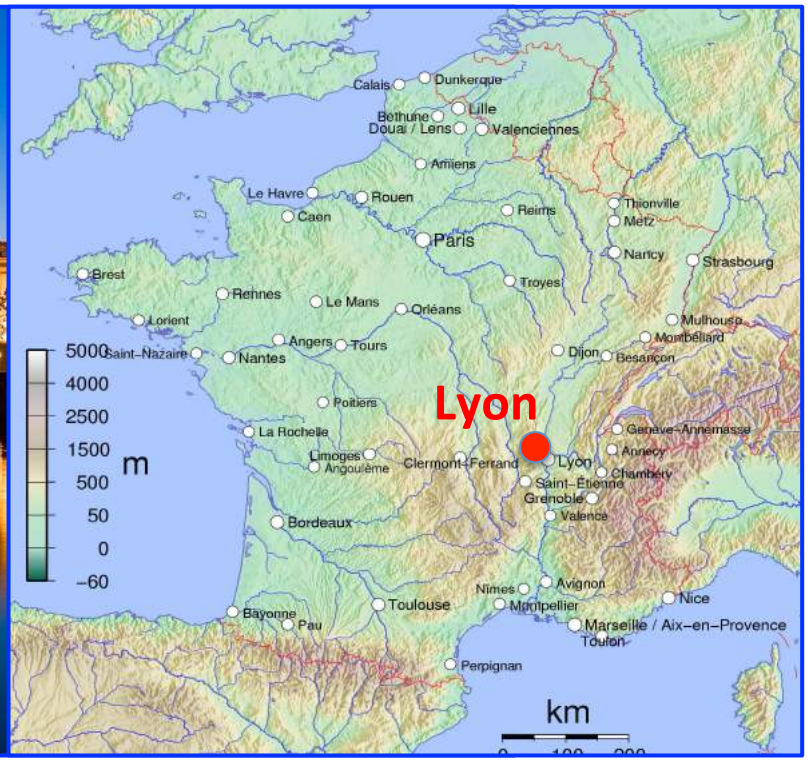
Hospices Civils de Lyon

# Modalités récentes de la correction des dysfonctionnement Valvulaires *JF Obadia (Lyon)*



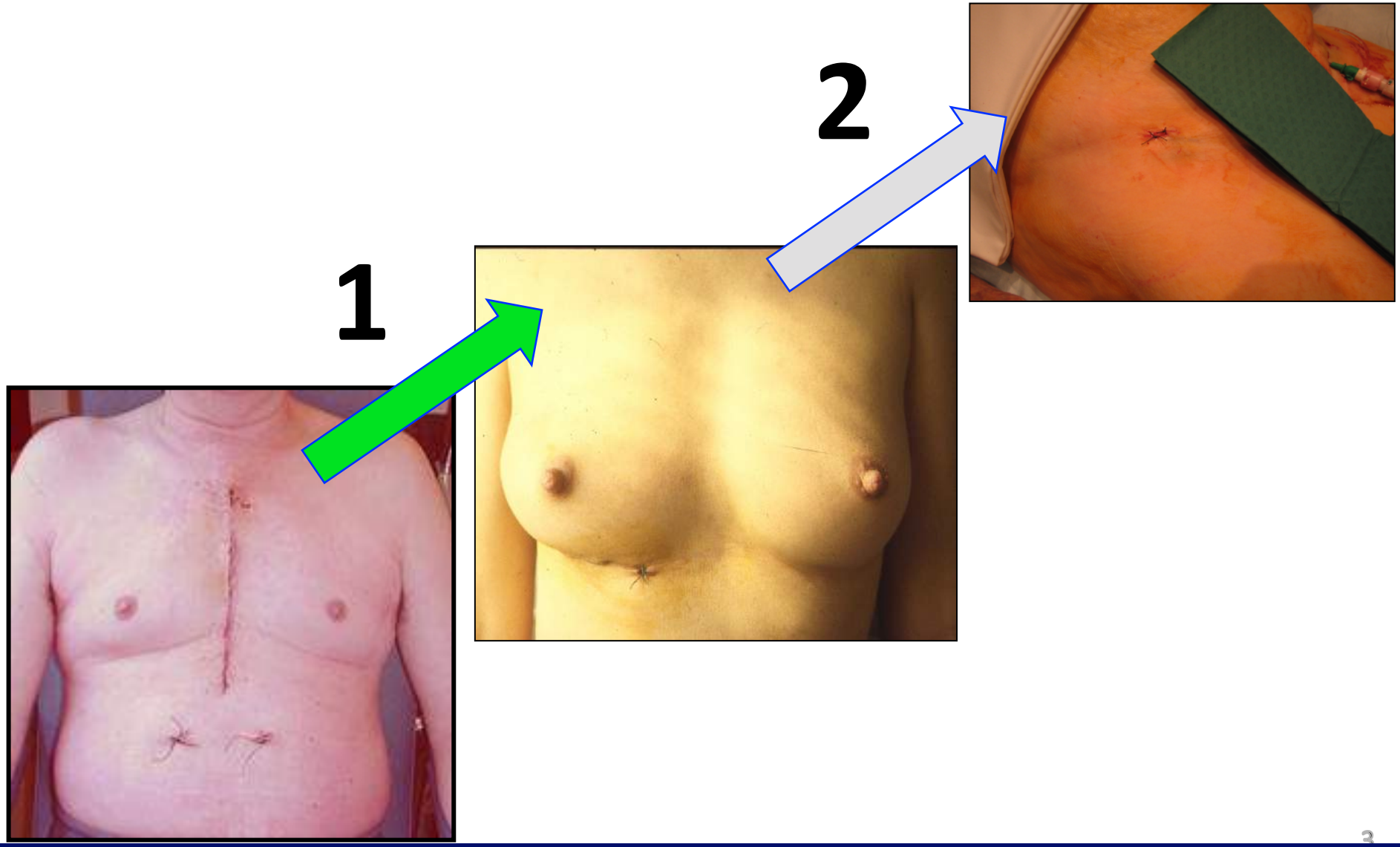


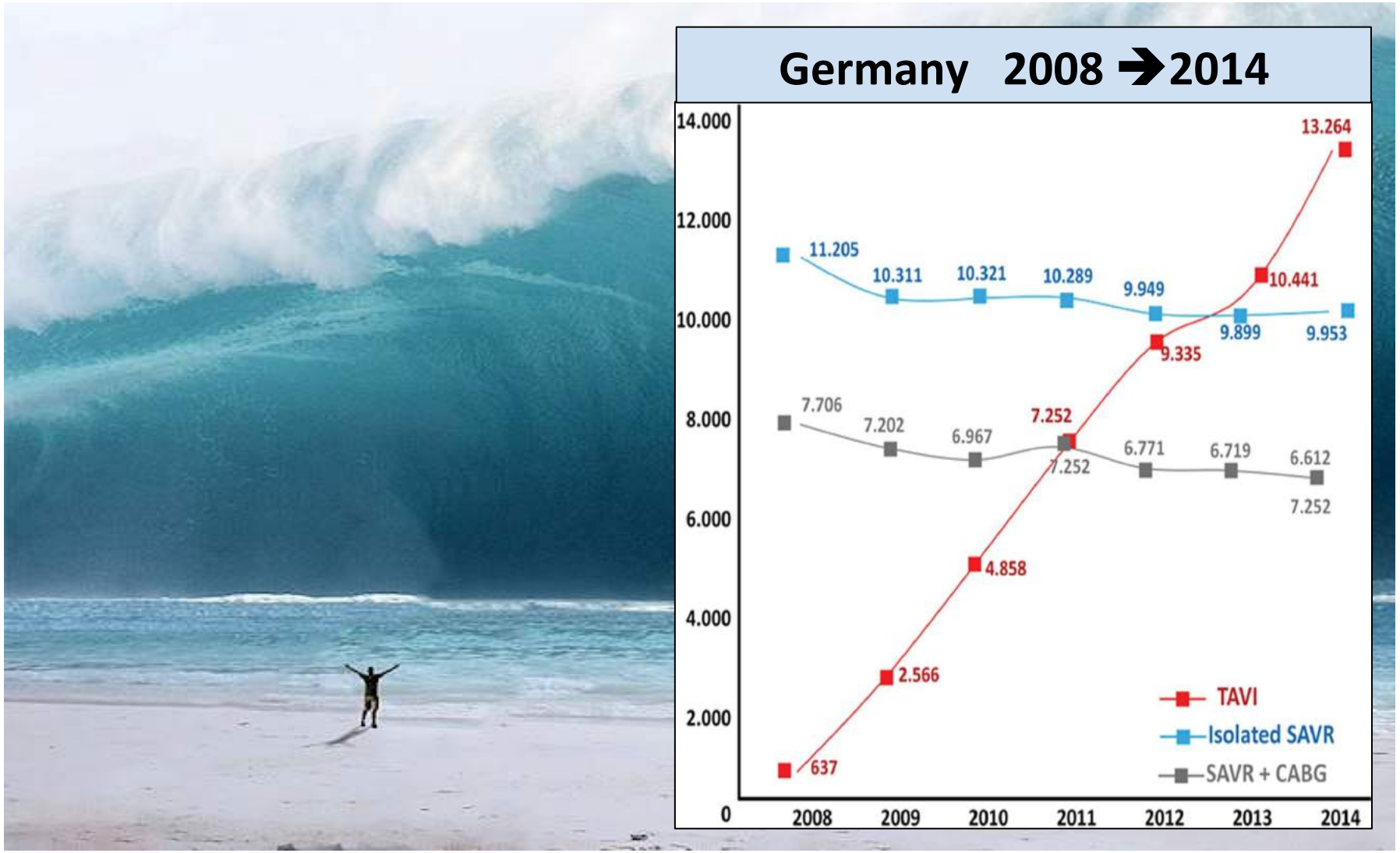
*Cardiothoracic and Vascular Surgery Department*
*Hôpital Louis Pradel*
**LYON - France**

Hospices Civils de Lyon

| *Disclosure Statement of Financial Interest* | List of companies |
|---|---|
| **> Grant/Research Support** | Boeringher, Abbott, Medtronic, Edwards |
| **> Consulting Fees/Honoraria** | Edwards, Saint Jude Medical, Medtronic, Servier, Novartis |
| **> Major Stock Shareholder/ Equity** | |
| **> Royalty Income** | Landanger, Delacroix-Chevalier |
| **> Ownership/Founder** | |
| **> Intellectual Property Rights** | Landanger, Delacroix-Chevalier |
| **> Other Financial Benefit** | Sorin, Thoratec, Astra Zeneca |

# From sternotomy to percutaneous procedure






*Eggebrecht H, Mehta R EuroIntervention 2016;11:1029-1033*


**In 2016, 5 issues deserve a particular attention and represent the matter of debate to limit the enlargement of the indications**

1) ~~*Neurologic Complications*~~

2) ~~*Vascular Complications*~~

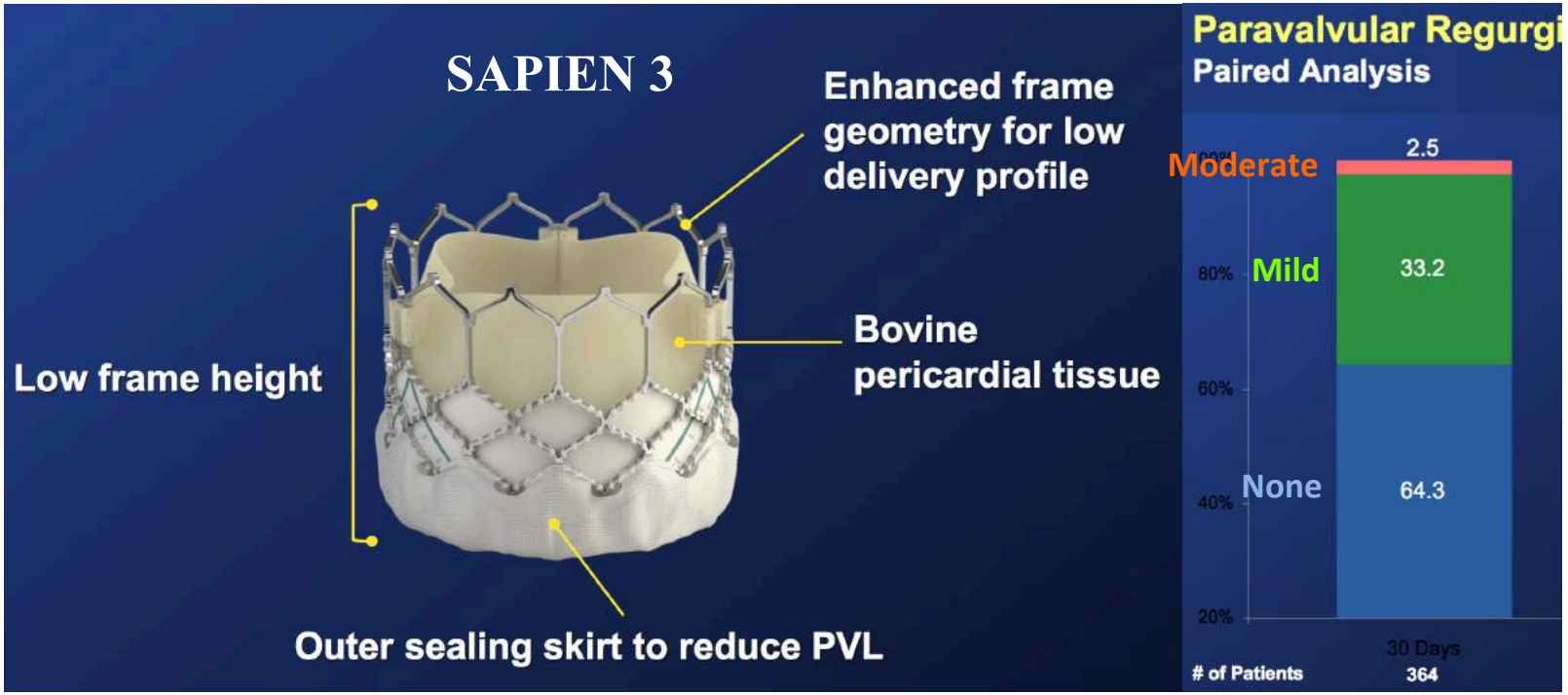
3) ~~*Residual Aortic Regurgitation*~~

4) ***Pacemaker Implantation***

5) ***Durability of the biological prostheses***

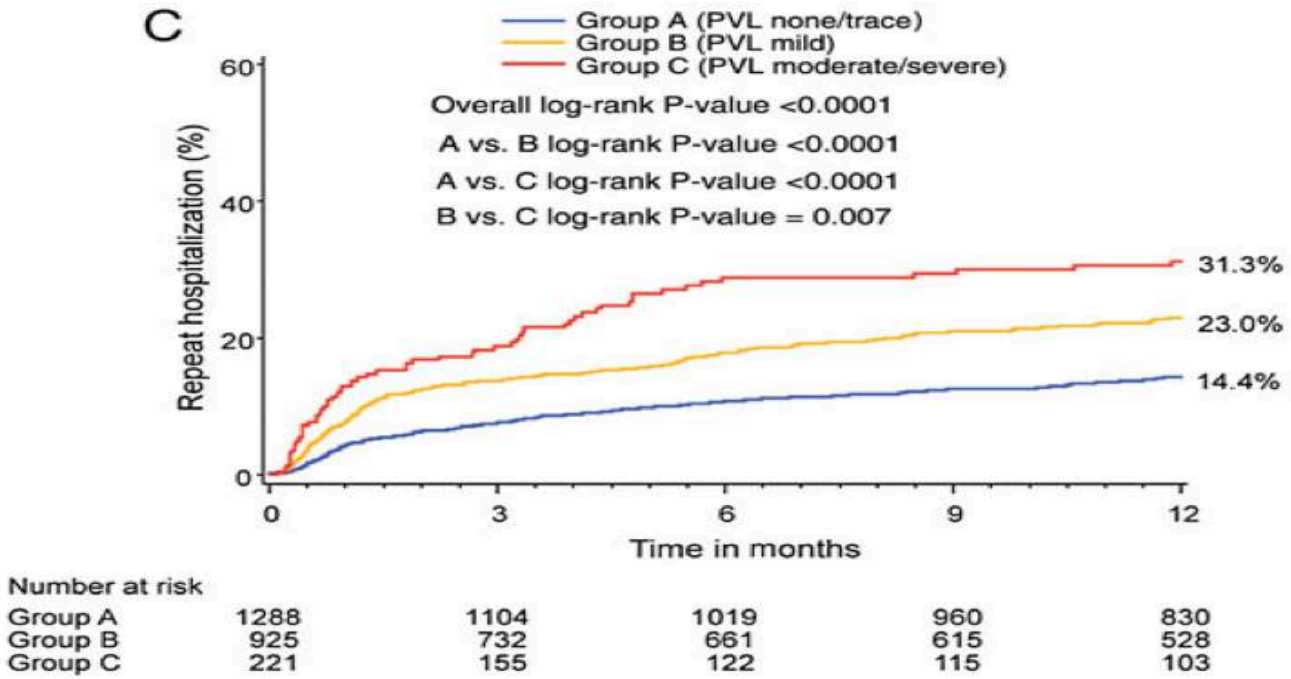
# 1) RESIDUAL AORTIC REGURG.

*Howard C. Herrman on behalf of*
*The PARTNER II Trial Investigators.* *TCT 2015*

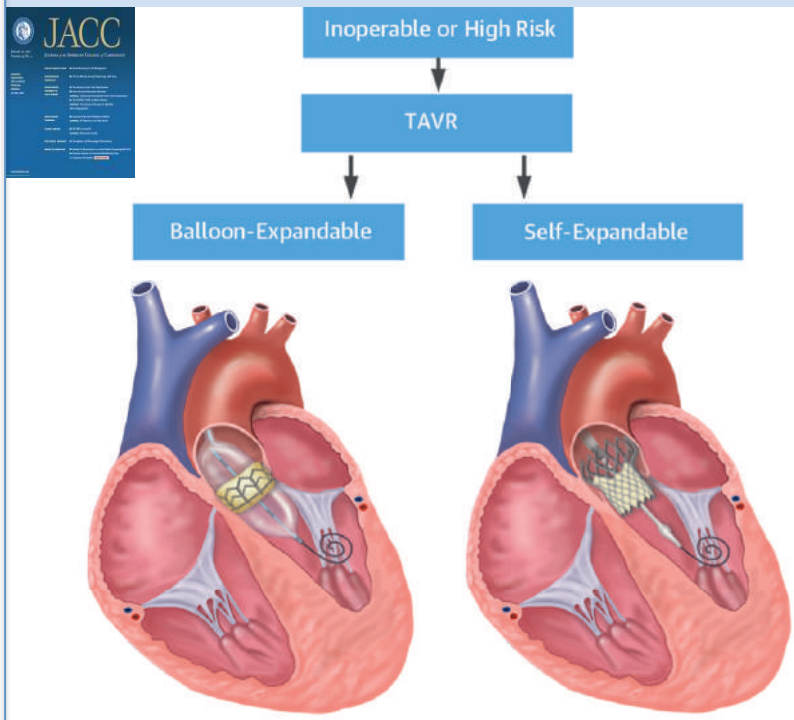
# 1) RESIDUAL AORTIC REGURGITATION

***Paravalvular regurgitation in the PARTNER trial***
***Kodali et al. Eur Heart J 2015;36:449-56***

# 4) PACEMAKER IMPLANTATION

***Results From the CHOICE Randomized Clinical Trial***
***Abdel-Wahab M, JACC VOL. 66, NO. 7, 2015***

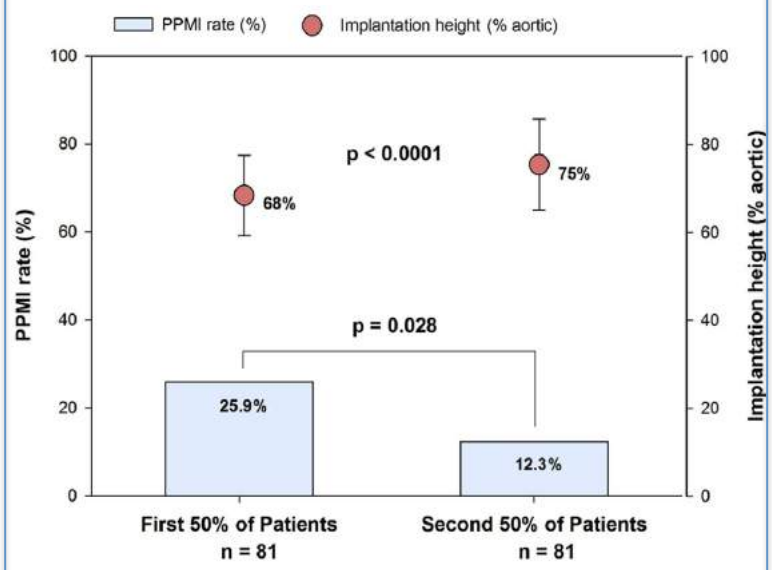



**New Pace Maker**

**23%** **38%**

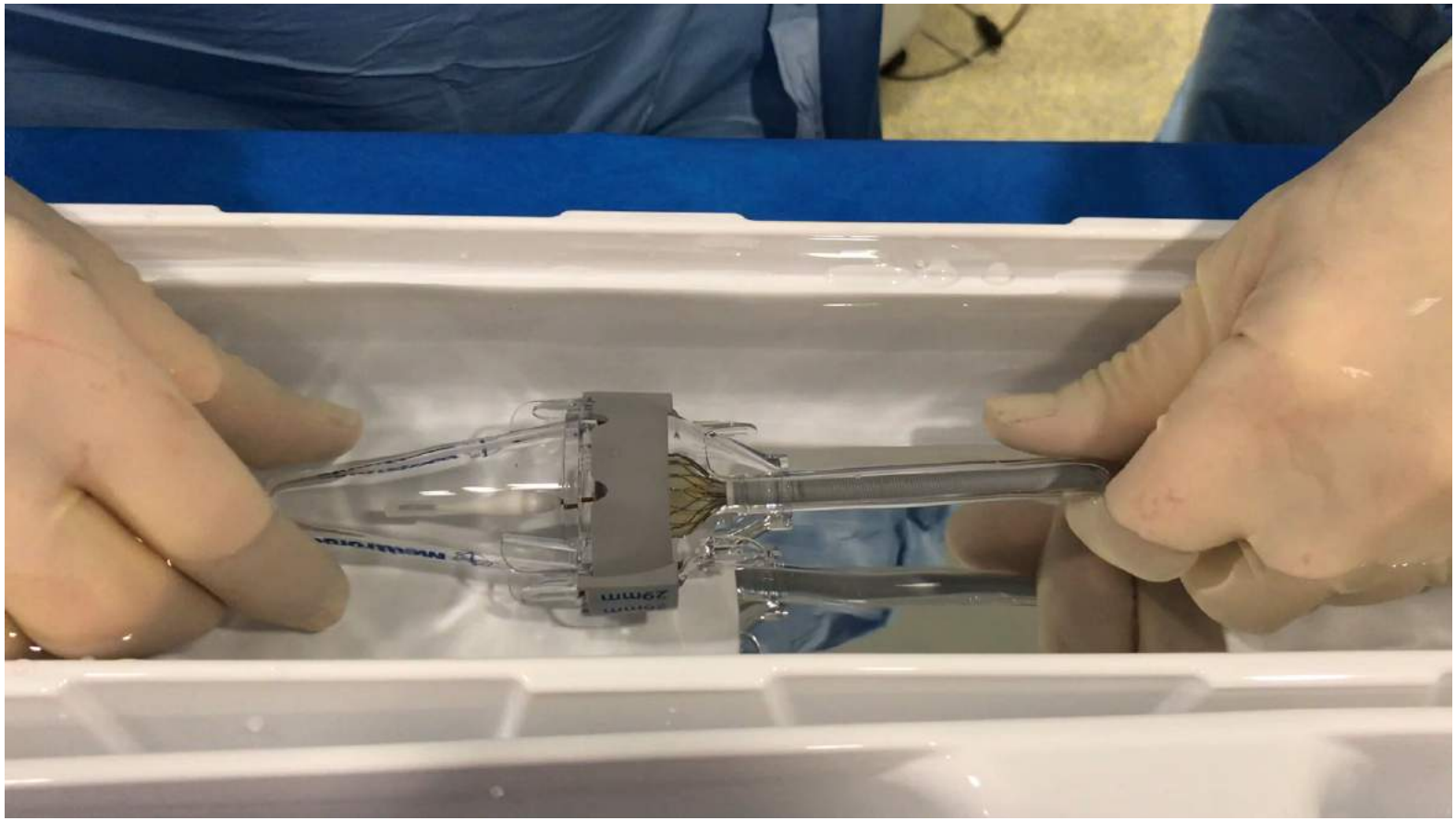
## Changes in the Pacemaker Rate After Transition From Edwards SAPIEN XT to SAPIEN 3 Transcatheter Aortic Valve Implantation

**JACC Intv 2016**




**New Pace Maker**

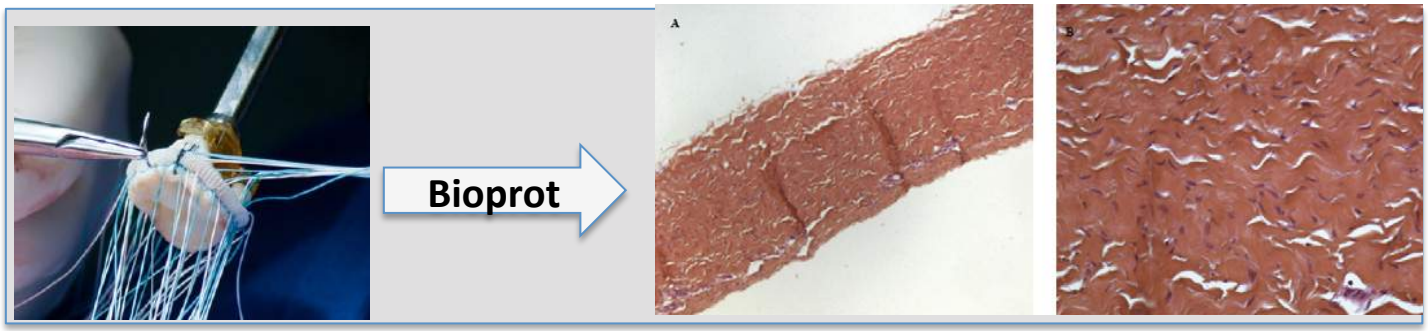
**26%** **12%**

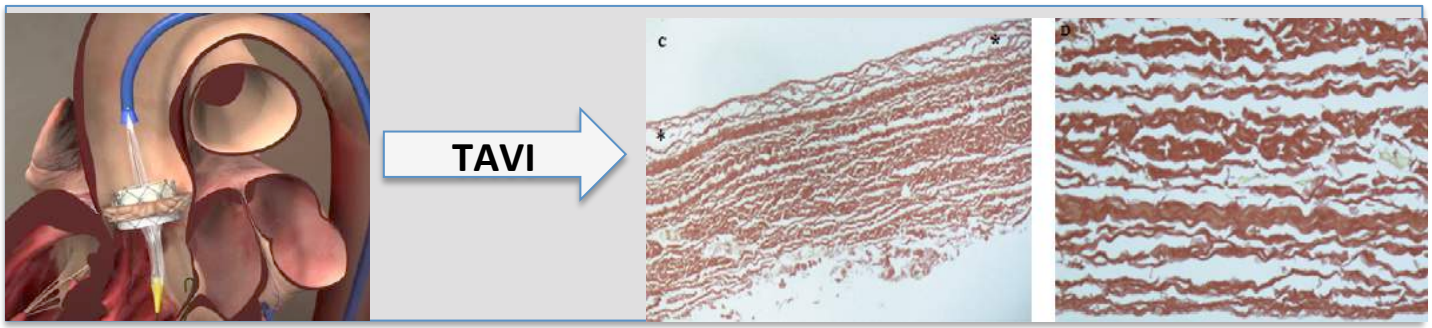

29mm

# 5) LONGEVITY OF BIOLOGICAL PROSTHESES

***Evidence of leaflet injury during TAVI deployment***

***Zegdi et al. Eur J Cardiothorac Surg 2011;40:257-9***

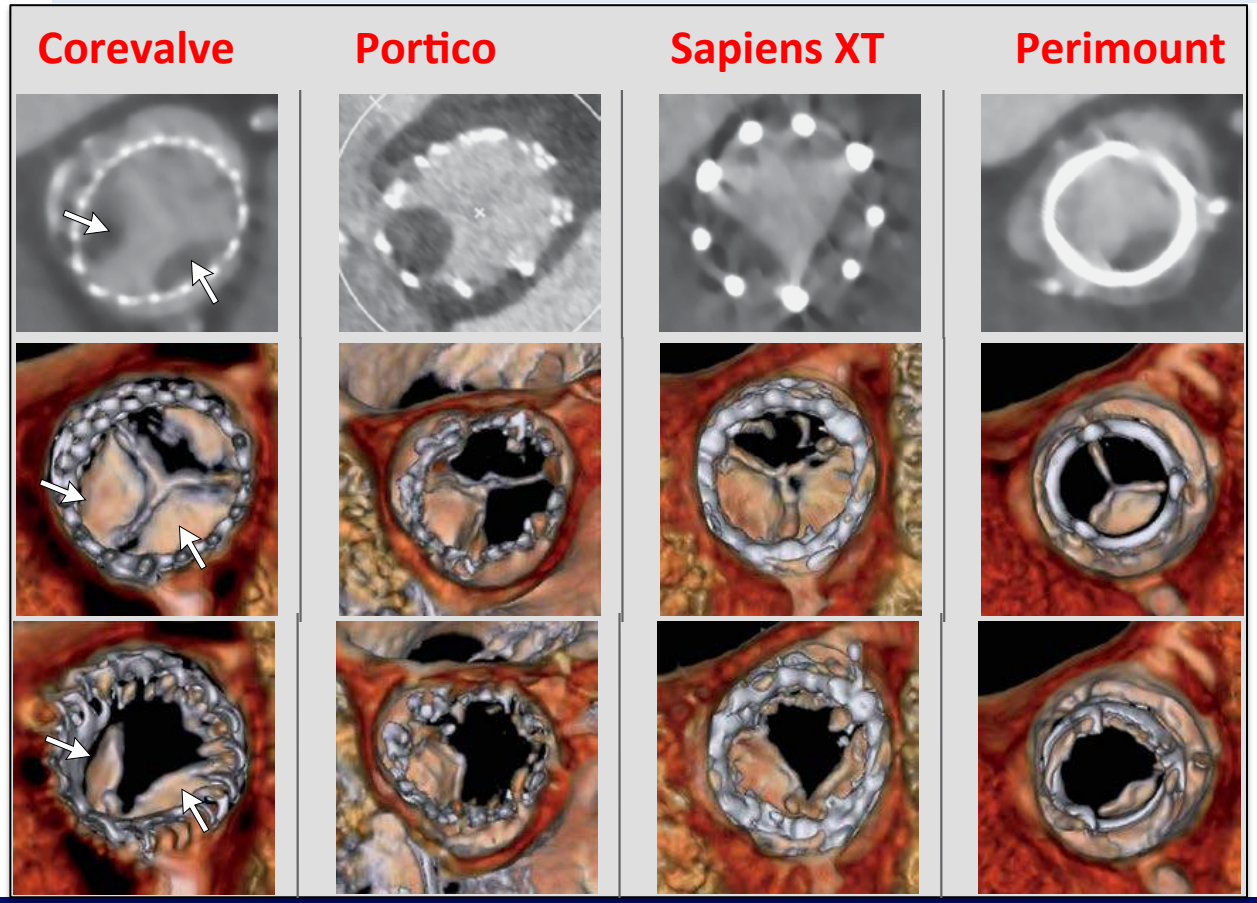




**Collagen fiber fragmentation and disruption**

# 5) LONGEVITY OF BIOLOGICAL PROSTHESES

## Possible Subclinical Leaflet Thrombosis in *TAVI*

*Makkar et al. N Engl J Med 2015;373:2015-24*




**Clinical Trial**
**55 pts → 40%**

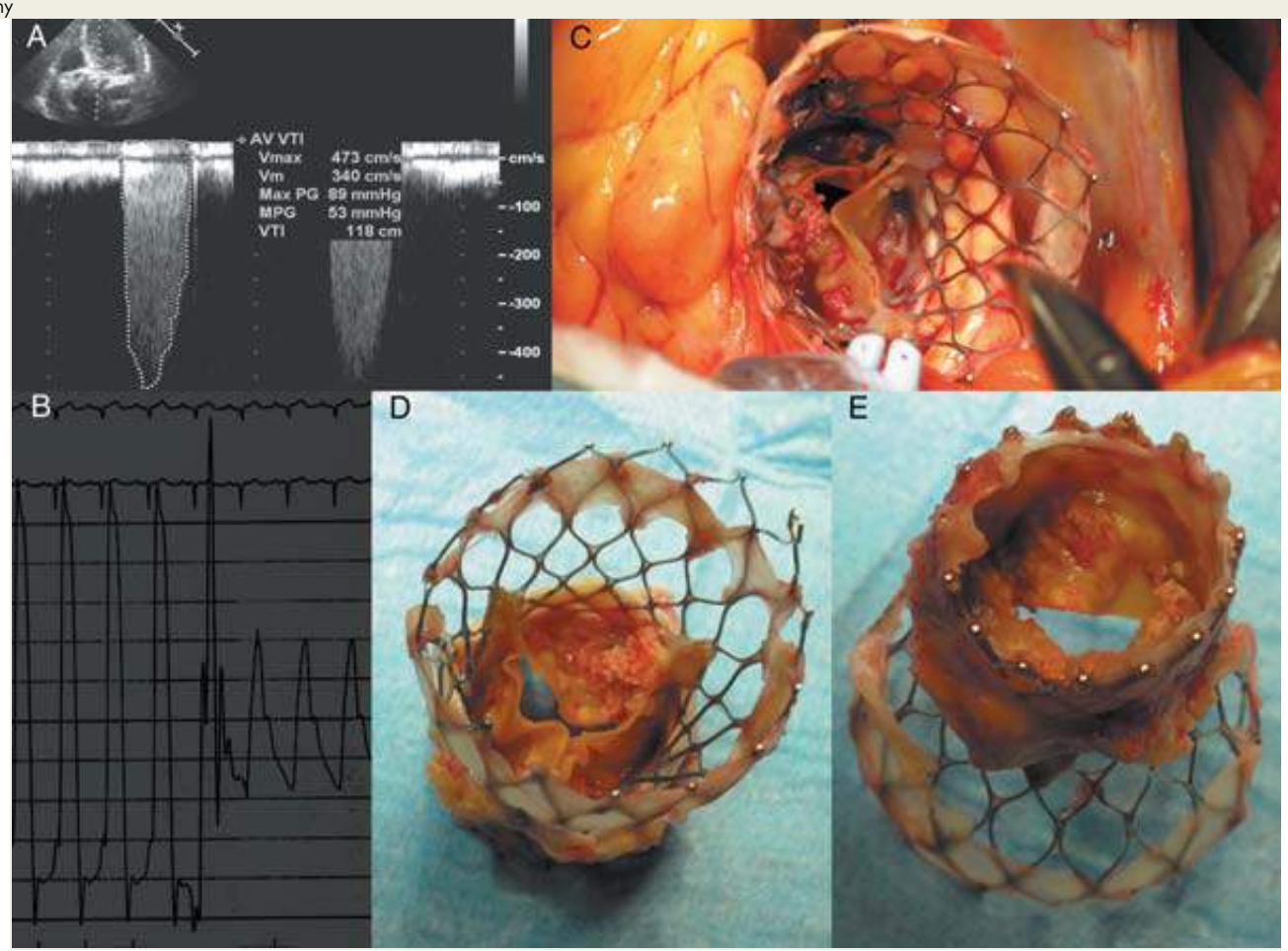
**Resolve/Savory**
**132 pts →13 %**

**VKA related**
**VKA sensible**

# Early calcific degeneration of a CoreValve transcatheter aortic bioprosthesis

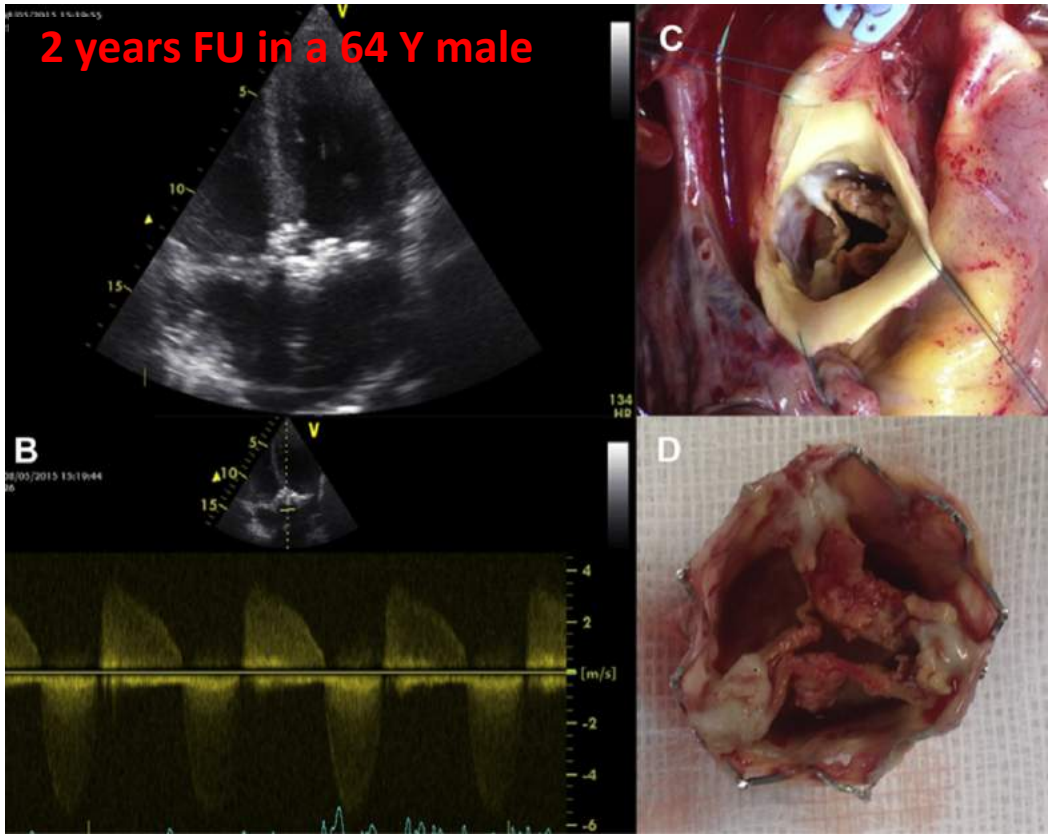
**Sea Hing Ong[1]*, Ralf Mueller[1], and Stein Iversen[2]** **5 years FU in a female aged 74**

[1]Department of Cardiology/Angiology, HELIOS Klinikum Siegburg, Siegburg, Germany and [2]Department of Cardiovascular Surgery, HELIOS Klinikum Siegburg, Siegburg, Germany



# Early Edwards SAPIEN Valve Degeneration After TAVR

Brahim Harbaoui, MD, MSC,*y Pierre-Yves Courand, MD, MSC,*y Zoé Schmitt, MD,z Fadi Farhat, MD, PHD,x Raphael Dauphin, MD,* Pierre Lantelme, MD, PHD*y **JACC Cardiovasc Interv. 2016**



# Early transcatheter aortic valve degeneration in the young

Mathieu van Steenberghe [a,*], Chun-Yi de Vasconcelos [b], Dominique Delay [a], Lars Niclauss [a], Matthias Kirsch [a]

[a] *Cardiac Surgery Unit, Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland*
[b] *Pathology Department, Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland*

**43 years old male BMI = 40.4 ➔ TAVI** → **3 years later ➔ Euroscore = 1.19%**
**Discharged on Day 10**


2016 euroPCR

# Methods

- The a … an 5 years ago:
  April
- **Sites**
  - S
  - H
- **Inclu**
  - P
  - B … SAPIEN XT).
- **Exclu**
  - M
  - Tl
  - D … urgitation).
  - P
  - In

Cardiovascular News

The international newspaper for cardiovascular specialists

August 2016 Issue 42



Olaf Wendler: TAVI for lower risk

Page 10



Philip Urban: Profile

Page 16



Adam Hartley: Patients and the web

Page 23

## Study indicates signal for valve degeneration in TAVI patients by eight years

**Speaking at EuroPCR (17–20 May, Paris, France), Danny Dvir reported that there is a significant increase in valve degeneration between five and seven years after a transcatheter aortic valve implantation (TAVI) device is deployed. Although stressing that this was a "preliminary analysis" using early-generation devices and, therefore, "we must be cautious", he estimated that, based on these findings, about half of patients who undergo TAVI may show early signs of valve degeneration within eight years of implantation.**

Dvir (St Paul's Hospital, Vancouver, Canada), who was presenting the data on behalf of the teams in Vancouver Canada and Rouen France, commented that as a result of TAVI being "increasingly being performed" in younger and lower-risk cohorts, more patients are expected to survive "long after" transcatheter heart valve implantation. However, he noted that durability of TAVI devices has "only been assessed over the



degeneration with the average time to degeneration being 61 months. Of these, 23 showed signs of aortic regurgitation and 12 showed signs of aortic stenosis/mixed regurgitation. Dvir commented that the "vast majority" of patients with aortic regurgitation had intravalvular regurgitation and that among patients with stenosis, "stenosis indices appeared only in long-term follow-up". In terms of valves that degenerated, three were a Cribier-Edwards device, 19

## Absorb now available in the USA following FDA approval

**Five years after receiving the CE mark, Abbott Vascular's bioresorbable vascular scaffold (Absorb) has been granted FDA approval—making it the first fully dissolving scaffold to be commercially available in the USA. The Absorb GT1 system, which is gradually absorbed by the body in approximately three years, is now approved for use in percutaneous coronary intervention (PCI) in patients with coronary artery disease.**

The approval was based on data from the ABSORB III trial, which showed that patients who received the Absorb GT1 system had a similar rate of target lesion failure (the trial's primary endpoint) at one year as those who received an everolimus-eluting stent with a permanent polymer (Xience, Abbott Vascular): 7.8% vs. 6.1%, respectively (p=0.007 for non-inferiority). This study also showed that there were no significant differences between devices in the rates of cardiac death, target-vessel myocardial revascularisation or device thrombosis.

However while there was not a significant

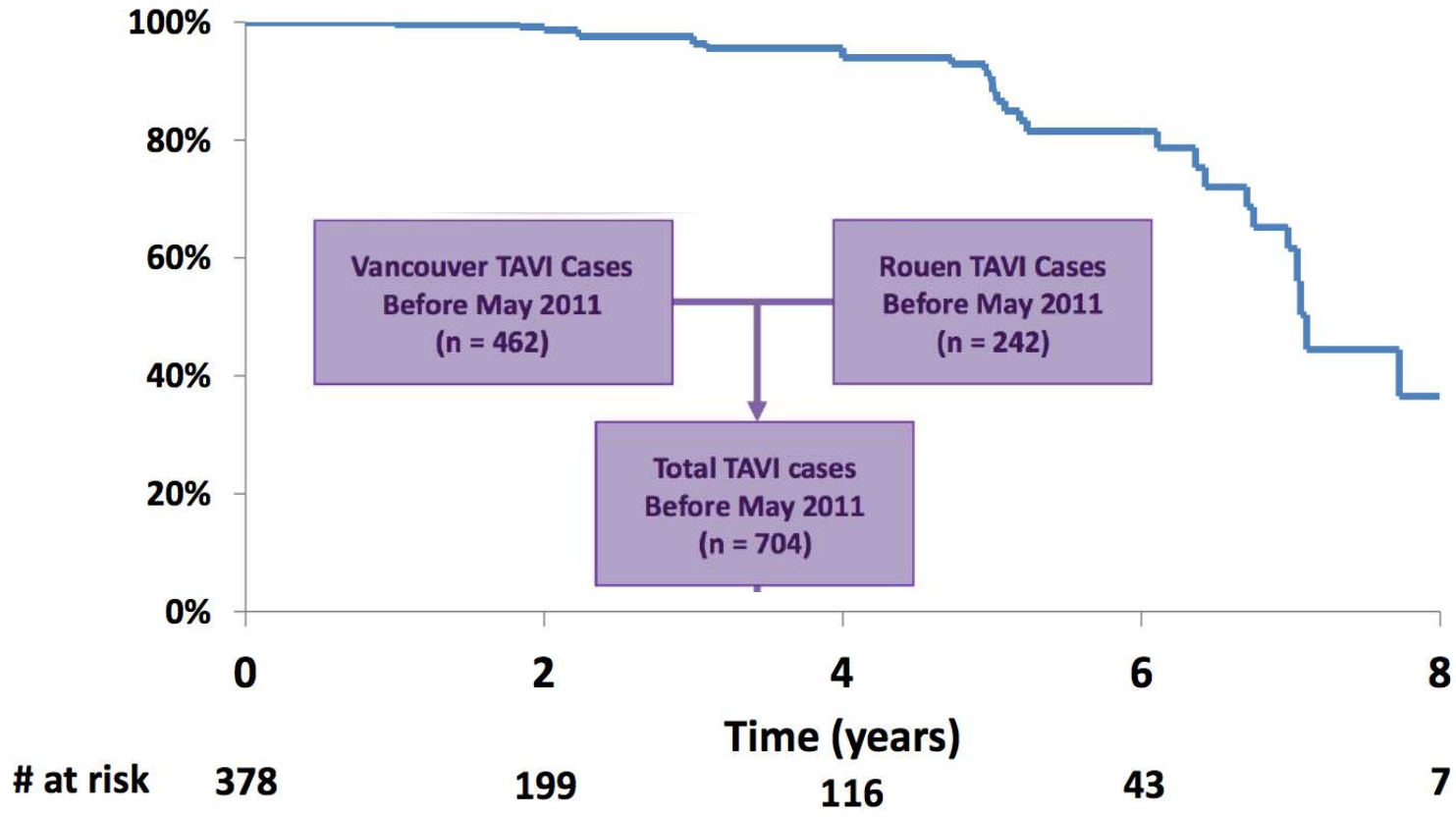
# Methods

- **Degeneration definition** in the current analysis:

  At least moderate regurgitation AND/OR mean gradient ≥ 20mmHg, which did not appear within 30 days of the procedure and is not related to endocarditis.

- Long-term echocardiographic exams performed during house visits.

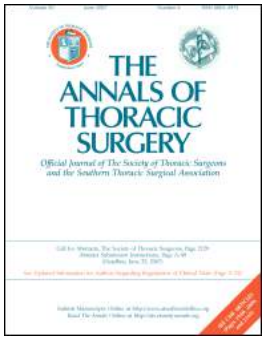

# 2016 euroPCR Freedom from THV degeneration




2016 euro PCR

# Summary

- The current analysis includes a first look at long-term durability after TAVI, evaluating cases performed 5-14 years ago with early-generation balloon-expandable THV devices.
- In this preliminary report, a significant increase in degeneration rate was observed between 5-7 years after TAVI.
- Estimate of THV degeneration (resulting in at least moderate stenosis AND/OR regurgitation) was ~50% within 8 years.
- Renal failure was the strongest correlate of THV degeneration.




# Very Long-Term Outcomes of the Carpentier-Edwards Perimount Valve in Aortic Position

Thierry Bourguignon, MD, Anne-Lorra
Alain Mirza, MD, Claudia Loardi, MD
Michel Marchand, MD, and Michel Au

*Structural Valve Deterioration (SVD) and Reoperation for SVD* ***Echographic evaluation 97.7%***

The bioprosthesis was considered to have deteriorated on strict echocardiographic assessment whenever severe aortic stenosis (mean transvalvular gradient > 40 mm Hg) or severe aortic regurgitation (effective regurgitant orifice area > 0.30 $cm^2$, vena contracta > 0.6 cm) was observed, even if the patient was asymptomatic.

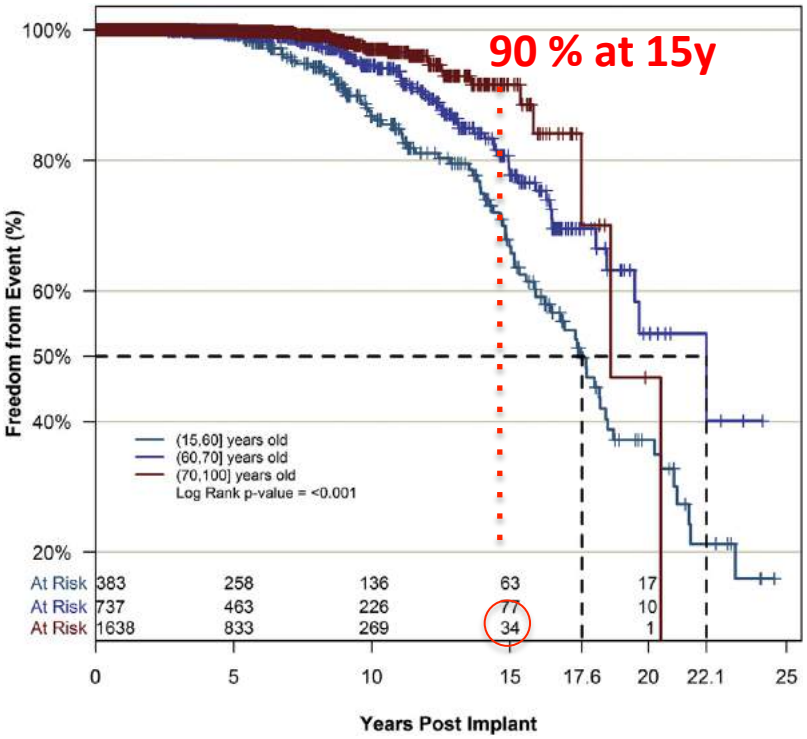



*Fig 3. Kaplan-Meier freedom from structural valve deterioration (SVD) by age groups. The expected valve durability (median survival time without SVD) was 17.6 and 22.1 years for the younger (≤ 60) and the 60 to 70 years group, respectively.*


# Hancock II Bioprosthesis for Aortic Valve Replacement: The Gold Standard of Bioprosthetic Valves Durability?

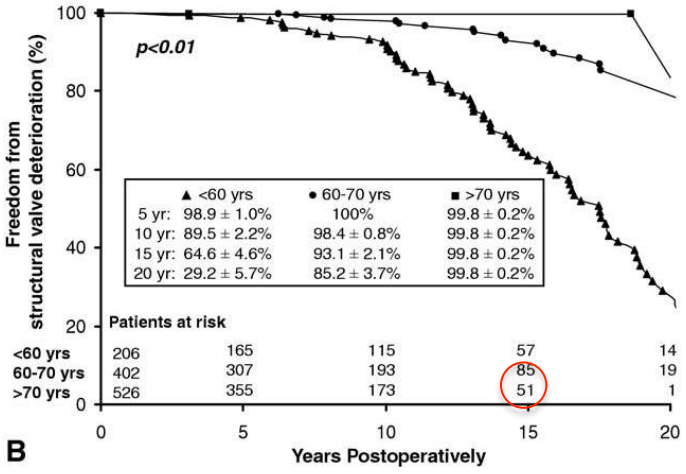
Tirone E. David, MD, Susan Armstrong, MS, and Manjula Maganti, MS

From September 1982 to December 2004, **1134 consecutive patients**... monitored prospectively **every second year**. Most patients **(94%)** had multiple echocardiographic studies to assess valve and heart function.

## *Structural Valve Deterioration*

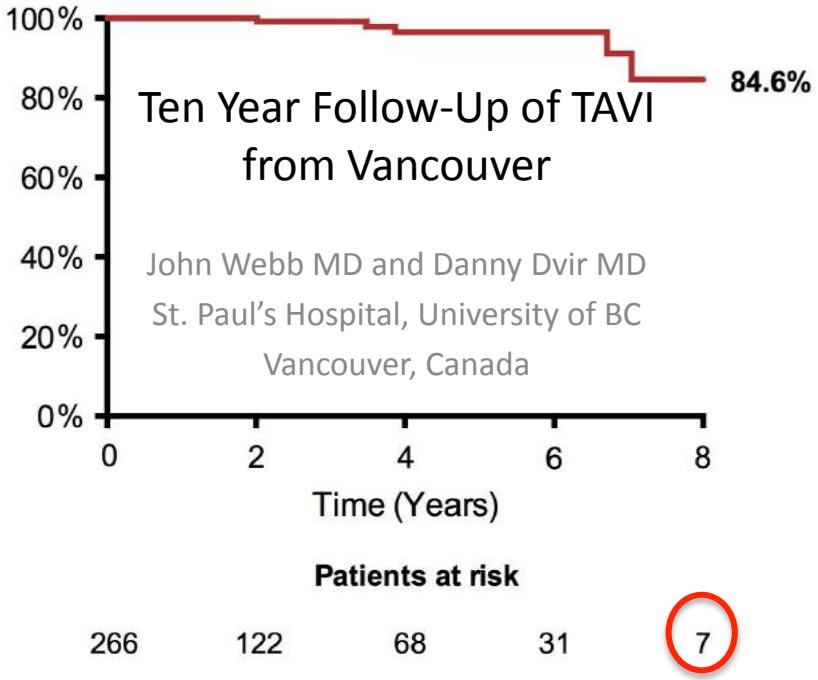
Structural valve failure (SVD) was documented in 87 patients by echocardiography or operati or both. Repeat AVR was performed in 74 pati 13 patients were believed to be inoperab 0 age group and 7 in ≥60 years group) only 2 valve failures in patients older th , 18 in patients aged 60 to 70 years, and 67 in pa nts younger than 60 years. Age was the only independent predictor of SVD. Freedom of SVD

**87 SVD → 2 < 70Y**



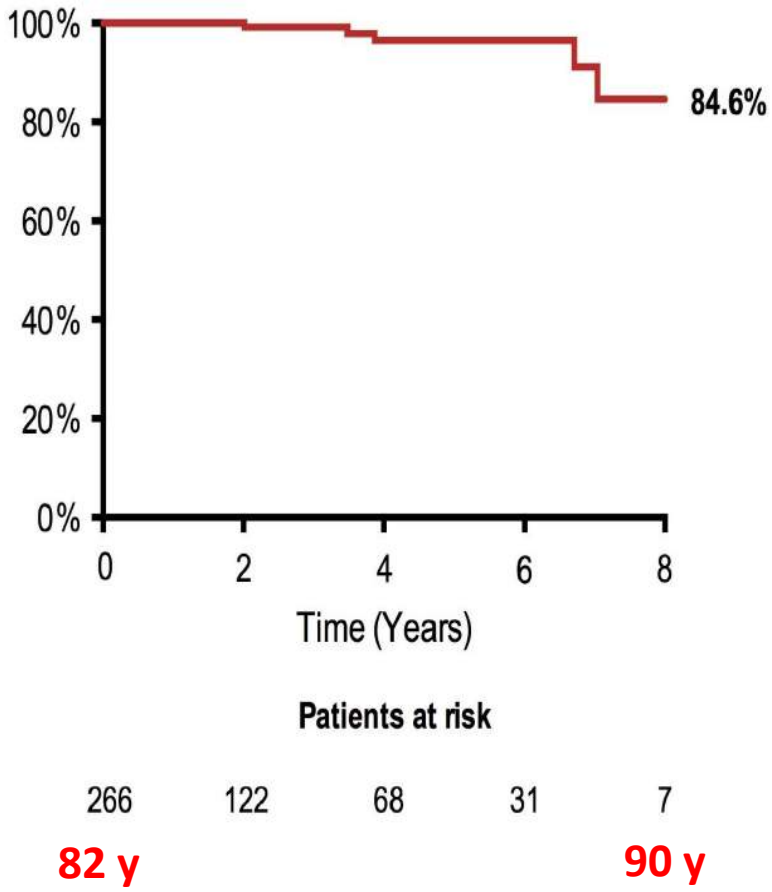
| SVD definition | # of cases | % of cases |
|---|---|---|
| Severe Stenosis and/or Regurgitation[1,] | 5 | 1.9% |
| Re-intervention (SAVR or TAVR)[3] | 3 | 1.1% |
| Severe AS, severe AR, or Re-intervention | 5 | 1.9% |

# Freedom from severe stenosis, regurgitation, or re-intervention




THV severe failure was defined severe AS AND/OR severe AR. KM estimate of THV degeneration included censoring of patients at their date of last known THV functioning well without evidence for failure per study definition.

# Ten Year Follow-Up of TAVI from Vancouver




**Very Long-Term Outcomes of the Carpentier-Edwards Perimount Valve in Aortic Position**

Thierry Bourguignon, MD, Anne-Lorraine Bouquiaux-Stablo, MD, Pascal Candolfi, PhD, Alain Mirza, MD, Claudia Loardi, MD, Marc-Antoine May, MD, Rym El-Khoury, MD, Michel Marchand, MD, and Michel Aupart, MD

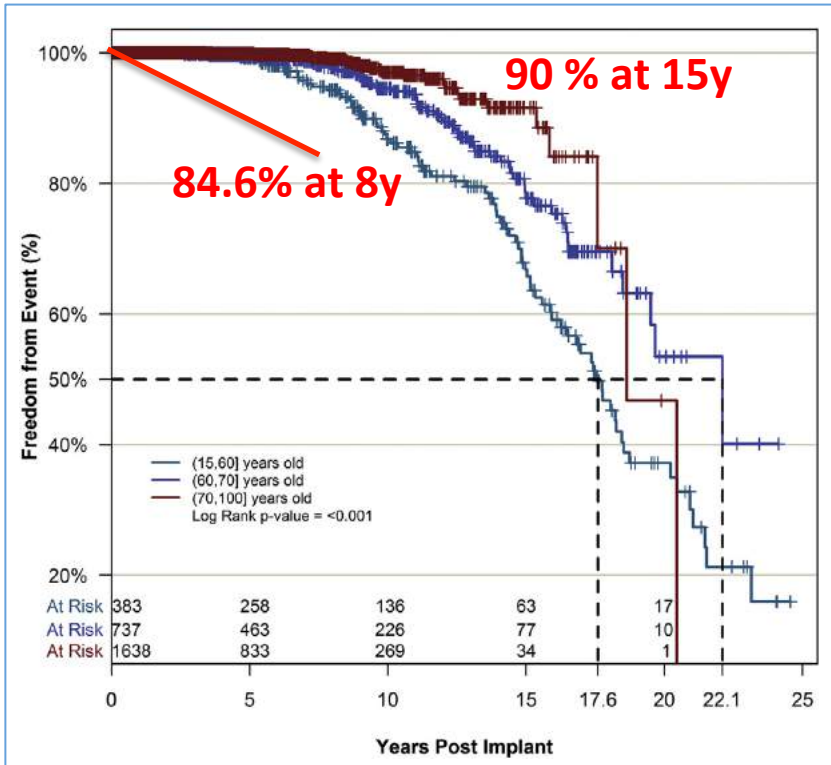
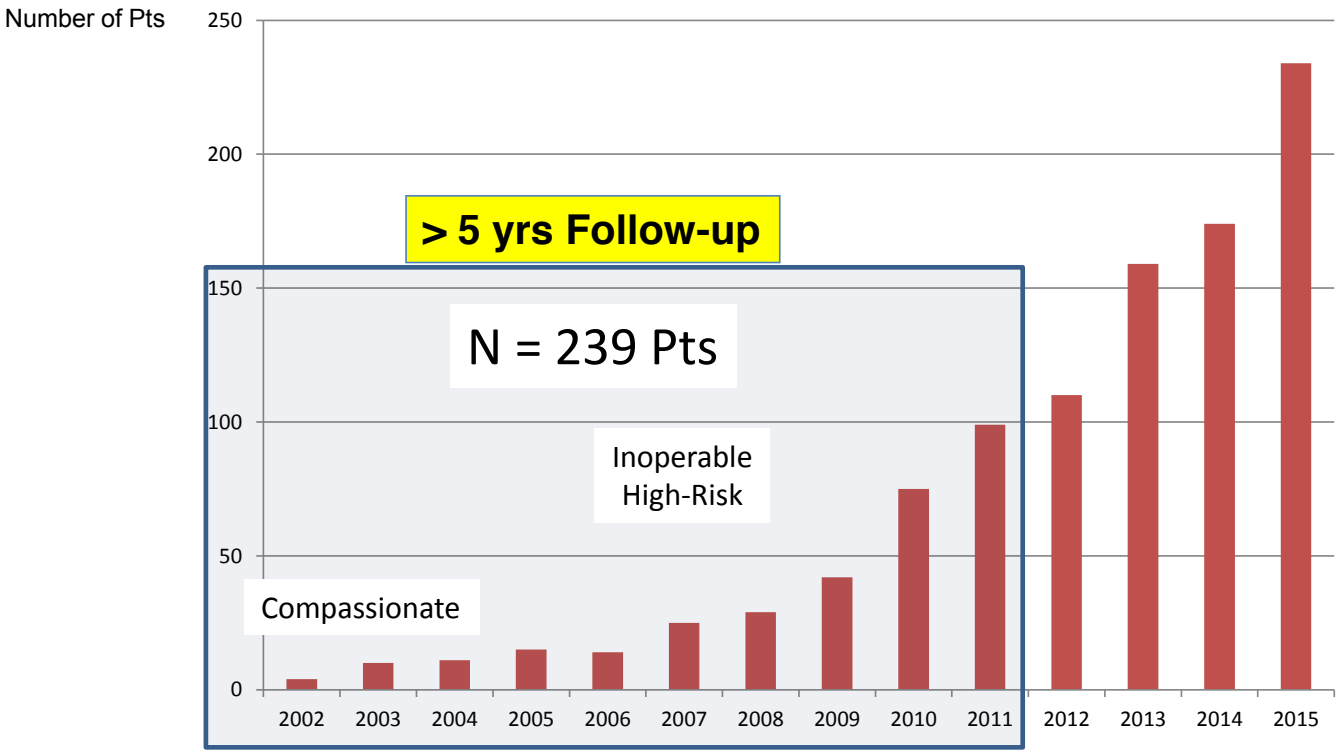


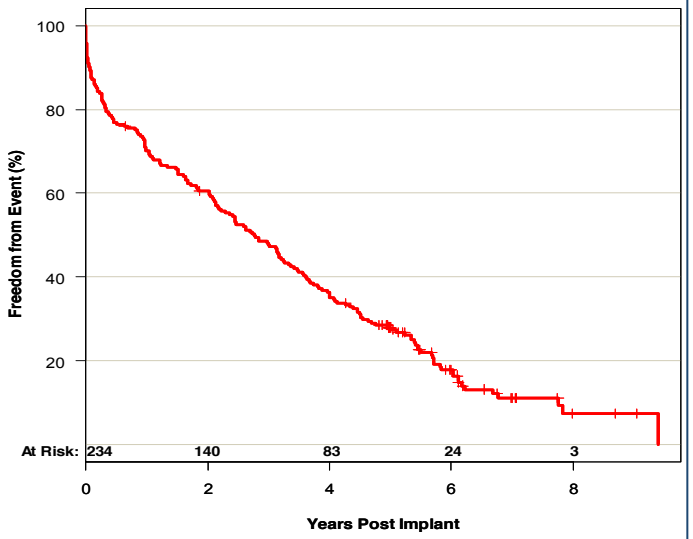

*Fig 3. Kaplan-Meier freedom from structural valve deterioration (SVD) by age groups. The expected valve durability (median survival time without SVD) was 17.6 and 22.1 years for the younger (≤ 60) and the 60 to 70 years group, respectively.*

# TAVR in Rouen since 2002



# Actuarial Analysis – Freedom from Mortality

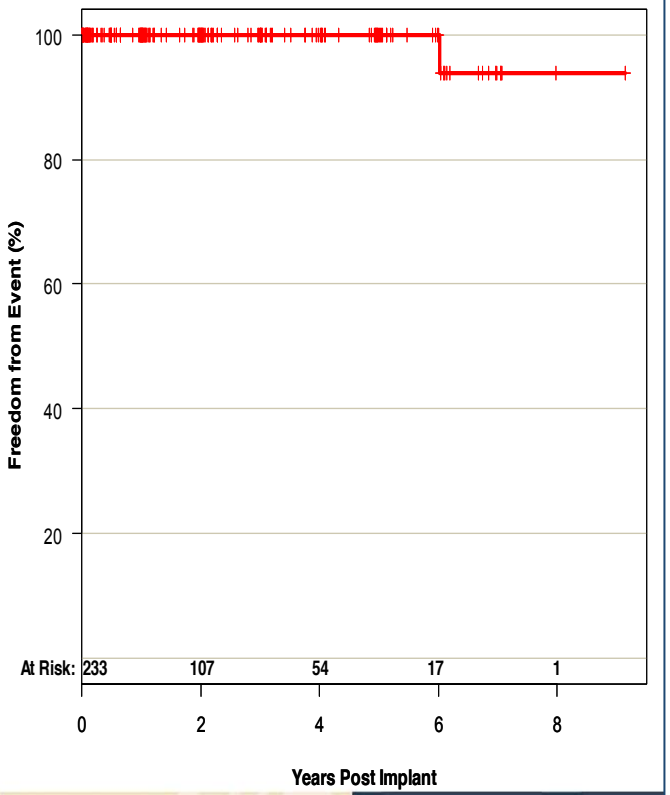
- 5 patients (2%) excluded (lost FU)
- 194 patients died
- Total FU: 686.3 patient-years
- Maximum FU: 9.4 years
- Patients still alive were censored to the latest visit or echo date available



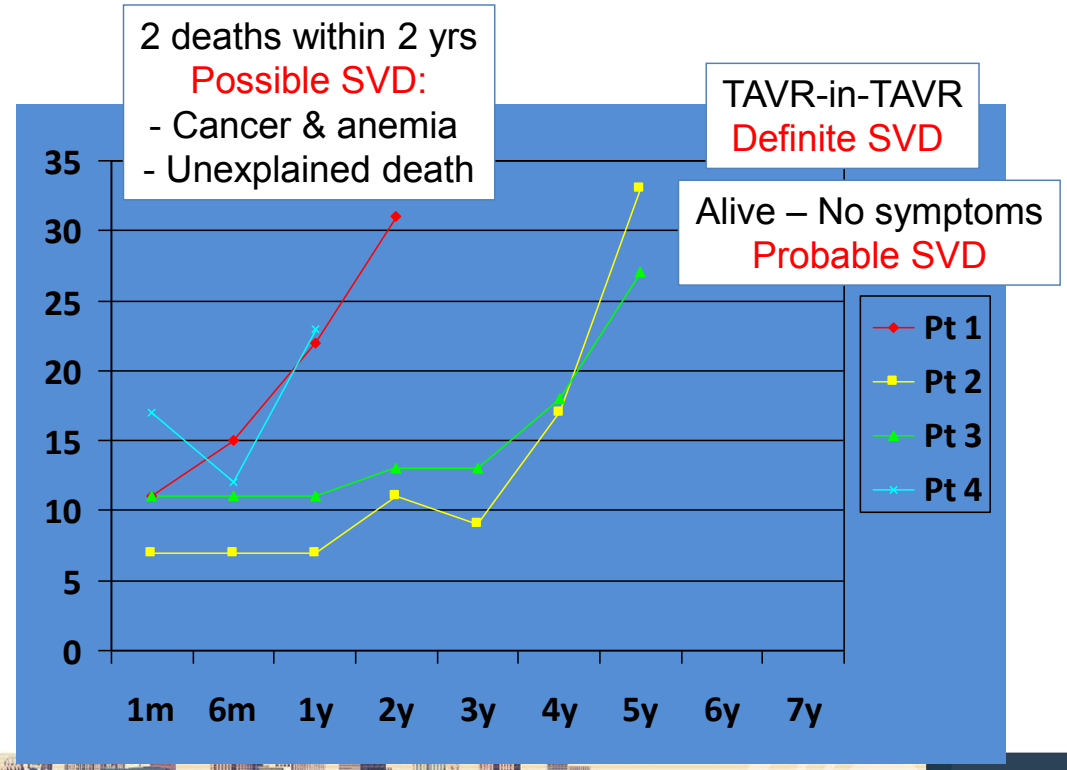
# Freedom from SVD in Rouen - Using cardiac surgeon's definition

- 6 patients were excluded (lost FU)
- Last available echo date was used in this actuarial analysis

- No patient with mean GR > 40mmHg
- Only 1 patient had definite SVD: severe AR + elevated gradient, leading to re-intervention (TF-TAVR in TA-TAVR )



# Our 4 cases according to this definition



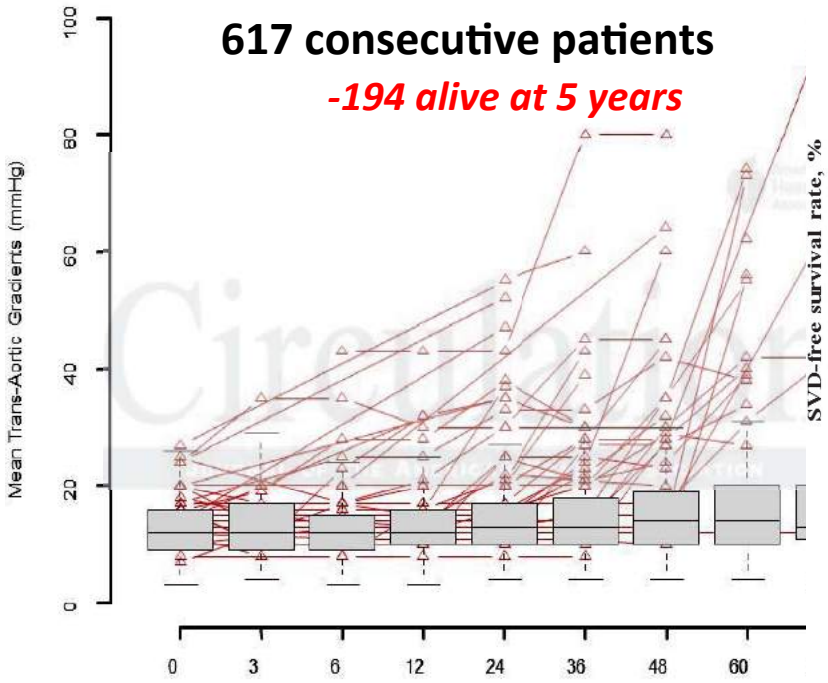
**Early Structural Valve Deterioration of Mitroflow Aortic Bioprosthesis: Mode, Incidence and Impact on Outcome in a Large Cohort of Patients**

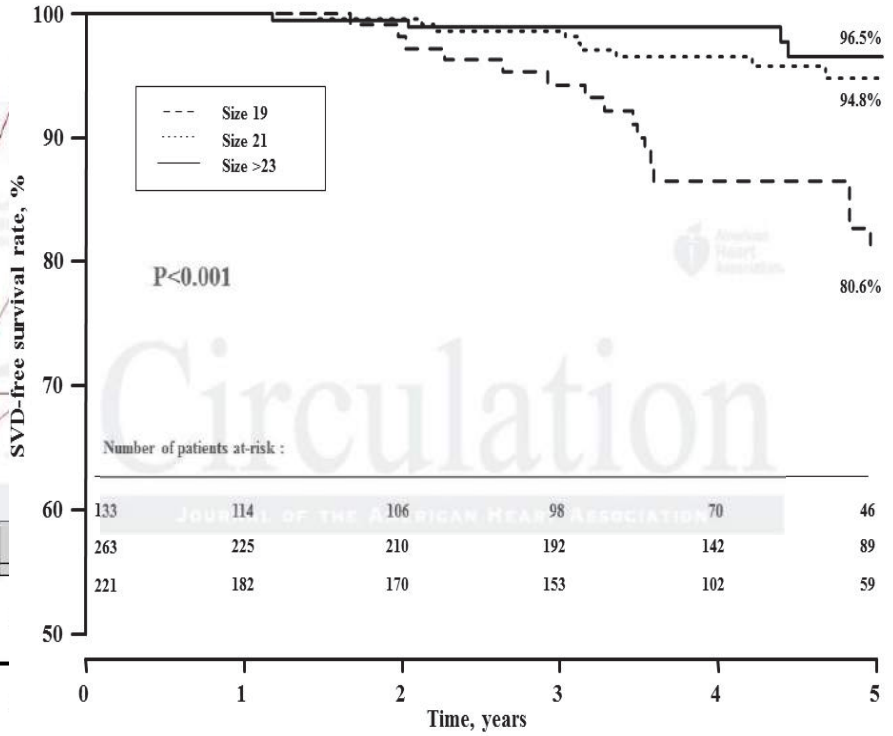
Thomas Sénage, Thierry Le Tourneau, Yohann Foucher, Sabine Pattier, Caroline Cueff, Magali Michel, Jean-Michel Serfaty, Hubert François Carton, Christian Perigaud, Antoine Mugniot, Ousama Al Habash, Olivier Baron and Jean Christian Roussel

Circulation 2014

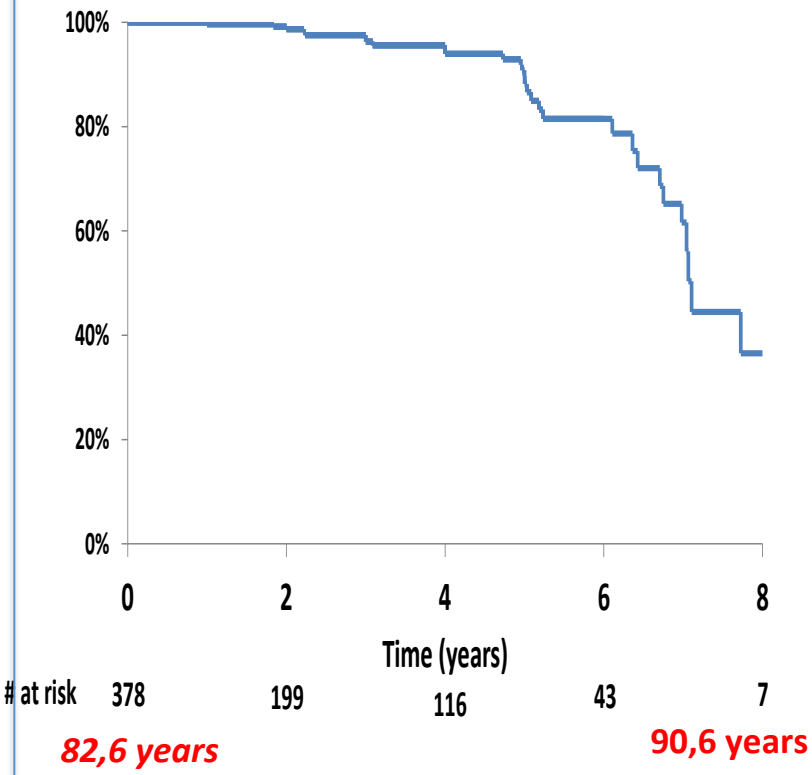
**617 consecutive patients**

***-194 alive at 5 years***




## 2016 euroPCR Freedom from THV degeneration

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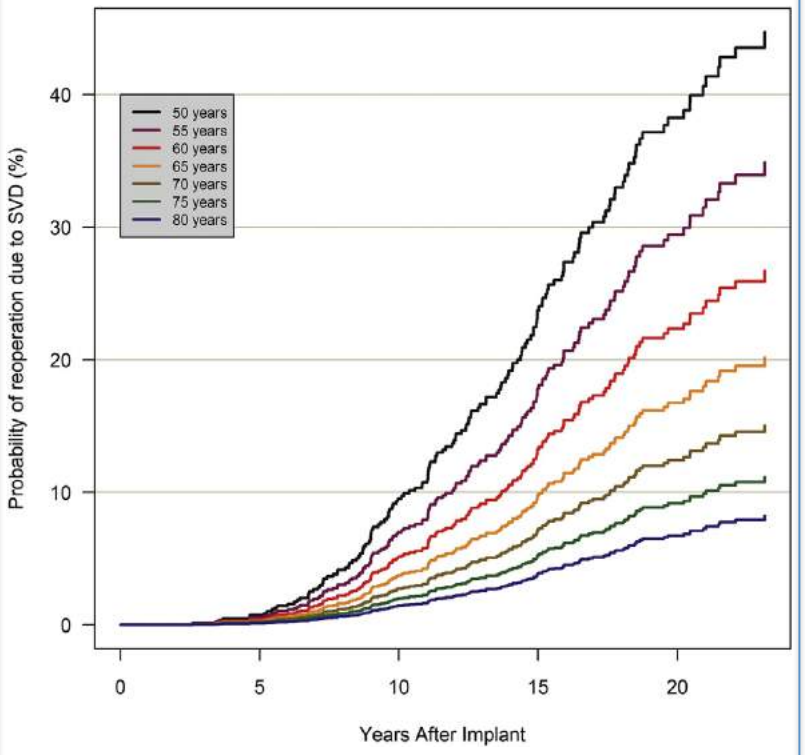
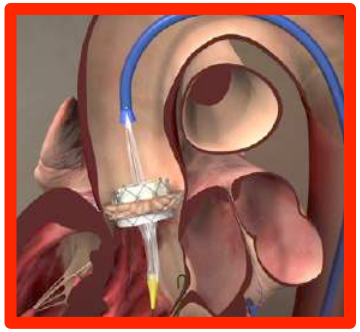


# Weak Follow-up ➔ Real Signal on Durability

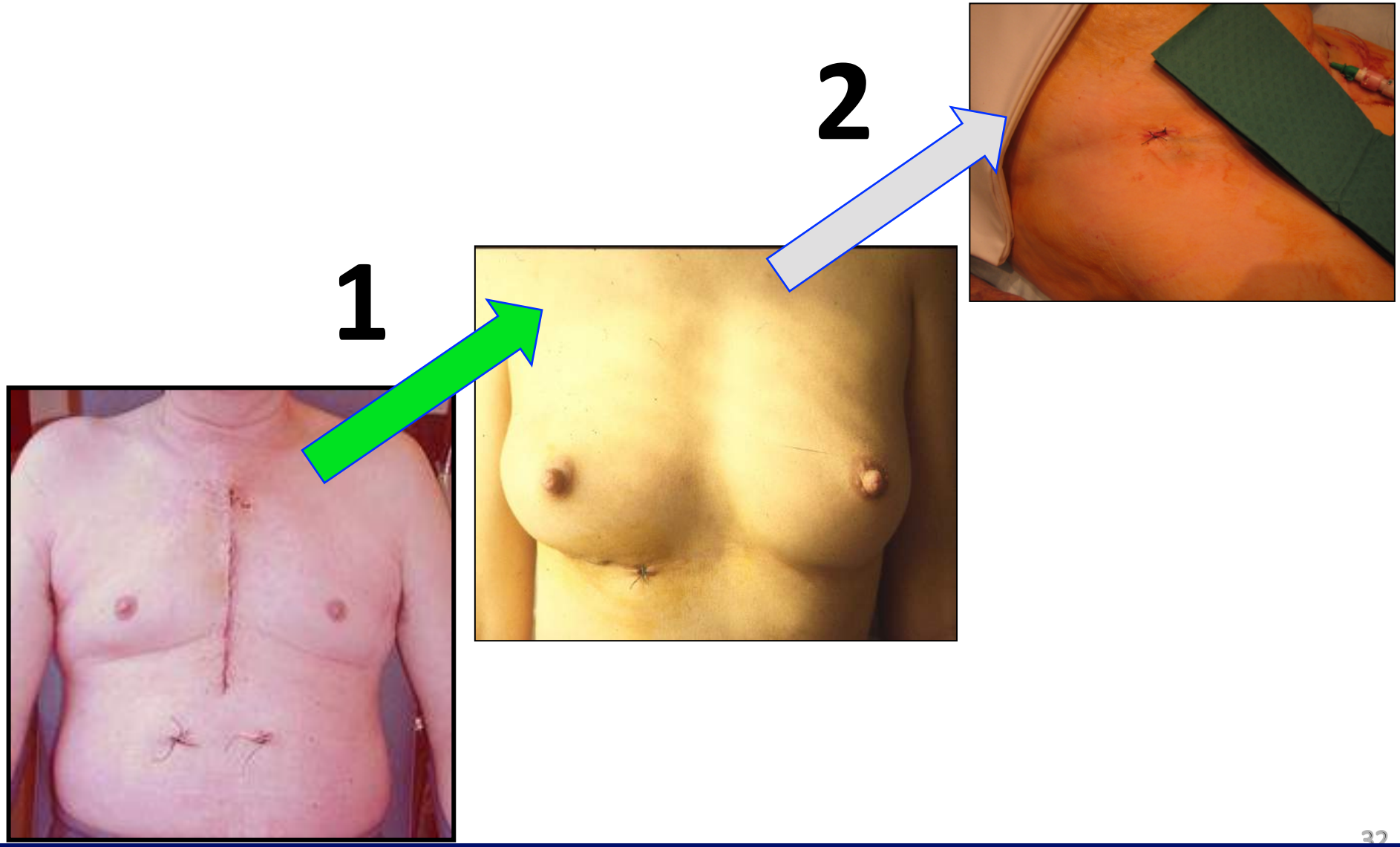


~~TAVI only for High Risk Patients ?~~
~~TAVI only for elderly Patients ?~~

**life expectancy above 5 years ? 10 years ?**

L'espérance de vie d'un homme de 87 ans est de 5 ans (5,03).
L'espérance de vie d'une femme de 87 ans est de 6 ans et 4 mois (6,3).

# From sternotomy to percutaneous procedure



# Video Assisted Mitral Valve Surgery

**<u>> 1500 Patients</u> ➔ 14 to 92 years, 42 to 145 Kg**

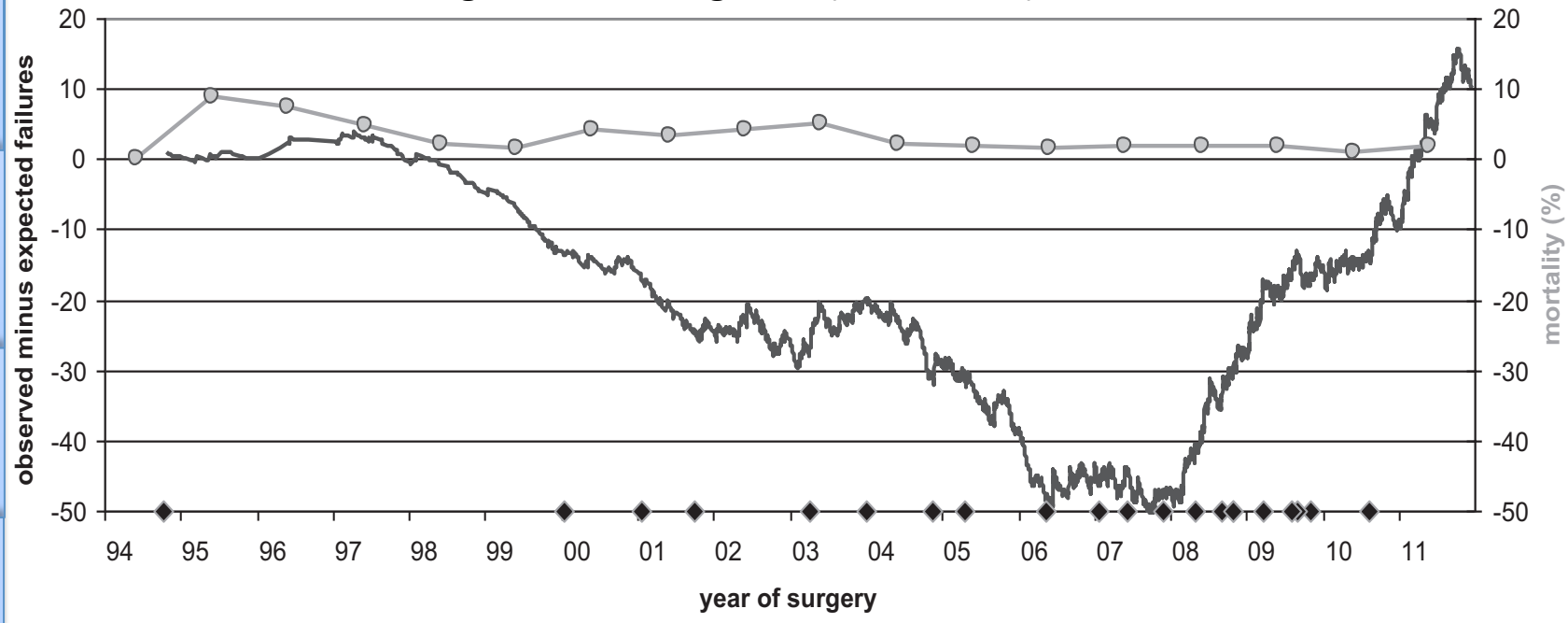
# Learning Minimally Invasive Mitral Valve Surgery

## A Cumulative Sum Sequential Probability Analysis of 3895 Operations From a Single High-Volume Center

*Circulation*. 2013;128:483–491

David M. Holzhey, MD, PhD; Joerg Seeburger, MD; Martin Misfeld, MD, PhD; Michael A. Borger, MD, PhD; Friedrich W. Mohr, MD, PhD

3895 Surgeries / 17surgeons (< 20 cases)



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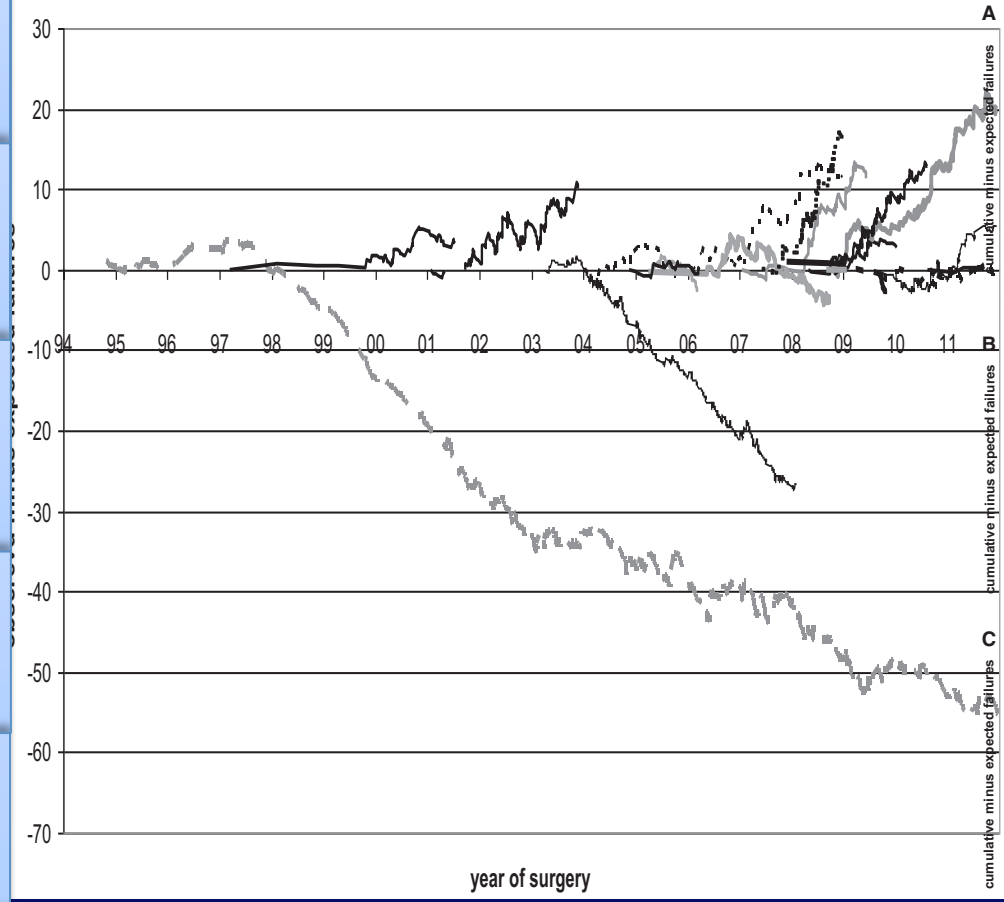


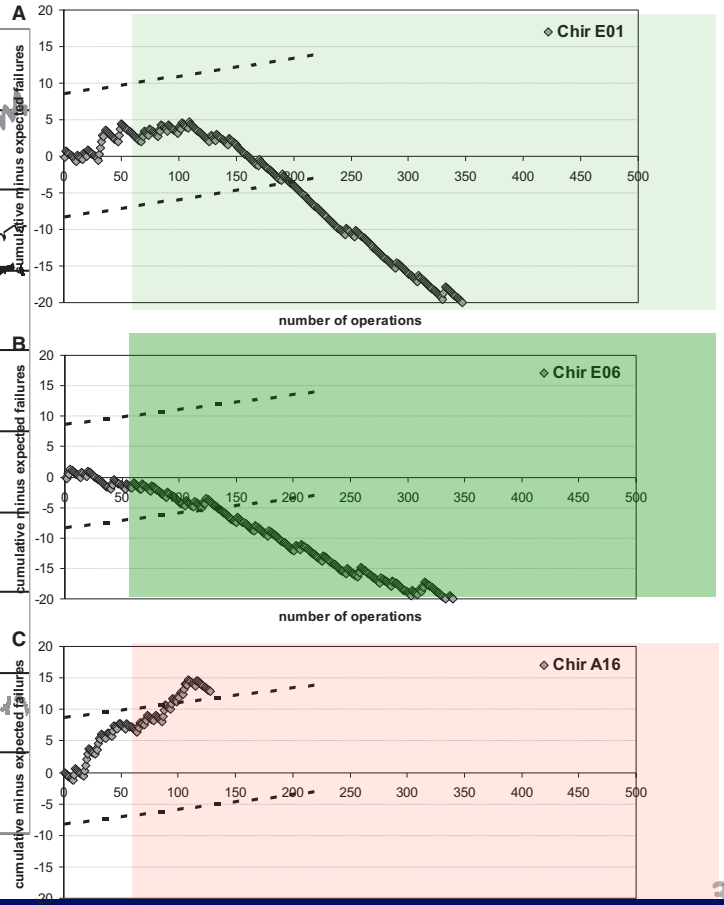

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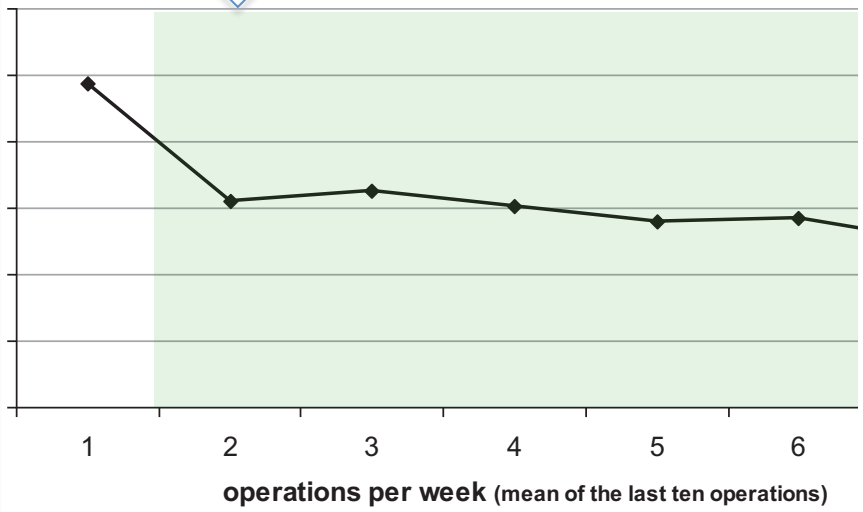
*Circulation*. 2013;128:483–491

David M. Holzhey, MD, PhD; Joerg Seeburger, MD; Martin Misfeld, MD, PhD; Michael A. Borger, MD, PhD; Friedrich W. Mohr, MD, PhD




## The lottery of mitral valve repair surgery

Anelechi C Anyanwu,[1] Benjamin Bridgewater,[2] David H Adams[1]

***Heart 2010;96:1964e1967.***

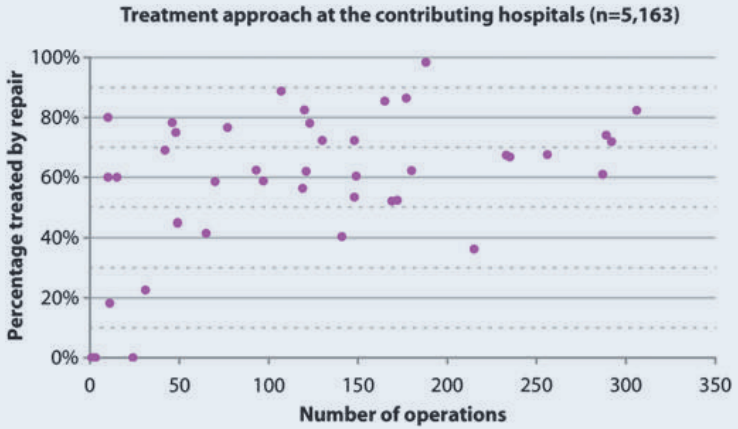
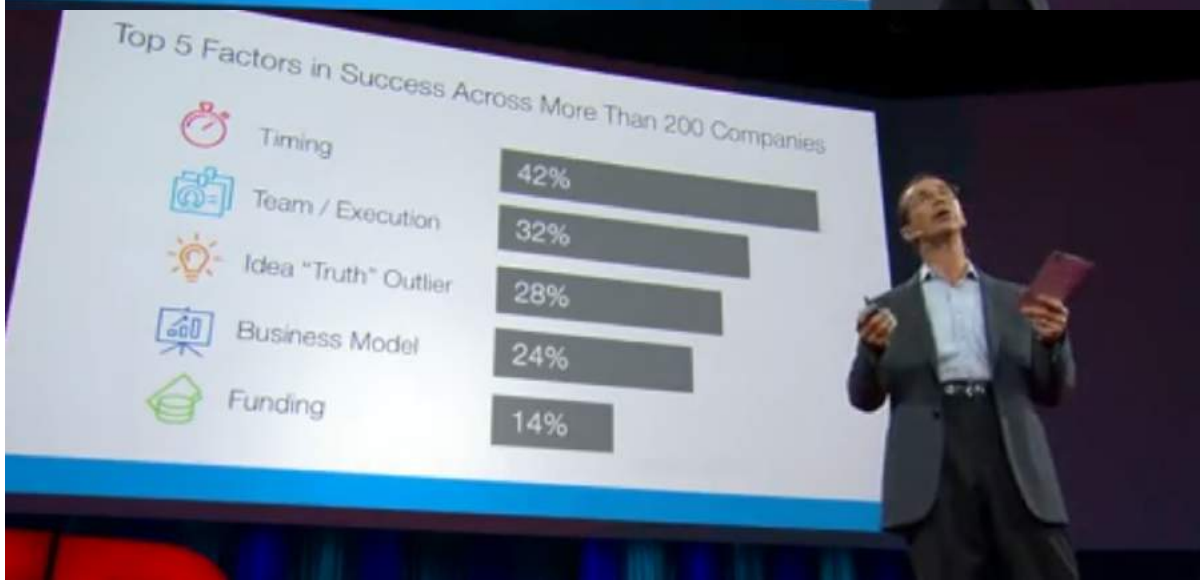



**Figure 1** Variations in rates of mitral valve repair for degenerative disease among 46 heart centres in the UK (adapted from Bridgewater, *et al*[1]).


Hôpitaux de Lyon


5 Essential Elements that Lead to Success
Ideas
Team
Business Model
Funding
Timing

**Bill GROSS**


Top 5 Factors in Success Across More Than 200 Companies
Timing
42%
Team / Execution
32%
Idea "Truth" Outlier
28%
Business Model
24%
Funding
14%


# Transcatheter techniques : *From repair to prostheses*

| Approach | Commercial | In Development | Abandoned |
|---|---|---|---|
| Edge-to-Edge Repair | Abbott Vascular | St. Jude Medical | |
| Direct Annuloplasty | | Kardium, mitralis, Valcare, Mitralign, Valtech, Guided Delivery Systems millipede llc. | QuantumCor, ReCor Medical |
| Indirect Annuloplasty | Cardiac Dimensions | | St. Jude Medical, Viacor, Edwards |
| Chordal Repair | neoCHORD | Valtech | |
| Ventricular Remodeling | | CardioKinetix Inc., Mardil Medical, BioVentrix | Myocor, Acorn |
| Enhanced coaptation | | middle peak, cardiosolutions, Mitralix, MitrAssist | |
| MV Replacement | | Medtronic, endoValve, neovasc, Valtech, twelve, Cassion, CardiAO, Highlife, Braile, Edwards, Tendyne, NaviGate | |


The NEW ENGLAND JOURNAL of MEDICINE

## TAVI → Sept. 2010 Partner

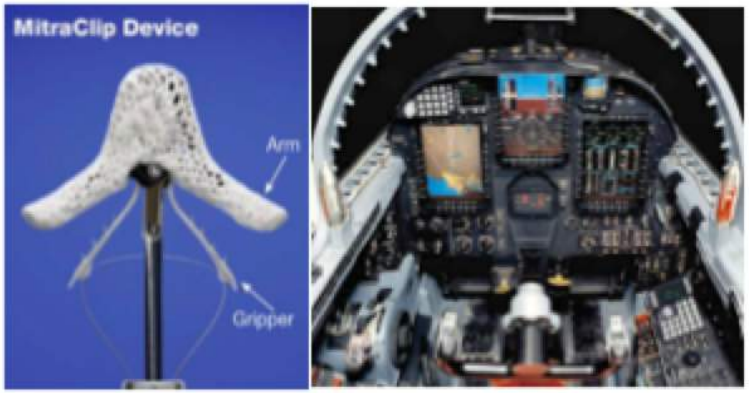
Transcatheter Aortic-Valve Implantation for Aortic Stenosis in Patients Who Cannot Undergo Surgery

1) One disease → Stenosis
2) One lesion → Calcification
3) One device → Stent + Bioprost

The NEW ENGLAND JOURNAL of MEDICINE

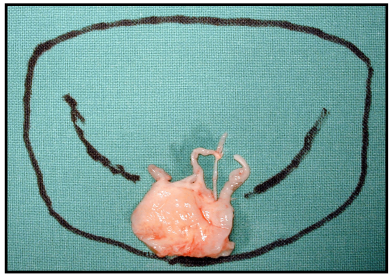
## MitraClip → Avril 2011 Everest

Percutaneous Repair or Surgery for Mitral Regurgitation




1) Multip diseases → Primary/secondary
2) Multip lesions → Dystophy/prolaps/restric
3) Multip devices → Stent / Bioprost / Goretex Clip / rings


## Surgical MV Repair



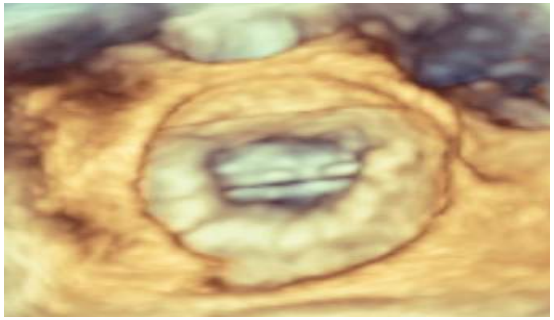
+

=

**Carpentier French Correction**

## Percutaneous Mitral Plasty techniques


+



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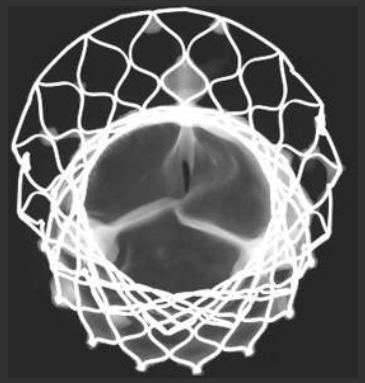
**Fully percutaneous Mitra valve repair**


## 200 000 TAVI



| Partner II | SURTAVI |
|---|---|
| *2000 Pts* | *2500 Pts* |

| | |
|---|---|
| Partner AB | *1057 pts* |
| Corevalve US | *747 pts* |
| Choice | *241 pts* |
| Notion | *280 pts* |

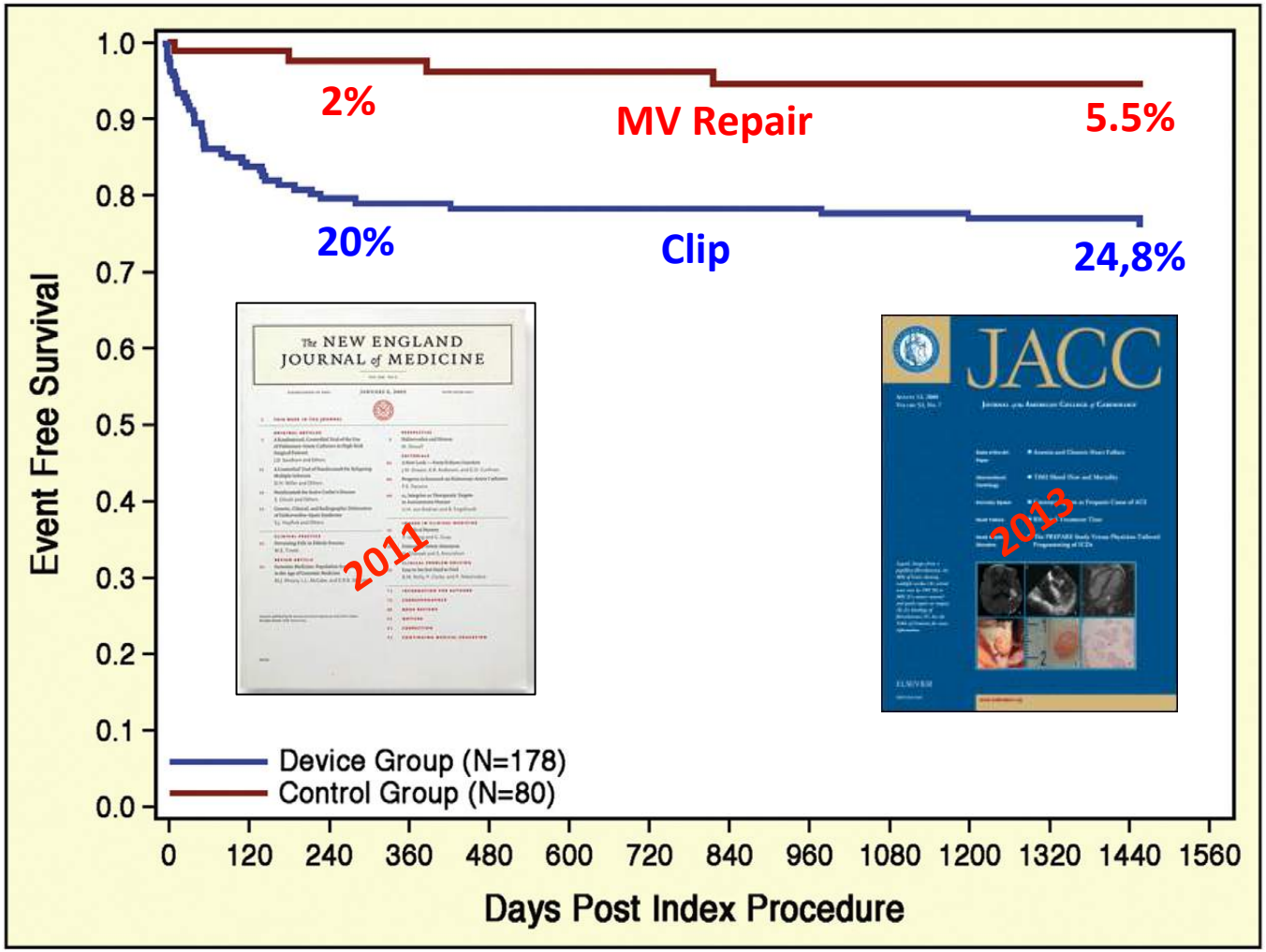
## 25 000 Clips

Coapt *500 pts*
Reshape *800 pts*
Mitra.fr *288pts*

Hiride *294 pts*

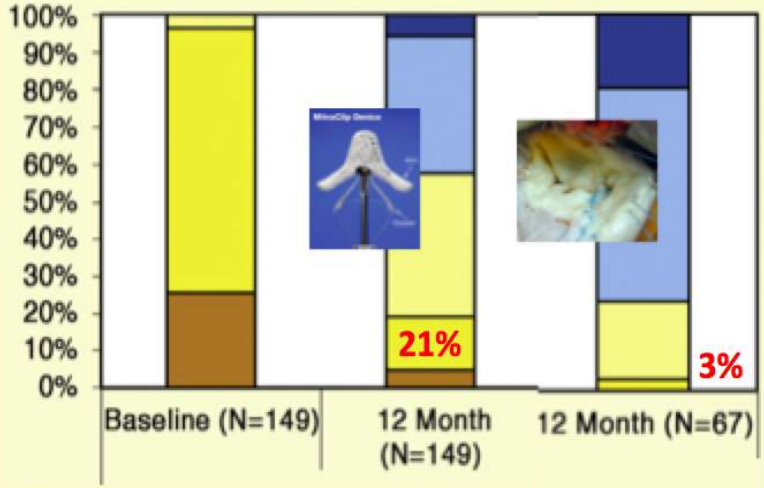
Everest 279 pts

# Reoperation at 1 and 4 years



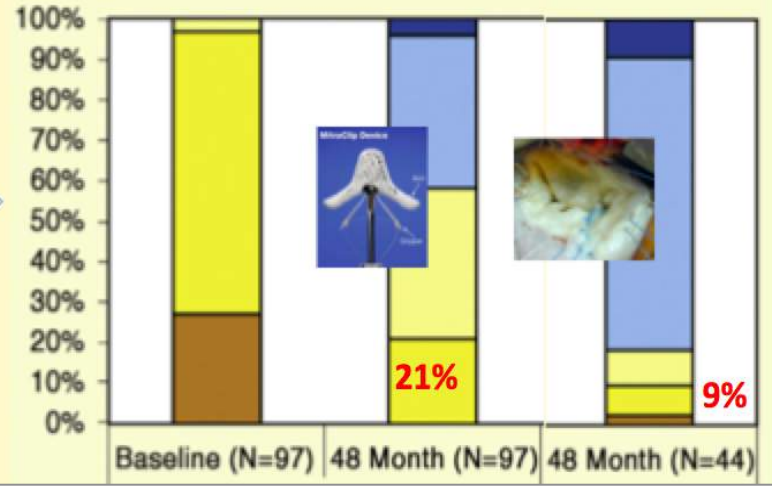
# Echography at 1 and 4 years


1 year



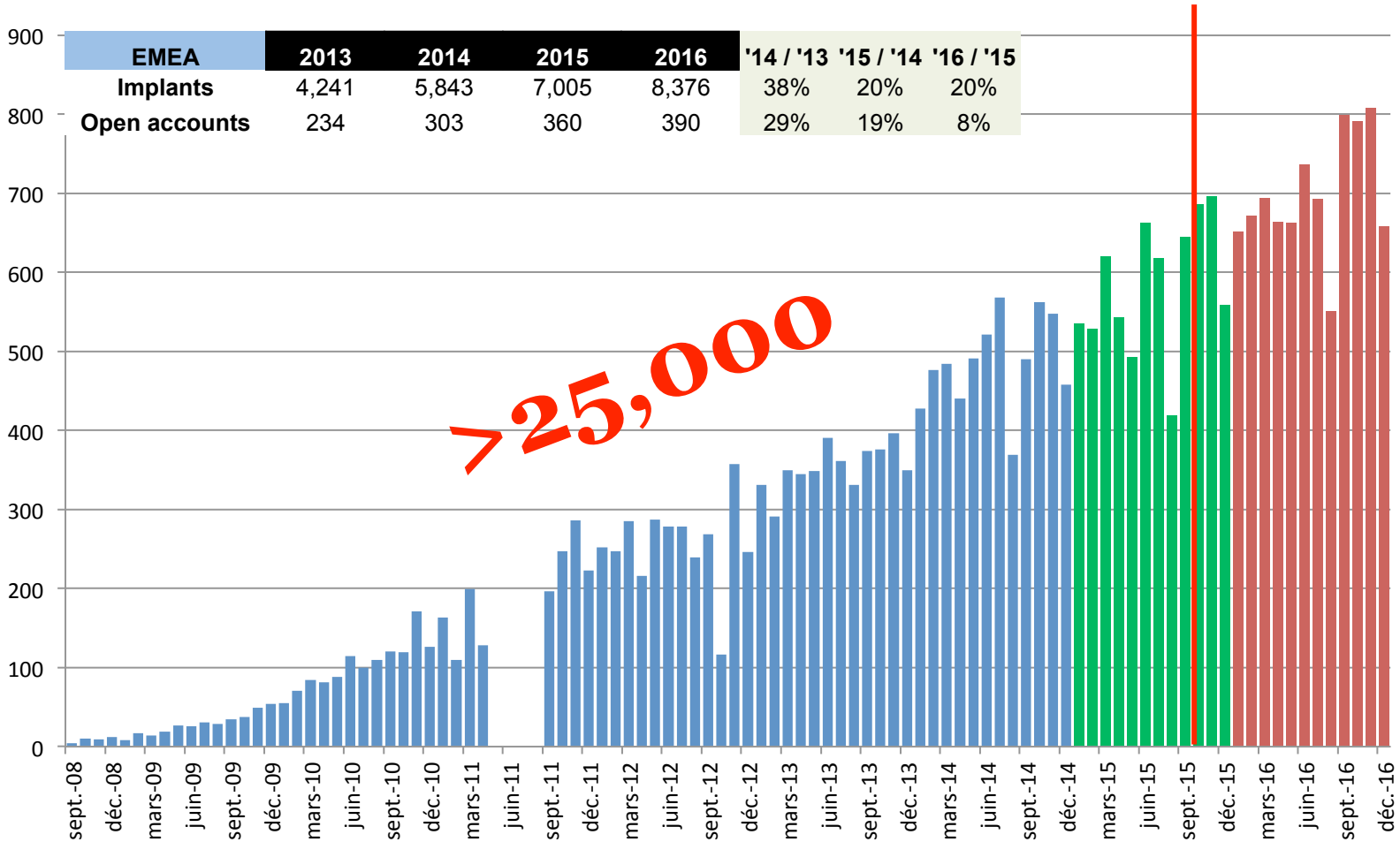


4 years




# Transcatheter techniques : *From Mitraclip to prostheses*

| EMEA | 2013 | 2014 | 2015 | 2016 | '14 / '13 | '15 / '14 | '16 / '15 |
|---|---|---|---|---|---|---|---|
| Implants | 4,241 | 5,843 | 7,005 | 8,376 | 38% | 20% | 20% |
| Open accounts | 234 | 303 | 360 | 390 | 29% | 19% | 8% |



# After Everest : *Cohorts & Registries ?*

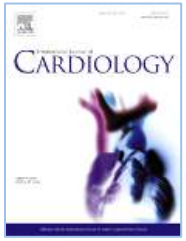

## Percutaneous Mitral Valve Edge-to-Edge Repair

### In-Hospital Results and 1-Year Follow-Up of 628 Patients of the 2011-2012 Pilot European Sentinel Registry

Long-term survival after MitraClip® therapy in patients with severe mitral regurgitation and severe congestive heart failure: A comparison among survivals predicted by heart failure models

Thomas Schau (MD)[a,1,*], Akihiro Isotani (MD)[a,1], Michael Neuss (MD)[a], Maren Schöpp (MD)[a], Martin Seifert (MD)[a], Christin Höpfner (MD)[a], Daniel Burkhoff (MD, PhD)[b], Christian Butter (MD)[a]

[a] Heart Center Brandenburg in Bernau, Bernau, Germany
[b] Columbia University, New York, NY, USA

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[a] Heart Center Brandenburg in Bernau, Bernau, Germany
[b] Columbia University, New York, NY, USA


## Percutaneous Mitral Valve Repair for Mitral Regurgitation in High-Risk Patients

### Results of the EVEREST II Study

Donald D. Glower, MD,* Saibal Kar, MD,† Alfredo Trento, MD,† D. Scott Lim, MD,‡ Tanvir Bajwa, MD,§‖ Ramon Quesada, MD,¶ Patrick L. Whitlow, MD,# Michael J. Rinaldi, MD,** Paul Grayburn, MD,†† Michael J. Mack, MD,†† Laura Mauri, MD,‡‡§§ Patrick M. McCarthy, MD,‖‖ Ted Feldman, MD¶¶


## Predictors of clinical outcomes after edge-to-edge percutaneous mitral valve repair

Davide Capodanno, MD, PhD,[a,c] Marianna Adamo, MD,[b,c] Marco Barbanti, MD,[a] Cristina Giannini, MD,[c] Maria Luisa Laudisa, MD,[d] Stefano Cannata, MD,[a] Salvatore Curello, MD,[b] Sebastiano Immè, MD,[a] Diego Maffeo, MD,[b] Francesco Bedogni, MD,[d] Anna Sonia Petronio, MD,[c] Federica Ettori, MD,[b] Corrado Tamburino, MD, PhD,[a] and Carmelo Grasso, MD[a], on behalf of the GRASP-IT Investigators *Catania, Brescia, Pisa, and Milan, Italy*

## Association of tricuspid regurgitation with clinical and echocardiographic outcomes after percutaneous mitral valve repair with the MitraClip System: 30-day and 12-month follow-up from the GRASP Registry

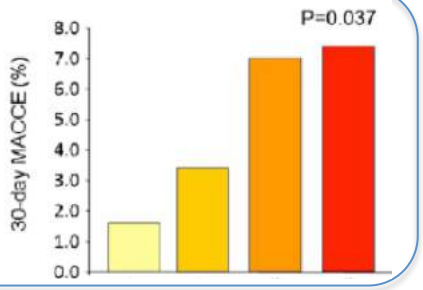
Yohei Ohno[1,2†], Guilherme F. Attizzani[1,3,4†], Davide Capodanno[1,5], Stefano Cannata[1], Fabio Dipasqua[1], Sebastiano Immé[1], Marco Barbanti[1], Margherita Ministeri[1], Anna Caggegi[1], Anna M. Pistritto[1], Marta Chiarandà[1], Giuseppe Ronsivalle[1], Sandra Giaquinta[1], Silvia Farruggio[1], Sarah Mangiafico[1], Salvatore Scandura[1], Corrado Tamburino[1,5], Piera Capranzano[1,5‡], and Carmelo Grasso[1‡*]

## Meta-Analysis of the Usefulness of Mitraclip in Patients With Functional Mitral Regurgitation

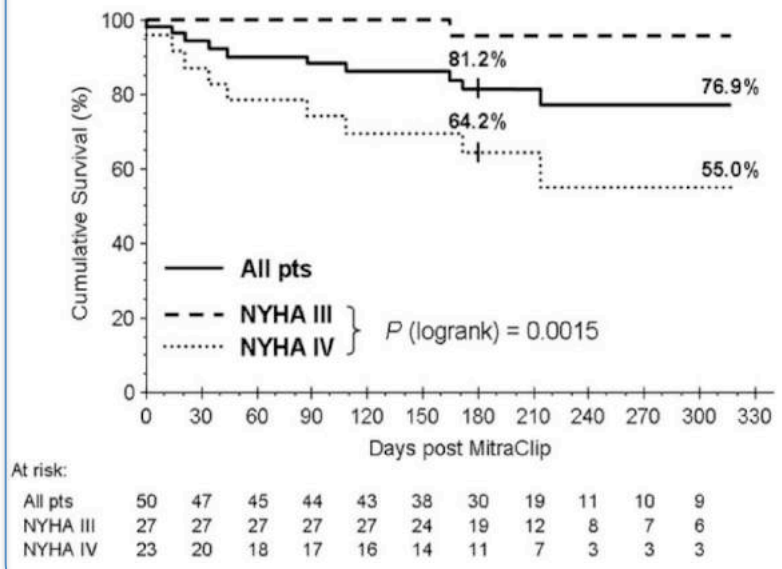
Fabrizio D'ascenzo, MD[a], Claudio Moretti, MD[a], Walter Grosso Marra, MD[a], Antonio Montefusco, MD[a], Pierluigi Omede, MD[a], Salma Taha, MD[a,b,*], Davide Castagno, MD[a], Oliver Gaemperli, MD[c], Maurizio Taramasso, MD[d], Simone Frea, MD[a], Stefano Pidello, MD[e], Volker Rudolph, MD[f], Olaf Franzen, MD[g], Daniel Braun, MD[h], Cristina Giannini, MD[i], Huseyin Ince, MD[j], Leor Perl, MD[k], Giuseppe Zoccai, MD[l], Sebastiano Marra, MD[a], Maurizio D'Amico, MD[a], Francesco Maisano, MD[m], Mauro Rinaldi, MD[a], and Fiorenzo Gaita, MD[a]


**Influence of non-cardiac comorbidities on outcome after percutaneous mitral valve repair: results from the German transcatheter mitral valve interventions (TRAMI) registry**

*Influence of extra-cardiac comorbities* ➔

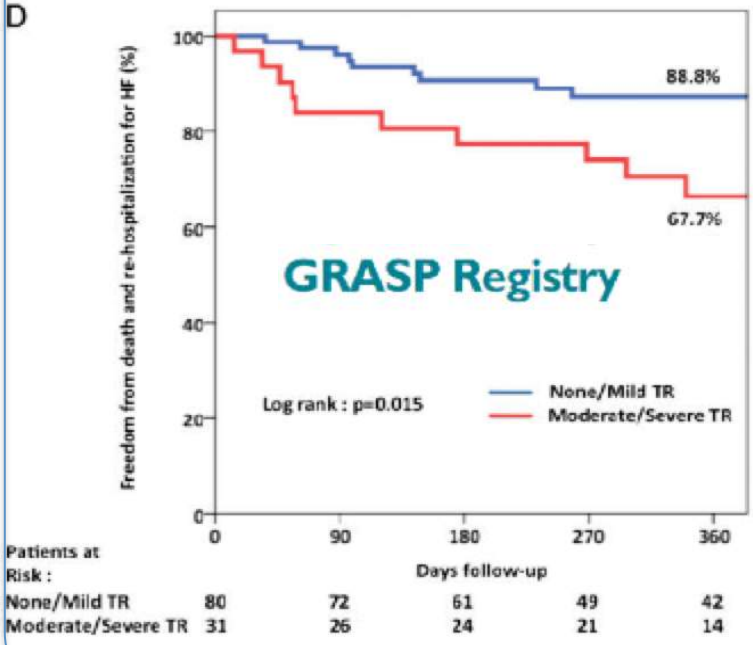



## MitraClip® therapy in patients with end-stage systolic heart failure



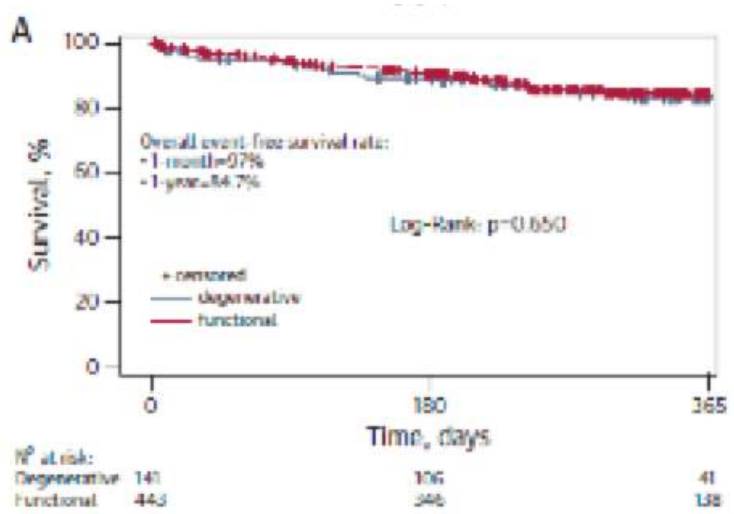

*Franzen O. Eur J Heart Failure 2011; 13: 569–576*

## Association of tricuspid regurgitation




*Ohno Y. Eur Heart Journal 2014; 15: 51246-55*

# 2) Questionable : Impact on mortality ?

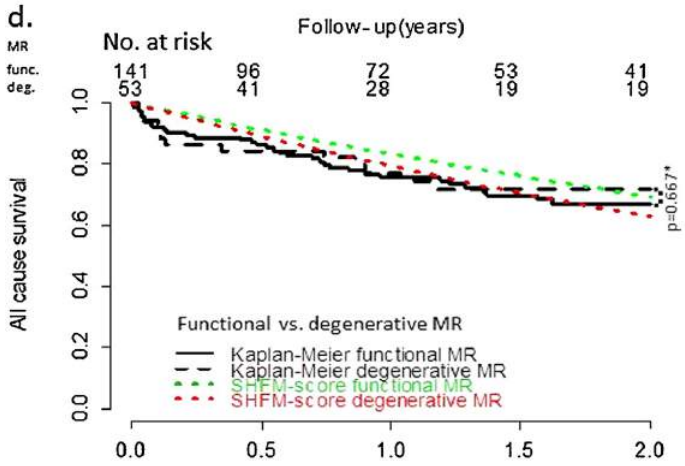



## Percutaneous Mitral Valve Edge-to-Edge Repair

### In-Hospital Results and 1-Year Follow-Up of 628 the 2011–2012 Pilot European Sentinel Registry


Georg Nickenig, MD, PhD,* Rodrigo Estevez-Loureiro, MD, PhD,† Olaf Franzen, MD,‡ Corrado Tamburino, MD, PhD,§

- 628 patients in Europe (25 centers, 8 countries)
- FU for secondary and primary MR
- 1 year echo assessement




## Long-term survival after MitraClip® therapy in patients with severe mitral regurgitation and severe congestive heart failure: A comparison among survivals predicted by heart failure models

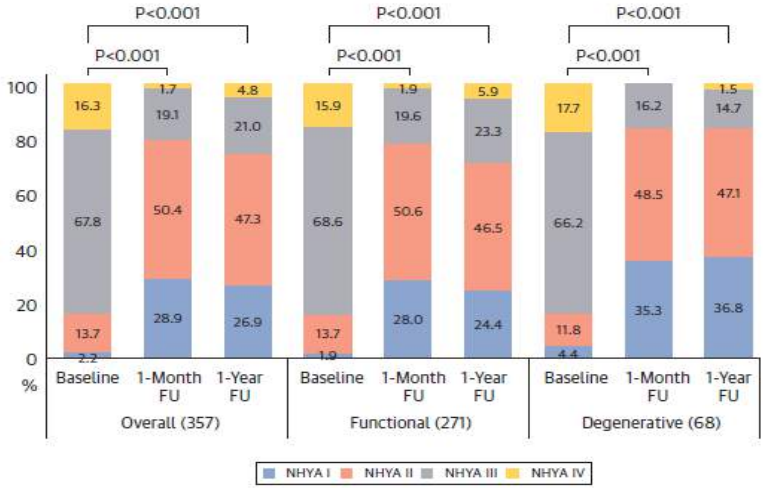
Thomas Schau (MD)[a,1,*], Akihiro Isotani (MD)[a,1], Michael Neuss (MD)[a], Maren Schöpp (MD)[a], Martin Seifert (MD)[a], Christin Höpfner (MD)[a], Daniel Burkhoff (MD, PhD)[b], Christian Butter (MD)[a]

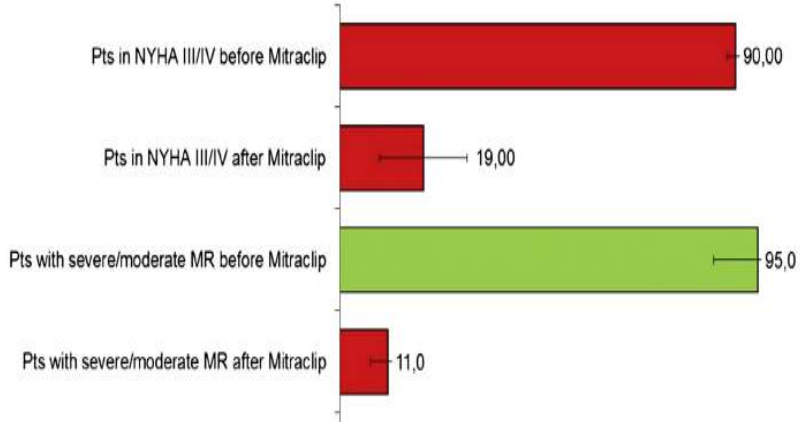
[a] Heart Center Brandenburg in Bernau, Bernau, Germany
[b] Columbia University, New York, NY, USA

2015

- 194 patients (brandeburgh, New york)
- Mortality versus Seattle HF model

# 3) Likely : Improved Symptoms / decreased MR




## Percutaneous Mitral Valve Edge-to-Edge Repair

In-Hospital Results and 1-Year Follow-Up of 628 Pa
the 2011–2012 Pilot European Sentinel Registry

Georg Nickenig, MD, PhD,* Rodrigo Estevez-Loureiro, MD, PhD,† Olaf Franzen, MD,‡ Corrado Tamburino, MD, PhD,§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- Meta analysis
  - -9 studies
  - -875 patients

# 4) Complex : Echographic analysis

## Percutaneous Mitral Valve Edge-to-Edge Repair

### In-Hospital Results and 1-Year Follow-Up of 628 Patients of the 2011–2012 Pilot European Sentinel Registry

Georg Nickenig, MD, PhD,* Rodrigo Estevez-Loureiro, MD, PhD,† Olaf Franzen, MD,‡ Corrado Tamburino,


- 628 patients in Europe (25 centers, 8 countries)
- FU for secondary and primary MR
- 1 year echo assessement
- 15 centers with > 90% FU ➔ 368 echo at 1 year

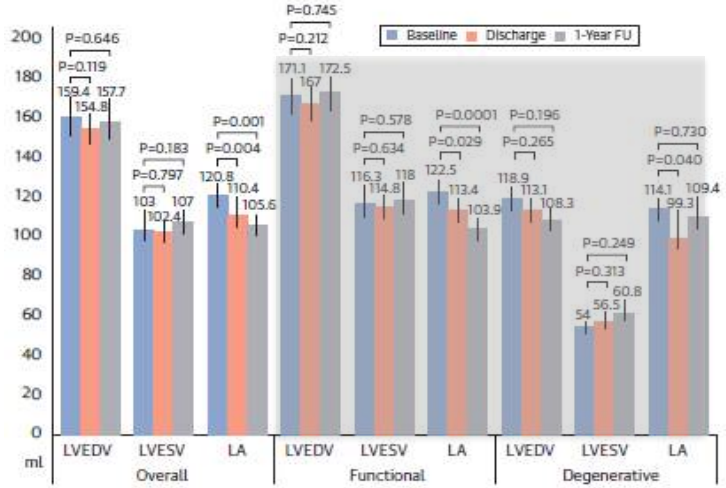



**FIGURE 5 Echocardiographic Measurement of Left Ventricular and Left Atrial Volumes at Baseline, Discharge, and 1-Year Follow-Up After TMVR (Paired Data From 368 Patients)**

In the overall cohort, a nonsignificant reduction in left ventricular end-diastolic volume (LVEDV) was observed, with a significant reduction in left atrial volume (LA). In functional mitral regurgitation, left ventricular volumes remained stable during follow-up, although a significant reduction in LA was noted. In degenerative mitral regurgitation, the most relevant finding was a reduction in LVEDV over time (nonsignificant). LVESV = left ventricular end-systolic volume; TMVR = transcatheter mitral valve repair.

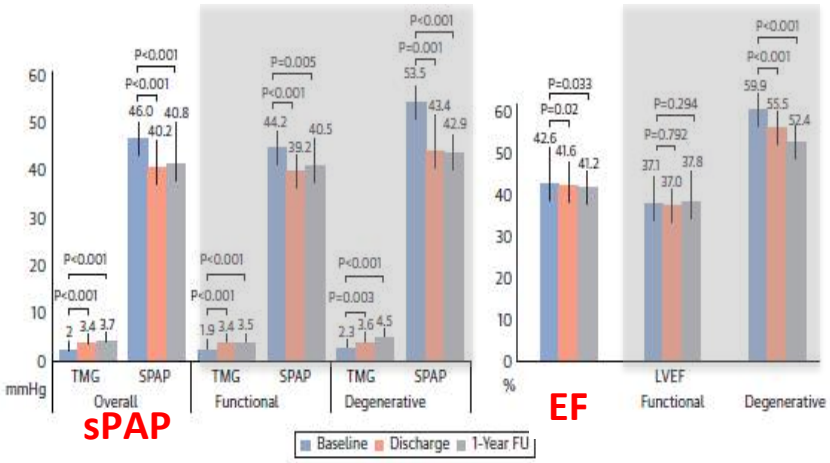
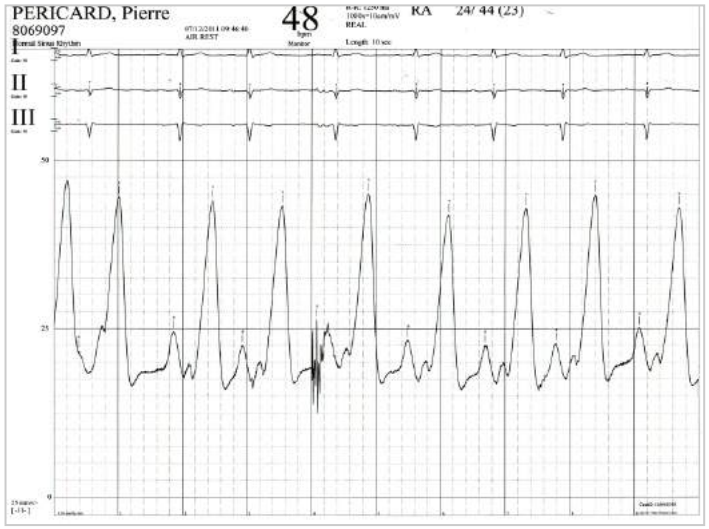



**FIGURE 6 Echocardiographic Measurement of Transmitral Pressure Gradient, SPAP, and Ejection Fraction, at Baseline, Discharge, and 1-Year Follow-Up**

Significant and persistent reductions in systolic pulmonary artery pressure (SPAP) were observed. After transcatheter mitral valve repair, transmitral pressure gradient (TMG) (mm Hg) increased significantly, although no cases of severe mitral stenosis were reported. LVEF = left ventricular ejection fraction (%).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48
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24/ 44 (23)
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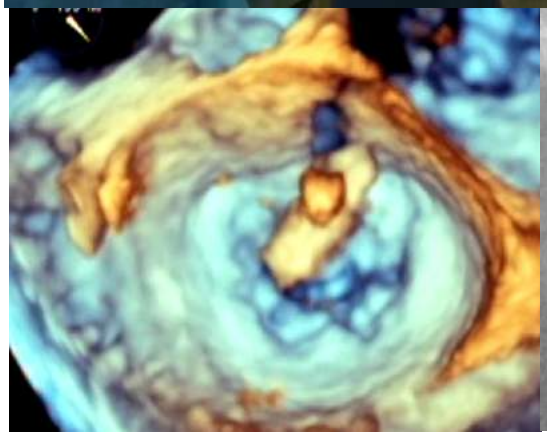
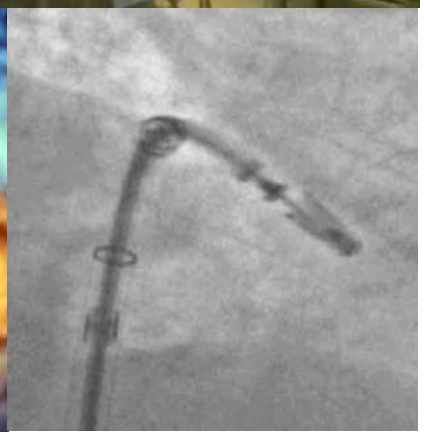
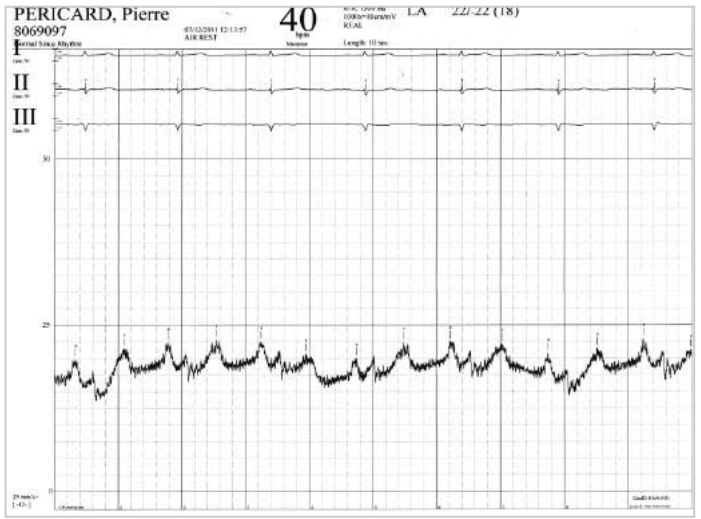
II
III



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LA
22/ 22 (18)
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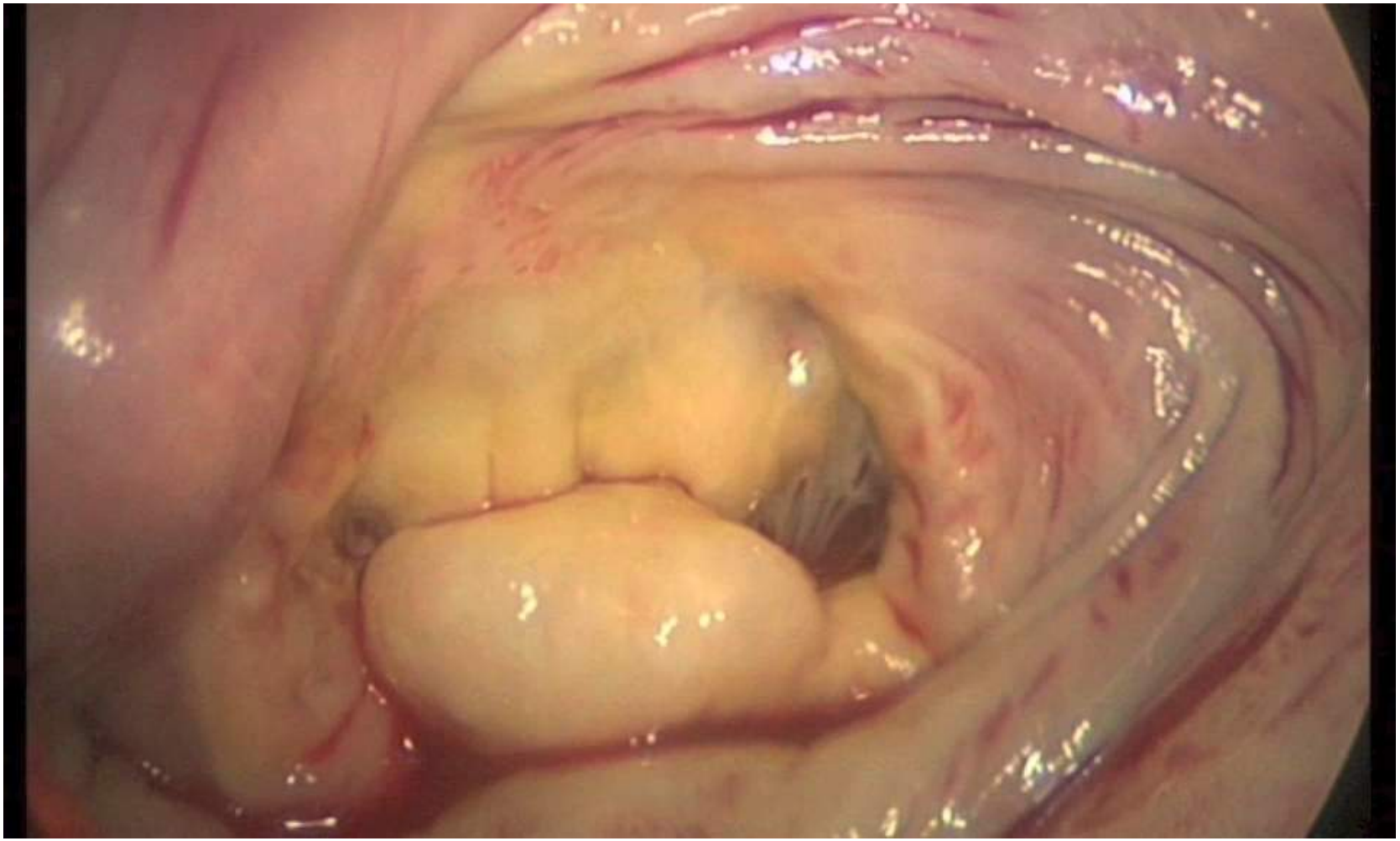
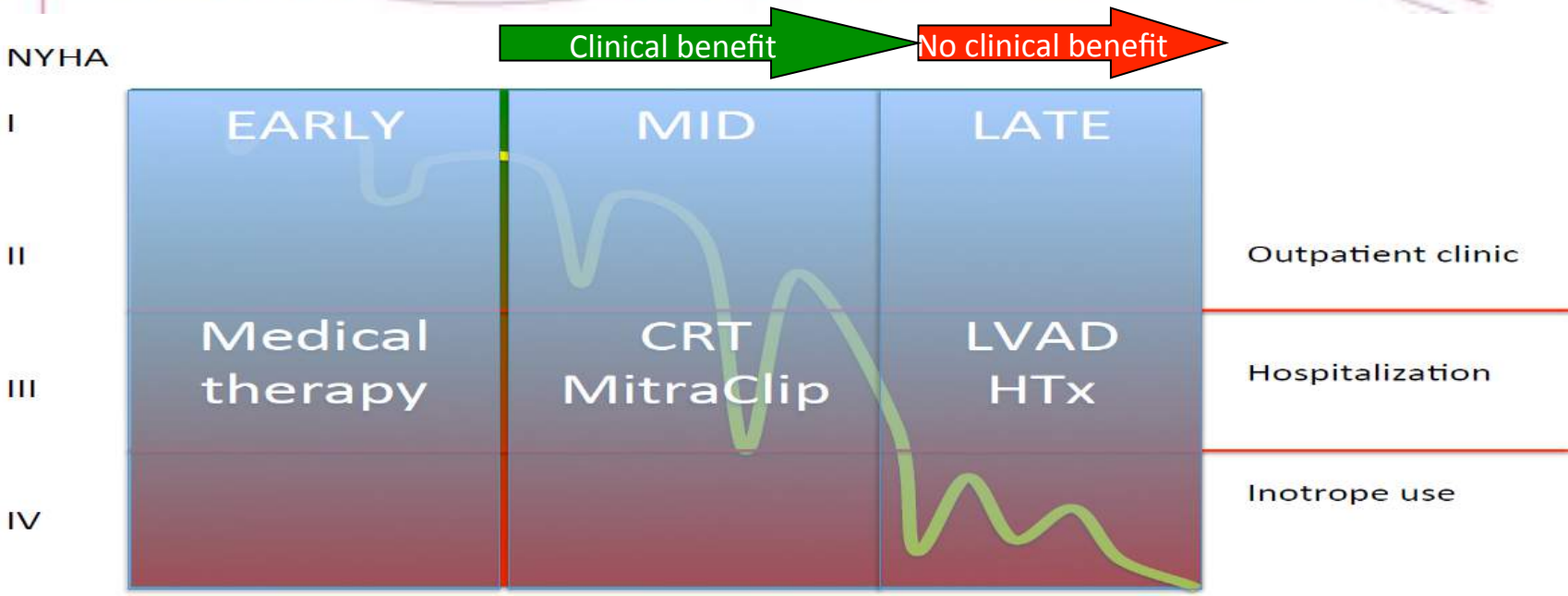
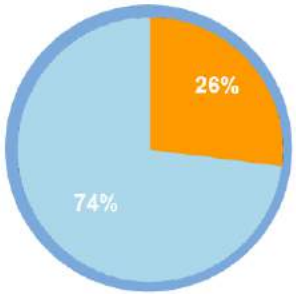
II
III



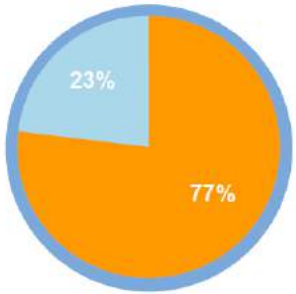




**EVEREST II**
(Randomized Controlled Trial)



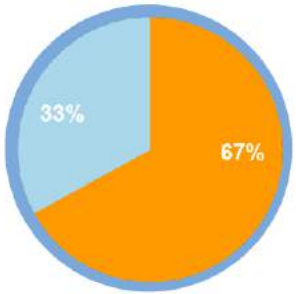

- 178 patients

**ACCESS EU**
(Europe)

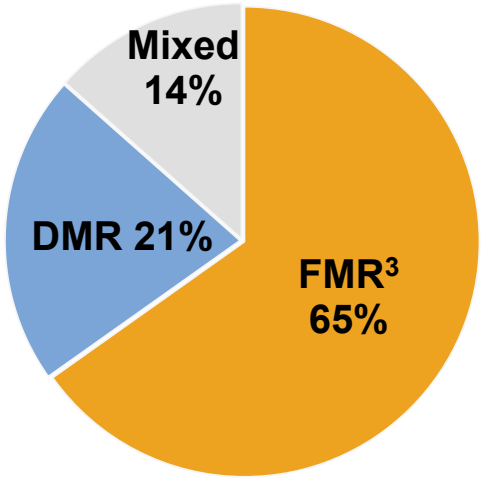



- 567 patients

**Commercial**
(APJ, CALA, Europe, US)




- 10,614 patients

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**MITRA.fr** (Currently enr

**COAPT** (Currently Enrolling)

**RESHAPE-HF** (Currently Enrolling)

**EVEREST I (Feasibility Study)**
(55 Patients Enrolled)

**High Risk Study**
(78 Patients Enrolled)

**ACCESS Europe (Commercial Registry)**
(567 Commercial Patients Enrolled)

2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

**First Implant**

**EVEREST II (Randomized Controlled Trial)**
(279 Patients Enrolled)

**CE Mark**

**REALISM (Continued Access)**
(815 Patients Enrolled)

Neochord

Premiers patients français

**STIC 2010 : TECH. INNOV. COUTEUSES**

*MITRACLIP® pour IM fonctionnelles symptomatiques.*

**Soumission Oct 2010 ➔ refus Sept 2011**

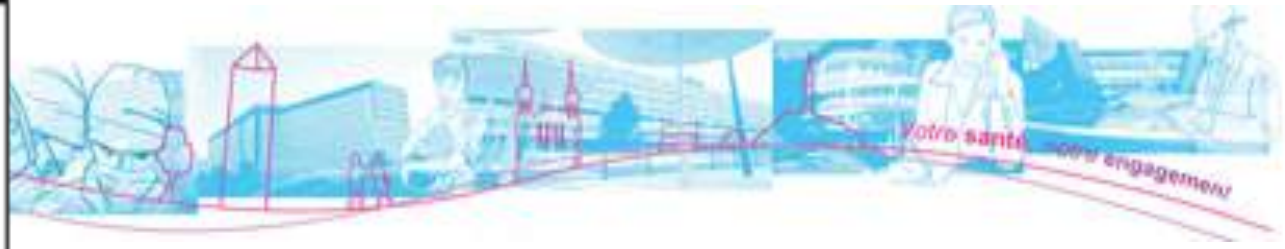
**PHRC 2012 : Appel à projet DGOS**

*MITRACLIP® pour IM fonctionnelles symptomatiques.*

**Soumission Janvier 2012 ➔ Acceptation Décembre 2012**

**Inclusion Janvier 2014**

Conclusion




MITRA.fr-planning

Mar | Aoû | Jan | Jul | Nov | Avr | Sep | Fév | Jul | Déc | Mai | Oct | Mar | Aoû

PROJET MITRA.fr

05/13

CPP 15/05/13

ANSM 23/05/13

CCTIRS 13/06/13

Autorisation CNIL 22/10/13

Today

End 2016

Inclusions

30/12/13 — 30/11/16

Suivi des patients à M12

30/12/13 — 01/12/17

Monitorage des données M12

30/12/13 — 01/02/18

Nettoyage de la base de données M12
02/02/18 — 28/02/18

Gel de base M12 28/02/18

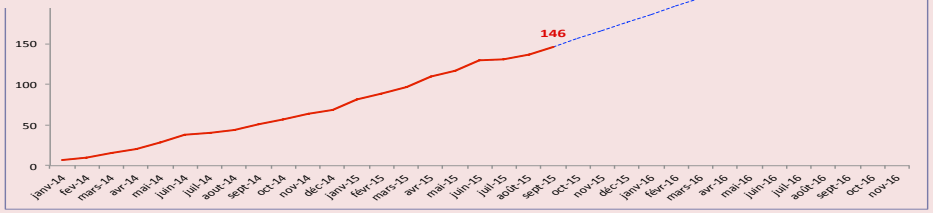
Analyses statistiques - Résultats M12
01/03/18 — 03/04/18

Soumission NEJM 01/05/18

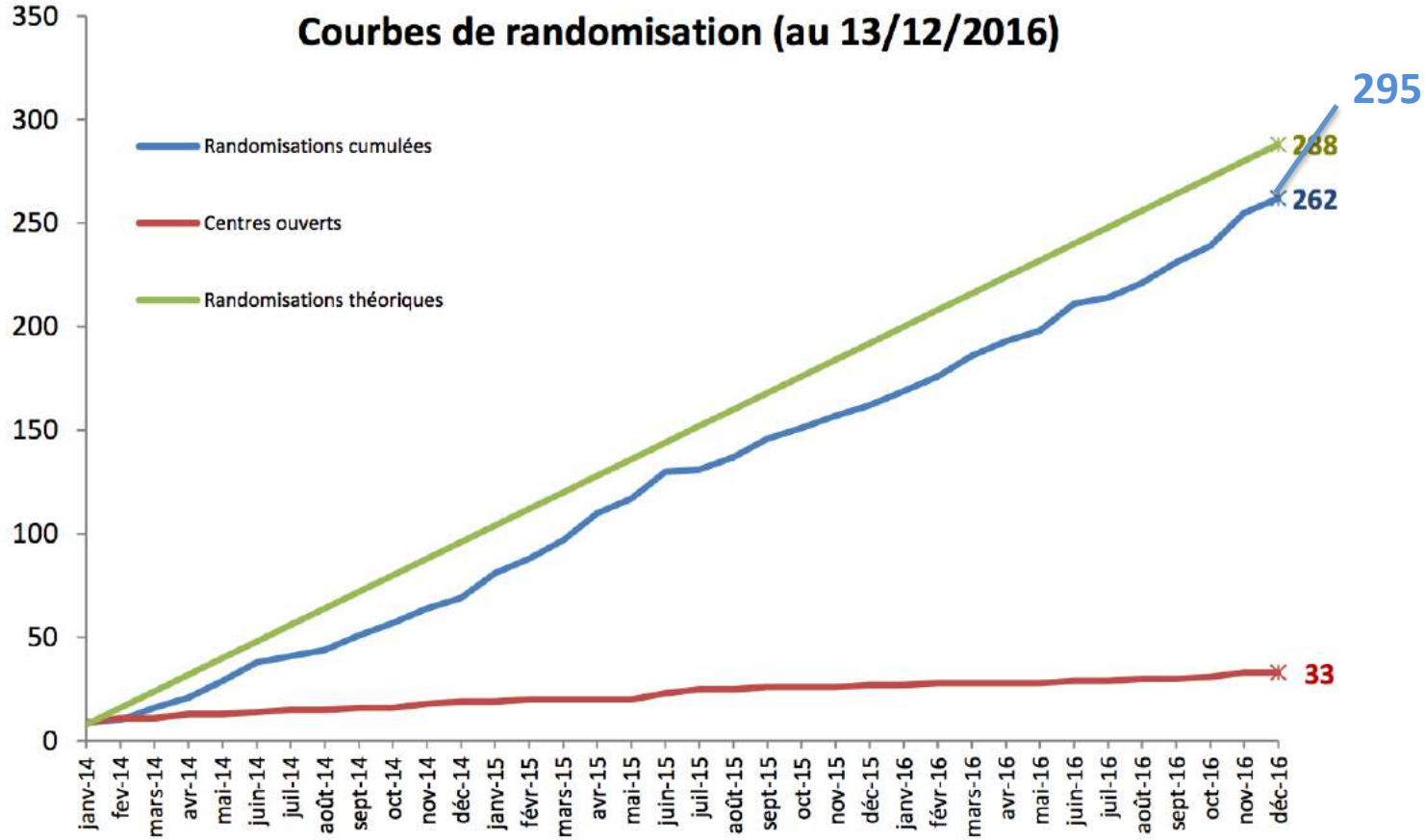
Publication HOTLINE ESC 2018 27/08/18

**Deaths + Hosp**
- Clip33%
- ttt 50%

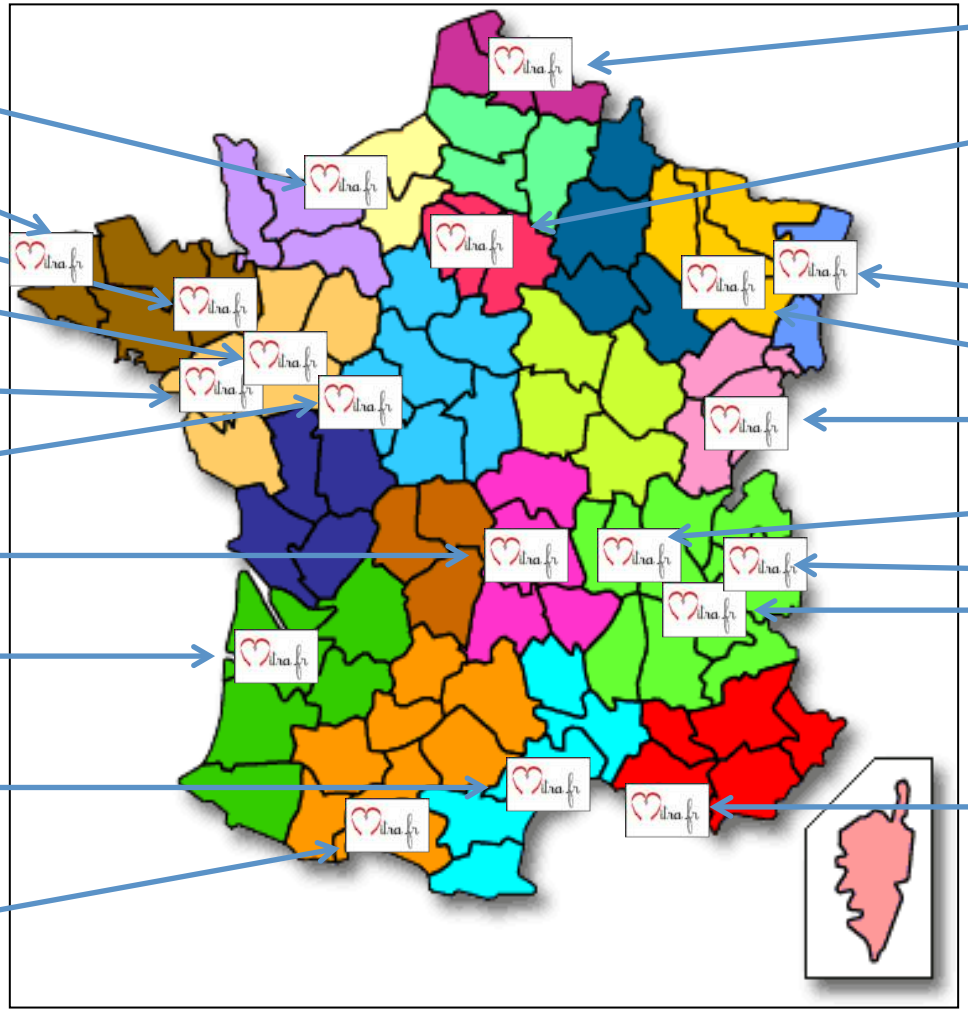
**Deaths = 19;1%**
**Hospit = 55%**




Hôpitaux de Lyon
Votre santé notre engagement


Courbes de randomisation (au 13/12/2016)
Randomisations cumulées
Centres ouverts
Randomisations théoriques
350
300
250
200
150
100
50
0
janv-14
fev-14
mars-14
avr-14
mai-14
juin-14
juil-14
août-14
sept-14
oct-14
nov-14
déc-14
janv-15
févr-15
mars-15
avr-15
mai-15
juin-15
juil-15
août-15
sept-15
oct-15
nov-15
déc-15
janv-16
févr-16
mars-16
avr-16
mai-16
juin-16
juil-16
août-16
sept-16
oct-16
nov-16
déc-16
295
288
262
33

Mitra.fr



Caen

Brest

Rennes

Angers

Nantes

Tours

Clermont-Ferrand

Bordeaux

Montpellier (CHU et Clinique Millénaire)

Toulouse (CHU, clinique Pasteur)

Lille

Bichat, Massy, Créteil, Le Plessis-Robinson, Parly 2, Neuilly, HEGP, Pitié salpêtrière, IMM

Strasbourg

Nancy

Besançon

Lyon

Annecy

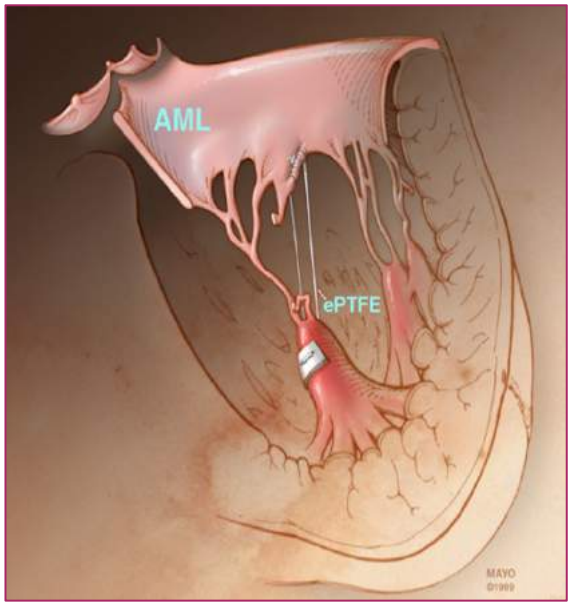
Grenoble

Marseille (La Timone, Saint Joseph)

**-26 open centers ➔ *295 pts /288 included***


| | RESHAPE-HF | COAPT | MITRA.fr |
|---|---|---|---|
| Sponsor | Abbott Vascular | Abbott Vascular | PHRC / Abbott |
| Méthodology | Prospective, randomized | Prospective, randomized | Prospective, randomized |
| Comparison | Optimal Medical Medication | Optimal Medical Medicatio | Optimal Medical Medication |
| MR etiology | Secondary MR | Secondary MR | Secondary MR |
| Ejection Fraction | 15 to 40% | > 30% | 15 to 40% |
| Hospitalisation HF < 12 months ? | 100% | | 100% |
| High Risk Patients | | Surgical CI (heart team) | Surgical CI (heart team) |
| NHYA | III to IV | II, III, IV | II, III, IV |
| Principal Criteria | % all deaths or rehospitalisation rate HF | Safety et efficacy (hospit pour CHF) | % all deaths ou % hospitalisation HF Idem Shift Ivabradine ➔ Lancet |
| Hypothesis | 18 vs 14 % death and 0,6 vs 0,45 hospit | | 50% versus 33% |
| Lost pats | 15% | | 10% |
| Number of inclusions | 400 x 2 Reshape 2 | 250 x 2 + 200 | 144 x 2 293 |
| Number of centres | 50 | 75 | 26 |

# Transapical Off Pump MV Repair



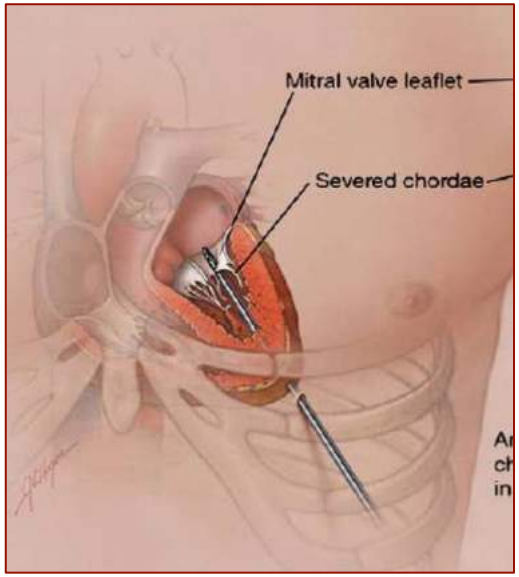

**2009** : 1er patient

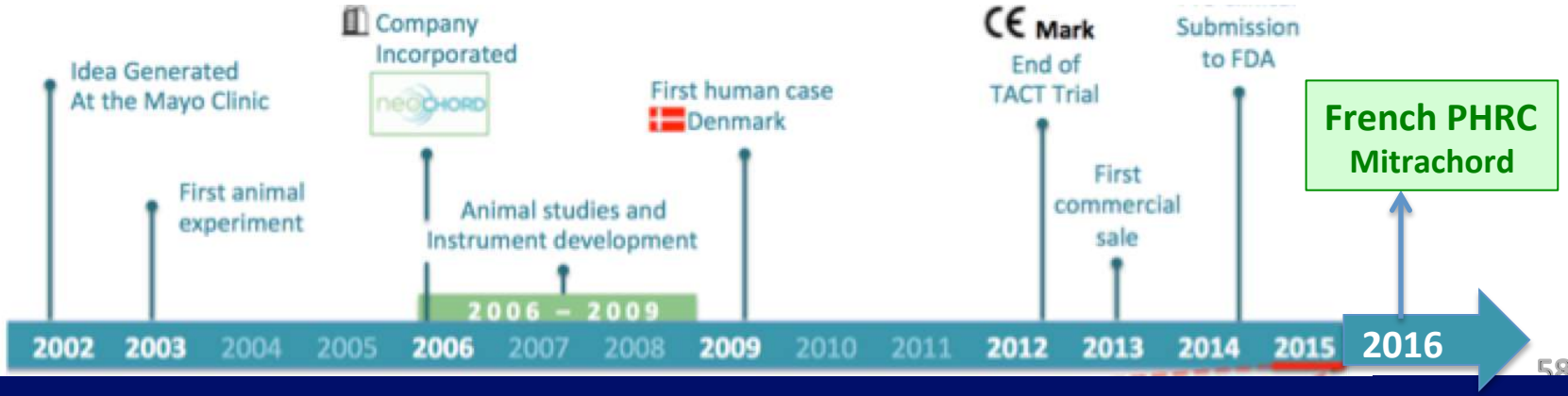
**2013** : CE mark

**2014** : 100 Pts

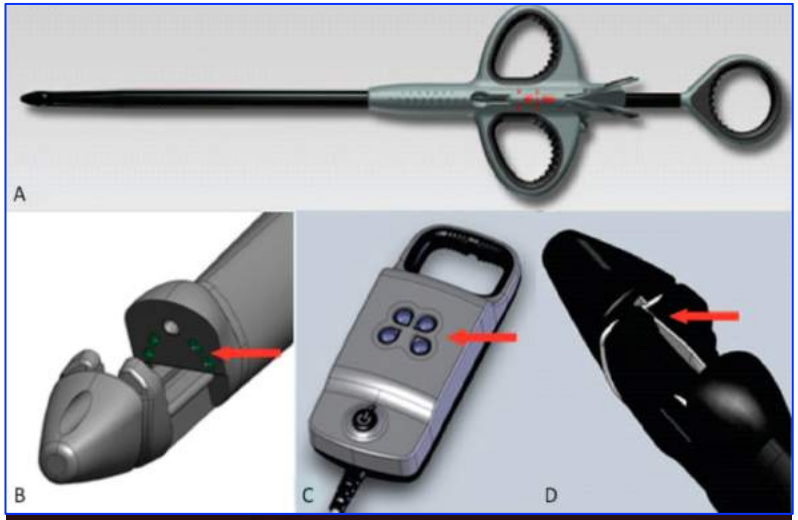
**2015** : 300 Pts

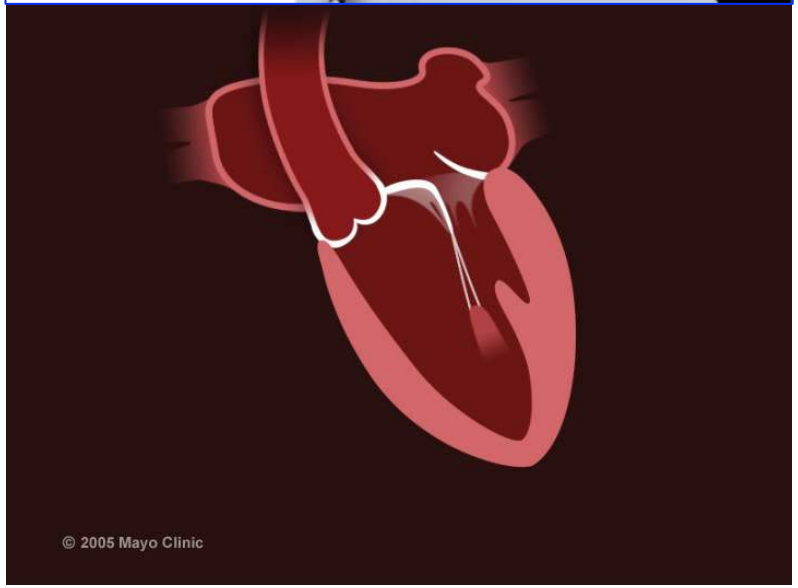
**2016** : > 500 Pts



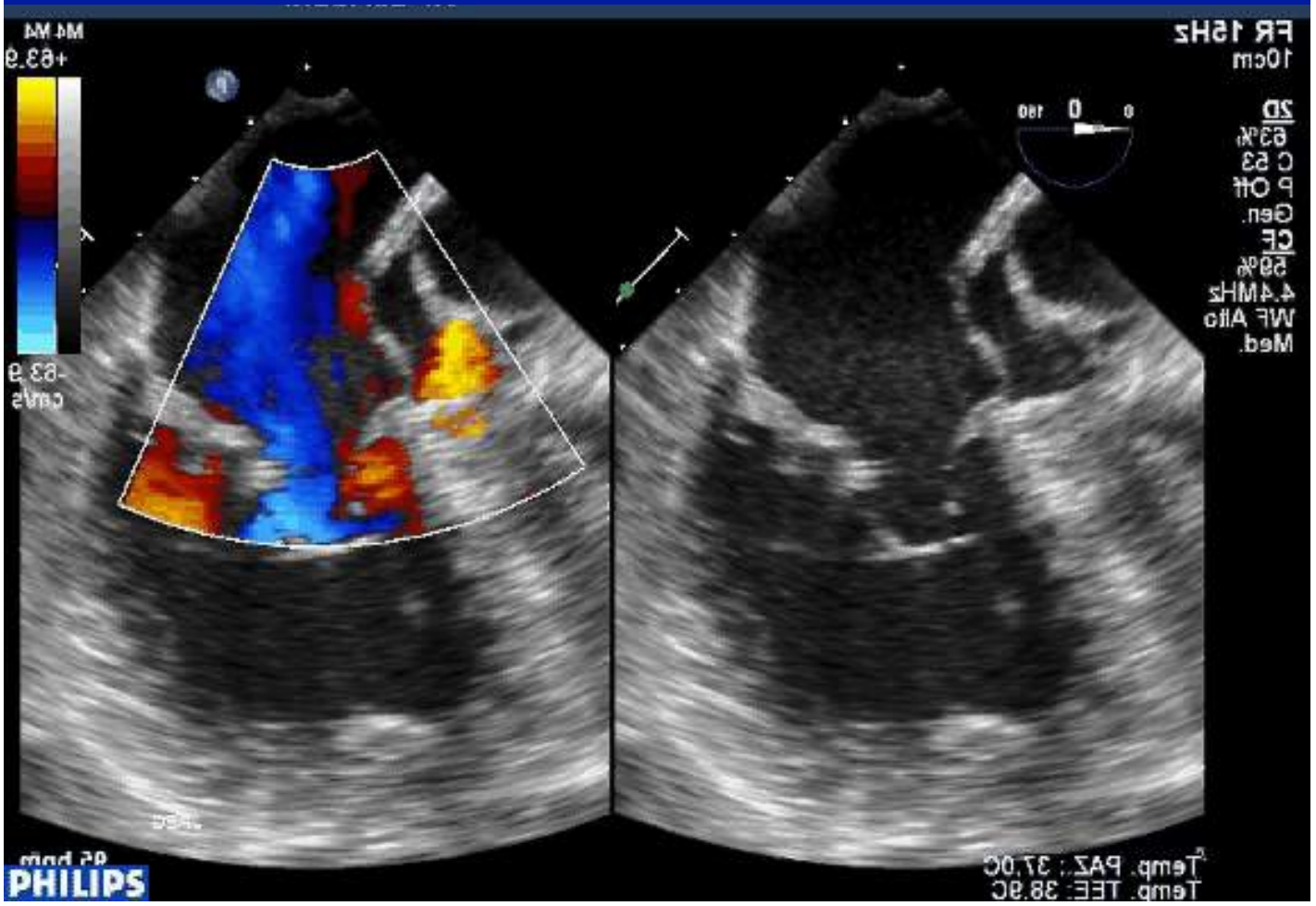



# Neochord

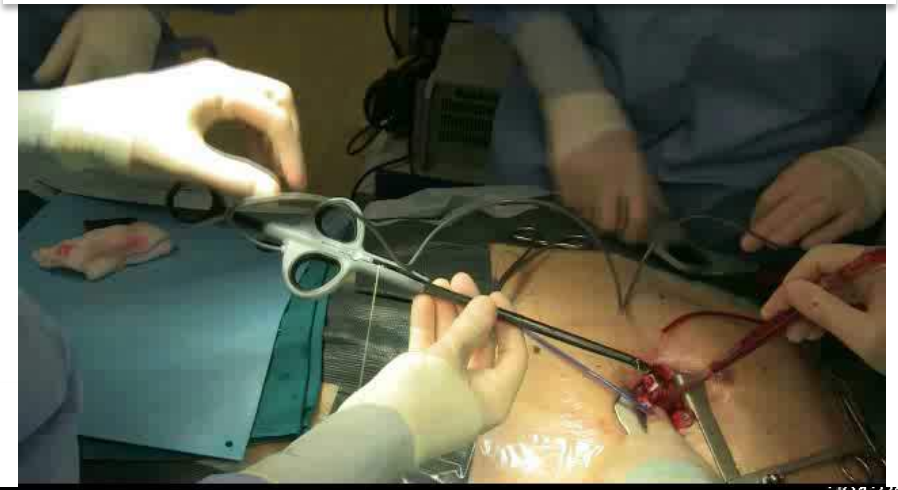


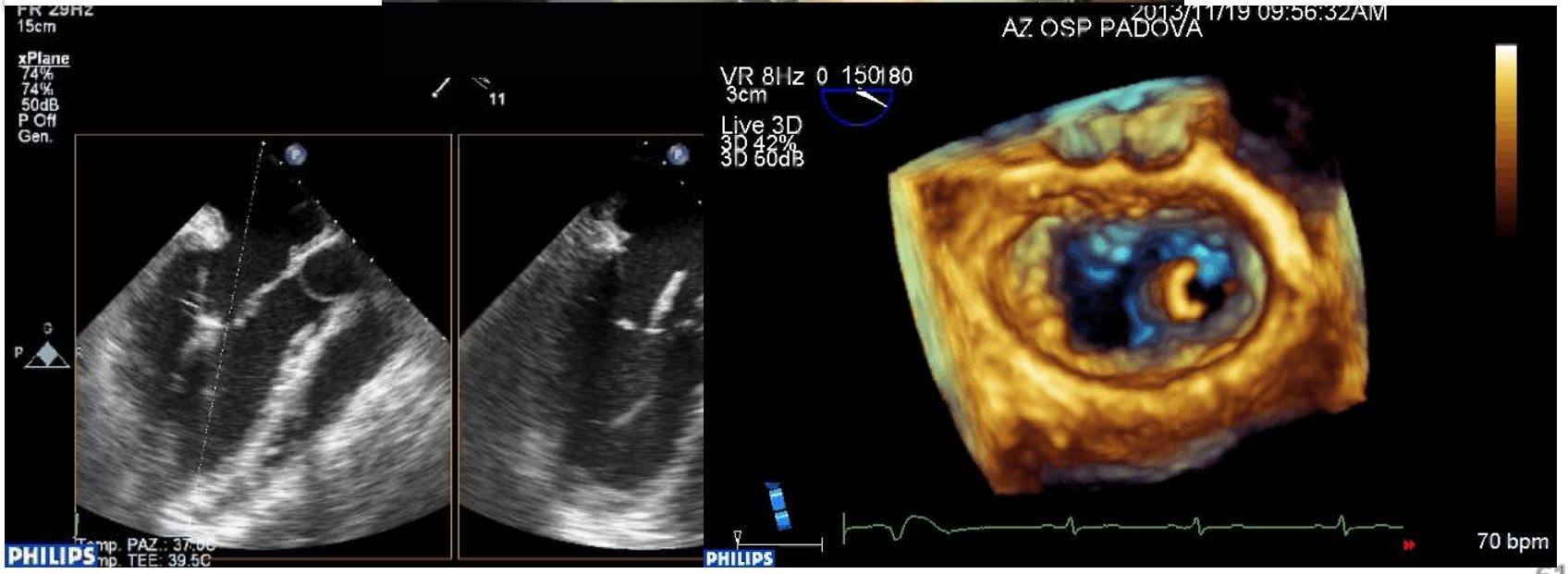



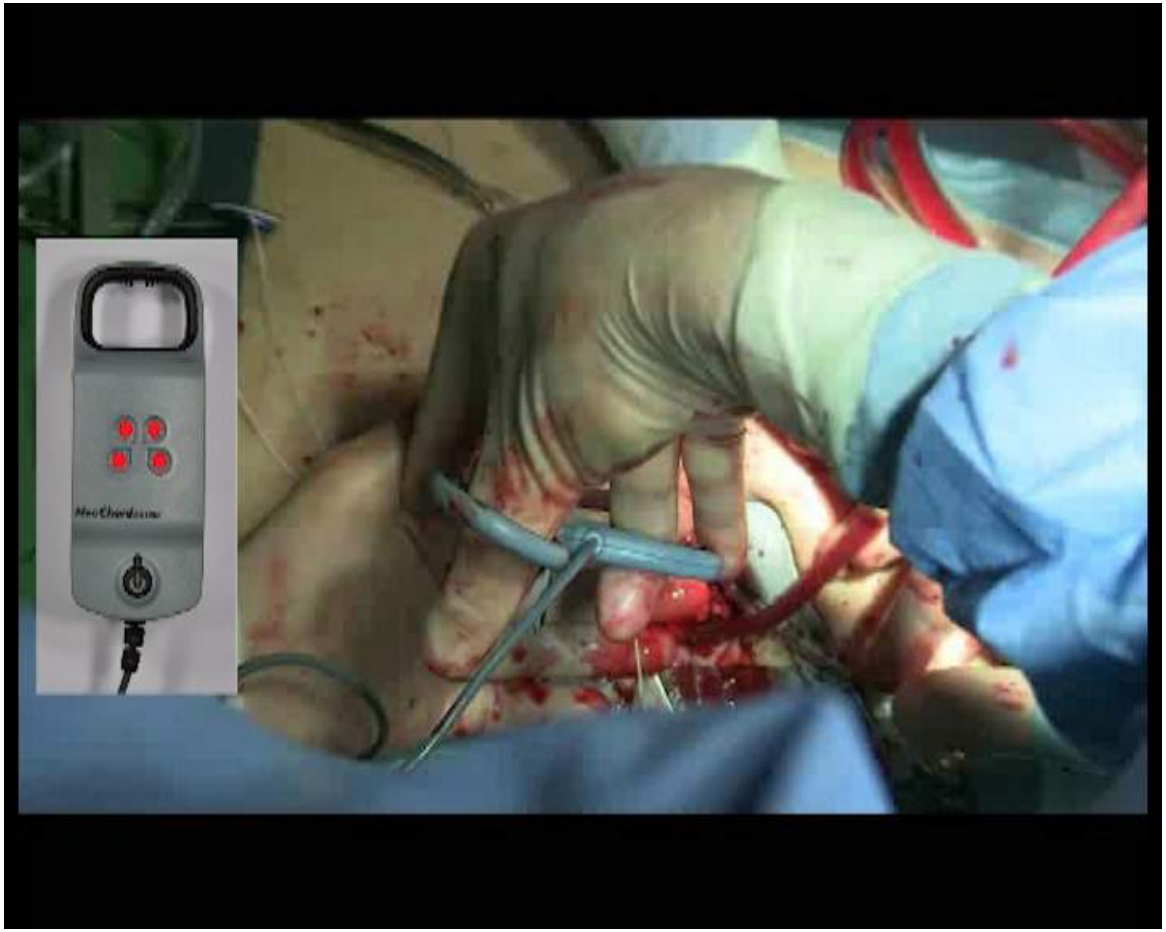
# Pre-operative evaluation

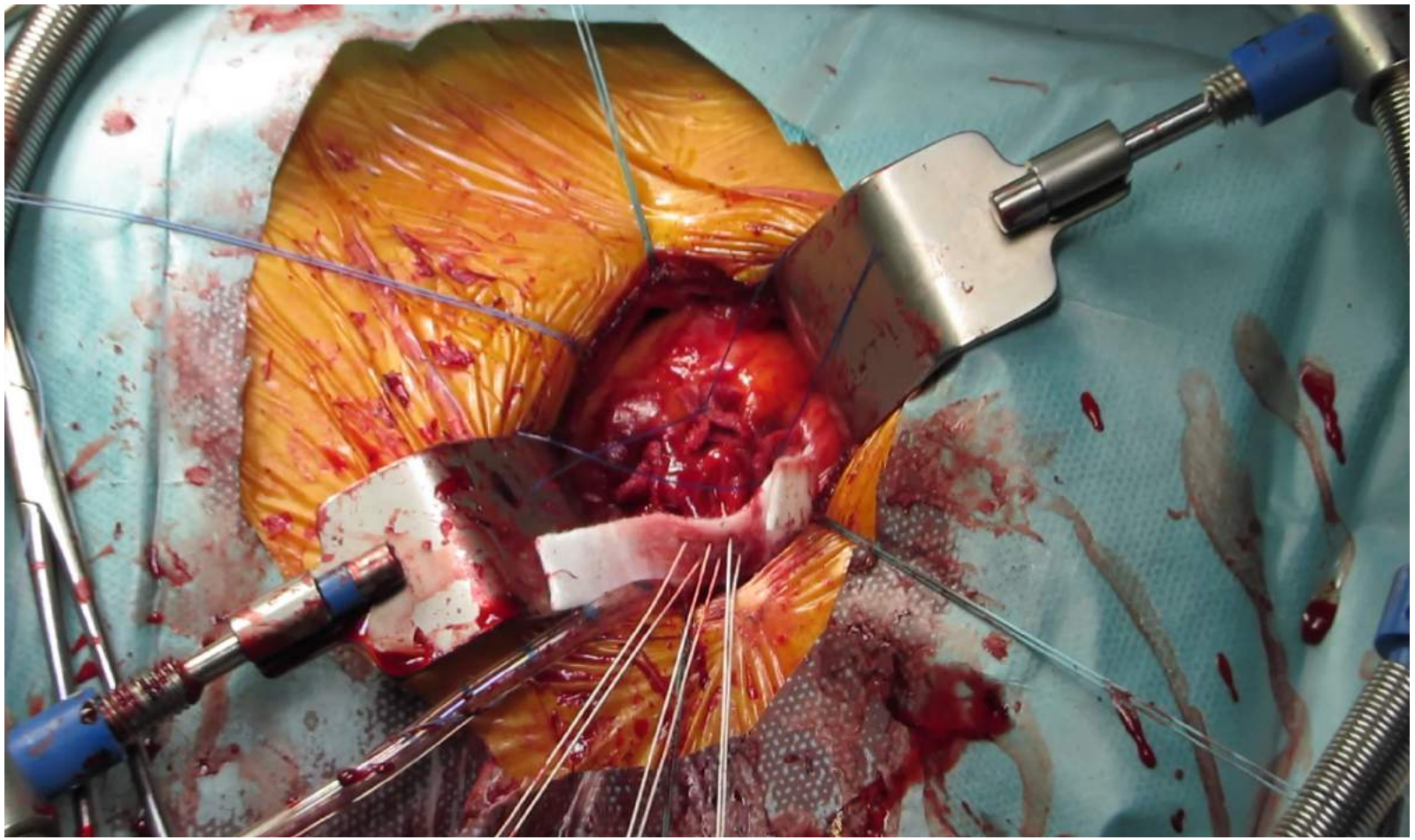


# Implantation Technique

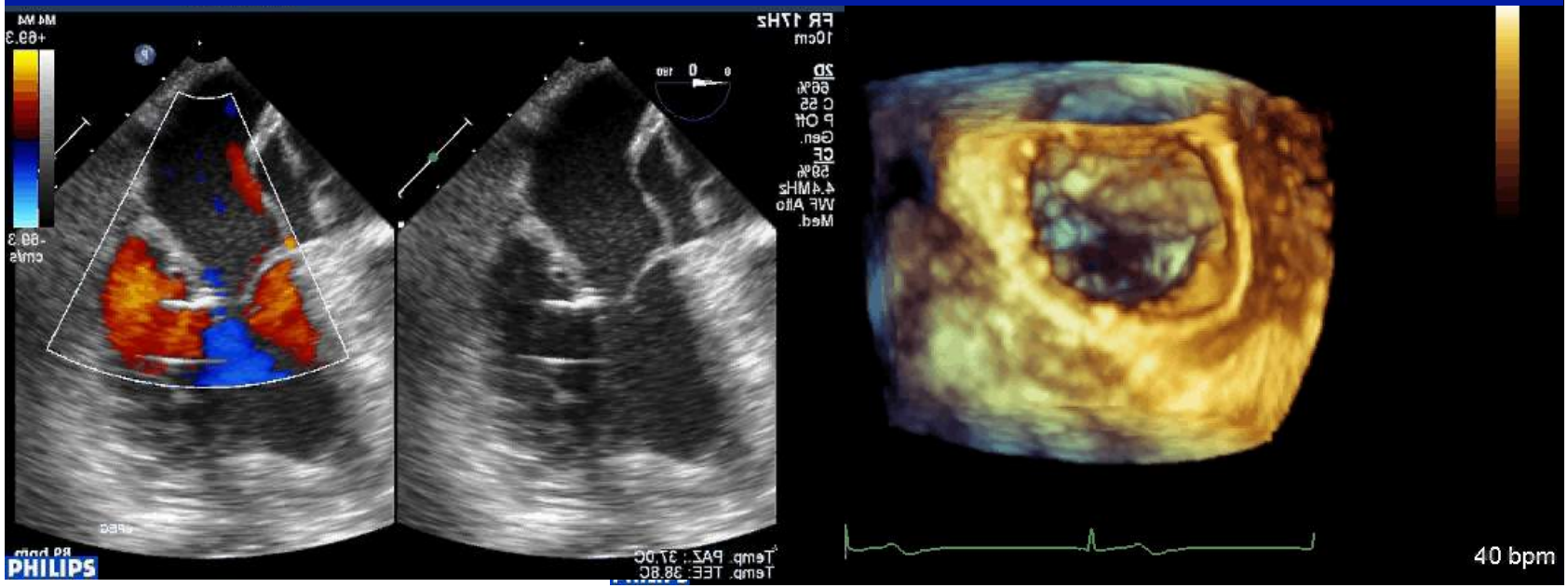




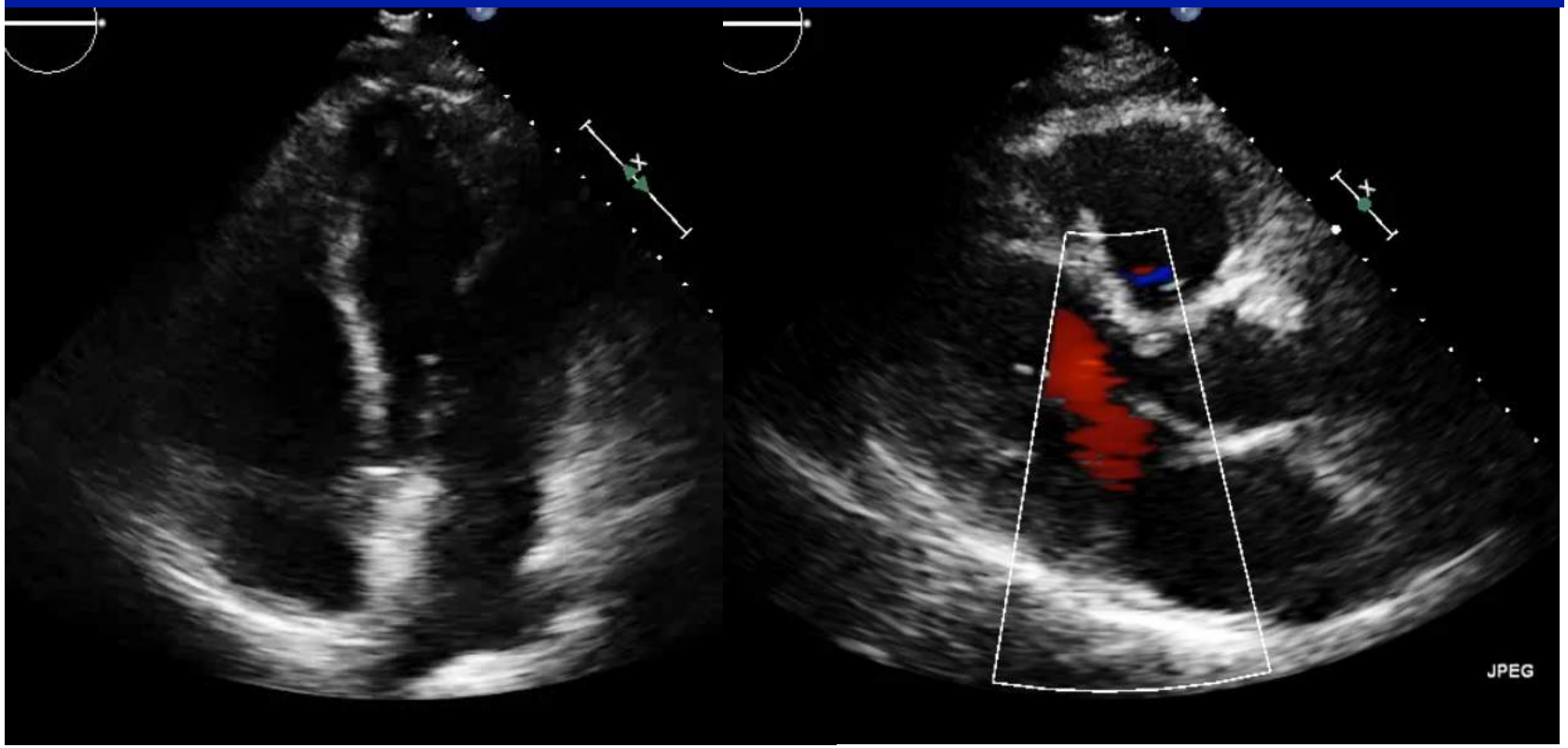




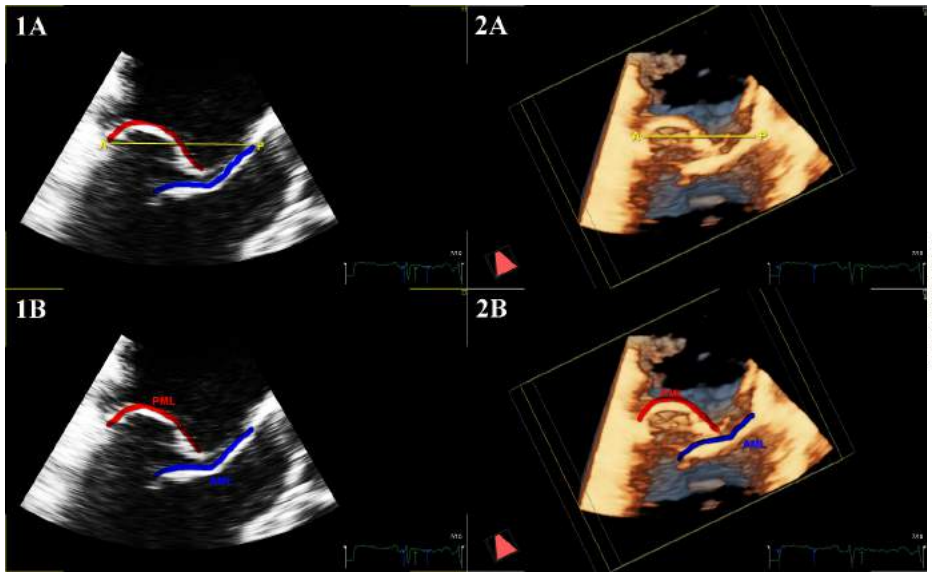

# Post-implantation control

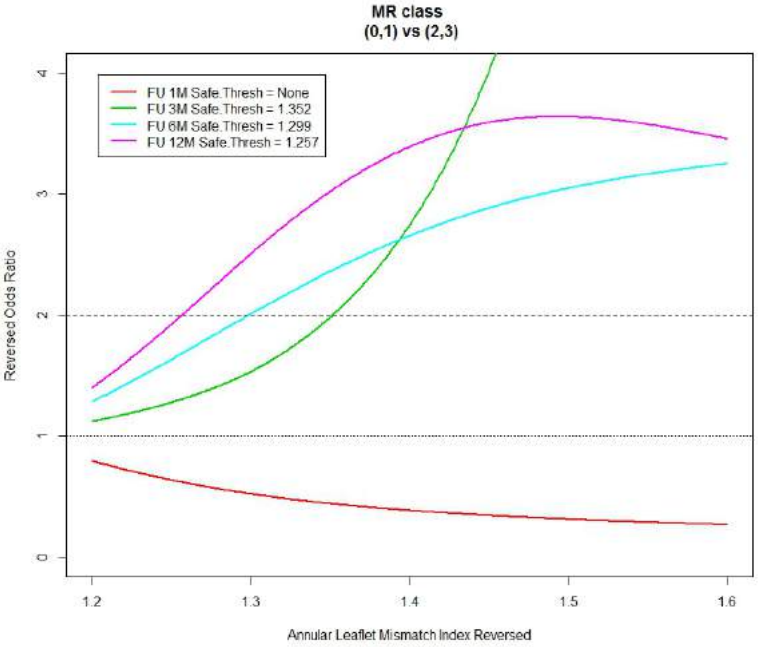



# 1 Year Follow-up



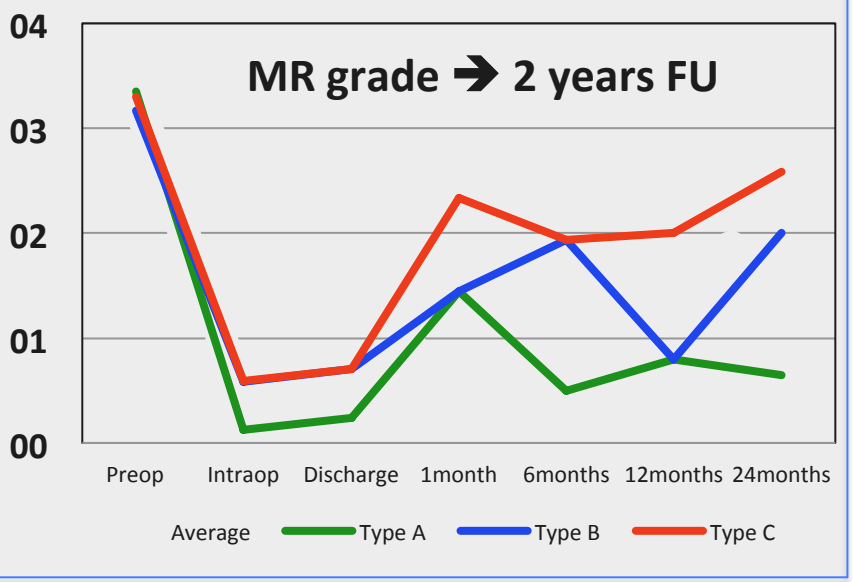
# Leaflet-to-Annulus Index (LAI)

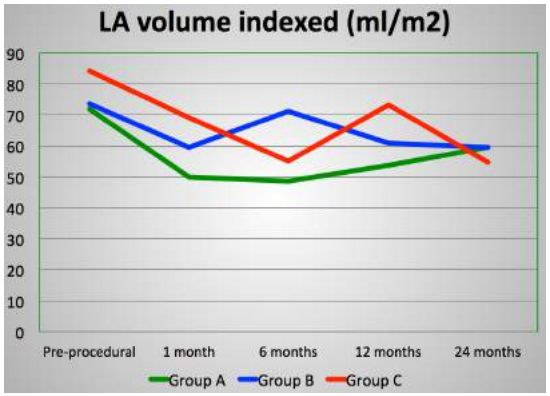


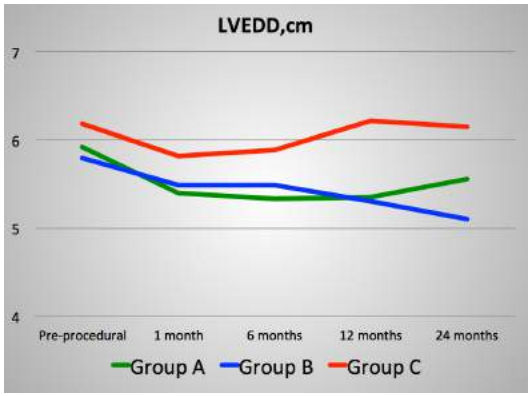



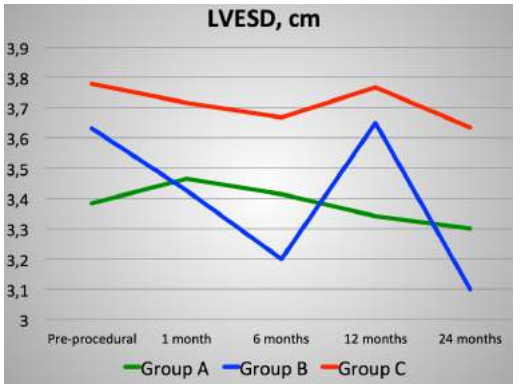

$$\frac{\text{PML} + \text{AML}}{\text{AP}}$$ >1.25 predictive of MR≤1+ at 1y FU


| Type A | Type B | Type C |
|---|---|---|
| • Eccentric regurgitant jet<br>• Central P2 prolapse, extension up to 50% of entire PML. No pericommissural involvement.<br>• No anterior leaflet prolapse or tethering<br>• No severe LV dilatation | • Eccentric regurgitant jet<br>• Extension of prolapse to include the portions of P1 or P3 adjacent to P2<br>• Or may have more than one prolapsing segment (P1+P2, P2+P3) | • Prolapse extending towards the commissures, involvement of anterior leaflet<br>• LV dilatation with initial tethering of AL (gullwing sign)<br>• Central component to regurgitant jet (lack of central coaptation)<br>• Calcified leaflet segments |




Vilniaus universiteto ligoninės SANTARIŠKIŲ KLINIKOS

*2 years Vilnius Experience, K. Rucinskas Vilnius, Lithuania*


| 92 patients | *Dr Andrea COLLI – Padua* |
|---|---|
| Age (years) | 65 (57-75) |
| Male | 68 (73.9%) |
| Euroscore-II (%) | 1,17 (0,7-1,9) |
| Previous Cardiac Surgery | 3 (3,3%) |
| - NYHA I | 10 (10,9%) |
| - NYHA II | 42 (45,7%) |
| - NYHA III | 39 (42,3%) |
| - NYHA IV | 1 (1,1%) |
| MR grade | |
| - Absent/trace | 0 (0%) |
| - Mild | 0 (0%) |
| - Moderate | 0 (0%) |
| - Severe | 92 (100%) |


| Baseline Characteristics | Median (I-III Quartile ) or N (%) |
|---|---|
| Anatomic MV type | |
| - A | 32 (34,8%) |
| - B | 60 (65,2%) |
| Left ventricular ejection fraction (%) | 62 (58-67) |
| - ≤ 30 | 0 (0%) |
| - 31-55 | 22 (23,9%) |
| - > 55 | 70 (76,1%) |
| Left ventricular end diastolic volume (ml/m²) | 81,0 (70,9-91,9) |
| - < 70 | 20 (21,7%) |
| - 70-100 | 63 (68,4%) |
| - > 100 | 9 (9,8%) |
| Pulmonary artery hypertension (mmHg) | 31.5 (26,8-40) |
| - ≤ 25 | 21 (22,8%) |
| - 26 – 35 | 34 (36.9%) |
| - 36 – 45 | 14 (15,2%) |
| - > 45 | 19 (20.7%) |


| Operative Characteristics | Median (I-III Quartile) or N (%) |
|---|---|
| Neochordae in place (n) | 4 (3-4) |
| - 2 | 3 (3,2%) |
| - 3 | 26 (28,3%) |
| - 4 | 45 (48,9%) |
| - 5 | 13 (14,1%) |
| - 6 | 4 (4,3%) |
| - 7 | 1 (1,1%) |
| Conversion to conventional surgery | 1 (1,1%) |
| Procedural ECMO support | 2 (2,2%) |
| Procedural IABP support | 1 (1.1%) |
| Access site complications | 0 (0.0%) |
| Ventricular fibrillation | 1 (1,1%) |
| Operative time (min) | 130 (116-155) |


| Postoperative Characteristics | (%) |
|---|---|
| Acute myocardial infarction | 1 (1,1%) |
| Vascular complications | 0 (0.0%) |
| Acute kidney injury | |
| - Stage I (creatinine increase > 150-199%) | 6 (6,6%) |
| - Stage II (creatinine increase > 200-299% | 0 (0,0%) |
| - Stage III (creatinine increase > 300%) | 2 (2,2%) |
| - Need of CVVH | 2 (2,2%) |
| Bleeding | |
| - Minor | 8 (8,7%) |
| - Major | 2 (2,2%) |
| - Extensive | 4 (4,4%) |
| New onset atrial fibrillation | |
| - Paroxysmal | 19 (20,9%) |
| - Persistent | 3 (3,3%) |

# Composite Success :

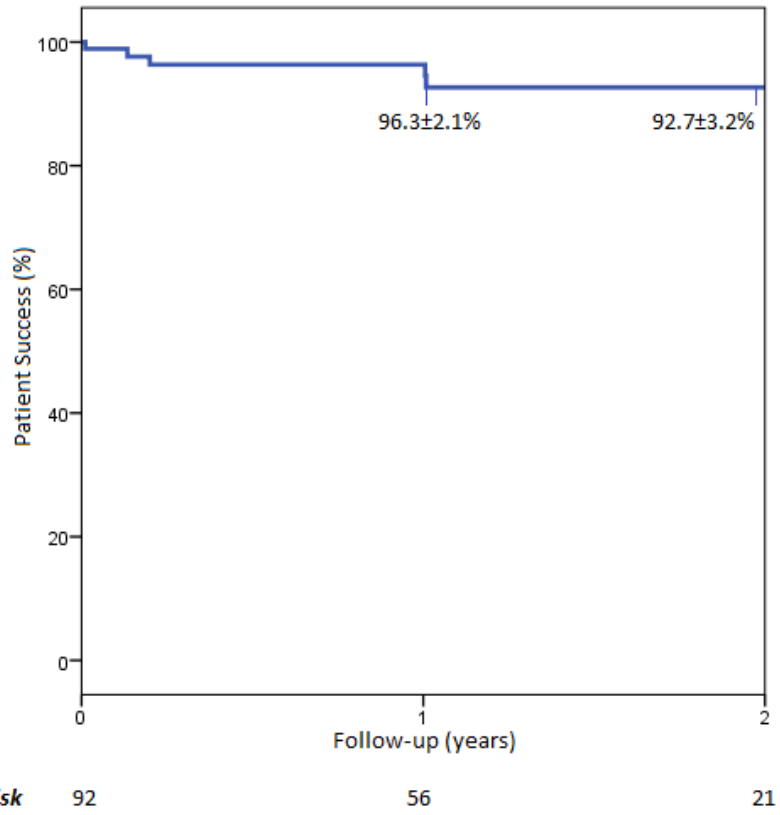
- **Procedure success**

at least 2 neochordae
MR≤mild VC < 3mm  VR < 30ml

- **Freedom from MACE**

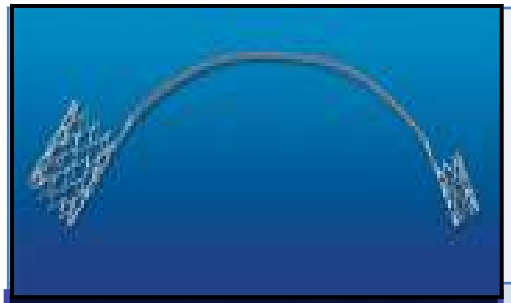
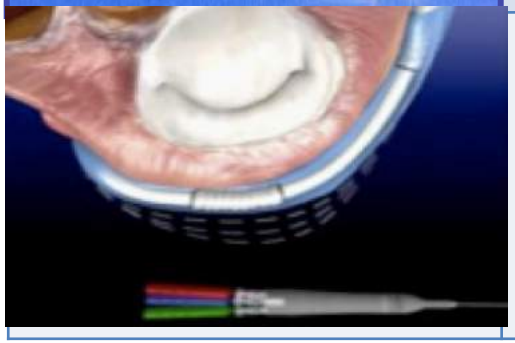
death, stroke, MR > moderate, unplanned interventions

- **decreased in NYHA** ≥1 class

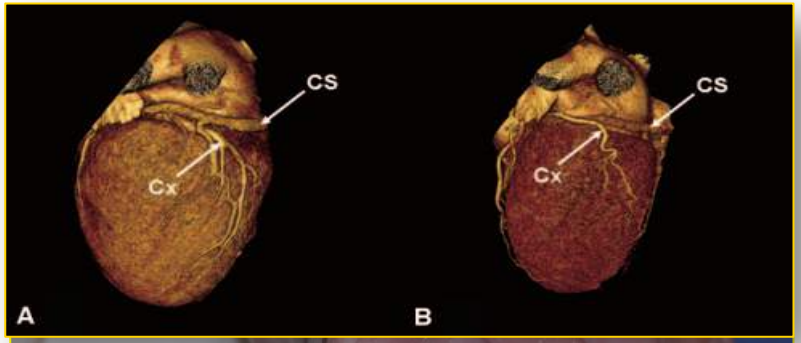


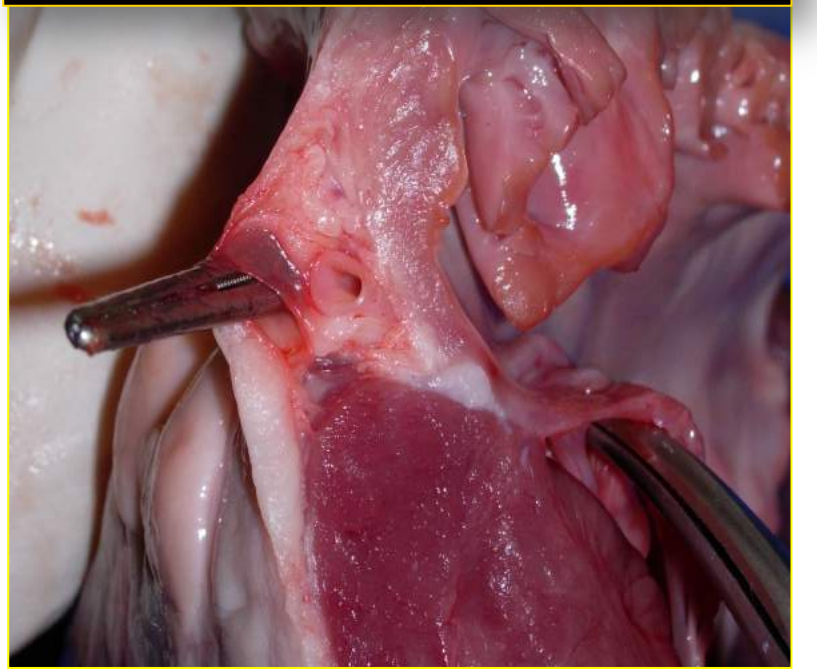

| TTE PARAMETERS | PRE-OP *(Mean±SD)* | 2 YEARS FU *(Mean±SD)* | Δ *(Mean±SD)* | p value |
|---|---|---|---|---|
| AP diameter *(mm)* | | | | |
| Systolic | 34.9 ± 5.9 | 35.1 ± 3.8 | ↓ 0.2 ± 5.8 | 0.862 |
| Diastolic | 39.8 ± 5.6 | 39.4 ± 4.3 | ↓ 0.4 ± 6.1 | 0.741 |
| LL diameter (mm) | | | | |
| Systolic | 36.3 ± 5.1 | 34.9 ± 4.9 | ↑ 1.5 ± 5.3 | 0.191 |
| Diastolic | 39.7 ± 4.4 | 39.6 ± 5.8 | ↑ 0.2 ± 6.7 | 0.904 |
| LVEDVi (mL/m$^2$) | 80 ± 19.6 | 63.8 ± 19.8 | ↑ 16.2 ± 21.1 | 0.001 |
| LVESVi (mL/m$^2$) | 35.8 ± 14.2 | 26 ± 8.9 | ↑ 9.7 ± 16.1 | 0.008 |
| LAVi (mL/m$^2$) | 52.9 ± 21 | 45.5 ± 20 | ↑ 7.3 ± 16.7 | 0.057 |
| LAD (mm) | 58.5 ± 10.1 | 48.7 ± 9.7 | ↑ 9.8 ± 12.1 | 0.001 |
| sPAP (mmHg) | 39.5 ± 14.3 | 23.1 ± 8.5 | ↑ 16.4 ± 13.3 | <0.001 |
| LVEF (%) | 60.4 ± 10 | 60 ± 5.1 | ↑ 0.4 ± 10.3 | 0.844 |

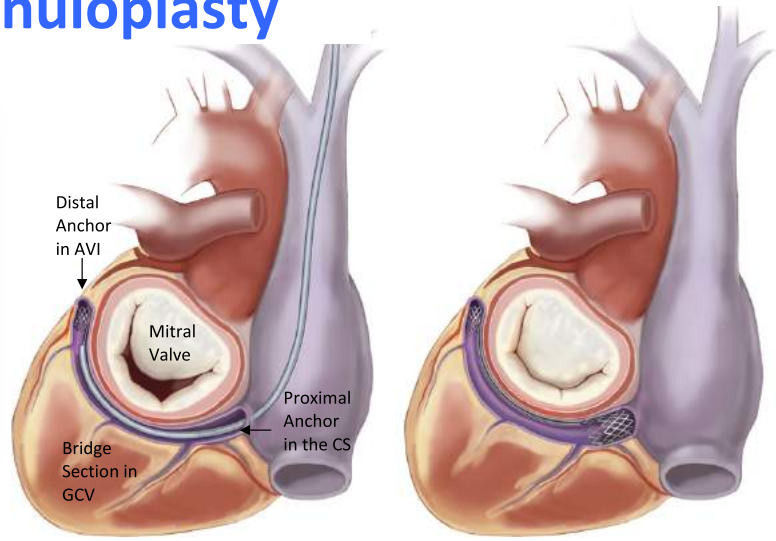

# INDIRECTE Annuloplasty

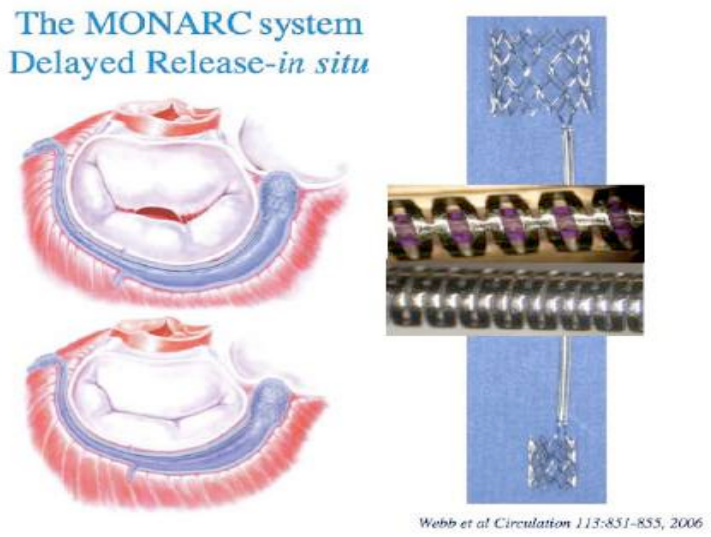
| | | | |
|---|---|---|---|
|  | **MONARC (Edwards Lifesciences LLC)** | **Two-anchor design with chronic reshaping (6weeks) by a foreshortening bridge** | **EVOLUTION trial (72 pts 82% success)** |
|  | **CARILLON (Cardiac Dimensions Inc)** | **Acute reshaping device acting in P2P3, repositionable, retrievable** | **AMADEUS trial (113 pts 58 % success )** |
|  | **PTMA (Viacor Inc)** | **Tri-lumen catheter, reshapable, possibility of multiple long term adjustment** | **PTOLEMY (31 pts 29 % success )** |

# INDIRECTE Annuloplasty



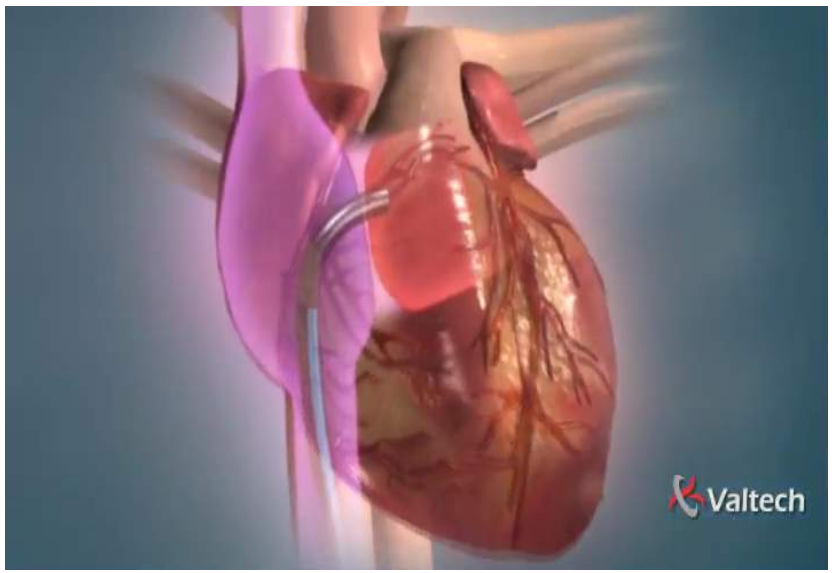



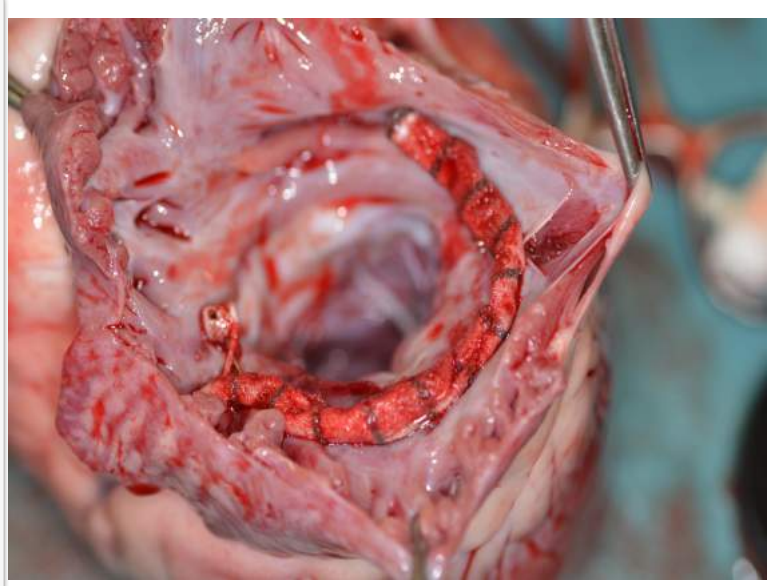


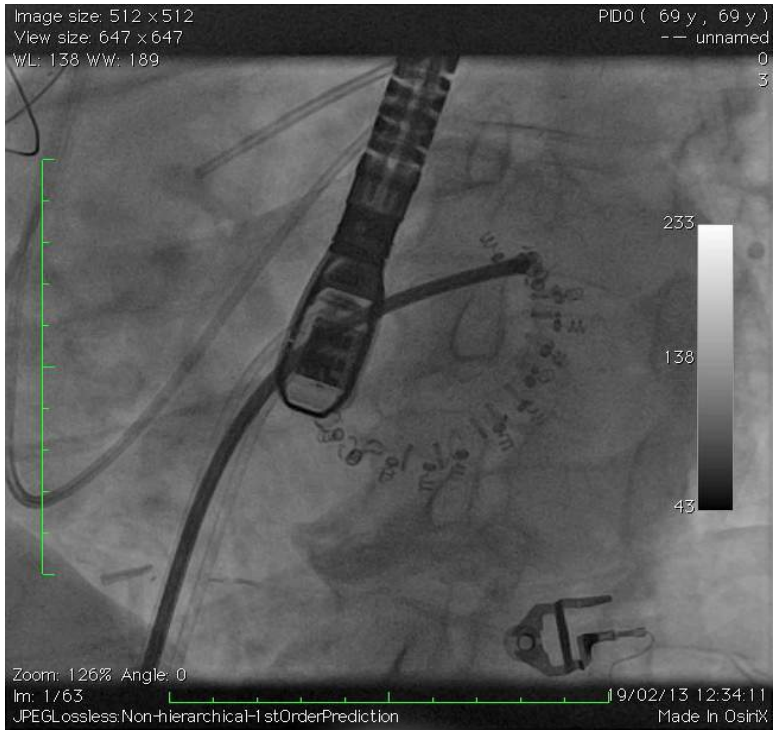
# Valtech Cardio – CARDIOBAND

***First in man in 2013***



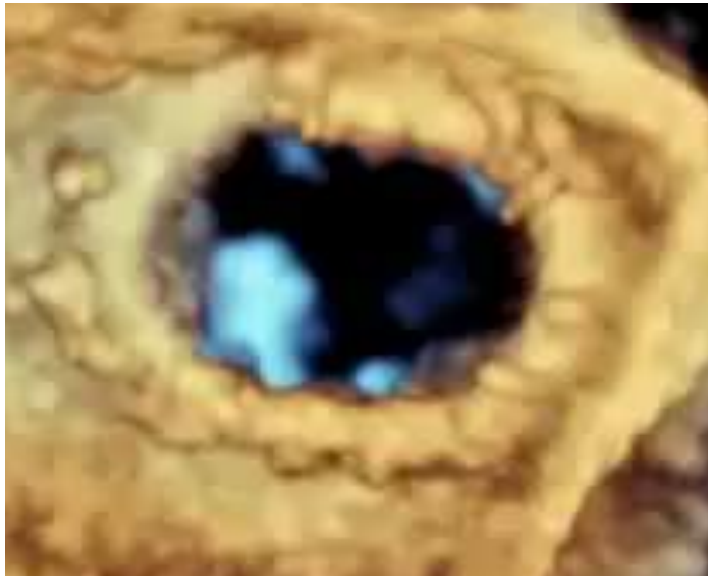



# Valtech Cardio – CARDIOBAND

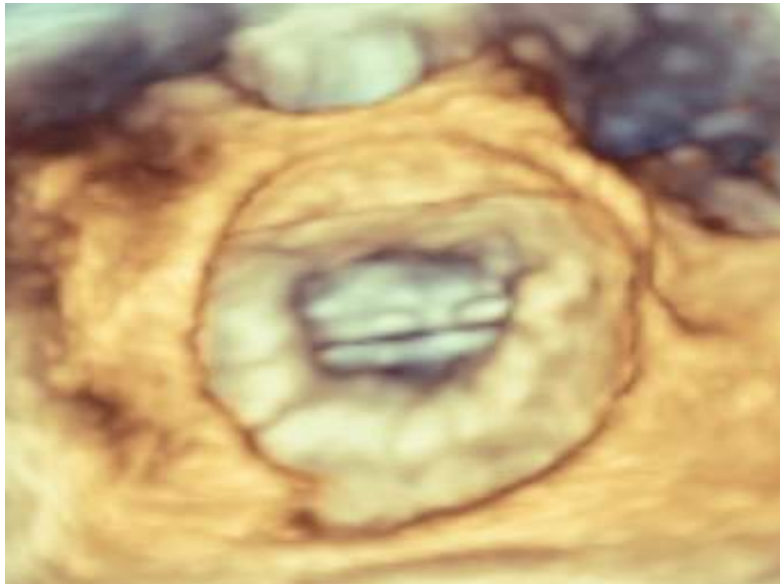




# Which is surgical ? Percutaneous ?



Surgical Ring



Cardioband


# Cardioband European Study Early Outcomes (N=30)

*Courtesy of Francesco MAISANO*

## Procedure

- Implants successfully deployed on annulus (30/30)
- Average reduction of septolateral diameter 20%

## Effectiveness

- MR ≤ 2+ in 1 month follow up (N=27) 89%
- MR ≤ 2+ in 6 month follow up (N=16) **88%**

## Safety

- Procedural mortality 0/30
- 30 days Mortality (according to VARC) 2/30

**No Device Related Major Adverse Events as adjudicated by independent committee**


# Cardioband European Study
# Early Outcomes (N=30)

## Effectiveness

- MR ≤ 2+ in 1 month follow up (N=27) 89%
- MR ≤ 2+ in 6 month follow up (N=16) 88%
- Accumulative implantation time >270months

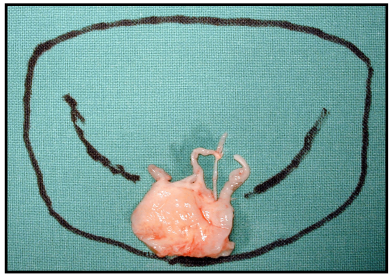
## Procedure

- Implants successfully deployed on annulus (30/30)
- Intra-procedure MR reduction ≥1 degree (28/30)
- Average reduction of septolateral diameter 20%

## Safety

- Procedural mortality 0/30
- 30 days Mortality (according to VARC) 2/30
- **No Device Related Major Adverse Events as adjudicated by independent committee**

## Surgical MV Repair



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**Carpentier French Correction**

## Percutaneous Mitral Plasty techniques


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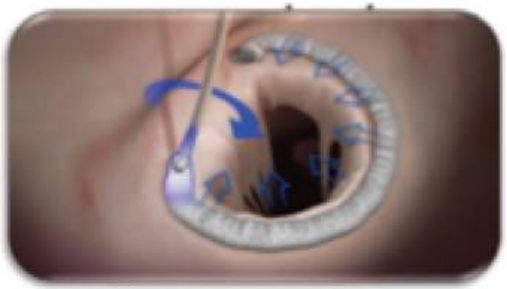

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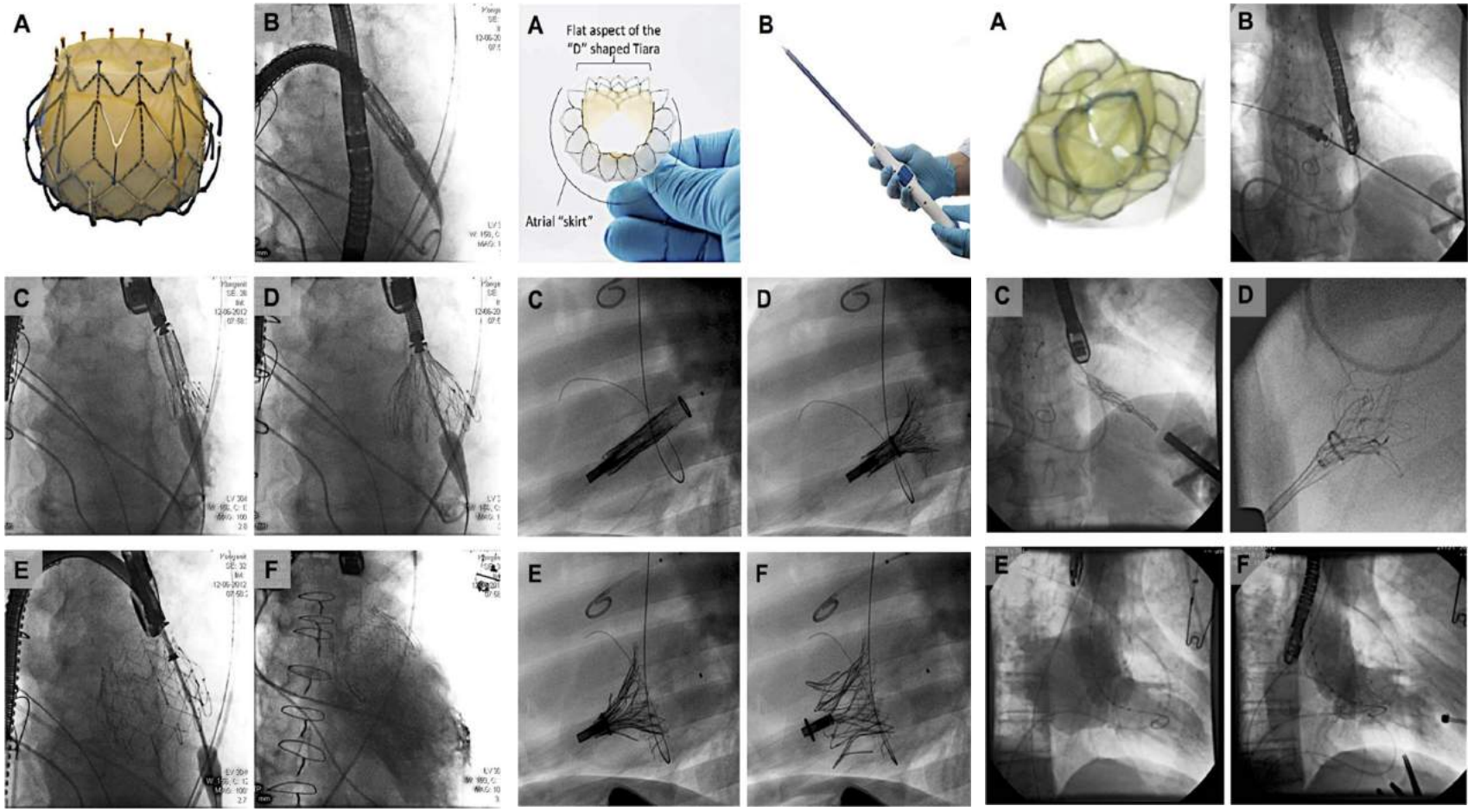
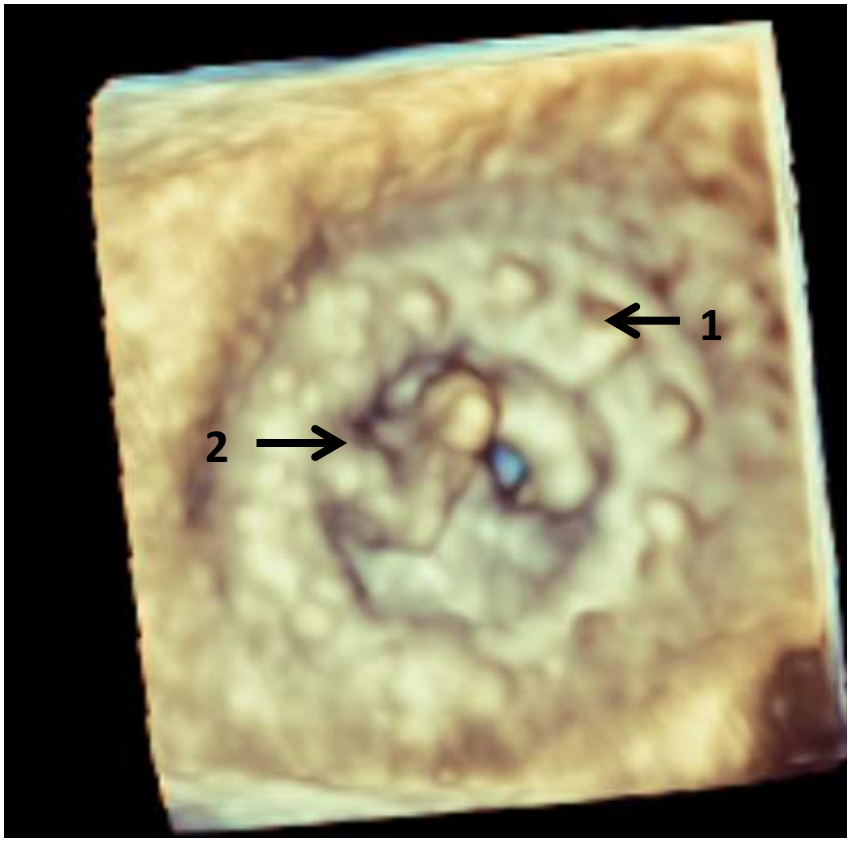
**Fully percutaneous Mitra valve repair**


**CardiAQ valve** **Tiara valve** **Tendyne valve.**

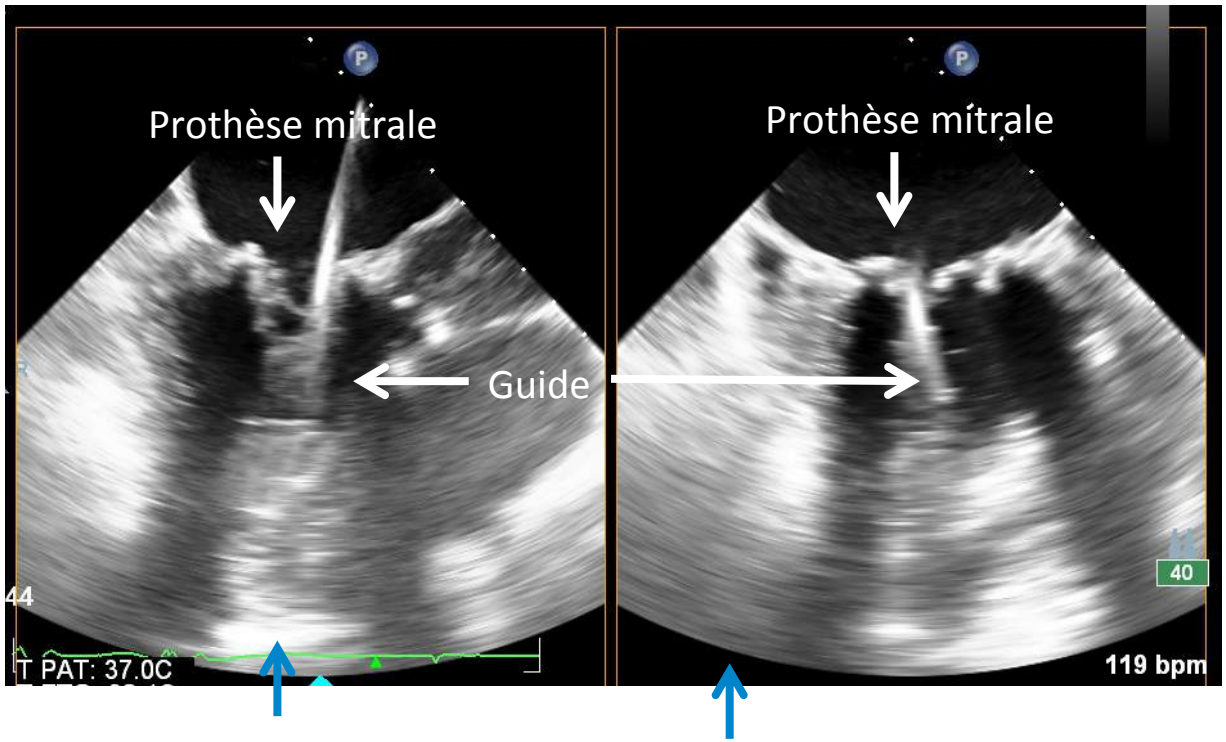
## Vue en échographie 3D de la prothèse (face auriculaire) avant l'intervention



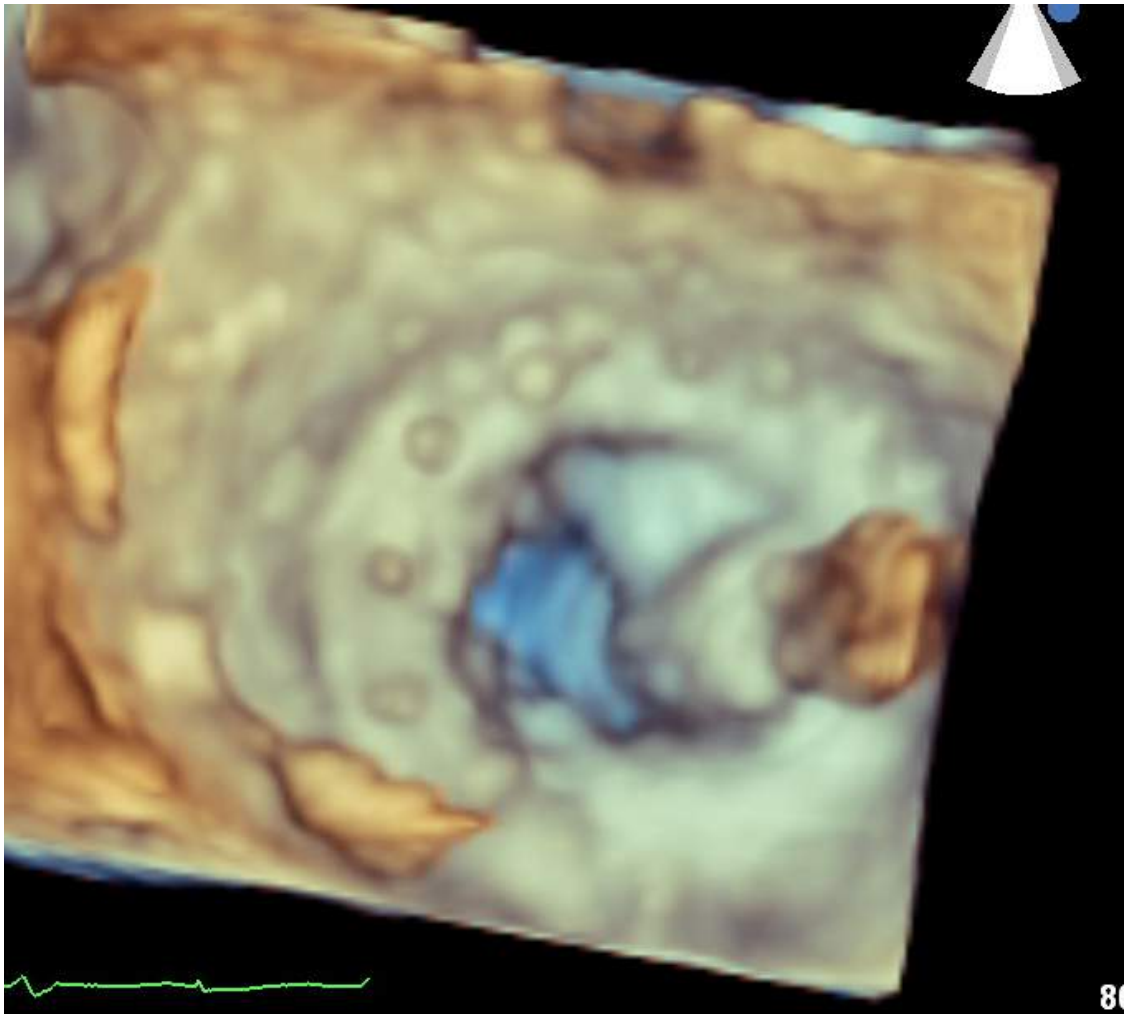

1: Anneau de la prothèse

2: Eversion complète d'une cusp expliquant la fuite importante

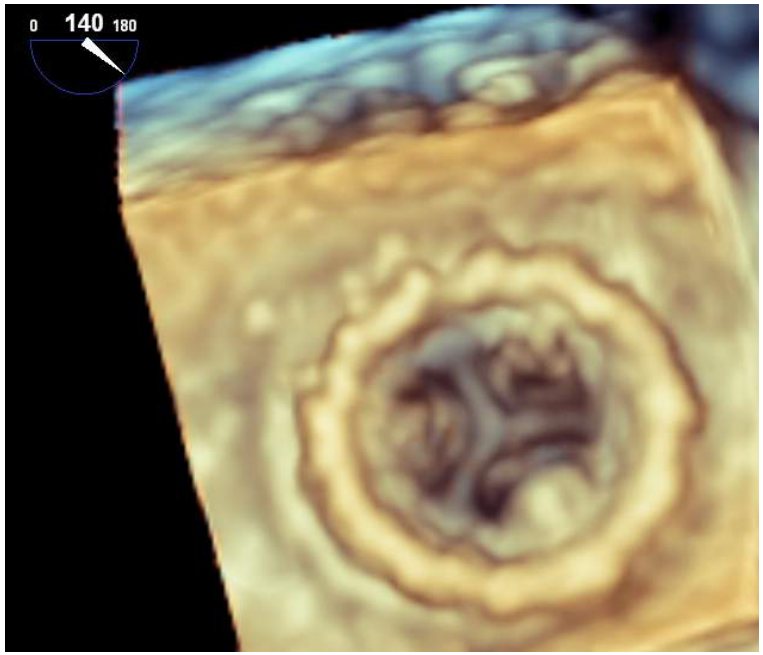

# Guidage échographique de l'implantation de la prothèse




Vue en biplan de la progression du guide à partir de l'apex du ventricule gauche (flèche bleu)



## Vue en échographie 3D de la prothèse mitrale (face auriculaire) en fin d'intervention

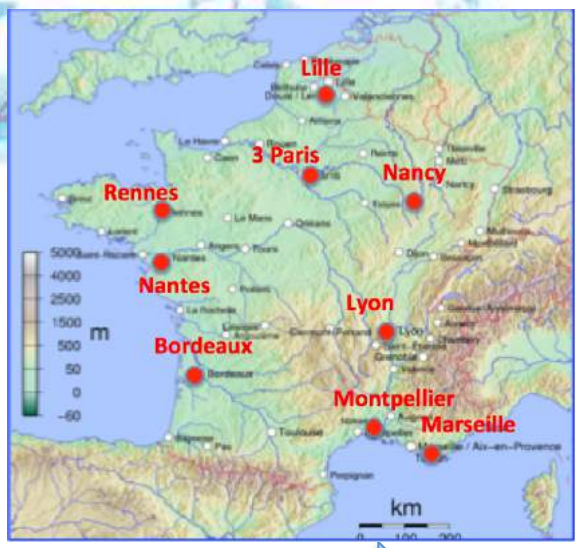


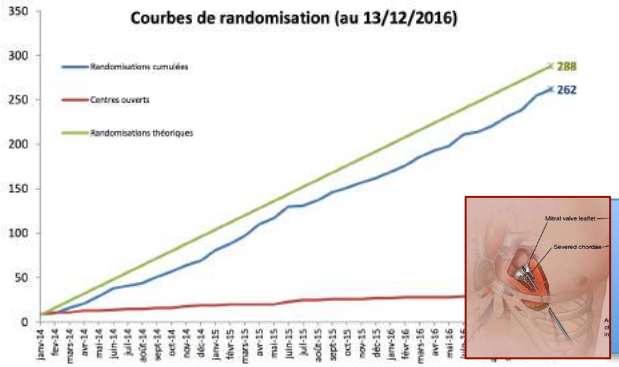

Prothèse fermée


Prothèse ouverte

Le contrôle en échographie 3D en fin d'intervention montre un bon positionnement de la prothèse percutanée (qui recouvre complètement la prothèse défectueuse) et l'absence de fuite mitrale résiduelle.

# Prospective French Studies



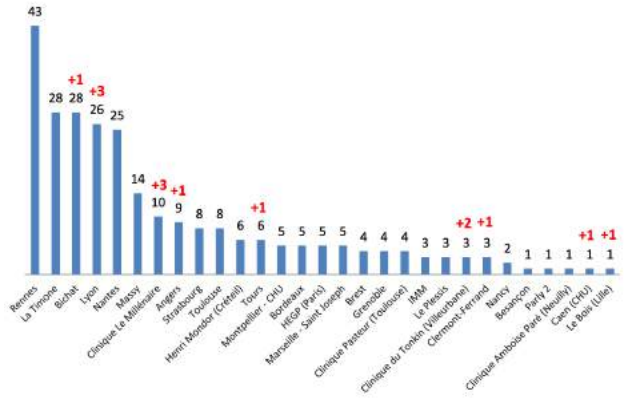



**PHRC 2015** *Mitrachord Primary MR / surg*

2017 2018 2019 2020

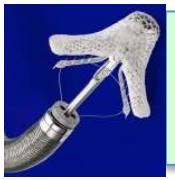
**PHRC 2014** *Mitra.fr (Secondary MR)*

2015 2016 2017 2018




**PHRC 2016** *Primary MR High risk*

2018 2019 2020 2021….



**Reimbursment**

**Contrindication to Surgery**

Regular meetings at a precise time (Weekly basis)
Pre-program announcing the files to discus
a minimum of 3 different specialties
Several members / Specialties
Involving Coordinator/nurse
Written decisions recorded
Yearly evaluation


HAPPY
NEW
YEAR