Prélèvements microbiologiques et IPOA

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CH DRON – TOURCOING

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Prélèvements systématiques ?

OUI

-MSIS 2018

NON

-EBJIS
-SPILF

Parvizi J et al. The 2018 Definition of Periprosthetic Hip and Knee Infection: An Evidence-Based and Validated Criteria. J Arthroplasty. 2018.
McNally M et al. The EBJIS definition of periprosthetic joint infection. Bone Joint J. 2021

Recommandations de pratique clinique
Infections ostéo-articulaires sur matériel
(prothèse, implant, ostéosynthèse)

Prélèvements = ANTIOBIQUE

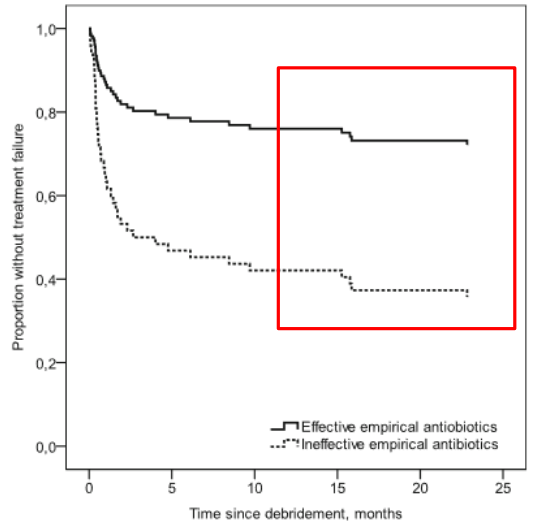


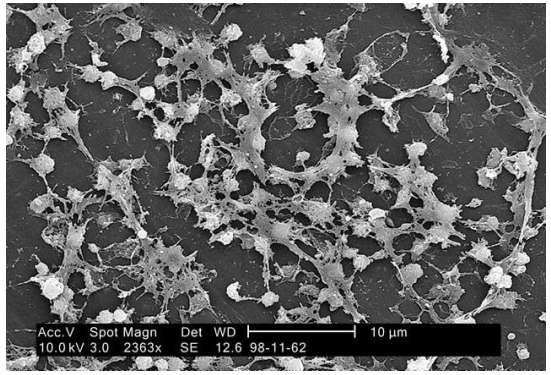
Fig. 2 Survival curves for effective and ineffective empirical antibiotics

Puhto et al. Int Orthopaedics. 2015

Table 2. Characteristics of Surgical Procedures and Antibiotic Therapy in 98 Patients With Total Hip or Knee Prosthesis Infection Due to *Staphylococcus aureus* According to Outcome

Characteristic	Remission (n = 77)	Treatment failure (n = 21)	P
Delay from onset of infection to revision, mean days ± SD	119.4 ± 238.2	79 ± 111.7	.80
Removal of all infected implants	45 (58.4)	12 (57.1)	.99
Gentamicin-loaded cement spacer[a]	27 (35.1)	7 (33.3)	.84
Adequate empirical postsurgical antibiotic therapy[b]	73 (94.8)	17 (80.9)	.04
Rifampin-fluoroquinolone combination therapy	37 (48.1)	2 (9.5)	.001
Rifampin combination therapy	58 (75.3)	10 (47.6)	.002
Total duration of antibiotic therapy, mean days ± SD	165.7 ± 108.8	145.1 ± 101.6	.44

Senneville et al. CID. 2011



Quelle antibiothérapie ?

Table 2 Microbiological results from cultured tissue specimens

Microbe	Number of patients (%) N=113
Staphylococcus aureus[a]	42 (37.2)
Coagulase-negative staphylococci	23 (20.4)
Streptococcus species	17 (15.0)
Enterococcus species	3 (2.7)
Gram-negative rods	11 (9.7)
Polymicrobial infection	17 (15.0)

Puhto et al. Int Orthopaedics. 2015

Characteristic	Late Acute (n = 267)	Early (n = 160)	Chronic (n = 142)	Late (Not Classifiable) (n = 84)
Staphylococcus aureus	135 (51%)	65 (41%)	39 (27%)	29 (35%)
MRSA	8 (3%)	5 (3%)	7 (5%)	3 (4%)
CoNS	29 (11%)	47 (29%)	45 (32%)	24 (29%)
Beta-hemolytic Strep	45 (17%)	14 (9%)	3 (2.0%)	8 (10%)
Enterococci	6 (2%)	26 (16%)	7 (5%)	4 (5%)
Enterobacteriaceae	10 (4%)	19 (12%)	9 (6%)	6 (7%)

Joshua S Davis et al. CID. 2022

Table 1. Microorganisms Identified in Hip and Knee Periprosthetic Joint Infection (PJI).*

Microorganism	Frequency (%)
Aerobic gram-positive bacteria	82
Coagulase-negative staphylococcus species (other than *S. lugdunensis*)	37
S. aureus	24
S. lugdunensis	4
Streptococcus species	14
Enterococcus species	8
Corynebacterium species	5
Aerobic gram-negative bacteria	11
Enterobacterales	7
Pseudomonas species	3
Anaerobic bacteria	13
Cutibacterium species	8
Other species	5
Fungi	3
Mycobacteria	0.5

* Data are from a single tertiary referral center; 70% of the PJIs were monomicrobial, and 25% were polymicrobial.[1] Pathogen distributions may vary from institution to institution.

Patel et al. NEJM. 2023

Table 4. Microorganisms and groups of organisms involved in non-hematogenous prosthetic joint infections according to time of infection after surgery (≤1 month, 2–3 months, 4–12 months, >12 months).

Microorganism or Microorganism Group	PJI within 1 Month after Surgery *n* = 844	PJI 2-3 Months after Surgery *n* = 243	PJI 4-12 Months after Surgery *n* = 277	PJI > 12 Months after Surgery *n* = 619	*p*-Value
	Total no. (%)*				
Staphylococcus species					
• Coagulase-negative staphylococci	236 (28.2) **	107 (44) ** †	167 (60.3) †	348 (56.2)	<0.001
○ *Staphylococcus epidermidis*	132 (15.6) **	68 (28) ** †	106 (38.3) †	203 (32.8)	<0.001
○ *Staphylococcus lugdunensis*	2 (0.2) **	3 (1.3) **	10 (3.6)	22 (3.6)	<0.001
• *Staphylococcus aureus*	301 (35.7)	60 (24.7)	60 (21.7)	108 (17.4)	<0.001
Streptococcus species	36 (4.3) **	25 (10.3) **	14 (5.1)	49 (7.9)	<0.001
○ *Streptococcus agalactiae*	8 (0.9) **	11 (4.5) **	6 (2.2)	10 (1.6)	0.003
○ Viridans group streptococci not identified to species level	6 (0.7) **	7 (2.9) **	2 (0.7) †	18 (2.9) †	0.003
Enterococcus species	106 (12.6)	23 (9.5)	15 (5.4)	32 (5.4)	<0.001
Aerobic Gram-negative bacilli	396 (46.9) **	50 (20.6) ** †	37 (13.4) †	37 (13.4)	<0.001
• *Enterobacteriaceae*	303 (35.9) **	37 (15.2) ** †	25 (9) †	48 (7.8)	<0.001
○ *Escherichia coli*	129 (15.3)	12 (4.9)	10 (3.6)	21 (3.4)	<0.001
○ *Proteus* spp.	75 (8.9)	7 (2.9)	7 (2.5)	14 (2.3)	<0.001
○ *Enterobacter* spp.	73 (8.6) **	11 (4.5) ** †	2 (0.7) †	6 (1)	<0.001
○ *Klebsiella* spp.	48 (5.7)	2 (0.8)	4 (1.4)	3 (0.5	<0.001
• Non-fermenting Gram-negative bacilli	138 (16.4) **	16 (6.6) **	11 (4)	41 (6.6)	<0.001
○ *Pseudomonas* spp.	128 (15.2) **	17 (7) **	11 (4)	35 (5.7)	<0.001
Aerobic Gram-positive bacilli	16 (1.9)	3 (1.2)	7 (2.5)	23 (3.7)	0.083
Anaerobic Gram-positive bacilli	19 (2.3) **	14 (5.7) **	16 (5.8)	61 (9.7)	<0.001
• *Cutibacterium* spp.	17 (2) **	12 (4.9) **	16 (5.8)	51 (8.2)	<0.001
Anaerobic Gram-positive cocci	8 (0.9)	4 (1.6)	5 (1.8)	13 (2.1)	0.330
Anaerobic Gram-negative bacilli	12 (1.4)	2 (0.8)	1 (0.4)	5 (0.8)	0.409
Mycobacterium species	2 (0.2)	1 (0.9)	4 (1.4)	2 (0.3)	0.068
Fungi	8 (0.9)	3 (1.2)	3 (1.1)	12 (1.9)	0.418
Multidrug-resistant organisms	202 (23.9)	20 (8.2)	20 (7.2)	43 (6.9)	<0.001
• Methicillin-resistant *S. aureus*	93 (11)	14 (5.8)	14 (5.1)	30 (4.8)	<0.001
• Multidrug-resistant Gram-negative bacilli	112 (13.3)	7 (2.5)	5 (1.8)	14 (2.3)	<0.001
• Extended-spectrum beta-lactamases producing *Enterobacteriaceae*	36 (4.3)	1 (0.4)	2 (0.7)	1 (0.3)	<0.001
Ciprofloxacin-resistant Gram-negative bacilli	84 (10)	5 (2.1)	4 (1.4)	11 (1.8)	<0.001
Polymicrobial infections	230 (27.2)	36 (14.7)	32 (11.1)	77 (11.1)	<0.001

Natividad et al. J. Clin. Med. 2019

Antibiothérapie d'attente

Bêta-lactamine

- Pipéracilline-tazobactam < 80kg 4g/8h >80kg 4g/6h
- Céfépime 60mg/kg/j
  - Encéphalopathie
- Ceftobiprole 500mg-1g/8h
  - Protocole MECOS

+

Anti cocci Gram +

- Daptomycine 10-12 mg/kg/j
  - CPK, éosinophilie, pneumopathie interstitielle

- ~~Vancomycine / Teicoplanine~~
  - ~~Dosages~~

+ Prise en compte documentation antérieure

En pratique

Antibiothérapie

- IV, large spectre
- 3 à 5 jours

→

- Toxicité/effets secondaires
- Pression de sélection
- Durée d'hospitalisation

Prélèvements

- Multiples
- Acheminés rapidement

→

- Temps chirurgical
- Temps laboratoire
- Coût matériel

Et donc :

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Prélèvements : quelles situations ?

- ATCD d'infection au site concernée
  - *Quel que soit le délai*
- Cicatrice inflammatoire
- Prothèse douloureuse
  - *Sans explications mécanique*

- Sd inflammatoire biologique
  - CRP, leucocytes
- Hémocultures positives
- Signes radiologiques
  - Collection, descellement
- 2ème temps d'un RT2

Et en cas de doute ?

Ponction en amont

- Rentabilité modérée
  - Se 59%

    Barker et al. JBJI 2021.
- Interprétation (parfois) difficile
  - Micro-organismes commensaux

- Geste simple, peu invasif
  - PTG
- Répétable
- Marqueurs synoviaux
  - Leucocyte estérase
  - Alpha-défensine
  - Calprotectine
  - CRP

Marqueurs synoviaux

Table 3
Synovasure performance.

Performance of Synovasure™ test	MSIS indicating infection	MSIS ruling out infection
Synovasure Positive	21 Sensitivity: 95.5%	8[a] PPV: 72.4%
Synovasure Negative	1 NPV: 98.8%	81 Specificity: 91%

PPV: positive predictive value; NPV: negative predictive value.
[a] One case of positive Synovasure™ test with metallosis identified on macroscopic joint fluid aspect, excluded from analysis.

- **Leucocyte estérase**
  - Pas de sang OU centrifugé
    - Se : 85% MSIS ; 81% EBJIS
    - Spe : 95% MSIS ; 91% EBJIS

- **Alpha défensine**
  - Se : 86% MSIS ; 74% EBJIS
  - Spe : 93% MSIS ; 93% EBJIS

- **Calprotectine**
  - Se : 94% MSIS ; 93% EBJIS
  - Spe : 94% MSIS ; 100% EBJIS

- **CRP**
  - Se : 83%
  - Spe : 92%

Chirurgie > 3 mois

Volume suffisant
(5 à 10 mL)

Vale et al. Journal of Arthroplasty. 2023

Nombre de prélèvements

- IDSA 2013 : **3 à 5 prélèvements**
- HAS 2014 : **3 prélèvements**
- EFORT/EBJIS 2023 : **5 prélèvements**

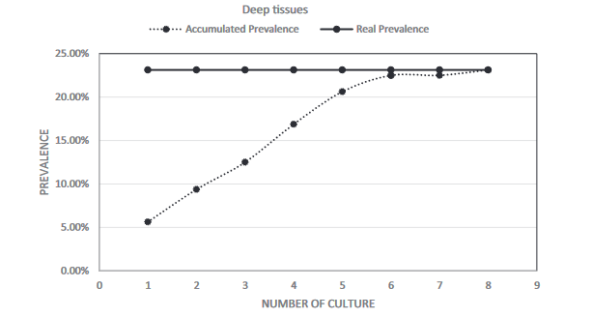
- Bémer et al 2016 : **4 prélèvements**
  - 3 sur flacons aéro/anaérobies
- Peel et al 2017 : **4 prélèvements**

- Variable selon le micro-organisme

0	Resistant	Variant	*Gram-positive*	*Gram-negative*	MSSA	CNS	*P acnes*	*Pseudomonas*
Number of samples	3	7	3	4	3	4	10	4
Days to culture	3.84 ± 0.12, range 2-17	6.57 ± 0.57, range 3-11	4.41 ± 0.07, range 2-19	4.87 ± 0.33, range 2-18	4.12 ± 0.10, range 2-15	5.15 ± 0.15, range 2-19	10.75 ± 2.14, range 8-17	4.23 ± 0.43, range 3-8

Kheir et al. J Arthroplasty. 2018

- *Cutibacterium acnes :* **5-6 prélèvements**



Torrens et al. J Shoulder Elbow Surgery. 2022

-TROIS prélèvements

Cinq sur épaule

-Profonds

-Sites différents

Identifiés

-Acheminés en 2h à température ambiante

Quand ? Fenêtre antibiotique

- Maximiser les chances de prélèvements informatifs
  - Risque X4 de prélèvements négatifs

Malekzadeh et al. Clin Orthop Relat Res. 2010

  - Sensibilité avec fenêtre : 60% (49%-71%)
  - Sensibilité sans fenêtre : 45%

Trampuz et al. NEJM. 2007

JAMAIS AU DETRIMENT DE L'URGENCE

- Durée : 2 semaines *IDSA, EFORT, EBJIS*
  - 3-4 semaines si : cyclines, clindamycine, fluoroquinolones, rifampicine

Wito et al. Acta Orthop Scand. 1999

Et l'antibioprophylaxie ?

Et l'antibiothérapie ?

En résumé

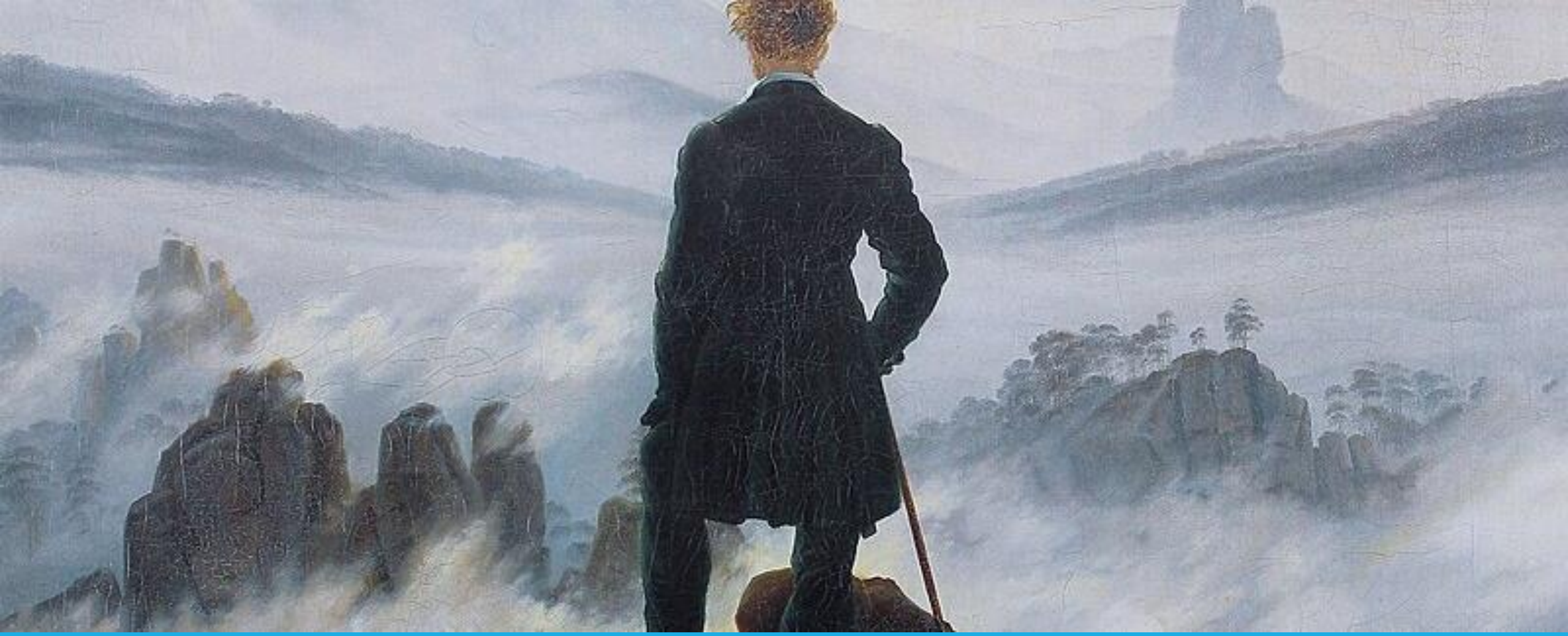
- **Prélèvement SI suspicion**
  - Antibiothérapie large spectre systématique
- **Ponction pré-opératoire**

en cas de situations douteuses

  - +/- enrichie de marqueurs synoviaux
- **Prélèvements multiples**
  - 3 à 5
  - 5 en cas de suspicion de *C. acnes*
  - Après fenêtre ATB (2-4 semaines)
  - Suivi d'une antibiothérapie d'attente

	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[e]
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[i]	

EBJIS guidelines 2021



Merci de votre attention

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