# Transcatheter prosthetic valve management:

## *Managing prosthetic valve endocarditis*

Gilbert Habib
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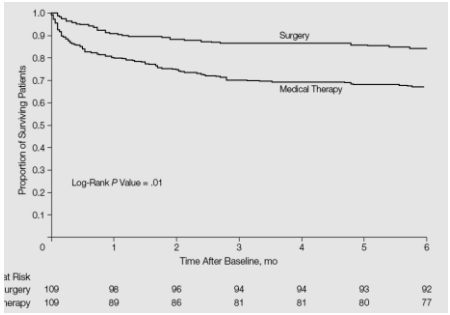
September 25th, 2025

EDITORIAL

# Infective Endocarditis After Transcatheter Aortic Valve Replacement: The Worst That Can Happen

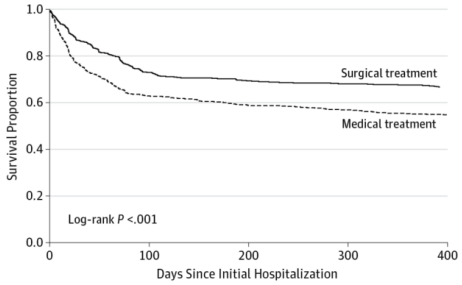
Gilbert Habib, MD, PhD

**Habib G– JAHA 2018**



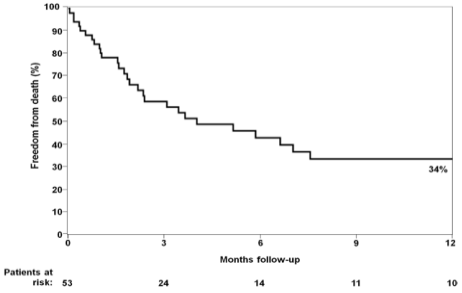

**513 patients**
**Native Valve IE**

**Vikram– JAMA 2003**




**1025 patients**
**Prosthetic Valve IE**

**Lalani T– JAMA 2013**




**53 patients**
**TAVI IE**

**Amat-Santos IJ et al. Circulation 2015**

# Managing TAVI Endocarditis

1. ***Diagnosis***

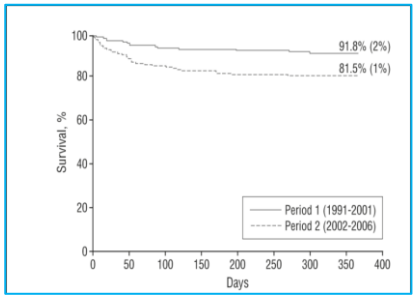
2. **Treatment**

# The multidisciplinary endocarditis team

## Dramatic Reduction in Infective Endocarditis–Related Mortality With a Management-Based Approach

*Elisabeth Botelho-Nevers, MD; Franck Thuny, MD; Jean Paul Casalta, MD; Hervé Richet, MD, PhD; Frédérique Gouriet, MD, PhD; Frédéric Collart, MD; Alberto Riberi, MD; Gilbert Habib, MD; Didier Raoult, MD, PhD*

The management of IE by a multidisciplinary medical-surgical team using a standardized protocol to treat IE was associated with a significant decrease in mortality




| Recommendations | Class[a] | Level[b] |
|---|---|---|
| Diagnosis and management of patients with complicated IE are recommended to be performed at an early stage in a Heart Valve Centre, with immediate surgical facilities and an 'Endocarditis Team' to improve the outcomes.[36–41,122,123,125,126] | I | B |
| For patients with uncomplicated IE managed in a Referring Centre, early and regular communication between the local and the Heart Valve Centre endocarditis teams is recommended to improve the outcomes of the patients.[36–41,122,123,125,126] | I | B |

**ESC guidelines 2023**

# The « Endocarditis Imaging team »

Circulation

## Multimodality Imaging in Infective Endocarditis

### An Imaging Team Within the Endocarditis Team

**ABSTRACT:** Infective endocarditis (IE) is a complex disease with cardiac involvement and multiorgan complications. Its prognosis depends on prompt diagnosis that leads to an aggressive therapeutic management combining antibiotic therapy and early cardiac surgery when indicated. However, IE diagnosis always poses a challenge, and echocardiography remains diagnostically imperfect in cases of prosthetic valve IE or cardiac implantable electronic device infection. In recent years, other imaging modalities (computed tomography, magnetic resonance imaging, nuclear imaging) have experienced significant technical improvements, and their application to the detection of

Paola A. Erba, MD, PhD*
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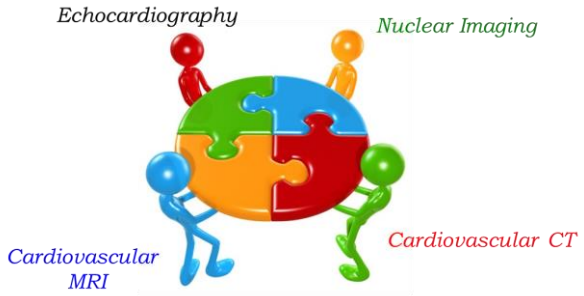
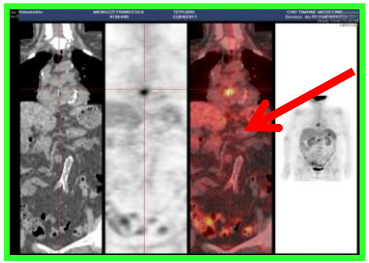
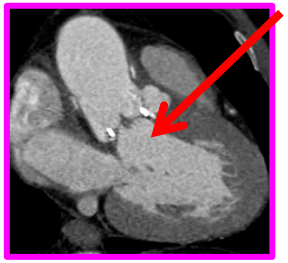



**TOE**
**Morphology**



**PET CT**
**Inflammation / infection**



**Cardiac CT**
**Perivalvular lesions**

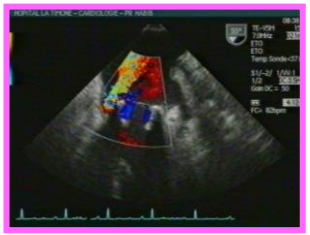
# Endocarditis diagnostic criteria

## The 1994 Duke echographic criteria

*Durack DT Am J Med 1994 ; 96 : 200-9*

Vegetation

Abscess

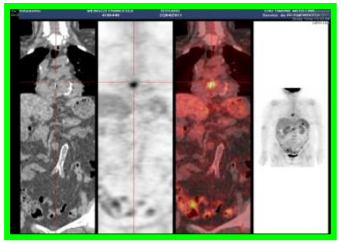


New dehiscence of prosthetic valve

## The ESC 2015 imaging criteria

*Habib G et al - ESC guidelines Europ Heart J 2015*

Echocardiography
Morphology



PET CT
Inflammation / infection

Cardiac CT - Perivalvular lesions

# Value of the ESC 2015 criteria

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## Comparison Between ESC and Duke Criteria for the Diagnosis of Prosthetic Valve Infective Endocarditis

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**ABSTRACT**

**OBJECTIVES** The primary objective was to assess the value of the European Society of Cardiology (ESC) criteria, including $^{18}$F-fluorodeoxyglucose positron emission tomography/computed tomography ($^{18}$F-FDG-PET/CT) in prosthetic valve infective endocarditis (PVE). Secondary objectives were: 1) to assess the reproducibility of $^{18}$F-FDG-PET/CT; 2) to compare its diagnostic value with that of echocardiography; and 3) to assess the diagnostic value of the presence of a diffuse splenic uptake

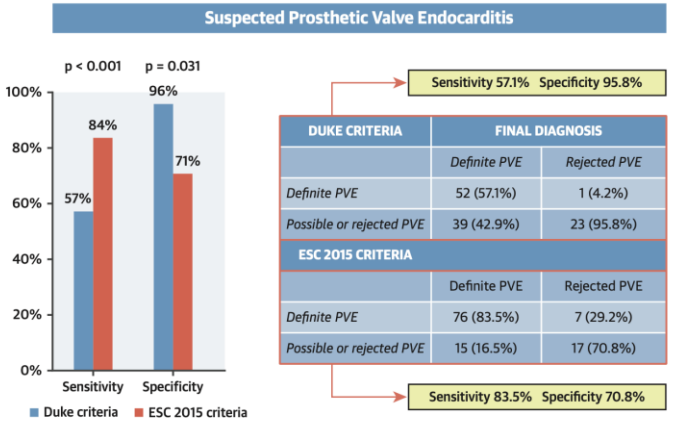
**BACKGROUND** $^{18}$F-FDG PET/CT has been added as a major criterion in the ESC 2015 infective endocarditis (IE) guidelines, but the benefit of the ESC criteria has not been prospectively compared with the conventional Duke criteria.

**METHODS** Between 2014 and 2017, 175 patients with suspected PVE were prospectively included in 3 French centers. After exclusion of patients with uninterpretable $^{18}$F-FDG PET/CT, 115 patients were evaluated, including 91 definite and 24 rejected IE, as defined by an expert consensus.

**RESULTS** Cardiac uptake by $^{18}$F-FDG PET/CT was observed in 67 of 91 patients with definite PVE and 6 with rejected IE (sensitivity 73.6% [95% confidence interval (CI): 63.3% to 82.3%], specificity 75% [95% CI: 53.3% to 90.2%]). The ESC 2015 classification increased the sensitivity of Duke criteria from 57.1% (95% CI: 46.3% to 67.5%) to 83.5% (95% CI: 74.3% to 90.5%) ($p < 0.001$), but decreased its specificity from 95.8% (95% CI: 78.9% to 99.9%) to 70.8% (95% CI: 48.9% to 87.4%). Intraobserver reproducibility of $^{18}$F-FDG PET/CT was good (kappa = 0.84) but interobserver reproducibility was less satisfactory (kappa = 0.63). A diffuse splenic uptake was observed in 24 (20.3%) patients, including 23 (25.3%) of definite PVE, and only 1 (4.2%) rejected PVE ($p = 0.024$).

**CONCLUSIONS** $^{18}$F-FDG PET/CT is a useful diagnostic tool in suspected PVE, and explains the greater sensitivity of ESC criteria than Duke criteria. However, $^{18}$F-FDG PET/CT also presents with important limitations concerning its feasibility, specificity, and reproducibility. Our study describes for the first time a new endocarditis criterion, that is, the presence of a diffuse splenic uptake on $^{18}$F-FDG PET/CT. (J Am Coll Cardiol Img 2020;■:■–■) © 2020 by the American College of Cardiology Foundation.

**CENTRAL ILLUSTRATION** Additional Diagnostic Value of European Society of Cardiology 2015 Criteria Including Positron Emission Tomography Valvular Uptake Over Duke Criteria




| DUKE CRITERIA | FINAL DIAGNOSIS | |
|---|---|---|
| | *Definite PVE* | *Rejected PVE* |
| *Definite PVE* | 52 (57.1%) | 1 (4.2%) |
| *Possible or rejected PVE* | 39 (42.9%) | 23 (95.8%) |
| **ESC 2015 CRITERIA** | | |
| | Definite PVE | Rejected PVE |
| *Definite PVE* | 76 (83.5%) | 7 (29.2%) |
| *Possible or rejected PVE* | 15 (16.5%) | 17 (70.8%) |

Adding $^{18}$F-FDG PET/CT increases the sensitivity of Duke criteria but decreases their specificity

**Philip, M. et al. J Am Coll Cardiol Img. 2020;13(12):2605–15.**

Adding $^{18}$F-FDG PET/CT increases the sensitivity of Duke criteria but decreases their specificity. $^{18}$F-FDG PET/CT = $^{18}$F-fluorodeoxyglucose positron emission tomography/computed tomography; ESC = European Society of Cardiology.

Philip M, Tessonier L, Mancini J, Mainardi JL, Fernandez-Gerlinger MP, Lussato D, Attias D, Cammilleri S, Weinmann P, Hagege A, Arregle F, Martel H, Oliver L, Camoin L, Casalta AC, Casalta JP, Gouriet F, Riberi A, Lepidi H, Raoult D, Drancourt M, Habib G. Comparison Between ESC and Duke Criteria for the Diagnosis of Prosthetic Valve Infective Endocarditis. JACC Cardiovasc Imaging. 2020 Dec;13(12):2605-2615. doi: 10.1016/j.jcmg.2020.04.011.

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

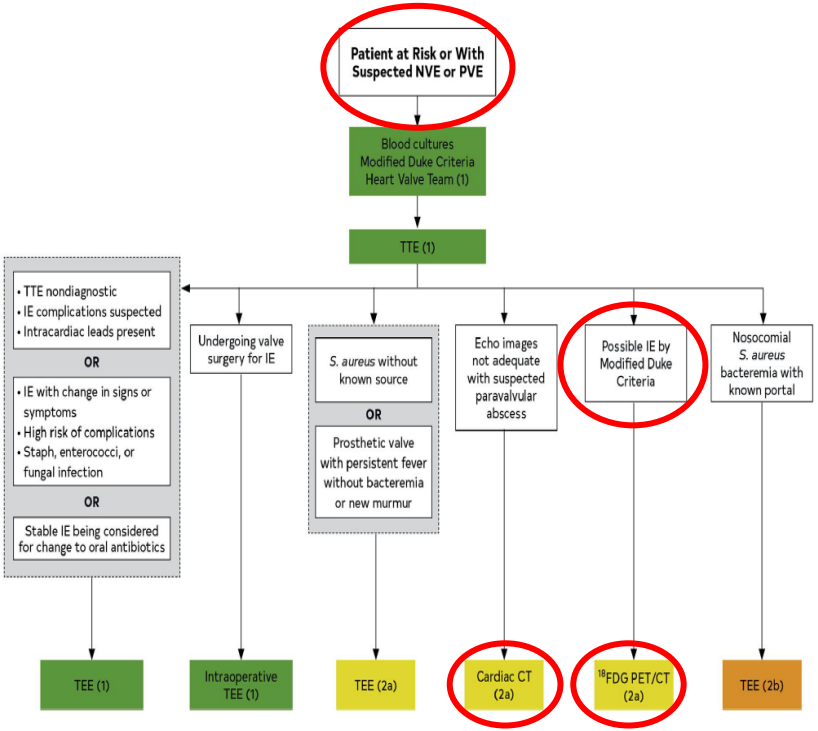


# 2023 ESC Guidelines for the management of endocarditis

| | | |
|---|---|---|
| Cardiac CTA is recommended in patients with possible NVE to detect valvular lesions and confirm the diagnosis of IE. | I | B |
| [18F]FDG-PET/CT(A) and cardiac CTA are recommended in possible PVE to detect valvular lesions and confirm the diagnosis of IE. | I | B |
| [18F]FDG-PET/CT(A) may be considered in possible CIED-related IE to confirm the diagnosis of IE. | IIa | B |
| Cardiac CTA is recommended in NVE and PVE to diagnose paravalvular or periprosthetic complications if echocardiography is inconclusive. | I | B |
| Brain and whole-body imaging (CT, [18F]FDG-PET/CT, and/or MRI) are recommended in symptomatic patients with NVE and PVE to detect peripheral lesions or add minor diagnostic criteria. | I | B |

CLINICAL PRACTICE GUIDELINE: FULL TEXT

# 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease

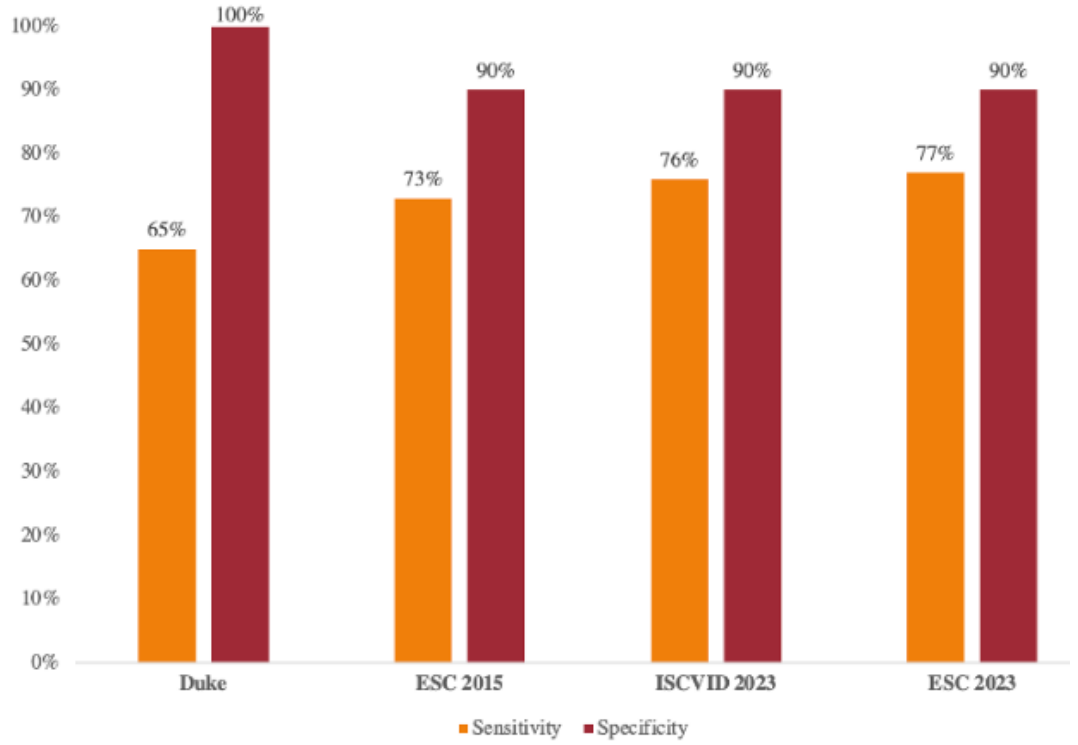


# Can we apply the ESC criteria to TAVI IE ?

**Boufoula et al EHJCVI 2024**

- ✓ 92 patients with suspected TAVI-IE
- ✓ 82 definite
- ✓ 10 rejected

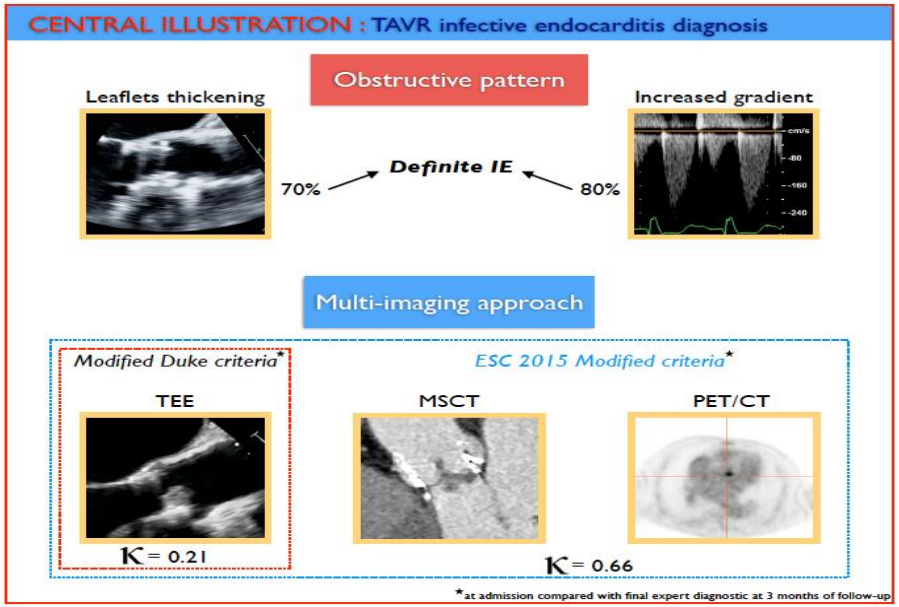
Se Duke vs ESC 2015: **p=0.016**
Se ISCVID vs Duke: **p=0.004**
Se ESC 2023 vs Duke: **p=0.002**
All other p values were not significant.



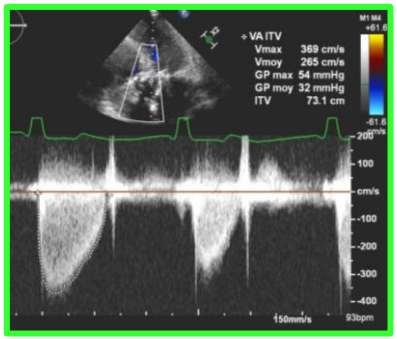
# TAVI endocarditis

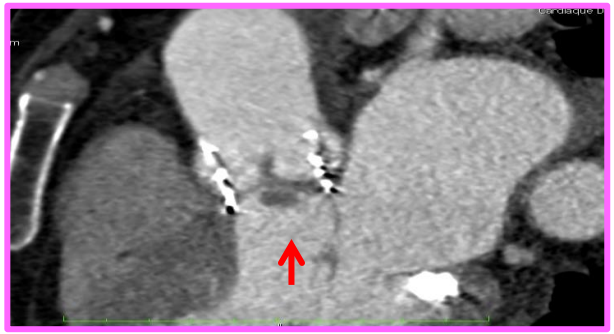
**Salaun E – JACC Imaging 2017**

- 16 suspected TAVI IE, 10 definite cases
- Leaflet thickening and increased mean gradient in 70% and 80% of definite TAVI IE
- Major additional diagnostic value of PET CT and cardiac CT over echocardiography
- Low diagnostic value of Duke criteria (sensitivity = 50%)
- High sensitivity (100%) of ESC 2015 modified criteria, including a multimodality approach

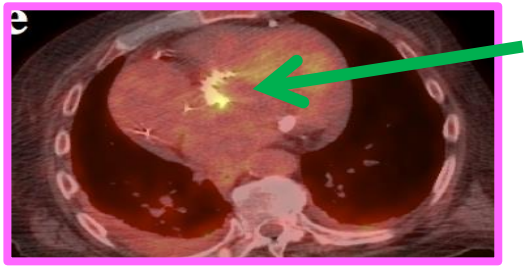


# Case 1: TAVI endocarditis



- 83 year-old man
- streptococcus salivarius IE
- 6 months after Edwards Sapien 3 implantation
- TTE: High mean gradient = 32 mmHg
- TEE: thickening of THV leaflets
- MSCT: leaflets thickening and vegetation
- PET/CT showed the THV $^{18}$F-FDG uptake



**1 – Multimodality imaging is of major value in TAVI IE**

**2 - Atypical lesions of leaflets thickening and high transvalvular gradient (obstructive pattern) are frequent in TAVI IE**

# Managing TAVI Endocarditis

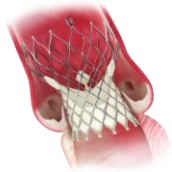
1. **Diagnosis**
2. ***Treatment***

# Indications and timing of surgery ESC 2023

| Recommendations | Class[b] | Level[c] |
|---|---|---|
| **(i) Heart failure** | | |
| Emergency[d] surgery is recommended in aortic or mitral NVE or PVE with severe acute regurgitation, obstruction, or fistula causing refractory pulmonary oedema or cardiogenic shock.[420,423,424,429,476,477] | I | B |
| Urgent[d] surgery is recommended in aortic or mitral NVE or PVE with severe acute regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance.[5,420–422,429] | I | B |

| Recommendations | Class[b] | Level[c] |
|---|---|---|
| **(ii) Uncontrolled infection** | | |
| Urgent[d] surgery is recommended in locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation, prosthetic dehiscence, new AVB).[5,420,421,429,445] | I | B |
| Urgent[d] or non-urgent surgery is recommended in IE caused by fungi or multiresistant organisms according to the haemodynamic condition of the patient.[420] | I | C |
| Urgent[d] surgery should be considered in IE with persistently positive blood cultures >1 week or persistent sepsis despite appropriate antibiotic therapy and adequate control of metastatic foci.[436,437] | IIa | B |
| Urgent[d] surgery should be considered in PVE caused by *S. aureus* or non-HACEK Gram-negative bacteria[5,385,449] | IIa | C |

| Recommendations | Class[b] | Level[c] |
|---|---|---|
| **(iii) Prevention of embolism** | | |
| Urgent[d] surgery is recommended in aortic or mitral NVE or PVE with persistent vegetations ≥10 mm after one or more embolic episodes despite appropriate antibiotic therapy.[451,455,457,471,478] | I | B |
| Urgent[d] surgery is recommended in IE with vegetation ≥10 mm and other indications for surgery.[5,460,465,466,471,478] | I | C |
| Urgent[d] surgery may be considered in aortic or mitral IE with vegetation ≥10 mm and without severe valve dysfunction or without clinical evidence of embolism and low surgical risk.[460,463,465,473,478] | IIb | B |

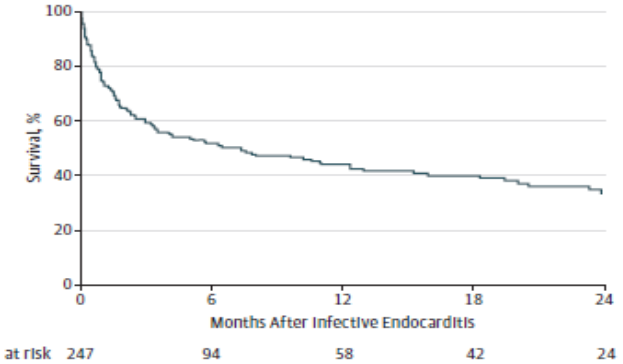


Research

JAMA | Original Investigation

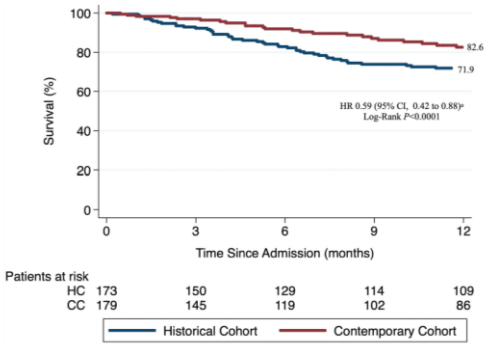
# Association Between Transcatheter Aortic Valve Replacement and Subsequent Infective Endocarditis and In-Hospital Death

- 20006 patients between 2005-2015
- 250 IE
- incidence, 1.1%per person-year
- median age, 80 years; 64%men
- Enterococci species and Staphylococcus aureus the most frequent microorganisms (24.6% and 23.3%)
- in-hospital mortality: 36% (90 deaths; 160 survivors)
- Surgery performed in 14.8%

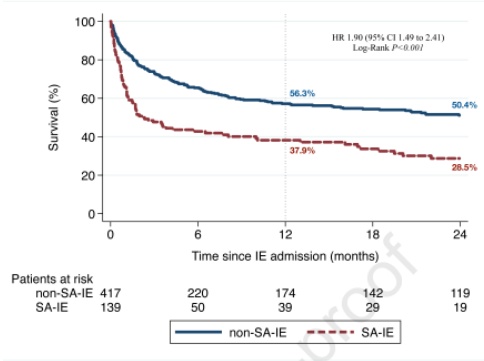


# Prognosis of TAVI endocarditis

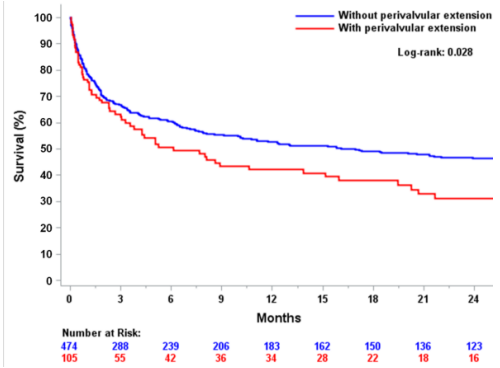
## Del Val CID 2021




## Del Val Can J Cardiol 2022




## Panagides V CID 2022




## Staphylococcal TAVI IE

## TAVI IE with / without abscess

# Prognosis of TAVI vs SAVR endocarditis

**Panagides V, CID 2023**

## Infective Endocarditis After Transcatheter versus Surgical Aortic Valve Replacement

Panagides et al., 2023 | *Clinical Infectious Diseases*

IDSA Infectious Diseases Society of America

BACKGROUND: Scarce data are available comparing infective endocarditis following SAVR and TAVR.

PARTICIPANTS: Data were collected from two international cohorts : "The infective Endocarditis after TAVR" and the "International Collaboration on Endocarditis" registries

METHODS

A 1:1 paired matching approach was used to compare clinical characteristics and outcomes of TAVR and SAVR patients.

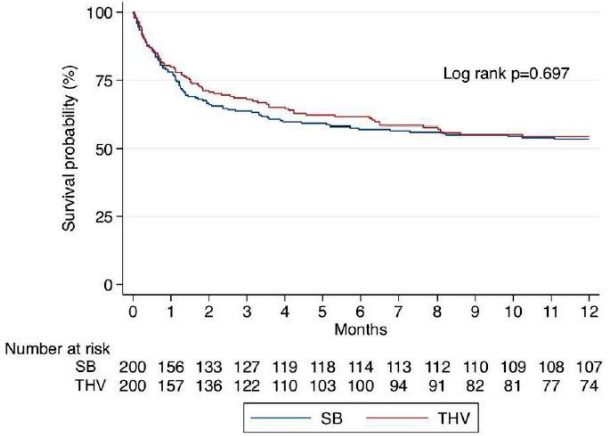
1688 patients included

- 602 (35.7%) surgical bioprostheses
- 666 (39.5%) mechanical prostheses
- 70 (4.2%) homograft
- 350 (20.7%) TAVR

| | Bioprosthetic SAVR (N=200) | TAVR (N=200) | |
|---|---|---|---|
| Vegetations | 62.5% | 82% | *p<0.001* |
| New moderate or severe aortic regurgitation | 43.4% | 13.5% | *p<0.001* |
| Perivalvular extension | 47.9% | 27% | *p<0.001* |
| *Staphylococcus aureus* | 13.4% | 22% | *p=0.033* |
| Enterococci | 21.2% | 22.9% | *p=0.695* |
| Cardiac surgery | 44.4% | 27.3% | *p<0.001* |
| 1-year mortality | 46.5% | 44.8% | *p=0.697* |

CONCLUSION: Clinical presentation, type of causative microorganism and treatment differed between patients with an IE located on SB compared to TAVR. Despite these differences, both groups exhibited very high and similar mortality rates at 1-year follow-up.

Clinical Infectious Diseases https://doi.org/10.1093/cid/ciad464




**Kaplan-Meyer curves of TAVI vs SAVR in propensity-matched population**

# Take-home messages: TAVI IE

1. The incidence of IE after TAVI is 0.3 to 2.0 per 100 person-years, like that after SAVR
2. IE after TAVI most commonly involves enterococcal and staphylococcal organisms and is associated with high rates of complications and in-hospital mortality
3. Echocardiography first, but multimodality imaging mandatory
4. Early surgery, if not contraindicated
5. Surgery is less frequently performed than in SAVR IE, but the prognosis is similar

# La Timone Hospital; Marseille, France


# Algorithm for diagnosis and treatment of PVE