NEJM:
Two-Year Outcomes with a Magnetically Levitated Cardiac Pump

In patients with advanced heart failure, a fully magnetically levitated centrifugal-flow pump was superior to a mechanical-bearing axial-flow pump.

- MHIF Participated as a site in the study

FEATURED IN CARDIOLOGY TODAY
New Frontiers in Valvular Heart Disease

“\nThe feasibility of these transcatheter technologies has been established. There is no doubt about the fact that what we once thought to be difficult or impossible is now very possible.\n”

- Dr. Sorajja

SCAI 2018
Opportunity for MHIF research to have national and global impact

Featured Session In Main Arena
Dr. Tajti
Thurs., April 26

Two Live Cases
Drs. Brilakis and Sorajja
Thurs., April 26

“Attendees will have ample opportunities to get more involved with the day-to-day activities of SCAI and make an impact on improving patient care and advancing their practice to the next level,”

- Dr. Brilakis, SCAI2018 Scientific Sessions co-chair; quoted in Cardiology Today

Congrats!
Dr. Sandoval appointed Social Media Editor for JACC Journals

52
Publications in 2018 sharing MHIF research
Bioprosthetic Valve Thrombosis
What we learned in 5 years

Sorin Pislaru, MD, PhD, FACC, FASE
Professor of Medicine
Vice-Chair, Division of Cardiovascular Ultrasound

Disclosures

• None
Bioprosthetic Valve Thrombosis (BPVT)
What We Learned in 5 Years

• Does it exist?
• Timing?
• How to diagnose it?
• When to image?
• Treatment options
• Take home points
BPVT: Does It Exist?

**Patient A**
- 78 yo woman
- DOE class III
- 3/6 SEM
- s/p TAVR
- (2 months ago)

**Patient B**
- 82 yo man
- DOE Class III
- 3/6 SEM
- s/p SAVR
- (2 years ago)

Gradient 40 mmHg (baseline 12 mmHg)

Gradient 42 mmHg (baseline 15 mmHg)
**Differential diagnosis of increased bioprosthetic gradient**

- Early prosthetic valve degeneration
- Pannus ingrowth
- Pressure recovery
- Unrecognized regurgitation
- Patient-prosthesis mismatch
- High cardiac output

*Prosthetic valve thrombosis*
Patient A

Patient B

Bioprosthetic Valve Thrombosis

Normal LV size
EF 70%

Normal LV size
EF 70-75%

Gradients on VKA
1 mo: 32 mmHg
3 mo: 24 mmHg
1 year: 14 mmHg
Bioprosthetic Valve Thrombosis
Timing
BPVT: Initial Mayo Experience

• Retrospective series 1997-2013

• Patients identified with Mayo Clinical Notes Search Tool

• BPVT diagnosis
  • Presumed if resolution with VKA/lytics AND initial echo consistent with thrombosis
  • Confirmed in surgical cases

BPVT: Mayo Experience

• 220 patients with clinical records containing pre-defined search terms

• BPVT identified in 31
  • 17 treated initially with surgery (N=15) or thrombolytic therapy (N=2)
  • 15 patient managed initially with oral VKA
  • (1 patient treated initially with surgery, then VKA for second episode; included in both groups)
Thrombosed Mitral Bioprosthesis

- 76 yo man, 29 mm Hancock prosthesis
- Pre-discharge TTE mean gradient 13 mmHg@78 bpm
Thrombosed Tricuspid Bioprosthesi

- 72 yo woman, 31mm CE tricuspid prosthesis
- Mean gradient 11 mmHg@70 bpm
Misconceptions in BPVT
#1 BPVT occurs within first 3 months

Pislaru et al. EJCTS 2014

Peak incidence second year
Longest interval: 6.5 years
Bioprosthetic Valve Thrombosis

How to diagnose it?

Proposed Echo Criteria

1. Increased gradient > 50% over baseline within first 5 years post-implant
2. Thickened, non-calcified leaflets
3. Restricted leaflet mobility

Pislaru et al. EJCTS 2014.
BPVT: Mayo Surgical Experience

• All bioprosthetic re-operations 1994-2014

• 46 BPVT  (11.6% of all reoperations)

• 92 structural failure (2:1 for age, gender, prosthetic position, and year of implantation)
Misconceptions in BPVT

#2 BPVT is an easy diagnosis

• TTE

The eyes will not see what the mind does not know

• Retrospective (blinded) look: thrombus seen in majority of mitral / tricuspid bioprostheses
• Challenging imaging for aortic BPV
Proposed Echo Criteria

1. Increased gradient > 50% over baseline within first 5 years post-implant
2. Thickened, non-calcified leaflets
3. Restricted leaflet mobility

All 3 parameters: 72% sensitivity, 90% specificity for BPVT

Egbe, Pislaru et al. JACC 2015.
CT for TAVR Prostheses

- Better delineation of cusps
- Hypo-attenuating leaflet thickening / mass
- Distinction thrombosis vs. calcification / degeneration

- Learning curve
- A word of caution
Symptomatic TAVR-related thrombosis is rare (<1%).

CT reconstruction – Portico TAV
CT: Medtronic Freestyle

BPVT: Gradients in 135 BPVT patients

Subclinical Thrombosis
• Registry of 931 patients with CT after SAVR, TAVR
• 96% interpretable scans
• 12% “subclinical thrombosis”
  • Some while on AC (4%)
  • All resolved with AC (36 warfarin, 12 NOACs)

• Registry of 434 patients with CT after TAVR
• 12.5% HALT and/or reduced motion
  • Slight increase in gradient
  • Slight reduction in EOA
• No effect on stroke / embolism
• At 3 years only 3% with abnormal echo findings
Bioprosthetic Valve Thrombosis
A Word of Caution

A Word of Caution Before You Treat
#1 Not all immobile cusps are thrombosed

At implantation  Day #4  IOTEE

Waterbury et al. JACC Interventions 2017.
A Word of Caution Before You Treat
#2 Not all thick cusps are thrombosed

2012: BPVT  
2017: Structural degeneration

Petrescu et al. EHJ 2017.

A Word of Caution Before You Treat
#3 If it looks like a duck, walks like a duck, and quacks like a duck….

- Gradient 31 mmHg (from16)
- Not responding to VKA
- Positive blood cultures
- S. salivarius

Sometimes it is not a duck

Miranda et al. Int J Cardiol 2018
My Approach:

- Screen with TTE
- TAVR, SAVR
  - TAVR: CT probably better
  - SAVR: TEE and CT equivalent
- A fib, rapid rates: TEE
- Mitral: TEE
- Tricuspid: go back to TTE images, if suboptimal TEE
- Pulmonary: CT vs TEE?

Bioprosthetic Valve Thrombosis
When to Image?
Imaging after Bioprosthetic Valve Implantation

2017 ACC/AHA
- When change in clinical status
- Yearly after 10 years

2014 ESC
- When change in clinical status
- Yearly after 5 years

Imaging at Guideline Recommendations

ESC Guidelines: miss ~80% of BPVT
ACC/AHA Guidelines: miss ~90% of BPVT
Suggested Imaging Schedule

• When change in clinical status
• Yearly for first 3 years
• Watch for subclinical changes

Bioprosthetic Valve Thrombosis
Treatment Options
Bioprosthetic Valve Thrombosis Guideline Therapy

- ACC/AHA 2014, ESC 2012 guidelines
  - no specific therapy for BPVT
  - recommendations for “prosthetic thrombosis”
- ACC/AHA 2014
  - Left-sided, hemodynamic instability: favor surgery
  - Right-sided, small thrombi (<0.8 cm²): favor lytics
- ESC 2012
  - “optimal AC” if small thrombus

Misconceptions in BPVT
#3 Surgery / lytics are main treatment

VKA as effective as surgery / lytics
41 yo with severe dyspnea
• Wait until INR<2.0
• Cycles of
  • UFH (6h, target aPTT 50-70 sec)
  • tPA 25 mg over 24 hours
• Check effect, repeat as needed

114 patients
• Death: 1
• Non-fatal major complications: 4
• Stroke: none hemorrhagic, 9 of 11 improved with tPA

This is all retrospective…..

• January 2014: Shared BPVT results with Cardiology and Cardiac Surgery

• Prospective registry of suspected BPVT
  • Direct communication with physician with expertise in BPVT diagnosis / management
  • TEE / CT recommended, but at discretion of primary cardiologist
  • Trial of warfarin unless hemodynamically unstable
Prospective Registry

- January 2014 – May 2016
- 55 cases suspected BPVT
  - 43 responders (gradient decrease >50%)
  - 9 non-responders
  - 3 lost to f/u
- Echo: 48 (92%) with adequate data
  - 3 criteria: response to VKA 38/39
  - 2 echo criteria: response to VKA 4/9

Egbe, Pislaru et al. JACC Interventions 2017.
Prospective Registry

• BPVT is more common than previously reported
• Echo criteria: excellent prediction of response to VKA
• Suggest yearly echo within first 3 years post-implantation

Medical Therapy: Safety and Efficacy

• BPVT patients from prospective registry (N=85)
• Age, gender, prosthesis type and position-matched patients undergoing surgery (N=170)
<table>
<thead>
<tr>
<th></th>
<th>BPVT</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment success</td>
<td>85.9%</td>
<td>100%</td>
</tr>
<tr>
<td>Death</td>
<td>14.5%</td>
<td>16.5%</td>
</tr>
<tr>
<td>Stroke</td>
<td>4.8%</td>
<td>8.1%</td>
</tr>
<tr>
<td>Embolic event</td>
<td>4.8%</td>
<td>14.5%</td>
</tr>
<tr>
<td>Bleeding (Major)</td>
<td>21.7% (3%)</td>
<td>1.8% (0.7%)</td>
</tr>
<tr>
<td>Redo surgery</td>
<td>27.7%</td>
<td>9.0%</td>
</tr>
</tbody>
</table>

**Bioprosthetic Valve Thrombosis**

**Take Home Points**
BPVT: Take Home Points
Diagnosis

• You have to think about it!!
BPVT: Take Home Points
How to Treat?

- Prevention
  - VKA for at least 3 months in all BPV, ASA after
  - NOACs: no data, not recommended at this time

- BPVT
  - VKA first line therapy if hemodynamically stable
  - Shock: surgery, thrombolysis

Thank you!
piislaru.sorin@mayo.edu