# **Prosthetic Valve Endocarditis**

Luis Afonso MD. FACC Professor, Internal Medicine, Division of Cardiology, Director Echocardiography Laboratory, Director Cardiovascular Fellowship Program, Wayne State University School of Medicine, Detroit Medical Center, Detroit, MI



## **Prosthetic Valve Endocarditis (PVE)**

- PVE accounts for over 20% of all IE cases (1-6% of pts with PV)
- Staphylococcus aureus is the leading cause of PVE
- o In-hospital mortality 20-40%
- Mortality predictors
  - Health-care associated infection
  - persistent bacteremia
  - heart failure
  - intracardiac abscess and
  - stroke

JAMA. 2007;297(12):1354-1361. Habib et al 2015 Eur Heart J 30:2369–2413.

#### In-hospital Mortality as a Function of Causative Organism (top panel) and Health Care Association (bottom)

#### PVE Caused by Staph Aureus or Other Oganisms



#### Health Care-Associated or Community-Acquired PVE



### **Prosthetic Valve Endocarditis**

### Early infection: (<1 yr)

Direct contamination intraoperatively or via hematogenous spread

### Late infection: (>1 yr)

Pathophysiology similar to native valve endocarditis (adherence to platelet-fibrin thrombi on valve), as foreign material endothelialized

- Staph aureus (40%)
- Coag neg staph (20%)
- Gram neg bacilli
- Cx neg
- Fungal

- Coag neg Staph (20%)
- Staph aureus (15%)
- Enterococcus
- Strep viridans

Culture negative PVE: Legionella species, Bartonella species, C. burnetii, Mycoplasma hominis, HACEK, and fungi.



## **PVE: Pathogenesis (Early)**

Direct intraoperative or hematogenous spread





Mechanical and Tissue Mitral Valves

**Bacteria** 



Endothelialization of ring, annulus, sutures absent

### Fibronectin and fibrinogen promote adhesion



**Periannular Extension** 

- Abscess ( Phlegmon)
- Fistula
- Dehiscence





## **Prosthetic Valve Endocarditis**

Occurs with equal frequency at aortic and mitral sites

### **Clinical Manifestations:**

- Persistent fever, malaise (80%)
- New (48%) or changing murmurs
- New onset heart failure
- New ECG conduction disturbances
- Clinically overt arterial emboli (40 %)
- CNS embolic infarcts or hemorrhages (20-40%)



## **PVE Diagnosis: TTE vs. TEE**

Transthoracic echocardiography (TTE) is the recommended initial modality of choice for both native valve infective endocarditis (NVE) and PVE

- Transthoracic echo (TTE) and TEE are complementary
- TEE has a sensitivity of 86 to 92 % compared with 17 to 36 % for TTE
- TEE superior for MV prosthesis and invasive complications
- Ventricular surfaces of valves better visualized with TTE

TTE value in assessment of <u>ventricular size and function, hemodynamic severity of valve</u> <u>lesions</u>, and in the diagnosis of <u>anterior prosthetic aortic valve abscesses</u>

### Acoustic Masking : TTE/TEE







Zoghbi et al JASE Sep 2009

### Imaging Studies in Native Valve Endocarditis and Prosthetic Valve Endocarditis (2017 AHA/ACC VHD Guidelines)



### **PVE: Periannular Extension**

#### **Valve Dehiscence**

Paravalvular regurgitation with or without rocking motion of the prosthesis

#### **Fistula**

Color-Doppler communication between two neighboring cavities through a perforation

#### Abscess (Phlegmon)

Thickened, nonhomogeneous perivalvular area with echodense or echolucent appearance

Periannular extension occurs in 56% to 100% of patients. Perivalvular extension should be suspected in cases with persistent unexplained fever or new AV- block.

Despite surgical intervention (87%), mortality remains high at approx. 40 %

## **PVE: Other Complications**

#### Vegetation



Oscillating or nonoscillating intracardiac mass on valve or other endocardial structure

### **Perforation/Flail**



Interruption of endocardial tissue continuity traversed by color flow Doppler

#### Dehiscence



Abscess



#### Harper University Hospital Echo Lab Archives

## **PVE: Is there a role for 3D?**

#### **Paravalvular Leak: Location / Severity Assessment**



#### **Prosthetic Valve Stenosis: Estimating Valve area**

#### Lead Endocarditis



Biplane Imaging

**MPR: AVA planimetry** 

3D-Zoom

Harper Echo Archives

### Is Echocardiography good enough to diagnose PVE?

### Up to <u>30% of patients with subsequently proven IE are</u> labeled as <u>"possible</u>" due to <u>equivocal or negative</u> findings on <u>echocardiography</u> or <u>blood cultures</u>



Habib et al 2009 Eur Heart J 30:2369–2413.

### **Emergence of MSCT and FDG PET/CTA Hybrid Imaging**

A 48-year-old patient with mechanical aortic tube infective endocarditis and positive blood culture for Staphylococcus aureus



Pocket and generator infection of an implantable cardioverterdefibrillator placed 4 years previously, with positive blood culture for coagulase-negative Staphylococcus



Infective endocarditis of a pacemaker implanted 20 years previously. Blood cultures were negative, likely owing to 2 weeks of empirical antibiotic treatment. PET/CTA revealed various foci of fluorodeoxyglucose uptake along the pacemaker leads (arrows)





Habib et al 2015 Eur Heart J 30:2369–2413.

### Definitions of the terms used in the European Society of Cardiology 2015 modified criteria for the diagnosis of infective endocarditis

### 2. Imaging positive for IE (Major Criteria) a. Echocardiogram positive for IE:

- Vegetation;
- Abscess, pseudoaneurysm, intracardiac fistula
- Valvular perforation or aneurysm;
- New partial dehiscence of prosthetic valve.

**b. Abnormal activity around the site of prosthetic valve implantation** detected by 18F-FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabeled leukocytes SPECT/CT.

### c. Definite paravalvular lesions by cardiac CT



### Factors Associated With Lower Diagnostic Performance of 18F-FDG PET for Infective Endocarditis

False Positive	False Negative
Surgical adhesives*	Low C-reactive protein levels*
Inadequate myocardial suppression of <sup>18</sup> F-FDG	Small vegetations that do not involve annulus
Motion/attenuation correction related artifacts	Prolonged prior antibiotic therapy†
Recent valve implantation (<3 mo)‡	



*Circulation.* 2018;138:1428–1430.

Swart et al Circulation. 2018;138:1428-1430.

# **PVE After TAVR**

- Incidence: 1-3 %, median time 5 mos
- Risk factors: young or very old, DM males, 3-4+ AR
- Typical organism: <u>Enterococci</u>( 34.4%),
  - S. aureus, fungi

#### Management: 60% PVE managed medically

#### despite complications

Iocal extension, embolism and heart failure in more than 50%

### **Explantation rate:**

- ✓ 57% balloon expandable
- ✓ 23% self-expandable valves
- In-hospital mortality: 34.4 %.



Amat-Santos et al. Prosthetic Valve Endocarditis After Transcatheter Valve Replacement A Systematic Review JACC Cardiovasc Interv2015;8:334-346. Circ Cardiovasc Interv. 2015. JAMA. 2016 Sep 13;316(10):1083-

# **PVE After TAVR**

## **Echo findings**

- Leaflet vegetation (50 %)
- Abscesses(47%)
- Fistulae (9%)
- Other valves (22%)
- Valve stenosis common
  (high gradients/leaflet thickening)

- Modified Duke criteria: low diagnostic value
- Multi-modality imaging approach (ESC-2015 modified criteria) enhances sensitivity
- When 18F-FDG PET was combined, sensitivity and specificity reached 96% and 100%, respectively



Amat-Santos IJ, Ribeiro HB, Urena M, et al. Prosthetic Valve Endocarditis After Transcatheter Valve Replacement: A Systematic Review. *JACC Cardiovasc Interv*2015;8:334-346.

### Multi Modality Diagnosis of Endocarditis (TAVR)



An 83-year-old man with *S. salivarus* definite-IE 6 months after 26-mm Edwards Sapien 3 implantation. Transesophageal echocardiography (TEE) showed a large vegetation (red arrow in a) and leaflets thickening (white arrows in b) with moderate obstruction (transvalvular mean gradient = 20 mm Hg and high turbulent jet [c]). Multislice computed tomography (CT) (d) confirmed the leaflet thickening at the upper level of the transcatheter heart valve (THV) and the vegetation at the lower levels and found asymptomatic cerebral embolism and minor cerebral meningeal hemorrhage. Positron-emission tomography (PET)/CT showed the THV <sup>18</sup>-FDG) uptake(e).

#### JACC: Cardiovascular Imaging, 2018-01-01

# **Infective Endocarditis post-TAVR**





# **PVE: Early Surgery Indications**

#### Heart Failure

- Dehiscence
- Severe Valve Dysfunction
- Intracardiac Fistula

#### **Other Complications**

- Heart Block
- Annular or aortic abscess
- Destructive lesions

Class Ia Class IIa Class IIb

#### Persistent Bacteremia

 despite appropriate antibiotics for 5-7 days

### Fungi or highly resistant organisms

- Relapsing PVE
- Recurrent emboli despite appropriate Abx Rx
- Mobile vegetations:
  - > 10 mm size

### Influence of the timing of surgery on the prognosis of patients with cerebral thromboembolism complicating prosthetic valve endocarditis.



Piper C, *Heart* 2001;**85:** 

### Valve Surgery in Patients With Prior Emboli/Hemorrhage/Stroke

Valve surgery may be performed in IE patients with stroke or subclinical cerebral emboli without delay if intracranial hemorrhage has been excluded

In patients with major ischemic stroke or intracranial hemorrhage, it is reasonable to delay valve surgery for at least 4 weeks

## **PVE: Anticoagulation**

Discontinuation of all forms of anticoagulation in patients with mechanical valve IE who have experienced a CNS embolic event for at least 2 weeks is reasonable (Class IIa)

The continuation of long-term antiplatelet therapy at the time of development of IE with no bleeding complications may be considered (*Class IIb*)

Initiation of aspirin or other antiplatelet agents as adjunctive therapy in IE is not recommended (*Class III*)



L Baddour et al AHA Scientific Statement .Circulation. 2015;132:1435-486

Thank you for your kind attention !!