



Sezione Regione Piemonte

Con il patrocinio di:

TORINO - 4 GIUGNO 2026

**PERCORSO DIAGNOSTICO
DELLE INFEZIONI DEL TORRENTE CIRCOLATORIO:
FOCUS SULLE ENDOCARDITI**

NH Torino Centro
C.so Vittorio Emanuele II, 104
10121 Torino



www.amcli.it

Microbiologia delle endocarditi

Giulia Menchinelli

Dipartimento di Scienze di Laboratorio ed Ematologiche
Laboratorio di Microbiologia e Virologia
Fondazione Policlinico Universitario Agostino Gemelli IRCCS

giulia.menchinelli@policlinicogemelli.it

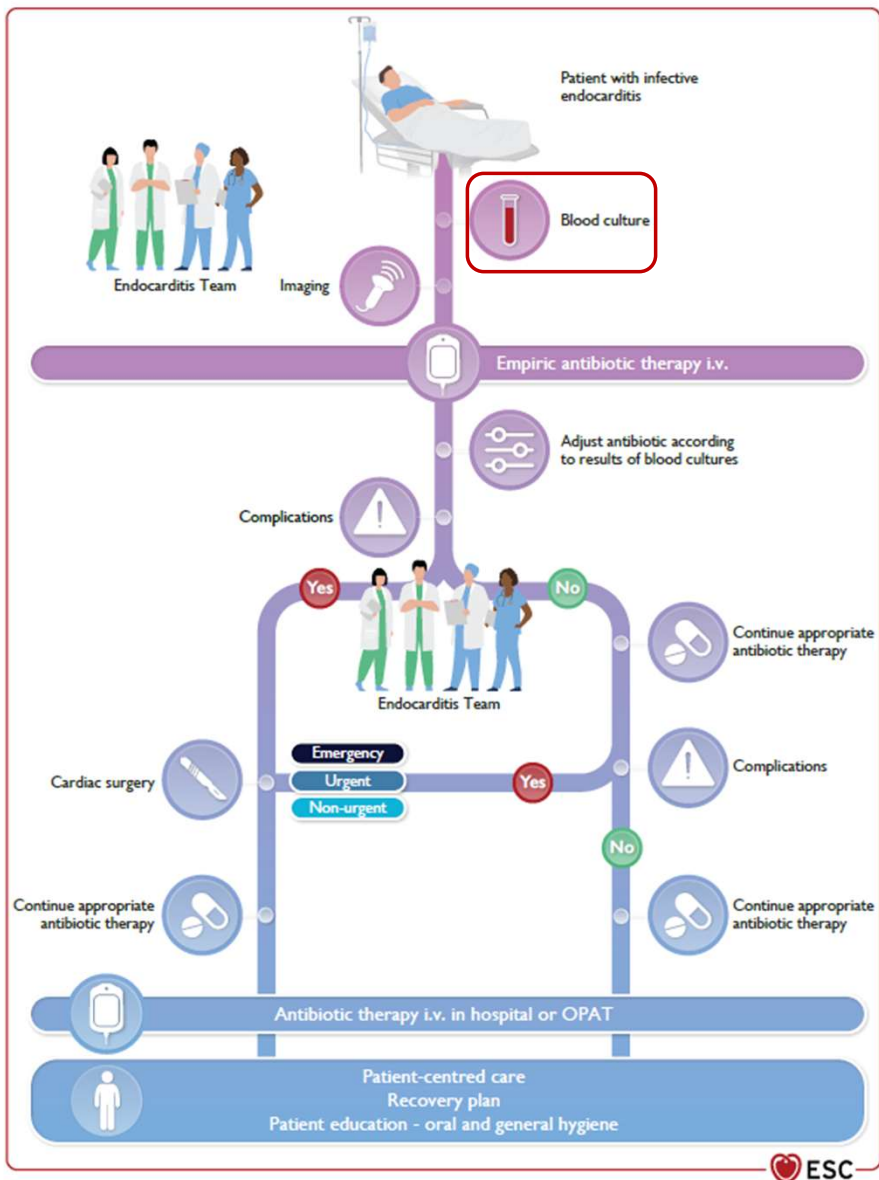


Table 10 Definitions of the 2023 European Society of Cardiology modified diagnostic criteria of infective endocarditis

Major criteria
<p>(i) Blood cultures positive for IE</p> <p>(a) Typical microorganisms consistent with IE from two separate blood cultures: Oral streptococci, <i>Streptococcus gallolyticus</i> (formerly <i>S. bovis</i>), HACEK group, <i>S. aureus</i>, <i>E. faecalis</i></p> <p>(b) Microorganisms consistent with IE from continuously positive blood cultures:</p> <ul style="list-style-type: none"> • ≥ 2 positive blood cultures of blood samples drawn >12 h apart. • All of 3 or a majority of ≥ 4 separate cultures of blood (with first and last samples drawn ≥ 1 h apart). <p>(c) Single positive blood culture for <i>C. burnetii</i> or phase I IgG antibody titre $>1:800$.</p> <p>(ii) Imaging positive for IE: Valvular, perivalvular/periprosthetic and foreign material anatomic and metabolic lesions characteristic of IE detected by any of the following imaging techniques:</p> <ul style="list-style-type: none"> • Echocardiography (TTE and TOE). • Cardiac CT. • $[^{18}\text{F}]\text{-FDG-PET/CT(A)}$. • WBC SPECT/CT.
Minor criteria
<p>(i) Predisposing conditions (i.e. predisposing heart condition at high or intermediate risk of IE or PWIDs)^a</p> <p>(ii) Fever defined as temperature $>38^\circ\text{C}$</p> <p>(iii) Embolic vascular dissemination (including those asymptomatic detected by imaging only):</p> <ul style="list-style-type: none"> • Major systemic and pulmonary emboli/infarcts and abscesses. • Haematogenous osteoarticular septic complications (i.e. spondylodiscitis). • Mycotic aneurysms. • Intracranial ischaemic/haemorrhagic lesions. • Conjunctival haemorrhages. • Janeway's lesions. <p>(iv) Immunological phenomena:</p> <ul style="list-style-type: none"> • Glomerulonephritis. • Osler nodes and Roth spots. • Rheumatoid factor. <p>(v) Microbiological evidence:</p> <ul style="list-style-type: none"> • Positive blood culture but does not meet a major criterion as noted above. • Serological evidence of active infection with organism consistent with IE.
IE Classification (at admission and during follow-up)
<p>Definite:</p> <ul style="list-style-type: none"> • 2 major criteria. • 1 major criterion and at least 3 minor criteria. • 5 minor criteria. <p>Possible:</p> <ul style="list-style-type: none"> • 1 major criterion and 1 or 2 minor criteria. • 3–4 minor criteria. <p>Rejected:</p> <ul style="list-style-type: none"> • Does not meet criteria for definite or possible at admission with or without a firm alternative diagnosis.

$[^{18}\text{F}]\text{-FDG-PET/CT}$, ^{18}F -fluorodeoxyglucose positron emission tomography; CT(A), computed tomography (angiography); HACEK, *Haemophilus*, *Aggregatibacter*, *Cardiobacterium*, *Eikenella*, and *Kingella*; IE, infective endocarditis; Ig, immunoglobulin; PWID, people who inject drugs; TOE, transoesophageal echocardiography; TTE, transthoracic echocardiography; WBC SPECT/CT, white blood cell single photon emission tomography/computed tomography.

Key Points on Blood Cultures

- **Blood volume per bottle/ Number of BCs:** most critical factor
- **Timing:** possibly drawn before starting antimicrobial therapy
- **Sampling strategy**
- **Contamination**

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

Vance G. Fowler Jr.,^{1,2,6} David T. Durack,¹ Christine Selton-Suty,³ Eugene Athan,⁴ Arnold S. Bayer,^{5,6} Anna Lisa Chamis,¹ Anders Dahl,⁷ Louis DiBernardo,¹ Emanuele Durante-Mangoni,⁸ Xavier Duval,⁹ Claudio Querido Fortes,¹⁰ Emil Fosbol,¹¹ Margaret M. Hannan,¹² Barbara Hasse,¹³ Bruno Hoen,¹⁴ Adolf W. Karchmer,¹⁵ Carlos A. Mestres,¹⁶ Cathy A. Petti,^{1,17} Maria Nazarena Pizzi,¹⁸ Stephen D. Preston,¹⁹ Albert Roque,²⁰ Francois Vandenesch,^{21,22} Jan T. M. van der Meer,²³ Thomas W. van der Vaart,²³ and Jose M. Miro^{24,25}

CRITERIA	Change
MAJOR CLINICAL CRITERIA	
Microbiology	
Blood cultures	Removed requirements for timing and separate venipunctures for blood cultures.
Definition of typical organisms	<p>Added typical pathogens:</p> <p>1) <i>S. lugdunensis</i>; <i>E. faecalis</i>; all streptococci except <i>S. pneumoniae</i> and <i>S. pyogenes</i>; <i>Granulicatella</i> spp.; <i>Abiotrophia</i> spp.; and <i>Gemella</i> spp.</p> <p>2) Organisms to be considered "typical" IE pathogens in the setting of intracardiac prosthetic material: coagulase negative staphylococci, <i>Corynebacterium striatum</i>; <i>C. jeikeium</i>, <i>Serratia marcescens</i>, <i>Pseudomonas aeruginosa</i>, <i>Cutibacterium acnes</i>, nontuberculous mycobacteria, and <i>Candida</i> spp.</p>

Single- Versus Multiple-sampling Strategy for Blood Cultures in the Diagnosis of Infective Endocarditis: The Prospective Multicenter UniEndo Study

François Goehringier,^{1,6} Marc Soudant,² Corentine Alauzet,^{3,6} Christine Selton-Suty,⁴ Nelly Agrinier,² Jean-Marc Virion,^{2,6} Benjamin Lefevre,^{1,6} Nejla Aissa,⁵ François Alla,⁶ Yvon Ruch,^{7,6} Yohan N'Guyen,^{8,6} Lionel Piroth,⁹ Kevin Bouiller,^{10,6} Pierre-Yves Royer,¹¹ Vincent Le Moing,¹² Bruno Hoen,^{13,14,6} and Xavier Duval^{15,16,6}; the UniEndo-AEPEI Study group

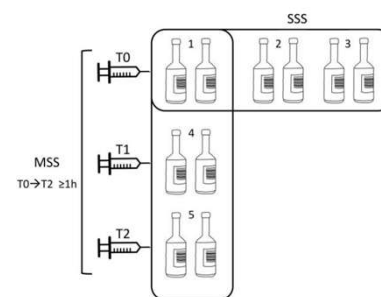


Figure 1. Schematic representation of the experimental protocol. Abbreviations: MSS, multiple-sampling strategy; SSS, single sampling strategy.

- 256 patients enrolled
- An IE was diagnosed in 101 patients (39.4%).
- Sensitivity rates of SSS and MSS were 50.5% and 45.5%, respectively (P = .063)
- Specificity rates were 94.8% and 95.5%, respectively (P = 1)
- **Using SSS to define the major microbiologic criterion was as sensitive and specific as using MSS for diagnosing IE.**

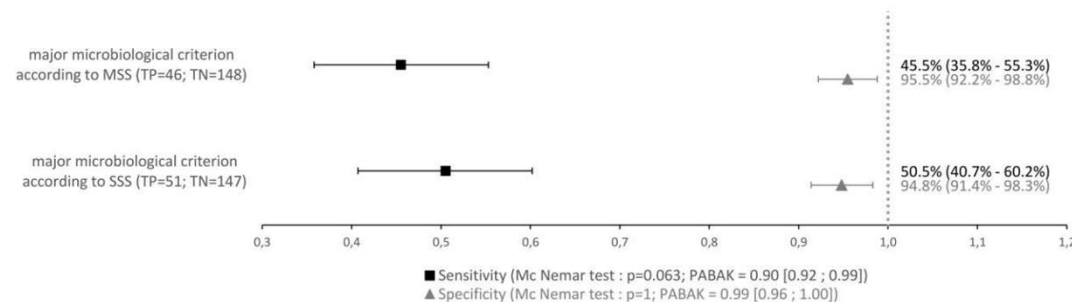


Figure 3. Compared sensitivities and specificities of the major microbiologic criterion of the 2015 ESC classification for the diagnosis of infective endocarditis, using single- versus multiple-sampling strategy for blood cultures. Abbreviation: ESC, European Society of Cardiology; MSS, multiple-sampling strategy; PABAK, prevalence-adjusted bias-adjusted κ ; SSS, single sampling strategy; TP, true positives; TN, true negatives.

Key Points on Blood Cultures

- **Blood volume per bottle/ Number of BCs:** most critical factor
- **Timing:** possibly drawn before starting antimicrobial therapy
- **Sampling strategy**
- **Contamination (ConS)**



MONITORAGGIO DEI KPI DELLA FASE PREANALITICA

European Journal of Clinical Microbiology & Infectious Diseases (2025) 44:2761–2770
<https://doi.org/10.1007/s10096-025-05238-x>

RESEARCH



Evaluation of a digital remote extraction analysis and monitoring tool for key performance indicators (KPIs) in the blood culture process

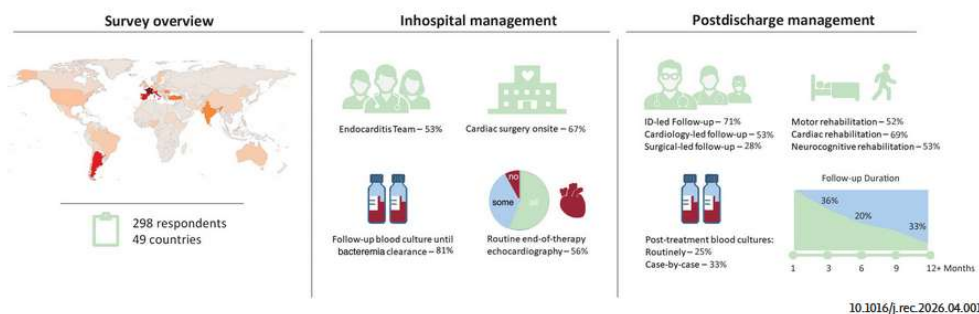
Claudio Palmieri¹ · Laura Bartolini² · Andrea Berlinger³ · Barbara Camilloni^{4,5} · Gianfranco La Bella^{6,7} · Michela Pascarella⁸ · Marina Selleri⁹ · Felice Valzano⁶ · Chiara Vismara¹⁰ · Simone Ambretti^{3,11} · Carla Fontana⁹ · Mario Rasso⁸ · Gian Maria Rossolini^{2,12} · Fabio Arena^{6,13} · Antonella Mencacci^{4,5} ·
on behalf of the GLIPaC Working Group

Original article

Management and follow-up of patients with infective endocarditis: an international cross-sectional survey

Abordaje y seguimiento de los pacientes con endocarditis infecciosa: resultados de una encuesta transversal internacional

Laura Escolà-Vergé^{a,b,c,d}, Philipp Mathé^e, Burcu Isler^{f,g,h}, Michele Bartoletti^{i,j}, Siegbert Rieg^e, Brigitte Lamy^k, Sara Grillo^{a,b,c}, Miguel Villamarín^{a,b,c}, Pierre Tattevin^l, Nuria Fernández-Hidalgo^{c,d,m},
on behalf of the ESCMID Study Group for Bloodstream Infections, Endocarditis, Sepsis (ESGBIES)



Article

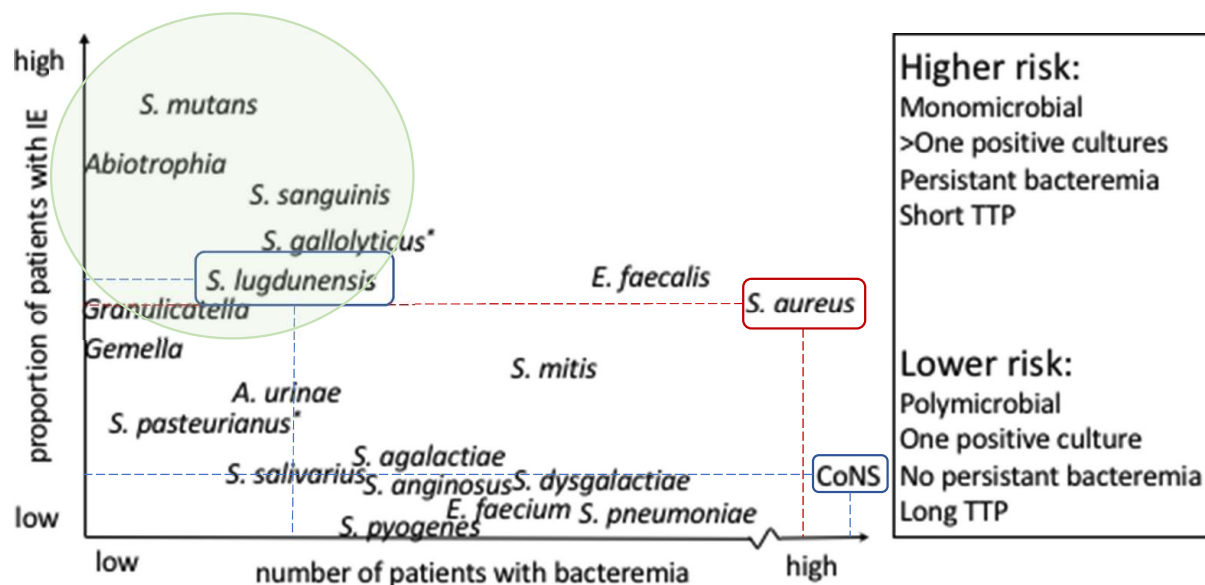
End-to-End Timeliness of Blood Culture Diagnostics: A One-Month Observational Study of 5121 Bottles

Carlotta Magri^{1,†}, Damiano Squitieri^{1,†}, Barbara Fiori², Tiziana D’Inzeo^{1,2}, Maurizio Sanguinetti^{1,2,†}, Brunella Posteraro^{1,3,†} and Giulia Menchinelli^{2,†}



Review

Bacteraemia with gram-positive bacteria—when and how do I need to look for endocarditis?

Magnus Rasmussen^{1,2,*}, Patrik Gilje³, Erika Fagman^{4,5}, Andreas Berge^{6,7}

Risk of infective endocarditis (IE) is related to the bacterial species found in blood cultures:

- *S. aureus* is the most common cause of IE, with a risk ranging between 4% and 23% in patients with bacteremia.
- Coagulase-negative staphylococci (CoNS) are frequently found in patients with intravascular devices but rarely cause IE, except for *S. lugdunensis*, which has a risk similar to *S. aureus*.
- Streptococci, high IE risk
- Streptococcus-like bacteria, such as *Abiotrophia* and *Granulicatella*, carry a high risk of IE.

Streptococcal endocarditis: a meta-analysis of species dependant risk

Gavin Deas,^{a,*} Todd C. Lee,^b Julia Colston,^c Mahableshwar Albur,^c Julia Vasant,^d Angela H. Nobbs,^e Philip Williams,^a and Fergus Hamilton^{a,f}

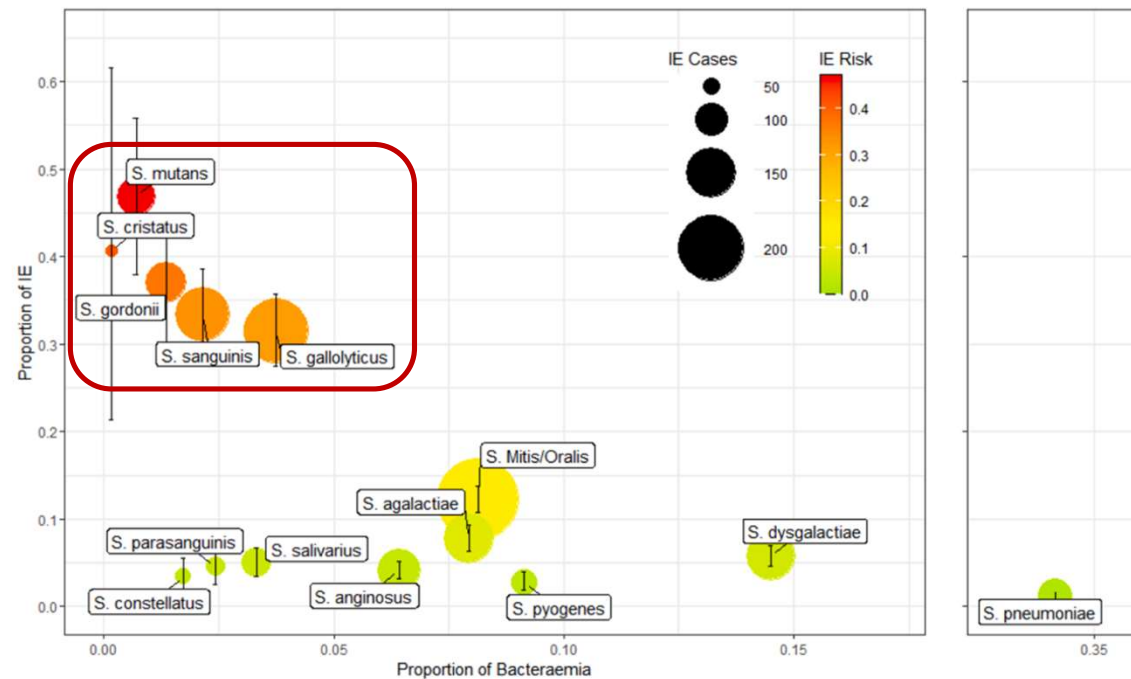
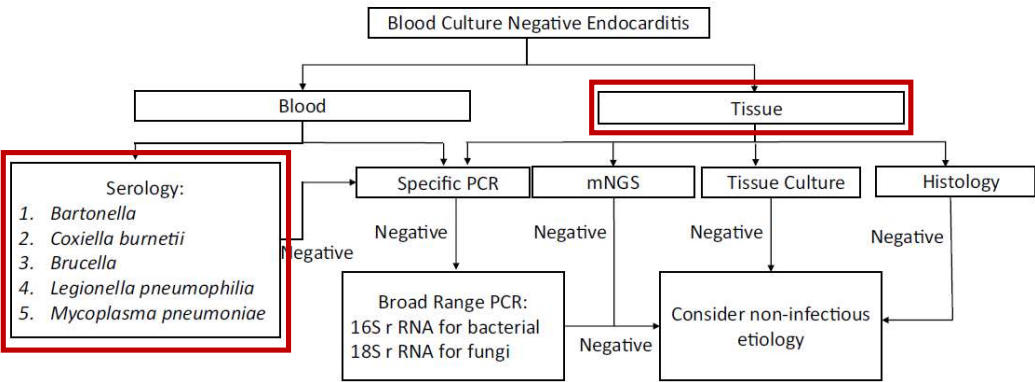


Fig. 2: Infective endocarditis prevalence of streptococcal species vs. proportion of streptococcal species bacteraemia. Coloured by increasing endocarditis risk, green (low < 10%) to red (high > 35%). Circles are proportionate to the total number of endocarditis cases. The vertical lines represent the 95% confidence intervals around the proportion of bacteraemias with endocarditis.

- A total of **14,183 isolates with 1028 endocarditis cases** were included (absolute rate of IE 7.2%).
- Bacteraemia with **five particular species** of streptococci had a proportion of endocarditis of greater than 20% of cases, and formed a cluster of **high risk streptococci for IE**.
 - *S. mutans* (47%)
 - *S. cristatus* (41%)
 - *S. gordonii* (37%)
 - *S. sanguinis* (33%)
 - *S. gallolyticus* (31%)
- **The risk of endocarditis was dependent on the infecting streptococcal species**

Blood Culture Negative Endocarditis: A Review of Laboratory Diagnostic Approaches

Kuan-Pei Lin¹, Ting-Kuang Yeh^{1,2}, Yu-Chuan Chuang¹, Li-An Wang¹, Yun-Ching Fu^{3,4,*}, Po-Yu Liu^{1,4-6,*}



Diagnostic strategy for patients with blood culture-negative endocarditis (BCNE)

Figure 1 A pragmatic approach for determining the causative organism in suspected endocarditis.

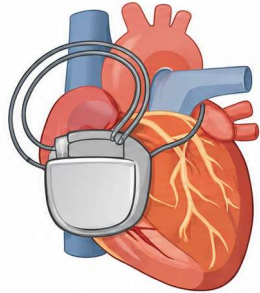
Table 9 Investigation of rare causes of blood culture-negative infective endocarditis

Pathogen	Diagnostic procedures
<i>Brucella</i> spp.	Serology, blood cultures, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>C. burnetii</i>	Serology (IgG phase I >1:800), tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>Bartonella</i> spp.	Serology (IgG phase I >1:800), blood cultures, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>T. whipplei</i>	Histology and 16S rRNA sequencing of tissue
<i>Mycoplasma</i> spp.	Serology, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
<i>Legionella</i> spp.	Serology, blood cultures, tissue culture, immunohistology, and 16S rRNA sequencing of tissue
Fungi	Serology, blood cultures, 18S rRNA sequencing of tissue
Mycobacteria (including <i>Mycobacterium chimaera</i>)	Specific blood cultures, 16S rRNA sequencing of tissue

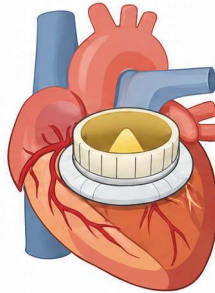
Ig, immunoglobulin; rRNA, ribosomal ribonucleic acid.

Negative Blood Cultures? Look Beyond the Blood

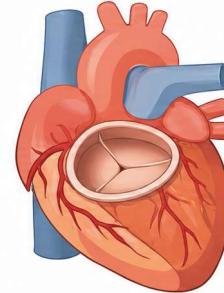
Dispositivi CIED



Protesi Valvolari



Valvola Nativa



Diagnostic Workup:

- ✓ Sonication (biofilm)
- ✓ Culture on enriched media (aerobic+anaerobic)
- ✓ Molecular testing (16S rRNA PCR/metagenomics)

Sonication

The sonication process disrupts the biofilm formed on device surfaces by means of ultrasonic waves, resulting in the release of bacteria adherent to the device surface into the sonication fluid

- When a cardiac device, Pv or NV is removed, it should be placed in a sterile container with the addition of Ringer's solution or sterile saline solution.
- The sample is vortexed for 30 seconds at 2000–3000 rpm and then sonicated at a frequency of 40 ± 2 kHz in an ultrasonic bath for 5 minutes at room temperature.
- After sonication, the sample is vortexed again for 30 seconds.
- 50 ml of sonication fluid are then transferred into a tube and centrifuged for 5 minutes.
- The supernatant is discarded, leaving 0.5 mL in the tube; 0.1 mL is inoculated under aerobic conditions and another 0.1 mL under anaerobic conditions.
- Plates are incubated at 35–37 °C in 5–7% CO₂ for 7 days, and under anaerobic conditions for 14 days.

Dithiothreitol (DTT) evidence in endocarditis is limited compared with prosthetic joint infections; protocols are less standardized

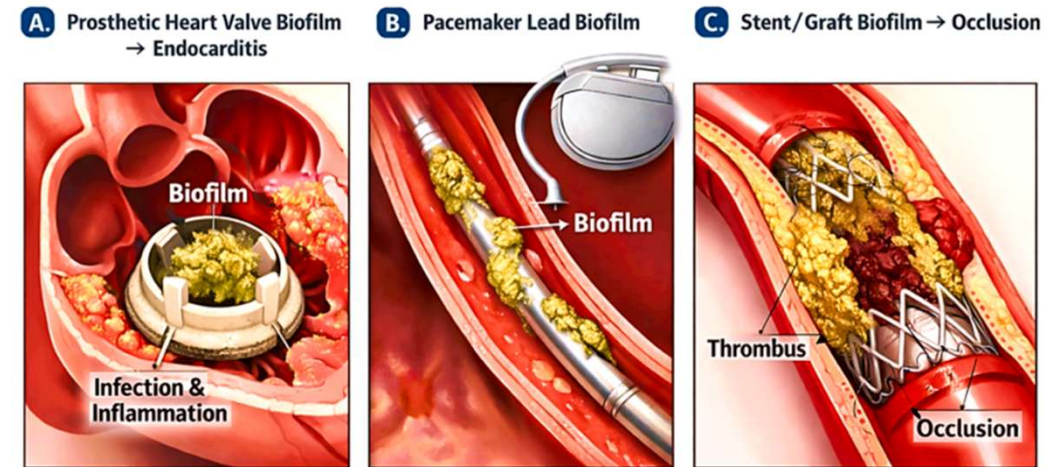
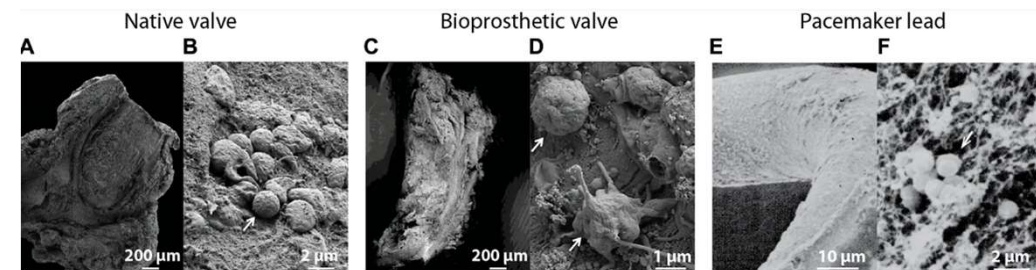


Fig. 2. Biofilm formation on cardiovascular devices.



Syndromic panels

Unyvero System - Implant & Tissue Infection (ITI) Cartridge



- | | | |
|---------------------------------------|---|----------------------------------|
| • <i>Staphylococcus aureus</i> | • <i>Klebsiella oxytoca</i> | • <i>ermA</i> |
| • Coagulase negative staphylococci | • <i>Klebsiella variicola</i> | • <i>ermC</i> |
| • <i>Streptococcus</i> species | • <i>Proteus</i> spp. | • <i>aac(6')/aph(2'')</i> |
| • <i>Streptococcus agalactiae</i> | • <i>Acinetobacter baumannii</i> complex | • <i>aacA4</i> |
| • <i>Streptococcus pneumoniae</i> | • <i>Pseudomonas aeruginosa</i> | • <i>mecA</i> |
| • <i>Streptococcus pyogenes</i> | • <i>Cutibacterium acnes</i> | • <i>mecC</i> |
| • <i>Granulicatella adiacens</i> | • <i>Finnegoldia magna</i> | • <i>vanA</i> |
| • <i>Abiotrophia defectiva</i> | • <i>Bacteroides fragilis</i> group | • <i>vanB</i> |
| • <i>Enterococcus</i> spp. | • <i>Corynebacterium</i> species | • <i>bla_{IMP}</i> |
| • <i>Enterococcus faecalis</i> | | • <i>bla_{KPC}</i> |
| • <i>Citrobacter freundii/koseri</i> | • <i>Candida</i> spp. | • <i>bla_{NDM}</i> |
| • <i>Escherichia coli</i> | • <i>Candida albicans</i> | • <i>bla_{OXA-48}</i> |
| • <i>Enterobacter cloacae</i> complex | • <i>Candida glabrata</i> | • <i>bla_{VIM}</i> |
| • <i>Klebsiella aerogenes</i> | • <i>Issatchenkia orientalis</i> (<i>C. krusei</i>) | • <i>bla_{CTX-M}</i> |
| • <i>Klebsiella pneumoniae</i> | • <i>Candida tropicalis</i> | • <i>bla_{OXA-23}</i> |
| | | • <i>bla_{OXA-24/40}</i> |
| | | • <i>bla_{OXA-58}</i> |

Synovial fluid, bone fragments, drainage fluid, exudate/pus, puncture fluid, sonication fluid, swabs, tissue, transudate

Implant and Tissue Infection – ITI panel: Sonicato **VALVOLE CARDIACHE**



Valvole cardiache n=14

SENSIBILITA'	89%
SPECIFICITA'	100%
VALORE PREDITTIVO POSITIVO	100%
VALORE PREDITTIVO NEGATIVO	83%
OVERDETECTION	12,5% (1/8)

Tabella contingenza valvole cardiache	GS+	GS-
T+	8	0
T-	1	5



16S rRNA Gene PCR/Sequencing of Heart Valves for Diagnosis of Infective Endocarditis in Routine Clinical Practice

Hyo-Lim Hong,^{a,b} Laure Flurin,^{a,c} Kerry E. Greenwood-Quaintance,^a Matthew J. Wolf,^a Bobbi S. Pritt,^{a,d} Andrew P. Norgan,^{a,e} Robin Patel^{a,d}

TABLE 2 Comparison of diagnostic performances of microbiologic tests

Method	No. positive		Sensitivity (%) (95% CI) ^a	Specificity (%) (95% CI)
	Infective endocarditis (n = 40)	Noninfective valvular disease (n = 11)		
Culture				
Valve	13	0	33 (19–49)	100 (72–100)
Blood	22	1	55 (38–71)	91 (59–100)
Valve 16S rRNA gene PCR/sequencing	30	0	75 (59–86)	100 (72–100)
Fresh tissue	26 of 35	0 of 9	74 (57–87)	100 (66–100)
Formalin-fixed paraffin-embedded tissue	4 of 5	0 of 2	80 (28–99)	100 (16–100)
Valve Gram stain				
Fresh tissue (performed in microbiology laboratory)	5 of 35	0 of 8	14 (5–30)	100 (63–100)
Formalin-fixed paraffin-embedded tissue (performed in pathology laboratory)	9 of 35	0 of 9	26 (12–43)	100 (66–100)
Valve histopathology				
Active endocarditis	22 of 34	0 of 9	65 (46–80)	100 (67–100)

^aCI, confidence interval.

- Fifty-four subjects, including 40 with IE, three with cured IE, and 11 with noninfective valvular disease, were studied
- Overall, 61% of blood culture-negative IE subjects had positive valve 16S rRNA gene PCR/sequencing results. 16S rRNA gene-based PCR/sequencing of heart valves is a useful diagnostic tool for pathogen identification in patients with blood culture-negative IE undergoing valve surgery in routine clinical practice

Evaluation of Commercial Universal rRNA Gene PCR plus Sequencing Tests for Identification of Bacteria and Fungi Associated with Infectious Endocarditis

Christian Kühn^{1,*}, Claudia Disqué², Helge Mühl², Peter Orszag¹, Meike Stiesch³, Axel Haverich¹

Clinical Microbiology and Infection 23 (2017) 888.e1–888.e5



Research note

Added diagnostic value and impact on antimicrobial therapy of 16S rRNA PCR and amplicon sequencing on resected heart valves in infective endocarditis: a prospective cohort study

B. Peeters^{1,*}, P. Herijgers^{2,3}, K. Beuselinck¹, J. Verhaegen^{1,4}, W.E. Peetermans^{4,5}, M.-C. Herregods^{3,6}, S. Desmet^{1,4}, K. Lagrou^{1,4,*}

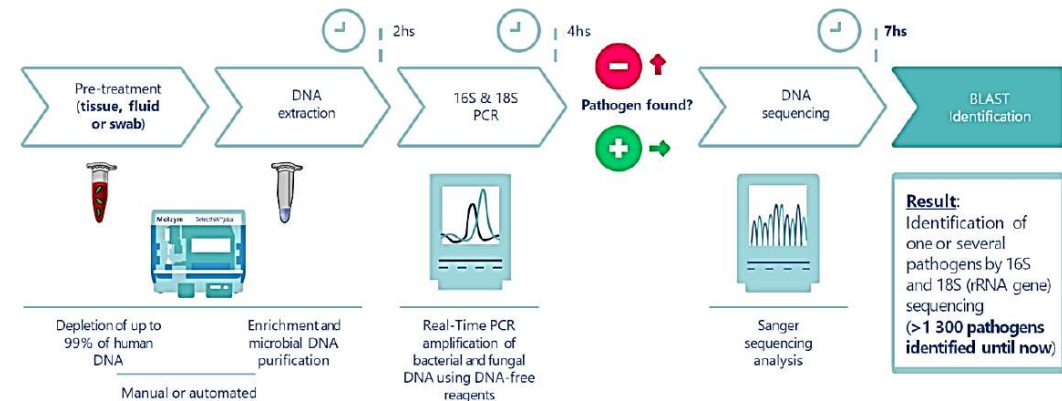


Fig. 2: MMDx broad-range diagnostic workflow

- Step 1: extracts and enriches microbial DNA by depleting up to 99% of human DNA, improving sensitivity for bacteria and fungi detection.
- Step 2: uses broad-range 16S and 18S PCR or Real-Time PCR to detect bacterial and fungal DNA, even from non-growing or difficult-to-culture pathogens.
- Step 3: identifies the pathogen through Sanger sequencing and database/BLAST analysis, allowing genus- or species-level identification.

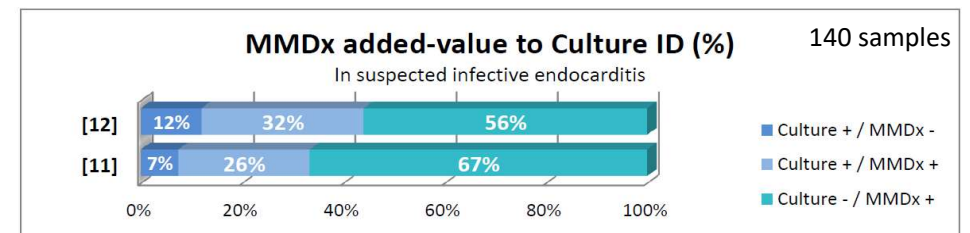


Fig. 4: Ratio of positive results by culture, Molzym's Molecular Diagnostic kits (MMDx) or both methods obtained from heart valves

The Next Step: The Role of Metagenomic Next-Generation Sequencing in Microbial Detection of Culture-Negative Cardiovascular Infections

Sarwat Khalil,^{1,2} Molly L. Paras,³ Emily Eichenberger,⁴ and M. Rizwan Sohail^{1,2}

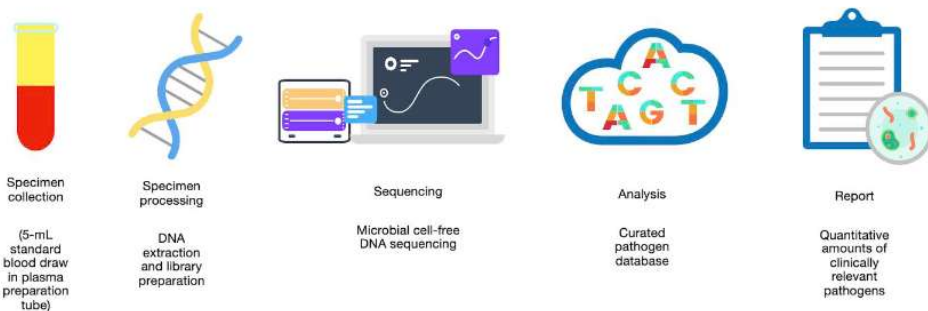
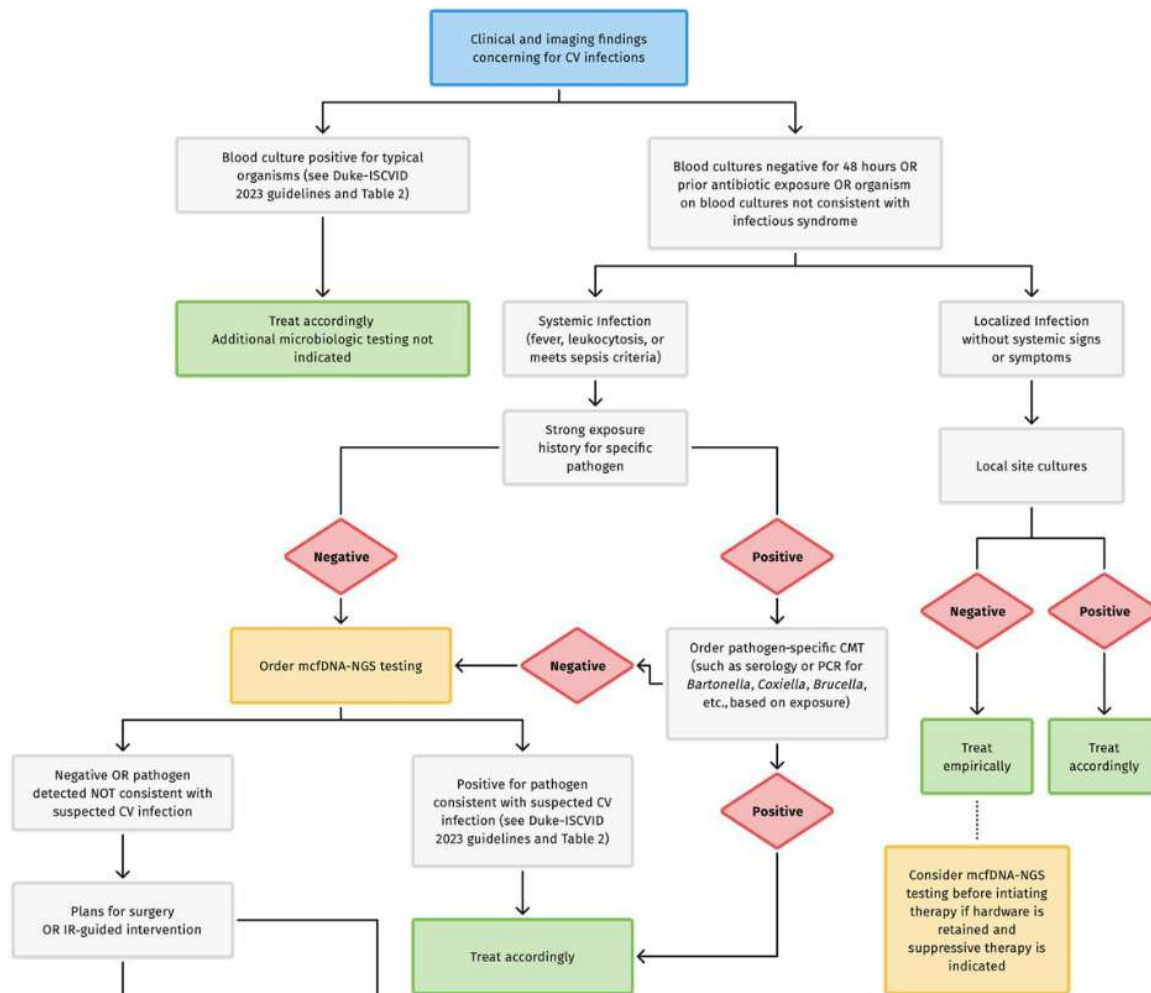


Figure 1. Microbial cell-free DNA testing process.

- Plasma microbial cell-free DNA (mcfDNA) and other meta-genomic tests are emerging methods that can detect a wide array of organisms, including both typical and atypical pathogens.
- With a broad range of detection and rapid TAT, metagenomic testing may be helpful in scenarios where conventional microbiology fails to provide an accurate or timely microbiologic diagnosis.
- It may help establish a diagnosis when deep tissue biopsies or other invasive diagnostic interventions are not feasible.

Table 2. Proposed Criteria for Interpretation of Clinical Relevance of Pathogens Detected on Microbial Cell-Free DNA Next-Generation Sequencing Testing in Patients With Suspected Cardiovascular Infection*

Likelihood That Organism Identified on mcfDNA-NGS Is Causative Pathogen for Cardiovascular Infection	Examples	Strength of Evidence	
Infective endocarditis:			
Definite	Clinical signs/symptoms and imaging consistent with valvular endocarditis (based on 2023 Duke-ISCVID criteria) and plasma mcfDNA-NGS positive for typical organisms for infective endocarditis	TEE showing mobile valvular vegetation and mcfDNA positive for <i>Staphylococcus aureus</i> PET-CT showing uptake at cardiac valve and mcfDNA-NGS positive for <i>Bartonella</i> spp. or <i>Coxiella</i> spp.	Moderate-quality evidence from 1 or more well-designed, observational or retrospective cohort studies
Probable	Clinical signs/symptoms and imaging consistent with valvular endocarditis (based on 2023 Duke-ISCVID criteria) and mcfDNA-NGS positive for organisms included in minor (2023 Duke-ISCVID) criteria	TEE showing mobile vegetation on native valve and mcfDNA-NGS positive for <i>Staphylococcus epidermidis</i> PET-CT showing uptake at native valve and mcfDNA-NGS positive for <i>Serratia</i> spp.	...
Unlikely	Clinical signs/symptoms and imaging consistent with valvular endocarditis (based on 2023 Duke-ISCVID criteria), positive mcfDNA-NGS result explained by an alternative infectious focus or considered nonpathogenic	TEE showing mobile valvular vegetation and mcfDNA-NGS positive for cytomegalovirus Positive mcfDNA-NGS explained by alternative infectious focus, eg, <i>Lactobacillus</i> spp. in a patient with intraabdominal abscess	...
CIED infection			
Definite	Clinical signs/symptoms and imaging consistent with CIED pocket or lead infection, and plasma mcfDNA-NGS positive for organisms consistent with implant-related infection	TEE showing lead vegetation and mcfDNA-NGS positive for <i>S. epidermidis</i> PET-CT showing uptake at generator pocket area and mcfDNA-NGS positive for <i>Corynebacterium jeikeium</i>	Limited data from observational or retrospective studies with limitations of design
Probable	Clinical signs/symptoms and imaging consistent with CIED pocket or lead infection, and plasma mcfDNA-NGS positive for organisms with low probability to be causative pathogen for CIED infection	TEE showing mobile lead vegetation and mcfDNA-NGS positive for <i>Staphylococcus capitis</i>	...
Unlikely	Clinical signs/symptoms and imaging consistent with CIED pocket or lead infection, and positive mcfDNA-NGS result explained by an alternative infectious focus or considered nonpathogenic	TEE showing lead vegetation and mcfDNA-NGS positive for <i>Staphylococcus pneumoniae</i> Positive mcfDNA-NGS explained by alternative infectious focus, eg, <i>Proteus</i> spp. in a patient's intraabdominal abscess	...



•mcfDNA-NGS is an emerging, noninvasive, pathogen-agnostic diagnostic tool with significant potential to identify causative pathogens in culture-negative cardiovascular infections.

•In infective endocarditis and CIED-related infections, preliminary studies have shown excellent sensitivity, particularly when conventional cultures are negative.

•By improving pathogen detection and inform AMR, mcfDNA-NGS may help clinicians optimize pathogen-directed antimicrobial therapy and potentially improve patient outcomes.

•Serial mcfDNA monitoring could provide useful information on treatment response and may help inform the duration of antimicrobial therapy.

•Given the rarity of some cardiovascular infection syndromes, multicenter registries and collaborative studies are needed to better define the optimal role of mcfDNA-NGS in routine clinical practice.

2023 ESC Guidelines for the management of endocarditis

The aetiology of IE is described in the EURO-ENDO registry³ and the International Collaboration on Endocarditis-Prospective Cohort Study (ICE-PCS).¹⁴⁵ In 2009, the ICE-PCS showed that the most frequent microorganisms causing IE were *S. aureus* (31%), followed by oral streptococci (17%), and CoNS (11%).¹⁴⁵ Similar results were reported in the EURO-ENDO registry.^{5,145} Other registries have highlighted the increasing incidence of IE caused by *E. faecalis* and CoNS, particularly in the elderly.^{146–149} However, the results of these registries should be carefully interpreted due to inherent biases (type of participating centres, geographical differences, lack of complete granular data, etc.).



Circulation

Volume 131, Issue 18, 5 May 2015, Pages 1566–1574
<https://doi.org/10.1161/CIRCULATIONAHA.114.014089>

VALVULAR HEART DISEASE

Infective Endocarditis After Transcatheter Aortic Valve Implantation

Results From a Large Multicenter Registry

Clinical presentation, aetiology and outcome of infective endocarditis. Results of the ESC-EORP EURO-ENDO (European infective endocarditis) registry: a prospective cohort study

Home | JAMA Internal Medicine | Vol. 169, No. 5

Original Investigation

Clinical Presentation, Etiology, and Outcome of Infective Endocarditis in the 21st Century

The International Collaboration on Endocarditis-Prospective Cohort Study

David R. Murdoch, MD, MSc; G. Ralph Corey, MD; Bruno Hoen, MD; et al

Open Forum Infectious Diseases

MAJOR ARTICLE

IDSA
Infectious Diseases Society of America

hivma
hiv medicine association

OXFORD

Non-nosocomial Healthcare-Associated Infective Endocarditis: A Distinct Entity? Data From the GAMES Series (2008–2021)

David Alonso-Menchén,^{1,6} Emilio Bouza,^{1,2,3} Maricela Valerio,^{1,2} Aristides de Alarcón,^{4,5} Encarnación Gutiérrez-Carretero,^{6,7} José M. Miró,^{5,8} Miguel Ángel Goenaga-Sánchez,⁹ Antonio Plata-Ciezar,¹⁰ Claudia González-Rico,^{8,11} Luis Eduardo López-Cortés,^{6,12} María Ángeles Rodríguez Esteban,¹³ Francisco Javier Martínez-Marcos,¹⁴ and Patricia Muñoz,^{1,2,3} for the GAMES Investigators⁸



American
Heart
Association

Open Forum Infectious Diseases

MAJOR ARTICLE

IDSA
Infectious Diseases Society of America

hivma
hiv medicine association

OXFORD

Prevalence and Mortality of Infective Endocarditis in Community-Acquired and Healthcare-Associated *Staphylococcus aureus* Bacteremia: A Danish Nationwide Registry-Based Cohort Study

Lauge Østergaard,^{1,2,3} Marianne Voldstedlund,^{4,5} Niels Eske Bruun,^{4,5,6} Henning Bundgaard,^{1,6} Kasper Iversen,⁴ Nana Køber,² Anders Dahl,^{5,6} Sandra Chamat-Hedemand,^{1,5} Jeppe Kolofod Petersen,^{1,6} Andreas Dalsgaard Jensen,¹ Jens Jørgen Christensen,¹ Flemming Schønning Rosenqvist,⁴ Jens Otto Jørgensen,⁴ Claus Moser,^{4,11} Christian Østergaard Andersen,^{1,6} John Coia,^{1,6} En Sofie Marmolin,^{1,6} Kirstine K. Søgaard,^{4,5,6} Lars Lemming,^{1,7} Lars Køber,^{1,6} and Emil Lørdrup Følshøj¹

Editorial

Organization and Functioning of a Multidisciplinary Team for the Diagnosis and Treatment of Infective Endocarditis: A 30-year Perspective (1985-2014)

Organización y funcionamiento de un grupo multidisciplinario de diagnóstico y tratamiento de la endocarditis infecciosa: perspectiva de 30 años (1985–2014)

Carlos A. Mestres^a, J. Carles Paré^b, José M. Miró^c, the Working Group on Infective Endocarditis of the Hospital Clínic de Barcelona

- The multidisciplinary management of IE cases within an Endocarditis Team is recommended by the guidelines as it is associated with improved clinical outcomes.
- **Among the organizational aspects, the creation of a dedicated prospective database, accessible to all team specialists, enables continuous feedback on the quantity and quality of the work performed.**

Table 3.
Quality Control of the Multidisciplinary Working Group on Infectious Endocarditis

Organizational aspects
1. Provide response within 24 h to inquiries from other centers, including transfer requests made by telephone or via the internet
2. Prospective collection of echocardiographic, microbiological, surgical, and clinical course data in a specialized database
3. Weekly meetings with all members of the group
4. Prevention of nosocomial endocarditis: provision of information and education to decrease catheter bacteremia and implantable cardiac device infections
Clinical aspects
1. Echocardiography within 48 h of diagnosis of suspected infective endocarditis
2. Embolic study within 72 h, especially in the case of fungal infectious endocarditis and staphylococcal endocarditis (<i>Staphylococcus aureus</i> , <i>Staphylococcus lugdunensis</i>)
3. Regular review of the suitability, duration, and toxicity of empirical and definitive antibiotic regimens
Microbiological aspects
1. A minimum of 2 nonsimultaneous blood cultures by direct venipuncture using different veins at the time of suspicion of IE. Control blood cultures at 3 days and 7 days
2. Real-time communication from the group's microbiologist to the infectious disease specialist if growth is observed in blood cultures of typical pathogens of infective endocarditis (< 24 h)
3. Staining, cultures, and molecular biology (16S and 18S) of all valvular vegetations, embolic material, and intracardiac devices of patients with suspected infective endocarditis
Surgical aspects
1. In less than 24 h, discuss with the surgeon patients with indications for surgery
2. Adhere to the time limits recommended in the guidelines for patients with urgent and emergency surgical indication
3. Removal of all infected intracardiac devices and review and discuss patients in which this is not done

Logon to TrakCare | Posta - Francesca Giovanna | 2024_Endocarditis_PolicGemelli

redcap.dimes.unical.it/redcap/redcap_v13.7.2/DataEntry/index.php?pid=22&id=1&page=patient_data&event_id=49&instance=1

REDCap®

Logged in as [Name] | Log out

My Projects

REDCap Messenger

Contact REDCap administrator

Project Home and Design

Project Home | Codebook

Project status: Development

Data Collection

Record Status Dashboard

Add / Edit Records

Patient ID 1 (health_structure_code(codice_sanitario) 47760103)

Data Collection Instruments:

- Patient Data
- Comorbidities
- Risk Factors
- Signs And Symptoms
- Embolic Events
- Microbiology
- Ecocardiography
- Heart Ct Scan
- Fdg Petct Scan
- Histopathology
- Other Diagnostics
- Endocarditis Diagnosis Definition
- Antibiotic Therapy
- Long-Acting Antibiotic
- Antibiotics Sum Up
- Risk Score
- Preoperative evaluation
- Surgery
- Postoperative ICU
- Outcome

Calendar

2024_Endocarditis_PolicGemelli PID 22

Actions: Download PDF of instrument(s) | Video: Basic data entry

Save & Exit Form

Save & Go To Next Form

Cancel

Patient Data

Editing existing Patient ID 1. (health_structure_code(codice_sanitario) 47760103)

Patient ID 1

health_structure_code(codice_sanitario) 47760103

Date of birth 1949-03-12 Today Y-M-D

* must provide value

Ethnicity

White

Black

Hispanic

Asian

Other

Gender

Female Male Other

* must provide value

Weight [Kg] 60

* must provide value

Height [cm] 160

* must provide value

BMI 23.4 View equation

BSA 1.6 View equation

Age 74 View equation

Hospital admission (ER) 2023-03-18 Today Y-M-D

Hospital admission (ward) 2023-03-22 Today Y-M-D

Transfer from another Hospital Yes No

IE Diagnostic Data

Endocarditis Team FPG

- Core: infettivologi, microbiologi, cardiologi (ecocardiografisti), cardiochirurghi, cardioanestesisti, radiologi e specialisti in medicina nucleare
- On demand: neurologi, elettrofisiologi, emodinamisti
- Meeting due volte a settimana

CRF REDCap

- 28 utenti
- 20 sezioni

Project Home and Design

Project Home · Codebook
Project status: Development

Data Collection

Record Status Dashboard
- View data collection status of all records
Add / Edit Records
- Create new records or edit/view existing ones

Patient ID 196 [Select other record](#)

Data Collection Instruments:
Patient Data
Comorbidities
Risk Factors
Signs And Symptoms
Embolic Events
Microbiology
Ecocardiography
Heart Ct Scan
Fdg Petct Scan
Histopathology
Other Diagnostics
Endocarditis Diagnosis Definition
Antibiotic Therapy
Long-Acting Antibiotic
Antibiotics Sum Up
Risk Score
Preoperative evaluation
Surgery
Postoperative ICU
Outcome

Applications

Calendar
Data Exports, Reports, and Stats
Field Comment Log
File Repository

Reports [Search](#) [Organize](#) [Edit](#)

1) TestSet2024

Help & Information

2024_Endocarditis_PolicGemelli

PID 22

Actions: [Download PDF of instrument\(s\)](#)

[Video: Basic data entry](#)

Save & Exit Form

Save & Go To Next Form

Cancel

Microbiology

Adding new Patient ID 196.

Patient ID	196	
Diagnostic blood cultures	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not Performed	reset
Any antibiotics before diagnostic blood culture	<input type="radio"/> Yes <input type="radio"/> No	reset
Control blood culture performed	<input type="radio"/> Yes <input type="radio"/> No	reset
Coxiella spp serology	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not performed	reset
Bartonella spp. serology	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not performed	reset
Tropheryma whippelii PCR	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not performed	reset
Brucella spp. serology	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not performed	reset
Mycoplasma spp. serology	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not performed	reset
Legionella spp. serology	<input type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not performed	reset
Other relevant microbiological samples different from blood culture and valve culture	<input type="radio"/> Yes <input type="radio"/> No	reset
Form Status		
Complete?	Incomplete	

if positive

- ☐ Methicillin-susceptible Staphylococcus aureus
- ☐ Methicillin-resistant Staphylococcus aureus
- ☐ Staphylococcus lugdunensis
- ☐ Enterococcus faecalis
- ☐ Streptococcus gallolyticus
- ☐ Other streptococcal spp
- ☐ Streptococci like bacteria (abiotrophia spp or Granulicatella spp or Gemella spp)
- ☐ HACEK group microorganisms (Haemophilus species, Aggregatibacter actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, and Kingella kingae)
- ☐ coagulase negative Staphylococci
- ☐ Corynebacterium spp
- ☐ Serratia marcescens
- ☐ Pseudomonas aeruginosa
- ☐ Cutibacterium acnes
- ☐ Candida spp
- ☒ Other

Valve culture		<input checked="" type="radio"/> Negative <input type="radio"/> Positive <input type="radio"/> Not performed	reset
Valve molecular diagnostics		<input type="radio"/> Negative <input checked="" type="radio"/> Positive <input type="radio"/> Not performed	reset
Valve molecular ID		<input type="checkbox"/> Staphylococcus aureus <input type="checkbox"/> Staphylococcus lugdunensis <input type="checkbox"/> Enterococcus faecalis <input checked="" type="checkbox"/> All streptococcal species <input type="text"/> <input type="checkbox"/> Streptococci like bacteria (abiotrophia spp or Granulicatella spp or Gemella spp) <input type="checkbox"/> HACEK group microorganisms (Haemophilus species, Aggregatibacter actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, and Kingella kingae) <input type="checkbox"/> coagulase negative Staphylococci <input type="checkbox"/> Corynebacterium spp <input type="checkbox"/> Serratia marcescens <input type="checkbox"/> Pseudomonas aeruginosa <input type="checkbox"/> Cutibacterium acnes <input type="checkbox"/> Candida spp <input type="checkbox"/> Other	reset
Other relevant microbiological samples different from blood culture and valve culture		<input type="radio"/> Yes <input checked="" type="radio"/> No	reset
Form Status			
Complete?		Complete ▾	
		<input type="button" value="Save & Exit Form"/> <input type="button" value="Save & Go To Next Form"/>	
		<input type="button" value="- Cancel -"/>	



Database Endocarditis Team

— Sintesi clinico-microbiologica della coorte —



Pazienti

283



Età

70 anni

mediana (IQR 60,2–78,0)



Sesso maschile

72,4%



NVE

63,6%



PVE

35,7%



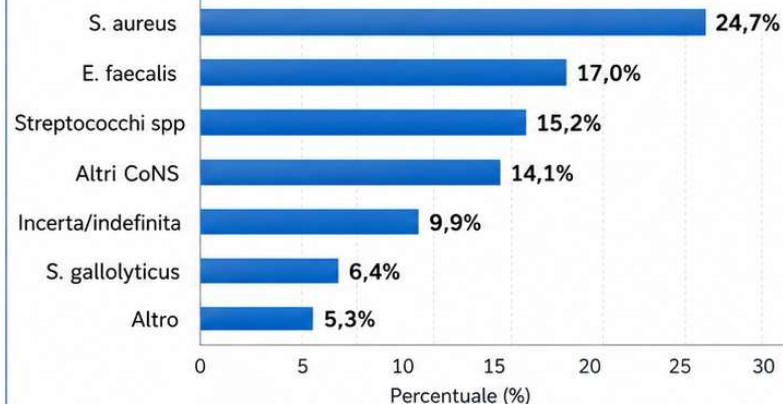
CIED-IE

6,7%



Principali dati microbiologici

Patogeno indice (%)



MSSA 19,1% e MRSA 5,7% sono sottocategorie di *S. aureus*



Gestione clinica



Discussione in Endocarditis Team

71,4% (202/283)

Tempo alla discussione

13 giorni

mediana, IQR 6–21



Tempo alla diagnosi

3 giorni (IQR 0–8)



ETT

68,9%



ETE

70,3%



Cardio-TC

36,7%



PET-TC

8,5%



Indicazione chirurgica

71,7%



Chirurgia eseguita

42,4%



Degenza

38 giorni (IQR 26–54)



Mortalità intraospedaliera

22,3%



Mortalità a 1 anno

25,1%

Fonte: report endocteam(1).csv

Aprile2026: La reportistica viene generata automaticamente con cadenza mensile sulla base dei dati in RedCap e inviata a i membri del Team

TAKE HOME MESSAGES:

- Microbiological diagnosis is a key component in the management of patients with infective endocarditis, supporting clinical decision-making and pathogen-directed antimicrobial therapy.
- Optimization of the pre-analytical phase is essential to maximize diagnostic yield
- Molecular approaches can significantly improve pathogen detection, especially in blood culture-negative endocarditis, but they must be carefully integrated into the diagnostic workflow and interpreted by experienced microbiologists.
- The Endocarditis Team is central to patient management, ensuring multidisciplinary integration of clinical, microbiological, imaging, surgical, and therapeutic information. Systematic documentation of diagnostic and clinical Endocarditis Team activity is crucial, both to track the work performed and to monitor local case-mix, diagnostic performance, and quality indicators over time.



*Quartiere Testaccio, Roma
Courtesy of Dr. Francesca Giovannenze*

Endocarditis Team

Giancarlo Scoppettuolo

Francesca Giovannenze

Natalia Pavone

Maria Calabrese

Federico Cammertoni

Eleonora Taddei

Antonella Lombardo

Giulia Iannaccone

Giuseppe Rovere

Lucia Leccisotti

Andrea Guarneri

Tiziana D'Inzeo

....