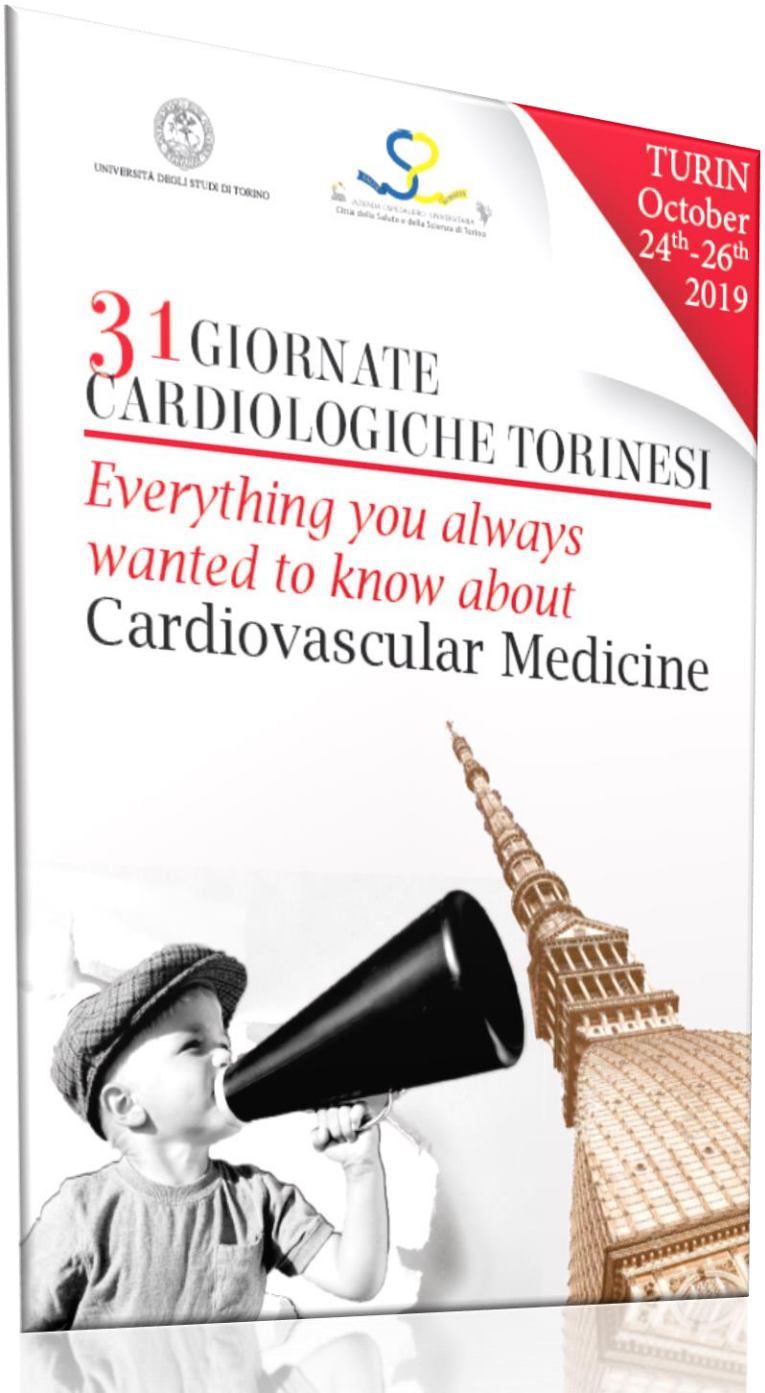



SISTEMA SANITARIO REGIONALE
AZIENDA OSPEDALIERA
SAN CAMILLO FORLANINI

# New approaches and techniques to the Mitral Valve

## What's new in 2019

**Francesco Musumeci MD, FECTS**
*Director Department of Cardivascular Medicine*
*Director Cardiac Surgery and Transplantation*
*San Camillo Hospital – **Rome, Italy***

# Approaches to the Mital Valve



## From big….to….small

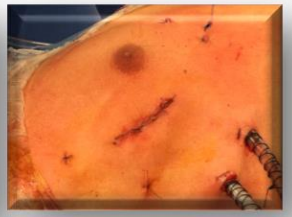
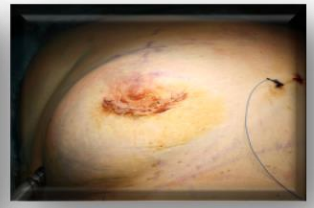
# Today surgical standards

ORIGINAL ARTICLE

Minimally Invasive Versus Conventional Open Mitral Valve Surgery

*A Meta-Analysis and Systematic Review*

*Davy C. H. Ch*
*Anno Diegeler, MD*
*Ehud Raanani, M*

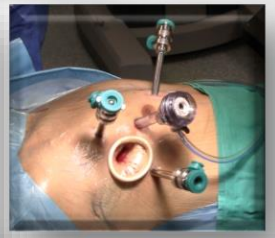




Systematic Review

**A meta-analysis of minimally invasive versus conventional mitral valve repair for patients with degenerative mitral disease**

Christopher Cao[1], Sunil Gupta[1],
Su C. Ang[1], Kevin Phan[1,2], Trista

[1]The Collaborative Research (CORE) Group, M
Australia




Sündermann et al — Acquired Cardiovascular Disease

**Mitral valve surgery: Right lateral minithoracotomy or sternotomy? A systematic review and meta-analysis**

Simon H. Sünderman
Burkhardt Seifert, MI


ORIGINAL RESEARCH ARTICLE

**Propensity-matched analysis of minimally invasive approach versus sternotomy for mitral valve surgery**

Stuart W Grant,[1] Graeme L Hickey,[2] Paul Modi,[3] Steven Hunter,[4] Enoch Akowuah,[5] Joseph Zacharias[6]

ORIGINAL RESEARCH ARTICLE

# Propensity-matched analysis of minimally invasive approach versus sternotomy for mitral valve surgery

Stuart W Grant,[1] Graeme L Hickey,[2] Paul Modi,[3] Steven Hunter,[4] Enoch Akowuah,[5] Joseph Zacharias[6]

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one-to-one propensity score calliper matching without replacement was performed. The main outcome measure was midterm reintervention free survival that was summarised by the Kaplan-Meier estimator and compared between treatment arms using the stratified log-rank test.

**Results** A total of 2404 procedures (1757 sternotomy and 647 minimally invasive) were performed during the study period. Propensity score matching resulted in 639 matched pairs with improved balance postmatching in all 31 covariates (absolute standardised mean differences <10%). Despite longer procedural times patients who

often undesicable, particularly in younger patients; there is a small but significant risk of deep sternal wound infection, and the sternotomy can take up to 3 months to heal completely. During this time, return to usual physical activities and work can be significantly restricted.

To counter some of the disadvantages associated with sternotomy, minimally invasive techniques for mitral valve surgery were developed in the mid-1990s and have been adopted worldwide.[3] Although there is no standard approach to minimally invasive mitral valve surgery, it includes all



## How might this impact on clinical practice?

- As short-term outcomes are improved or comparable with minimally invasive techniques, this approach should be considered for all patients requiring mitral valve intervention.



**To cite:** Grant SW, Hickey GL, Modi P, *et al*. *Heart* Epub ahead of print: [please include Day Month Year]. doi:10.1136/heartjnl-2018-314049

cation for patients with symptomatic severe primary mitral regurgitation and asymptomatic patients with severe primary mitral regurgitation and impaired left ventricular function.[1] Surgery is also now recommended as a class II indication for asymptomatic patients with primary mitral regurgitation and preserved left ventricular function who also have either atrial fibrillation (AF), pulmonary hypertension, a flail leaflet or significant left atrial dilatation.[2] This shift towards operating on more asymptomatic patients with primary mitral

mitral valve intervention are lacking. The objective of this study was therefore to compare both short-term and midterm outcomes between sternotomy and minimally invasive approaches for mitral valve surgery.

## METHODS

### Data collection and definitions

Data were collected from all patients undergoing mitral valve surgery (with or without concomitant

# Today surgical standards

**Mitral Valve REPAIR is today the standard of care for valve regurgitation due to prolapse**

1. Mitral Valve repair must be offered with a very high likelihood (>95%)
2. Operations must be performed with extremely low mortality and morbidity risk (<1%)
3. Repair must be durable with a <1% per year reoperation risk

# Surgery for Degenerative Mitral Valve Regurgitation

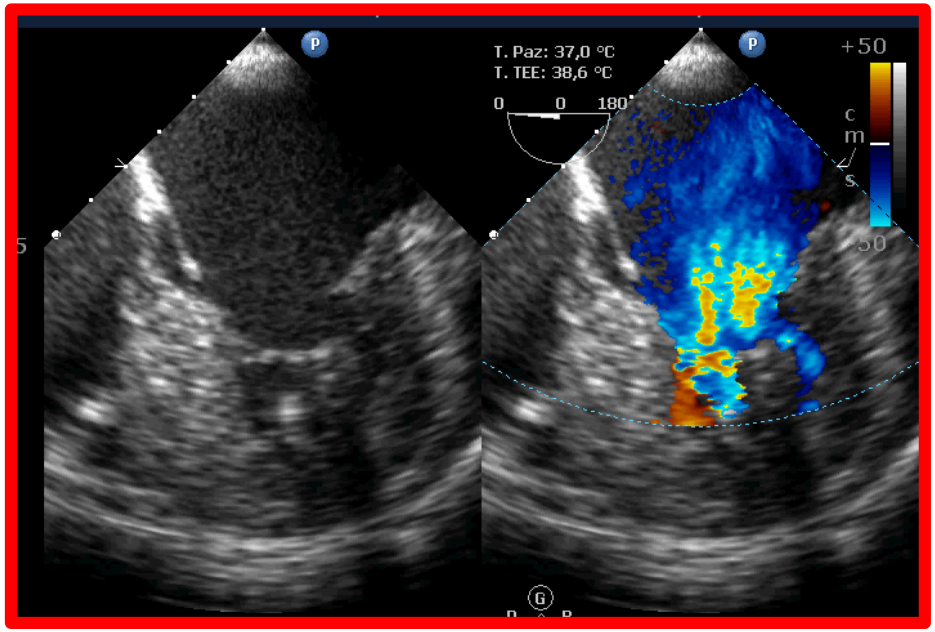
**Table 1** Lesions found in degenerative mitral valve disease and the surgical techniques used to correct them

| Lesions | Surgical techniques | Probability of repair |
|---|---|---|
| Annular dilatation | Annuloplasty procedure:<br>complete ring*<br>partial ring/band†<br>suture annuloplasty‡ | >95% |
| PMLP | Artificial chordal implantation*<br>Leaflet resection*<br>Sliding plasty†<br>Notch closure between segments†<br>Chordal shortening/transposition‡ | >98% |
| AMLP | Artificial chordal implantation*<br>Chordal shortening/transposition†<br>Suture plication (minor prolapse)†<br>Leaflet resection‡ | >95% |
| Commissural leaflet prolapse | Commissural closure ('magic stitch')*<br>Papillary muscle shortening†<br>Artificial chordal implantation†<br>Chordal shortening/transposition‡ | >95% |
| Leaflet restriction/small size | Patch augmentation†<br>Leaflet thinning†<br>Secondary chordal resection† | 70%–80% |
| Annular calcification | Decalcification†<br>Decalcification + patch reconstruction‡ | 70%–80% |

**Near 100% probability of repair in Heart Valve Centers**

Coutinho GF, Antunes MJ. *Heart* 2017

# “Flail” Lembo Posteriore

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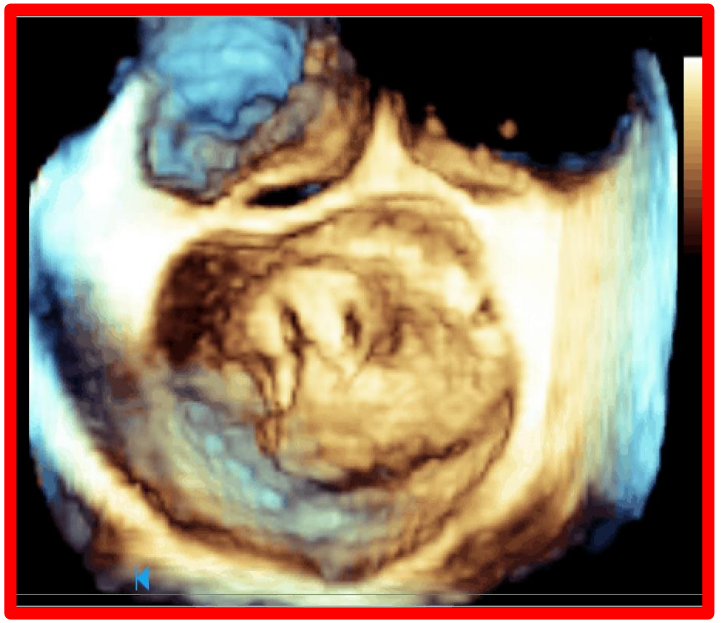

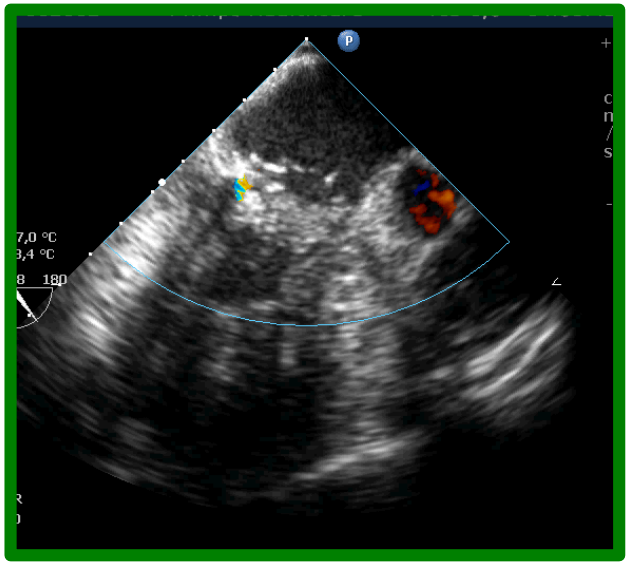


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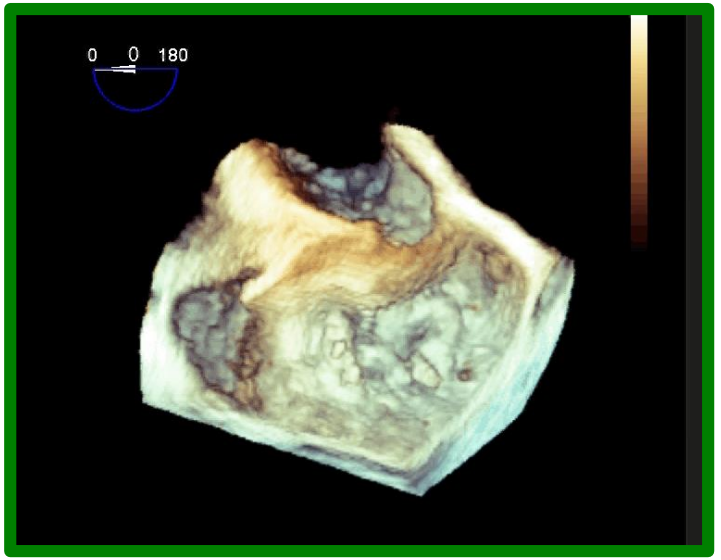
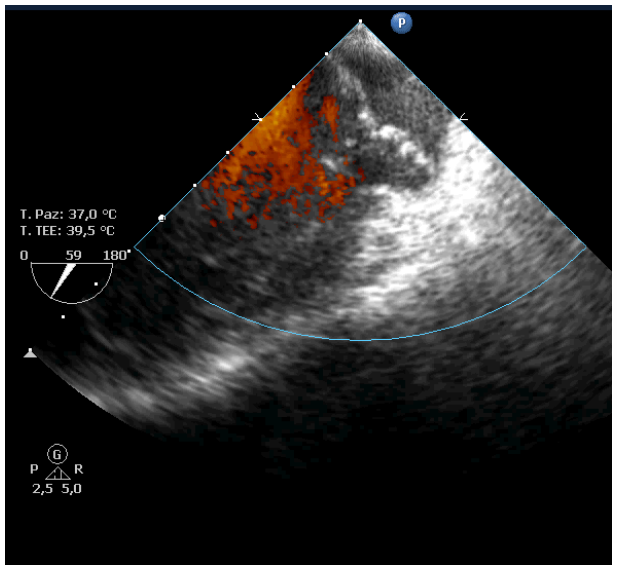
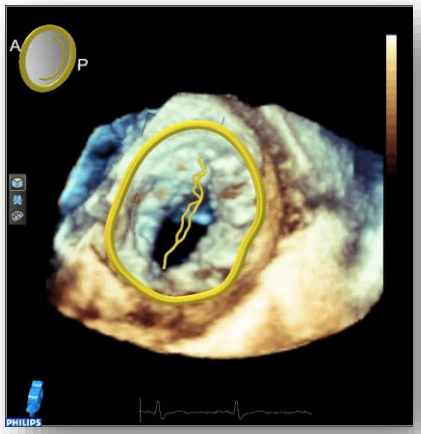
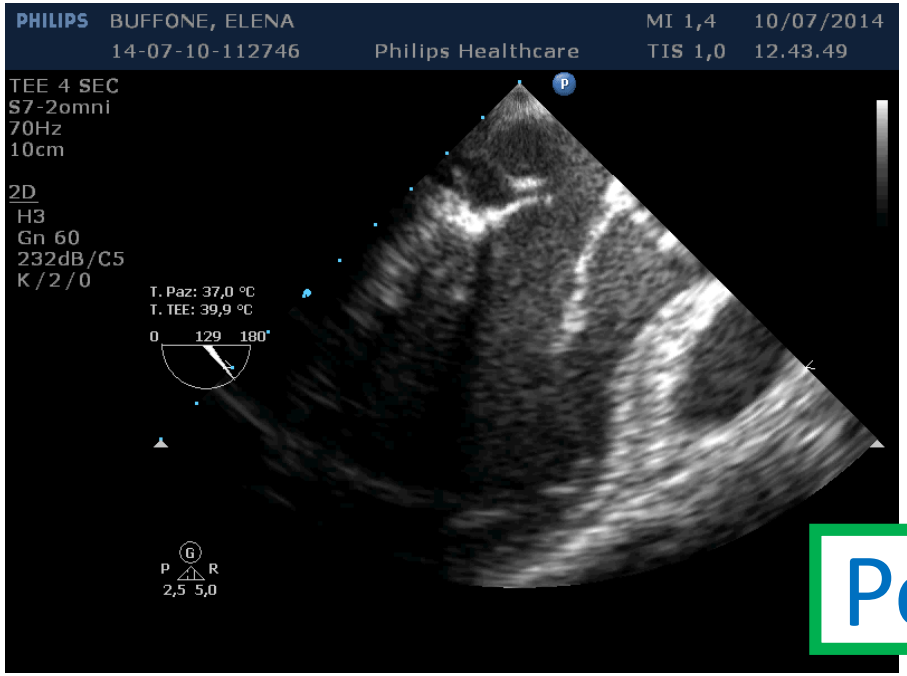


# Barlow Disease

Pre

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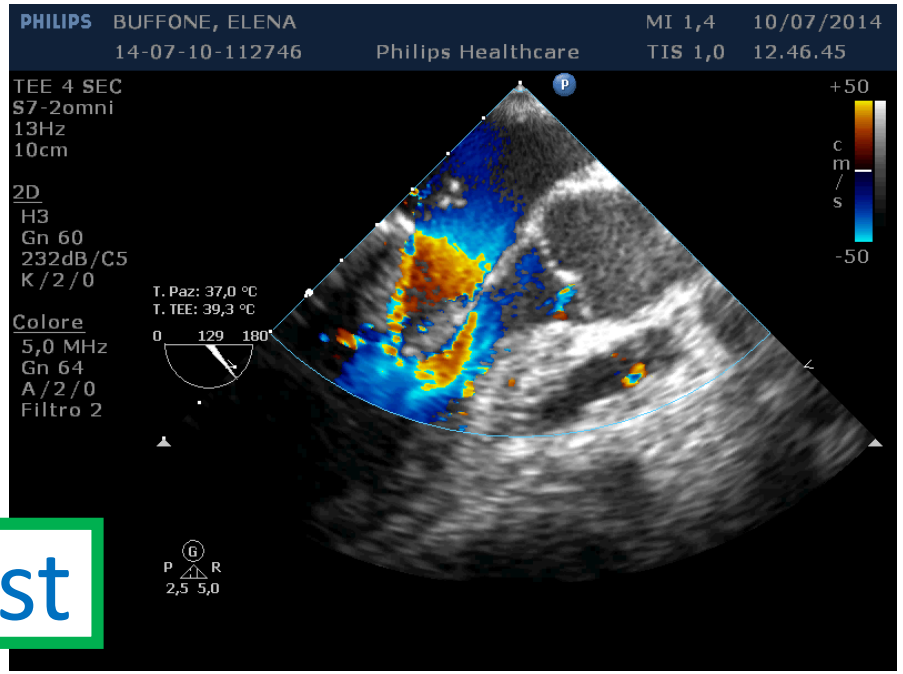


# Surgery for Degenerative Mitral Valve Regurgitation

**Table 2** Mitral valve repair outcomes according to the site of prolapse among different surgical groups

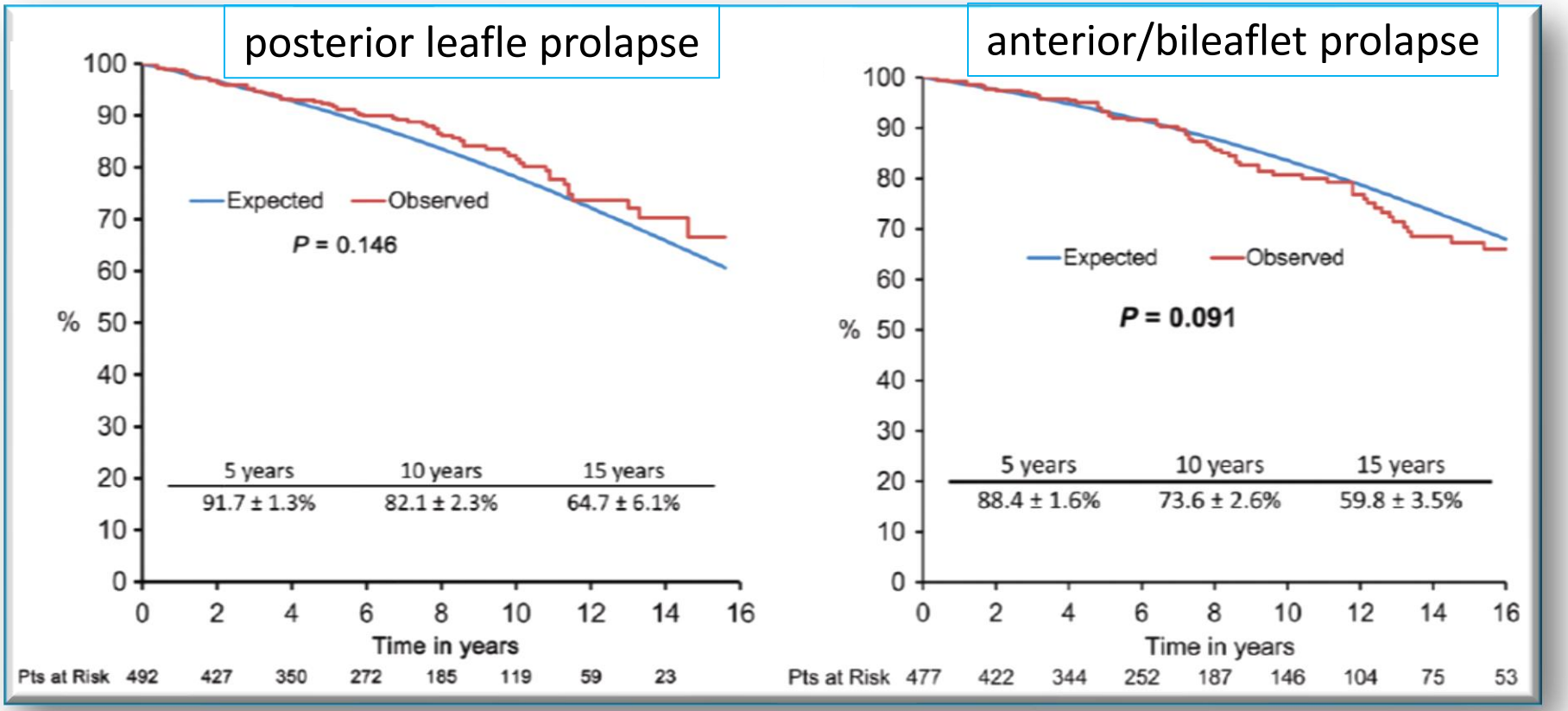
| Authors | | n | Repair rate | Early mortality | Long term survival | Reoperation |
|---|---|---|---|---|---|---|
| PMLP | Castillo *et al*[21] | 556 | 100% | 0.8% | 5 years – 97% | 7 years – 97% |
| | David *et al*[11] | 359 | 95% | 0.6% | 12 years – 75% | 12 years – 96% |
| | Johnston *et al*[22] | 3383 | 97% | 0.1% | 15 years – 76% | 15 years – 97% |
| | Suri *et al*[7] | 736 | 92% | 0.7% | 15 years – 58% | 15 years – 95%? |
| | Correia *et al*[20] | 492 | 98.4% | 0.2% | 15 years – 65% | 15 years – 97% |
| AMLP/BLP | Castillo *et al*[18] | 42/146 | 100%/99% | 4.8%/0% | 7 years – 86%/89% | 7 years – 80%/92% |
| | David *et al*[11] | 93/316 | 95%? | 0.6% | 12 years – 73%/78% | 12 years – 88%/94% |
| | De Bonis *et al*[19] | 139/- | Nd | 0% | 17 years – 72% | 17 years – 90% |
| | Goldstone *et al*[17] | 131 | 98.5% | 0.2% | 8 years – 92% | Nd |
| | Seeburger *et al*[26] | 156/402 | 91%/90.3% | 2.6%/2.2% | 5 years – 87.3% | 5 years – 95.6% |
| | Coutinho *et al*[24] | 274/227 | 94.5% | 1.2% | 20 years – 43% | 20 years – 88% |

AMLP, anterior leaflet prolapse; BLP, bileaflet prolapse; N, number of patients; Nd, not documented; PMLP, posterior leaflet prolapse.

**Excellent Early and Long Term Results**

Coutinho GF, Antunes MJ. *Heart* 2017

# Surgery for Degenerative Mitral Valve Regurgitation




Survival similar to that of the age- and sex-matched general population

Coutinho GF, Antunes MJ. *Heart* 2017

ORIGINAL RESEARCH ARTICLE

# Twenty-Year Outcome After Mitral Repair Versus Replacement for Severe Degenerative Mitral Regurgitation

## Analysis of a Large, Prospective, Multicenter, International Registry


supporting current recommendations is low, and recent data cast doubts on its validity in the current era. Accordingly, the aim of the present study was to analyze very long-term outcome after MV repair and replacement for degenerative mitral regurgitation with a flail leaflet.

**METHODS:** MIDA (Mitral Regurgitation International Database) is a multicenter registry enrolling patients with degenerative mitral regurgitation with a flail leaflet in 6 tertiary European and US centers. We analyzed the outcome after MV repair (n=1709) and replacement (n=213) overall, by propensity score matching, and by inverse probability-of-treatment weighting.

**RESULTS:** At baseline, patients undergoing MV repair were younger, had more comorbidities, and were more likely to present with a posterior leaflet prolapse than those undergoing MV replacement. After propensity score



PhD
Rakesh M. Suri, MD, PhD
Jean-Francois Avierinos, MD
Christophe de Meester, PhD
Andrea Barbieri, MD
Dan Rusinaru, MD, PhD
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Agnès Pasquet, MD, PhD
Hector I. Michelena, MD
Marianne Huebner, PhD
Joseph Maalouf, MD
Marie-Annick Clavel, DVM, PhD
Catherine Szymanski, MD, PhD


**CONCLUSIONS:** Among patients with degenerative mitral regurgitation with a flail leaflet referred to mitral surgery, MV repair was associated with lower operative mortality, better long-term survival, and fewer valve-related complications compared with MV replacement.


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Key Words: mitral valve ■ mitral valve insufficiency







*Circulation*. 2017;135:410–422. DOI: 10.1161/CIRCULATIONAHA.116.023340

ORIGINAL RESEARCH ARTICLE

# Twenty-Year Outcome After Mitral Repair Versus Replacement for Severe Degenerative Mitral Regurgitation

## Analysis of a Large, Prospective, Multicenter, International Registry

Editorial, see p 423

Siham Lazam, MS*
Jean-Louis Vanoversche MD, PhD*
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**BACKGROUND:** Mitral valve (MV) repair is preferred over replacement in clinical guidelines and is an important determinant of the indication for surgery in degenerative mitral regurgitation. However, the level of evidence supporting current recommendations is low, and recent data cast doubts on its validity in the current era. Accordingly, the aim of the present study was to analyze very long-term outcome after MV repair and replacement for degenerative mitral regurgitation with a flail leaflet.

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groups were balan
<10%, indicating a
occurring within 30
was lower after MV
population (1.3% v
population (0.2% v
years, 552 deaths
origin. Twenty-year
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the matched popul
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reduced incidence

**CONCLUSIONS:** A
with a flail leaflet re
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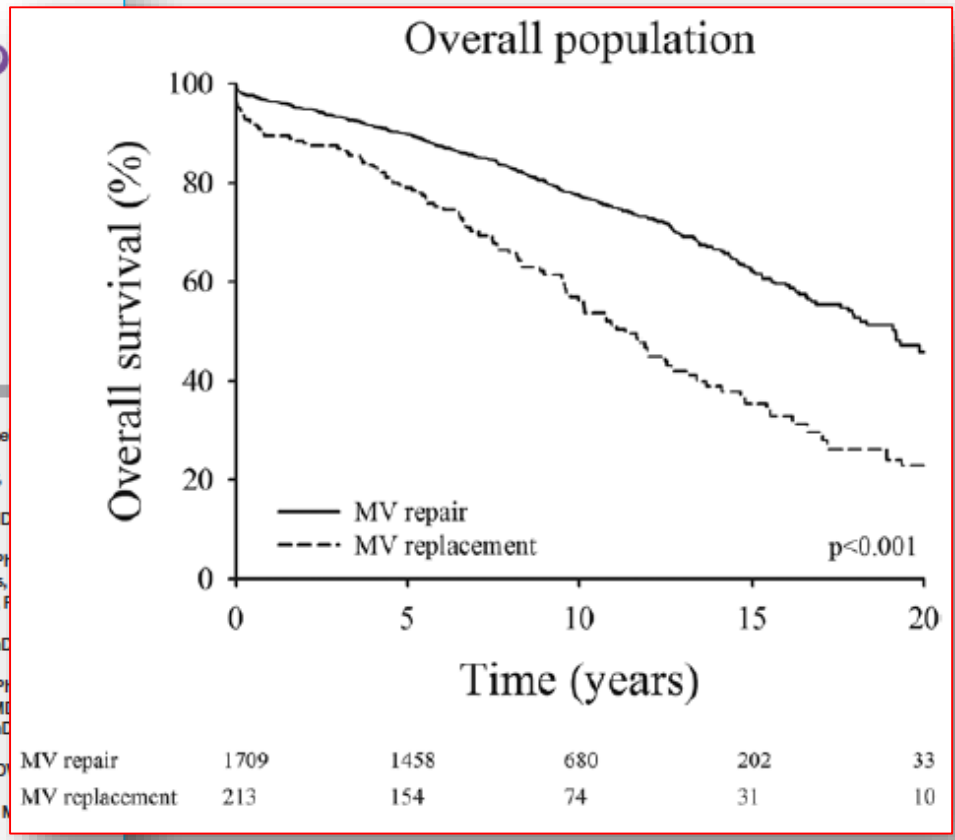
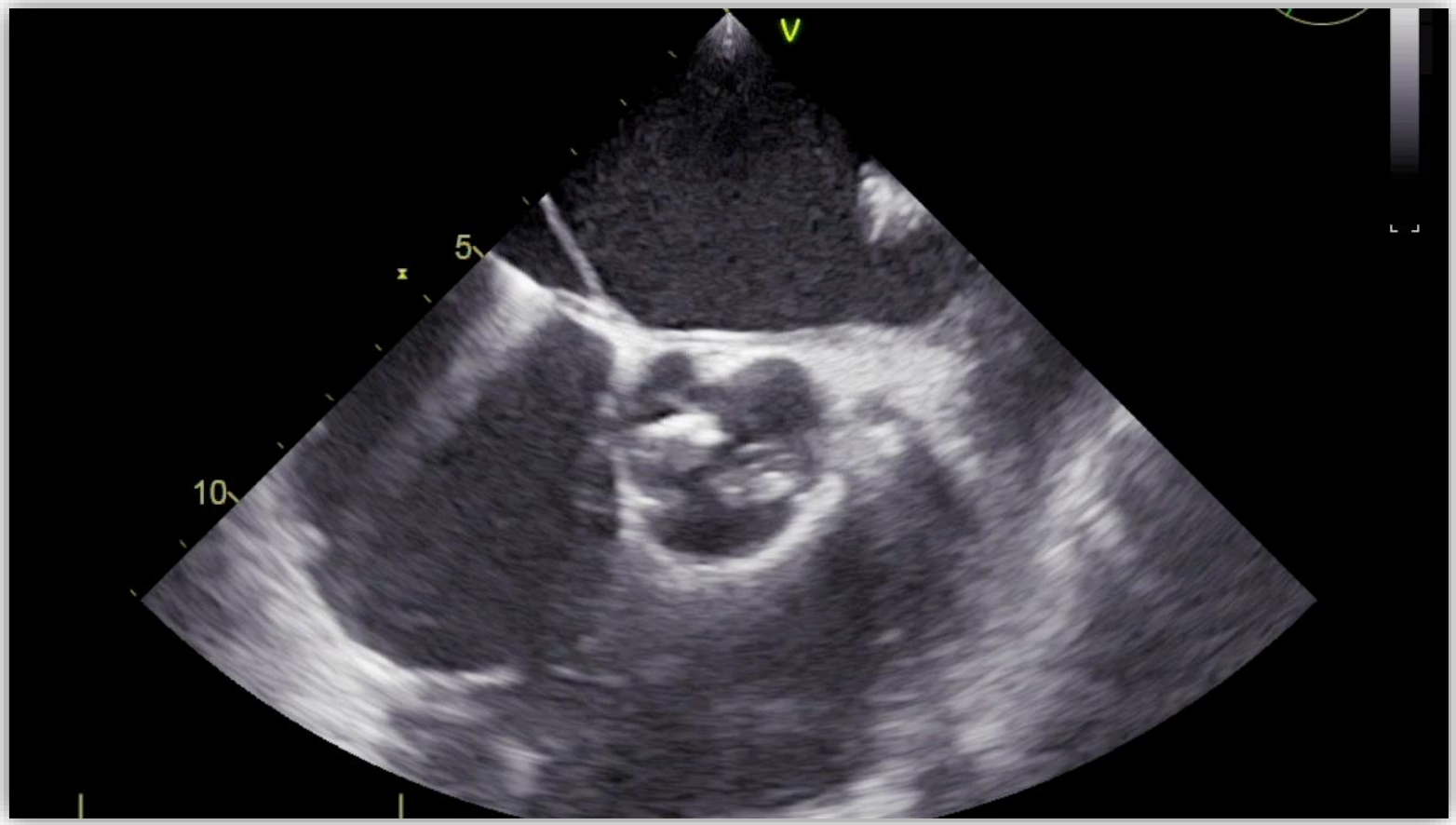



## What Are the Clinical Implications?

- Our findings suggest that MV repair should be preferred over MV replacement for patients with degenerative mitral regurgitation and a flail leaflet.
- Whenever possible, patients should be referred to surgical centers experienced in performing MV repair.

# MITRAL, AORTIC and TRICUSPIDE VALVES

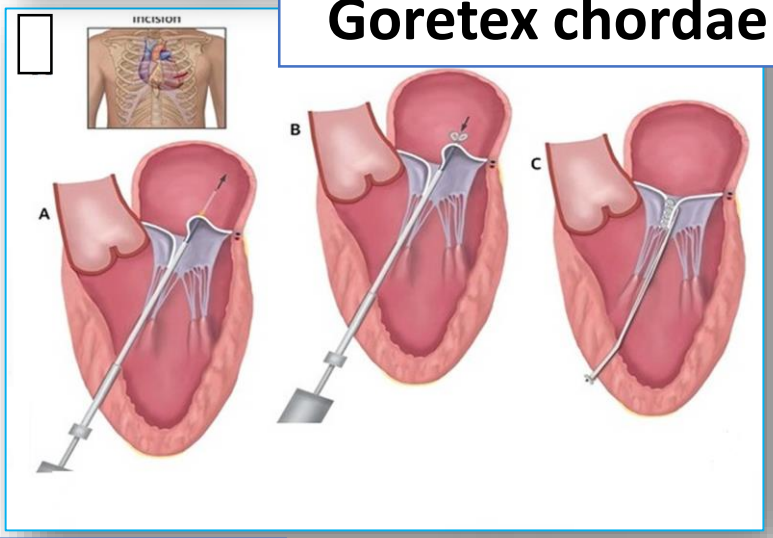
## Right Mini-thoracotomy



# … what the Future is preparing for Surgeons

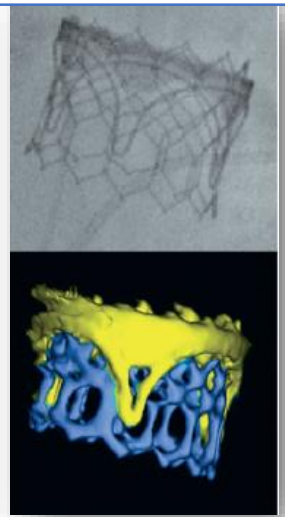
## Surgery *vs* Transcatheter Approachss

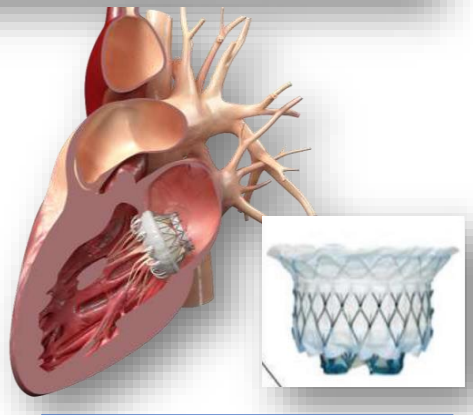
Goretex chordae



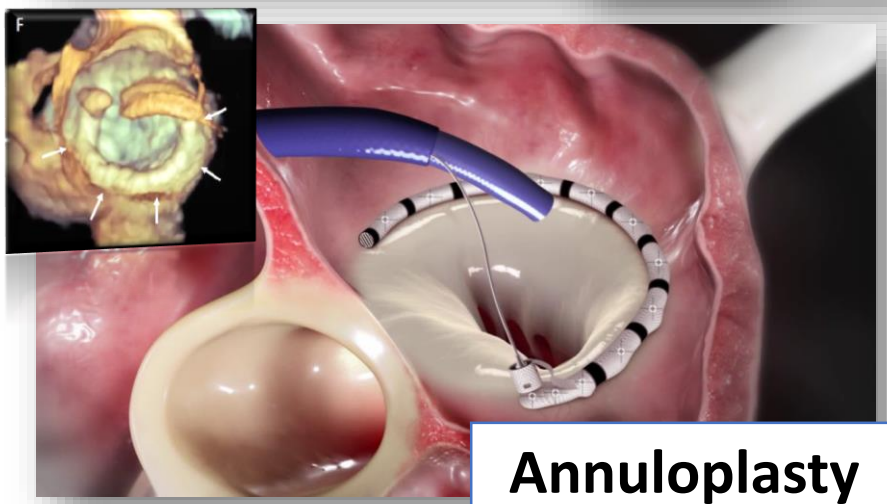

MitraClip

Valve in valve





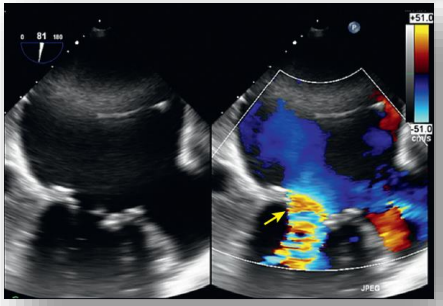
Mitral Valve Implantation

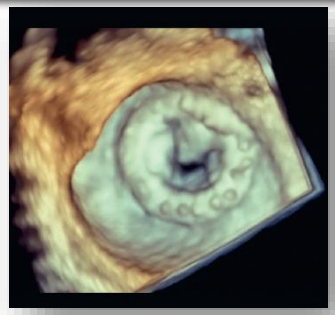


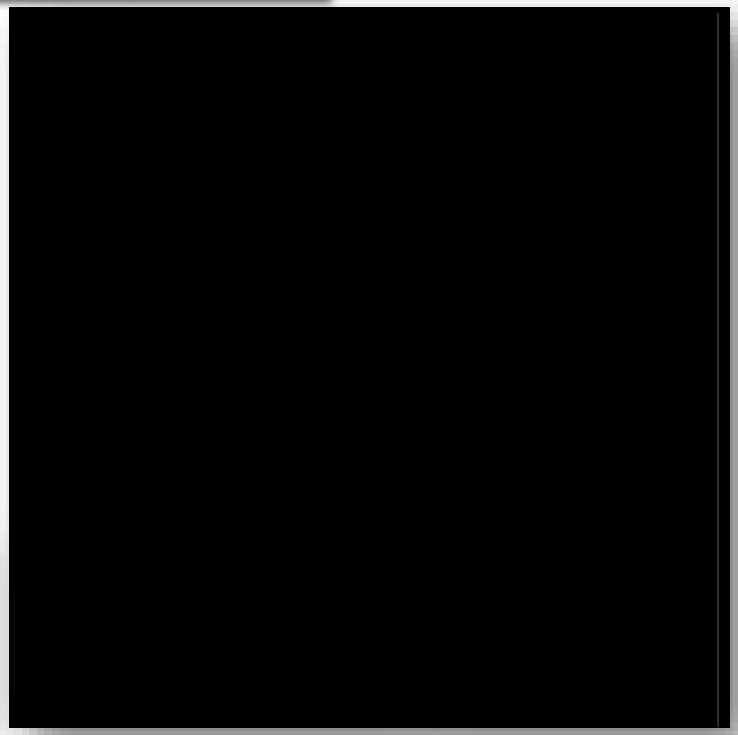
Annuloplasty

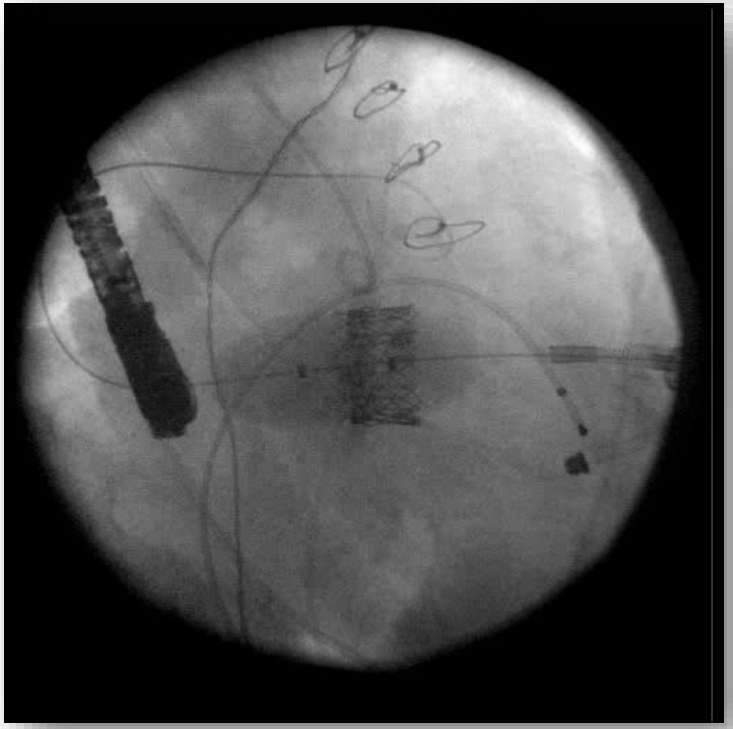
# Transcatheter Mitral Valve Implantation

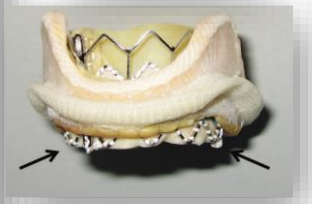
## Mitral Valve in Valve

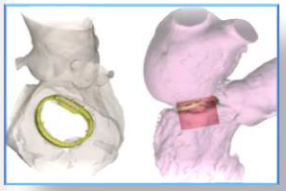


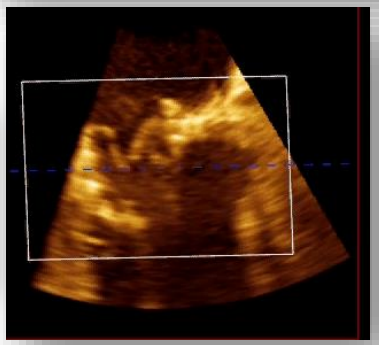


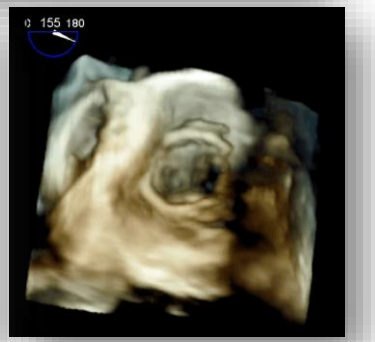






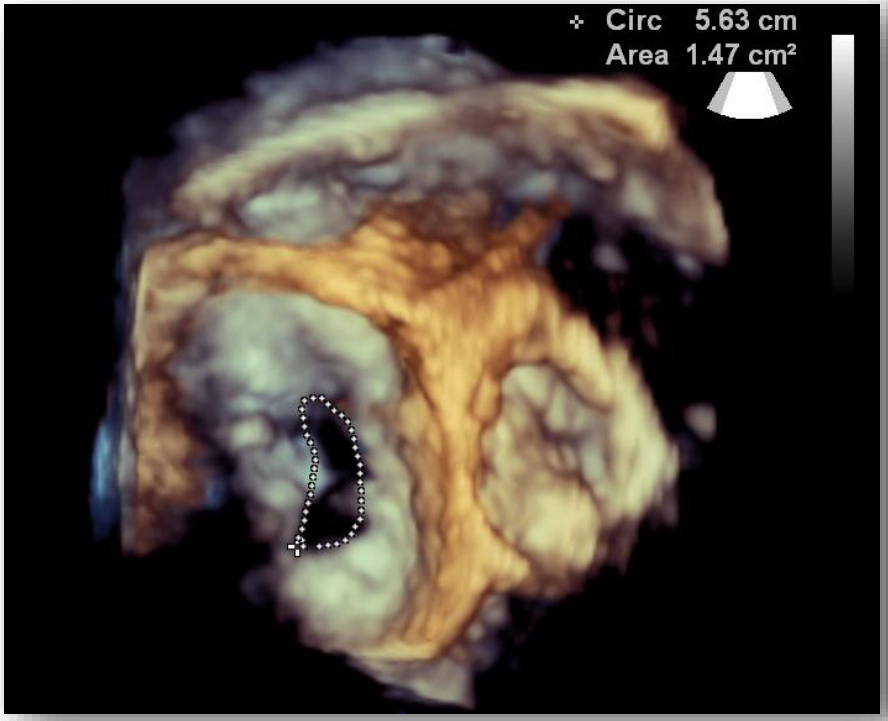


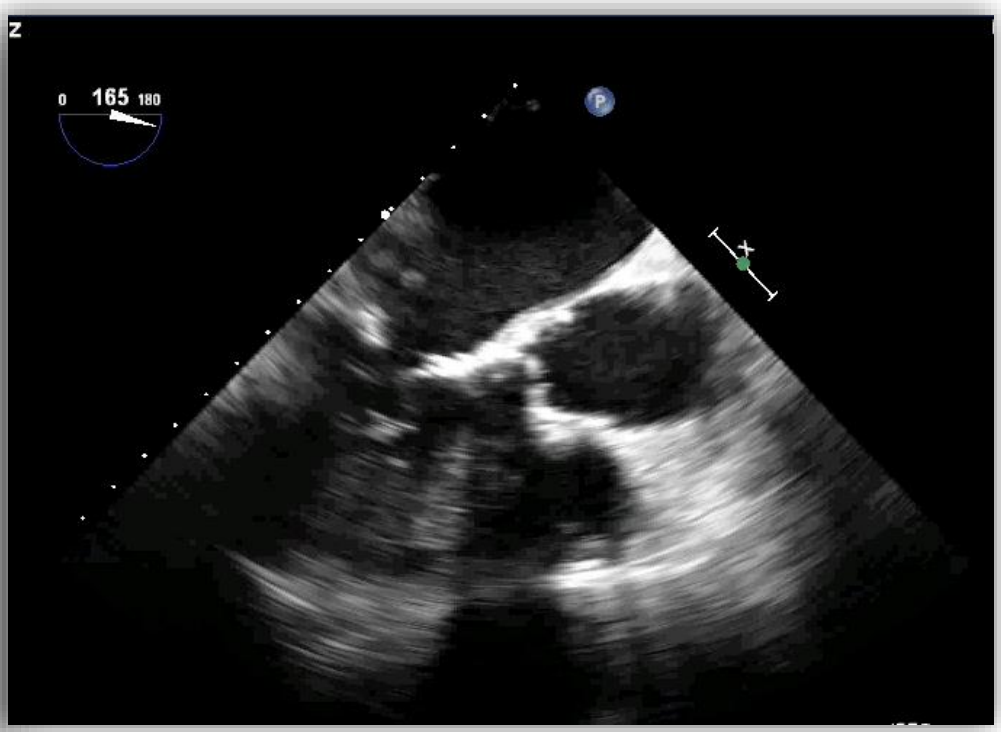




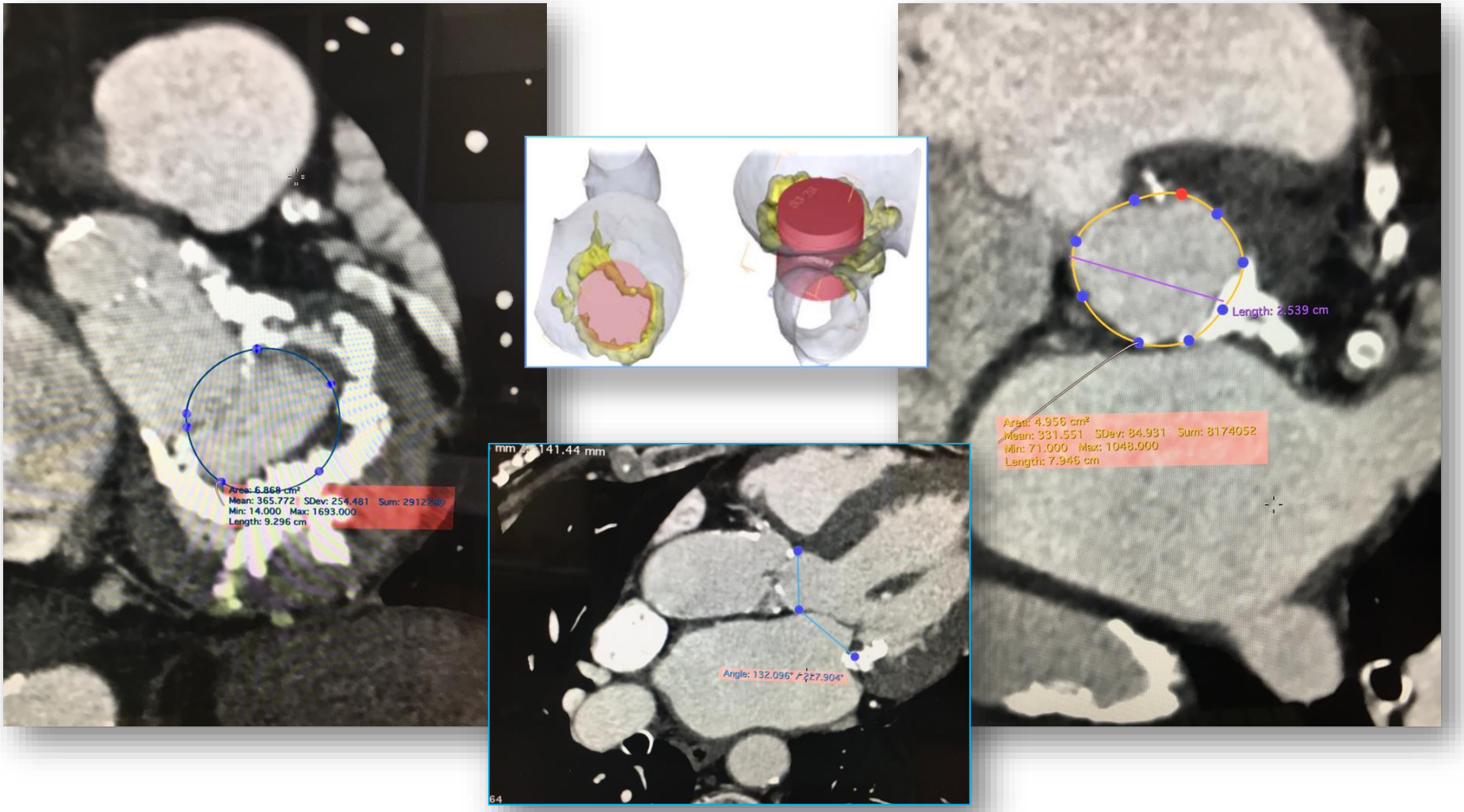
# Transcatheter Mitral Valve Implantation

## Haevly calcified Mitral and Aortic Valve



# The best imaging techniques to visualize MA calcification is undoubtedly CT



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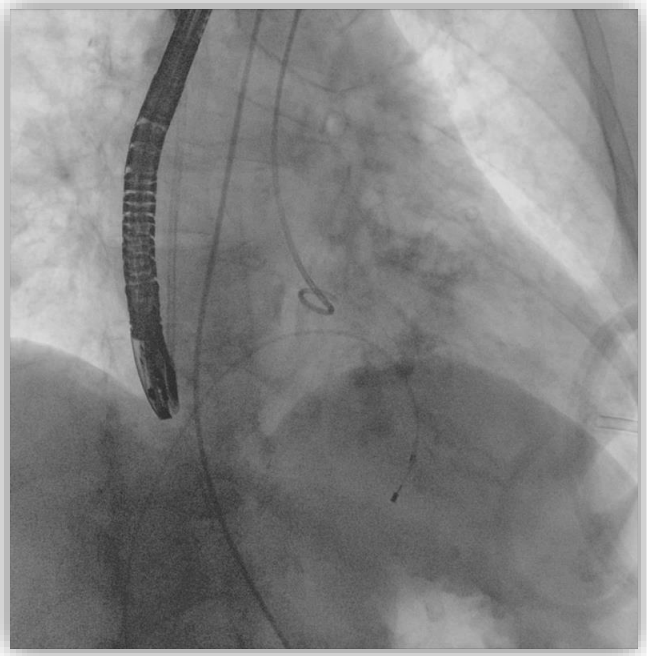
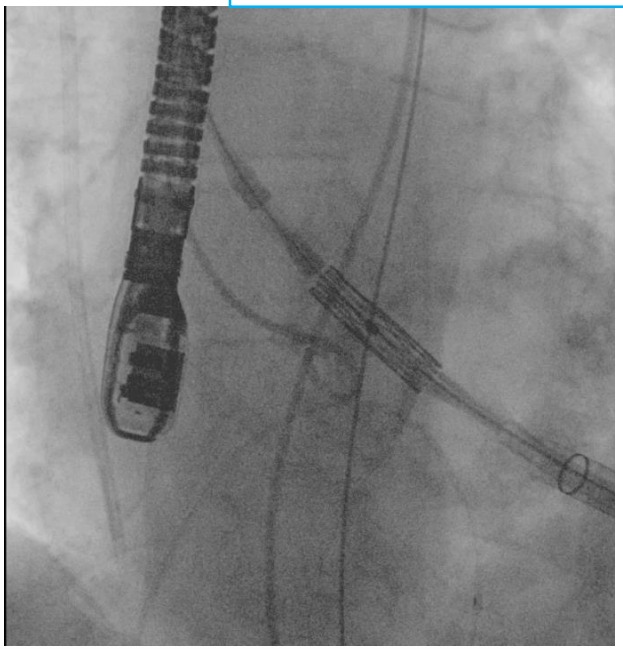
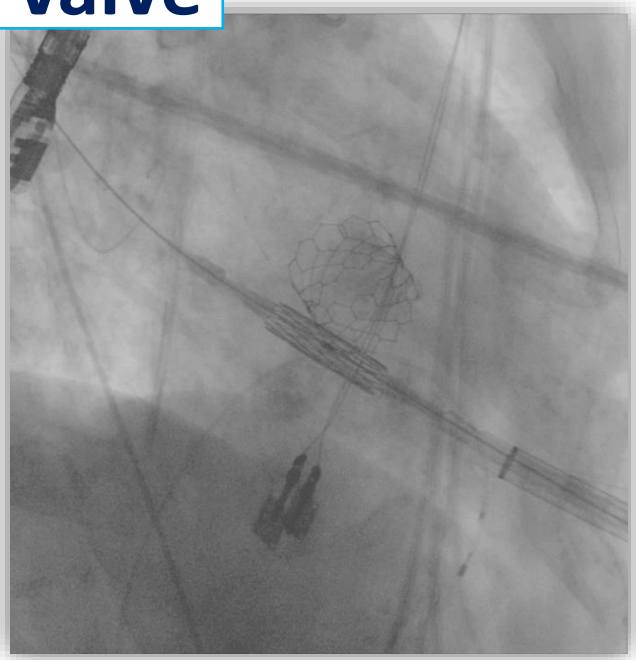
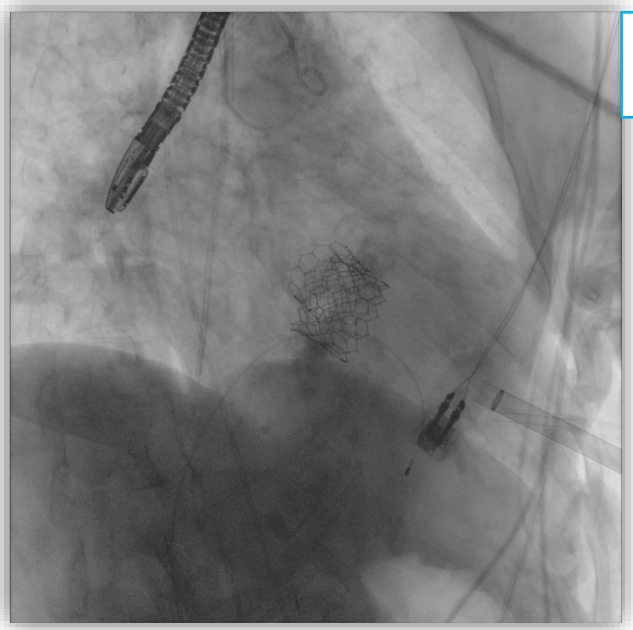


Aortic valve

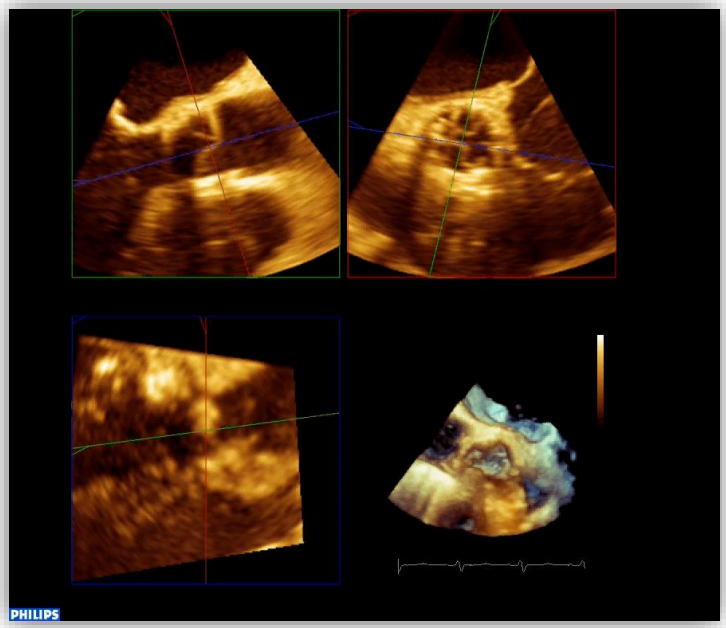


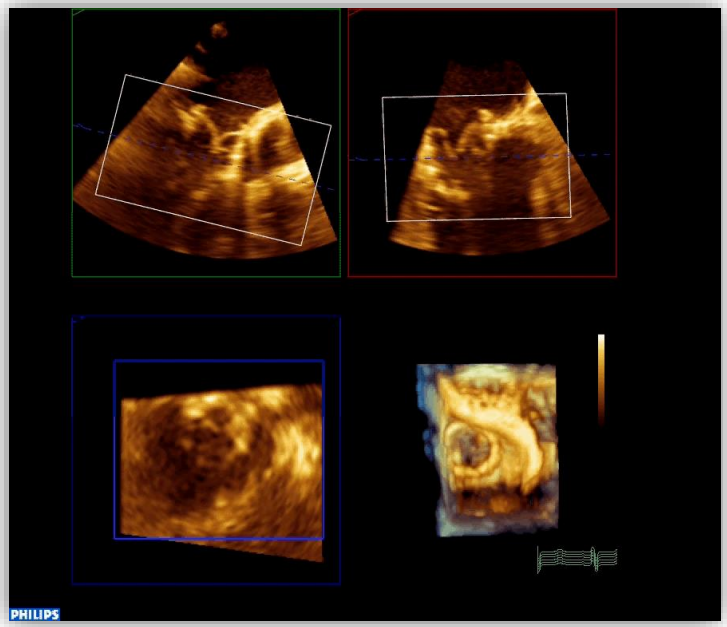
Mitral valve

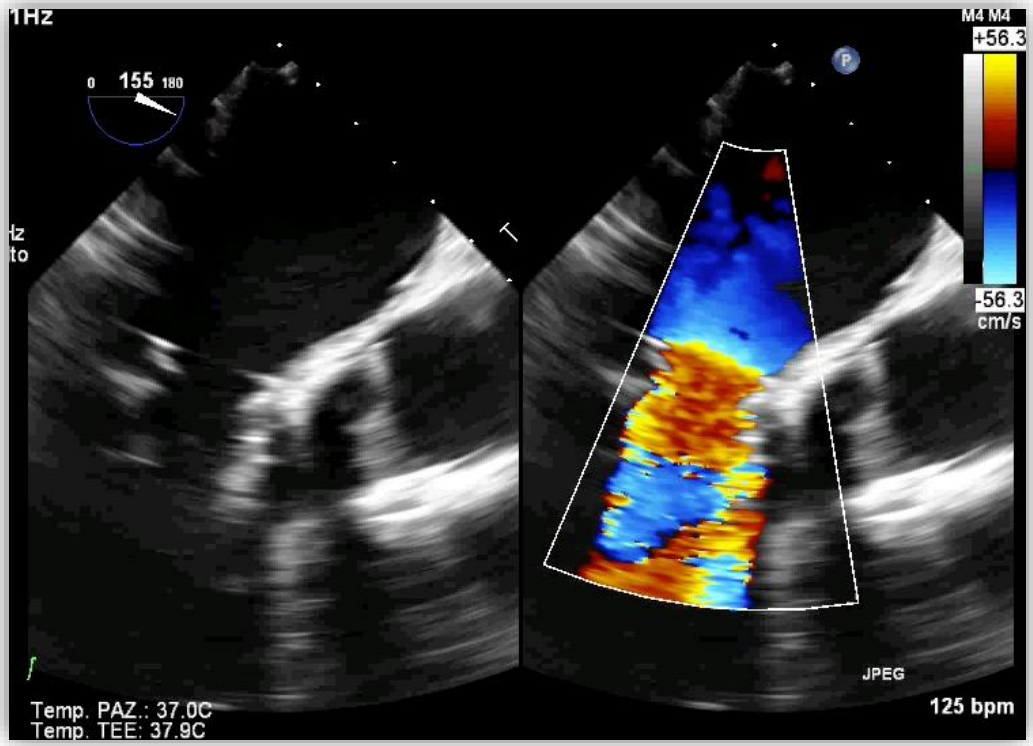




Final


PHILIPS


PHILIPS


THz
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M4 M4
+56.3
-56.3
cm/s
JPEG
Temp. PAZ.: 37.0C
Temp. TEE: 37.9C
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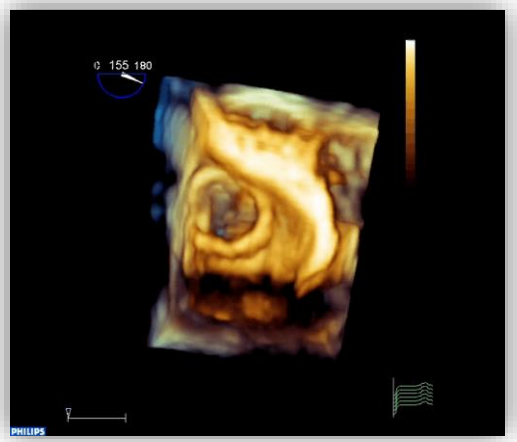
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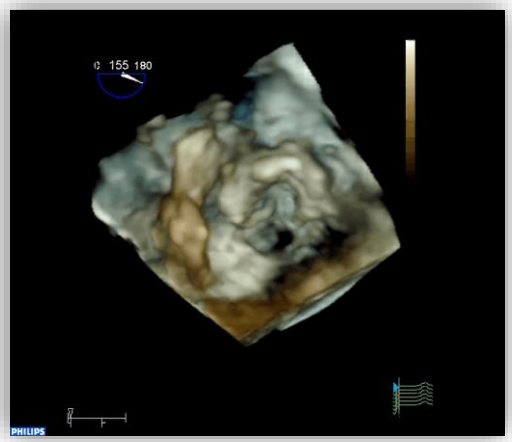
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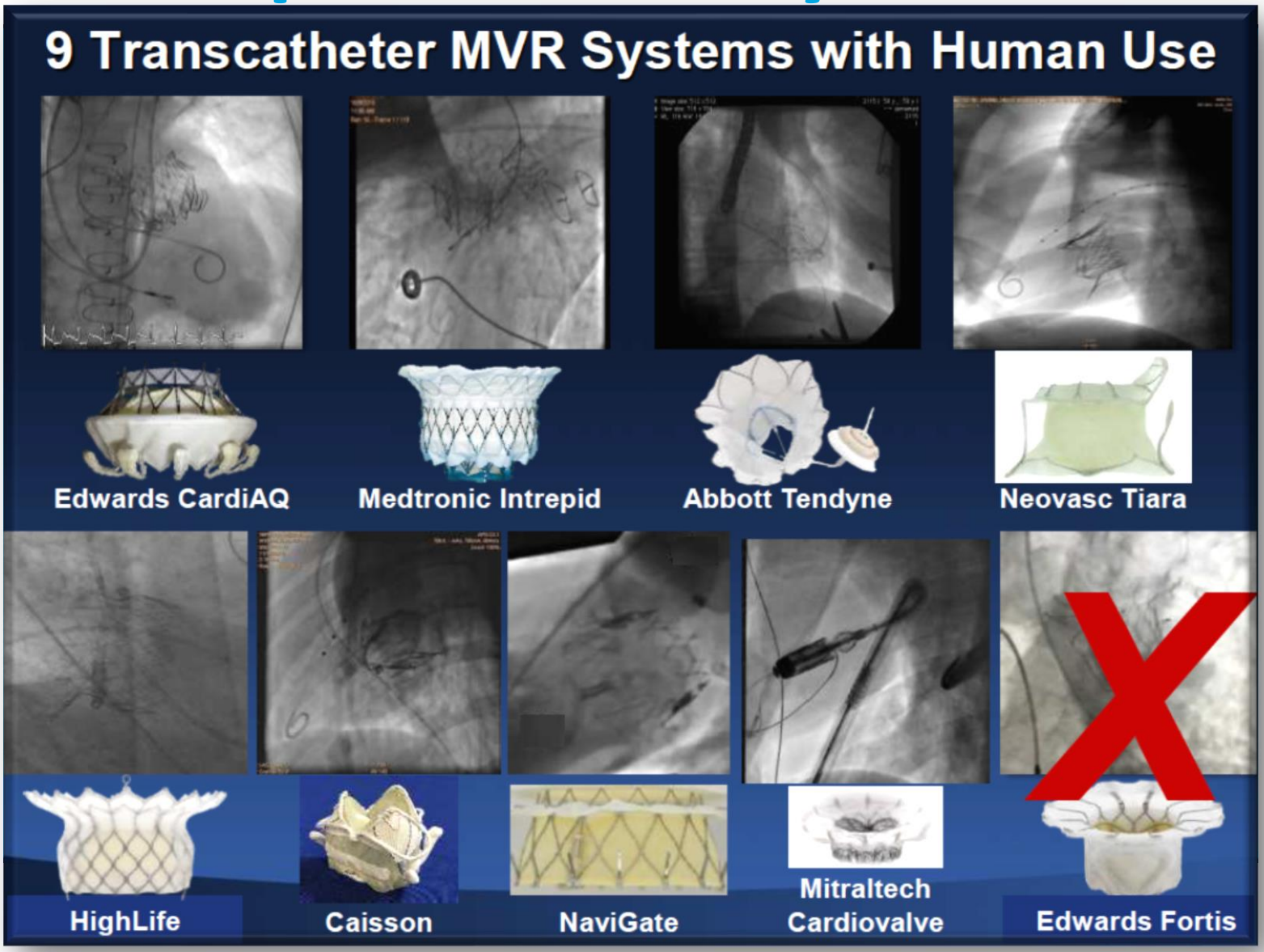
# Transcatheter Mitral Valve Replacement Systems

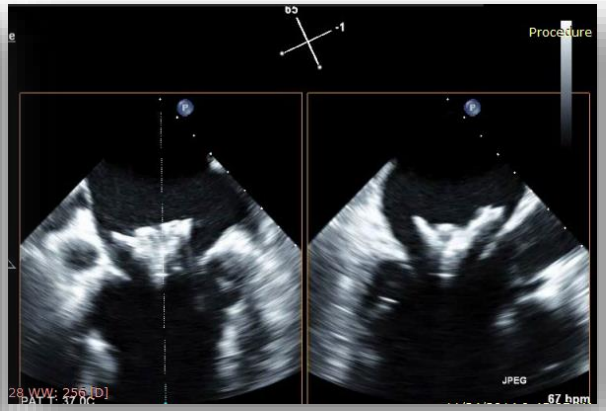


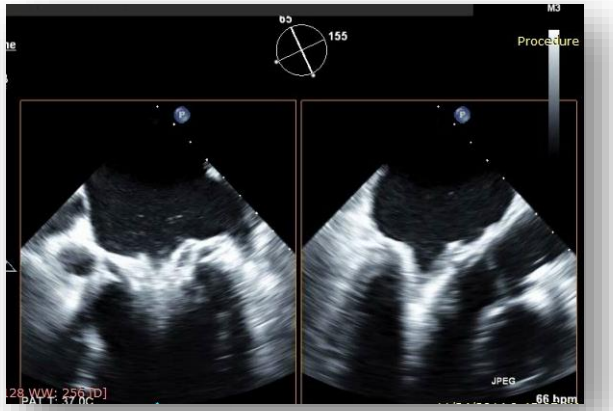
# Transcatheter Mitral Valve Implantation

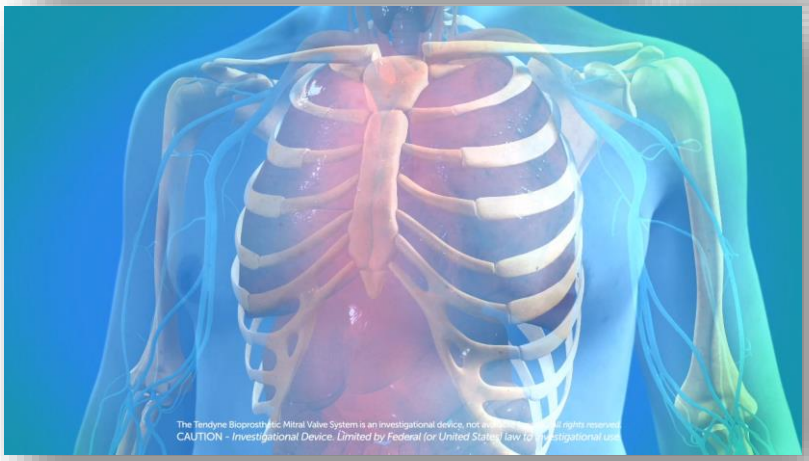
## Functional Mitral Regurgitation

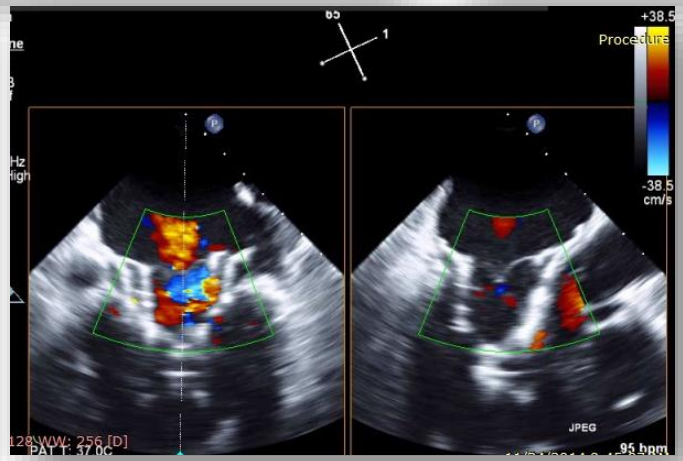
Deployment Step I

Deployment Step II



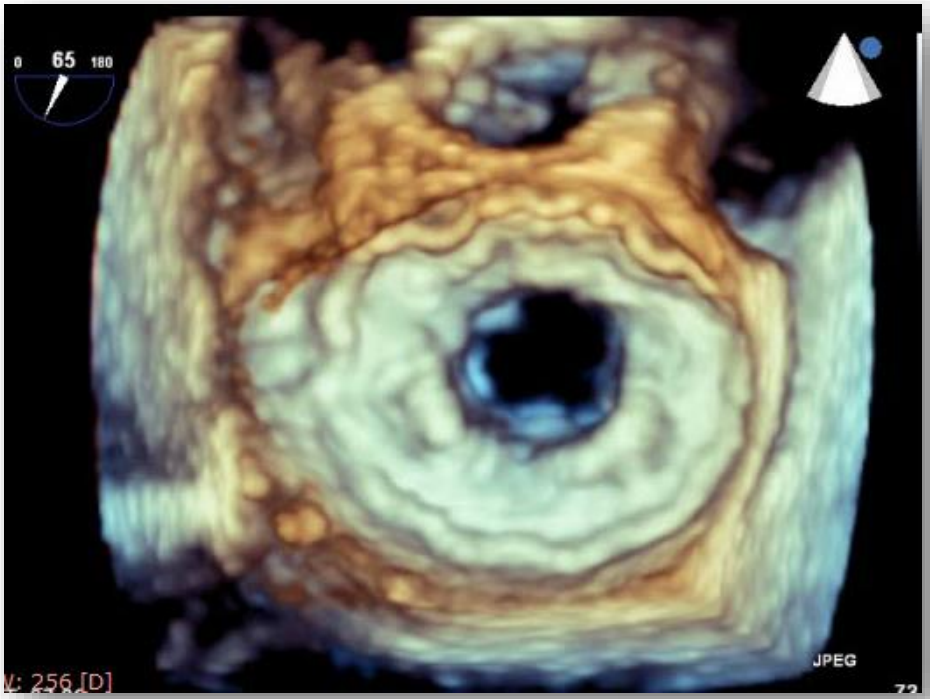



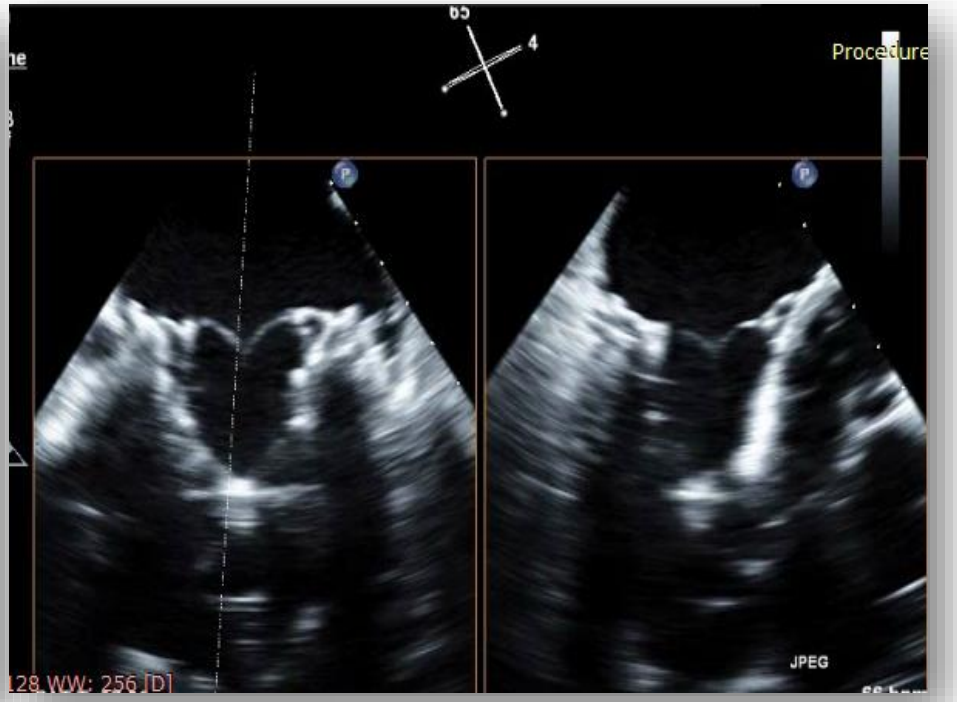



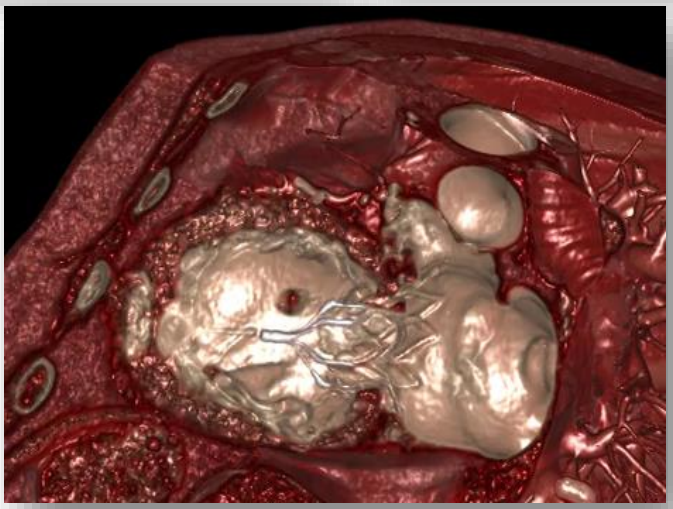




Post deployment echo

# Final result



# Evolving imaging technologies

## Mitral Annular Dimensions and Geometry in Patients With Functional Mitral Regurgitation and Mitral Valve Prolapse

### Implications for Transcatheter Mitral Valve Implantation

Christo
George
David
Philipp

## Multimodality Imaging in the Context of Transcatheter Mitral Valve Replacement

### Establishing Consensus Among Modalities and Disciplines

Philipp Blan
Paul Graybu

## Imaging for Mitral Interventions

### Methods and Efficacy

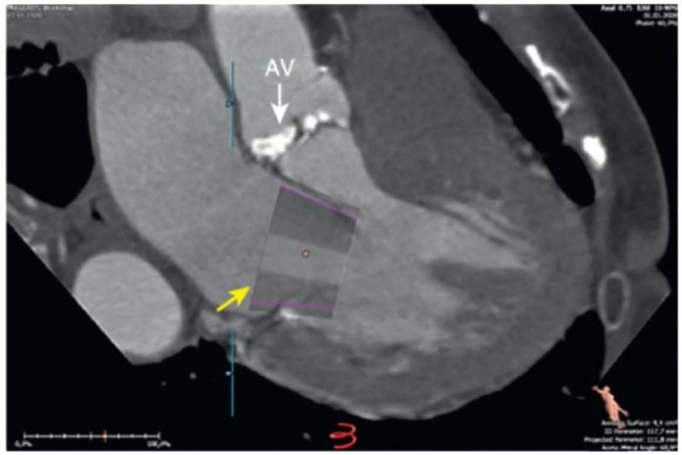
Nina C. Wunde
Eustachio Agric

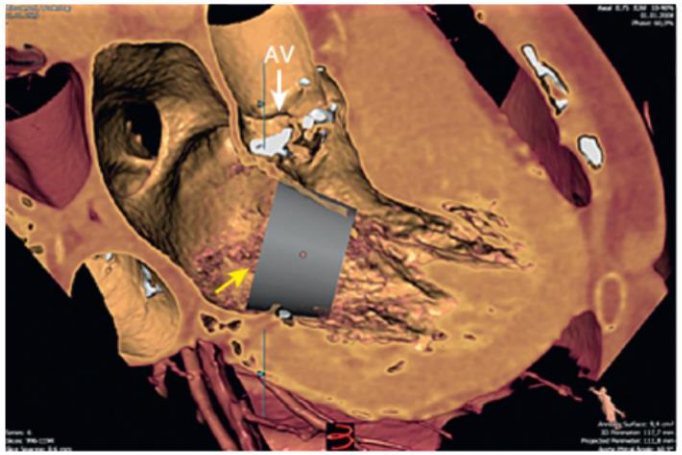
## Mitral Annular Evaluation With CT in the Context of Transcatheter Mitral Valve Replacement

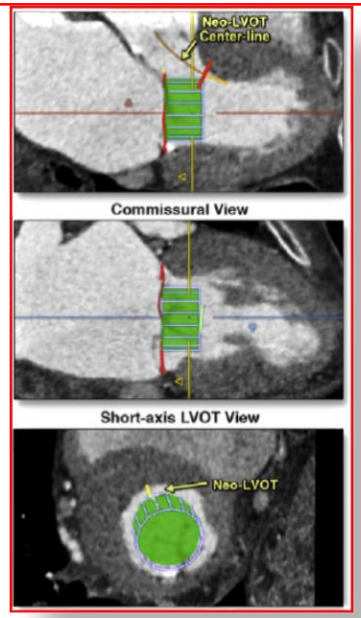
Philipp Blanke, MD,* Danny Dvir, MD,* Anson Cheung, MD,* Robert A. Levine, MD,† Christopher Thompson, MD,* John G. Webb, MD,* Jonathon Leipsic, MD*

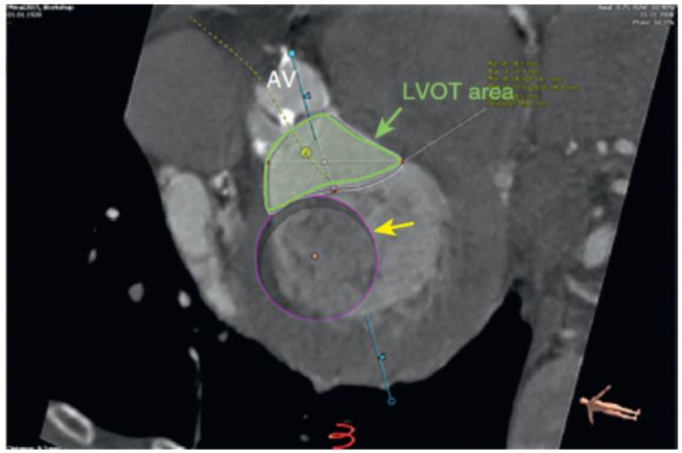
# Simulation of Transcatheter Mitral Valve Implantation

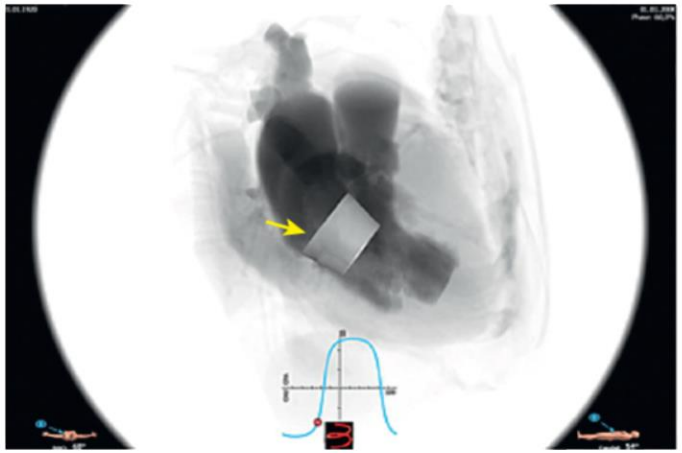
**High** risk for LVOT obstruction

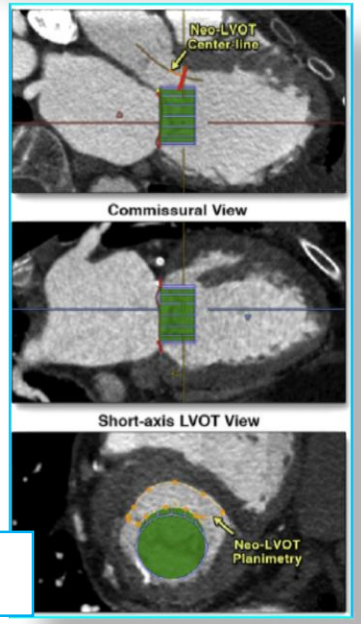


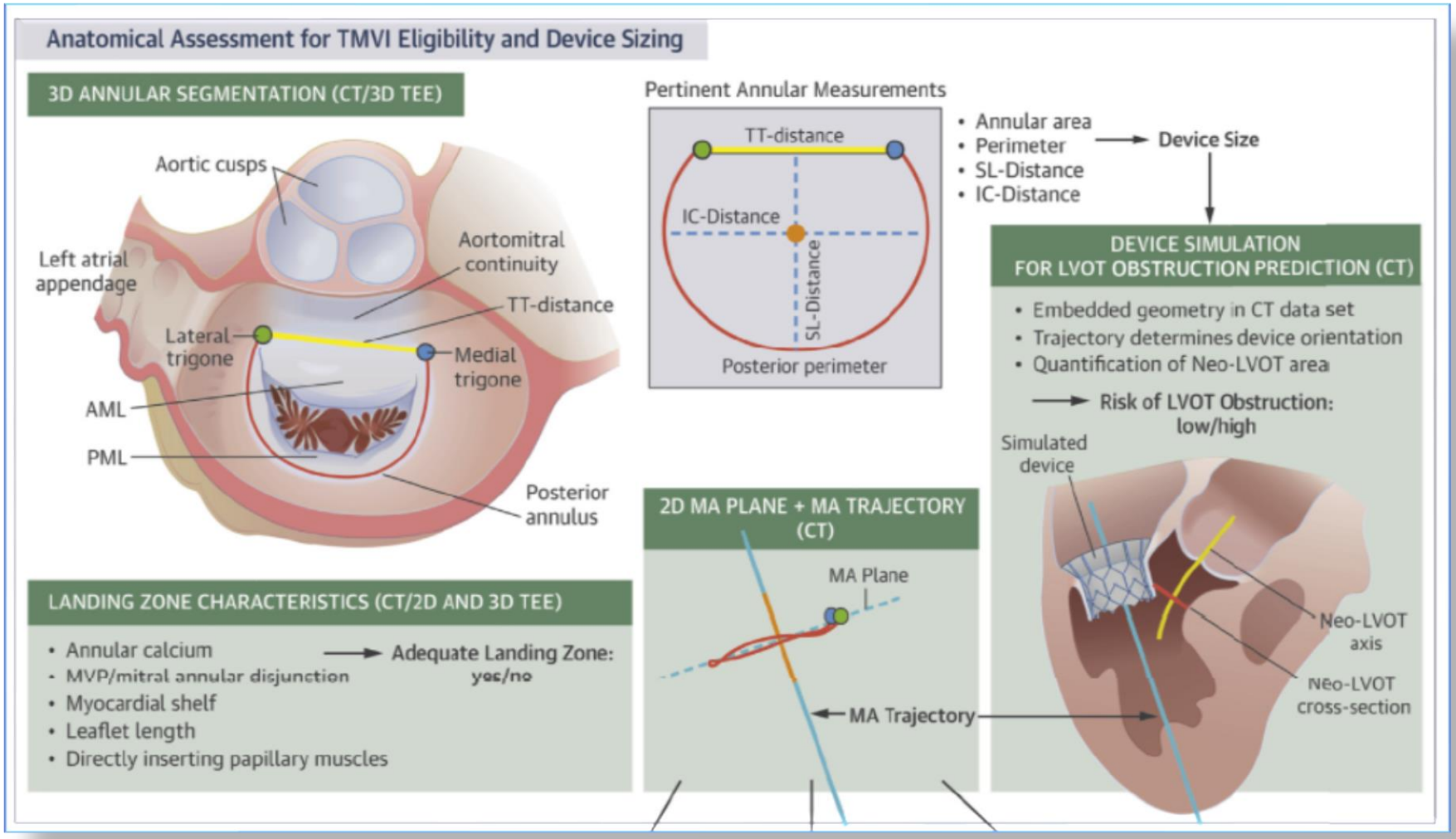



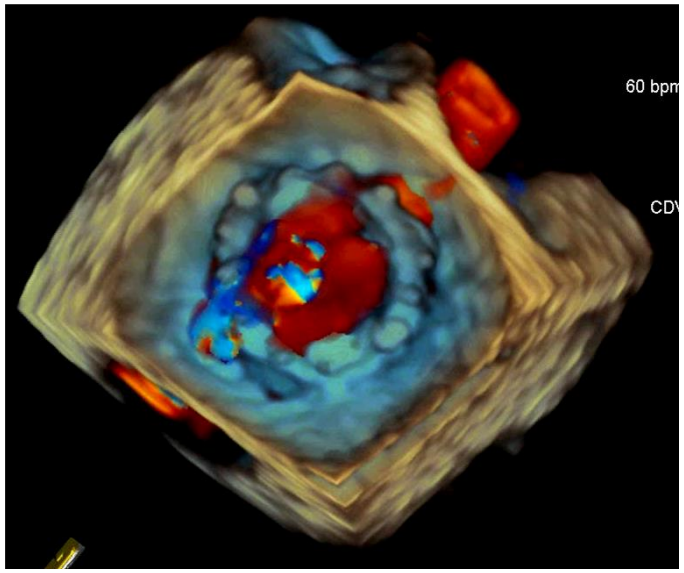



**Low** risk for LVOT obstruction

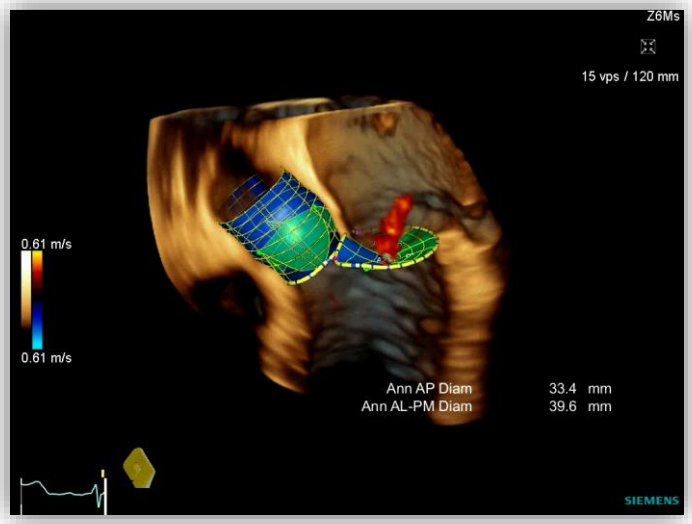
# Multimodality Imaging for TMVI



# Artificial Intelligence in Cardiology Imaging



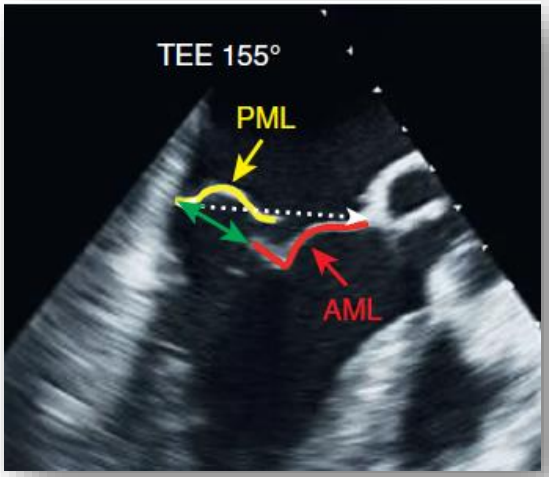

FUSION IMAGING increases diagnostic accuracy by combining anatomic, morphological, and functional information

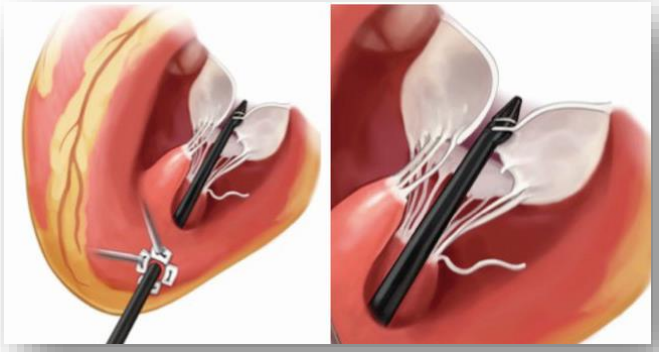


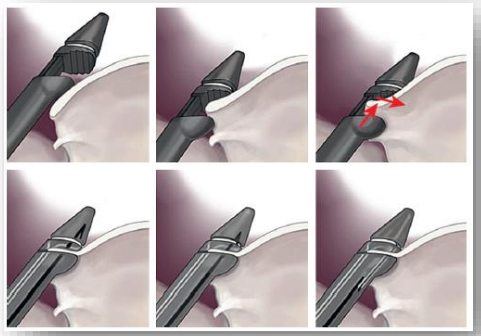


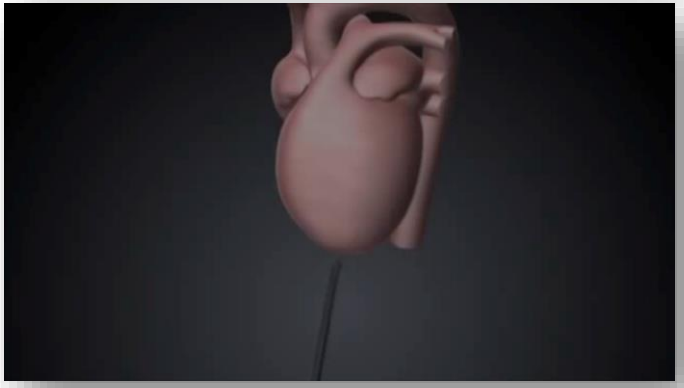
## Real-time fusion of echo and fluoroscopy

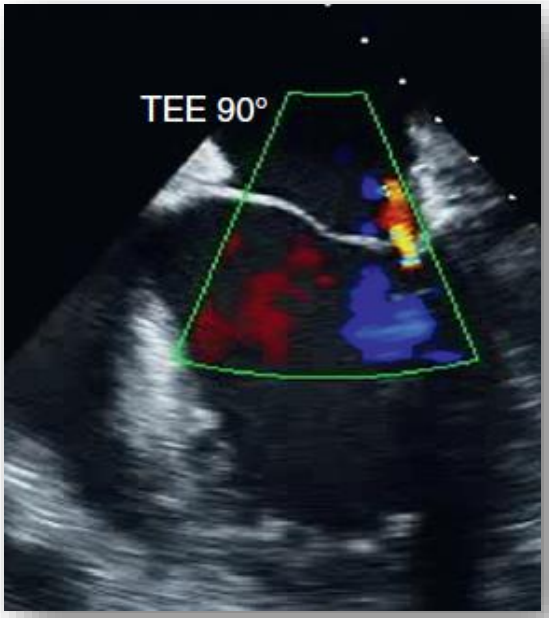
# NEOCHORD Implantation

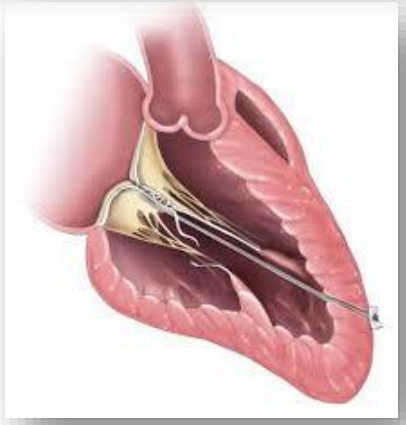


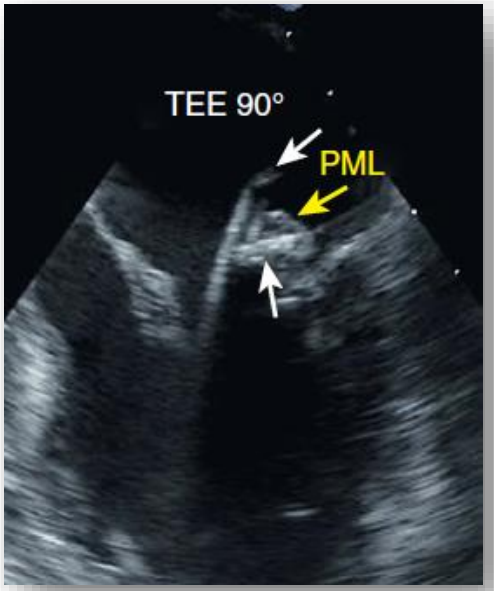











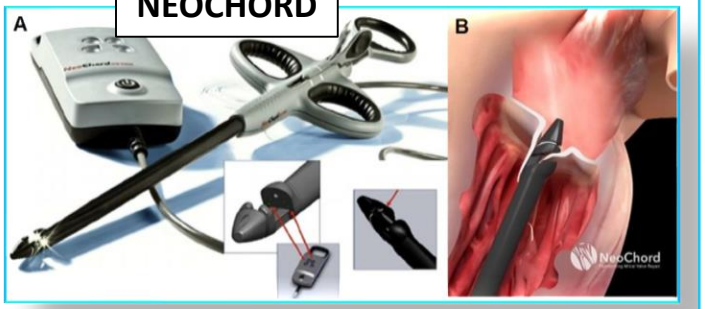
# Transcatheter Mitral Valve Chordal Repair: Current Indications and Future Perspectives

Alessandro Fiocco [1], Matteo Nadali [1], Giovanni Speziali [2] and Andrea Colli [1,3*]

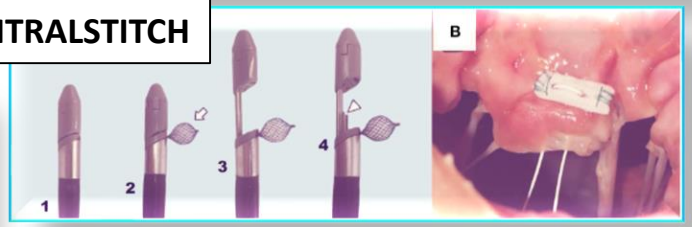
[1] Cardiac Surgery Unit, Department of Cardiac, Thoracic and Vascular Sciences, University of Padua, Padua, Italy, [2] Division of Cardiac Surgery, St. Louis University, Saint L... Vascular Department, University of Pisa, Pisa, ...

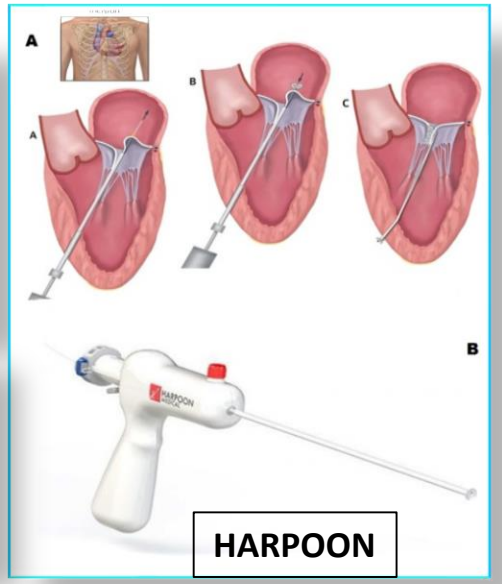
September 2019

NEOCHORD




MITRALSTITCH

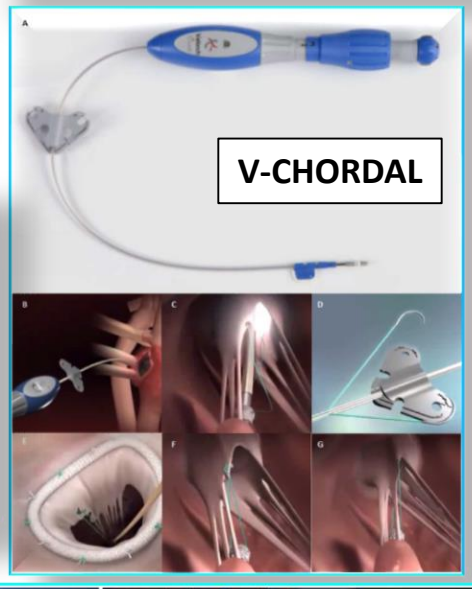


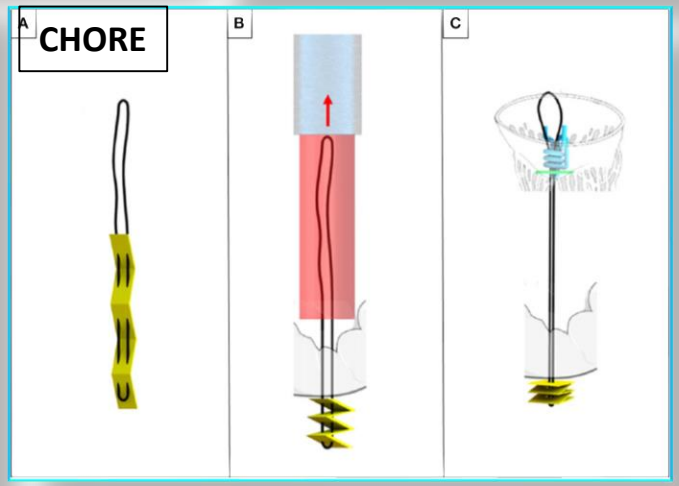


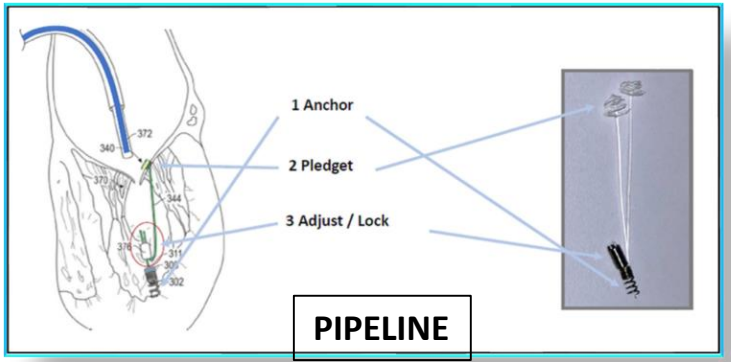
CHORDART

V-CHORDAL



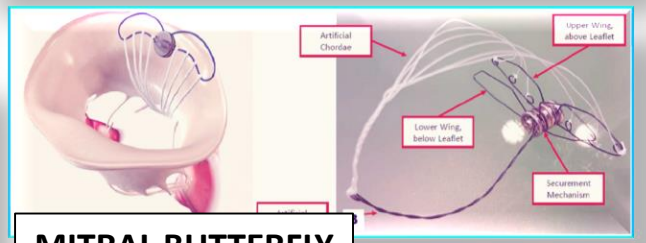

CHORE



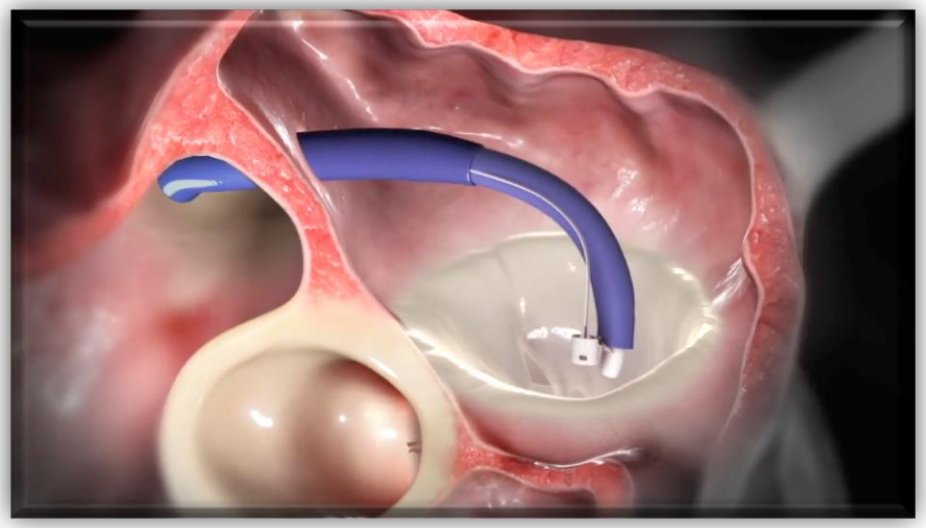

PIPELINE


CARDIOMECH

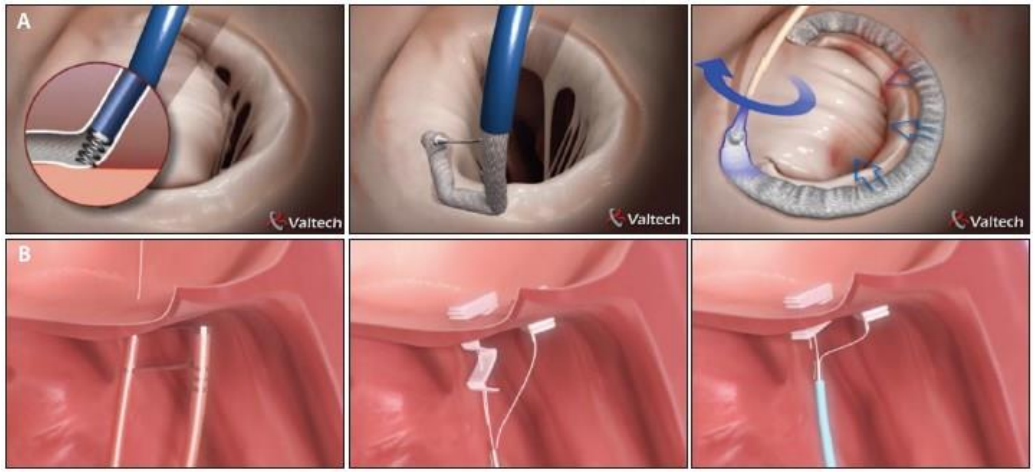



MITRAL BUTTERFLY

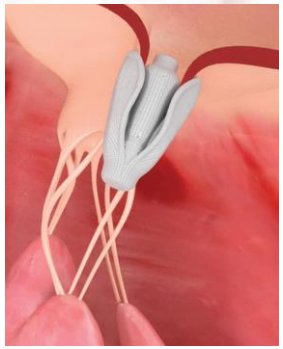
# Cardioband



## Association of Cardioband and…..

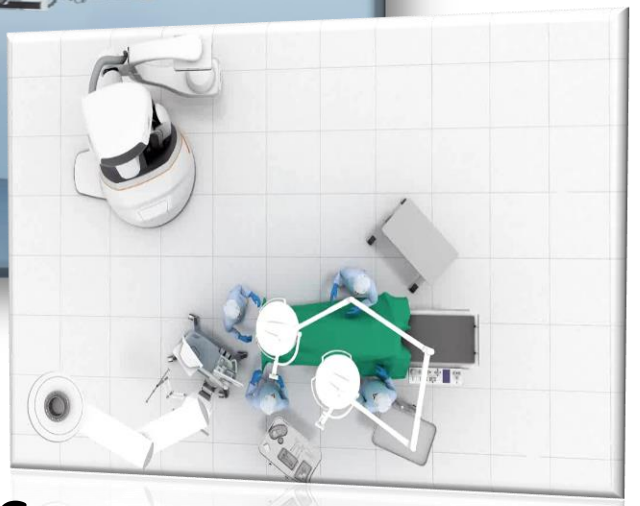



Trans-catheter chordal repair



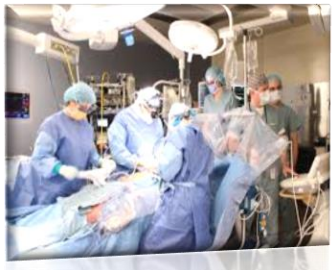
MitraClip

# Hybrid Operating Room



## Equipment

- *Surgical and Cath-lab facilities*
- *Angiography with 3D multimodal imaging*
- *2D/3D Trans-Esophageal Echo facilities*



# Trans-catheter Cardiac Surgeon

Can do **conventional** surgery, **minimally invasive** surgery, **trans-catheter** surgery and therefore **can choose** the most appropriate procedure for the each patient with **no bias**

# Conclusion

- A Minimally Invasive access is today the standard for Mitral Valve surgery.
- Over 95% surgical repair and exc… results can be expected fo… …itral Valve regurgitation
- Untill long … …and effectiveness are pr… …ter-based technology have to be … …gh risk patients and heart failure … …nts with a limited a life expectancy.
- The maintanance of high quality decision-making and excellent outcomes requires patients to be referred to highly experienced Centres.

**Thank you for your attention!**