Cause of Procedural TAVR-Related Strokes – DEBRIS!

Autopsy specimen of Aortic Valve

Radiograph of surgical specimen
Sources of Debris During TAVR

**ASCENDING ARCH**
Arterial wall, calcific and atherosclerotic material

**TRANSVERSE ARCH**
Arterial wall, calcific and atherosclerotic material

**STENOTIC VALVE**
Leaflet tissue and calcific deposits

**TAVI DEVICES**
Foreign material

**NATIVE HEART**
Myocardium
Debris from a Hostile Arch

• Debris can be released while transversing a hostile arch

• TAVR traverses\(^1\):
  • Iliac artery
  • Abdominal aorta
  • Thoracic aorta
  • Aortic arch
  • Ascending aorta

• Arch atheroma is common in the aortic arch and susceptible to embolization during device manipulation in the arch.

• Patients with moderate or severe aortic stenosis are known to have more extensive atheroma than those with mild stenosis\(^2\).

Debris heterogeneity across different valve types captured by a cerebral protection system during TAVR

- Capture of embolic debris is universal across different THV types and supports the benefit of using CEP in all TAVR procedures.
- A total of 53% of patients had debris particles larger than 1 mm.

**Histopathology**

- Using pooled treatment data from the SENTINEL IDE and SENTINEL H Trials, histopathology and histomorphometry measured particle size, count and area of debris captured in 492 filters from 246 patients.

Schmidt T et al. 2017, TCT oral presentation
Automated Histomorphometry: Particle size

- In this analysis, debris was generated regardless of valve type placed.

Percent of patients with particles by particle size

- Pooled treatment data from the SENTINEL IDE and SENTINEL H Trials. Histomorphometry of debris captured in 492 filters from 246 patients.

Schmidt T et al. TCT 2017, (manuscript in preparation)

Note: 150μm used as size cut-off as filter pore size is 140μm
Why is Cerebral Protection Needed in TAVR?

- Stroke is an unpredictable and devastating event which is under diagnosed and under reported in TAVR.
  - In the SENTINEL trial, prospective assessment by neurologists revealed a 30-day stroke rate in unprotected TAVR of 9.1%, encompassing ALL strokes

- Cerebral embolic debris is generated in at least 99% of TAVR patients\(^1\)

- Capturing and removing this debris with the Sentinel Cerebral Protection System significantly (p=0.05) reduces the risk of periprocedural stroke in TAVR by \(63\)%\(^2\)

- Patients deserve “Protected TAVR”, and as TAVR expands to lower surgical risk and less symptomatic populations, the imperative to protect will be even more paramount

- The American Association of Neurological Surgeons has endorsed the key role of Sentinel in the reduction of stroke during TAVR

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Automated Histomorphometry: Median particle count

Schmidt T et al. TCT 2017, (manuscript in preparation)

- Pooled treatment data from the SENTINEL IDE and SENTINEL H Trials. Histomorphometry of debris captured in 492 filters from 246 patients.

Lotus > EvR  p=0.004
Lotus > S3  p<0.001
Lotus > XT  p=0.020
Lotus > S3  p=0.001
EvR > S3  p=0.001
STS score does not predict frequency or type of embolic debris captured by Sentinel®

The data above did not reach statistical significance, per Fisher’s Exact Test.
STS score is not associated with debris size

The data above did not reach statistical significance, per Fisher’s Exact Test.
STS score does not predict total particle count or total area of embolic debris captured by Sentinel®

1. Claret Medical. Data on file from patients with histopathology analysis from SENTINEL and Sentinel-H studies
TAVR cerebral protection risk and benefit considerations across the surgical risk spectrum

- Risk of cerebral embolic injury likely similar for all severe AS, at least
  - Most emboli are created during crossing of the stenotic aortic valve, positioning and expanding the new valve\textsuperscript{1,2}
  - Patients with severe AS have severely stenotic valves, by definition, regardless of surgical risk score (which has more to do with other health factors)
  - Risk of cerebral embolic injury ≠ surgical operative mortality risk\textsuperscript{3}

- Benefit of cerebral protection may actually increase with lower STS score, younger patients
  - Lower surgical risk, and younger, patients likely have longer life expectancies over which to benefit from reduced neurological injury (stroke and cognitive decline)
  - Patients with higher cognitive function at baseline may be more likely to show decline\textsuperscript{4}

Sentinel® Study - High Rate of Debris Capture

Debris captured in 99% of TAVR patients

Debris Captured & Removed by Sentinel® CPS

Cedars-Sinai, Los Angeles, CA, USA
SENTINEL Trial 2015

Institute Dante Pazzanese, São Paulo, Brazil
TCT Live Case 2013

Henry Ford Hospital, Detroit, MI
SENTINEL Trial 2015

Approx. 8 mm, captured in LCC
Debris Captured & Removed by Sentinel® CPS
Debris Captured & Removed by Sentinel® CPS

Cedar Sinai
Los Angeles, CA USA
Evolut-R, July 2017

Pinnacle Health
Harrisburg, PA USA
S3, August 2017

WVU-Ruby Memorial Hospital
Morganton, WV USA
S3, September 2017

New York-Presbyterian
Weill Cornell, NYC USA
Evolut Pro, November 2017

Kaleida Health
Buffalo, NY USA
S3, September 2017

Billings Clinic
Billings MT USA
S3, October 2017

St Thomas Hospital, London
Symetis Acurate neo TF
September 2017

Princeton Baptist Hospital,
Birmingham, AL USA
November 2017
Debris Captured & Removed by Sentinel® CPS

Hospital: Billings Clinic (Billings, MT)
Physician: Per Sommers, MD
Date: 10/04/2017
Valve: S3
Debris: Calcium and fragments of atherosclerotic plaque
Notes:
• Site making Sentinel standard of care for all TAVR
Debris Captured & Removed by Sentinel® CPS

Hospital: Pinnacle Health (Harrisburg, PA, USA)

Physician: Hemal Gada, MD

Date: 8/22/2017

Valve: S3

Debris: Calcium and tissue

Notes:
• Sentinel placed in < 5 min
• Site making Sentinel standard of care for all TAVR
Debris Captured & Removed by Sentinel® CPS

Hospital: West Virginia University – Ruby Memorial Hospital (Morgantown, WV, USA)

Physician: Bryan Raybuck, MD

Date: 9/26/2017

Valve: S3 (26 mm)

Debris: ~8 mm long piece; gray-white soft tissue acellular debris consistent with fragments of atherosclerotic plaque

Notes:
• Sentinel placed in < 5 min
• Site making Sentinel standard of care for all TAVR
Debris Captured & Removed by Sentinel® CPS

Hospital: Kaleida Health (Buffalo, NY, USA)
Physician: Vijay Iyer, MD
Date: 9/26 and 10/11/2017
Valve: S3
Debris: Calcium, thrombus, possible valvular tissue
Notes:
- Sentinel placed in < 2 min in both cases
- Type I arch
- Site making Sentinel standard of care for all TAVR
Debris Captured & Removed by Sentinel® CPS

Date: 10/10/2017

Valve: Corevalve EvolutR Pro

Debris: ~7 mm valve leaflet material

Notes:
Straightforward deployment of valve no post-dilatation
Debris Captured & Removed by Sentinel® CPS

Date: 10/17/2017

Valve: Evolut-R Pro- 26 mm

Debris: Soft tissue acellular debris

Notes: Normal Type I arch, both valve and arch were calcified and post dilatation observed.
Debris Captured & Removed by Sentinel® CPS

Date: 11/15/2017
Valve: S3
Debris: Thrombus and calcium
Notes: Type II arch, STS score 2.7
Debris Captured & Removed by Sentinel® CPS

Hospital: Wellspan York Hospital (York, PA, USA)
Physician: James Harvey, MD
Date: 11/14/2017
Valve: S3
Debris: Calcium
Notes: Normal Type I arch
Debris Captured & Removed by Sentinel® CPS

Hospital: Princeton Baptist Medical Center (Birmingham, AL, USA)

Physician: Mustafa Ahmed, MD

Date: 11/09/2017

Debris: Thrombus and calcium

Notes: Bovine arch with tortuous LCC, high surgical risk patient, balloon aortic valvuloplasty (BAV)