Journal of the Minneapolis Heart Institute Foundation

**Informs and educates** medical professionals about

**leading cardiovascular research**

directed by MHIF and its partners

- Publishes clinical research, case reports, viewpoints, literature reviews
- Features topics across the spectrum of cardiovascular disease
- Published 2x year
- Open access; available in print and digital
- Submissions always accepted; Instructions for authors on website
- Increasing the impact and reach of MHIF research!

[www.mplsheartjournal.org](http://www.mplsheartjournal.org)
MHIF CV Grand Rounds – January 22, 2018

Transcatheter Valve Therapy

Why, How, and What’s Coming

Paul Sorajja, MD
Roger L. and Lynn C. Headrick Family Chair
Valve Science Center
Minneapolis Heart Institute Foundation
Abbott Northwestern Hospital

Disclosures

• Abbott Vascular: research, consulting, speaking
• Boston Scientific: research, consulting, speaking
• Edwards Lifesciences: research, consulting, speaking
• Admedus: consulting
• Medtronic: research, consulting, speaking
WHY = long-term success

Smaller Footprint is Desirable
Invasive Medicine

Patients in need

Only 1 in 3 treated

Iung B et al., EHJ 2005
Bach DS et al., Circ CV Qual Out 2009
Commercial TAVR in 2018

Sapien S3

Evolut R Pro

Tri-leaflet AS that is not low risk
14 to 18 Fr transfemoral
Procedural mortality = 1%
Pacemaker = 10 to 15%

TAVR Approaches

Conscious Sedation

Transcarotid

Transcaval

Balloon Valve Fracturing

0.5 mg midazolam
50 mcg fentanyl

$$ millions saved$$
Essential Frailty Toolkit

- Fine chair rises <15 seconds: 0 Points
- Fine chair rises ≥15 seconds: 1 Point
- Unable to complete: 2 Points
- No cognitive impairment: 0 Points
- Cognitive impairment: 1 Point
- Hemoglobin ≥13.0 g/dL: 0 Points
- Hemoglobin ≥12.0 g/dL: 1 Point
- Serum albumin ≥3.5 g/dL: 0 Points
- Serum albumin <3.5 g/dL: 1 Point

EFT ≥3 potential futility


Low-risk TAVR Trials

- PARTNER 3 Sapien 3
  - Key inclusion: Age >65
  - Prominent: Symptomatic
  - PROM <2%
  - Primary outcome: 1-yr death, CVA, re-hospitalization
  - Follow-up: Annual for 10 years

- Medtronic Evolut
  - Key inclusion: Any age
  - Prominent: Symptomatic or Asymptomatic
  - PROM <3%
  - Primary outcome: 2-yr death or CVA
  - Follow-up: Annual for 10 years
Boston Scientific TAVR

Lotus Edge

Acurate Neo

Minneapolis Heart Institute

Treated Patients with Severe Aortic Stenosis

<table>
<thead>
<tr>
<th>Year</th>
<th>Total no. patients</th>
<th>AVR</th>
</tr>
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<tbody>
<tr>
<td>2013</td>
<td>30%</td>
<td></td>
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<tr>
<td>2014</td>
<td>38%</td>
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</tr>
<tr>
<td>2015</td>
<td>41%</td>
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<tr>
<td>2016</td>
<td>37%</td>
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</table>
Contemporary Patient Needs
366 appropriate AVR candidates

- 40% low surgical risk
- 54% no AVR referral
- 89% no heart team evaluation

One-year outcomes
19% hospitalization for heart failure
55% death

Tang L, et al. ACC 2018

Mitral Regurgitation
Prevalence of Mitral Regurgitation Increases with Age

> 9.3% for ≥75 year olds


Survival with Mitral Regurgitation

Primary MR

Secondary MR

Enriquez-Sarano M et al. NEJM 2005;352:875-83
Transcatheter Mitral Repair
MitraClip

>55,000 pts worldwide
U.S. approval in 2013
Outcomes with MitraClip

STS/ACC TVT Registry

2,952 patients
Median age = 82 years
STS-PROM (MVR) = 9.2%

Baseline Post-implant

MR grade

93%
61%

Clinical Outcomes

STS/ACC TVT Registry

• In-hospital mortality…2.7%
• Procedure success….91.8%
• SLDA..................1.5%
• Length-of-stay.......... 2 d (1,5 d)
• Home discharge........ 85.9%

Sorajja P, et al., J Am Coll Cardiol 2017
Challenging Anatomy

MitraClip

Anatomical Observations

Mitraclip in STS/ACC TVT Registry

- Prior surgical repair…. 1.5%
- FMR……………………….. 17.5%
- MVA < 4 cm² .............. 20.5%
- Gradient ≥5 mmHg...... 17.7%
- Leaflet Ca +2............. 18.8%

Sorajja P, et al., ACC 2017
Clinical Outcomes at One-Year

TVT Registry for MitraClip

- Either: 37.9%
- Death: 25.9%
- HF hospitalization: 20.2%
- Repeat Mitraclip = 6.2%
- MV surgery = 2.1%

Cumulative incidence (%) vs. Follow-up (months)

<table>
<thead>
<tr>
<th>No. at risk</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
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<td>1867</td>
<td>1095</td>
<td>723</td>
<td>464</td>
<td>263</td>
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<tr>
<td>1867</td>
<td>1293</td>
<td>889</td>
<td>570</td>
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<tr>
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<td>1095</td>
<td>723</td>
<td>464</td>
<td>263</td>
<td></td>
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</tr>
</tbody>
</table>
Many Developing Repair Options

1,218 surgical pts
15 year FU
13% MR ≥2

Remaining Challenges
Unaddressed MR

Suri R et al., J Am Coll Cardiol 2016
**Post-Procedural MR and Survival**

**TVT Registry for MitraClip**

- **Cumulative incidence of death**
- **Follow-up (months)**
- **No. at risk**
  - III/IV: 591, 65, 47, 25
  - II: 114, 480, 278, 168
  - 0/I: 1146, 810, 559, 373

- **Grade III/IV**
  - 48.9%

- **Grade II**
  - 29.2%

- **Grade I or none**
  - 21.7%

- **p<0.0001**

---

**A Procedure of Millimeters**

- **Lateral move**
MHIF CV Grand Rounds – January 22, 2018

MitraClip and Mitral Surgery
Minneapolis Heart Institute (n=604)

- Annual volumes
  - All mitral surgery
  - Isolated MV surgery
  - MitraClip

- Procedural mortality <2% for all

Niikura H, et al. ACC 2018

Transcatheter Mitral Valves
First Transcatheter TMVR in U.S.

April 8, 2015

The Tendyne Valve
Transapical, 34 Fr

- D-shaped
- Outer and inner frame
- Anchoring tether with hemostatic pad
- Retrievable, repositionable
Transcatheter Mitral Valve Replacement for Patients With Symptomatic Mitral Regurgitation

A Global Feasibility Trial

30 patients
STS-PROM: 7.3%
No procedural deaths
No MR in 26 of 27
30-day success: 87%

Muller DWM, Sorajja P JACC 2017
The Intrepid Prosthesis

Self-expanding, nitinol valve
43, 46, or 50 mm
Houses a 27 mm bovine valve
35 Fr transapical

Images courtesy of Drs. Richard Bae and John Lesser
Intrepid Global Pilot Study
1-Year Survival

79% NYHA I or II
MLWHFQ: 56 ±27 vs. 32 ±22

74 year-old woman

HF hospitalization
Severe MR
Minimal morbidity

Bapat V and Sorajja P et al. J Am Coll Cardiol 2017
Tendyne Valve-in-MAC
International Early Feasibility Study

Early Feasibility Study of Tendyne Mitral Valve System in Mitral Annular Calcification (MAC)

Principal Investigators
Paul Sorajja, MD
Vinod Thourani, MD

Launch in Q2 2018

Principal Investigators
Paul Sorajja, MD
Vinod Thourani, MD

Launch in Q2 2018

Next Gen Intrepid TMVR
Trans-septal

- Enabled by implant design not requiring rotational alignment or need to capture leaflets
- One implant platform for both TS and TA
**Treatment of Pathophysiology**

- **Aortic Stenosis**
  - Pressure Hypertrophy
  - “Curative”
  - Surgery

- **Mitral Regurgitation**
  - Volume Hypertrophy
  - “Curative?”

---

**Accucinch**
Tricuspid Regurgitation

Impact of Tricuspid Regurgitation

Cumulative incidence of death

No. at risk

<table>
<thead>
<tr>
<th>Severity</th>
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<td>Severe</td>
<td>298</td>
<td>198</td>
<td>141</td>
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<td>83</td>
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<tr>
<td>Moderate</td>
<td>666</td>
<td>451</td>
<td>307</td>
<td></td>
<td>203</td>
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<tr>
<td>Mild/none</td>
<td>883</td>
<td>631</td>
<td>431</td>
<td></td>
<td>277</td>
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</table>

p < 0.0001
Tricuspid Surgery
Peri-operative Mortality

National Trends and Outcomes in Isolated Tricuspid Valve Surgery

All patients = 8.8%
TV replacement = 13.4%

Zack CJ, et al., J Am Coll Cardiol 2017

So many options, a few here

FORMA
Trico
Hiragi
82 year-old woman
MitraClip for TR

64 patients
88% functional TR
22 combined with MV rx
91% with ≥1 grade reduction

Challenges
Can’t treat if can’t see
Guideline Absence

- L-sided valve surgery, severe TR (I)
- L-sided valve surgery, annular dilatation or RHF (IIA)
- Primary TR refractory to med rx (IIA)
- L-sided valve surgery with mod TR and PH (IIB)
- Severe TR and progressive RV enlargement (IIB)

No class I indications for isolated TR

Lack of Standard Endpoints

VARC-II

Updated standardized endpoint definitions for transcatheter aortic valve implantation: the Valve Academic Research Consortium-II consensus document

MVARC

Clinical Trial Design Principles and Endpoint Definitions for Transcatheter Mitral Valve Repair and Replacement: Part 2: Endpoint Definitions

TVARC
What is meaningful?

Asymptomatic

TRILUMINATE (EU and US)
Early Feasibility Study

Moderate or severe TR
Single-arm therapy with Triclip
First 2 patients worldwide treated at MHI
U.S. pivotal study planned for 2018
The New Generation

Active lifestyle
Like less invasive
Innovative

MHIF Valve Science Center

A Call to Action

Vision
A world class research center for valvular heart disease

Mission
To improve the health of patients with valvular disease through research, education, and innovation
Establishment of the Valve Science Center

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
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<td>Steer steering committee</td>
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<td>Create financial plan</td>
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<tr>
<td>Complete vision, goals and metrics</td>
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<td>Begin Valve Scholar program</td>
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<td>Implement novel pathway tools</td>
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<td>Complete patient education materials</td>
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<tr>
<td>Operationalize live case courses</td>
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<tr>
<td>Apply for AHA, ACC grants</td>
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<td>Serve as training site for feasibility research</td>
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<tr>
<td>Enroll 2,500 patients in VHD database</td>
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<td>Enroll 5,000 patients in VHD database</td>
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<td>Enroll 15,000 patients in VHD database</td>
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Patient awareness

FEB 22
EDINA COUNTRY CLUB | 5:30-6PM

Please join us
The Mechanics of a Healthy Heart
Valentine’s Day 5K

DATE AND TIME
Saturday, February 10, 2018
10:00am

LOCATION
Lake Nokomis
Minneapolis, MN

SHARE WITH FRIENDS

CARDIOVASCULAR INNOVATIONS 2018

REGISTER NOW

Masters’ Approach to Critical Limb Ischemia
Complex High-Risk PCI
Frontiers in Structural Heart Disease

JULY 26-28, 2018
THE GRAND HYATT HOTEL • DENVER, CO

Fellow travel grants on a first-come, first-serve basis

REGISTER AT:
www.cvinnovations.org
Thank you!

paul.sorajja@allina.com
507-513-1357

Durability
PARTNER 5-yr Follow-Up

HR [95% CI] = 1.04 [0.86, 1.24]
p (log rank) = 0.76

<table>
<thead>
<tr>
<th></th>
<th>TAVR</th>
<th>SAVR</th>
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<tbody>
<tr>
<td>No. at Risk</td>
<td>348</td>
<td>351</td>
</tr>
<tr>
<td>12 months</td>
<td>262</td>
<td>236</td>
</tr>
<tr>
<td>24 months</td>
<td>223</td>
<td>210</td>
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<td>36 months</td>
<td>191</td>
<td>174</td>
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<tr>
<td>48 months</td>
<td>154</td>
<td>131</td>
</tr>
<tr>
<td>60 months</td>
<td>67.8%</td>
<td>62.4%</td>
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