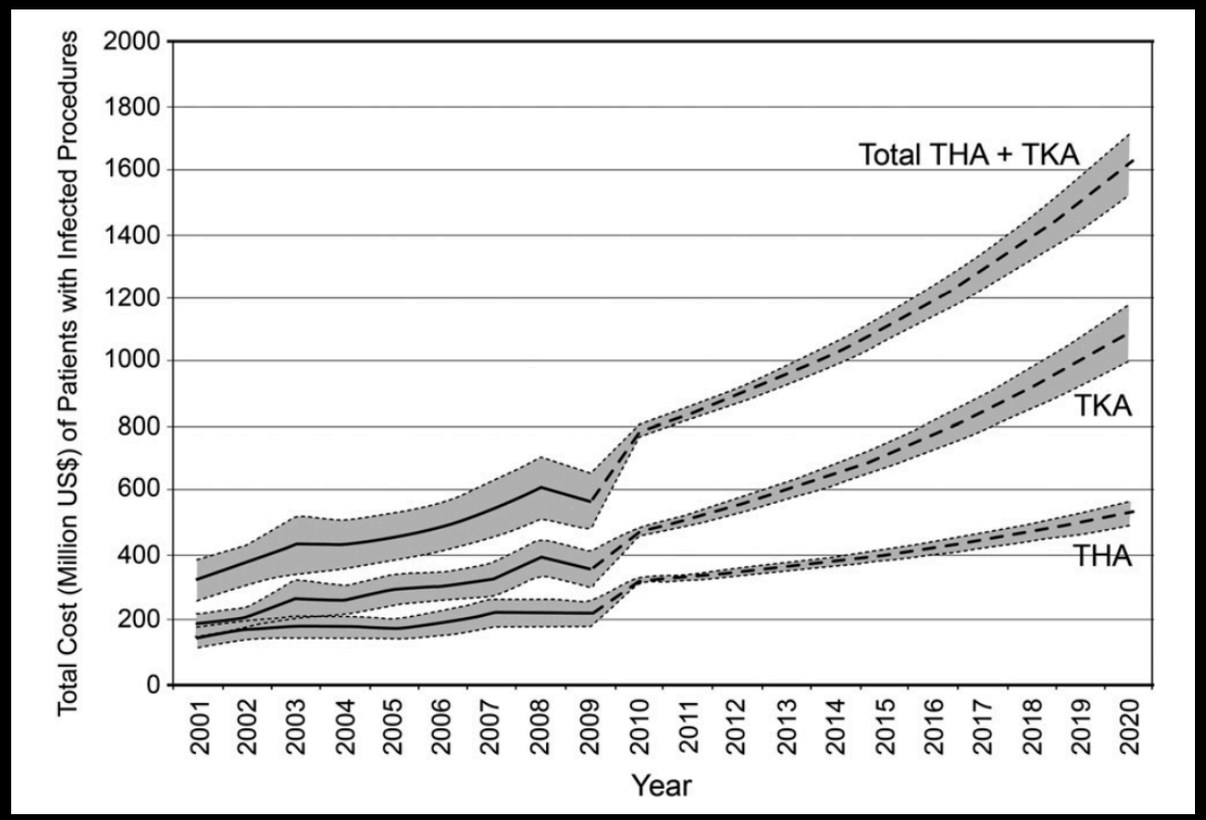
EPIDEMIOLOGIE

LE NOMBRE D'INFECTIONS PÉRI-PROTHÈTIQUES (IPP) AUGMENTE REGULIEREMENT…



Nbre d'infections (projection) ATH-ATG

…ET LEUR COÛT AUSSI….



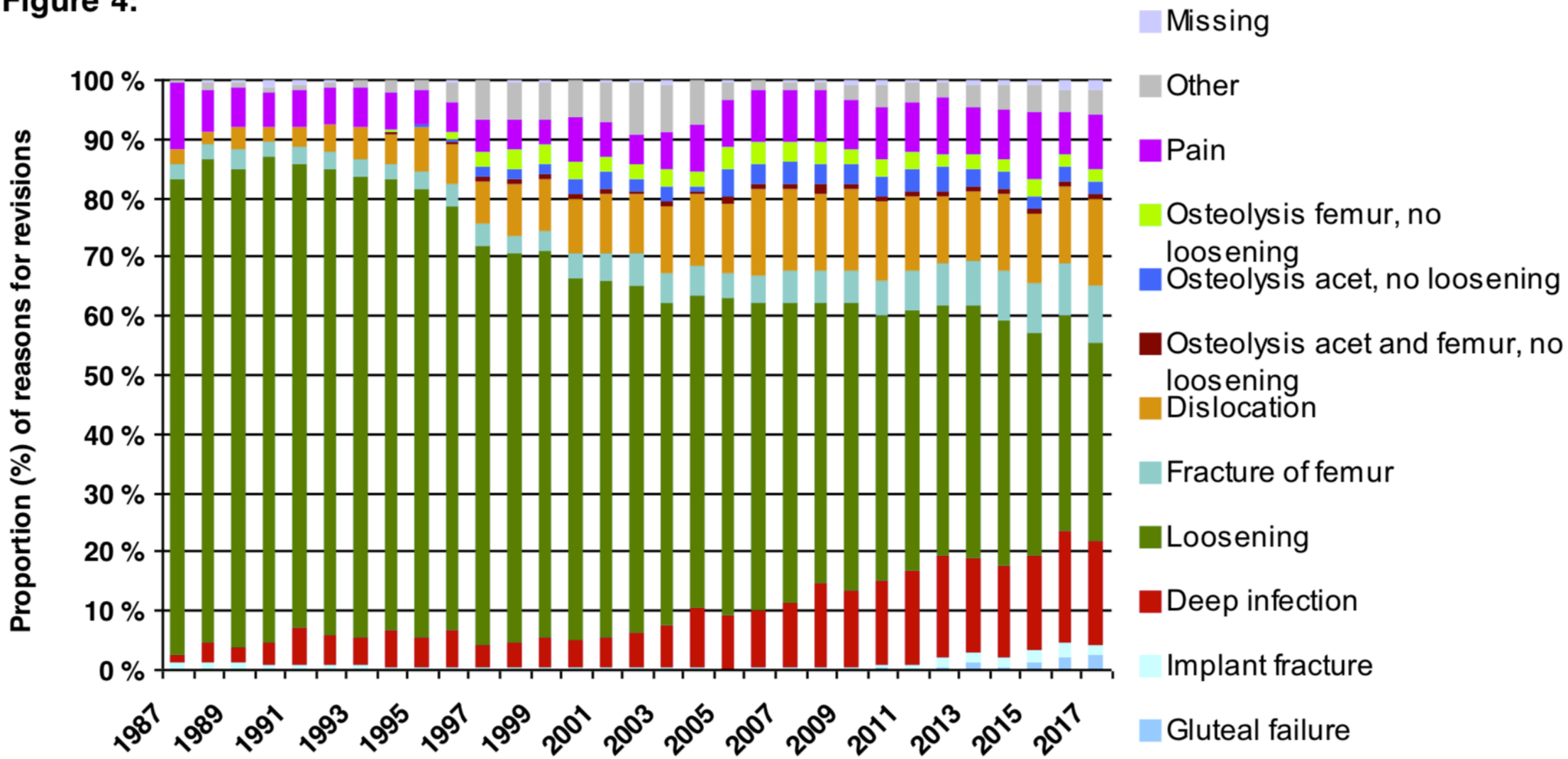
Coût (projection)

Kurtz, JOA, 2012

EPIDEMIOLOGIE

MOTIFS DE REPRISE (ATH)

Figure 4:

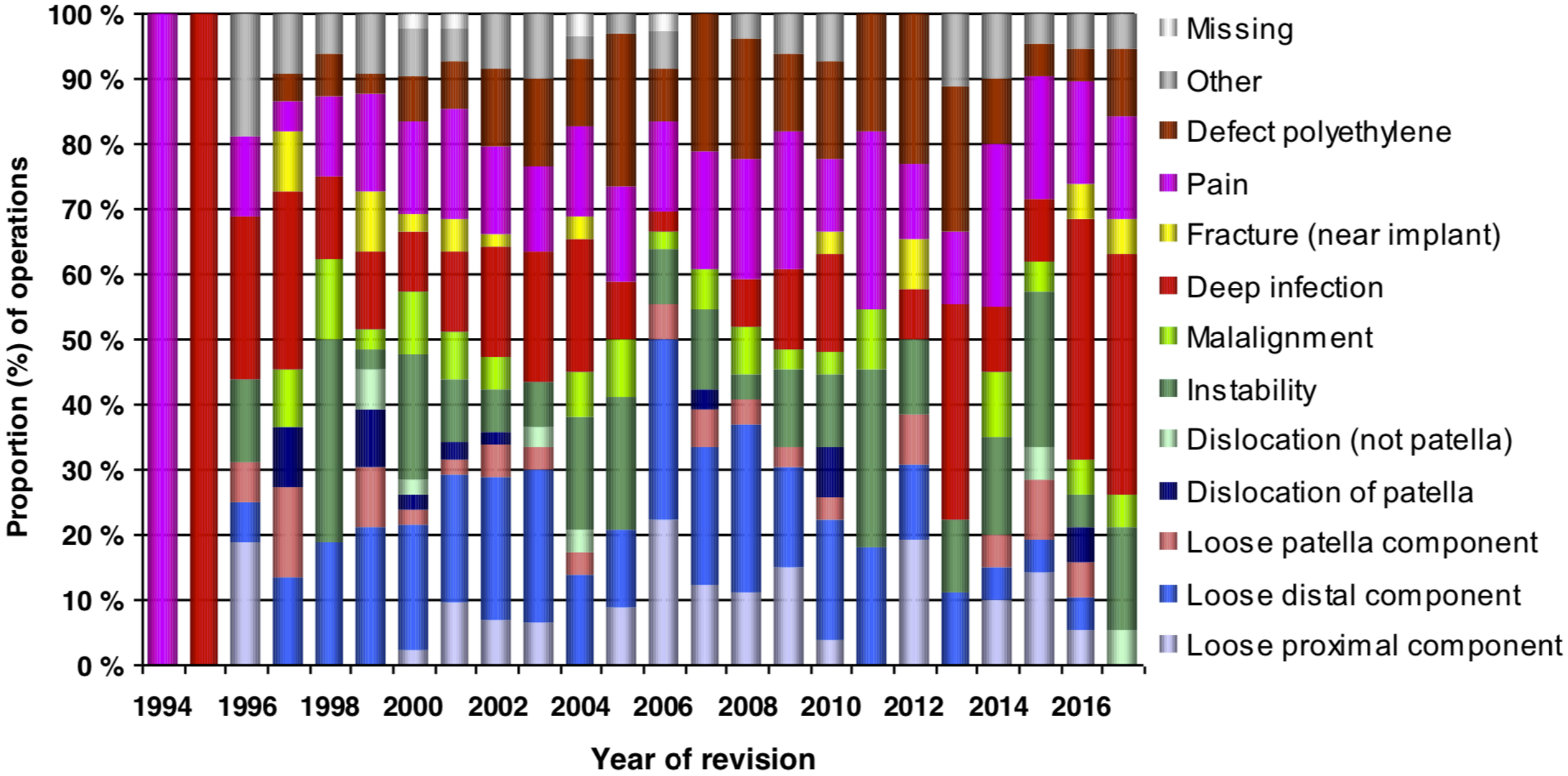


Registre Norvégien des Arthroplasties, 2018

EPIDEMIOLOGIE

MOTIFS DE REPRISE (ATG)

Figure 16: Reasons for revisions of total knee prostheses with patella



Registre Norvégien des Arthroplasties, 2018

EPIDEMIOLOGIE

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Complications - Infection

Are We Winning or Losing the Battle With Periprosthetic Joint Infection: Trends in Periprosthetic Joint Infection and Mortality Risk for the Medicare Population

Steven M. Kurtz, PhD [a, b, *], Edmund C. Lau, MS [c], Min-Sun Son, PhD [c], Ellen T. Chang, ScD [c], Werner Zimmerli, MD [d], Javad Parvizi, MD [e]

JOA, 2018

- Autour de **1% pour ATH** (primaires) / **1,4% pour ATG** ==> stable sur 2005-2015, mais ↗↗ en nombre absolu

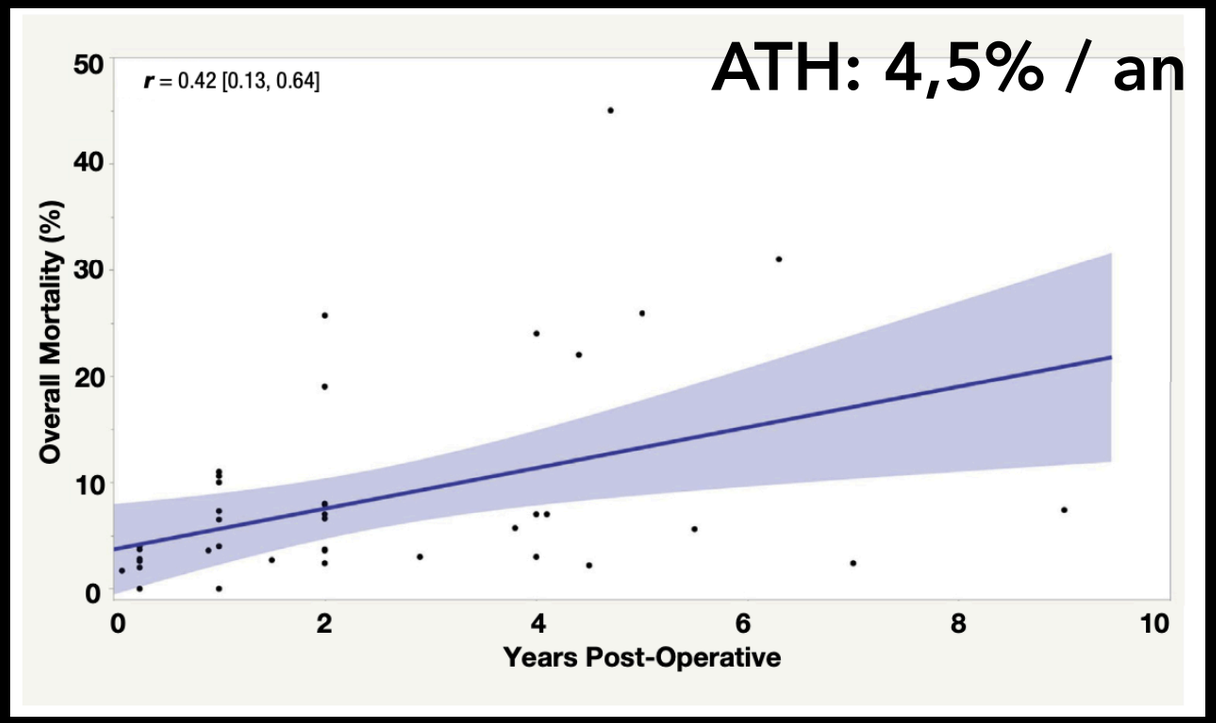
- **FDR principaux**
  - ATG > ATH
  - ATH: obésité, maladies cardiaques, sexe masculin
  - ATG: sexe masculin, maladies cardiaques, score de Charlson (prédictif de mortalité à un an)

EPIDEMIOLOGIE

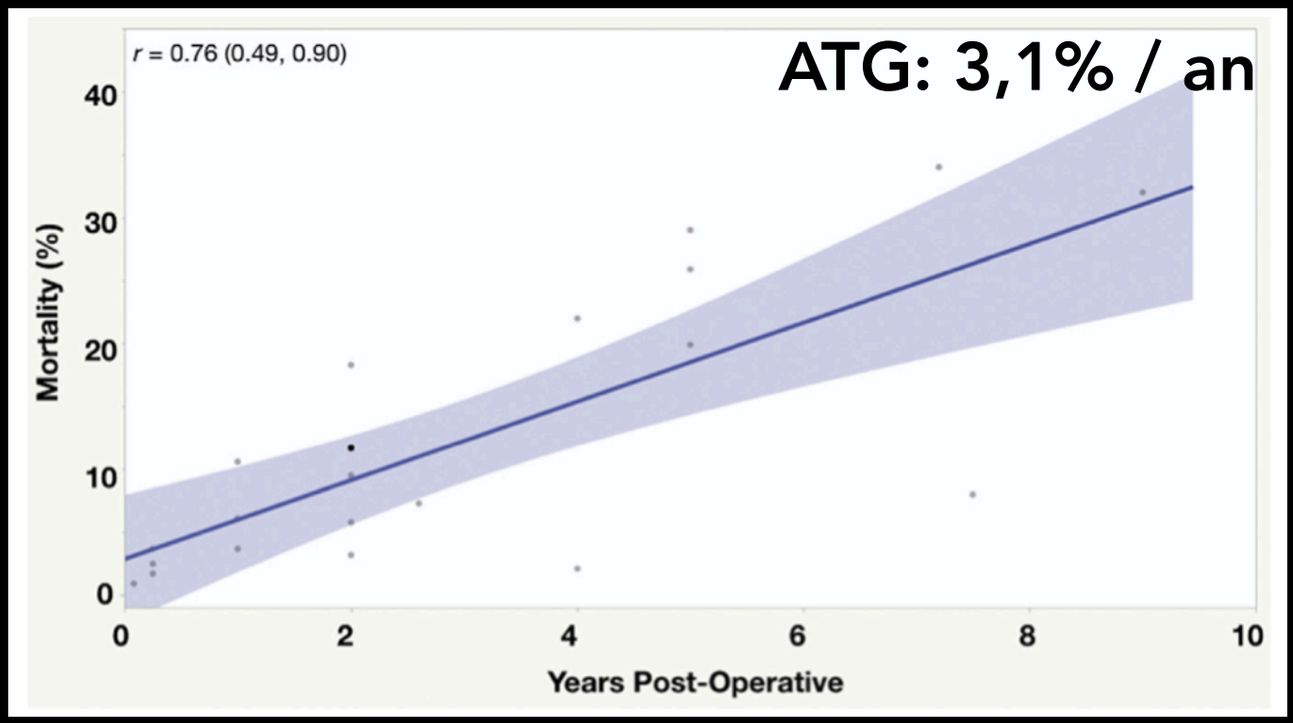
- Morbi/mortalité liée aux IPP
  - **Mortalité = élevée +++**
    - ATH > ATG
    - survie à 5 ans après IPP
      - ATH = 67%
      - ATG = 72%

= Kc prostate, sein

- **Risque DC (OR): X 3 à 3,6 / pop générale**



Natsuhara, JOA, 2018



Lum, JOA, 2018

DIAGNOSTIC

INFECTIONS PÉRI-PROTHÉTIQUES

Musculo Skeletal Infection Society 2018 (*Parvizi, JOA, 2018*)

Major criteria (at least one of the following)	Decision
Two positive cultures of the same organism	Infected
Sinus tract with evidence of communication to the joint or visualization of the prosthesis	

		Minor criteria	Score	Decision
Preoperative Diagnosis	Serum	Elevated CRP *or* D-Dimer	2	≥ 6 Infected 2–5 Possibly Infected 0–1 Not Infected
		Elevated ESR	1	
	Synovial	Elevated synovial WBC count *or* LE	3	
		Positive alpha-defensin	3	
		Elevated synovial PMN (%)	2	
		Elevated synovial CRP	1	

	Inconclusive pre-op score *or* dry tap	Score	Decision
Interoperative Diagnosis	Preoperative score	-	≥ 6 Infected **4–5 Inconclusive** ≤ 3 Not Infected
	Positive histology	3	
	Positive purulence	3	
	Single positive culture	2	

DIAGNOSTIC

BIOMARQUEURS SYNOVIAUX: ALPHA-DÉFENSINE

- Test Synovasure: **Sn 54 à 84%** selon les classifications, **Sp > 95% élevée** ==> **<u>test de confirmation, pas de détection</u>**

Renz, JBJSA, 2018

- VPP 100%, VPN 95% (critères MSIS)
- Précision similaire test Synovasure // ELISA

Gehrke, JBJSA, 2018

DIAGNOSTIC

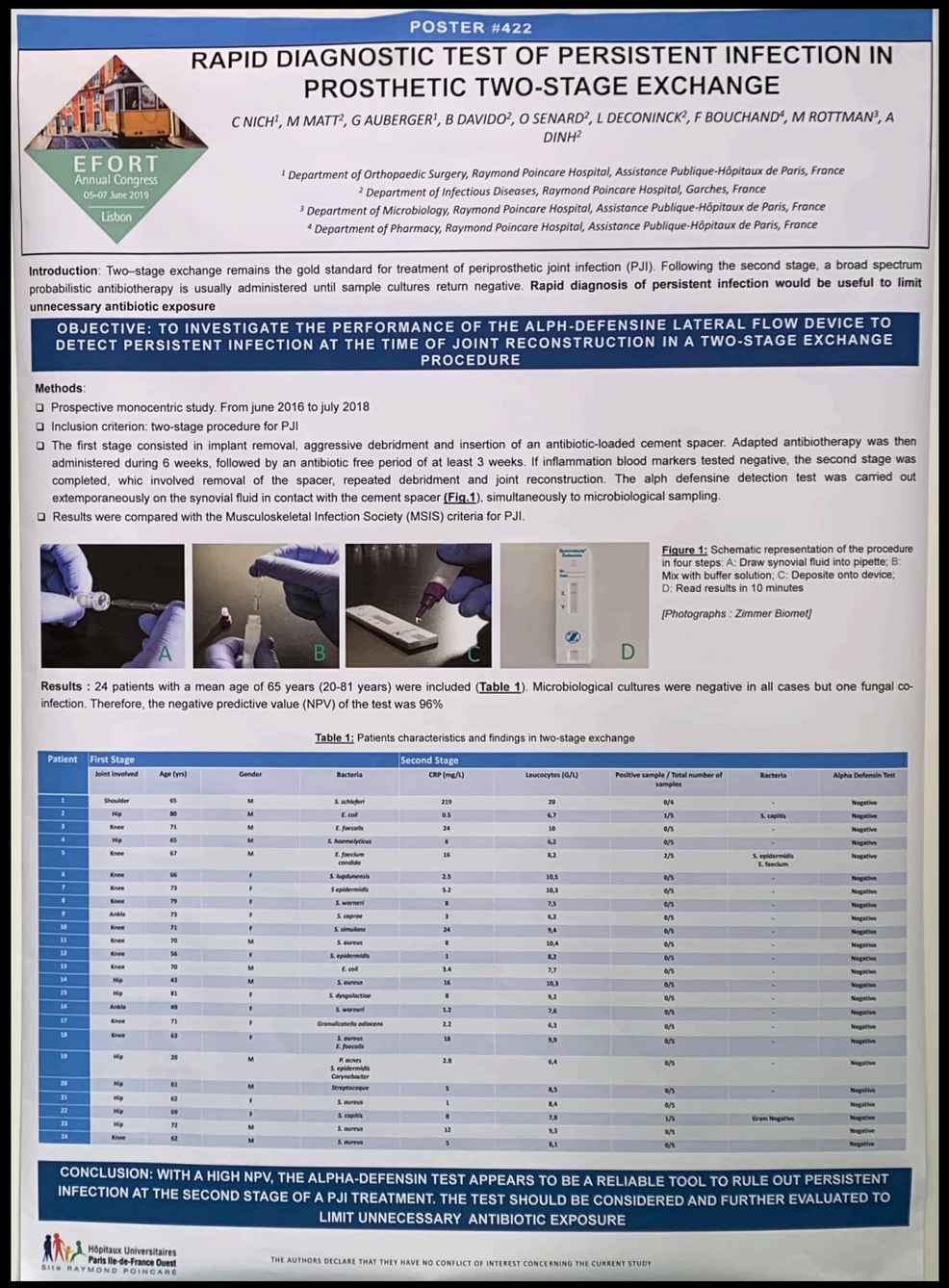
BIOMARQUEURS SYNOVIAUX: ALPHA-DÉFENSINE

- Indication idéale: <u>situations microbiologiques complexes</u>
  - IPP décapitée, discordance des résultats
- Limites du test :
  - Faux positifs: métallose, ALTR, chirurgie < 2 mois
  - Faux négatifs: germes à croissance lente
  - intérêt couplage avec la CRP synoviale

de Saint Vincent, RCO, 2018, Stone, JBJSA, 2018, Okroj, JOA, 2018

DIAGNOSTIC

NICH ET AL, EFORT, LISBONNE, 2019



POSTER #422

RAPID DIAGNOSTIC TEST OF PERSISTENT INFECTION IN PROSTHETIC TWO-STAGE EXCHANGE

C NICH[1], M MATT[2], G AUBERGER[1], B DAVIDO[2], O SENARD[2], L DECONINCK[2], F BOUCHAND[4], M ROTTMAN[3], A DINH[2]

[1] Department of Orthopaedic Surgery, Raymond Poincare Hospital, Assistance Publique-Hôpitaux de Paris, France
[2] Department of Infectious Diseases, Raymond Poincare Hospital, Garches, France
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[4] Department of Pharmacy, Raymond Poincare Hospital, Assistance Publique-Hôpitaux de Paris, France

EFORT Annual Congress 05-07 June 2019 Lisbon

Introduction: Two–stage exchange remains the gold standard for treatment of periprosthetic joint infection (PJI). Following the second stage, a broad spectrum probabilistic antibiotherapy is usually administered until sample cultures return negative. **Rapid diagnosis of persistent infection would be useful to limit unnecessary antibiotic exposure**

OBJECTIVE: TO INVESTIGATE THE PERFORMANCE OF THE ALPH-DEFENSINE LATERAL FLOW DEVICE TO DETECT PERSISTENT INFECTION AT THE TIME OF JOINT RECONSTRUCTION IN A TWO-STAGE EXCHANGE PROCEDURE

Methods:

- Prospective monocentric study. From june 2016 to july 2018
- Inclusion criterion: two-stage procedure for PJI
- The first stage consisted in implant removal, aggressive debridment and insertion of an antibiotic-loaded cement spacer. Adapted antibiotherapy was then administered during 6 weeks, followed by an antibiotic free period of at least 3 weeks. If inflammation blood markers tested negative, the second stage was completed, whic involved removal of the spacer, repeated debridment and joint reconstruction. The alph defensine detection test was carried out extemporaneously on the synovial fluid in contact with the cement spacer (Fig.1), simultaneously to microbiological sampling.
- Results were compared with the Musculoskeletal Infection Society (MSIS) criteria for PJI.

Figure 1: Schematic representation of the procedure in four steps: A: Draw synovial fluid into pipette; B: Mix with buffer solution; C: Deposite onto device; D: Read results in 10 minutes

[Photographs : Zimmer Biomet]

Results : 24 patients with a mean age of 65 years (20-81 years) were included (Table 1). Microbiological cultures were negative in all cases but one fungal co-infection. Therefore, the negative predictive value (NPV) of the test was 96%

Table 1: Patients characteristics and findings in two-stage exchange

Patient	First Stage				Second Stage				
	Joint involved	Age (yrs)	Gender	Bacteria	CRP (mg/L)	Leucocytes (G/L)	Positive sample / Total number of samples	Bacteria	Alpha Defensin Test
1	Shoulder	65	M	*S. schleferi*	219	20	0/4	-	Negative
2	Hip	80	M	*E. coli*	0.5	6,7	1/5	S. capitis	Negative
3	Knee	71	M	*E. faecalis*	24	10	0/5	-	Negative
4	Hip	65	M	*S. haemolyticus*	6	6,2	0/5	-	Negative
5	Knee	67	M	*E. faecium candida*	16	8,2	2/5	S. epidermidis E. faecium	Negative
6	Knee	66	F	*S. lugdunensis*	2.5	10,5	0/5	-	Negative
7	Knee	73	F	*S epidermidis*	5.2	10,3	0/5	-	Negative
8	Knee	79	F	*S. warneri*	8	7,5	0/5	-	Negative
9	Ankle	73	F	*S. caprae*	3	6,2	0/5	-	Negative
10	Knee	71	F	*S. simulans*	24	9,4	0/5	-	Negative
11	Knee	70	M	*S. aureus*	8	10,4	0/5	-	Negative
12	Knee	56	F	*S. epidermidis*	1	8,2	0/5	-	Negative
13	Knee	70	M	*E. coli*	3.4	7,7	0/5	-	Negative
14	Hip	43	M	*S. aureus*	16	10,3	0/5	-	Negative
15	Hip	81	F	*S. dysgalactiae*	8	9,2	0/5	-	Negative
16	Ankle	49	F	*S. warneri*	1.2	7,6	0/5	-	Negative
17	Knee	71	F	*Granulicatella adiacens*	2.2	6,3	0/5	-	Negative
18	Knee	63	F	*S. aureus E. faecalis*	18	9,9	0/5	-	Negative
19	Hip	20	M	*P. acnes S. epidermidis Corynebacter*	2.8	6,4	0/5	-	Negative
20	Hip	61	M	*Streptocoque*	5	8,5	0/5	-	Negative
21	Hip	62	F	*S. aureus*	1	8,4	0/5		Negative
22	Hip	69	F	*S. capitis*	8	7,8	1/5	Gram Negative	Negative
23	Hip	72	M	*S. aureus*	12	9,3	0/5		Negative
24	Knee	62	M	*S. aureus*	5	8,1	0/5		Negative

CONCLUSION: WITH A HIGH NPV, THE ALPHA-DEFENSIN TEST APPEARS TO BE A RELIABLE TOOL TO RULE OUT PERSISTENT INFECTION AT THE SECOND STAGE OF A PJI TREATMENT. THE TEST SHOULD BE CONSIDERED AND FURTHER EVALUATED TO LIMIT UNNECESSARY ANTIBIOTIC EXPOSURE

Hôpitaux Universitaires Paris Ile-de-France Ouest Site RAYMOND POINCARE

THE AUTHORS DECLARE THAT THEY HAVE NO CONFLICT OF INTEREST CONCERNING THE CURRENT STUDY

- ***<u>Valeur diagnostique du test Synovasure au cours du 2ème temps ?</u>***
  - 24 IPP, 2 temps
  - Test < 0 dans tous les cas
  - 1 infection fungique non détectée
- ==> VPN 96%
- CCL: intérêt du test au cours des 2 temps // prochaine étape: limiter l'exposition ATB ?

TRAITEMENT

SYNOVECTOMIE LAVAGE CHANGEMENT DES PIECES MOBILES

A multicenter study of irrigation and debridement in total knee arthroplasty periprosthetic joint infection: Treatment failure is high

Kenneth L. Urish, MD, PhD,
Arthritis and Arthroplasty Design Group, The Bone and Joint Center, Magee Womens Hospital of

JOA, 2018

- Etude rétrospective, multicentrique, MSIS+: 216 ATG
- FU: 32 mois

==> **Taux d'échec à 2 ans: 53% (probabilité 57% à 4 ans)**

==> Meilleur profil : **symptômes < 1 semaine, infection non-*S. aureus* (probabilité d'échec 40% à 4 ans)**

- Importance du critère « délai »:

- < 15 jours post op: 82% succès
- > 15 jours : 50% succès

Narayanan, JOA, 2018

TRAITEMENT

SYNOVECTOMIE LAVAGE VS RPTG INF FUNGIQUE

Complications - Infection

Two-Stage Exchange Arthroplasty Is a Favorable Treatment Option Upon Diagnosis of a Fungal Periprosthetic Joint Infection

Feng-Chih Kuo, MD [a, b, c], Karan Goswami, MD, MRCS [b], Noam Shohat, MD [b, d], Kier Blevins [b], Alexander J. Rondon, MD, MBA [b], Javad Parvizi, MD, FRCS [b, *]

[a] *Department of Orthopaedic Surgery, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan*
[b] *The Rothman Institute at Thomas Jefferson University, Philadelphia, PA*
[c] *College of Medicine, Chang Gung University, Kaohsiung, Taiwan*
[d] *Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel*

JOA, 2018

- **Etude rétrospective, MSIS+: 29 IPP (ATH, ATG) *Candida sp.***

  ==> succès à 5 ans (NS):
  - Synovectomie lavage : 29%
  - Chgt 1 temps: 33%
  - Chgt 2 temps: 46%

TRAITEMENT

LUTTE CONTRE LE BIOFILM

Topical Adjuvants Incompletely Remove Adherent *Staphylococcus Aureus* From Implant Materials

Emily P. Ernest,[1] Anthony S. Machi,[2] Brock A. Karolcik,[2] Paul R. LaSala,[3] Matthew J. Dietz[1]

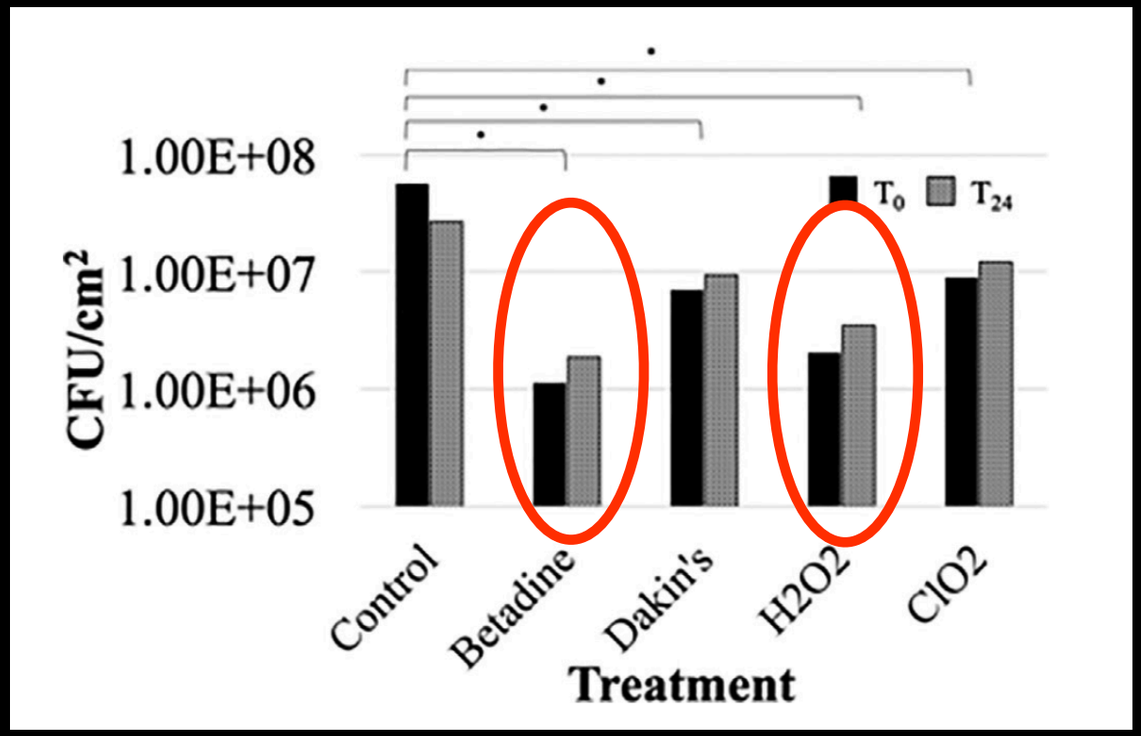
[1]Robert C. Byrd Health Sciences Center, Department of Orthopaedics, West Virginia University School of Medicine, P.O. Box 9196, Morgantown, West Virginia 26506-9196, [2]Robert C. Byrd Health Sciences Center, West Virginia University School of Medicine, P.O. Box 9100, Morgantown, West Virginia 26506-9100, [3]Robert C. Byrd Health Sciences Center, Department of Pathology, West Virginia University School of Medicine, P.O. Box 9203, Morgantown, West Virginia 26506-9203

Received 10 August 2017; accepted 11 November 2017
Published online 15 November 2017 in Wiley Online Library (wileyonlinelibrary.com). DOI 10.1002/jor.23804

JOR, 2018

- **Efficacité des solutions antiseptiques *in vitro* ?**

==> H202 (-98% CFU/cm2) = Bétadine (-97%) >> Dakin, ClO2



TRAITEMENT

CHANGEMENT PRECOCE EN UN TEMPS

American Association of Hip and Knee Surgeons
ANNUAL MEETING

Early one-stage revision is indicated for infected cementless THA

Orthopaedics Today Europe, November 2019

ADD TOPIC TO EMAIL ALERTS

Fares S. Haddad

DALLAS — Simple lavage and irrigation and debridement are inappropriate for managing a patient whose cementless total hip arthroplasty is acutely infected. This situation calls for a rapid return to the OR for one-stage revision surgery and aggressive debridement and treatment of the infection, according to a presenter at the American Association of Hip and Knee Surgeons Annual Meeting

AAHKS, Dallas, 7-10 nov 2019

- **Etude rétrospective**
- **IPP post opératoires: 39 ATH sans ciment**
- **4 échecs**

==> succès à 5 ans : 90 %

PREVENTION

OPTIMISER/IDENTIFIER LES RISQUES +++

Castano-Betancourt *et al. Journal of Orthopaedic Surgery and Research*
(2018) 13:328
https://doi.org/10.1186/s13018-018-1036-2

Journal of Orthopaedic Surgery and Research

RESEARCH ARTICLE Open Access

Identification of high-risk groups for complication after arthroplasty: predictive value of patient's related risk factors

Martha Cecilia Castano-Betancourt*, Ricardo Fruschein Annichino, Marcelo de Azevedo e Souza Munhoz, Eduardo Gomes Machado, Monica Vannucci Lipay and Evaldo Marchi

==> PR ou > 2 comorbidités (diabète, anémie)

Stryker, JBJSA,2013

- **HbA1c pré opératoire et complications cicatricielles**:

  ==> X 9 si HbA1c pré op > 6,7%

PREVENTION

OPTIMISER/IDENTIFIER LES RISQUES +++

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Review

Does Prior Bariatric Surgery Improve Outcomes Following Total Joint Arthroplasty in the Morbidly Obese? A Meta-Analysis

Shuxiang Li, MD, Xiaomin Luo, MD, Han Sun, MD, Kun Wang, MD, PhD, Kaifeng Zhang, MD, Xiaoliang Sun, MD, PhD *

Department of Articular Orthopaedics, The Third Affiliated Hospital of Soochow University, Changzhou, Jiangsu, People's Republic of China

JOA, 2019

- **<u>Intérêt de la chirurgie bariatrique pré opératoire ?</u>**
  - Méta analyse: 38 728 pts (ATH, ATG), BMI > 40 kg/m2 avant chir bariatrique

    ==> moins de complications médicales précoces

    ==> diminution DDS, durée op.

    ==> <u>IPP précoces: mieux pour les ATG, pas de modif pour les ATH</u>

    ==> <u>IPP tardives: pas de changement</u>

PREVENTION

EVALUATION DU RISQUE INFECTIEUX APRES ATH/ATG

https://s-spire-clintools.shinyapps.io/TJARiskCalculator/

Risk Calculator for Total Hip or Knee Arthoplasty

Age (yrs)
80

Gender
Male

Race
White

BMI
Moderate-risk obesity (35.0-39.9)

Functional Status
Dependent

ASA Class
I: A normal healthy patient

Dypsnea
None

- [ ] Diabetes being treated with oral agents or insulin
- [ ] Currently on dialysis
- [ ] Disseminated Cancer
- [ ] Newly diagnosed or new symptoms of congestive heart failure in 30 days
- [ ] History of severe COPD (functional disability or chronic medication or prior admissions, or FEV1<75%)
- [ ] Hypertension with Medication

Results	Your Risk (%)	Population Average Risk	Model Accuracy
Risk of Death within 30 days	0.40	Average Population Risk is 0.13% or 1.3 per thousand	C-statistic = 0.73
Risk of Cardiac Complications within 30 days	0.46	Average Population Risk is 0.29% or 2.9 per thousand	C-statistic = 0.73
Risk of Renal Complications within 30 days	0.13	Average Population Risk is 0.16% or 1.6 per thousand	C-statistic = 0.78
Risk of CNS-CVA Complications within 30 days	0.09	Average Population Risk is 0.08% or 0.8 per thousand	C-statistic = 0.70
Risk of Sepsis within 30 days	0.62	Average Population Risk is 0.28% or 2.8 per thousand	C-statistic = 0.69

For more information about this calculator

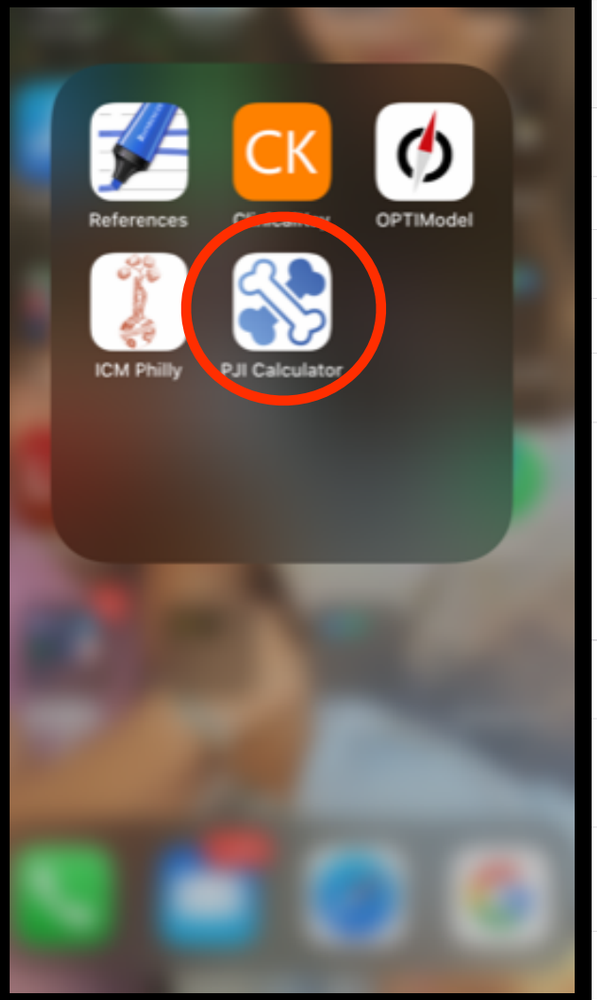
See the following publication

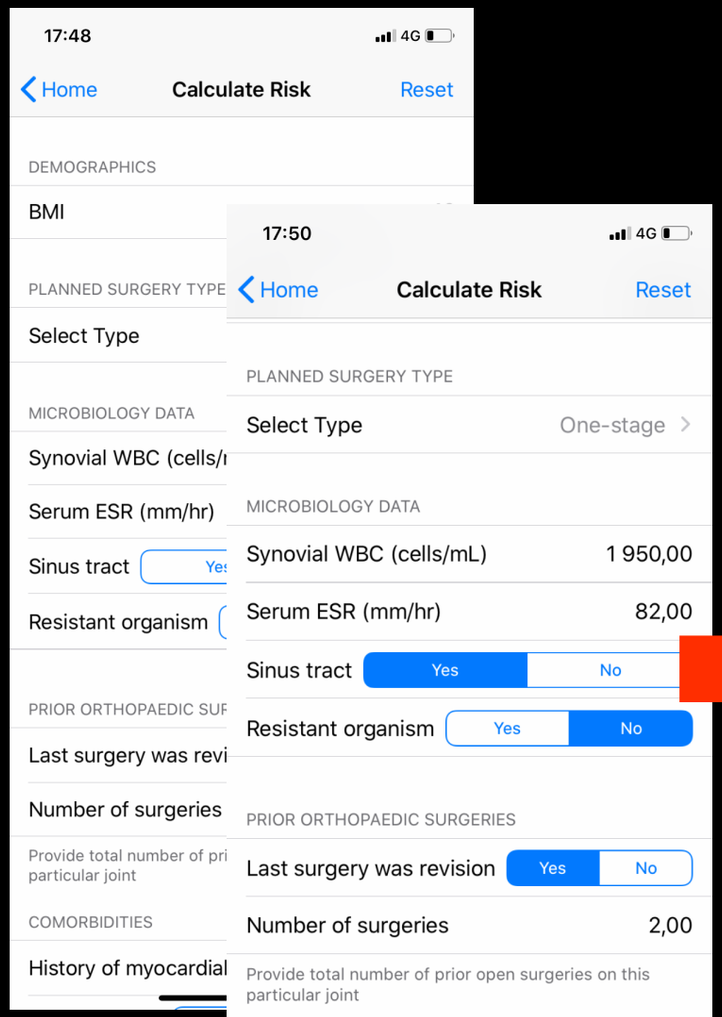
Harris AHS, Kuo AC, Weng Y, Trickey AW, Bowe T, Giori, NG (2019). Can Machine Learning Methods Produce Accurate and Easy to Use Prediction Models of 30-day Complications and Mortality After Knee or Hip Arthroplasty. Clinical Orthopaedics & Related Research. Journal of Clinical Orthopaedics and Related Research, 477(2), 452-460

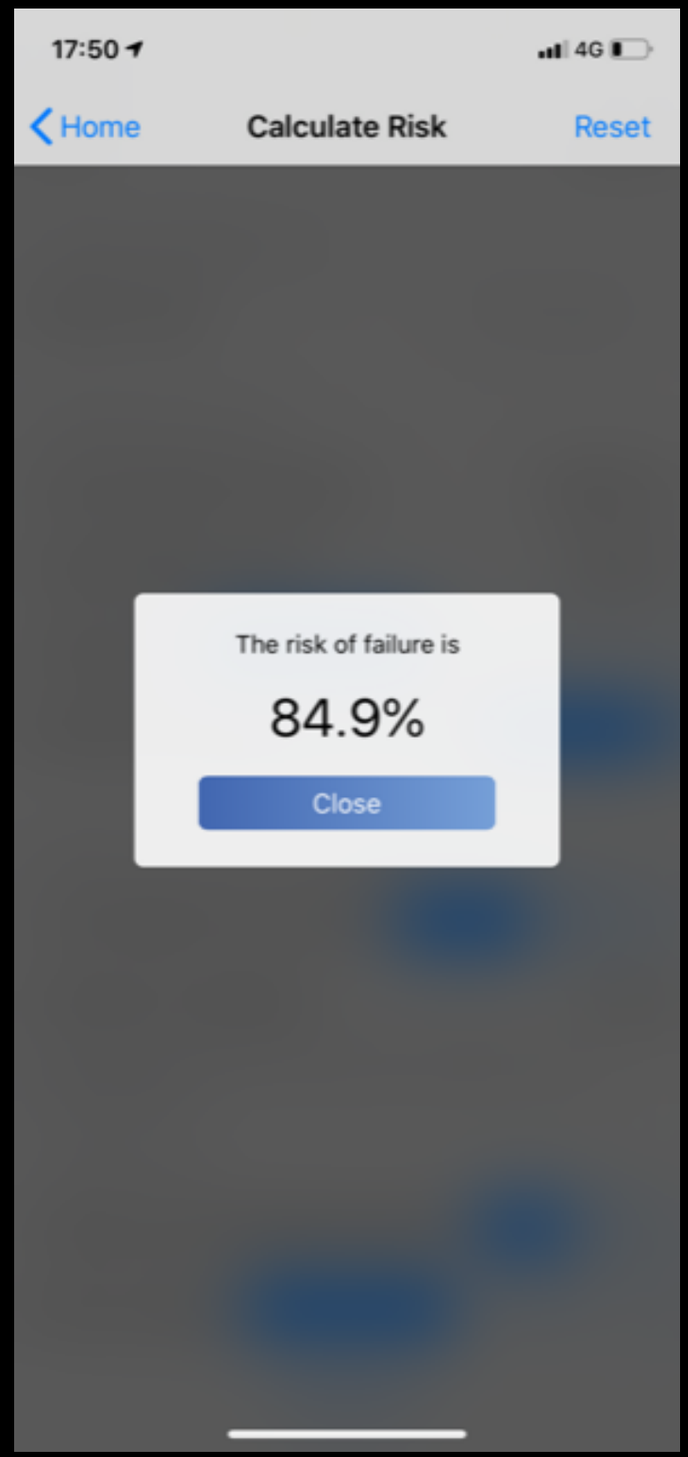
For questions or suggestions, contact Alex Sox-Harris at alexsox@stanford.edu

PREVENTION

EVALUATION DU RISQUE D'ECHEC APRES RPTH/RPTG







MESSAGES

LES IPP SONT FREQUENTES ET AUGMENTENT (ATG > ATH)

FACTEUR ETABLI DE MORTALITE (ATH >ATG)

Le DIAGNOSTIC et le TRAITEMENT doivent être PRECOCES

Les indications de SYNOVECTOMIE-LAVAGE sont limitées

Intérêt du CHANGEMENT PRECOCE en UN TEMPS (SC)

INFORMATION au patient (outils numériques)