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Journées Nationales d'infectiologie
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Journée Nationale de Formation des Paramédicaux en Infectiologie
Jeudi 12 juin 2025

Les Biomarqueurs synoviaux dans l'infection de prothèse : Quoi de neuf ?

Nantes Université
CHU NANTES

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

Déclaration de liens d'intérêt avec les industriels de santé en rapport avec le thème de la présentation (loi du 04/03/2002) :

L'orateur ne souhaite pas répondre ☐

- **Intervenant** : Louise Ruffier d'Epenoux
- **Titre** : Les Biomarqueurs synoviaux dans l'infection de prothèse : Quoi de neuf ?

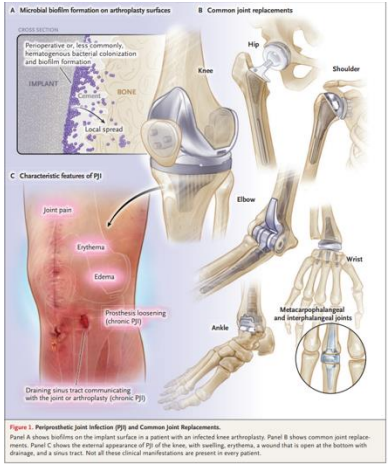
• Consultant ou membre d'un conseil scientifique	☐ OUI	☑ NON
• Conférencier ou auteur/rédacteur rémunéré d'articles ou documents	☐ OUI	☑ NON
• Prise en charge de frais de voyage, d'hébergement ou d'inscription à des congrès ou autres manifestations	☐ OUI	☑ NON
• Investigateur principal d'une recherche ou d'une étude clinique	☐ OUI	☑ NON

Introduction

- Infection ostéo articulaire sur prothèse (IOAP) :

  - Incidence : 1-2 % sur la durée de vie d'une prothèse Jafari *et al.,* 2010 ; Zardi *et al.,* 2020

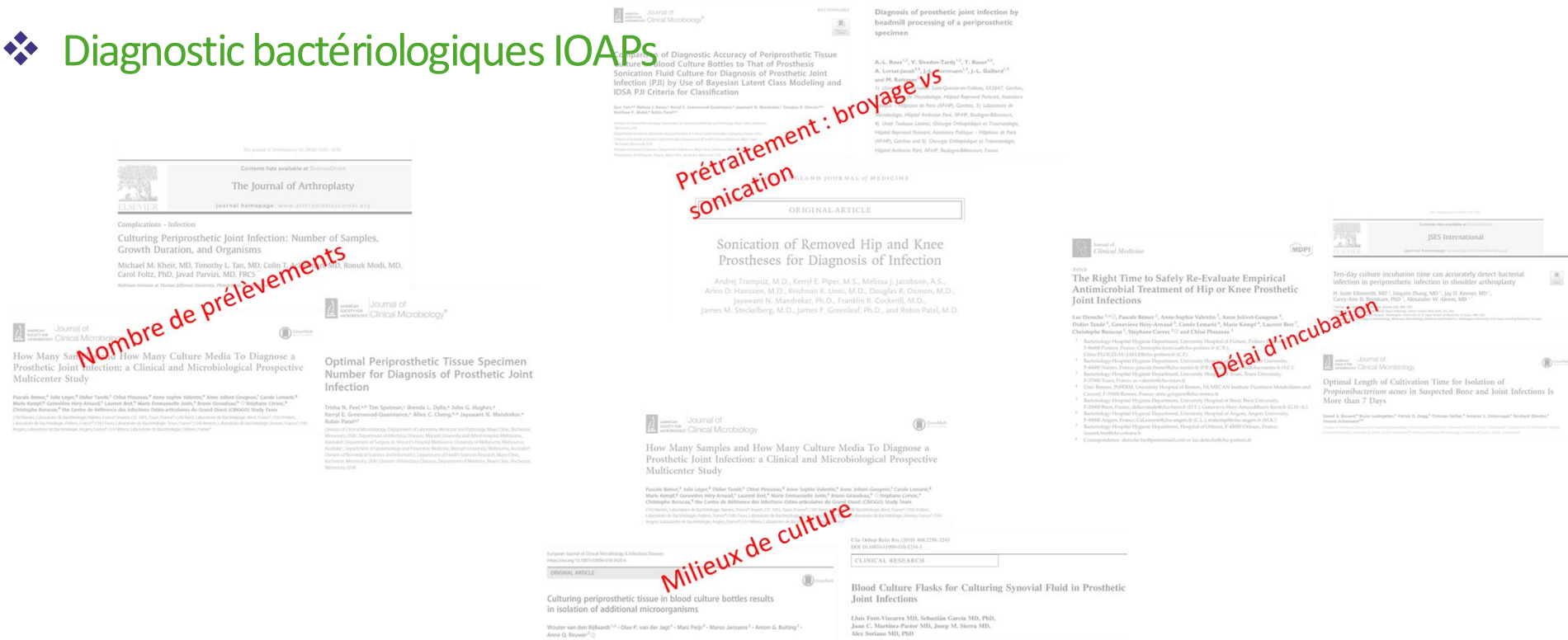
  - Conséquences sur la morbi-mortalité Lentino *et al.,* 2003 ; Kurtz *et al.,* 2012



Patel *et al.,* 2023

Introduction

- Diagnostic bactériologiques IOAPs



Introduction

- Mais :
  - Cultures négatives dans 5-15 % des cas de suspicion d'IOAPs Corvec *et al.,* 2012 ; Tande et Patel 2014
  - Faux négatifs : ATB préalable, bactéries à croissance exigeante, biofilm, intra ostéoblastique Donlan *et al.,* 2005; Josse *et al.,* 2015

Intérêt de la Biologie moléculaire

et des Biomarqueurs Synoviaux

Introduction

- Scores composites de diagnostic :

2013 MSIS criteria

Table I. Musculoskeletal Infection Society criteria, reproduced from: Parvizi J, Gehrke T, Chen AF. Proceedings of the International Consensus on Periprosthetic Joint Infection. *Bone Joint J* 2013;95-B:1450-1452.

Periprosthetic joint infection is defined as:
Two positive periprosthetic cultures with phenotypically identical organisms, or
A sinus tract communicating with the joint, or
Meeting three of the following minor criteria:
-Elevated serum C-reactive protein AND erythrocyte sedimentation rate
-Elevated synovial fluid white blood cell count OR ++change on leukocyte esterase test strip
-Elevated synovial fluid polymorphonuclear neutrophil percentage
-Positive histological analysis of periprosthetic tissue
-A single positive culture

Table 2. The threshold for the minor diagnostic criteria according to the International Consensus Group

Criterion	Acute PJI (< 90 days)	Chronic PJI (> 90 days)
Erythrocyte sedimentation rate (mm/hr)	Not helpful; no threshold was determined	30
C-reactive protein (mg/L)	100	10
Synovia white blood cell count (cells/μL)	10,000	3,000
Synovial polymorphonuclear percentage (%)	90	80
Leukocyte esterase	+ or ++	+ or ++
Histological analysis of tissue	> 5 neutrophils per high-power field in 5 high-power fields (×400)	Same as acute

Table 1. 2018 ICM criteria for PJI definition.

MAJOR CRITERIA		DECISION
Two positive cultures of the same organism		INFECTED (at least one of the following is present)
Sinus tract evidence of communication to the joint or visualization of the prosthesis		
MINOR CRITERIA	**SCORE**	**DECISION**
Elevated serum CRP or D-dimer	2	≥6, infected 2–5, possibly infected 0–1, not infected
Elevated serum ESR	1	
Elevated synovial WBC count or LE	3	
Positive synovial alpha-defensin	3	
Elevated synovial PMN (%)	2	
Elevated synovial CRP	1	

CRP = C-Reactive Protein; ESR = Erythrocyte Sedimentation Rate; WBC = White Blood Cells; LE = Leucocyte Esterase; PMN = Polymorphonuclear Cells.

Marker	Chronic (>90 d)	Acute (<90 d)
Serum CRP (mg/dL)	1.0	10
Serum D-dimer (ng/mL)	860	860[c]
Serum ESR (mm/h)	30	-
Synovial WBC count (cells/μL)	3000	10,000
Synovial PMN (%)	80	90
Synovial CRP (mg/L)	6.9[c]	6.9
Synovial alpha-defensin (signal-to-cutoff ratio)	1.0	1.0

EBJIS 2021

	Infection Unlikely (all findings negative)	Infection Likely (two positive findings)[a]	Infection Confirmed (any positive finding)
Clinical and blood workup			
Clinical features	Clear alternative reason for implant dysfunction (e.g. fracture, implant breakage, malposition, tumour)	1) Radiological signs of loosening within the first five years after implantation 2) Previous wound healing problems 3) History of recent fever or bacteraemia 4) Purulence around the prosthesis[b]	Sinus tract with evidence of communication to the joint or visualization of the prosthesis
C-reactive protein		> 10 mg/l (1 mg/dl)[c]	
Synovial fluid cytological analysis[d]			
Leukocyte count[c] (cells/μl)	≤ 1,500	> 1,500	>3,000
PMN (%)[c]	≤ 65%	> 65%	> 80%
Synovial fluid biomarkers			
Alpha-defensin[e]			Positive immunoassay or lateral-flow assay[f]
Microbiology[f]			
Aspiration fluid		Positive culture	
Intraoperative (fluid and tissue)	All cultures negative	Single positive culture[g]	≥ two positive samples with the same microorganism
Sonication[h] (CFU/ml)	No growth	> 1 CFU/ml of any organism[g]	> 50 CFU/ml of any organism
Histology[c,i]			
High-power field (400x magnification)	Negative	Presence of ≥ five neutrophils in a single HPF	Presence of ≥ five neutrophils in ≥ five HPF
			Presence of visible microorganisms
Others			
Nuclear imaging	Negative three-phase isotope bone scan[c]	Positive WBC scintigraphy[c]	

Introduction


Review

What's New in the Diagnosis of Periprosthetic Joint Infections: Focus on Synovial Fluid Biomarkers

Giuseppe Solarino [1,†], Davide Bizzoca [1,2,*,†], Lorenzo Moretti [1], Giovanni Vicenti [1], Andrea Piazzolla [1,2] and Biagio Moretti [1]

- Biomarqueurs synoviaux :


Diagnosing periprosthetic joint infection: has the era of the biomarker arrived?

Carl Deirmengian [1], Keith Kardos, Patrick Kilmartin, Alexander Cameron, Kevin Schiller, Javad Parvizi

Neopterin

α2 microglobulin

D-dimère

IL-6

Leucocyte estérase

CRP articulaire

α défensine

Adenosine deaminase

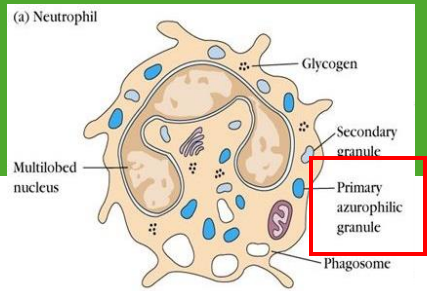
Cathelicidin

Presepsin

Human beta-defensins 2 et 3

Calprotectine articulaire

α défensine



- Peptide antimicrobien produit par les PNN en réponse à une infection Tajima *et al.*, 2020 ; Selsted *et al.*, 2005

- ELISA 96 puits dosage en série : 24h, 800 €/plaque
  - Seuil = 1 signal-to-cutoff ratio

- Test rapide unitaire (Synovasure®, Zimmer) : 10 minutes, 300 €/test

α défensine

- Méta- analyse : 31 études
- 2043 patients : PTH ou PTG
- *vs* MSIS 2011- 2013
- ELISA (11 études), TestU (10 études)

Han et al. Journal of Orthopaedic Surgery and Research (2019) 14:274
https://doi.org/10.1186/s13018-019-1320-9

Journal of Orthopaedic Surgery and Research

RESEARCH ARTICLE Open Access

Synovial fluid α-defensin in the diagnosis of periprosthetic joint infection: the lateral flow test is an effective intraoperative detection method

Xuequan Han[1†], Kai Xie[1†], Xu Jiang[1], Liao Wang[1], Haishan Wu[1], Xinhua Qu[2] and Mengning Yan[1*]

Table 1 Characteristics of the 19 studies in meta-analysis for the diagnosis of PJI using α-defensin

Study	Country	Patients number	Mean age (years)	Study design	Excluded antibiotic therapy	Site of arthroplasty	Reference standard	QUADAS
Laboratory-based immunoassay								
Deirmengian et al., 2014 [10]	USA	95	67	Prospective	N	Hip, knee	MSIS (2011)	14
Bingham et al., 2014 [9]	USA	57	64.2	Retrospective	NA	Hip, knee	MSIS (2011)	13
Deirmengian et al., 2014 [10]	USA	149	65	Prospective	N	Hip, knee	MSIS (2011)	13
Deirmengian et al., 2014 [10]	USA	46	65	Prospective	N	Hip, knee	MSIS (2011)	13
Frangiamore et al., 2016 [15]	USA	78	63.3	Prospective	NA	Hip, knee	MSIS (2011)	14
Bonanzinga et al., 2017 [19]	Germany	156	NA	Prospective	N	Hip, knee	MSIS (2013)	14
Gehrke et al., 2018 [23]	Germany	173	NA	Prospective	Y	Hip, knee	MSIS (2013)	14
Kanwar et al., 2018 [24]	USA	70	66	Retrospective	NA	Hip, knee	MSIS (2013)	14
Sigmund et al., 2018 [42]	Germany	71	70	Retrospective	Y	Hip, knee	MSIS (2013)	13
Stone et al., 2018 [43]	USA	183	65.7	Retrospective	Y	Hip, knee	MSIS (2011)	14
Kelly et al., 2018 [39]	USA	32	64	Retrospective	N	Hip, knee	MSIS (2013)	13
Lateral flow test								
Kasparek et al., 2016 [16]	Austria	40	NA	Retrospective	Y	Hip, knee	MSIS (2013)	13
Suda et al., 2017 [21]	Germany	28	67.7	Prospective	N	Hip, knee	MSIS (2013)	13
Balato et al., 2018 [17]	Italy	51	63	Prospective	Y	Knee	MSIS (2013)	12
Berger et al., 2017 [18]	Belgium	121	63.5	Prospective	N	Hip, knee	MSIS (2011)	14
Gehrke et al., 2018 [23]	Germany	191	NA	Prospective	Y	Hip, knee	MSIS (2013)	14
Plate et al., 2018 [26]	Switzerland	109	65	Prospective	Y	Hip, knee	MSIS (2013)	13
de Saint Vincent et al., 2018 [22]	French	39	62	Prospective	N	Hip, knee	MSIS (2013)	12
Riccio et al., 2018 [41]	Italy	71	69	Retrospective	N	Hip, knee	MSIS (2013)	13
Sigmund et al., 2018	Germany	71	70	Retrospective	Y	Hip, knee	MSIS (2013)	13
Renz et al., 2018 [40]	Germany	221	70	Prospective	N	Hip, knee	MSIS (2013)	14

PJI periprosthetic joint infection, *NA* not available, *MSIS* Musculoskeletal Infection Society, *QUADAS* Quality Assessment of Diagnostic Accuracy Studies

α défensine

Han et al. Journal of Orthopaedic Surgery and Research (2019) 14:274
https://doi.org/10.1186/s13018-019-1320-9

Journal of Orthopaedic Surgery and Research

RESEARCH ARTICLE Open Access

Synovial fluid α-defensin in the diagnosis of periprosthetic joint infection: the lateral flow test is an effective intraoperative detection method

Xuequan Han[1†], Kai Xie[1†], Xu Jiang[1], Liao Wang[1], Haishan Wu[1], Xinhua Qu[2] and Mengning Yan[1*]

Table 2 Subgroup analysis of laboratory-based immunoassay and lateral flow test for PJI diagnosis

Subgroup analyses	No. of studies	No. of patients	Sensitivity (95%CI)	Specificity (95%CI)	AUC (95%CI)	PLR (95%CI)	NLR (95%CI)	DOR (95%CI)
Laboratory-based immunoassay								
Overall studies	11	1110	0.96 (0.90–0.98)	0.97 (0.95–0.99)	0.99 (0.98–1.00)	35.0 (18.5–66.2)	0.04 (0.02–0.11)	811 (220–2990)
Excluded metallosis								
Yes	4	416	0.97 (0.88–0.99)	0.99 (0.96–1.00)	0.99 (0.98–1.00)	80.7 (26.0–251.1)	0.03 (0.01–0.13)	2447 (383–15,647)
No and NA	7	694	0.94 (0.84–0.98)	0.96 (0.94–0.97)	0.98 (0.96–0.99)	23.1 (14.2–37.6)	0.06 (0.02–0.17)	382 (103–1414)
Study design								
Prospective	6	697	0.97 (0.92–0.99)	0.98 (0.96–0.99)	0.99 (0.98–1.00)	42.9 (22.9–80.4)	0.03 (0.01–0.09)	1480 (423–5172)
Retrospective	5	413	0.91 (0.79–0.96)	0.95 (0.90–0.98)	0.98 (0.96–0.99)	19.9 (8.9–44.5)	0.10 (0.04–0.24)	207 (52–830)
Lateral flow test								
Overall studies	10	933	0.86 (0.81–0.91)	0.96 (0.93–0.98)	0.95 (0.93–0.97)	21.2 (11.7–38.5)	0.14 (0.10–0.21)	148 (64–343)
Excluded antibiotic therapy								
Yes	5	462	0.86 (0.77–0.92)	0.97 (0.91–0.99)	0.94 (0.92–0.96)	32.7 (9.3–114.6)	0.15 (0.08–0.25)	225 (46–1099)
No and NA	5	471	0.87 (0.78–0.92)	0.95 (0.91–0.97)	0.97 (0.95–0.98)	17.3 (9.1–33.1)	0.14 (0.08–0.23)	124 (46–336)
Number of patients								
≥ 50	7	826	0.89 (0.84–0.92)	0.97 (0.94–0.99)	0.95 (0.92–0.96)	30.9 (15.4–61.9)	0.12 (0.08–0.17)	263 (109–631)

PLR positive likelihood ratio, *NLR* negative likelihood ratio, *DOR* diagnostic odds ratio, *AUC* area under the curve

ELISA > TestU

α défensine : FN/FP

2018 BY THE JOURNAL OF BONE AND JOINT SURGERY,

Clinical Evaluation of Synovial Alpha Defensin and Synovial C-Reactive Protein in the Diagnosis of Periprosthetic Joint Infection

William Z. Stone, MD, Chancellor F. Gray, MD, Hari K. Parvataneni, MD, Mamun Al-Rashid, MD, Richard G. Vlasak, MD, MaryBeth Horodyski, EdD, ATC, LAT, FNATA, and Hernan A. Prieto, MD

- Prospective
- 183 patients
- 37 (20 %) IOAP *vs* MSIS 2011
- TestU

TABLE II False-Positive Results for Alpha Defensin Testing for the Initial Diagnosis of a Periprosthetic Joint Infection

Patient	Alpha Defensin	Synovial Fluid CRP *(mg/L)*	Findings
H	Positive	0.4	Metal-on-metal implant with pseudotumor
I	Positive	0.4	Metal debris from wear-through
J	Positive	0.9	Metal debris from wear-through
K	Positive	1.7	2 minor MSIS criteria for infection
L	Positive	0.4	Metal-on-metal implant with pseudotumor
M	Positive	6.5	2 minor MSIS criteria for infection

n=6

TABLE III False-Negative Results for Alpha Defensin Testing for Initial Diagnosis of Periprosthetic Joint Infection

Patient	Alpha Defensin	Synovial Fluid CRP *(mg/L)*	MSIS Criteria Met
A	Negative	8.1	Draining sinus
B	Negative	4.2	Coagulase-negative Staphylococcus on 3 intraoperative cultures
C	Negative	1.6	Coagulase-negative Staphylococcus on 3 intraoperative cultures, purulence in joint at time of surgery
D	Negative	3.2	Draining sinus, coagulase-negative Staphylococcus on 3 intraoperative cultures
E	Negative	0.4	Coagulase-negative Staphylococcus on 3 intraoperative cultures
F	Negative	48.5	Draining sinus, methicillin-sensitive *Staphylococcus aureus* on 2 cultures, purulence in joint at time of surgery
G	Negative	0.8	*Propionibacterium acnes* on 3 intraoperative cultures

n=7

FP : Métallose

FN : Germes peu virulents

α défensine : FN/FP

The Journal of Arthroplasty 31 (2016) 456–460

α-Defensin Accuracy to Diagnose Periprosthetic Joint Infection—Best Available Test?

Salvatore J. Frangiamore, MD, MS [a], Nicholas D. Gajewski, BS [b], Anas Saleh, MD [a], Mario Farias-Kovac, MD [a], Wael K. Barsoum, MD [a], Carlos A. Higuera, MD [a]

[a] Department of Orthopedic Surgery, The Cleveland Clinic Foundation, Cleveland, Ohio
[b] Lerner College of Medicine, The Cleveland Clinic Foundation, Cleveland, Ohio

- Prospective
- 116 Révisions
- 27 (23 %) IOAP *vs* MSIS 2011
- TestU

Performances ↙ pour les 2ème étapes d'une révision en 2T

Table 3
Diagnostic Parameters of Synovial Fluid α-Defensin Compared With Serum ESR and CRP for First-Stage and Single-Stage Revisions.

Parameter	α-Defensin	Serum ESR	Serum CRP
Cutoff value	5.2 mg/L	30 mm/h	10 mg/L
Sensitivity (%)	100	58	83
Specificity (%)	98	81	79
Positive likelihood ratio[a]	54	3	4
Negative likelihood ratio[b]	0	0.5	0.2

[a] A value greater than 5 is considered useful for ruling-in infection.
[b] A value less than 0.2 is considered useful for ruling out infection.

n=78

Table 4
Diagnostic Parameters of Synovial Fluid α-Defensin Compared With Serum ESR and CRP for Second-Stage Revisions.

Parameter	α-Defensin	Serum ESR	Serum CRP
Cutoff value	5.2 mg/L	30 mm/h	10 mg/L
Sensitivity (%)[a]	67 (12-95)	0 (0-70)	33 (5-88)
Specificity (%)[a]	97 (83-99)	84 (67-95)	82 (65-93)
Positive likelihood ratio[a,b]	21 (3-167)	0	1.9 (0.3-11)
Negative likelihood ratio[a,c]	0.3 (0.07-1.7)	1.2 (1-1.4)	0.8 (0.4-1.8)

[a] Values reported with 95% CI.
[b] A value greater than 5 is considered useful for ruling in infection.
[c] A value less than 0.2 is considered useful for ruling out infection.

n=38

α défensine : Impact des ATBs ?

Clin Orthop Relat Res (2016) 474:1610–1615

The Alpha-defensin Test for Periprosthetic Joint Infections Is Not Affected by Prior Antibiotic Administration

Alisina Shahi MD, Javad Parvizi MD, FRCS, Gregory S. Kazarian AB, Carlos Higuera MD, Salvatore Frangiamore MD, Joshua Bingham MD, Christopher Beauchamp MD, Craig Della Valle MD, Carl Deirmengian MD

- Rétrospective
- 106 patients IOAP
  - 30 (28 %) ABX group (= ATB 2 sem avant diagnostic)
  - 76 (72 %) NO-ABX (= pas ATB)
- MSIS 2013

Pas d'influence des ATBs

Table 3. The median levels for alpha-defensin, ESR, CRP, fluid WBCs, and fluid PMNs in the ABX and NO-ABX groups

Diagnostic	ABX group (n = 30) Median (range)	NO-ABX group (n = 76) Median (range)	Difference (95% CI)	p value
Alpha-defensin (S/CO)	4.2 (1.8–12.8)	4.9 (0.5–16.8)	0.68 (−0.98 to 1.26)	0.451
ESR (mm/hr)	62 (3–140)	65 (1–140)	3 (−11 to 22)	0.252
CRP (mg/L)	25.7 (1.0–302)	62.0 (3.0–535)	36.3 (4.0–56.2)	0.008*
WBC (cells/μL)	17,325 (413–104,200)	29,404 (1100–356,000)	12,079 (1915–22,650)	0.008*
PMN (%)	87 (3–100)	92 (40–100)	5.0 (0.0–7.0)	0.034*

*Statistical significance; ESR = erythrocyte sedimentation rate; CRP = C-reactive protein; WBCs = white blood cells; PMN = polymorphonuclear; ABX = antibiotics; CI = confidence interval.

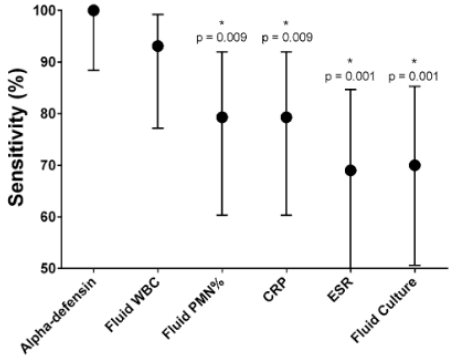


Fig. 2 Comparison of diagnostic sensitivities of laboratory tests among patients treated with antibiotics before diagnostic testing for PJI. The asterisks denote tests that demonstrated a statistically significant lower sensitivity when compared with the alpha-defensin sensitivity.

α défensine

- Performances ↗ Vale *et al.,* 2023; Li *et al.,* 2020
- TestU
  - Rapide
  - Facile d'utilisation
- ATB Shahi *et al.,* 2016
- LA hématique Renz *et al.,* 2018
- Critères mineurs

- Coût ↗
- FP : Métallose Stone *et al.,* 2018 ; Han *et al.,* 2019
  Pathologies inflammatoires non infectieuses Plate *et al.,* 2019 ; Patridge *et al.,* 2017
- FN : Germes peu virulents Stone *et al.,* 2018
- 2ème étape 2T : ↙ performances
  Frangiamore *et al.,* 2016
- Non disponible en routine

Leucocyte esterase (LE)

- Enzyme sécrétée par les leucocytes Zheng *et al.,* 2023
- Test colorimétrique
- Seuil = (1+) 2013 MSIS; Chisari *et al.,* 2018 ou (2+) 2018 ICM; Salari *et al.,* 2020

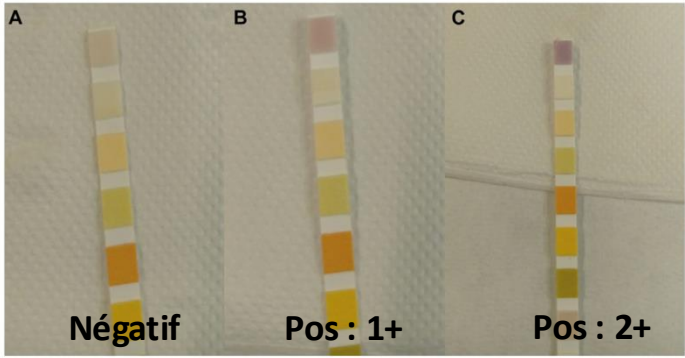


Fig. 2. Leukocyte esterase strip test in synovial fluid samples: (A) negative; (B) positive 1+; and (C) positive 2+.

Logoluso *et al.,* 2022

Leucocyte esterase (LE)

Knee Surgery, Sports Traumatology, Arthroscopy (2018) 26:3039–3047
https://doi.org/10.1007/s00167-018-4904-8

A meta-analysis of synovial biomarkers in periprosthetic joint infection: Synovasure™ is less effective than the ELISA-based alpha-defensin test

Sufian S. Ahmad[1,7] · Michael T. Hirschmann[2] · Roland Becker[3] · Ahmed Shaker[1] · Atesch Ateschrang[4] · Marius J. B. Keel[1,5] · Christoph E. Albers[1] · Lukas Buetikofer[6] · Sithombo Maqungo[7] · Ulrich Stöckle[4] · Sandro Kohl[1,5]

- Méta analyse : 12 articles

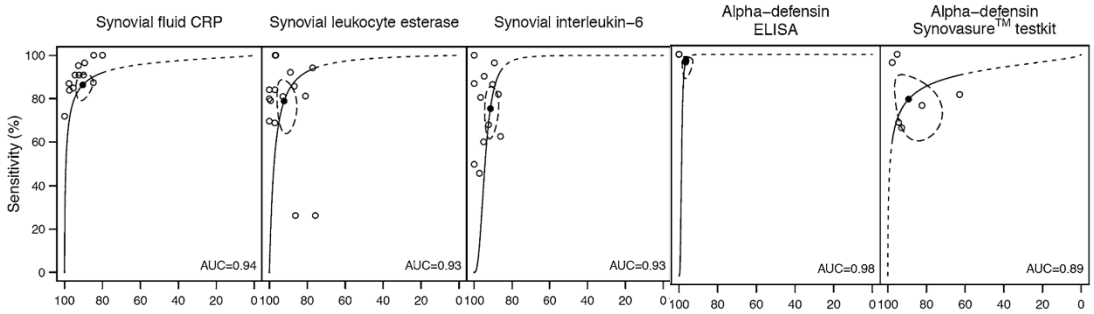


Table 2 Characteristics of diagnostic studies for synovial leukocyte esterase with 95% confidence intervals

	Sensitivity	Specificity	Positive LR	Negative LR	DOR
Colvin [6]	98 (80–100)	96 (83–99)	22.1 (4.62–106)	0.03 (0.00–0.40)	845 (33–21,781)
Deirmengian [8]	69 (49–84)	98 (83–100)	33.0 (2.10–519)	0.32 (0.18–0.58)	103 (6–1939)
Guenther [19]	99 (90–100)	96 (94–98)	27.5 (15.6–48.6)	0.01 (0.00–0.18)	2441 (141–42,138)
Kheir [22]	28 (13–49)	86 (74–92)	1.91 (0.74–4.91)	0.85 (0.63–1.13)	2 (1–8)
Koh [23]	83 (69–92)	98 (82–100)	38.3 (2.46–597)	0.17 (0.08–0.34)	225 (12–4198)
Nelson [25]	28 (13–49)	75 (64–84)	1.12 (0.49–2.55)	0.96 (0.71–1.30)	1 (0–4)
Parvizi [30]	79 (62–90)	99 (94–100)	125 (7.83–1991)	0.21 (0.11–0.42)	592 (32–10,885)
Shafafy [35]	80 (59–91)	92 (85–96)	10.4 (4.82–22.4)	0.22 (0.10–0.51)	47 (13–174)
Shafafy [35]	84 (64–94)	86 (78–92)	6.22 (3.52–11.0)	0.18 (0.07–0.48)	34 (9–124)
Tarabichi [38]	79 (72–85)	99 (96–100)	87.8 (17.8–433)	0.21 (0.16–0.29)	412 (79–2155)
Tischler [40]	79 (56–92)	81 (74–86)	4.12 (2.80–6.08)	0.25 (0.10–0.65)	16 (5–56)
Tischler [40]	68 (44–85)	97 (93–99)	21.4 (8.83–51.9)	0.33 (0.17–0.66)	64 (17–241)
Wang [42]	83 (69–92)	96 (83–99)	19.4 (4.04–93.6)	0.17 (0.09–0.35)	112 (18–703)
Wetters [43]	92 (81–96)	89 (83–93)	8.07 (5.27–12.4)	0.10 (0.04–0.23)	84 (29–247)
Wetters [43]	93 (83–98)	77 (70–83)	4.07 (3.06–5.4)	0.09 (0.03–0.24)	47 (15–148)
Pooled	79 (67–87)	92 (87–92)	10.5 (5.82–17.6)	0.23 (0.14–0.36)	49 (18–108)

Articles cited more than once denote more than one mentioned threshold value

LR likelihood ratio, *DOR* diagnostic odds ratio

LE bonne précision, mais non supérieure sWBC ou la culture bactériologique

Leucocyte esterase (LE)

- Simple d'utilisation
- Coût faible
- Facilement disponible

- Variabilité d'interprétation inter opérateur
- Interférence (Ø liq hémorragique) Chen *et al.,* 2019 ; Zheng *et al.,* 2020
- Performances moyennes Ahmad *et al.,* 2018 ; Vale *et al.,* 2023
- Seuil ? Salari *et al.,* 2020; Vale *et al.,* 2023

sCRP

- Protéine synthétisée par le foie et libérée en cas d'inflammation aigue
- Seuil = 8,8 mg/L Gallo *et al.*, 2018 **6,9 mg/L** ICM 2018 12,2 mg/L Deimengian *et al.*, 2014
- ELISA , Immunoturbidimétrie

sCRP

Orthopaedics & Traumatology: Surgery & Research 107 (2021) 102903

Original article

Value of the synovial C-reactive protein test in the diagnosis of total hip and knee periprosthetic joint infections: A case-control study

César Praz[a,*], Laura Gubbiotti[a], Geoffrey Buia[a], Valentin Chapus[a], Julien Dunet[a], Frederique Grandhomme[b], Jocelyn Michon[a], Goulven Rochcongar[a], Christophe Hulet[a]

[a] Unit Inserm COMETE, UMR U1075, département de chirurgie orthopédique et traumatologique, centre hospitalo-universitaire de Caen, avenue de la Côte-de-Nacre, 14000 Caen, France
[b] Secteurs biochimie et harmonologie, centre hospitalo-universitaire de Caen, avenue de la Côte-de-Nacre, 14000 Caen, France

- Prospective, monocentrique
- 194 patients :
  - 42 : arthroplasties primaires (CG)
  - 111 : révision aseptique (ARG)
  - 41 : prothèses septiques (SRG)
- *vs* MSIS 2011
- Néphélométrie
- Seuil : 6,9 mg/L

sCRP pas plus discriminante que la CRP sérique

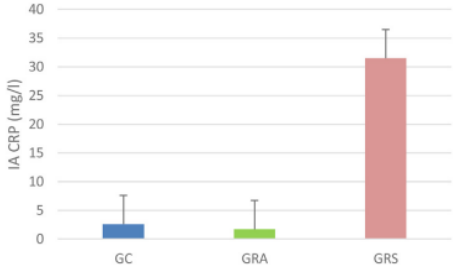


Fig. 2. Synovial CRP (mean ± standard deviation – mg/L): CG: control group (42 patients); ARG: aseptic revision group (111 patients); SRG: septic revision group (41 patients); CG vs. SRG: $p < 0.0001$; ARG vs. SRG: $p < 0.0001$; CG vs. SRG: $p = 1$.

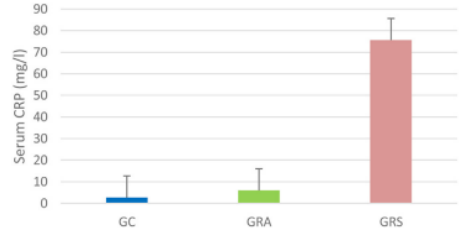


Fig. 3. Serum CRP (mean ± standard deviation – mg/L): CG: control group (42 patients); ARG: aseptic revision group (111 patients); SRG: septic revision group (41 patients); CG vs. SRG: $p < 0.0001$; ARG vs. SRG: $p < 0.0001$; CG vs. SRG: $p = 1$.

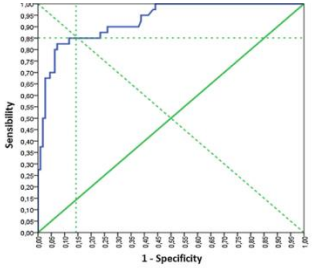


Fig. 5. ROC curve for synovial CRP. Curve based on synovial CRP levels measured in ARG (111 patients) and SRG (41 patients).

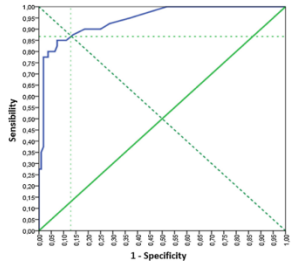


Fig. 6. ROC curve for serum CRP. Curve based on serum CRP levels measured in ARG (111 patients) and SRG (41 patients).

sCRP

The Journal of Arthroplasty 37 (2022) 2437–2443
Contents lists available at ScienceDirect
The Journal of Arthroplasty
journal homepage: www.arthroplastyjournal.org

Complications - Infection

Synovial C-Reactive Protein is a Useful Adjunct for Diagnosis of Periprosthetic Joint Infection

Colin M. Baker, BS, Graham S. Goh, MD, Saad Tarabichi, MD, Noam Shohat, MD, Javad Parvizi, MD, FRCS *
Rothman Orthopaedic Institute at Thomas Jefferson University, Philadelphia, Pennsylvania

- Étude rétrospective basée sur des données prospectives
- 621 patients : PTH, PTG
  - 394 : abs IOAP
  - 194 : IOAP
  - 33 : non concluant
- *vs* ICM 2018
- Seuil : 6,9 mg/L

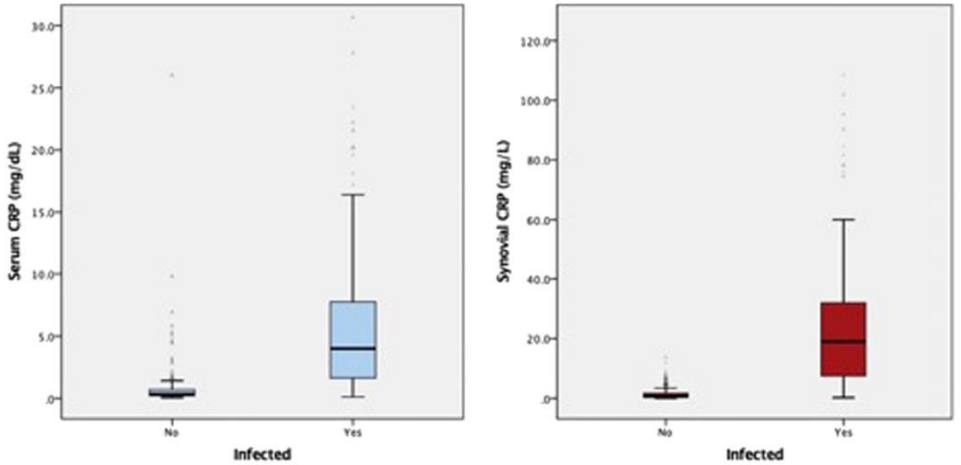


Fig. 1. Box plots of serum and synovial CRP according to infection groups.

Table 3
Receiver Operating Characteristic (ROC) Curve Analysis for Each Biomarker.

Biomarker	AUC	SE	95% CI Lower	95% CI Upper	2018 ICM Cutoff	Sensitivity	Specificity
Synovial CRP	0.951	0.010	0.932	0.970	6.9	0.742	0.980
Serum CRP	0.926	0.018	0.903	0.949	1.0	0.835	0.883
Serum ESR	0.848	0.018	0.813	0.884	30	0.874	0.729
Synovial PMN	0.973	0.009	0.956	0.991	80	0.864	0.992
Synovial WBC	0.978	0.007	0.963	0.992	3,000	0.917	0.987
Alpha-Defensin	0.925	0.013	0.898	0.951	-	0.986	0.869

AUC, area under the curve; SE, standard error; CI, confidence interval; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; PMN%, polymorphonuclear leukocyte percentage; WBC, white blood cell count; ICM, International Consensus Meeting.

sCRP

The Journal of Arthroplasty 37 (2022) 2437–2443

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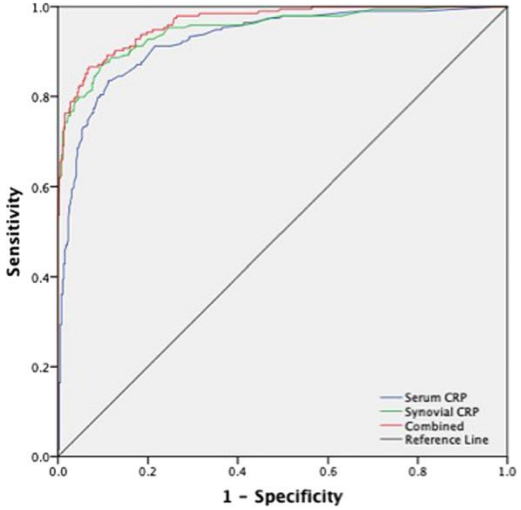

Fig. 3. Receiver operating characteristic curves of serum and synovial CRP.

Biomarker	AUC
Synovial CRP	0.951
Serum CRP	0.926
Serum ESR	0.848
Synovial PMN	0.973
Synovial WBC	0.978
Alpha-Defensin	0.925

Valeur ajoutée de la sCRP+ CRP sérique *vs* sCRP seule?

Wang et al. BMC Musculoskeletal Disorders (2021) 22:670
https://doi.org/10.1186/s12891-021-04545-6

sCRP

Combined serum and synovial C-reactive protein tests: a valuable adjunct to the diagnosis of chronic prosthetic joint infection

Hai Wang[1,2], Leilei Qin[1], Jiawei Wang[1], Ning Hu[1] and Wei Huang[1*]

- Prospective
- 97 patients : PTH, PTG
- 39 (40 %) IOAPs chroniques (symptômes > 6 sem) *vs* MSIS 2013
- Immunoturbidimétrie

Table 3 Sensitivity, Specificity, PPV, NPV, and accuracy of inflammatory markers

Parameters	ESR (mm/h)	Serum CRP (mg/L)	Synovial PMN (%)	Synovial CRP (mg/L)	Serum CRP OR Synovial CRP (mg/L)	Serum CRP AND Synovial CRP (mg/L)
AUC (95%CI)	0.600 (0.495, 0.698)	0.703 (0.601, 0.791)	0.810 (0.718, 0.882)	0.937 (0.869, 0.976)	/	/
Cut-off level	34	10.2	69.79	7.26	Serum CRP > 10.2 OR Synovial CRP > 7.26	Serum CRP > 10.2 AND Synovial CRP > 7.26
Sensitivity (%) (95%CI)	51.28 (34.8, 67.6)	84.62 (69.5, 94.1)	84.62 (69.5, 94.1)	84.62 (69.5, 94.1)	97.44 (92.5, 100)	71.79 (57.7, 85.9)
Specificity (%) (95%CI)	77.59 (64.7, 87.5)	56.90 (43.2, 69.8)	74.14 (61.0, 84.7)	93.10 (83.3, 98.1)	50.00 (37.1, 62.9)	100 (/)
PPV (%)	60.6 (46.6, 73.1)	56.9 (48.8, 64.6)	68.7 (58.2,77.6)	89.2 (76.0, 95.5)	56.72 (44.9, 68.6)	100 (/)
NPV (%)	70.3 (62.5, 77.1)	84.6 (71.8, 92.2)	87.8 (77.2, 93.8)	90.0 (81.1, 95.0)	96.67 (90.2, 100)	84.06 (75.4, 92.7)
Accuracy (%)	67.01	68.04	78.35	89.69	69.07	88.66

CRP C-reactive protein, *ESR* erythrocyte sedimentation rate, *PMN%* Percentage of Polymorphonuclear Cells, *CI* confidence interval, *PPV* positive predictive value, *NPV* negative predictive value

↙ FN Ø FP

↙ Se sCRP dans IOAPs chronique
Intérêt combinaison CRP sérique

sCRP

- Performances Parvizi *et al.,* 2011 ; Ahmad *et al.,* 2018 ; Wang *et al.,* 2021
- Coût faible (0,38€ HT)
- Facilement disponible
- Valeur quantitative
- Intérêt en association avec seCRP (IOAP chronique) Wang *et al.,* 2021

- ↙ Se dans les IOAPs chroniques Wang *et al.,* 2021
- Seuil ?
- Pathologies inflammatoires non infectieuses

sCalprotectine

- Protéine pro inflammatoire sécrétée par les granulocytes neutrophiles et les monocytes → rôle dans la migration des leucocytes et leur stimulation Striz *et al.*, 2004
- Diagnostic et suivi MICI Kwapisz *et al.*, 2017
- Seuil = 50 mg/L Warren *et al.*, 2022; Grassi *et al.*, 2022; Salari *et al.*, 2014
- ELISA , Test unitaire

Liquide articulaire : Lyfstone AS, Lysaker, Norway
Lazic *et al.*, 2022

Selle : Quantum Blue® fCAL, BÜHLMANN
Wouthuyzen-Bakker *et al.*, 2017-2018

Selle : CalFastNeXT kit, Eurospital, Triest, Italy
Grassi *et al.*, 2022

sCalprotectine

Archives of Orthopaedic and Trauma Surgery (2024) 144:5217–5227
https://doi.org/10.1007/s00402-024-05416-0

ORTHOPAEDIC SURGERY

Synovial calprotectin in prosthetic joint infection. A systematic review and meta-analysis of the literature

E. Festa[1] · T. Ascione[2] · D. Di Gennaro[1] · D. De Mauro[1,3] · M. Mariconda[1] · G. Balato[1]

Received: 28 February 2024 / Accepted: 22 June 2024 / Published online: 8 July 2024

- Méta analyse : 14 articles
- 902 patients : PTH, PTG
- 331 (37 %) IOAPs *vs* MSIS, MSIS modifié, ICM 2018, EBJIS 2021
- ELISA, TestU

sCalprotectine

Archives of Orthopaedic and Trauma Surgery (2024) 144:5217–5227
https://doi.org/10.1007/s00402-024-05416-0

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Received: 28 February 2024 / Accepted: 22 June 2024 / Published online: 8 July 2024

Table 2 Characteristics of diagnostic studies for calprotectin

Lead Author	Optimal cutoff	Sensitivity	Specificity	AUC	LR+	LR-	PPV	NPV	DOR (IC 95%)	Mean calprotectin concentration in septic Vs. aseptic joints
Wouthuyzen-Bakker et al. [15]	> = 50 mg/L	89%	90%	0.94	8.9	0.1	81%	95%	80.7500 (13.4663–484.2120)	991 mg/L Vs 11 mg/L
Wouthuyzen-Bakker et al. [16]	> = 50 mg/L	86.7%	91.7%	0.94	10.9	0.14	81.3%	94.4%	73.6667 (11.0187-492.5054)	859 mg/L Vs 7 mg/L
Salari et al. [17]	> = 50 mg/L	100%	95%	0.996	22	0	-93.33%	100%	969.0000 (44.8350-20942.5933)	320 mg/L Vs 5.5 mg/L
Zhang et al. [18]	173 µg/ml	95.2%	97.6%	0.993	39.6	0.049	95.2%	97.6%	820.0000 (48.7335-13797.4917)	776 µg/ml Vs 54.5 µg/ml
Trotter et al. [19]	> = 14 mg/L	75%	75.56%	0.78	3.07	0.33	62.07%	85%	9.2727 (2.9445–29.2012)	-
Grzelecki et al. [20]	1.5 mg/L	95.6%	95%	0.95	19.11	0.05	95.5%	95%	408.5000 (54.8444-3042.6512)	20.46 mg/L Vs 0.7 mg/L
Warren et al. [21]	* > = 50 mg/L > = 14 mg/L	ELISA 98.1% POC 98.1%	ELISA 95.7% POC 95.7%	ELISA 0.969 POC 0.969	ELISA 22.89 POC 22.89	ELISA 0.02 POC 0.02	ELISA 94.5% POC 94.5%	ELISA 98.5% POC 98.5%	ELISA and POC 1161.3333 (117.3670-11491.2629)	-
Grassi et al. [22]	> = 50 mg/L	ELISA 92.3% POC 97.4%	ELISA 100% POC 94%	ELISA 0.962 POC 0.957	ELISA NA POC 16.239	ELISA 0.077 POC 0.027	ELISA 100% POC 92.7%	ELISA 94.3% POC 97.9%	ELISA 1053.2857 (52.7725-21022.5283) POC 595.333 (59.4937-5957.2978)	ELISA 290.6 mg/L Vs 6.5 mg/ L
Warren et al. [23]	> = 50 mg/L	[a] 98.2%	98.5%	0.984	-68.68	0.02	98.2%	98.5%	3588.0000 (219.2516-58716.7506)	-
Lazic I. et al. [24]	70.5 mg/ dl	88%	88%	0.89	7.06	0.13	88.24%	87.5%	52.5000 (6.4874–424.8650)	-
Lazic I. et al. [25]	76 mg/dl	71%	81%	0.77	3.81	0.35	77%	76%	10.8333 (1.9614–59.8358)	-
Suren et al. [26]	85.5 mg/L	92%	95%	0.94	23.48	0.09	88.57%	97.06%	255.7500 (54.2621-1205.4094)	-
Lazic et al. [27]	70 mg/dl	60%	78%	0.71	2.76	0.51	54.55%	81.82%	5.4000 (1.0826–26.9339)	-
Bottagisio et al. [28]	529.5 µg/g	80%	94.4%	0.852	11.7	0.179	-	-	40.0000 (6.9086-231.5967)	874 µg/g Vs 30 µg/g
Pooled		92.44%	93.43%	93.05	14.07	0.08	89.8%	95.18%		

Performances sCalpro ↗

ELISA vs TestU

- Pas de ≠ Se et Sp
- $AUC_{ELISA} > AUC_{TestU}$

sCalprotectine : FN

The Journal of Arthroplasty 33 (2018) 1149–1153
Contents lists available at ScienceDirect
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journal homepage: www.arthroplastyjournal.org

Complications - Infection

Synovial Calprotectin: An Inexpensive Biomarker to Exclude a Chronic Prosthetic Joint Infection

Marjan Wouthuyzen-Bakker, MD, PhD [a,*], Joris J.W. Ploegmakers, MD [b], Karsten Ottink, MD [b], Greetje A. Kampinga, MD, PhD [a], Lucie Wagenmakers-Huizenga [c], Paul C. Jutte, MD, PhD [b], Anneke C.M. Kobold, MD, PhD [c]

- Prospective
- 52 patients : PTH ou PTG
- 15 (29 %) IOAP *vs* MSIS 2011
- TestU

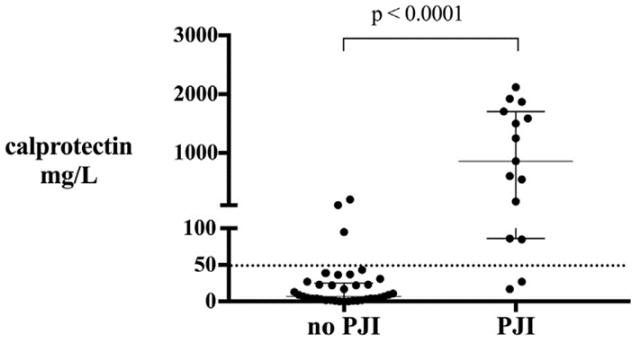

Table 1
Diagnostic Accuracy of Synovial Calprotectin (Cut-Off Value 50 mg/L), Serum CRP (Cut-Off Value 10 mg/L), and ESR (Cut-Off Value 30 mm/h) for Diagnosing a PJI.

	Synovial Calprotectin	Serum CRP	Serum ESR	Serum CRP and ESR
Sensitivity	86.7% (95% CI 59.5-98.3)	66.7% (95% CI 38.8-88.2)	72.7% (95% CI 39.0-93.9)	63.7% (95% CI 30.8-89.1)
Specificity	91.7% (95% CI 78.1-98.3)	70.4% (95% CI 49.8-86.3)	69.6% (95% CI 47.1-86.8)	75.0% (95% CI 50.9-91.3)
PPV	81.3% (95% CI 59.0-92.9)	55.6% (95% CI 38.7-71.2)	53.3% (95% CI 35.8-70.1)	58.3% (95% CI 36.7-77.2)
NPV	94.4% (95% CI 82.3-98.4)	79.2% (95% CI 64.1-89.0)	84.2% (95% CI 66.2-93.6)	80.0% (95% CI 62.3-89.5)
PLR	10.9 (95% CI 3.6-32.2)	2.3 (95% CI 1.1-4.5)	2.4 (95% CI 1.2-4.9)	2.6 (95% CI 1.1-6.1)
NLR	0.14 (95% CI 0.04-0.53)	0.47 (95% CI 0.2-1.0)	0.4 (95% CI 0.1-1.1)	0.5 (95% CI 0.2-1.1)

PPV, positive predictive value; PLR, positive likelihood ratio; NLR, negative likelihood ratio; CI, confidence interval.

sCalprotectine : FN


The Journal of Arthroplasty 33 (2018) 1149–1153
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ELSEVIER
Complications - Infection
Synovial Calprotectin: An Inexpensive Biomarker to Exclude a Chronic Prosthetic Joint Infection
Marjan Wouthuyzen-Bakker, MD, PhD [a,*], Joris J.W. Ploegmakers, MD [b], Karsten Ottink, MD [b], Greetje A. Kampinga, MD, PhD [a], Lucie Wagenmakers-Huizenga [c], Paul C. Jutte, MD, PhD [b], Anneke C.M. Kobold, MD, PhD [c]

En + Analyse supplémentaire, 12 patients, 2ème T

- 2 (17 %), cultures + → infection persistante ou une réinfection
- CRP, ESR et sCalprotectine : Neg

Faibles inocula de bactéries → sCalprotectine manque de Se

sCalprotectine : FP

International Orthopaedics (2023) 47:929–944
https://doi.org/10.1007/s00264-023-05691-3

ORIGINAL PAPER

The synovial fluid calprotectin lateral flow test for the diagnosis of chronic prosthetic joint infection in failed primary and revision total hip and knee arthroplasty

Christian Suren[1] · Igor Lazic[2] · Bernhard Haller[3] · Florian Pohlig[2] · Rüdiger von Eisenhart-Rothe[2] · Peter Prodinger[4]

- Prospective
- 137 patients : PTH ou PTG
- 34 (25 %) IOAP *vs* ICM 2018
- TestU

Lyfstone AS, Lysaker, Norway
Faible risque (<14 mg/ml
Intermediaire (14-50 mg/ml)
Fort risque (>50 mg/ml)

Table 5 Overview of patients with metallosis

Patient no	M/F	Age (y)	Hip/knee	Primary/ revision	No. of previous surgeries	Medical diagnoses	CRP (mg/dl)	Synovial WBC (cells/µl)	Synovial PMN (%)	Synovial fluid culture	Synovial calprotectin (mg/dl)	Tissue biopsy culture	Sonication fluid culture	Histology (type)	ICM score
Metallosis															
5	Female	64	Hip	Revision	3	Klippel-Trenaunay's syndrome LEOPARD-syndrome Carotid artery stenosis Hypothyroidism	0.1	1.8	52	Negative	14	Negative	Negative	Infectious	Negative
91	Female	80	Knee	Revision	5	None	2.9	0.8	77	Negative	243	Negative	Negative	Wear-induced	Negative

WBC white blood cell count, *PMN* polymorphonuclear neutrophils, *ICM score* International Consensus Meeting of 2018 Score

Table 7 Overview of patients with wear-induced osteolysis

Patient no	M/F	Age (y)	Hip/knee	Primary/ revision	No. of previous surgeries	Medical diagnoses	CRP	Synovial WBC (cells/µl)	Synovial PMN (%)	Synovial fluid culture	Synovial calprotectin (mg/dl)	Tissue biopsy culture	Sonication fluid culture	Histology (type)	ICM score
Wear disease															
8	Female	89	Hip	Primary	1	Status post-cerebral ischemic insultHypertension	1.1	n/a	n/a	Negative	32	Negative	*S. warneri*	Wear-induced	Negative
19	Male	58	Knee	Revision	4	Hypertension GERD Hypothyroidism	0.4	0.8	8	Negative	60	Negative	Negative	Wear-induced	Negative
38	Male	80	Knee	Revision	3	Cardiac arrhythmia Hypertension	0.5	0.1	24	Negative	14	Negative	Negative	Indifferent	Negative
48	Female	68	Hip	Primary	1	Hypertension	0.1	0.6	23	Negative	14	Negative	Negative	Wear-induced	Negative
58	Female	76	Knee	Revision	4	Rheumatoid arthritis Diabetes mellitus Hypertension GERD	0.9	1.5	74	Negative	251	Negative	Negative	Infectious	Negative
72	Male	77	Hip	Revision	2	Prostate cancer Diabetes mellitus	0.1	0.6	3	Negative	14	*Cutibacterium acnes*	*Cutibacterium acnes*	Indifferent	Positive
86	Female	78	Hip	Primary	3	Hypertension Osteoporosis Renal insufficiency	1.7	n/a	n/a	Negative	14	Negative	Negative	Indifferent	Negative
142	Male	73	Knee	Primary	1	Hypertension	0.1	0.2	2	Negative	14	Negative	Negative	Wear-induced	Negative
152	Male	75	Knee	Primary	1	Hypertension Nicotine abuse	0.5	4.8	16	Negative	23	Negative	Negative	Wear-induced	Negative

n=9

Peu d'effet de la métallose
Effet de l'ostéolyse induite par l'usure

sCalprotectine : Impact des ATBs ?

Bone Joint Res 2020;9(8):450–457.
BJR
INFECTION

The value of calprotectin in synovial fluid for the diagnosis of chronic prosthetic joint infection

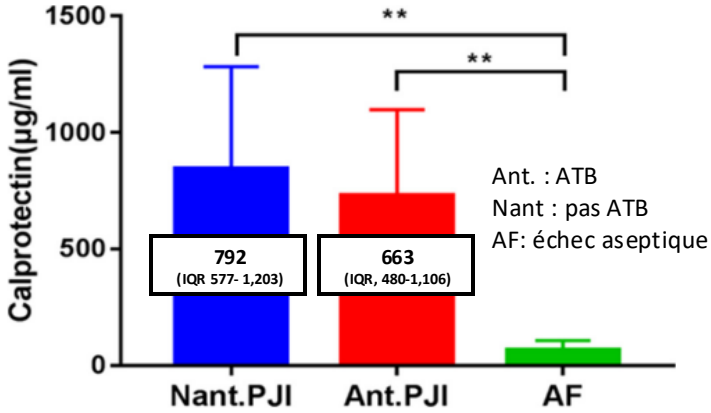
Z. ZHANG, Y. CAI, G. BAI, C. ZHANG, W. LI, B. YANG, W. ZHANG

- Prospective
- 63 patients : PTH ou PTG
- 21 (33 %) IOAP *vs* MSIS 2013
- ELISA

Table I. Characteristics of patients with aseptic failure (AF) or prosthetic joint infection (PJI).

Characteristic	PJI (n = 21)	AF (n = 42)	p-value*
Sex, n,(M/F)	4/17	17/25	0.089
Age (yrs)			< 0.001
< 60	7	23	
60 to 70	8	9	
> 70	6	10	
BMI (kg/m²)			0.04
< 24	8	14	
24 to 28	10	20	
> 28	3	8	
Hypertension	8	22	0.29
Diabetes	7	18	0.47
Joint involved			0.00
Hip	15	30	
Knee	6	12	
Preoperative antibiotic	15	5	< 0.001
Administration of immunosuppressive drugs	12	22	0.721

*Chi-squared test was performed.
BMI, Body mass index



Pas d'effet de la prise préalable d'ATB

sCalprotectine

- Performances ↗ Festa *et al.,* 2024
- Métallose Suren *et al.,* 2022
- ATB Zhang *et al.,* 2020
- Coût faible (10,60€ HT)
- Disponible dans nos laboratoires
- Valeur quantitative

- Ø MICI
- Ø Ostéolyse sévère Suren *et al.,* 2023
- 2T Whouthuyzen *et al.,* 2018

Discussion

- Performances ↗ des biomarqueurs synoviaux

Vale *et al.*, 2023

Table 1
List of Sensitivity and Specificity for Diagnostic Tests.

Synovial Fluid Biomarkers	Sensitivity*	Specificity*
Alpha-defensin (lateral flow test)	0.859 (0.818, 0.892)	0.931 (0.906, 0.949)
Alpha-defensin (ELISA)	0.869 (0.815, 0.909)	0.947 (0.924, 0.963)
CRP	0.860 (0.823, 0.890)	0.903 (0.861, 0.934)
LE (+1)	0.853 (0.800, 0.894)	0.912 (0.877, 0.937)
LE (+2)	0.780 (0.689, 0.850)	0.948 (0.925, 0.964)
Calprotectin	0.923 (0.840, 0.965)	0.945 (0.865, 0.979)

CRP, C-reactive protein; LE, leukocyte esterase; ELISA, enzyme-linked immunosorbent assay.
* Overall sensitivity and specificity of biomarkers regardless of the definition used.

- Aucun biomarqueur synovial seul ne peut être considéré comme un test de diagnostic définitif
- Intérêt d'une combinaison de plusieurs biomarqueurs synoviaux
- Prendre en compte les paramètres exposant à des FN ou FP

Discussion : Limites des études

- Populations hétérogènes :
  - Infections précoces/ tardives
  - Critères d'exclusions (maladies inflammatoires chroniques, Tt ATB antérieur)
- Techniques et seuils différents
- Peu d'études multicentriques
- Influence sur la Se des Scores Composites choisis

Vale *et al.*, 2023

α défensine

B = ICM 2018

Sensitivity

Studies	Estimate (95% C.I.)	TP/(TP + FN)
Huard 2020	0.878 (0.739, 0.948)	36/41
Kuiper 2020	0.955 (0.552, 0.997)	10/10
Saint Vicent 2021	0.955 (0.739, 0.994)	21/22
Shohat_2021	0.857 (0.676, 0.945)	24/28
Iori 2021	0.948 (0.852, 0.983)	55/58
Overall (I^2=0 %, P=0.527)	**0.906 (0.846, 0.944)**	**146/159**

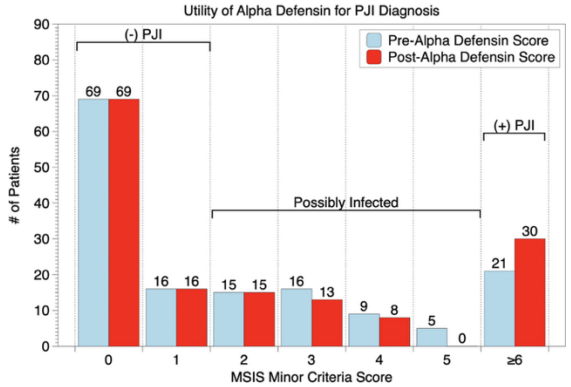
C = EBJIS

Sensitivity

Studies	Estimate (95% C.I.)	TP/(TP + FN)
Renz 2018	0.673 (0.539, 0.783)	37/55
Huard 2020	0.700 (0.560, 0.810)	35/50
Kuiper 2020	0.714 (0.439, 0.889)	10/14
Yu 2021	0.831 (0.720, 0.904)	54/65
Ivy 2021	0.875 (0.614, 0.969)	14/16
Overall (I^2=3194 %, P=0.209)	**0.747 (0.660, 0.817)**	**150/200**

Discussion : Place des Biomarqueurs synoviaux ?

- Heckmann *et al.,* 2023 : 172 patients, PTG, ponction pré op, MSIS 2018
  - 45 possibilité d'infection
  - Influence sur le diagnostic : 9/172 (5,2 %)



- Kleeman-Forsthuber *et al.,* 2021 : 152 patients, PTH, PTG, ponction pré op, MSIS 2018
  - Influence sur la décision d'intervention chirurgicale : 2 /152 (1,3 %)

Discussion : Place des Biomarqueurs synoviaux ?

Pré opératoire

Systématique

Per opératoire

Intérêt des tests unitaires

Post opératoire

Stabilité du biomarqueurs

Merci

Nantes Université
CHU NANTES

Louise Ruffier d'Epenoux

Pratricien Hospitalo Universitaire – CHU Nantes

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

Discussion

- Méta analyse : 75 articles
  - α défensine : 43 articles
  - sCRP : 22 articles
  - LE : 21 articles
  - sCalprotectine : 8 articles
- PTH, PTG
- *vs* MSIS, MSIS modifié, IDSA, ICM 2018, EBJIS 2021

Performance des BS
Hétérogénéité des définitions de l'IOAPs
→ influence sur la Se

Table 1
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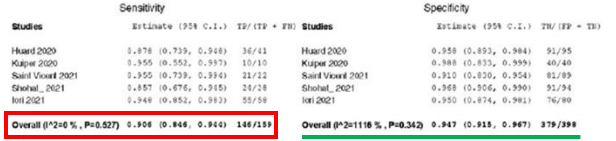
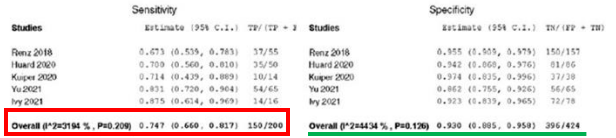
AD **B** = ICM 2018



C = EBJIS



Discussion

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

Etude CALPROS

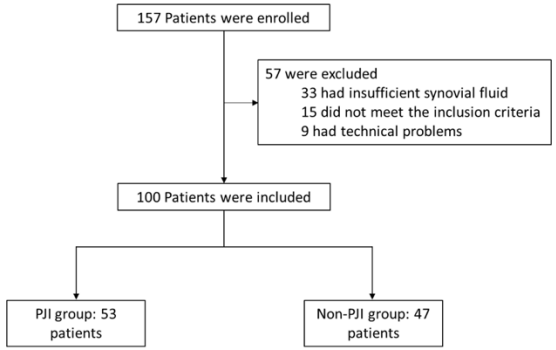
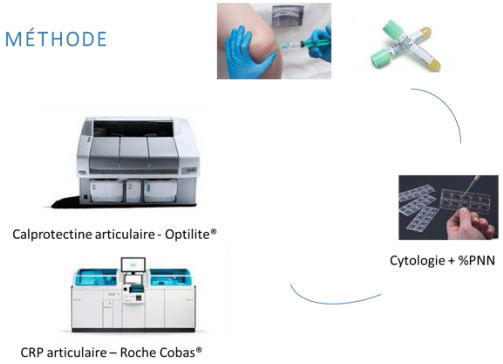


Figure 1. Study flow chart of patients included.



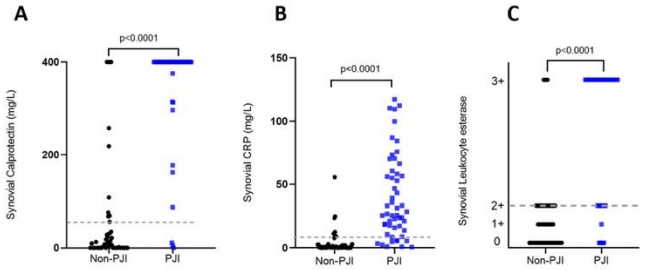


Figure 2. Synovial Levels of A) Calprotectin, B) C-Reactive Protein, and C) Leukocyte Esterase in Patients With PJI and Non-PJI.

Data on synovial calprotectin and C-reactive protein were available for all patients. Leukocyte esterase data were available for 50 patients in the PJI group and 41 patients in the non-PJI group

Table 2. Diagnostic Accuracy of Synovial Calprotectin, C-Reactive Protein and Leukocyte esterase.

Data on synovial calprotectin and C-reactive protein were available for all patients. Leukocyte esterase data were available for 50 patients in the PJI group and 41 patients in the non-PJI group. PLR : Positive Likelihood ratio ; NLR : Negative likelihood ratio ; AUC : Area Under the ROC curve ; CI : Confidence Interval

Test	Cutoff value	Sensitivity %	Specificity %	PLR	NLR	AUC
Calprotectin	50 mg/L	94.34% (95% CI 84.3-98.8)	76.60% (95% CI 62.0-87.7)	4.03	0.07	0.917 (95% CI 0.845-0.963)
Calprotectin	80 mg/L	94.34% (95% CI 84.3-98.8)	85.11% (95% CI 71.7-93.8)	6.33	0.07	
CRP	8.8 mg/L	79.25% (95% CI 65.9-89.1)	87.23% (95% CI 74.2-95.1)	6.21	0.24	0.935 (95% CI 0.867-0.974)
Leukocyte esterase	2+	68% (95% CI 53.3-80.5)	92.68% (95% CI 80.1-98.4)	9.29	0.35	0.835(95% CI 0.743-0.905)%

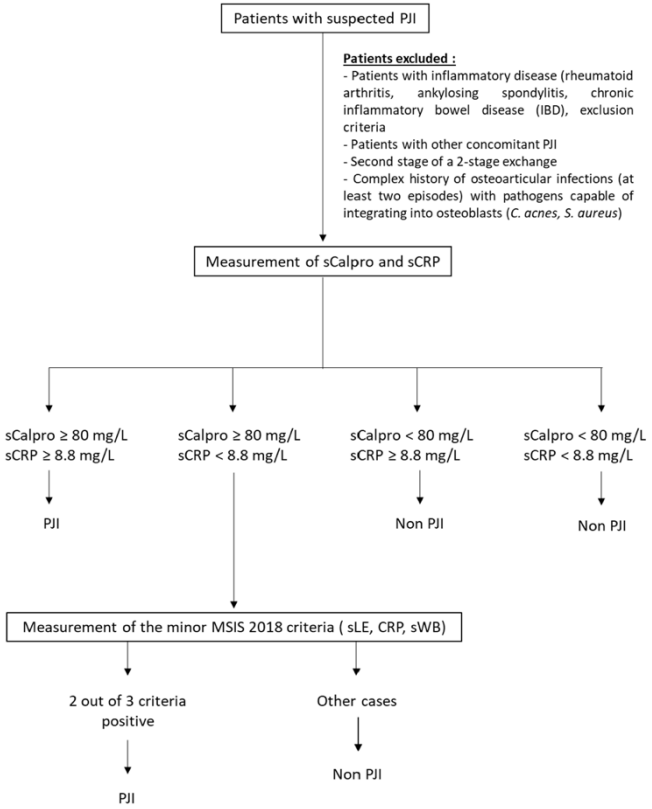
Discussion

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

Etude CALPROS

Figure 4. Proposal of an algorithm for routine Prosthetic joint infection diagnosis.

PJI, prosthetic joint infection ; sCalpro, synovial calprotectin ; sCRP, synovial CRP ; sLE, synovial leukocyte esterase ; CRP, serum C-reactive protein ; sWB : synovial white blood cell count.



Se = 95,7 %
Sp = 95,5 %
VPN = 95,5 %
VPP = 95,7 %.
2FP
2FN