# Minimalistic and Ambulatory TAVR Program

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Cleveland Clinic

# TAVR – Heart Team

## Assessment of Risk

TAVR Risk - Anatomy

Surgical Risk - Anatomy, Comorbidities

Cleveland Clinic

# XXX

| Kg | Cm | Ft-In | BSA |
|---|---|---|---|
| 76.6 | 154 | 5'0" | 1.81 |

## PMH

**77y/o**

- CAD s/p CABG
- T2DM
- Htn, hld

| | |
|---|---|
| **Allergies** | NKDA |
| **EKG** | NSR; QRS 100 |
| **Pacemaker** | None |

## Labs

| | | | |
|---|---|---|---|
| **Cr** | 0.85 | **Hgb** | 12.9 |
| **Plt** | 177 | **INR** | 1.1 |

## Cath

| | |
|---|---|
| **LMT** | 90% |
| **LAD** | pLAD 90%; Dg1 100% |
| **LCX** | pLCx 95%; OM1 100% |
| **RI** | N/A |
| **RCA** | rPDA 80% |
| **LIMA-LAD** | patent |
| **SVG-rPDA** | patent |
| **SVG-rPLV** | patent; occluded SVG-Dg |

## TTE

| | | | |
|---|---|---|---|
| **EF** | 62 | **Pericard** | Nml |
| **RV** | Nl | **RVSP** | - |
| **Pk/Mn** | 101/53 | **AVA** | 0.49 |
| **DI** | 0.17 | **SVI** | 31 |
| **AR** | Trace-1+ | **MR** | Trace |
| **MS** | N/A | **TR** | Trace |

| CTA | Rads | Fellow |
|---|---|---|
| **Annulus** | 20x28 | 20x28 |
| **CSA** | 410 | 412 (403) |
| **Perimeter** | 750 | 763 |
| **Sinus** | | 31x32x35 |
| **STJ** | | 27x26 |

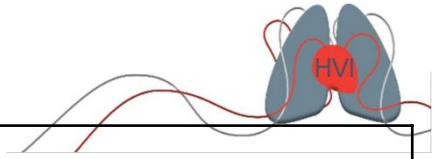
## Coronary Height

**LMT** 13 **RCA** 17

## Vasculature

| | |
|---|---|
| **RFA** | 7.7mm |
| **LFA** | 7.4mm |

| | |
|---|---|
| **Valve** | S3 23 nom |
| **Access** | R CFA |

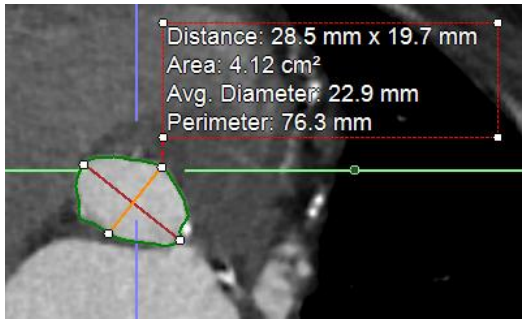


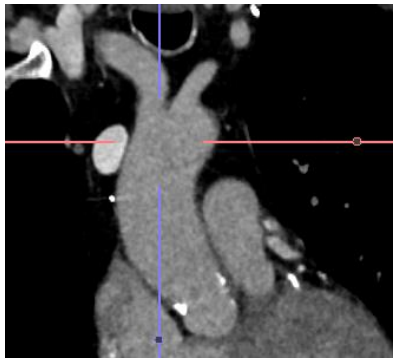

Access Issues N/A

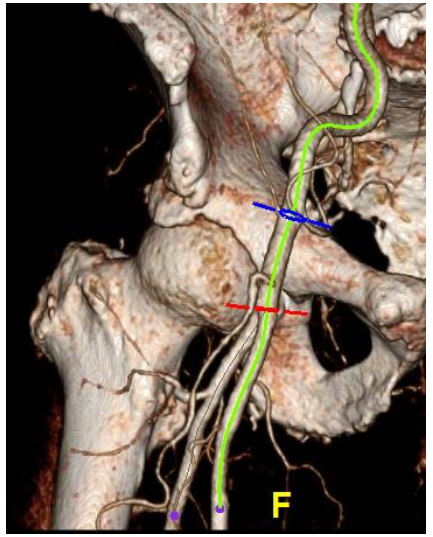
Sentinel N/A

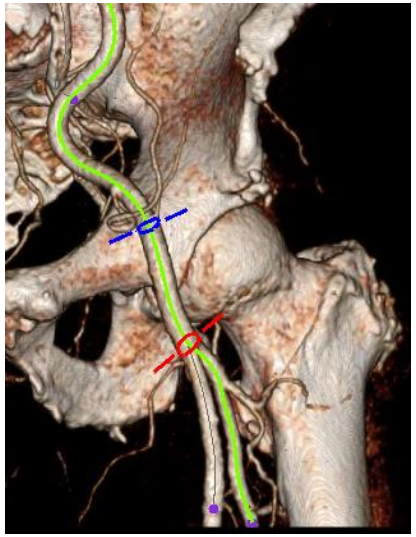
Implantation

Other

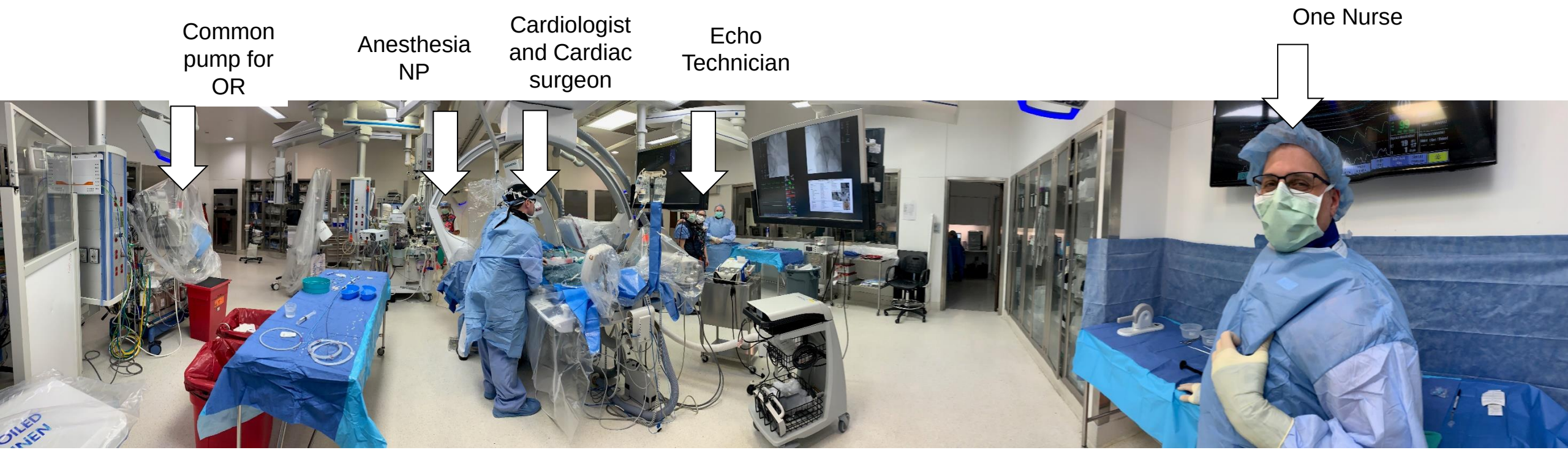




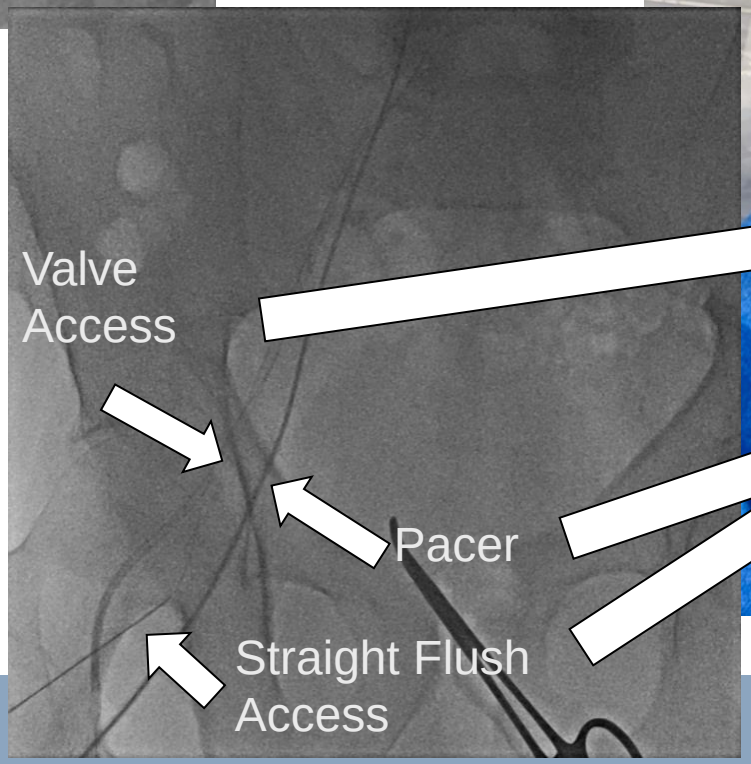



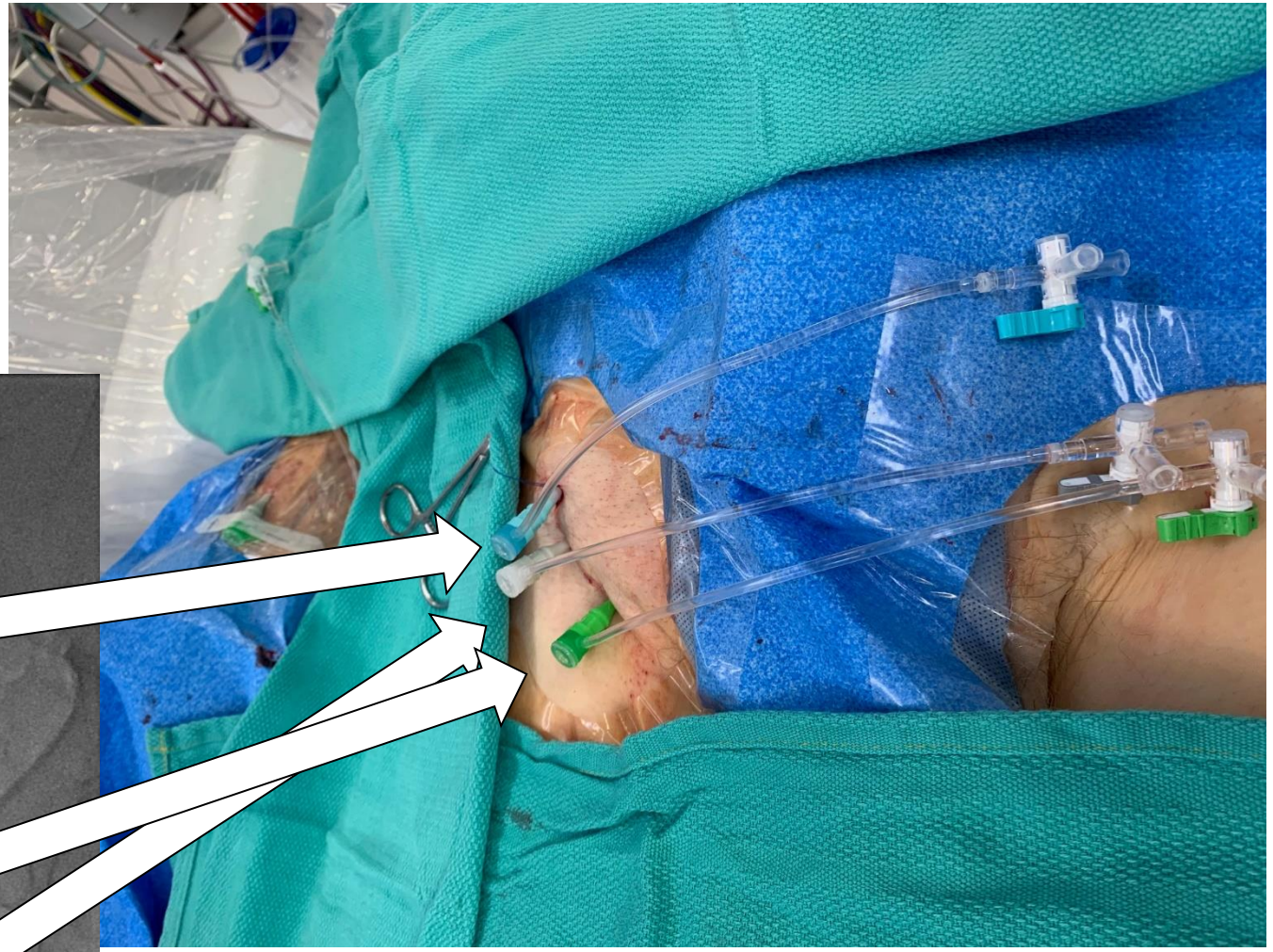
# Setup



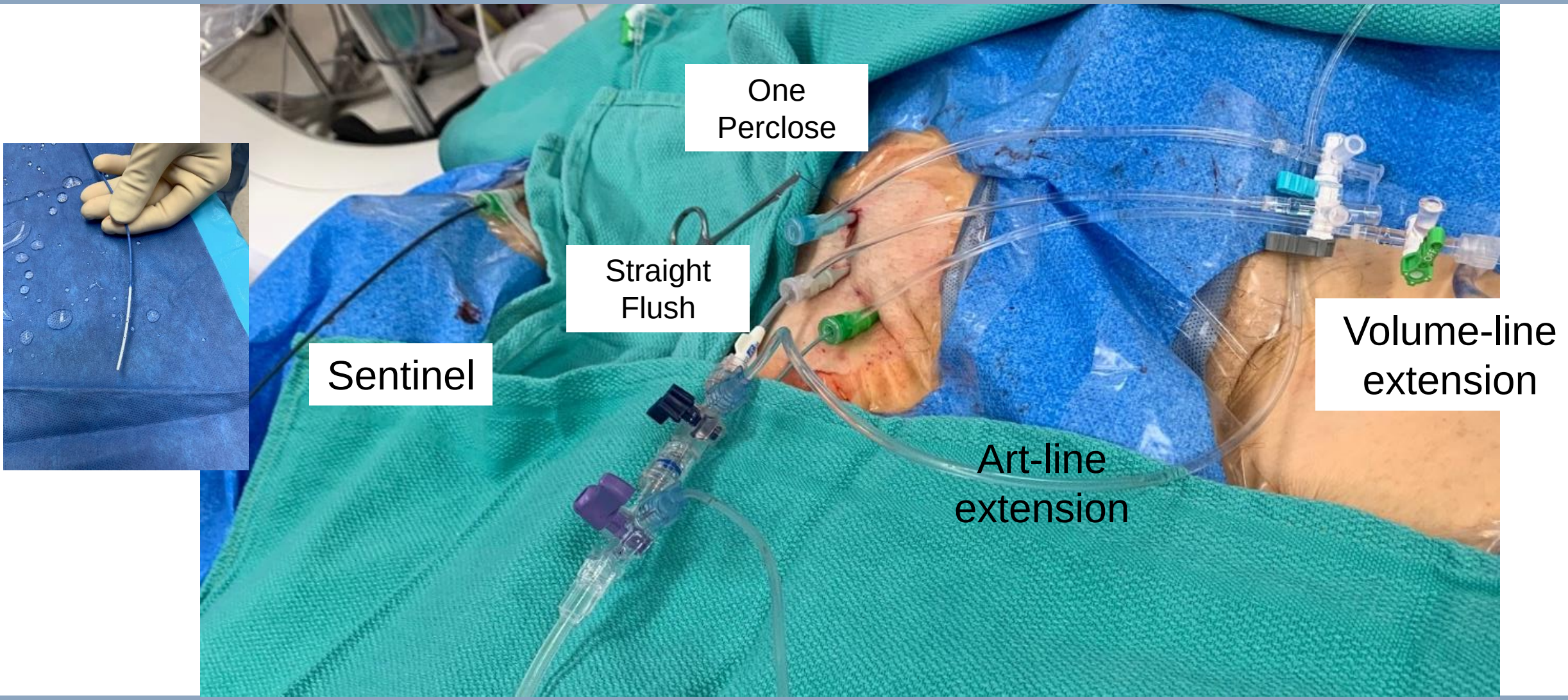

No GA, No Swan Ganz, No Arterial Line, No Foley

# Access



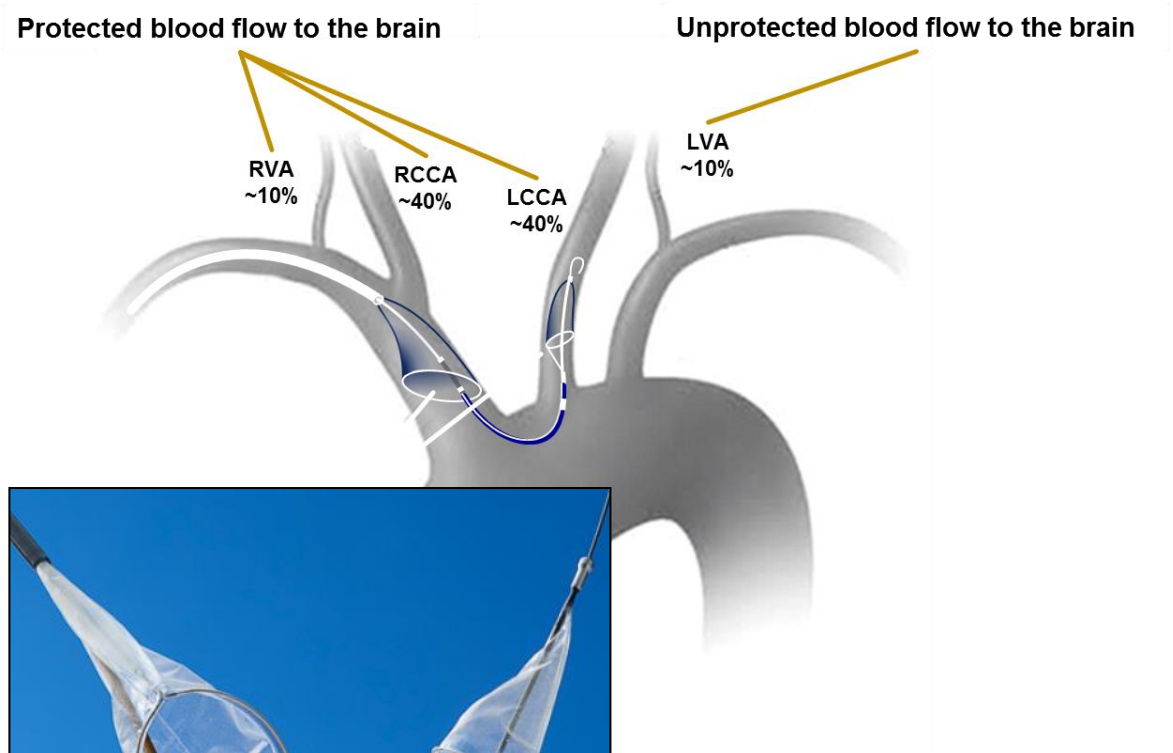
# Setup

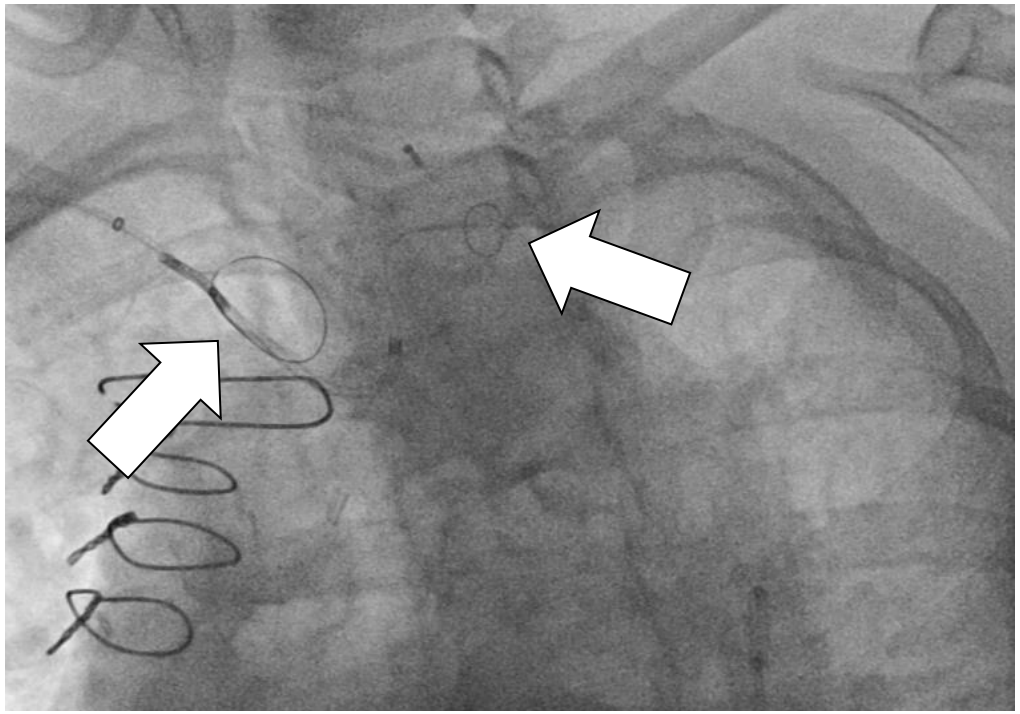

One Perclose
Straight Flush
Sentinel
Volume-line extension
Art-line extension

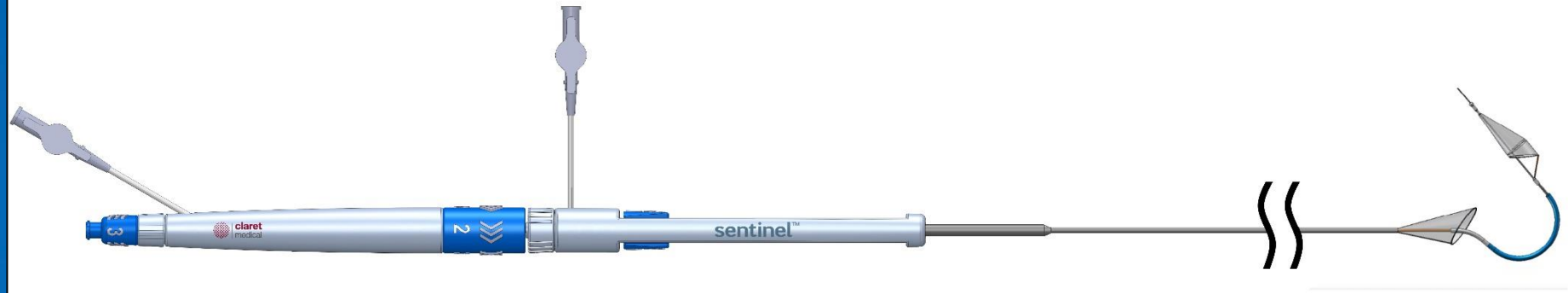
# Setup


CAUTION. DO NOT POSITION MONITOR OVER PATIENT.
LARGE INJECTION

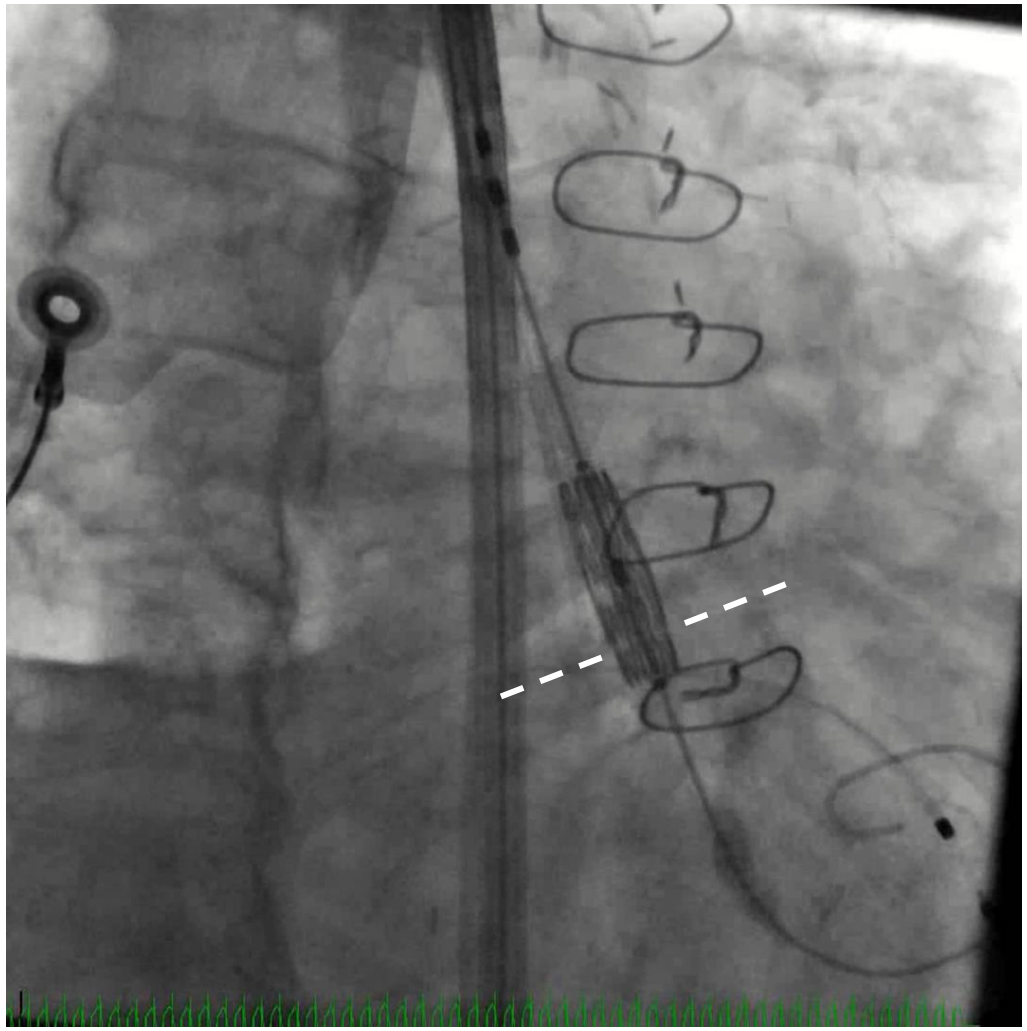
# Sentinel

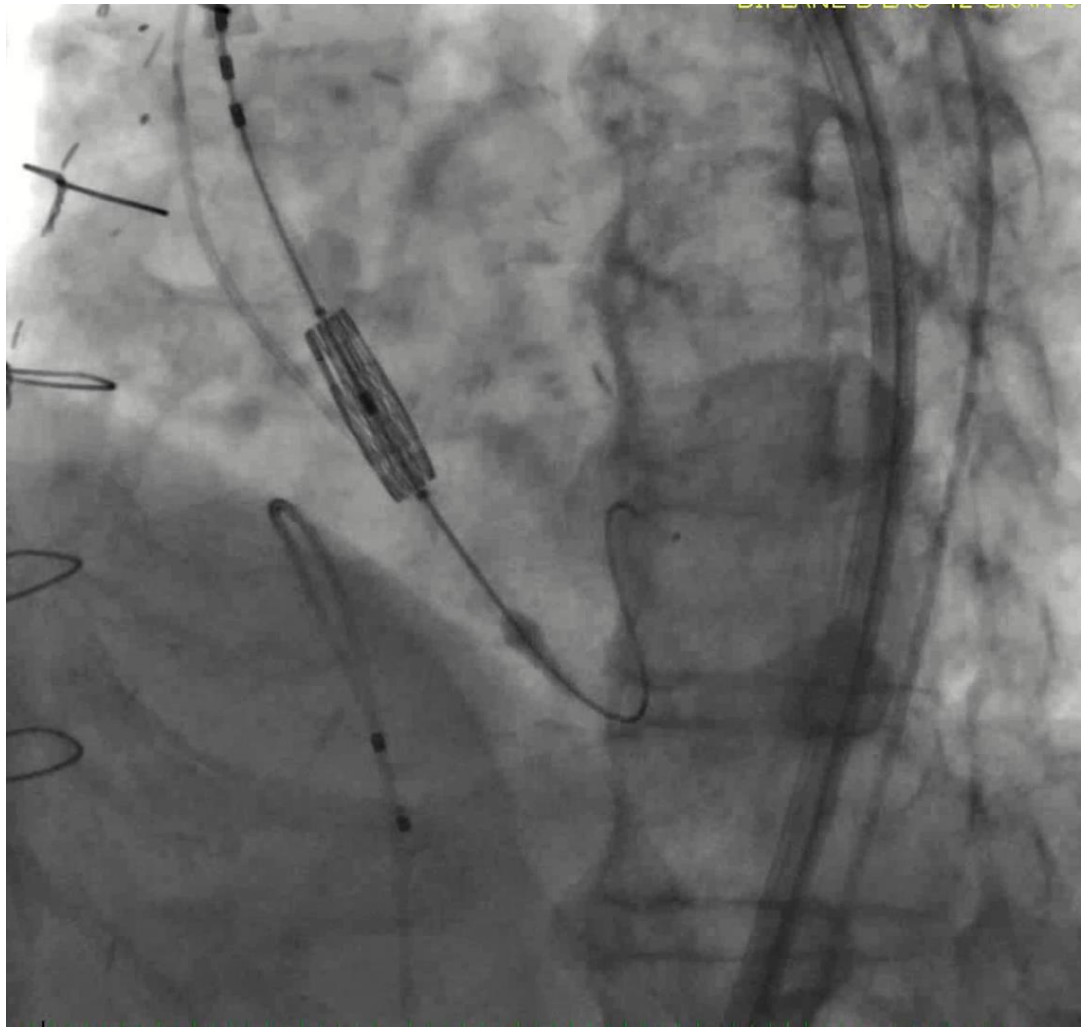

Protected blood flow to the brain
Unprotected blood flow to the brain
RVA
~10%
RCCA
~40%
LCCA
~40%
LVA
~10%



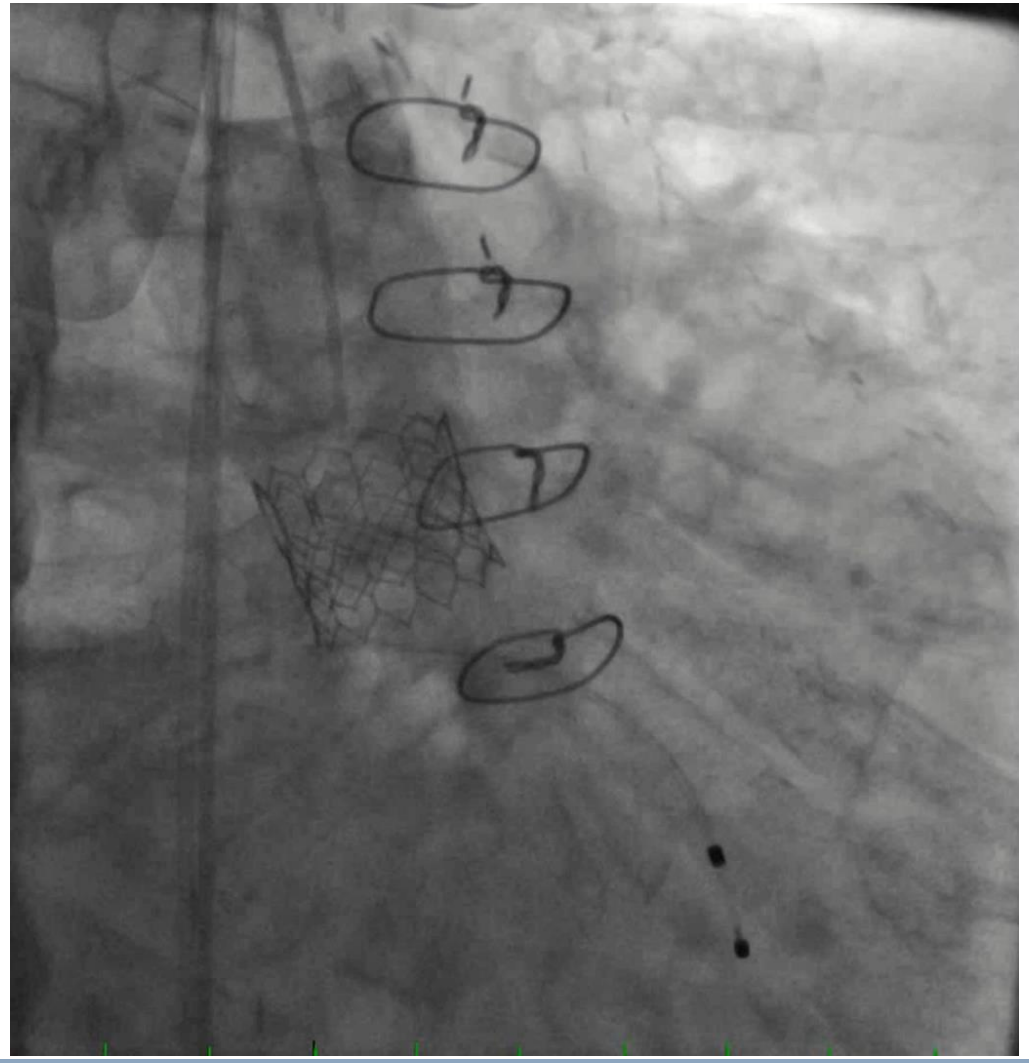

claret
medical
sentinel™

# Deployment

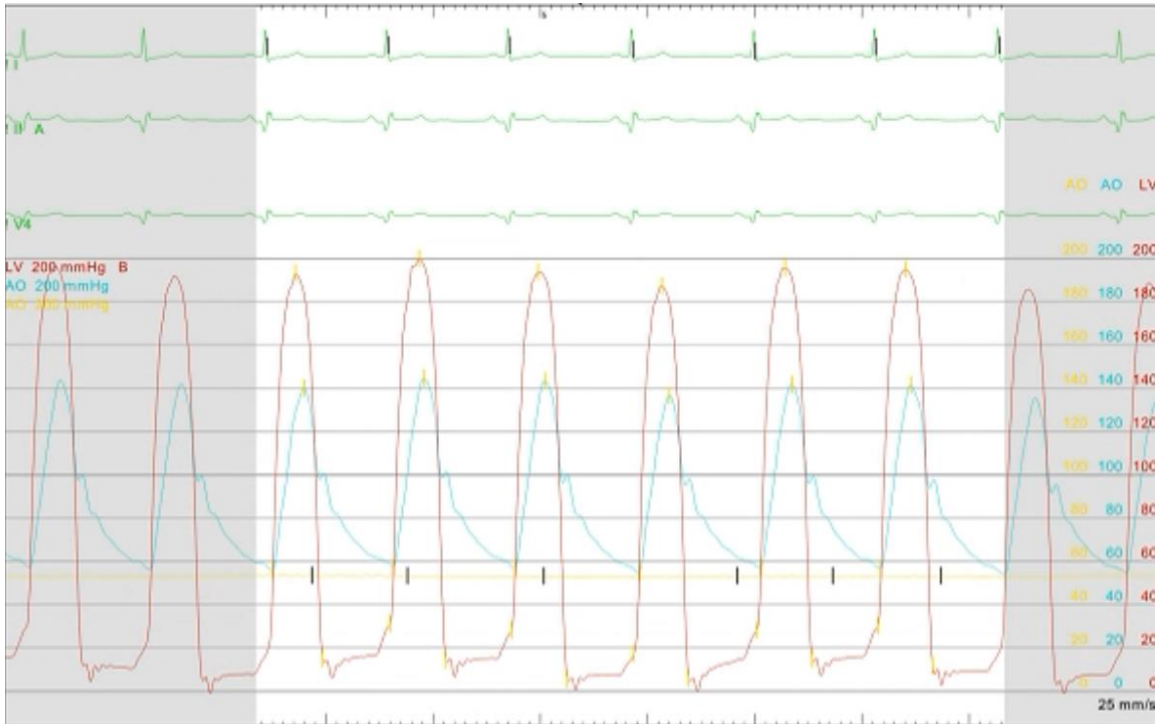


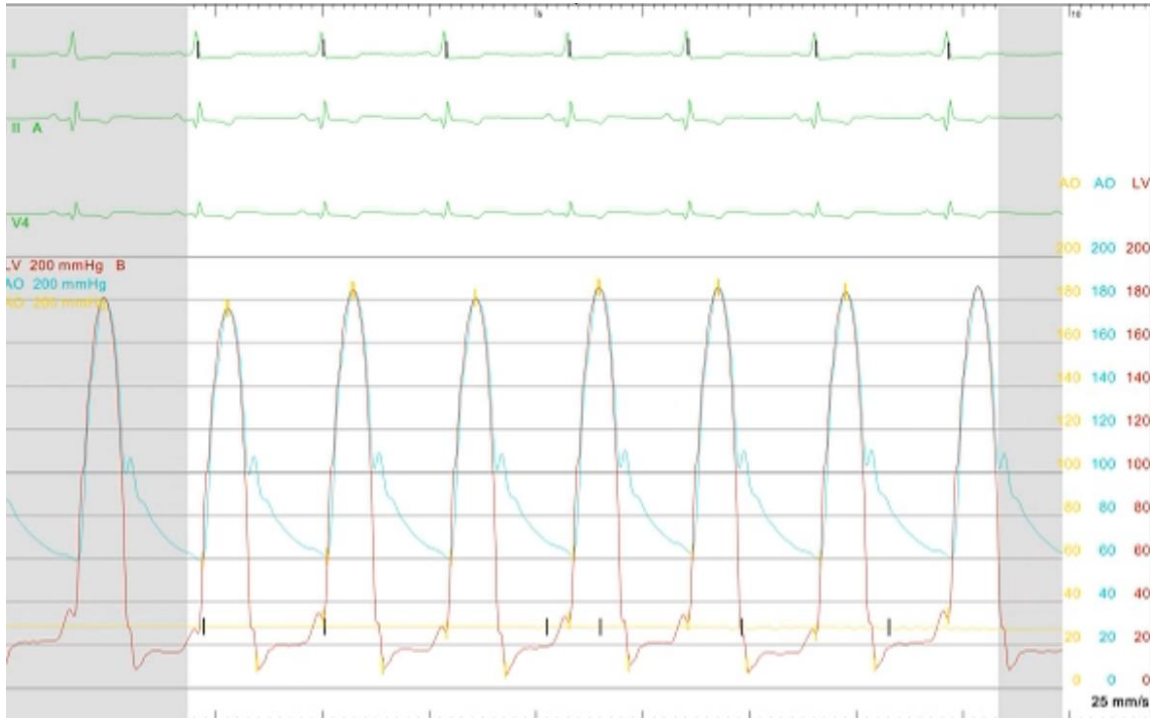


# AR Assessment

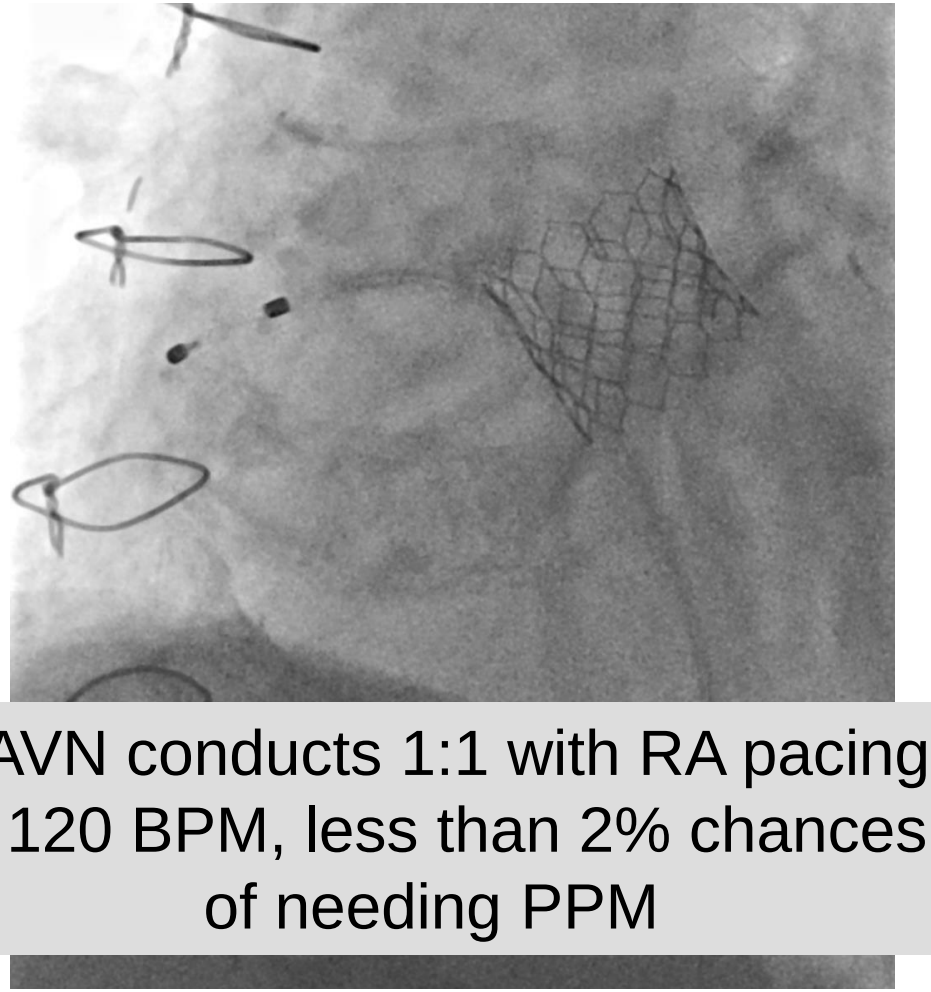


# Hemodynamics



# Rapid Pacing of RA if in SR



If AVN conducts 1:1 with RA pacing at 120 BPM, less than 2% chances of needing PPM

# Manual Pressure

# OR Team

# Same Day Discharge and Follow Up

- Same day discharge if patient meets criteria
- Patients discharged on ASA alone (all)
- If indication for AC – NOAC alone
- If recent stents NOAC + Clopidogrel
- Follow up in 1-2 days, 30 days, 6 months, 1 year
- If gradients increase by 10 mm Hg – CTA
- Consider NOAC / Warfarin for 6 months to 1 year

# GA versus MAC at CC

Received: 29 December 2020 | Accepted: 13 January 2021

DOI: 10.1002/ccd.29496

ORIGINAL STUDIES

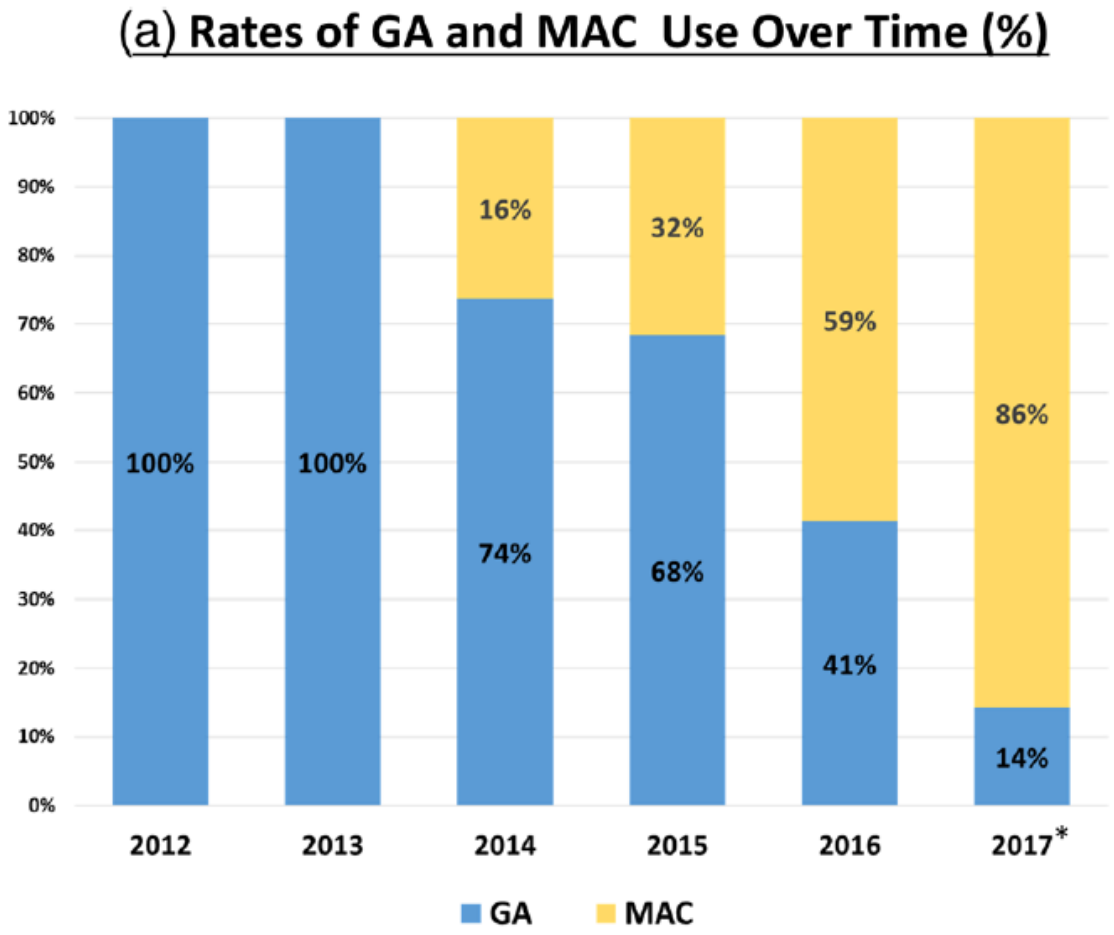
WILEY

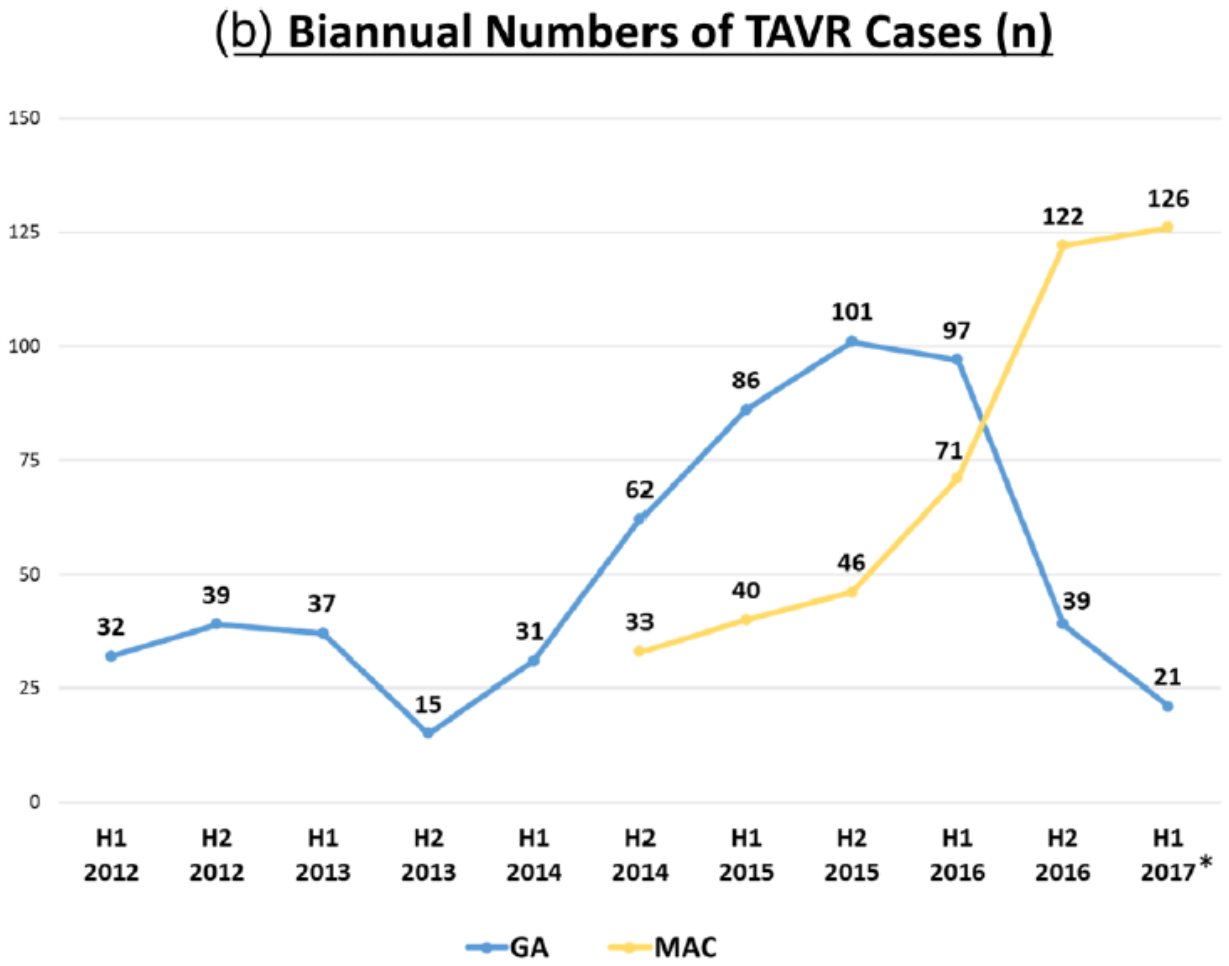
## Comparing outcomes of general anesthesia and monitored anesthesia care during transcatheter aortic valve replacement: The Cleveland Clinic Foundation experience

Yasser Sammour MD | Jimmy Kerrigan MD | Kinjal Banerjee MD | Rama Dilip Gajulapalli MD | Hassan Lak MD | Sanchit Chawla MD | Krystof Andress MD | Neha Gupta MD | Shinya Unai MD | Lars G. Svensson MD | James Yun MD | Grant W Reed MD | Andrej Alfirevic MD | Shiva Sale MD | Anand Mehta MD | Amar Krishnaswamy MD | Nikolaos Skubas MD | Samir Kapadia MD

Heart and Vascular Institute, Cleveland Clinic Foundation, Cleveland, Ohio

# GA or MAC



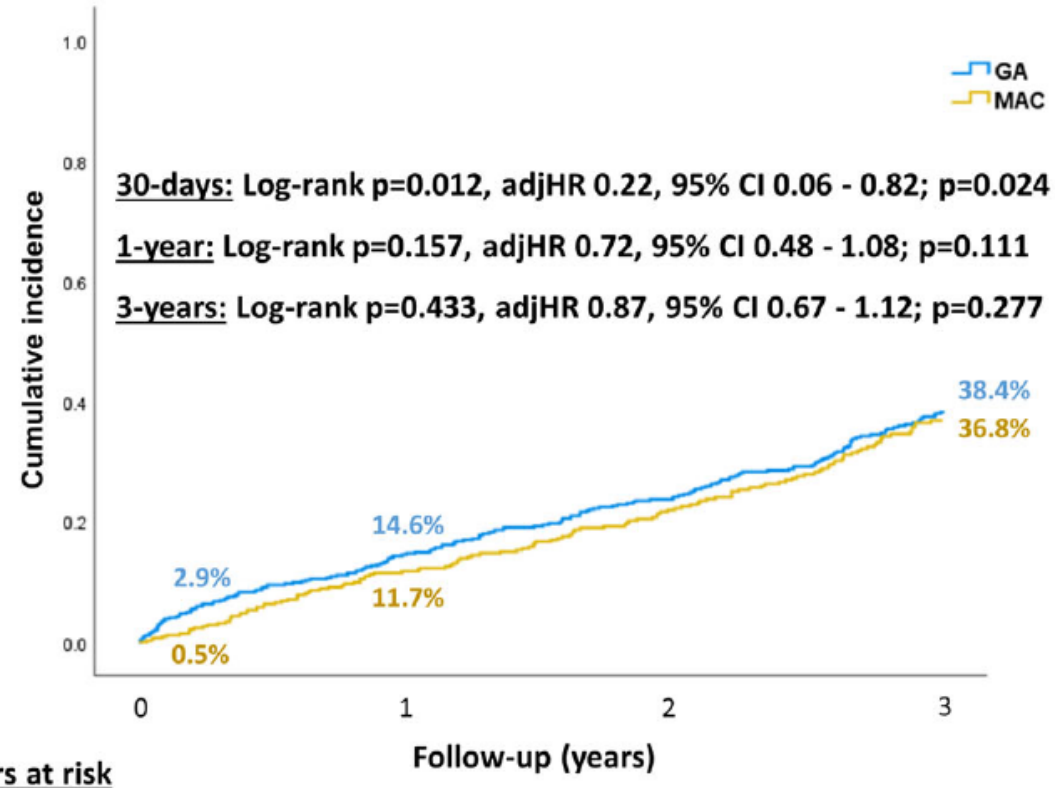






Sammour et al, Catheter Cardiovasc Interv. 2021;98:E436–E443

# GA versus MAC

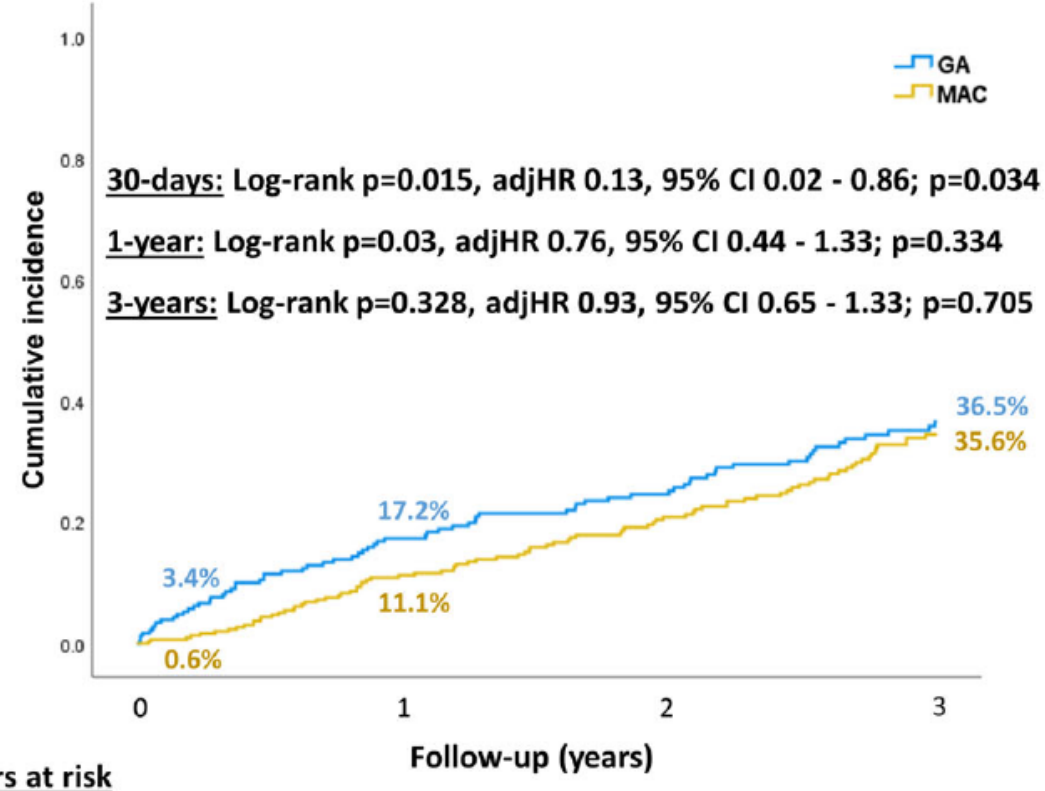
## (a) ALL-CAUSE DEATH, OVERALL




Numbers at risk

| | | | | |
|---|---|---|---|---|
| GA | 560 | 425 | 350 | 239 |
| MAC | 438 | 336 | 255 | 155 |

## (b) ALL-CAUSE DEATH, SAPIEN-3




Numbers at risk

| | | | | |
|---|---|---|---|---|
| GA | 238 | 166 | 139 | 84 |
| MAC | 320 | 242 | 186 | 106 |



Sammour et al, Catheter Cardiovasc Interv. 2021;98:E436–E443

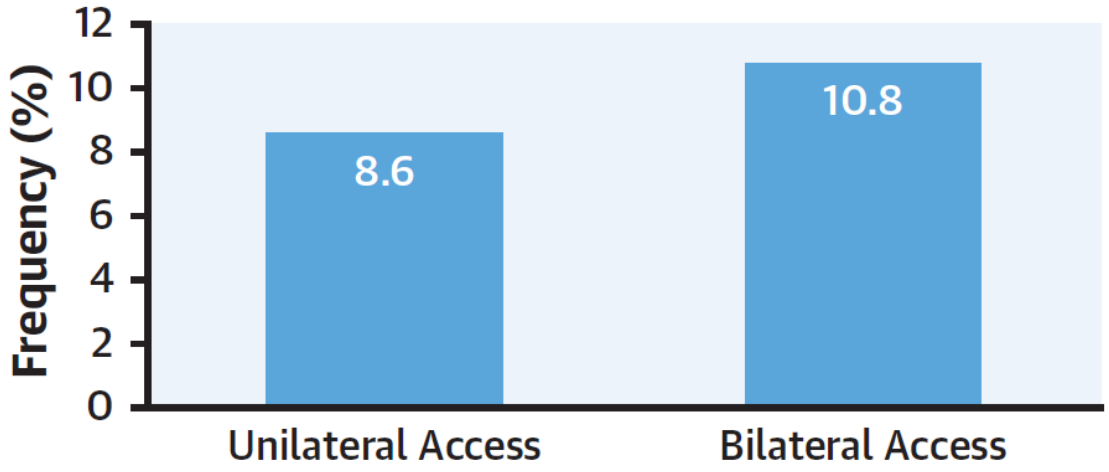
JACC: CARDIOVASCULAR INTERVENTIONS VOL. 12, NO. 21, 2019

PUBLISHED BY ELSEVIER

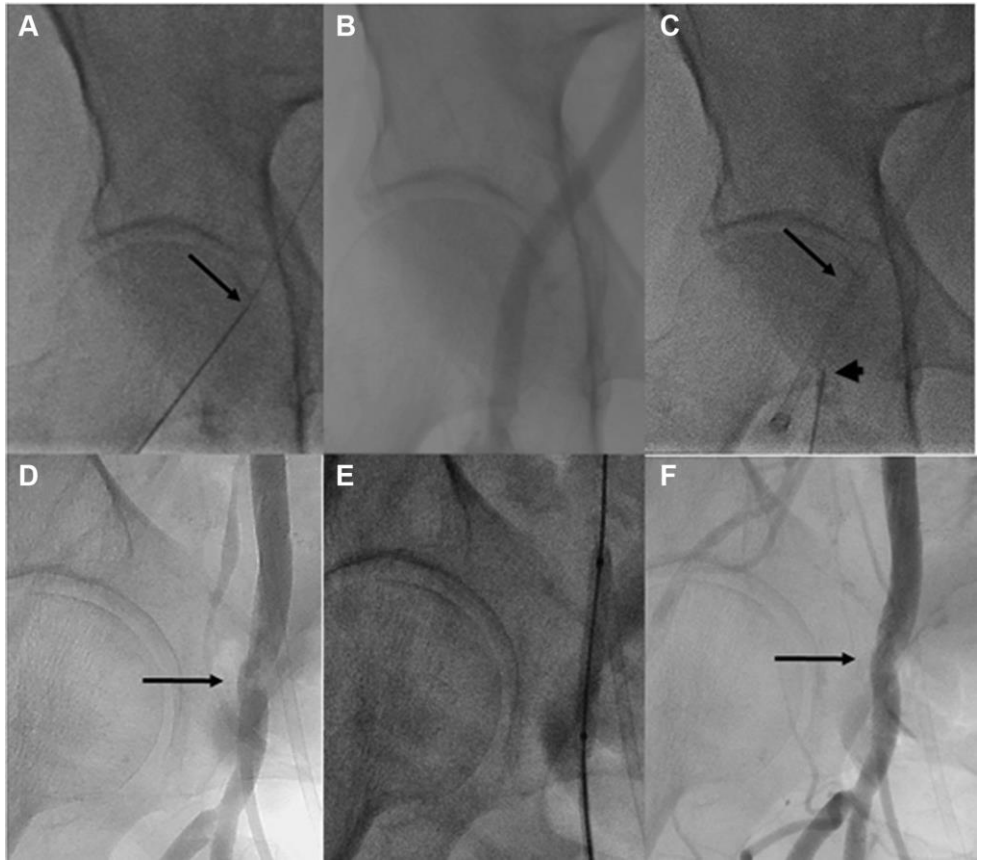
# Unilateral Access Is Safe and Facilitates Peripheral Bailout During Transfemoral-Approach Transcatheter Aortic Valve Replacement

Shameer Khubber, MD,* Najdat Bazarbashi, MD,* Divyanshu Mohananey, MD, Amer Kadri, MD, Mohamed M. Gad, MD, Manpreet Kaur, MD, Yasser M. Sammour, MD, Megan Lyden, BS, Keerat R. Ahuja, MD, Beni Verma, MD, Vivek Menon, MD, Stephanie L. Mick, MD, Grant W. Reed, MD, Rishi Puri, MBBS, PhD, Lars Svensson, MD, PhD, Jose L. Navia, MD, E. Murat Tuzcu, MD, Amar Krishnaswamy, MD, Samir R. Kapadia, MD

# Unilateral Versus Bilateral Access



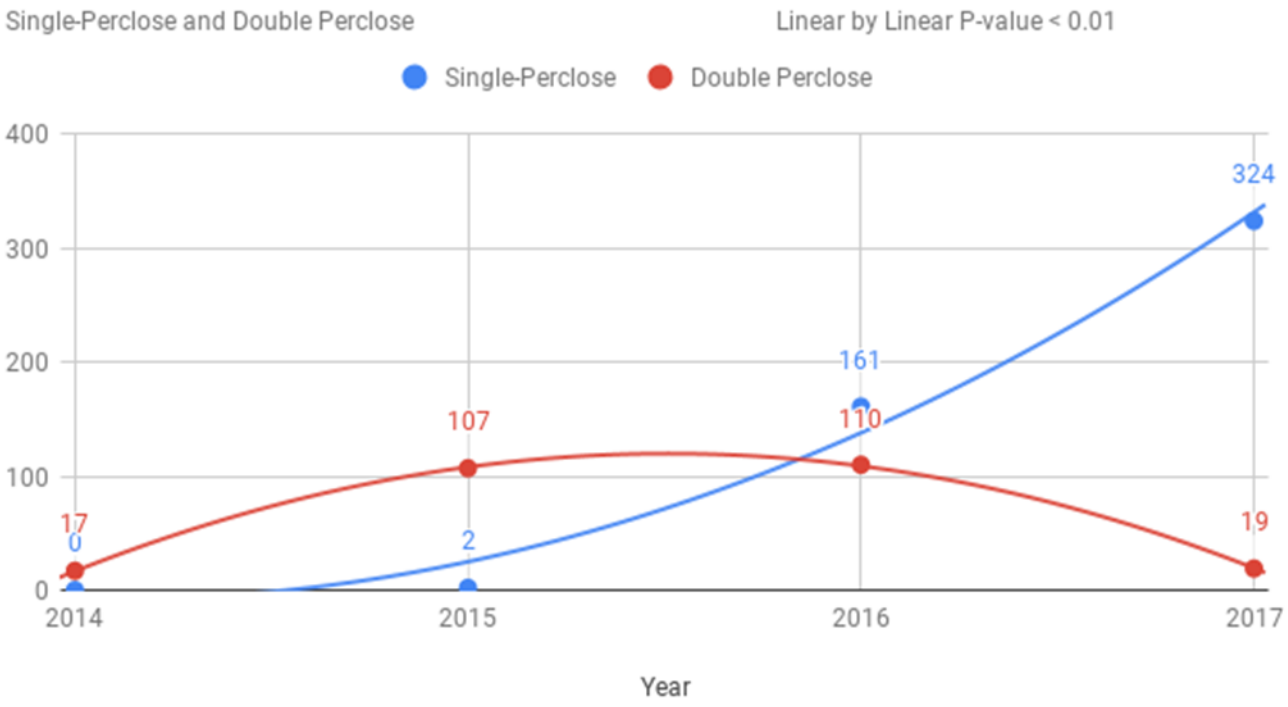

| | Bilateral Access (n = 139) | Unilateral Access (n = 139) | p Value |
|---|---|---|---|
| Vascular complications | 10.8 | 8.6 | 0.543 |
| Hematoma | 1.4 | 3.6 | 0.447 |
| Stenosis S/P balloon | 6.5 | 4.3 | 0.596 |
| Stenosis S/P stent | 1.4 | 0.7 | 1.00 |
| Dissection | 0 | 0 | |
| Pseudoaneurysm | 1.4 | 0 | 0.498 |






Khubber et al, J Am Coll Cardiol Intv 2019;12:2210–20

# Single Versus Double Perclose

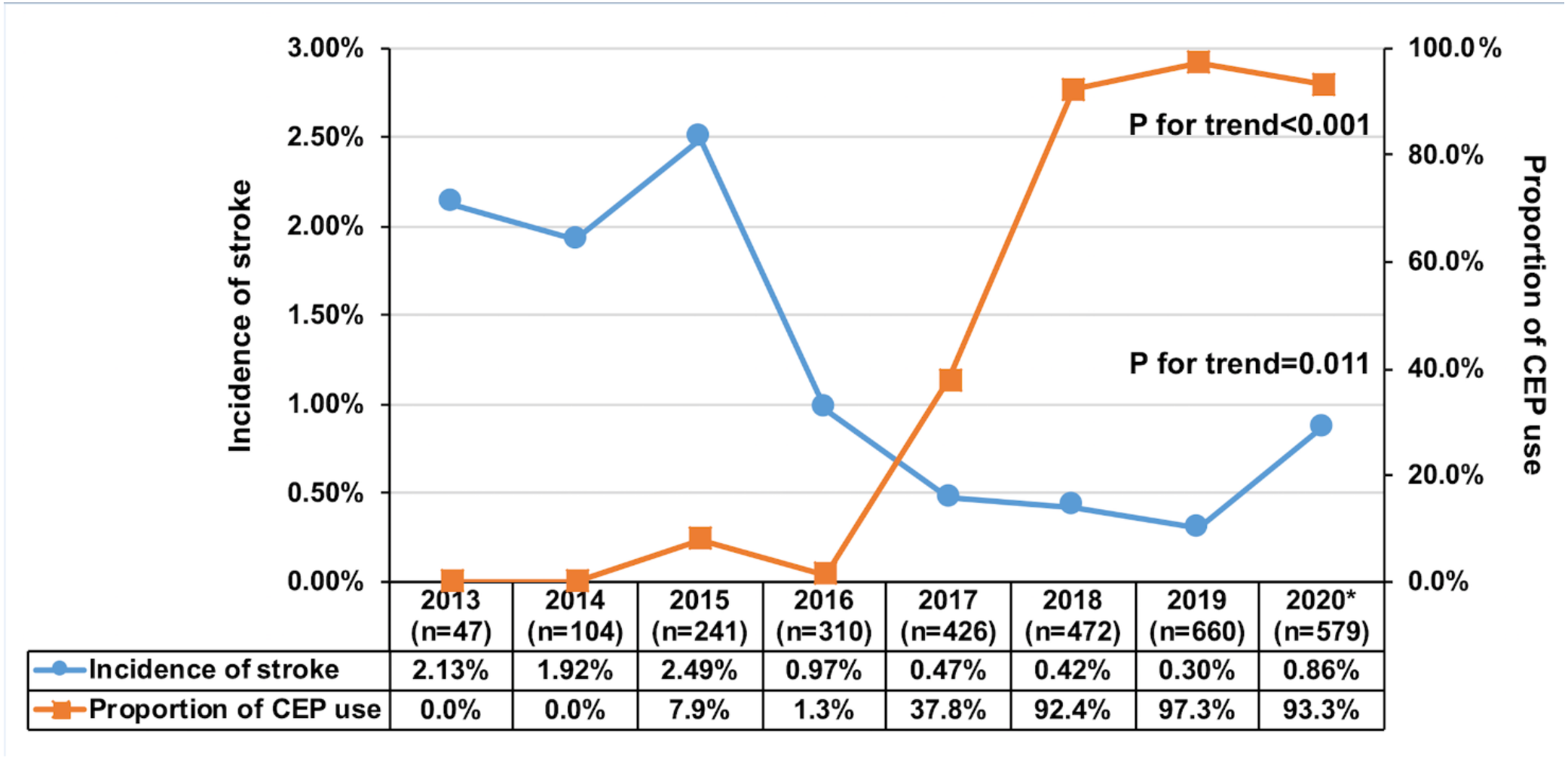



| | Single Perclose N= 234 | Double Perclose N= 234 | p-value |
|---|---|---|---|
| Major bleeding Complications | 0.00% | 0.40% | 1 |
| Hematoma of the access site | 0.90% | 1.70% | 0.6 |
| Stenosis s/p balloon | 6.00% | 5.10% | 0.8 |
| Stenosis s/p stenting | 1.70% | 1.30% | 1 |
| Dissection | 0.00% | 1.30% | 0.2 |
| Pseudoaneurysm | 0.90% | 0.90% | 0.1 |



Najdat et al, CCI in press

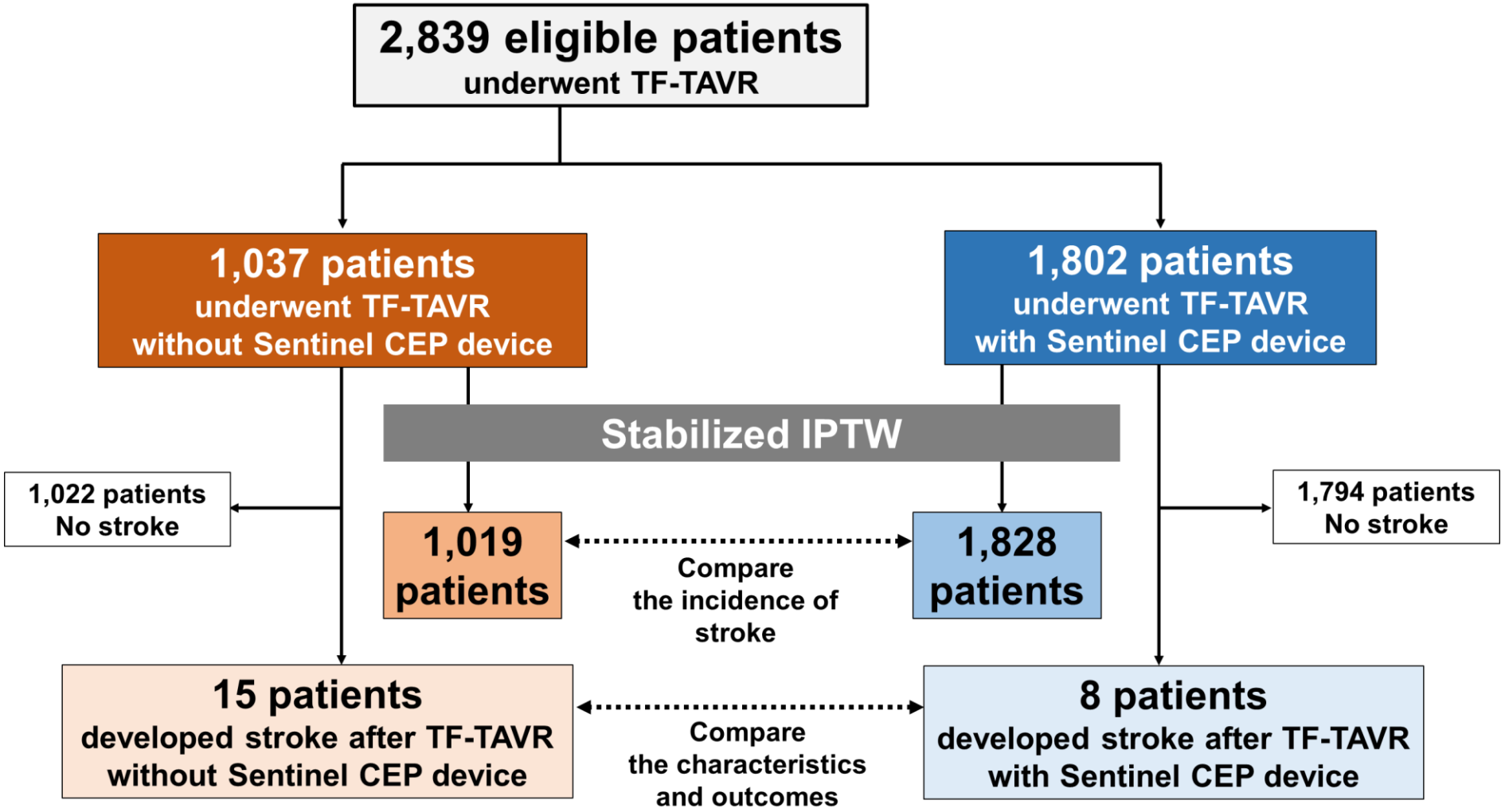
# Cleveland Clinic Experience




| | 2013 (n=47) | 2014 (n=104) | 2015 (n=241) | 2016 (n=310) | 2017 (n=426) | 2018 (n=472) | 2019 (n=660) | 2020* (n=579) |
|---|---|---|---|---|---|---|---|---|
| Incidence of stroke | 2.13% | 1.92% | 2.49% | 0.97% | 0.47% | 0.42% | 0.30% | 0.86% |
| Proportion of CEP use | 0.0% | 0.0% | 7.9% | 1.3% | 37.8% | 92.4% | 97.3% | 93.3% |

Isogai et al, AJC 2022 Dec 1:184:157-159

# Results – Study Patients




Isogai et al, AJC 2022 Dec 1:184:157-159

# Treatment and Mortality of Stroke

| | Stroke after TAVR without CEP (n=15) | Stroke after TAVR with CEP (n=8) | p value |
|---|---|---|---|
| **Treatment** | | | 1.00 |
| **Conservative medical management** | 11 (73.3) | 7 (87.5) | |
| **Thrombolysis alone** | 0 (0.0) | 0 (0.0) | |
| **Thrombectomy alone** | 3 (20.0) | 1 (12.5) | |
| **Both thrombolysis and thrombectomy** | 1 (6.7) | 0 (0.0) | |
| **Outcomes** | | | |
| **In-hospital death** | 3 (20.0) | 0 (0.0) | 0.53 |
| **Discharge disposition†** | | | 0.16 |
| **Home** | 2/12 (16.7) | 4/8 (50.0) | |
| **Rehabilitation center or SNF** | 10/12 (83.3) | 4/8 (50.0) | |
| **30-day death** | 4 (26.7) | 0 (0.0) | 0.26 |

Isogai et al, AJC 2022 Dec 1:184:157-159

# Rapid Atrial Pacing after TAVR

## The Utility of Rapid Atrial Pacing Immediately Post-TAVR to Predict the Need for Pacemaker Implantation

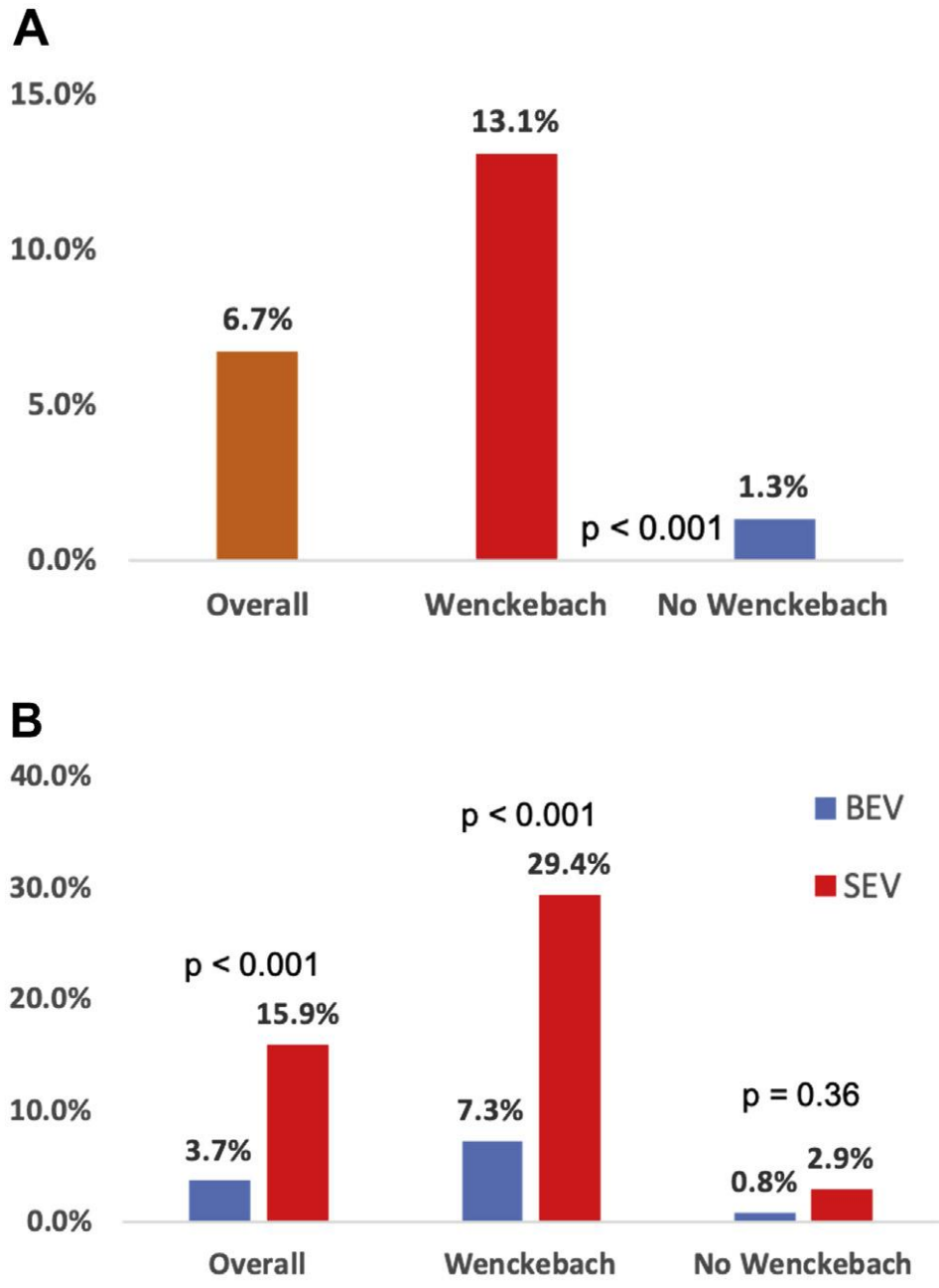
Amar Krishnaswamy, MD,[a] Yasser Sammour, MD,[a] Antonio Mangieri, MD,[b] Amer Kadri, MD,[a] Antonette Karrthik, MD,[a] Kinjal Banerjee, MD,[a] Manpreet Kaur, MD,[a] Francesco Giannini, MD,[b] Beniamino Pagliaro, MD,[c] Marco Ancona, MD,[c] Matteo Pagnesi, MD,[c] Alessandra Laricchia, MD,[b] Giora Weisz, MD,[d] Megan Lyden,[a] Najdat Bazarbashi, MD,[a] Mohamed Gad, MD,[a] Keerat Ahuja, MD,[a] Stephanie Mick, MD,[e] Lars Svensson, MD, PhD,[e] Rishi Puri, MBBS, PhD,[a] Grant Reed, MD, MPH,[a] John Rickard, MD,[f] Antonio Colombo, MD,[b] Samir Kapadia, MD,[a] Azeem Latib, MD[d]

**ABSTRACT**

**OBJECTIVES** The aim of this study was to determine the utility of rapid atrial pacing immediately after transcatheter aortic valve replacement (TAVR) to predict the need for permanent pacemaker implantation (PPI).

**BACKGROUND** Risk stratification for patients without high-grade atrioventricular block (AVB) after TAVR is imprecise and based on anatomic considerations, electrocardiographic characteristics, and clinical suspicion. A more reliable assessment is necessary to minimize inpatient rhythm monitoring and/or reduce unnecessary PPI.

**METHODS** Consecutive patients undergoing TAVR at 2 centers were included. After valve implantation in patients without pacemakers who did not have complete heart block or atrial fibrillation, the temporary pacemaker was withdrawn from the right ventricle and placed in the right atrium. Rapid atrial pacing was performed from 70 to 120 beats/min, and patients were assessed for the development of Wenckebach AVB. Patients were then followed for clinical outcomes, including PPI.



# Same Day Discharge: TAVR Cleveland Clinic

STRUCTURAL

## Feasibility and Safety of Same-Day Discharge Following Transfemoral Transcatheter Aortic Valve Replacement

Amar Krishnaswamy, MD,[a,*] Toshiaki Isogai, MD, MPH,[a,*] Ankit Agrawal, MD,[a] Shashank Shekhar, MD,[a] Rishi Puri, MBBS, PhD,[a] Grant W. Reed, MD, MSc,[a] James J. Yun, MD, PhD,[b] Shinya Unai, MD,[b] Daniel J.P. Burns, MD, MPhil,[b] Patrick R. Vargo, MD,[b] Samir R. Kapadia, MD[a]

**CONCLUSIONS** SDD after TF-TAVR was feasible in this early experience without impairing post-discharge safety. Our SDD pathway may serve as a useful strategy to improve bed utilization and reduce hospital stay for TAVR recipients.
(J Am Coll Cardiol Intv 2022;15:575–589) 



Krishnaswamy et al, J Am Coll Cardiol Intv 2022;15:575–589

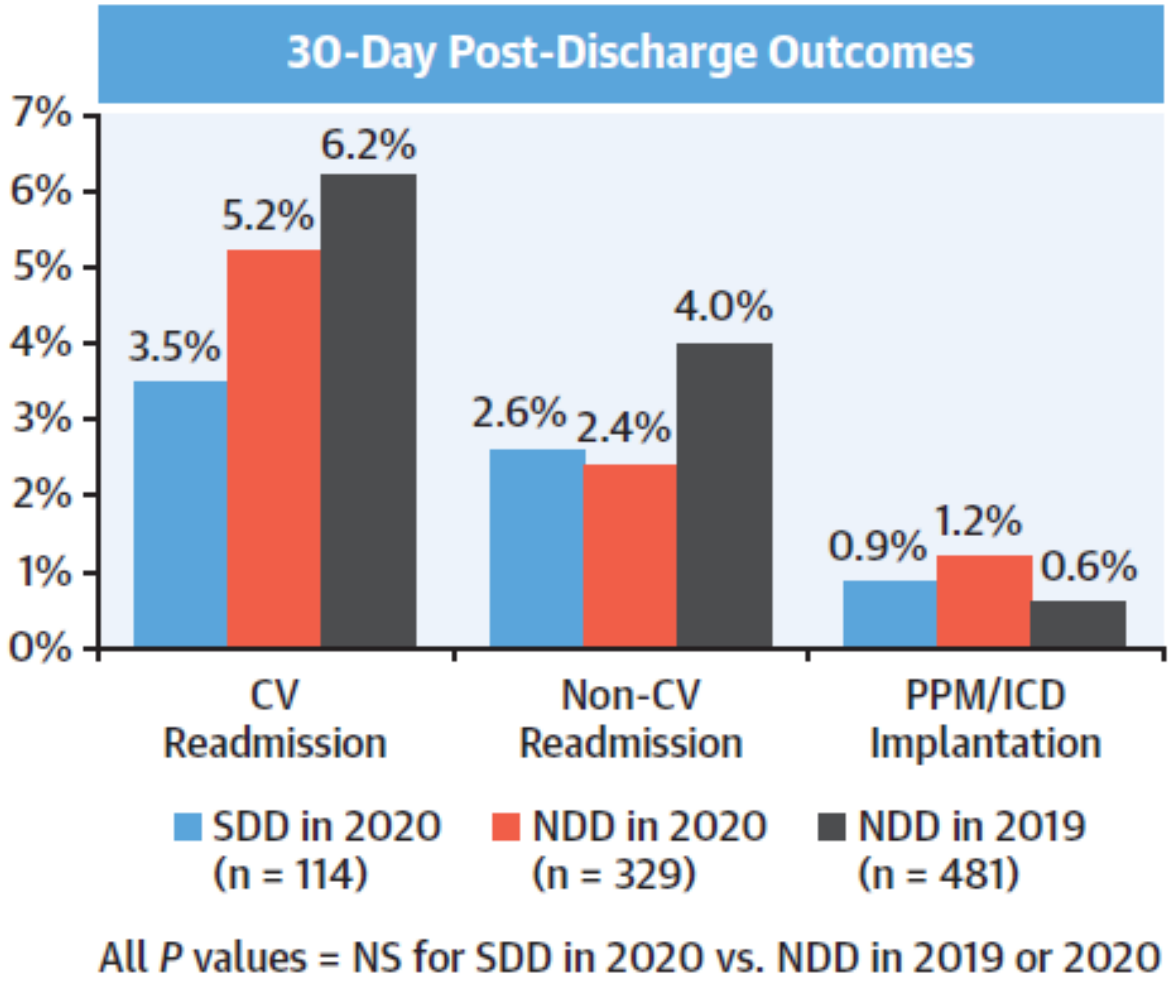
# Same Day Discharge

**Candidates for post-TAVR SDD need to meet all of the following:**

1) Transfemoral TAVR procedure under conscious sedation
2) 6-hour post-TAVR bedrest with rhythm monitoring
3) No major complications* or need for further observation
4) Stable hemodynamics and ECG during recovery†
5) Comfortable ambulation post-procedure
6) Post-discharge social support to assist in recovery

**Post-TAVR 6-hour observation with continuous telemetry and formal transthoracic echocardiography study**

1) Operators, bedside team, and patient discuss SDD
2) If they reach the consensus for SDD, discharge occurs before 7 PM
3) Outpatient visit (including ECG) on post-TAVR day 1 or 2



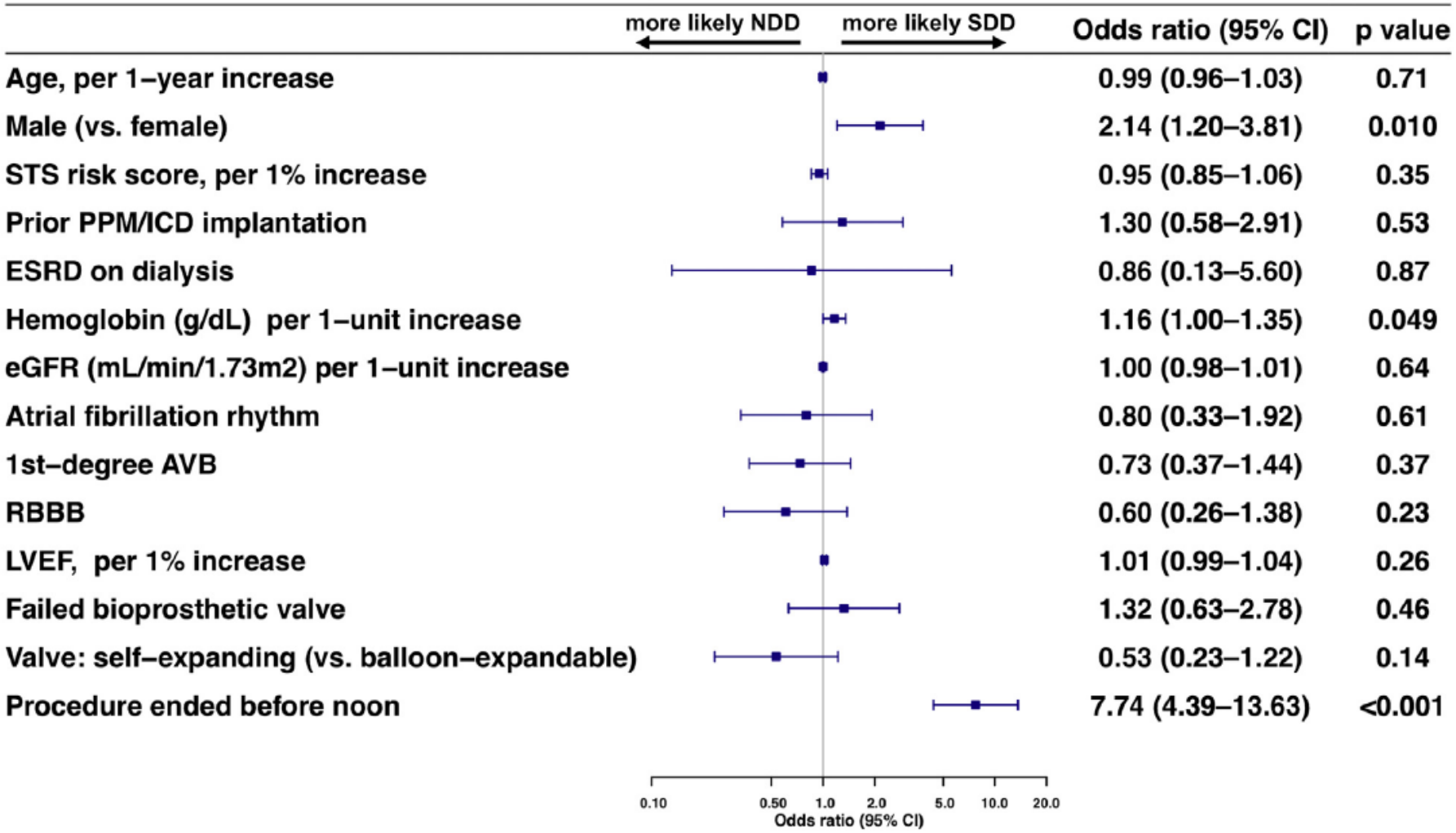

**CV Readmissions Within 30 Days After SDD (n = 4)**

- Rapid atrial fibrillation (POD 1)
- Pulmonary edema (POD 7)
- GI bleed related to DAPT (POD 15)
- Intermittent CHB (POD 25)



Krishnaswamy et al, J Am Coll Cardiol Intv 2022;15:575–589

# Predictors of Same Day Discharge






Krishnaswamy et al, J Am Coll Cardiol Intv 2022;15:575–589

# Same-Day Discharge After Elective Percutaneous Transcatheter Cardiovascular Interventions

Amar Krishnaswamy, MD,[a,*] Toshiaki Isogai, MD, MPH,[a,*] Emmanouil S. Brilakis, MD, PhD,[b] Aravinda Nanjundappa, MBBS,[a] Khaled M. Ziada, MD,[a] Sahil A. Parikh, MD,[c] Josep Rodés-Cabau, MD, PhD,[d] Stephan Windecker, MD,[e] Samir R. Kapadia, MD[a]

## ABSTRACT

Percutaneous transcatheter interventions have evolved as standard therapies for a variety of cardiovascular diseases, from revascularization for atherosclerotic vascular lesions to the treatment of structural cardiac diseases. Concomitant technological innovations, procedural advancements, and operator experience have contributed to effective therapies with low complication rates, making early hospital discharge safe and common. Same-day discharge presents numerous potential benefits for patients, providers, and health care systems. There are several key elements that are shared across the spectrum of interventional cardiology procedures to create a successful same-day discharge pathway. These include appropriate patient and procedure selection, close postprocedural observation, predischarge assessments specific for each type of procedure, and the existence of a patient support system beyond hospital discharge. This review provides the rationale, available data, and a framework for same-day discharge across the spectrum of coronary, peripheral, and structural cardiovascular interventions. (J Am Coll Cardiol Intv 2023;16:1561–1578) © 2023 by the American College of Cardiology Foundation.

# Cleveland Clinic - Volume and Outcomes

| | ALL | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| n | 3150 | 495 | 696 | 679 | 652 | 628 |
| Mortality | 0.4% | 0.2% | 0.0% | 0.4% | 0.6% | 0.6% |
| Stroke | 0.5% | 0.2% | 0.3% | 1.0% | 0.4% | 0.6% |
| AR(>=2+) | 0.4% | 0.8% | 0.3% | 0.3% | 0.4% | 0.5% |
| New PPM | 2.9% | 5% | 1.2% | 2.5% | 2.9% | 3.5% |

# Conclusions

- **TAVR has become a reproducible procedure which is safe and effective**
- **Excellent out comes are feasible with minimalistic approach with careful attention to the details and monitoring of outcomes**
- **Bar is high because of excellent surgical options in low-risk patients and so monitoring of quality is very important for credibility**