Recommandations endocardites

3ème Journée Régionale Annuelle Bon Usage Antibiotique et lutte contre l'antibiorésistance

Amandine Gagneux-Brunon (CHU St Etienne)
Patricia Pavese (CHU Grenoble)

Au menu

- Antibioprophylaxie
- Antibioprophylaxie des TAVI
- Traitement empirique des EI
- Traitement des EI à staphylocoque
- Traitement des EI à streptocoque
- Traitement des EI à entérocoque
- Relai oral
- Durée de traitement

Original article

International experts' practice in the antibiotic therapy of infective endocarditis is not following the guidelines

CMI CLINICAL MICROBIOLOGY AND INFECTION
ESCMID

- 13 centres
- Canada, Espagne, France, Israël, Pays-bas, USA, Suède
- Traitement conforme aux recommandations ESC AHA dans 58% des cas (54 à 62% pour les EI à staphylocoque)
- Janvier 2016

54 à 62% d'adhésion pour EI à staphylocoque

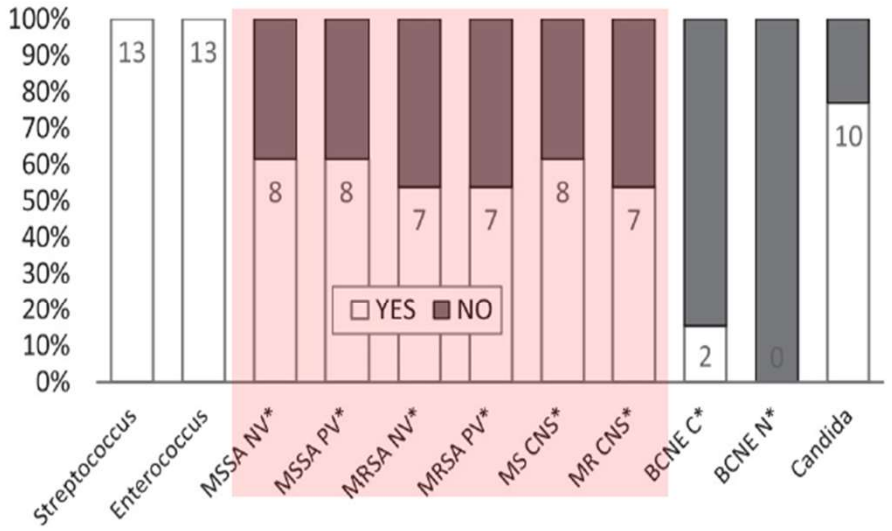

Fig. 1. Adherence to recommendations by microorganism/ conditions (figures in the bars indicate the number of centres adhering to the guidelines). Abbreviations: MSSA NV, methicillin susceptible *Staphylococcus aureus*—native valve; MSSA PV, MSSA—prosthetic valve; MRSA NV, methicillin-resistant *S. aureus*—native valve; MRSA PV, MRSA—prosthetic valve; MS CNS, methicillin-susceptible, coagulase-negative *Staphylococcus*; MR CNS, methicillin-resistant, coagulase-negative *Staphylococcus*; BCNE C, blood-culture-negative endocarditis—community-acquired; BCNE N, blood-culture-negative endocarditis—nosocomial.

Tissot-Dupont *et al.* Clin microbiol infect 2017

Original article

International experts' practice in the antibiotic therapy of infective endocarditis is not following the guidelines

CMI CLINICAL MICROBIOLOGY AND INFECTION
ESCMID

- 13 centres
- Canada, Espagne, France, Israël, Pays-bas, USA, Suède
- Recommandations ESC AHA suivies dans 58% des cas (54 à 62% pour les EI à staphylocoque)

42% pour les équipes françaises

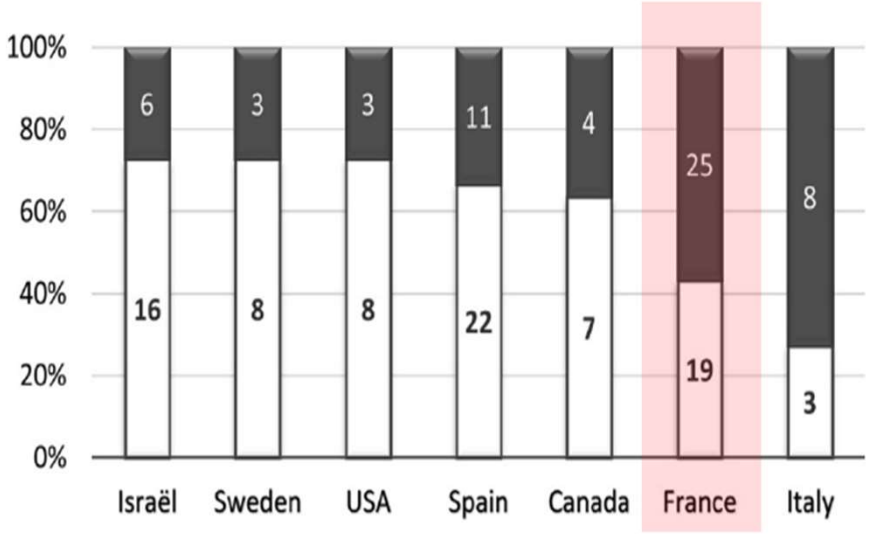

Fig. 2. Adherence to recommendations by country (figures in the bars indicate the number of microorganisms / conditions with or without adherence by the centres of each country).

Tissot-Dupont *et al.* Clin microbiol infect 2017

ESC European Society of Cardiology
European Heart Journal (2023) 00, 1–95
https://doi.org/10.1093/eurheartj/ehad193

ESC GUIDELINES

2023 ESC Guidelines for the management of endocarditis

Developed by the task force on the management of endocarditis of the European Society of Cardiology (ESC)

Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS) and the European Association of Nuclear Medicine (EANM)

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JAMA Network Open

Consensus Statement | Infectious Diseases

Guidelines for Diagnosis and Management of Infective Endocarditis in Adults
A WikiGuidelines Group Consensus Statement

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JN 25es Journées Nationales d'Infectiologie
DEAUVILLE et la région Normandie
du mercredi 12 au vendredi 14 juin 2024
SPILF CMIT

Position Statement SPILF/AEPEI
Endocardites Infectieuses
Recommandations ESC 2023

JOURNAL ARTICLE

The 2023 Duke-International Society for Cardiovascular Infectious Diseases Criteria for Infective Endocarditis: Updating the Modified Duke Criteria

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Antibioprophylaxie

Les nouveautés sur l'antibioprophylaxie de l'EI

Recommendation Table 1 — Recommendations for antibiotic prophylaxis in patients with cardiovascular diseases undergoing oro-dental procedures at increased risk for infective endocarditis

Recommendations	Class[a]	Level[b]
General prevention measures are recommended in individuals at high and intermediate risk for IE.	I	C
Antibiotic prophylaxis is recommended in patients with previous IE.[47,84,86]	I	B
Antibiotic prophylaxis is recommended in patients with surgically implanted prosthetic valves and with any material used for surgical cardiac valve repair.[47,87–89]	I	C
Antibiotic prophylaxis is recommended in patients with transcatheter implanted aortic and pulmonary valvular prostheses.[91–94]	I	C
Antibiotic prophylaxis is recommended in patients with untreated cyanotic CHD, and patients treated with surgery or transcatheter procedures with post-operative palliative shunts, conduits, or other prostheses. After surgical repair, in the absence of residual defects or valve prostheses, antibiotic prophylaxis is recommended only for the first 6 months after the procedure.[8,47,97,101]	I	C
Antibiotic prophylaxis is recommended in patients with ventricular assist devices.[102]	I	C
Antibiotic prophylaxis should be considered in patients with transcatheter mitral and tricuspid valve repair.[95]	IIa	C
Antibiotic prophylaxis may be considered in recipients of heart transplant.[105–107]	IIb	C
Antibiotic prophylaxis is not recommended in other patients at low risk for IE.[11,51]	III	C

Table 6 Prophylactic antibiotic regime for high-risk dental procedures

Situation	Antibiotic	Single-dose 30–60 min before procedure	
		Adults	Children
No allergy to penicillin or ampicillin	Amoxicillin	2 g orally	50 mg/kg orally
	Ampicillin	2 g i.m. or i.v.	50 mg/kg i.v. or i.m.
	Cefazolin or ceftriaxone	1 g i.m. or i.v.	50 mg/kg i.v. or i.m.
Allergy to penicillin or ampicillin	Cephalexin[a,b]	2 g orally	50 mg/kg orally
	Azithromycin or clarithromycin	500 mg orally	15 mg/kg orally
	Doxycycline	100 mg orally	<45 kg, 2.2 mg/kg orally >45 kg, 100 mg orally
	Cefazolin or ceftriaxone[b]	1 g i.m. or i.v.	50 mg/kg i.v. or i.m.

European Journal of Internal Medicine 87 (2021) 59–65

Contents lists available at ScienceDirect

European Journal of Internal Medicine

m/locate/ejim

Table 1
Comparison of patients with solid organ transplantation (SOT) and patients without SOT.

Variables (%)	No transplantation (N=4696)	SOT (N=85)	p
Place of acquisition			
Community	2843 (60.5)	24 (28.2)	<0.001
Nosocomial	1340 (28.5)	43 (50.5)	<0.001
Health care-related	366 (7.8)	17 (20.0)	0.001
Unknown	147 (3.1)	1 (1.2)	0.03
Etiology			
Staphylococcus aureus	1049 (22.3)	27 (31.8)	0.04
Coagulase - Staphylococcus	817 (17.4)	22 (25.9)	0.04
Enterococcus spp.	654 (13.9)	14 (16.5)	0.50
Streptococcus spp.	1218 (25.9)	2 (2.4)	<0.001
Candida spp.	82 (1.7)	0	0.22
Other fungi**	7 (0.1)	4 (4.7)	<0.001
Anaerobes	53 (1.1)	1 (1.2)	0.62
Gram negative bacilli	200 (4.3)	3 (3.5)	0.74
Polimicrobial	73 (1.6)	3 (3.5)	0.15
Other	148 (3.2)	1 (1.2)	0.52

transplantation. A

nen Fariñas[c],
larcón[f],
iguel Ángel Goenaga[i],
ía-Pérez[l],
nish Collaboration on
cciosa en ESpaña (GAMES)[1]

Table 3
Comparison of patients according to the type of solid organ transplantation.

Variables (%)	Kidney (56)	Liver (18)	Heart/ Lung (11)	p

Matched retrospective study of infective endocarditis among solid organ transplant recipients compared to non-transplant: Seven-year experience in a US Referral Center

TABLE 2 Characteristics of patients with IE among 14 SOT patients at Cleveland Clinic, 2008-2014

Pt	Type of transplant	Organism	Rejection prior to IE	CMV infection prior to IE	Number of immuno-suppressive agents	Death
1	Heart	*Enterococcus faecalis*	N	N	3	N
2	Lung	*Pseudomonas*	N	N	3	N
3	Kidney	*Enterococcus faecalis*, *Candida*	N	N	1	N
4	Kidney	Coagulase-negative *Staphylococcus*	N	N	3	N
5	Kidney pancreas	*Streptococcus*	N	N	3	N
6	Kidney pancreas	*Staphylococcus aureus*	N	N	3	N
7	Kidney	*Enterococcus faecalis*	N	N	3	N
8	Kidney	*Tropheryma whipplei*	N	N	3	N
9	Lung	*Enterococcus faecalis*	Y	N	3	N
10	Kidney	*Enterococcus faecalis*	N	N	3	N
11	Kidney	*Enterococcus faecalis*	N	N	3	N
12	Kidney	*Staphylococcus aureus*	N	N	2	Y
13	Kidney	*Coagulase-negative Staphylococcus*	N	N	2	Y
14	Lung	*Enterococcus faecalis*	N	N	2	N

Donc ATBp de l'EI visant strepto oraux peu logique pour les transplantés

Chuang S. et al, Transplant Infect Dis 2020

European Heart Journal (2009) **30**, 2369–2413
doi:10.1093/eurheartj/ehp285

2009

Reasons justifying revision of previous ESC Guidelines

Table 5 **Recommendations for prophylaxis of infective endocarditis in highest risk patients according to the type of procedure at risk**

Recommendations: prophylaxis	Class[a]	Level[b]
A - Dental procedures: **Antibiotic prophylaxis should only be considered for** dental procedures requiring manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa	IIa	C
Antibiotic prophylaxis is not recommended for local anaesthetic injections in non-infected tissue, removal of sutures, dental X-rays, placement or adjustment of removable prosthodontic or orthodontic appliances or braces. Prophylaxis is also not recommended following the shedding of deciduous teeth or trauma to the lips and oral mucosa	III	C
B - Respiratory tract procedures*: **Antibiotic prophylaxis is not recommended for respiratory tract procedures, including** bronchoscopy or laryngoscopy, transnasal or endotracheal intubation	III	C
C - Gastrointestinal or urogenital procedures*: **Antibiotic prophylaxis is not recommended for** gastroscopy, colonoscopy, cystoscopy or transoesophageal echocardiography	III	C
D - Skin and soft tissue*: **Antibiotic prophylaxis is not recommended for any procedure**	III	C

Jose Luis Zamorano (Spain)

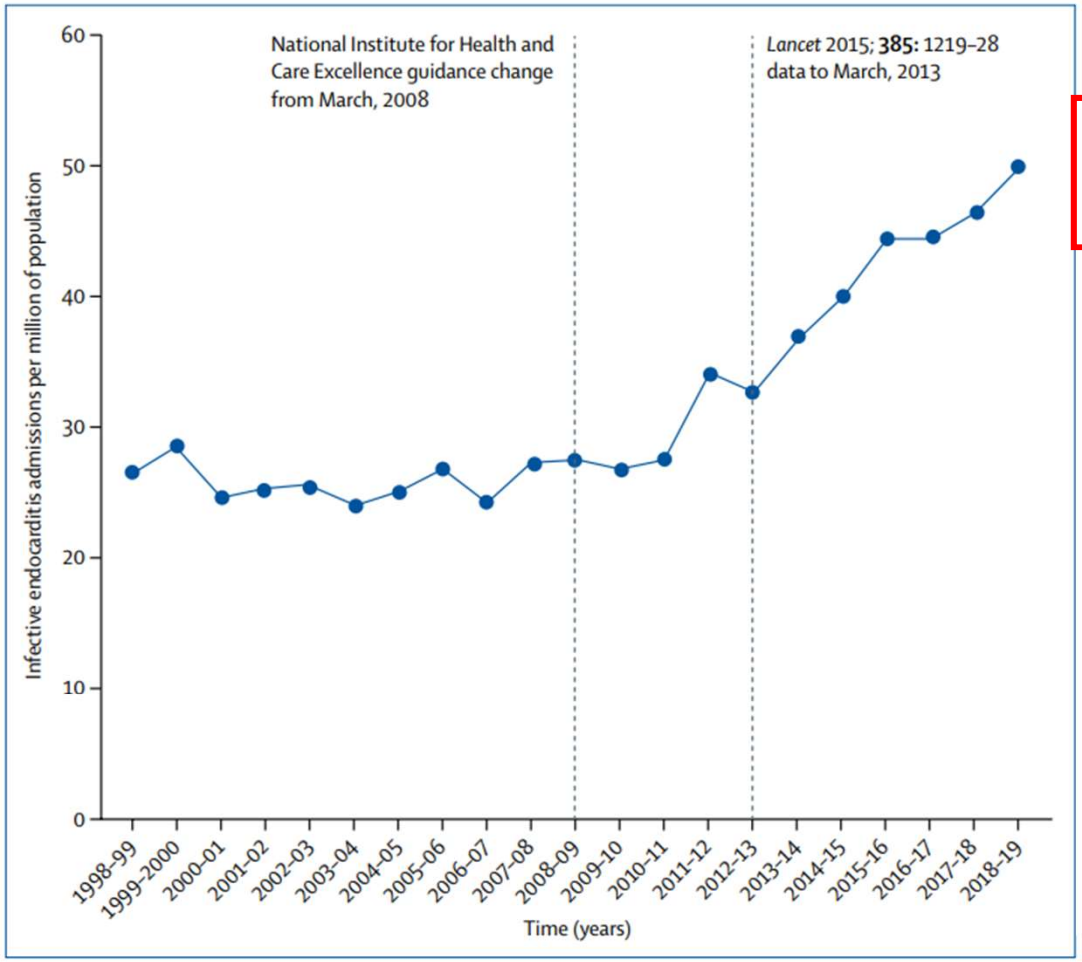


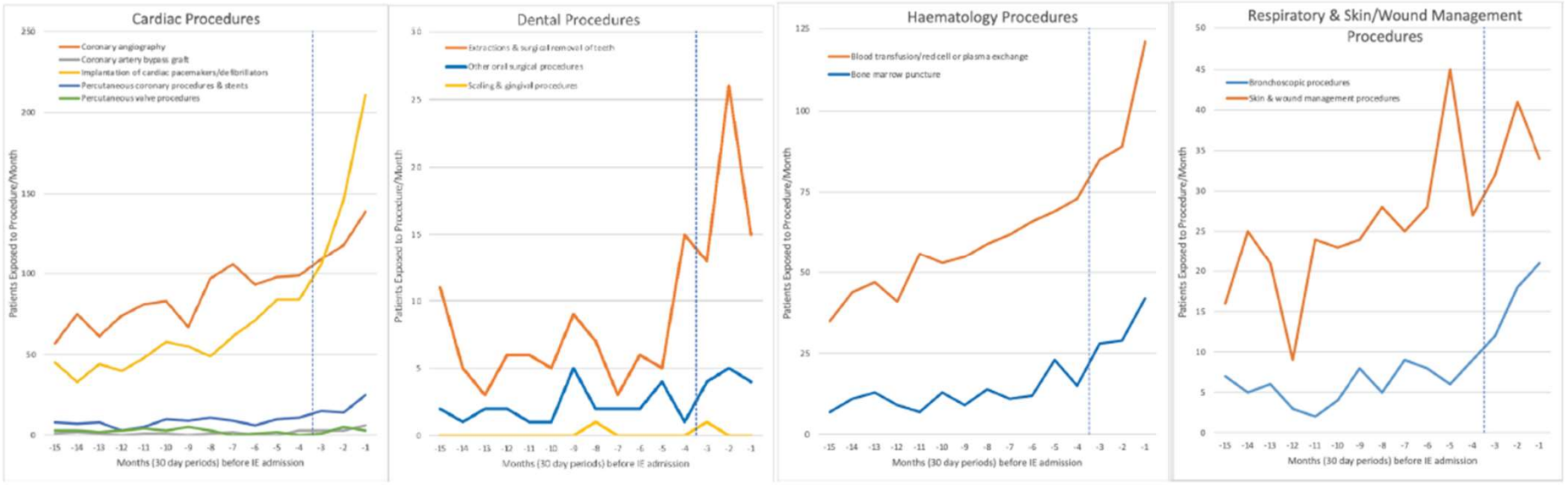
Figure: **English hospital admissions with a primary diagnosis of infective endocarditis (ICD-10 diagnostic code I33) corrected for population growth**

ıdocarditis in

In the absence of microbiological data, a rapidly increasing incidence of infective endocarditis cannot be attributed solely to cessation of antibiotic prophylaxis in the wake of the NICE recommendations. Multiple contributory factors are probable, including an ageing population, increased use of both intracardiac (eg, permanent pacemakers, implantable cardioverter defibrillators, or surgical and transcatheter heart valves) and vascular devices (eg, those used for chronic haemodialysis), epidemic levels of opioid addiction and associated injection drug use, emergence of staphylococci and enterococci (neither of which are targeted by antibiotic prophylaxis strategies) as more common causative organisms, and improved clinical awareness of infective endocarditis. Nevertheless, these findings are disturbing and contrast with reports of decreasing incidence in the USA[7–10] and decreasing or moderate increases in Europe,[11–13] where contributory factors are

Temporal association between invasive procedures and infective endocarditis

Thornhill et al, Heart 2023;109:223–231



Pourquoi est-il trop tôt pour élargir à nouveau les indications aux gestes autres que dentaires ?

- Risques liés à une prescription antibiotique indiscriminée

- Recommandations d'élargissement de l'ESC 2023 fondées sur deux études rétrospectives de faible niveau de preuve:
  - Codage ICD surestime la fréquence des EI (x 2 environ)
  - Biais d'indication probables (exemple de la BOM, des biopsies cutanées, des transfusions…)

- L'ESC ne propose pas de protocole d'antibioprophylaxie pour ces nouvelles recommandations

Groupe reco SPILF/JNI 2024

Antibioprophylaxie de l'EI: indications

- Uniquement chez sujets à haut risque d'EI
  - ATCD d'EI
  - Prothèses valvulaires (y compris TAVI et mitraclip)
  - Cardiopathies congénitales (cyanogènes non opérées ou opérées depuis moins de 6 mois, ou avec matériel)
  - Assistance ventriculaire

- Uniquement pour les gestes dentaires à risque (cf. recommandations HAS 2024 pour le détail)

Groupe reco SPILF/JNI 2024

Risk of Adverse Reactions to Oral Antibiotics Prescribed by Dentists

Table 1. Adverse Drug Reaction Data: 2010 to 2017.

	Adverse Drug Reactions/Million Prescriptions			
Drug Name	Nonserious	Serious	Fatal	Total
Amoxicillin	9.4	11.9	0.1	21.5
Amoxicillin + clavulanic acid	20.2	49.5	1.5	71.2
Penicillin V	75.0	61.7	0.4	137.0
Cephalosporins	9.0	17.9	0.5	27.4
Tetracyclines	16.8	32.6	0.9	50.2
Azithromycin	12.1	45.8	0.8	58.7
Clarithromycin	31.2	65.5	1.3	98.0
Erythromycin	19.8	26.7	0.7	47.2
Clindamycin	101.2	233.2	2.9	337.3
Metronidazole	18.5	51.4	0.7	70.6
All antibiotics prescriptions by dentists	19.9	30.5	0.5	50.9
All antibiotics	20.4	36.8	0.7	57.9

Prescriptions curatives, reporting, gravité non définie, durée de traitement non rapportée

Thornhill MH et al, J Dental Res 2019

Journal section: Oral Medicine and Pathology
Publication Types: Research

doi:10.4317/medoral.22818
http://dx.doi.org/doi:10.4317/medoral.22818

Données CPV France 09/1985-07/2015

Antibiotic prophylaxis for the prevention of infective endocarditis for dental procedures is not associated with fatal adverse drug reactions in France

Alexandra Cloitre [1], Xavier Duval [2], Sarah Tubiana [2], Pauline Giraud [1], Gwenaëlle Veyrac [3], Audrey Nosbaum [4], Aurore Gouraud [5], Julien Mahé [3], Philippe Lesclous [6]

Results: Of 11639 first-line recorded ADRs, 100 were for IE AP but no fatal anaphylaxis to amoxicillin or clindamycin and no *C. difficile* infection associated with clindamycin were identified. Only 17 cases of anaphylaxis to amoxicillin related to dental procedures were highlighted. The estimation of the crude incidence rate of anaphylaxis associated with amoxicillin for IE AP for invasive dental procedure was 1/57 000 (95% CI 0.2-0.6).

Conclusions: Fatal or severe ADRs with amoxicillin or clindamycin is not a rational argument to stop IE AP before invasive dental procedures.

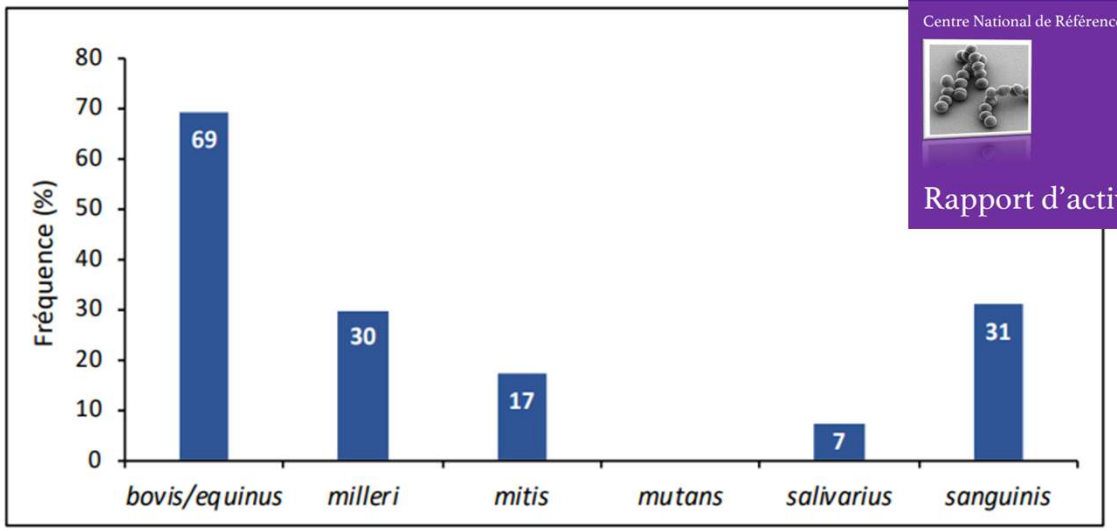


Figure 76. *Fréquence de la résistance aux tétracyclines parmi les 522 souches de streptocoques* viridans.

Tableau XI. *Syn*
streptocoques v

S. milleri (n=1
S. bovis (n=77
S. mitis (n=14
S. mutans (n=
S. salivarius (r
S. sanguinis (r

[a]S : sensible (CMI à la pénicil
≤ 0,5 mg/L, ceftriaxone ≤ 0,
ampicilline > 0,5 mg/L et ≤ 2
> 2 mg/L, ampicilline > 2 mg/

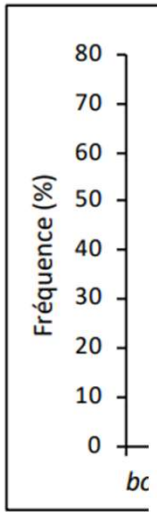


Figure 74. *F*
viridans.

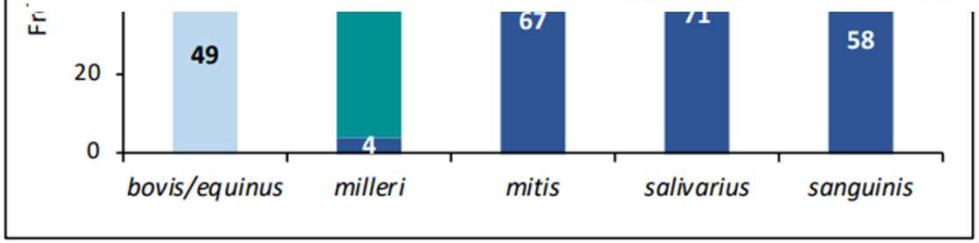


Figure 75. *Fréquence des phénotypes de résistance parmi les 218 souches de streptocoques* viridans *résistantes aux macrolides (M), lincosamides (L) et streptogramines A (S_A) et B (S_B). MLSB-c : phénotype MLS_B constitutif ; MLSB-i : phénotype MLS_B inductible.*

Antibioprophylaxie de l'EI: modalités

Dans l'heure précédant le geste

Situation	Molécule	Adultes	Enfants
Absence d'allergie à la pénicilline	Amoxicilline	2 g	50 mg/kg
Allergie à la pénicilline	Azithromycine	500 mg	20 mg/kg
	ou Pristinamycine	1 g	25 mg/kg CI < 6 ans

L'amoxicilline est le traitement dont l'efficacité est la mieux démontrée dans cette indication (grade A).

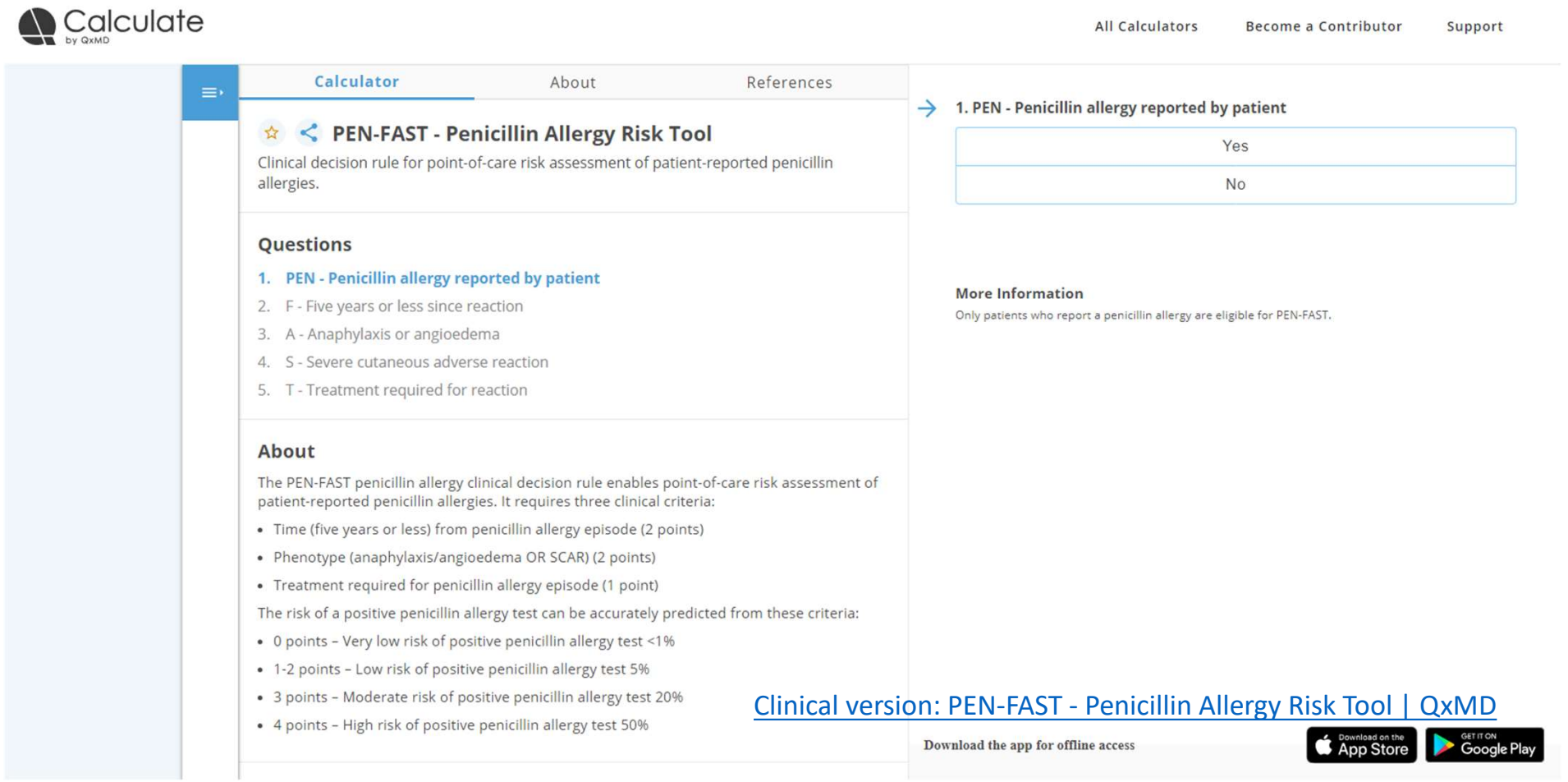
En cas de doute sur une allergie à l'amoxicilline, il est utile de faire des tests pour la confirmer* afin de ne pas inutilement priver un patient de ce traitement de référence. D'autant plus que le patient sera amené à avoir des soins dentaires répétés.

** cf. présentation du groupe recommandations de la SPILF tout à l'heure*

HAS • Prise en charge bucco-dentaire des patients à risque d'endocardite infectieuse • mars 2024

Groupe reco SPILF/JNI 2024

Est-ce que le problème n'est pas plutôt d'enlever l'étiquette allergie aux patients ?



[Clinical version: PEN-FAST - Penicillin Allergy Risk Tool | QxMD]

A Grenoble

- Nous avons endossé les indications de l'ATBp du position statement SPILF/AEPEI

- Nous gardons notre choix habituel d'ATB

Antibiotiques (60 min avant la procédure si prise orale, 30-60 mn avant la procédure si voie IV)			
Situation	Antibiotique	Adultes	Enfants
Pas d'allergie à la pénicilline	Amoxicilline	2 g per os ou IV, dose unique	50 mg/kg per os ou IV, dose unique
Allergie à la pénicilline	Clindamycine	600 mg per os ou IV, dose unique	20 mg/kg per os ou IV, dose unique

Antibioprophylaxie avant pose de TAVI

- Les RFE SFAR-SPILF prévalent sur les recommandations ESC 2023
- Rationnel: couvrir *Enterococcus faecalis* et *Staphylococcus aureus*

- Amoxicilline-acide clavulanique 2 g IV
  - Allergie: vancomycine 20 mg/kg ou teicoplanine 12 mg/kg
- Idem pour toute implantation de matériel intracardiaque par voie fémorale

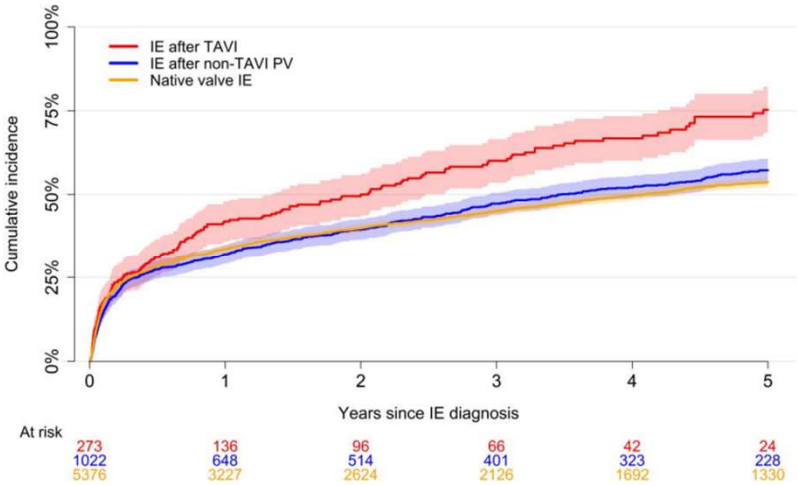
Groupe reco SPILF/JNI 2024

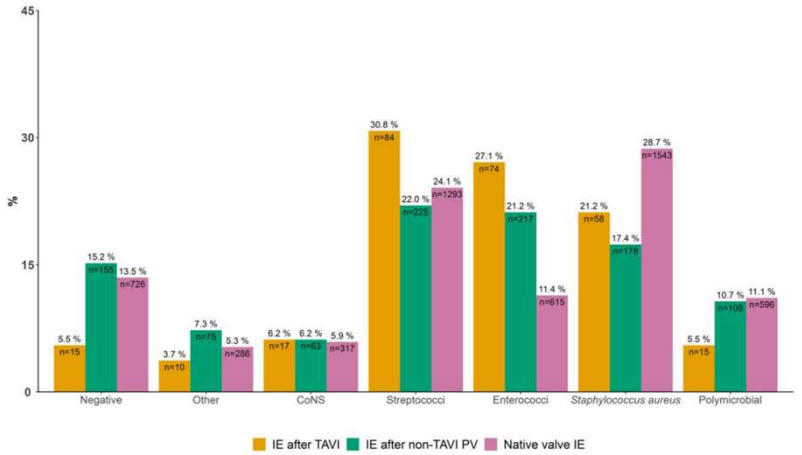
Patient Characteristics, Microbiology, and Mortality of Infective Endocarditis After Transcatheter Aortic Valve Implantation

Jarl Emanuel Strange,[1,2] Lauge Østergaard,[1] Lars Køber,[1] Henning Bundgaard,[1] Kasper Iversen,[2] Marianne Voldstedlund,[3] Gunnar Hilmar Gislason,[2,4,5] Jonas Bjerring Olesen,[2] and Emil Loldrup Fosbøl[1]

[1]Department of Cardiology, The Heart Center, Copenhagen University Hospital Rigshospitalet, Copenhagen, Denmark; [2]Department of Cardiology, Copenhagen University Hospital Herlev and Gentofte, Hellerup, Denmark; [3]Statens Serum Institut, Copenhagen, Denmark; [4]The Danish Heart Foundation, Copenhagen, Denmark; and [5]Department of Clinical Medicine, Faculty of Health and Sciences, University of Copenhagen, Copenhagen, Denmark

Registre Danois
273 IE/TAVI, 1022 IE /valve prothétique, 5376 IE/valve native
Mortalité à M3 similaire mais mortalité EI/TAVI > à 5 ans





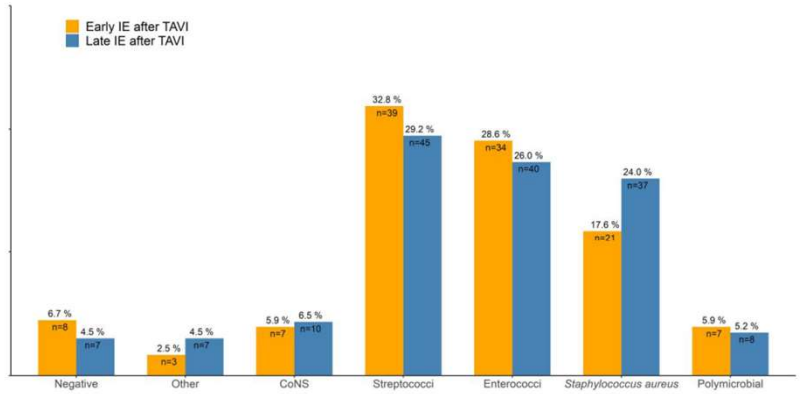


Figure 4. Long-term mortality. Five-year unadjusted mortality following IE after TAVI and native valve IE based on a reverse Kaplan-Meier curve. The shaded areas rep-

Antibiothérapie

Traitement empirique

2024

Indication du traitement empirique :

- Apparition aiguë avec progression rapide des symptômes au cours de la dernière semaine
- Végétation >10 mm
- Sepsis
- Chirurgie indiquée en urgence

- Dans toutes les autres situations, le traitement antibiotique peut être différé jusqu' à ce que les résultats des hémocultures soient disponibles.

Groupe reco SPILF/JNI 2024

Positionnement de la SPILF
Traitement empirique des endocardites
ESC 2015

Ce cadre doit être restreint et couvrir un nombre de situations très limité:

- Dans la plupart des cas, **il n'est pas nécessaire de débuter une antibiothérapie probabiliste en urgence**
- Aucune suspicion d'endocardite ne justifie un traitement sans avoir prélevé au moins 3 paires d'hémocultures et d'éventuels sites secondaires (arthrite, etc.)
- La complexité des situations incite à prendre en compte de nombreux paramètres (contage, terrain, évolutivité, porte d'entrée), idéalement dans une décision multidisciplinaire
- L'antibiothérapie sera adaptée secondairement aux résultats microbiologiques

Recommendation Table 10 — Recommendations for antibiotic regimens for initial empirical treatment of infective endocarditis (before pathogen identification)[a]

Recommendations		Class[b]	Level[c]
In patients with community-acquired NVE or late PVE (≥12 months post-surgery), ampicillin in combination with ceftriaxone or with (flu)cloxacillin and gentamicin should be considered using the following doses:[255]		IIa	C
Adult antibiotic dosage and route			
Ampicillin	12 g/day i.v. in 4–6 doses		
Ceftriaxone	4 g/day i.v. or i.m. in 2 doses		
(Flu)cloxacillin	12 g/day i.v. in 4–6 doses		
Gentamicin[d]	3 mg/kg/day i.v. or i.m. in 1 dose		
Paediatric antibiotic dosage and route			
Ampicillin	300 mg/kg/day i.v. in 4–6 equally divided doses		
Ceftriaxone	100 mg/kg i.v. or i.m. in 1 dose		
(Flu)cloxacillin	200–300 mg/kg/day i.v. in 4–6 equally divided doses		
Gentamicin[d]	3 mg/kg/day i.v. or i.m. in 3 equally divided doses		
In patients with early PVE (<12 months post-surgery) or nosocomial and non-nosocomial healthcare-associated IE, vancomycin or daptomycin combined with gentamicin and rifampin may be considered using the following doses:[395]		IIb	C
Adult antibiotic dosage and route			
Vancomycin[e]	30 mg/kg/day i.v. in 2 doses		
Daptomycin	10 mg/kg/day i.v. in 1 dose		
Gentamicin[d]	3 mg/kg/day i.v. or i.m. in 1 dose		
Rifampin	900–1200 mg i.v. or orally in 2 or 3 doses		
Paediatric antibiotic dosage and route			
Vancomycin[e]	40 mg/kg/day i.v. in 2–3 equally divided doses		
Gentamicin[d]	3 mg/kg/day i.v. or i.m. in 3 equally divided doses		
Rifampin	20 mg/kg/day i.v. or orally in 3 equally divided doses		

Box 1. Rational Choices of Empirical Antimicrobial Therapy Based on Likely Microbiology

This box lists reasonable options based largely on historical practice and in vitro susceptibility, with lit
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in vivo without evidence of increased nephrotoxicity.[4,5] For MSSA, there is observational

aureus is more likely clinically.
- Cefazolin: The combination of vancomycin or daptomycin and cefazolin is synergistic for MRSA

- Amoxicillin-clavulanate (IV)
- Ampicillin-sulbactam
- Cefazolin

Abbreviations: IV, intravenous; MRSA, methicillin-resistant *S aureus*; MSSA, methicillin-susceptible *S aureus*.

i) Only published antibiotic efficacy data from clinical trials and cohort studies in patients with IE (or bacteraemia if there are no IE data) have been considered in these guidelines. Data from experimental IE models have not been taken into account. A recent systematic review evaluating the existing evidence about clinical benefits and harms of different antibiotic regimens used to treat patients with IE has shown that there is limited and low- to very low-quality evidence to make strong conclusions on the comparative effects of different antibiotic regimens on cure rates or other relevant clinical outcomes and, therefore, there is not enough evidence to support or reject any regimen of antibiotic therapy for the treatment of IE.[262,263]

Table 2. Rational Choices of Empiric Antimicrobial Therapy Based on Likely Microbiology

	Principal Agent[a]	Second Agent
Native Valve	Vancomycin OR Daptomycin[b]	Ceftriaxone[d] OR Cefazolin[d]
		fly (<3 months): fepime . eracillin-tazobactam . bapenem . ftriaxone . er (>3 months): ftriaxone . ioxicillin-clavulanate (IV) . mpicillin-sulbactam . fazolin
		l practice and *in vitro* susceptibility, regimens. It is best practice to select local epidemiology. Please see the
		s the most evidence and will cover ay offer some advantages in terms esources required with a similar
		ve valve endocarditis if there is nylococci or enterococci since
		12mg/kg if enterococcus is being

targeted.

[c] Linezolid can be an alternative for patients where there are challenges in obtaining or maintaining IV access, where there is reasonable concern for vancomycin resistant organisms, or where both vancomycin and daptomycin are precluded (e.g., vancomycin allergy and pneumonia).

Traitement empirique pour EI valve native et EI prothétique > 1 an

- **Cible SAMS (35%), streptocoque (35%), entérocoque (10%)**

- **AMOXICILLINE 200mg/kg/j +CEFAZOLINE 100 mg/kg/j**
  - **Amoxiciline et cefazoline synergique sur *Enterococcus faecalis***

- Si sepsis + GENTAMICINE 5 mg/kg

- Si allergie DAPTOMYCINE 10 mg/kg/j + GENTAMICINE 3 mg/kg

- Ou VANCOMYCINE 30 mg/kg/j , perfusion continue après dose de charge

Groupe reco SPILF/JNI 2024

Traitement empirique pour EI prothétique < 1 an

- **Cible Staphylocoque dont méti R, entérocoque, BGN**

- **DAPTOMYCINE 12 mg/kg + CEFEPIME 80 mg/kg/j (PSE continu après dose de charge)**

- Si sepsis : + GENTAMICINE 5 mg/kg

Groupe reco SPILF/JNI 2024

Original Article

Gentamicin may have no effect on mortality of staphylococcal prosthetic valve endocarditis☆

- Espagne (GAMES)
- Janvier 2008 – Septembre 2016
- 3467 patients screenés, 334 PVE à staphylocoque
- 94 patients avec PVE à staphylocoque qui ont reçu Rifampicine + (vanco/βlactamine):
  - 77 patients (81,9%) ont reçu traitement par aminosides
  - 17 patients (18,1%) n'ont pas reçu d'aminosides
- *S. aureus* 40 cas (42,6%), SCN 54 cas (57,4%)
- 40 décès (40,6%)

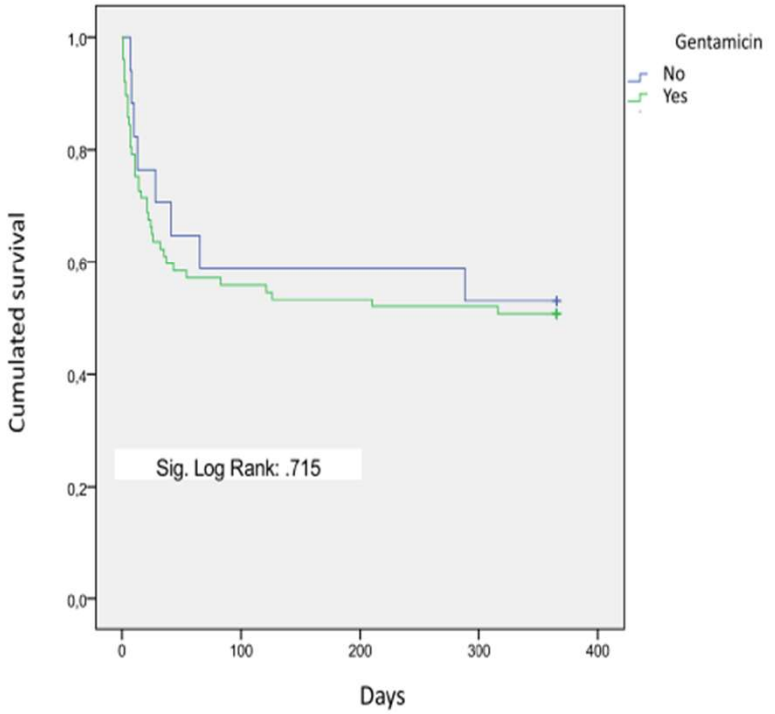

Fig. 2. One-year survival according to therapy with gentamicin in a cohort of staphylococcal prosthetic valve endocarditis (Cox regression model).

Ramos-Martínez *et al.* J infect chemother 2018

Aminosides et endocardites infectieuses : un consensus, une obligation??

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Narrative review

Aminoglycosides for infective endocarditis: time to say goodbye?

D. Lebeaux [1, *], N. Fernández-Hidalgo [2, 3], B. Pilmis [4], P. Tattevin [5], J.-L. Mainardi [1]

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PLOS ONE

RESEARCH ARTICLE

Improving peak concentrations of a single dose regime of gentamicin in patients with sepsis in the emergency department

Maarten Cobussen[1]*, Patricia M. Stassen[2], Dirk Posthouwer[2], Frank H. van Tiel[1], Paul H. M. Savelkoul[1], Thomas Havenith[3], Michiel B. Haeseker[1]

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2 Department of Internal Medicine, Maastricht University Medical Centre, Maastricht, the Netherlands,
3 Department of Clinical Pharmacy, Maastricht University Medical Centre, Maastricht, the Netherlands

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Table 2. Actual (a-5 and a-7) and simulated (s5 –s10) gentamicin peak concentrations in n (%).

	a-5 mg/kg	s-5 mg/kg	s-6 mg/kg	s-7 mg/kg	s-8 mg/kg	s-9 mg/kg	s-10 mg/kg	a-7 mg/kg
<16 mg/L	34 (39.5)	33 (38.4)	11 (12.8)	3 (3.5)	0	0	0	8 (15.1)
<20 mg/L	73 (84.9)	67 (77.9)	38 (44.2)	19 (22.1)	3 (3.5)	3 (3.5)	0	22 (41.5)
≥20 mg/L	13 (15.1)	19 (22.1)	48 (55.8)	67 (77.9)	83 (96.5)	83 (96.5)	86 (100)	31 (58.5)

a-5: actual dose given 5mg/kg; s5 –s10mg/kg: simulated doses using the formula: 'peak concentration simulated dose = (peak concentration/actual dose) × simulated dose'; a-7: actual dose given 7mg/kg.

https://doi.org/10.1371/journal.pone.0210012.t002

PLOS ONE January 22, 2019; Maarten Cobussen and al

Attention toxicité rénale : Cristaux d'amoxicilline

- **Facteurs favorisant :**
  - Faible débit urinaire
  - pHu entre 5 et 7
  - Densité U élevée
  - **Fortes doses d'amoxicilline**
  - **Vitesse d'administration**
  - **Dose unitaire>2g?**

- **Prévention :**
  - Hyperhydratation
  - Alcalinisation
  - Dosage médicamenteux et adaptation
  - Modalités d'administration ?

- Expression variée
  - Asymptomatique
  - Cristallurie macroscopique
- Lithiase
- Hématurie
  - Insuffisance rénale aigue Précipitation intratubulaire
  - ou IRA obstructive
  - Parfois sévère
  - Toujours résolutive

IRA dans l'EI

	% de patients	FDR
Gagneux-Brunon et al. 2019 Monocentrique	68,8 %	Vancomycine Valve prothétique Insuffisance cardiaque
Ortiz-Soriano et al. 2019 Monocentrique USA	66,2 %	Etat de choc Utilisation de diurétiques comorbidités
Von Tokarski et al. 2020	53 %	EI à SA Etat de choc Diabète Manifestations immunologiques
Petersen et al 2021 Etude sur tous les patients Danois	Dialyse au cours de l'épisode d'EI 5,7 %	Recours à une chirurgie
Legrand et al. 2013 Monocentrique patients opérés	59 % Près de la moitié en IRA en pré-op	Vancomycine Aminosides PCI Chirurgie multiple Transfusions

Avec ces doses de b-lactamines
Adaptation posologique si obésité importante

Votre patient

Sexe: Homme

Poids (en KG): 125

Taille (en cm): 163

Votre prescription

cefazoline

À titre indicatif, la(les) équivalence(s) de Dose(s) usuelle(s) quotidienne(s) standard pour la DCI séléctionnée et pour un(e) patient(e) de BMI normal est (sont) :

Renseignez ici la dose quotidienne que vous auriez prescrit pour un(e) patient(e) de BMI normal :

◉ en mg/kg/j: 100 ○ en mg/kg/dose

Recommandation

Le BMI de votre patient est de : **47 (Obésité massive (classe III))**.

En l'absence de données spécifiques et en raison des caractéristiques d'hydrophilie, les auteurs recommandent d'adapter la dose selon la formule générale des ß-lactamines pour la Céfazoline (poids ajusté au delà d'un BMI de 35).
Pour ce(cette) patient(e) le poids ajusté est de : **79.9 Kg**.

Adaptation posologique proposée pour ce(cette) patient(e) :
Céfazoline 7990mg/jour.

Clinical Infectious Diseases

MAJOR ARTICLE

Daptomycin Plus Fosfomycin Versus Daptomycin Alone for Methicillin-resistant *Staphylococcus aureus* Bacteremia and Endocarditis: A Randomized Clinical Trial

Miquel Pujol,[1,a] José-María Miró,[2,a] Evelyn Shaw,[1] Jose-María Aguado,[3] Rafael San-Juan,[3] Mireia Puig-Asensio,[4] Carles Pigrau,[4] Esther Calbo,[5] Miguel Montejo,[6] Regino Rodriguez-Álvarez,[6] María-Jose García-Pais,[7] Vicente Pintado,[8] Rosa Escudero-Sánchez,[8] Joaquín Lopez-Contreras,[9] Laura Morata,[9] Milagros Montero,[10] Marta Andrés,[11] Juan Pasquau,[12] María-del-Mar Arenas,[12] Belén Padilla,[13] Javier Murillas,[14] Alfredo Jover-Sáenz,[15] Luis-Eduardo López-Cortes,[16] Graciano García-Pardo,[17] Oriol Gasch,[18] Sebastian Videla,[19] Pilar Hereu,[19] Cristian Tebé,[20] Natalia Pallarès,[20] Mireia Sanllorente,[19] María-Ángeles Domínguez,[21] Jordi Càmara,[21] Anna Ferrer,[22] Ariadna Padullés,[22] Guillermo Cuervo,[1] and Jordi Carratalà[1,a]; for the MRSA Bacteremia (BACSARM) Trial Investigators

74 EI : dapto 10 mg/kg + fosfo 2 g x 4 IV
81 EI : dapto 10 mg/kg seule

Outcome	Daptomycin Plus Fosfomycin, No. of Patients/Total (%)	Daptomycin Alone, No. of Patients/Total (%)	Relative Risk (95% CI)
Primary endpoint			
Treatment success at TOC	40/74 (54.1)	34/81 (42.0)	1.29 (.93–1.8)
Secondary endpoints			
Positive blood cultures at day 3	2/74 (2.7)	15/81 (18.5)	0.15 (.04–.63)
Positive blood cultures at day 7	0/74 (0.0)	5/81 (6.2)	−6.2 (−11.4 to −.9)[a]
Positive blood cultures at TOC	0/74 (0.0)	4/81 (4.9)	−4.9 (−9.7 to −.2)[a]
Microbiological failure at TOC	0/74 (0.0)	9/81 (11.1)	−11.1 (−18.0 to −4.3)[a]
No. of episodes of complicated bacteremia at TOC	12/74 (16.2)	26/81 (32.1)	0.51 (.28–.94)
Any AE leading to treatment discontinuation	13/74 (17.6)	4/81 (4.9)	3.56 (1.21–10.44)
Overall mortality at day 7	3/74 (4.1)	6/81 (7.4)	0.55 (.14–2.12)
Overall mortality at TOC	18/74 (24.3)	22/81 (27.2)	0.9 (.53–1.54)

Adverse Events Leading to Treatment Discontinuation

Adverse Event	Daptomycin Plus Fosfomycin (n = 77)	Daptomycin Alone (n = 83)	Relation to Antibiotic Treatment
Patients with AE leading to treatment discontinuation, No. (%)	13 (16.9)	4 (4.8)	...
AE leading to treatment discontinuation, No. (%)	16 (20.8)	4 (4.8)	...

Alors pourquoi pas
DAPTOMYCINE 10 à 12 mg/kg
+ GENTAMICINE 7 mg/kg si sepsis
en première intention en empirique?

Staphylocoques

Propositions thérapeutiques pour les endocardites à staphylocoque, adaptées de l'AEPEI/ESC 2023						
Situations cliniques	**Bactérie**	**Absence d'allergie aux β-lactamines**		**Contre-indication aux β-lactamines**		**Durée**
		Antibiotique	**Posologie**	**Antibiotique**	**Posologie**	
Valve native	Staphylocoque méti-S	(Cl)oxacilline **OU** Céfazoline	200 mg/kg/24h[1] 80-100 mg/kg/24h[2]	Céfazoline[3] **OU** Daptomycine + fosfomycine	80-100 mg/kg/24h[2] 10 mg/kg/24h[4] 8-12 g/24h en 3 injections IVL	**Endocardite du cœur gauche :** - 4 semaines à 6 semaines - **Endocardite du cœur droit :** - 2 semaines à 4 semaines Si bithérapie avec daptomycine : bithérapie au maximum 7 jours après la date de la première hémoculture négative
Valve native	Staphylocoque méti-R	Daptomycine + ceftaroline **OU** Daptomycine + fosfomycine	10 mg/kg/24h[4] 1800mg/24h en 3 injections/j 10 mg/kg/24h[4] 8-12 g/24h en 3 injections IVL	Daptomycine + ceftaroline **OU** Vancomycine[5]	10 mg/kg/24h[4] 1800mg/24h en 3 injections/j 30 mg/kg/24h[6]	
Valve prothétique	Staphylocoque méti-S	(Cl)oxacilline **OU** Céfazoline + gentamicine **PUIS** rifampicine	200 mg/kg/24h[1] 80-100 mg/kg/24h[2] 3 mg/kg/24h[7] 600 à 900 mg/24h	Daptomycine + gentamicine **PUIS** rifampicine	10 mg/kg/24h[4] 3 mg/kg/24h[7] 600 à 900 mg/24h	- 6 semaines de durée totale de traitement - Durée gentamicine = jusqu'à négativation des hémocultures ou jusqu'à la chirurgie valvulaire - Introduction de la rifampicine après négativation des hémocultures ou après chirurgie valvulaire
Valve prothétique	Staphylocoque méti-R	Daptomycine **OU** vancomycine + gentamicine **PUIS** rifampicine	10 mg/kg/24h 30 mg/kg/24h[6] 3 mg/kg/24h[7] 600 à 900 mg/24h			

Place de la rifampicine dans les EI sur prothèse ?

Clinical Infectious Diseases

MAJOR ARTICLE

Is Rifampin Use Associated With Better Outcome in Staphylococcal Prosthetic Valve Endocarditis? A Multicenter Retrospective Study

Audrey Le Bot,[1] Raphaël Lecomte,[2] Pierre Gazeau,[3] François Benezit,[1] Cédric Arvieux,[1] Séverine Ansart,[3] David Boutoille,[2] Rozenn Le Berre,[4] Céline Chabanne,[5] Matthieu Lesouhaitier,[1] Loren Dejoies,[6,7] Erwan Flecher,[5] Jean-Marc Chapplain,[1] Pierre Tattevin,[1,7,8,9] and Matthieu Revest[1,7,8]; Pour le Groupe d'Epidémiologie et Recherche en Infectiologie Clinique du Centre et de l'Ouest (GERICCO)

[1]Infectious Diseases and Intensive Care Unit, Pontchaillou University Hospital, Rennes, France, [2]Department of Infectious Diseases, CIC UIC 1413 INSERM, University Hospital, Nantes, France, [3]Infectious Diseases and Tropical Medicine, La Cavale Blanche University Hospital, Brest, France, [4]Department of Internal Medecine and pneumology, La Cavale Blanche University Hospital, Brest, France, [5]Department of thoracic and cardiovascular surgery, Pontchaillou University Hospital, Rennes, France, [6]Department of bacteriology, Pontchaillou University Hospital, Rennes, France, [7]University of Rennes, Inserm, BRM (Bacterial Regulatory RNAs and Medicine), UMR_1230, France, and [8]CIC-Inserm 1414, Pontchaillou University Hospital, Rennes, France

Table 3. Outcome of Prosthetic Valve Endocarditis due to *Staphylococcus aureus* (n = 114), or Coagulase-negative Staphylococci (n = 66) in Patients Treated With or Without Rifampin

Variable	*Staphylococcus aureus* (n = 114)				Coagulase negative staphylococci (n = 66)			
	Rifampin-based (n = 64)	**No Rifampin** (n = 50)	**Odds Ratio (95% CI)**	***P* Value**	**Rifampin-based** (n = 37)	**No Rifampin** (n = 29)	**Odds Ratio (95% CI)**	***P* Value**
Mortality								
In-hospital mortality	18 (28.1)	12 (24.0)	1.24 (.53–2.89)	.78	8 (21.6)	4 (13.8)	1.72 (.46–6.41)	.61
Six-month mortality	26 (40.6)	16 (32.0)	1.45 (.66–3.16)	.45	10 (27.0)	6 (20.7)	1.42 (.45–4.50)	.76
One-year mortality	27 (42.2)	18 (36.0)	1.30 (.61–2.78)	.63	11 (29.7)	7 (24.1)	1.33 (.44–4.01)	.82
Relapse	4 (6.3)	4 (8.0)	0.93 (.22–3.91)	.79	2 (5.4)	3 (10.3)	.49 (.08–3.18)	.78
Vitamin K antagonist imbalance	9 (39.1)	4 (22.2)	2.25 (.56–9.05)	.41	6 (50.0)	2 (22.2)	3.5 (.50–24.3)	.40
Bleeding complication	10 (15.6)	10 (20.0)	0.72 (.28–1.95)	.71	3 (8.1)	0 (0)	5.99 (.29–120.8)	.33
Length of stay, days	42.8 ± 20.1	30.7 ± 14.7	…	.0006	41.4 ± 16.1	32.4 ± 12.9	…	.02

Quantitative variables are expressed as mean ± standard deviation; qualitative variables are expressed by numbers (%).

Abbreviation: CI, confidence interval.

Emergence de résistance sous traitement

AMERICAN SOCIETY FOR MICROBIOLOGY | Antimicrobial Agents and Chemotherapy

CLINICAL THERAPEUTICS
July 2008 Volume 52 Issue 7
https://doi-org.proxy.insermbiblio.inist.fr/10.1128/aac.00300-08

Addition of Rifampin to Standard Therapy for Treatment of Native Valve Infective Endocarditis Caused by *Staphylococcus aureus*

David J. Riedel[1,*], Elizabeth Weekes[2,†], Graeme N. Forrest[3]

81 % des patients traités par vancomycine

TABLE 3. Adverse effects of rifampin for cases and controls (Table view)

Characteristic or effect	Value for group		*P* value
	Cases	Controls	
Total no. of subjects	42	42	
Rifampin-resistant isolates [no. (%)][a]	9 (21)	0 (0)	<0.001
Median time to rifampin resistance[b] [days (range)]	16 (11-26)	NA[d]	NA
Elevated transaminases, ≥5 × baseline [no. (%)]	9 (21)	1 (2)	0.014
Drug interactions [no. (%)][c]	22 (52)	0 (0)	<0.001

[a] All nine isolates were from patients who were bacteremic at initiation of rifampin treatment.
[b] Nine isolates were analyzed.
[c] Drug interactions occurred with methadone (nine cases), warfarin (four cases), protease inhibitors (three cases), antifungal agents (e.g., fluconazole [three cases], voriconazole [one case]), and antiepileptic agents (e.g., phenytoin [two cases]).
[d] NA, not applicable.

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https://doi.org/10.1093/jac/dkad214 Advance Access publication 16 August 2023

Journal of Antimicrobial Chemotherapy

Effectiveness of adjunctive rifampicin for treatment of *aureus* bacteraemia: a systematic review and me of randomized controlled trials

R. Dotel [1]*, G. L. Gilbert [2], S. N. Hutabarat[3], J. S. Davis[4,5] and M. V. N.

[1]Department of Infectious Diseases, Blacktown Hospital, Sydney, New South Wales, Australia; [2]Sydney Ir The University of Sydney, Sydney, New South Wales, Australia; [3]Department of Microbiology and Infectio Liverpool, New South Wales, Australia; [4]Menzies School of Health Research, Charles Darwin University, D Hospital, University of Newcastle, Newcastle, Australia; [6]Centre for Infectious Diseases and Microbiology L Wales Health Pathology–Institute of Clinical Pathology and Medical Research, Westmead Hospital, Sydn

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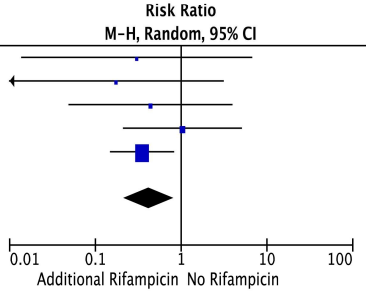
Received 2 April 2023; accepted 24 June 2023

(a) Bacteriological failure

Study or Subgroup	With rifampicin Events	Total	Without rifampicin Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Van Der Auwera 1983	0	10	1	9	4.7%	0.30 [0.01, 6.62]
Van Der Auwera 1985	0	13	3	16	5.4%	0.17 [0.01, 3.08]
Heldman 1996	1	19	3	25	9.4%	0.44 [0.05, 3.89]
Schrenzel 2004	4	29	2	15	17.9%	1.03 [0.21, 5.02]
Thwaites 2018	7	370	21	388	62.7%	0.35 [0.15, 0.81]
Total (95% CI)		**441**		**453**	**100.0%**	**0.41 [0.21, 0.81]**
Total events	12		30			

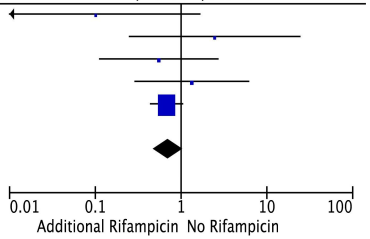
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.86$, df = 4 (P = 0.76); $I^2 = 0\%$
Test for overall effect: Z = 2.58 (P = 0.010)



(b) Clinical failure

Study or Subgroup	With rifampicin Events	Total	Without rifampicin Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Van Der Auwera 1983	0	10	4	9	1.9%	0.10 [0.01, 1.65]
Van Der Auwera 1985	2	13	1	16	2.9%	2.46 [0.25, 24.21]
Levine 1991	2	20	4	22	6.0%	0.55 [0.11, 2.69]
Schrenzel 2004	5	30	2	16	6.5%	1.33 [0.29, 6.12]
Thwaites 2018	31	370	48	388	82.6%	0.68 [0.44, 1.04]
Total (95% CI)		**443**		**451**	**100.0%**	**0.70 [0.47, 1.03]**
Total events	40		59			

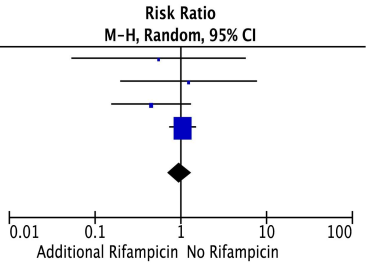
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.83$, df = 4 (P = 0.43); $I^2 = 0\%$
Test for overall effect: Z = 1.80 (P = 0.07)



(c) Death

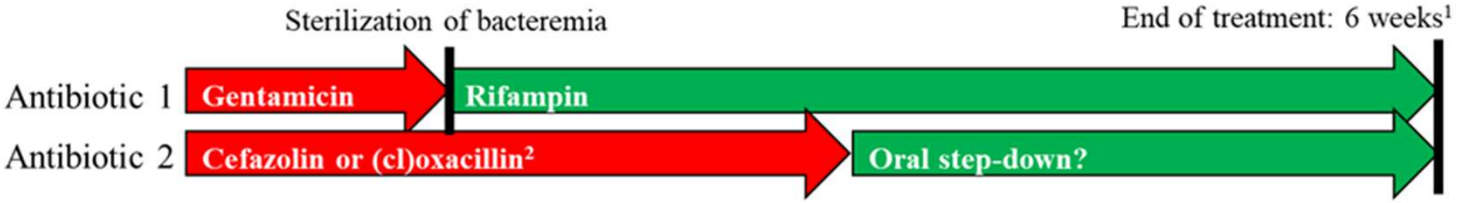
Study or Subgroup	With rifampicin Events	Total	Without rifampicin Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Levine 1991	1	20	2	22	1.9%	0.55 [0.05, 5.61]
Van Der Auwera 1985	2	13	2	16	3.0%	1.23 [0.20, 7.58]
Van Der Auwera 1983	3	10	6	9	9.1%	0.45 [0.16, 1.29]
Thwaites 2018	56	370	56	388	86.0%	1.05 [0.74, 1.48]
Total (95% CI)		**413**		**435**	**100.0%**	**0.96 [0.70, 1.32]**
Total events	62		66			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.55$, df = 3 (P = 0.47); $I^2 = 0\%$
Test for overall effect: Z = 0.22 (P = 0.82)



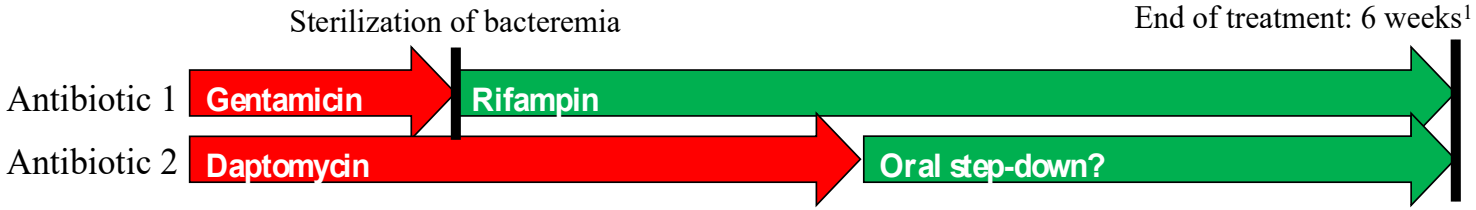
Dans la plupart des études intégrées, la rifampicine est débutée dès la confirmation de la bactériémie à SA

Treatment of methicillin-susceptible staphylococcal prosthetic valve endocarditis



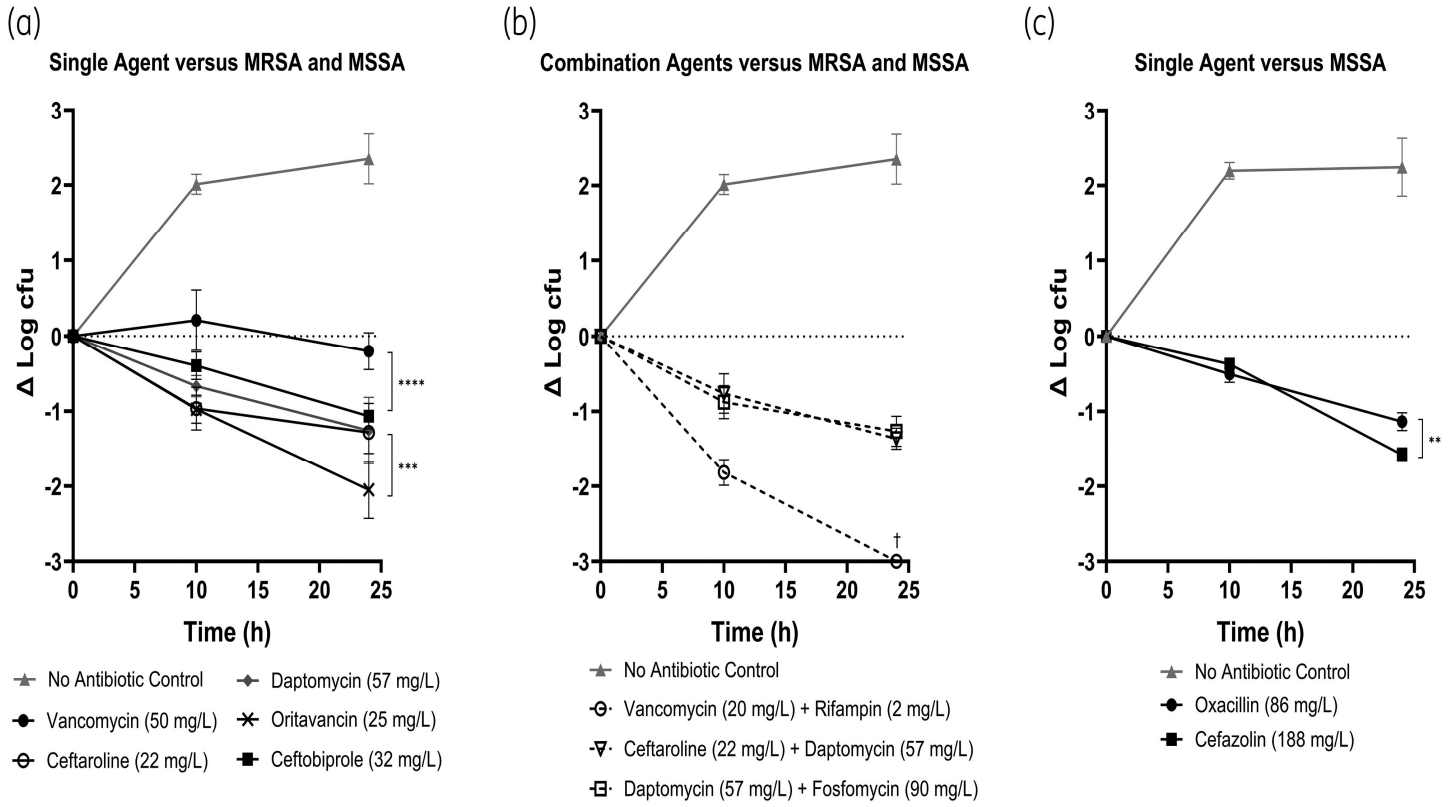
[1]6 weeks after the first day of effective therapy: negative blood culture in the case of initial positive blood culture or day of surgery if valve cultures are positive.
[2]The choice of cefazolin *vs* (cl)oxacillin should follow the same rules than for NVE

Treatment of methicillin-resistant staphylococcal prosthetic valve endocarditis (or in case of allergy to betalactams)



[1]6 weeks after the first day of effective therapy: negative blood culture in the case of initial positive blood culture or day of surgery if valve cultures are positive.

Rifampicine et réservoir intracellulaire de SA



J Antimicrob Chemother, Volume 79, Issue 10, October 2024, Pages 2471–2478, https://doi.org/10.1093/jac/dkae241

Streptocoque

Recommendations		Class[a]	Level[b]
Penicillin-susceptible oral streptococci and *Streptococcus gallolyticus* group			
Standard treatment: 4-week duration in NVE or 6-week duration in PVE			
In patients with IE due to oral streptococci and *S. gallolyticus* group, penicillin G, amoxicillin, or ceftriaxone are recommended for 4 (in NVE) or 6 weeks (in PVE), using the following doses.[277,278]		I	B
Adult antibiotic dosage and route			
Penicillin G	12–18 million[c] U/day i.v. either in 4–6 doses or continuously		
Amoxicillin	100–200 mg/kg/day i.v. in 4–6 doses		
Ceftriaxone	2 g/day i.v. in 1 dose		
Paediatric antibiotic dosage and route			
Penicillin G	200 000 U/kg/day i.v. in 4–6 divided doses		
Amoxicillin	100–200[c] mg/kg/day i.v. in 4–6 doses		
Ceftriaxone	100 mg/kg/day i.v. in 1 dose		
Standard treatment: 2-week duration (not applicable to PVE)			
2-week treatment with penicillin G, amoxicillin, ceftriaxone combined with gentamicin is recommended only for the treatment of non-complicated NVE due to oral streptococci and *S. gallolyticus* in patients with normal renal function using the following doses.[277,278]		I	B
Adult antibiotic dosage and route			
Penicillin G	12–18 million[c] U/day i.v. either in 4–6 doses or continuously		
Amoxicillin	100–200 mg/kg/day i.v. in 4–6 doses		
Ceftriaxone	2 g/day i.v. in 1 dose		
Gentamicin[d]	3 mg/kg/day i.v. or i.m. in 1 dose[d]		

EI à Streptocoque Recos AEPEI SPILF/ESC 2023

Propositions thérapeutiques pour les endocardites à streptocoque, adaptées de l'AEPEI/ESC 2023						
Situations cliniques	**Bactérie**	**Absence d'allergie aux β-lactamines**		**Allergie aux β-lactamines**		**Durée**
		Antibiotique	**Posologie**	**Antibiotique**	**Posologie**	
Toutes formes cliniques	Streptocoque CMI amox ≤ 0,5mg/l	Amoxicilline **OU** Ceftriaxone	100 mg/kg/24h[1] 2 g x 1/24h[3]	Vancomycine	30 mg/kg/24h[2]	- 4 semaines si valve native - 6 semaines si valve prothétique
	Streptocoque 0,5 < CMI amox ≤ 2 mg/l **ET** CMI ceftriaxone ≤ 0,5mg/l	Ceftriaxone	2 g x 1/24h[3]	Vancomycine	30 mg/kg/24h[2]	- 4 semaines si valve native - 6 semaines si valve prothétique
	Streptocoque 0,5 < CMI amox ≤ 2 mg/l **ET** CMI ceftriaxone > 0,5mg/l	Amoxicilline + Gentamicine	200 mg/kg/24h[1] 3mg/kg/24h[4]	Vancomycine	30 mg/kg/24h[2]	- 4 semaines si valve native - 6 semaines si valve prothétique Durée gentamicine = 2 semaines
	Streptocoque CMI amox > 2mg/l **ET** CMI ceftriaxone ≤ 0,5mg/l	Ceftriaxone	2 g x 1/24h[3]	Vancomycine	30 mg/kg/24h[2]	- 4 semaines si valve native - 6 semaines si valve prothétique
	Streptocoque CMI amox > 2mg/l **ET** CMI ceftriaxone > 0,5mg/l	Vancomycine	30 mg/kg/24h[2]	Vancomycine	30 mg/kg/24h[2]	- 4 semaines si valve native - 6 semaines si valve prothétique

Pas de place pour le traitement court en France, compte-tenu du risque d'IRA à la gentamicine, pas de place pour la daptomycine dans le traitement des EI à Streptocoques

Antimicrobial Agents and Chemotherapy
EXPERIMENTAL THERAPEUTICS
May 2013 Volume 57 Issue 5
https://doi-org.proxy.insermbiblio.inist.fr/10.1128/aac.01921-12

Early *In Vitro* and *In Vivo* Development of High-Level Daptomycin Resistance Is Common in Mitis Group Streptococci after Exposure to Daptomycin

Cristina García-de-la-Mària[a], Juan M. Pericas[a], Ana del Río[a], Ximena Castañeda[a], Xavier Vila-Farrés[b], Yolanda Armero[a], Paula A. Espinal[b], Carlos Cervera[b], Dolors Soy[c], Carlos Falces[d], Salvador Ninot[d], Manel Almela[b], Carlos A. Mestres[d], Jose M. Gatell[a], Jordi Vila[b,e], Asuncion Moreno[a], Francesc Marco[b], Jose M. Miró[a], the Hospital Clinic Experimental Endocarditis Study Group

TABLE 3 Rates of selection of resistance and high-level resistance after exposure to daptomycin (Table view)

Microorganism(s)	No. of strains	No. (%) screening positive[a]	No. (%) that were[b]: DNS (MIC, ≥2 mg/liter)	No. (%) that were[b]: HLDR (MIC, ≥256 mg/liter)
Mitis group	92	74 (80)	61 (66)	25 (27)
S. mitis	51	35 (69)	30 (59)	14 (27)
S. oralis	19	18 (95)	14 (74)	9 (47)
S. sanguis	15	15 (100)	11 (73)	2 (13)
S. gordonii	4	4 (100)	4 (100)	0 (0)
S. parasanguis	3	2 (67)	2 (67)	0 (0)
Bovis group	54	2 (4)	0	0
Anginosus group	10	5 (50)	5 (50)	0
Mutans group	8	0	0	0
Salivarius group	4	0	0	0

Enterocoque

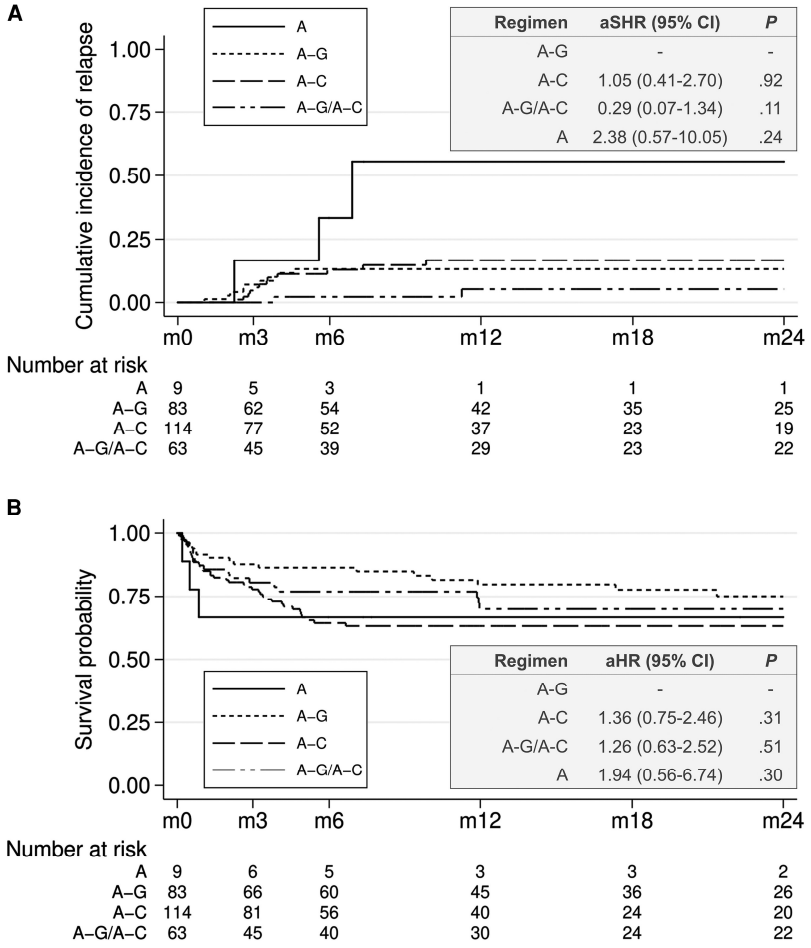
Attention pas de synergie amoxicilline/ceftriaxone avec *E.faecium*

Propositions thérapeutiques pour les endocardites à entérocoque, adaptées de l'AEPEI/ESC 2023						
Situations cliniques	**Bactérie**	**Absence d'allergie aux β-lactamines**		**Contre-indication aux β-lactamines**		**Durée**
		Antibiotique	**Posologie**	**Antibiotique**	**Posologie**	
Toutes formes cliniques	*Enterococcus faecalis*	Amoxicilline + Ceftriaxone **OU** (2ème ligne) Amoxicilline + Gentamicine	200 mg/kg/24h[1] 2 g x 2/24h[2] 200 mg/kg/24h[1] 3 mg/kg/24h[3]	Daptomycine (si CMI ≤ 2 mg/L) +/- Ceftaroline **OU** Vancomycine[4] + Gentamicine	12 mg/kg/24h en 1 injection/j 1800mg/24h en 3 injections/j 30 mg/kg/24h[5] 3 mg/kg/24h[3]	- Si amoxicilline – ceftriaxone : 6 semaines de bithérapie - Si amoxicilline – gentamicine : 6 semaines (dont 2 semaines de gentamicine) - Si daptomycine +/- ceftaroline : 6 semaines de traitement. Durée de bithérapie inconnue - Si vancomycine – gentamicine : 6 semaines. Durée théorique de gentamicine = 2 semaines mais moindre rationnel donc arrêt gentamicine si néphrotoxicité
Toutes formes cliniques	Entérocoque non *faecalis* sensible à l'amoxicilline et de bas niveau de résistance à la gentamicine	Amoxicilline + Gentamicine	200 mg/kg/24h[1] 3 mg/kg/24h[3]	Vancomycine[4] + Gentamicine	30 mg/kg/24h[5] 3 mg/kg/24h[3]	- Si amoxicilline – gentamicine : 6 semaines (dont 2 semaines de gentamicine) - Si vancomycine – gentamicine : 6 semaines. Durée théorique de gentamicine = 2 semaines mais moindre rationnel donc arrêt gentamicine si néphrotoxicité
Toutes formes cliniques	Entérocoque résistant à l'amoxicilline	Daptomycine (si CMI ≤ 2 mg/L) +/- Ceftaroline **OU** Vancomycine[4] + Gentamicine	12 mg/kg/24h en 1 injection/j 1800mg/24h en 3 injections/j 30 mg/kg/24h[5] 3 mg/kg/24h[3]	NA	NA	- Pour l'association vancomycine – gentamicine : 6 semaines (dont 2 semaines de gentamicine) - Pour daptomycine +/- ceftaroline : 6 semaines de traitement. Durée de bithérapie inconnue

Pas de recos SPILF AEPEI pour EI à ERV compte-tenu d'une fréquence extrêmement faible

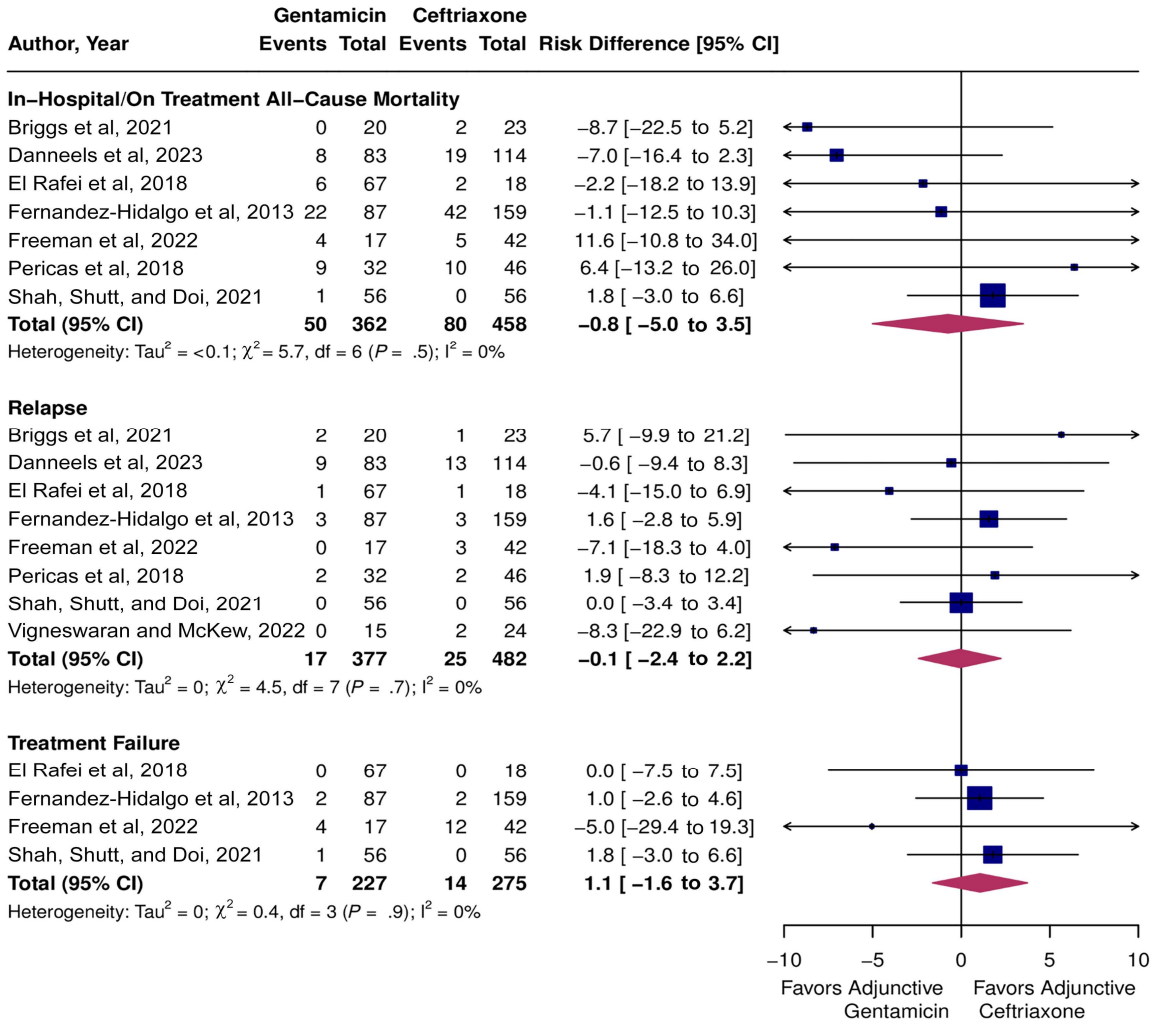
Ceftriaxone ou gentamicine : le match ?

The cumulative incidence of relapse 1 year after endocarditis diagnosis was 46.2% (95% CI: 17.8%–85.8%) for patients treated with A, 13.4% (7.2%–24.2%) for patients treated with A-G, and 14.7% (8.6%–24.5%) with A-C therapy. The lowest incidence was 4.3% (1.1%–16.0%) for patients sequentially treated with A-G/A-C.



Clin Infect Dis, Volume 76, Issue 2, 15 January 2023, Pages 281–290, https://doi.org/10.1093/cid/ciac777

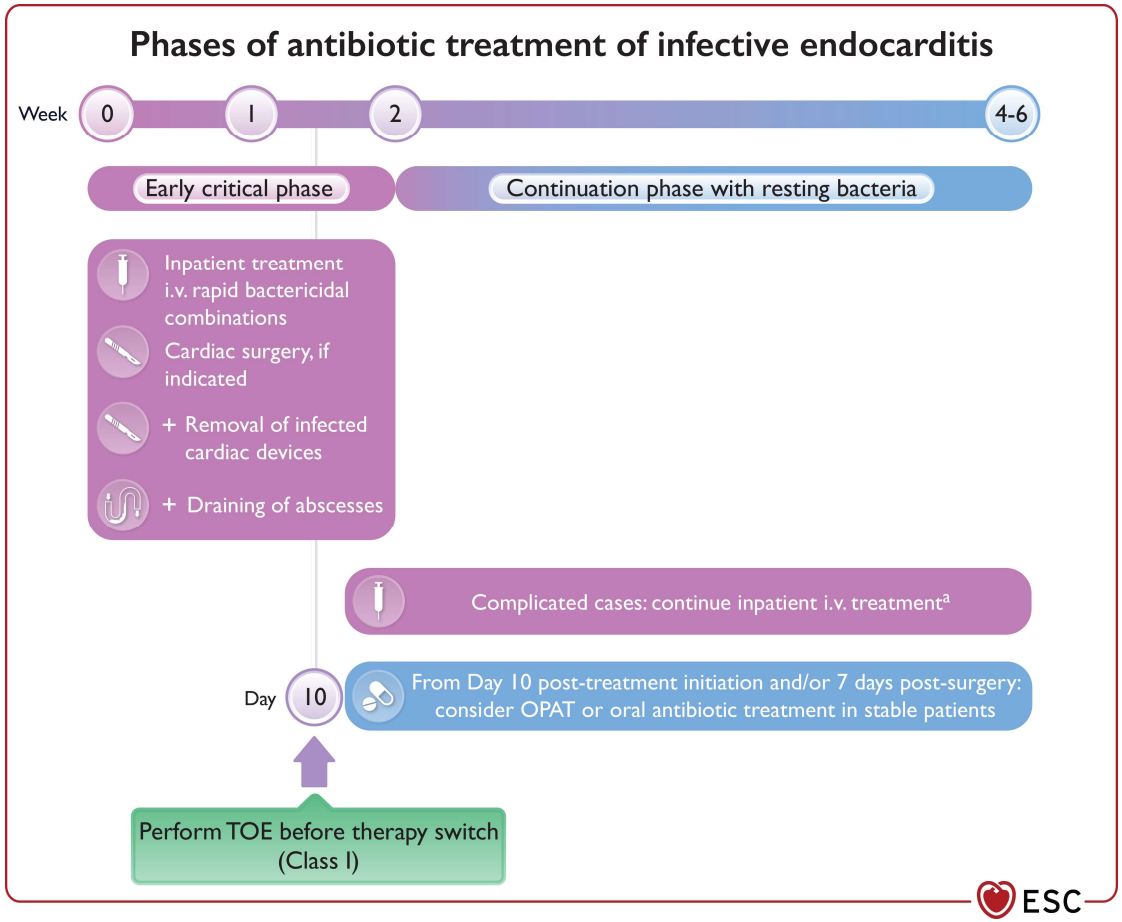
Ceftriaxone ou gentamicine : le match ?



Author, Year	Gentamicin Events	Gentamicin Total	Ceftriaxone Events	Ceftriaxone Total	Risk Difference [95% CI]
In–Hospital/On Treatment All–Cause Mortality					
Briggs et al, 2021	0	20	2	23	–8.7 [–22.5 to 5.2]
Danneels et al, 2023	8	83	19	114	–7.0 [–16.4 to 2.3]
El Rafei et al, 2018	6	67	2	18	–2.2 [–18.2 to 13.9]
Fernandez-Hidalgo et al, 2013	22	87	42	159	–1.1 [–12.5 to 10.3]
Freeman et al, 2022	4	17	5	42	11.6 [–10.8 to 34.0]
Pericas et al, 2018	9	32	10	46	6.4 [–13.2 to 26.0]
Shah, Shutt, and Doi, 2021	1	56	0	56	1.8 [–3.0 to 6.6]
Total (95% CI)	**50**	**362**	**80**	**458**	**–0.8 [–5.0 to 3.5]**
Heterogeneity: Tau^2 = <0.1; χ^2 = 5.7, df = 6 (*P* = .5); I^2 = 0%					
Relapse					
Briggs et al, 2021	2	20	1	23	5.7 [–9.9 to 21.2]
Danneels et al, 2023	9	83	13	114	–0.6 [–9.4 to 8.3]
El Rafei et al, 2018	1	67	1	18	–4.1 [–15.0 to 6.9]
Fernandez-Hidalgo et al, 2013	3	87	3	159	1.6 [–2.8 to 5.9]
Freeman et al, 2022	0	17	3	42	–7.1 [–18.3 to 4.0]
Pericas et al, 2018	2	32	2	46	1.9 [–8.3 to 12.2]
Shah, Shutt, and Doi, 2021	0	56	0	56	0.0 [–3.4 to 3.4]
Vigneswaran and McKew, 2022	0	15	2	24	–8.3 [–22.9 to 6.2]
Total (95% CI)	**17**	**377**	**25**	**482**	**–0.1 [–2.4 to 2.2]**
Heterogeneity: Tau^2 = 0; χ^2 = 4.5, df = 7 (*P* = .7); I^2 = 0%					
Treatment Failure					
El Rafei et al, 2018	0	67	0	18	0.0 [–7.5 to 7.5]
Fernandez-Hidalgo et al, 2013	2	87	2	159	1.0 [–2.6 to 4.6]
Freeman et al, 2022	4	17	12	42	–5.0 [–29.4 to 19.3]
Shah, Shutt, and Doi, 2021	1	56	0	56	1.8 [–3.0 to 6.6]
Total (95% CI)	**7**	**227**	**14**	**275**	**1.1 [–1.6 to 3.7]**
Heterogeneity: Tau^2 = 0; χ^2 = 0.4, df = 3 (*P* = .9); I^2 = 0%					

Clin Infect Dis, Volume 79, Issue 5, 15 November 2024, Pages 1162–1171, https://doi.org/10.1093/cid/ciae379

Relais par voie orale



Clinical Review & Education

JAMA Internal Medicine | Review

Evaluation of a Paradigm Shift From Intravenous Antibiotics to Oral Step-Down Therapy for the Treatment of Infective Endocarditis
A Narrative Review

Brad Spellberg, MD; Henry F. Chambers, MD; Daniel M. Musher, MD; Thomas L. Walsh, MD; Arnold S. Bayer, MD

JAMA Intern Med. 2020;180(5):769-777. doi:10.1001/jamainternmed.2020.0555
Published online March 30, 2020.

"In this disease, oral administration...has generally been discarded as inadequate. Presumably, the oral route is at times successful...it is more likely, however, that such usage is responsible for many therapeutic failures...However, little of this type of experience is recorded, and therefore this assumption cannot be authenticated." Marc Finland en 1954

Grands principes:
La voie d'administration ne change rien à la capacité de tuer la bactérie, c'est la capacité à atteindre des concentrations suffisantes qui est clé

Les ATB des années 50 n'atteignaient pas de niveaux de concentration suffisants, nombreux travaux dont des RCT montrent la capacité des ATB par voie orale à guérir des bactériémies

Eviter la voie IV c'est éviter des complications liées à l'abord veineux

- Les auteurs identifient 3 études observationnelles et 3 études randomisées
- Résultats:
  - Pas d'infériorité d'une désescalade vers la voie orale par rapport à la poursuite d'un traitement par voie IV
  - Le relais par voie orale peut-être envisagé chez des patients sélectionnés
  - Incertitude sur la durée de la phase initiale intra-veineuse, dans les études relais après 7 à 28 jours.

Contents lists available at ScienceDirect

Clinical Microbiology and Infection

journal homepage: www.clinicalmicrobiologyandinfection.com

Original article

Switch to oral antibiotics in the treatment of infective endocarditis is not associated with increased risk of mortality in non–severely ill patients*

A. Mzabi [1,2], S. Kernéis [1,2,3], C. Richaud [1,2,3], I. Podglajen [1,2,3], M.-P. Fernandez-Gerlinger [1,2,3], J.-L. Mainardi [1,2,3,4,*]

428 Patients

214 switchés par voie orale

Moins de switch chez les patients en choc, avec des embols cérébraux, en décompensation cardiaque et avec des bactériémies à SA.

No. of deaths/No. of patients followed up after diagnosis	Switch	Pas switch
Day 10	0/214	18/212
Day 30	1/188	25/200
Day 90	4/144	20/170

8 % de mortalité chez les patients switchés et 36 % chez les non switchés

FDR Mortalité:

Age>65 years, type 1 diabetes, immunosuppression, shock, disinsertion

of a prosthetic valve and *S. aureus* as the causative microorganism.

Le traitement par voie orale n'était pas associé à la mortalité

Table 3
Oral antibiotic regimen according to microorganism identified

Microorganism	Antibiotic regimen
Streptococci ($n = 91$)	• Amoxicillin ($n = 84$; 92%) • Amoxicillin—clindamycin ($n = 4$; 4%) • Amoxicillin—rifampin ($n = 3$; 3%)
Staphylococci ($n = 54$)	• Clindamycin—(rifampin or fluoroquinolone) ($n = 15$; 28%) • Fluoroquinolone—rifampin ($n = 13$; 24%) • Amoxicillin—(rifampin or fluoroquinolone or clindamycin) ($n = 9$; 17%) • Fluoroquinolone ($n = 4$; 7%) • Amoxicillin ($n = 4$; 7%) • Clindamycin ($n = 4$; 7%) • Rifampin—(Bactrim or doxycycline) ($n = 2$; 4%) • Linezolid ($n = 2$; 4%) • Rifampin ($n = 1$; 2%)
Enterococci ($n = 23$)	• Amoxicillin ($n = 21$; 91%) • Amoxicillin—rifampin ($n = 2$; 9%)

POET

Critère de jugement principal composite:

- Mortalité
- Chirurgie cardiaque non programm
- Embols
- Rechute microbiologique

Durée de suivi 6 mois

Pathogen — no. (%)†		
Streptococcus	104 (52.3)	92 (45.8)
Enterococcus faecalis	46 (23.1)	51 (25.4)
Staphylococcus aureus‡	40 (20.1)	47 (23.4)
Coagulase-negative staphylococci	10 (5.0)	13 (6.5)

Table 2. Distribution of the Four Components of the Primary Composite Outcome.*

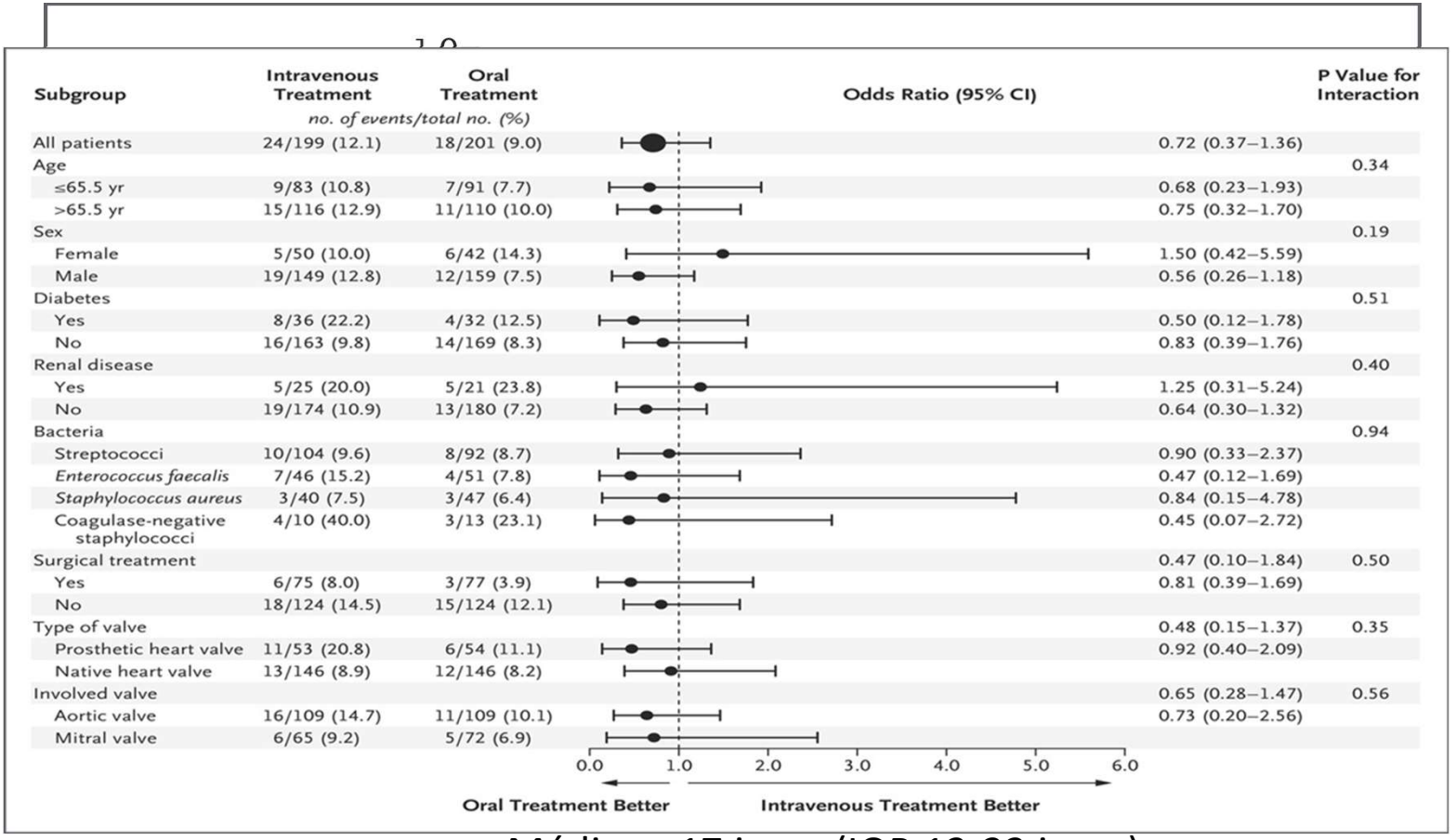
Component	Intravenous Treatment (N = 199)	Oral Treatment (N = 201)	Difference	Hazard Ratio (95% CI)
	number (percent)		*percentage points (95% CI)*	
All-cause mortality	13 (6.5)	7 (3.5)	3.0 (−1.4 to 7.7)	0.53 (0.21 to 1.32)
Unplanned cardiac surgery	6 (3.0)	6 (3.0)	0 (−3.3 to 3.4)	0.99 (0.32 to 3.07)
Embolic event	3 (1.5)	3 (1.5)	0 (−2.4 to 2.4)	0.97 (0.20 to 4.82)
Relapse of the positive blood culture†	5 (2.5)	5 (2.5)	0 (−3.1 to 3.1)	0.97 (0.28 to 3.33)

* Six patients, three in each group, had two outcomes.
† For details about relapse of the positive blood culture, see the Supplementary Appendix.

K Iversen et al. N Engl J Med 2019;380:415-424.

199 patients dans le bras traitement IV
201 patients dans le bras relais oral
Age moyen= 67,3 ans ± 12
Valve prothétique 27 %
Chirurgie de l'EI 38 % des cas

Poet



Subgroup	Intravenous Treatment	Oral Treatment	Odds Ratio (95% CI)	P Value for Interaction
	no. of events/total no. (%)			
All patients	24/199 (12.1)	18/201 (9.0)	0.72 (0.37–1.36)	
Age				0.34
≤65.5 yr	9/83 (10.8)	7/91 (7.7)	0.68 (0.23–1.93)	
>65.5 yr	15/116 (12.9)	11/110 (10.0)	0.75 (0.32–1.70)	
Sex				0.19
Female	5/50 (10.0)	6/42 (14.3)	1.50 (0.42–5.59)	
Male	19/149 (12.8)	12/159 (7.5)	0.56 (0.26–1.18)	
Diabetes				0.51
Yes	8/36 (22.2)	4/32 (12.5)	0.50 (0.12–1.78)	
No	16/163 (9.8)	14/169 (8.3)	0.83 (0.39–1.76)	
Renal disease				0.40
Yes	5/25 (20.0)	5/21 (23.8)	1.25 (0.31–5.24)	
No	19/174 (10.9)	13/180 (7.2)	0.64 (0.30–1.32)	
Bacteria				0.94
Streptococci	10/104 (9.6)	8/92 (8.7)	0.90 (0.33–2.37)	
Enterococcus faecalis	7/46 (15.2)	4/51 (7.8)	0.47 (0.12–1.69)	
Staphylococcus aureus	3/40 (7.5)	3/47 (6.4)	0.84 (0.15–4.78)	
Coagulase-negative staphylococci	4/10 (40.0)	3/13 (23.1)	0.45 (0.07–2.72)	
Surgical treatment			0.47 (0.10–1.84)	0.50
Yes	6/75 (8.0)	3/77 (3.9)	0.81 (0.39–1.69)	
No	18/124 (14.5)	15/124 (12.1)		
Type of valve			0.48 (0.15–1.37)	0.35
Prosthetic heart valve	11/53 (20.8)	6/54 (11.1)	0.92 (0.40–2.09)	
Native heart valve	13/146 (8.9)	12/146 (8.2)		
Involved valve			0.65 (0.28–1.47)	0.56
Aortic valve	16/109 (14.7)	11/109 (10.1)	0.73 (0.20–2.56)	
Mitral valve	6/65 (9.2)	5/72 (6.9)		

K Iversen et al. N Engl J Med 2019;380:415-424.

Médiane 17 jours (IQR 13-23 jours)

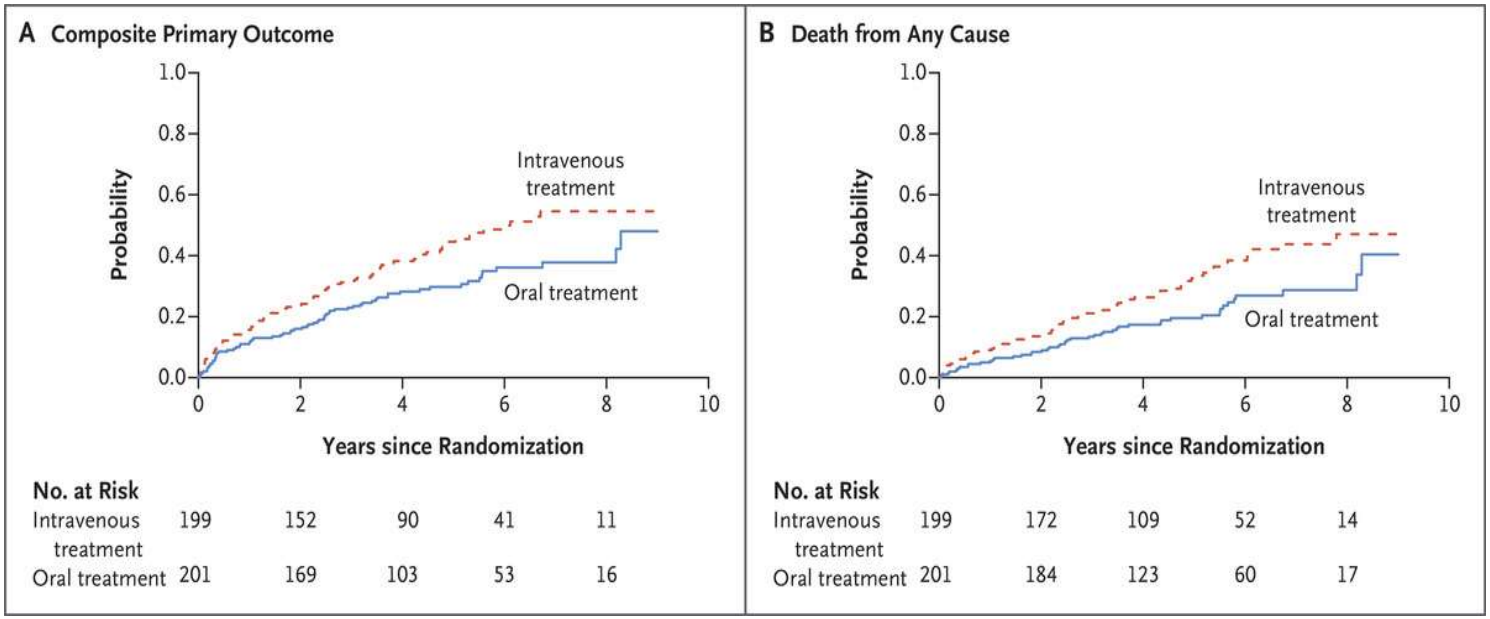
Durée médiane de séjour:

Bras IV 19 jours (IQR 14-25 jours)

Bras oral 3 jours (IQR 1-10 jours)

Taux d'effets secondaires similaires dans les 2 bras: 6 %

Le petit POET a eu 5 ans



Critère de judgment composite: décès quelle qu'en soit la cause, une chirurgie cardiaque non programmée, évènements emboliques, rechute (récidive?) microbiologique après 6 mois.

MM Pries-Heje et al. N Engl J Med 2022;386:601-602.

Relais oral et retentissement psychologique

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

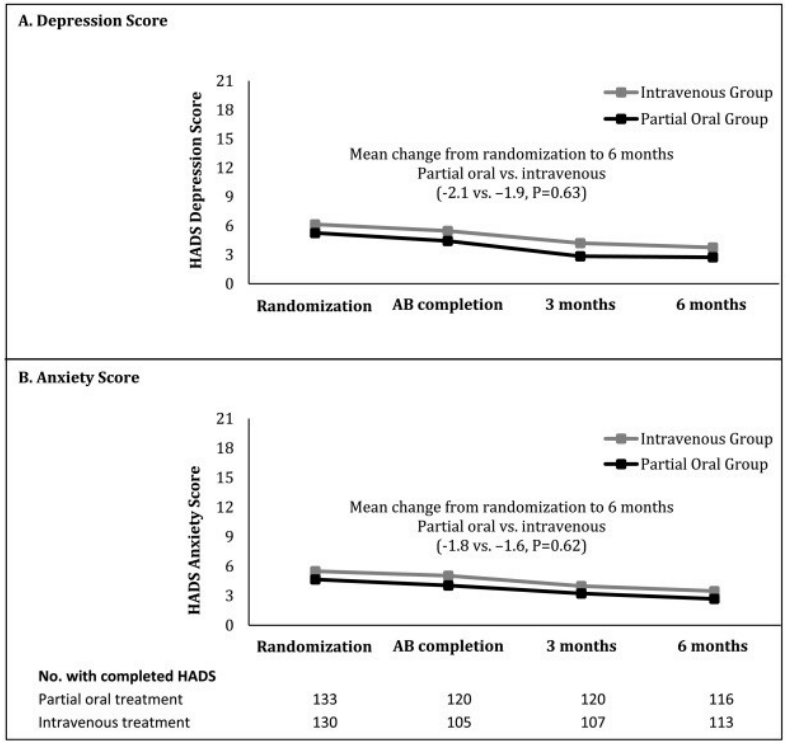
journal homepage: www.elsevier.com/locate/jpsychores

The impact of partial-oral endocarditis treatment on anxiety and depression in the POET trial

Johan S. Bundgaard [a,q,*], Kasper Iversen [b,q], Mia Pries-Heje [a,q], Nikolaj Ihlemann [a,q], Theis S. Bak [a,q], Lauge Østergaard [a,p,q], Sabine U. Gill [c], Trine Madsen [d], Hanne Elming [e], Kaare T. Jensen [f], Niels E. Bruun [e,l], Dan E. Høfsten [a,q], Kurt Fuursted [g], Jens J. Christensen [h,q], Martin Schultz [b,q], Flemming Rosenvinge [i], Henrik C. Schønheyder [j], Jannik Helweg-Larsen [m,q], Lars Køber [a,q], Christian Torp-Pedersen [k,d], Emil L. Fosbøl [a,q], Niels Tønder [n,q], Claus Moser [o,r], Henning Bundgaard [a,q], Ulrik M. Mogensen [a,q]

Janvier 2022

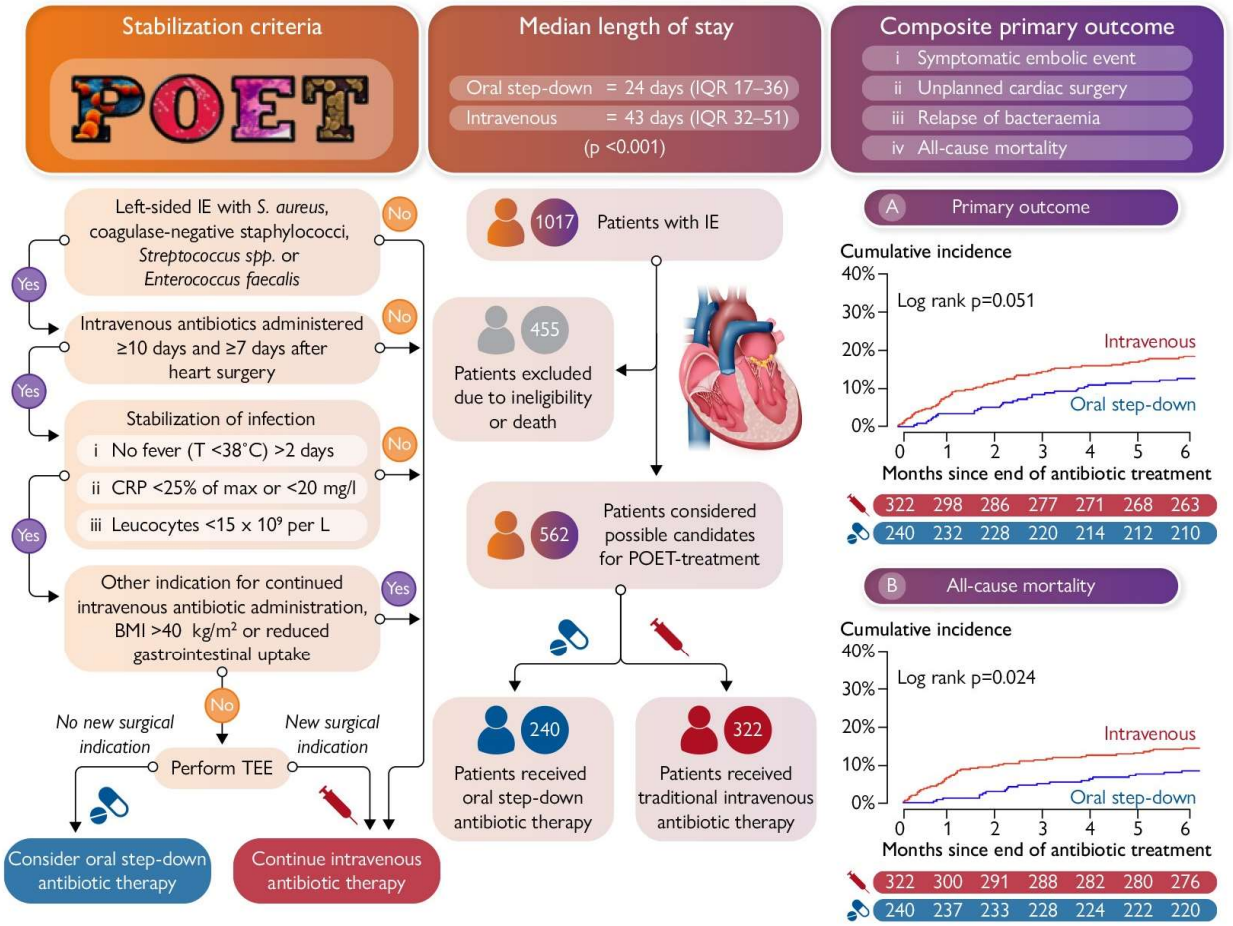
Pas de différence sur l'anxiété et la dépression entre les patients relayés par voie orale et ceux poursuite IV



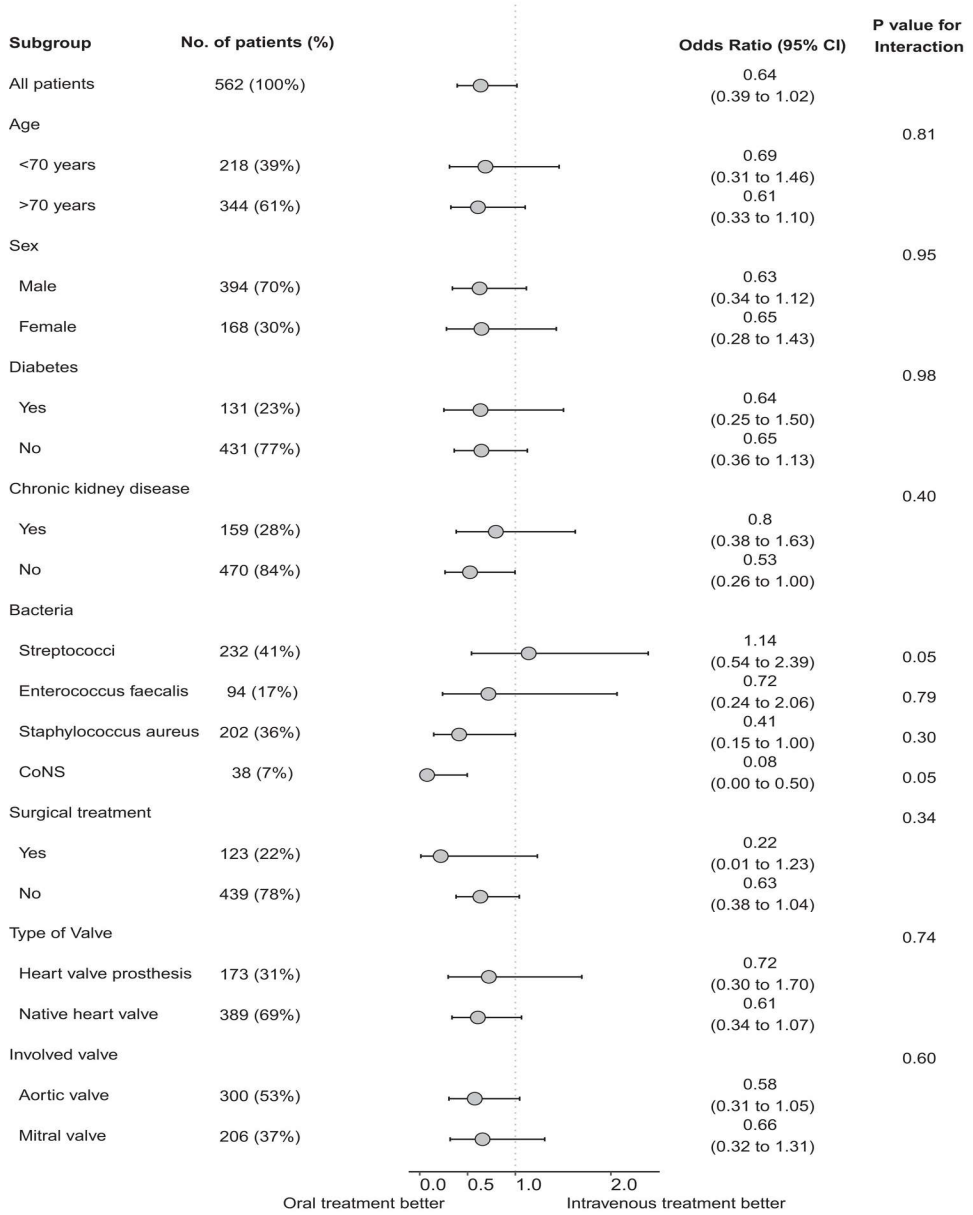
No. with completed HADS				
Partial oral treatment	133	120	120	116
Intravenous treatment	130	105	107	113

Results from clinical implementation of oral step-down antibiotic therapy of stabilized patients with infective endocardits

43 % des patients ont un relais par voie orale



Eur Heart J, Volume 44, Issue 48, 21 December 2023, Pages 5095–5106, https://doi.org/10.1093/eurheartj/ehad715



Eur Heart J, Volume 44, Issue 48, 21 December 2023, Pages 5095–5106, https://doi.org/10.1093/eurheartj/ehad715

Antibiothérapies orales proposées par les recommandations ESC 2023/AEPEI			
Staphylocoque	Streptocoque sensible à la pénicilline	*E. faecalis*	
Lévofloxacine 750 mg/j + Rifampicine 600-900mg/j	Amoxicilline 1,5-2g x 3/j + Rifampicine 600-900 mg/j Amoxicilline 1,5-2g x 3/j + Moxifloxacine 400 mg/j	Amoxicilline 1,5-2g x 3/j + Moxifloxacine 400 mg/j	
Antibiothérapies orales alternatives, moins documentées, après discussion collégiale			
Staphylocoque sur valve native	Streptocoque	*E. faecalis*	Bactérie Gram négatif
Clindamycine 600 mg x 3-4/j	Amoxicilline 1,5-2g x 3/j	Amoxicilline 1,5-2g x 3/j	Levofloxacine 750 mg/j si *Enterobacterales* ou HACEK
Linézolide 600 mg x 2/j	Linézolide 600 mg x 2/j		Ciprofloxacine 750mgx2/j si *P. aeruginosa*
	Clindamycine 600 mg x 3-4/j		
POET			
Dicloxacilline/acide fucidique Dicloxacilline/rifampicine Linézolide/rifampicine Linézolide/acide fucidique	Amoxicilline/Rifampicine Linézolide/moxifloxacine Linézolide/rifampicine Amoxicilline/moxifloxacine Moxifloxacine/rifampicine Moxifloxacine/clindamycine Linézolide/acide fucidique	Amoxicilline/rifampicine Amoxicilline/moxifloxacine Linézolide/rifampicine Linézolide/amoxicilline Amoxicilline/linézolide	

Combien de temps ?

Durée de traitement des endocardites infectieuses du cœur gauche (ESC 2023)

ESC European Society of Cardiology
European Heart Journal (2023) **00**, 1–95
https://doi.org/10.1093/eurheartj/ehad193

ESC GUIDELINES

2023 ESC Guidelines for the management of endocarditis

Penicillin-susceptible oral streptococci and *Streptococcus gallolyticus* group
Standard treatment: 4-week duration in NVE or 6-week duration in PVE
In patients with IE due to oral streptococci and *S. gallolyticus* group, penicillin G, amoxicillin, or ceftriaxone are recommended for 4 (in NVE) or 6 weeks (in PVE) using the following doses:[277,278]
Standard treatment: 2-week duration (not applicable to PVE)
2-week treatment with penicillin G, amoxicillin, ceftriaxone combined with gentamicin is recommended only for the treatment of non-complicated NVE due to oral streptococci and *S. gallolyticus* in patients with normal renal function using the following doses:[277,278]
IE caused by methicillin-susceptible staphylococci
In patients with NVE due to methicillin-susceptible staphylococci, (flu)cloxacillin or cefazolin is recommended for 4–6 weeks using the following doses:[264,314,316–318]
In patients with PVE due to methicillin-susceptible staphylococci, (flu)cloxacillin or cefazolin with rifampin for at least 6 weeks and gentamicin for 2 weeks is recommended using the following doses:[264,314,316–318,320]
Beta-lactam and gentamicin-susceptible strains
In patients with NVE due to non-HLAR *Enterococcus* spp., the combination of ampicillin or amoxicillin with ceftriaxone for 6 weeks or with gentamicin for 2 weeks is recommended using the following doses:[355,360,361]
In patients with PVE and patients with complicated NVE or >3 months of symptoms due to non-HLAR *Enterococcus* spp., the combination of ampicillin or amoxicillin with ceftriaxone for 6 weeks or with gentamicin for 2 weeks is recommended using the following doses:[355,360,361]

Traitement de 4 semaines pour les valves natives et 6 semaines pour les valves prothétiques avec quelques exceptions :

1) 2 semaines par amoxicilline + gentamicine pour les NVE à Streptocoques sensibles
2) Possibilité de faire 6 semaines sur les NVE à Staphylocoques (pas de précision sur les motifs)
3) Pour les PVE à staphylocoques, possibilité de faire plus que 6 semaines
4) 6 semaines pour toutes les EI à entérocoques

Facteurs qui modifient la durée de traitement des endocardites:

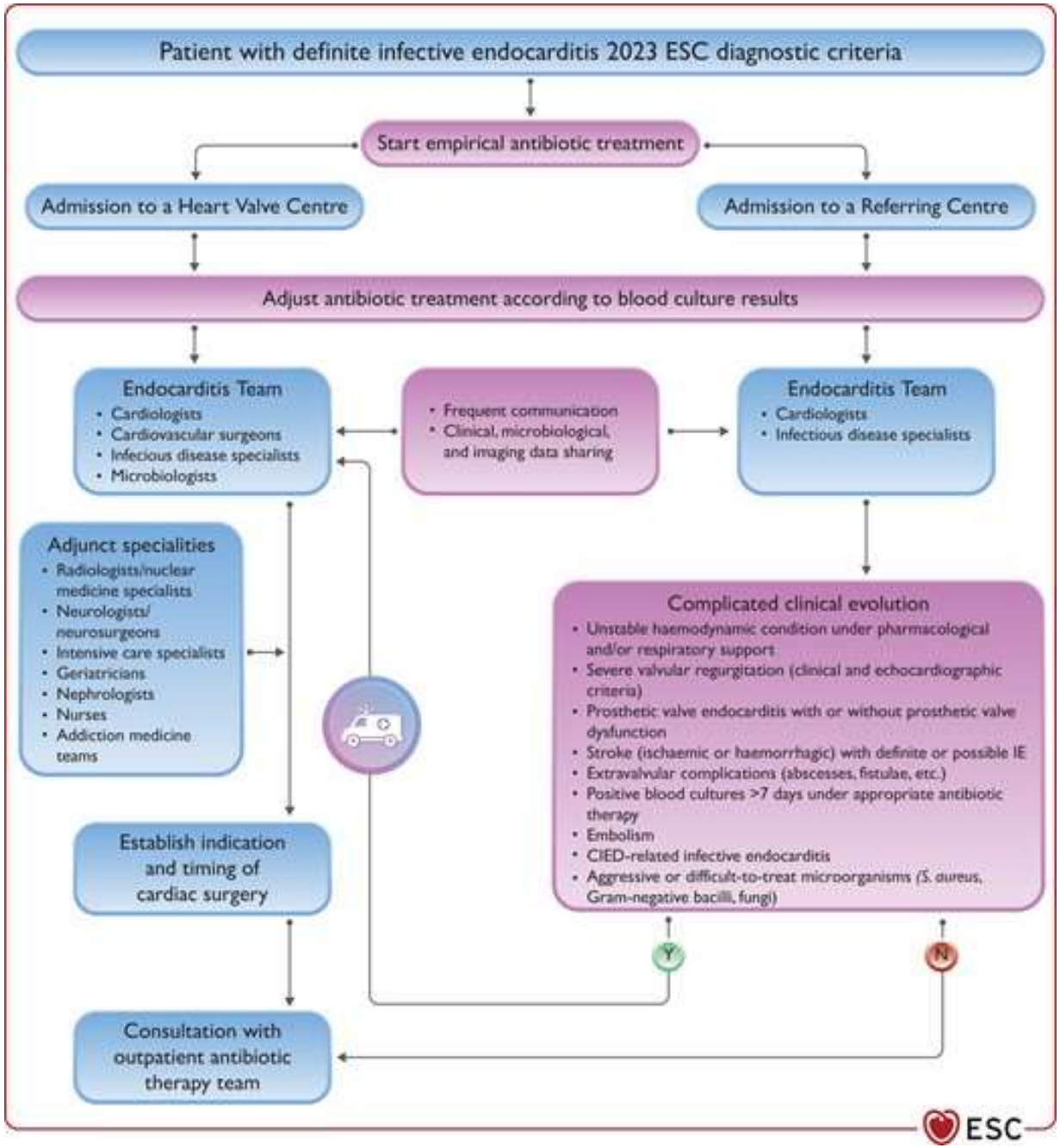
1) Germe : Staphylocoque > Entérocoque > Streptocoque
2) Type de valve (prothétique > native)
3) Complication de l'EI pour le staphylocoque (AHA/ESC)

Groupe reco SPILF/JNI 2024

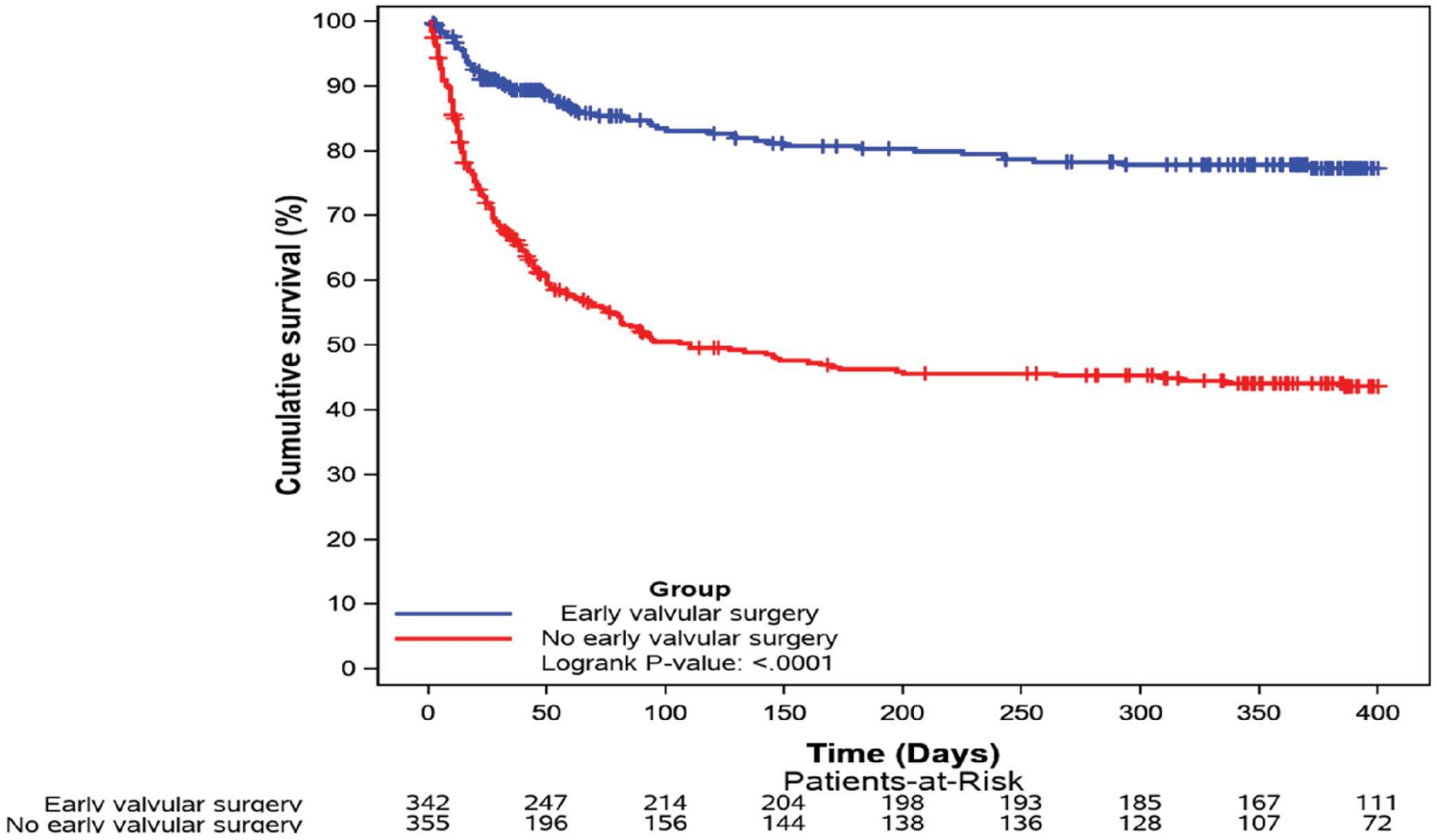
Durée de traitement

- En l'absence de chirurgie, le J0 de l'antibiothérapie est le 1er jour d'obtention d'hémocultures négatives

- Si chirurgie cardiaque en cours de traitement, 2 situations :
  - culture valve positive : J0 de l'antibiothérapie = jour de chirurgie;
  - culture valve négative : J0 de l'antibiothérapie = date 1ère hémoculture négative, avec durée minimale de traitement postopératoire de 14 jours.


Patient with definite infective endocarditis 2023 ESC diagnostic criteria
Start empirical antibiotic treatment
Admission to a Heart Valve Centre
Admission to a Referring Centre
Adjust antibiotic treatment according to blood culture results
Endocarditis Team
• Cardiologists
• Cardiovascular surgeons
• Infecious disease specialists
• Microbiologists
• Frequent communication
• Clinical, microbiological, and imaging data sharing
Endocarditis Team
• Cardiologists
• Infectious disease specialists
Adjunct specialities
• Radiologists/nuclear medicine specialists
• Neurologists/ neurosurgeons
• Intensive care specialists
• Geriatricians
• Nephrologists
• Nurses
• Addiction medicine teams
Complicated clinical evolution
• Unstable haemodynamic condition under pharmacological and/or respiratory support
• Severe valvular regurgitation (clinical and echocardiographic criteria)
• Prosthetic valve endocarditis with or without prosthetic valve dysfunction
• Stroke (ischaemic or haemorrhagic) with definite or possible IE
• Extravalvular complications (abscesses, fistulae, etc.)
• Positive blood cultures >7 days under appropriate antibiotic therapy
• Embolism
• CIED-related infective endocarditis
• Aggressive or difficult-to-treat microorganisms (S. aureus, Gram-negative bacilli, fungi)
Y
N
Establish indication and timing of cardiac surgery
Consultation with outpatient antibiotic therapy team
ESC

Sans oublier que l'antibiothérapie ne fait pas tout



European J of Heart Fail, Volume: 24, Issue: 7, Pages: 1253-1265, First published: 04 May 2022, DOI: (10.1002/ejhf.2525)

Merci de votre attention