Ischemic mitral regurgitation: survival guide

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ΑΝΕΠΑΡΚΕΙΑ ΜΙΤΡΟΕΙΔΟΥΣ

ΑΝΑΤΟΜΙΚΗ ΑΝΕΠΑΡΚΕΙΑ

ΛΕΙΤΟΥΡΓΙΚΗ ΑΝΕΠΑΡΚΕΙΑ
Relative Sizes of Clinical Needs

**Primary vs Functional MR**

Expected WW Ann. Incidence

- **Degenerative MR**
  - ~650,000

- **Functional MR**
  - ~2,570,000

- Cardiac Dimensions
- Guided Delivery Systems
- Mitralign
- Myocor
- Viacor
- Ample
- Edwards
- e-Valve
- others

*UC Davis Health System*
Long-term prognosis of medically treated patients with FMR and left ventricular dysfunction

- Mortality and morbidity of patients with LV dysfunction and FMR remain high despite treatment with currently accepted standard pharmacological therapy.
- **A high degree of regurgitation is an independent predictor of cardiac death and HF.**
- 45% of deaths had a non-cardiac etiology, thus several clinical co-morbidities, besides the degree of MR, represent risk factors for death and HF in this group of patients.

E Agricola et al Eur Heart Fail J 2009
Survival guide

- Diagnosis

- Medical Treatment

- Surgery?

- Intervention
Surgery may be high risk

Mitral valve replacement in elderly patients

- Hemodynamic Instability?
  - No
    - Renal Failure?
      - No
      - NYHA Class IV?
        - No
        - Concomitant CABG?
          - Yes
          - Mortality
            - N
            - 31.9
      - Yes
        - N
        - 25.3
  - Yes
    - Mortality
      - N
      - 15.7
      - 11.4
      - 7.7

(Mehta, AnnThorac Surg 2002)
Long-term carvedilol therapy in patients with chronic heart failure was able to prevent or partially reverse progressive left ventricular dilatation. The effects on left ventricular remodeling were associated with a concomitant recovery of diastolic reserve and a decrease of mitral regurgitation.
Sacubitril/Valsartan in Secondary MR

Pharmacological Reduction of Functional, Ischemic Mitral REgurgitation (PRIME)

Study Design

- **Study Type**: Interventional (Clinical Trial)
- **Actual Enrollment**: 118 participants
- **Allocation**: Randomized
- **Intervention Model**: Parallel Assignment
- **Masking**: Quadruple (Participant, Care Provider, Investigator, Outcomes Assessor)
- **Primary Purpose**: Treatment
- **Official Title**: Multicenter, Randomized, Double-blind, Active-controlled Study to Assess the Efficacy of LCZ696 Compared to Valsartan on Reduction of Mitral Regurgitation in Patients With Left Ventricular Dysfunction and Secondary Functional Mitral Regurgitation of Stage B and C
- **Actual Study Start Date**: March 2016
- **Actual Primary Completion Date**: January 2, 2018
- **Actual Study Completion Date**: January 2, 2018
Figure 1. Changes in severity of MR at 6-month follow-up. Improvement in severity of MR at 6 months follow-up was observed in all evaluated parameters (A, VCV; B, EROA; C, tenting area; D, LA volume; E, Jet area/LA volume; F, SPAP). Error bars represent standard deviation. VCV indicates vena contracta width; EROA, effective regurgitant orifice area; LA, left atrium; and SPAP, systolic pulmonary artery pressure.
Cardiac Resynchronization Therapy

**Figure 3.** Kaplan–Meier survival curves for time to all-cause mortality in MR improvers versus MR nonimprovers. During long-term follow-up, survival was superior in MR improvers compared with MR nonimprovers; log rank $P<0.001$. Respective 1- and 2-year survival rates were 97% and 92% in MR improvers compared with 88% and 67% in MR nonimprovers. MR indicates mitral regurgitation.
Surgical Repair for Functional MR: Annuloplasty
Two-Year Outcomes of Surgical Treatment of Moderate Ischemic Mitral Regurgitation (I)

In a trial comparing CABG alone with CABG plus mitral-valve repair in patients with moderate ischemic mitral regurgitation

A Death
Hazard ratio, 0.90 (95% CI, 0.45–1.83)
P = 0.78

B Major Adverse Cardiac or Cerebrovascular Event
Hazard ratio, 0.89 (95% CI, 0.60–1.34)
P = 0.58

RE Michler et al NEJM 2016
Reccurrence of MR after repair for ischaemic MR

59% MR ≥ moderate

(Goldstein D et al. N Engl J Med 2015.)
IMR Recurrence After Surgical Annuloplasty
n=585

68% Cosgrove band, 21% Carpentier ring, 11% Peri-Guard
Recurrent mitral regurgitation after annuloplasty for functional ischemic mitral regurgitation

Electronic Appendix 1. Annuloplasty type use by calendar year. Proportion of patients receiving Carpentier-Edwards classic annuloplasty ring (open circles), Cosgrove-Edwards annuloplasty system (filled circles), and Peri-Guard bovine pericardial annuloplasty (open squares) by year of operation.

No correlation between annuloplasty technique and survival
Two-Year Outcomes of Surgical Treatment of Severe Ischemic MR

Goldstein D et al. N Engl J Med 2015. DOI: 10.1056/NEJMo1512913
Mitral-Valve Repair versus Replacement for Severe Ischemic Mitral Regurgitation

No significant difference in left ventricular reverse remodeling or survival at 12 months between patients who underwent mitral-valve repair and those who underwent mitral-valve replacement.

Replacement provided a more durable correction of mitral regurgitation, but there was no significant between-group difference in clinical outcomes.

Mitral valve repair is the preferred method, but mitral valve replacement should be considered in patients with unfavourable morphological characteristics.

MA Acker et al NEJM 2014
Figure 6 - Survival curves over 15 years of follow-up adjusted with a Cox proportional hazards model for differences in all important baseline patient characteristics. The blue curve represents adjusted survival characteristics for 16,209 patients having coronary bypass alone without intraoperative transesophageal (Group 1). The red curve represents adjusted survival for 3,181 patients with mild-to-moderate Intraoperative transesophageal treated with coronary bypass alone (Group 2a). The green curve is adjusted survival for 416 patients with moderate-to-severe intraoperative transesophageal managed with mitral valve repair (Group 2b). And finally, the brown curve represents adjusted survival of 106 patients with moderate-to-severe intraoperative transesophageal receiving mitral valve replacement (Group 2c). Mitral repair for moderate-to-severe intraoperative transesophageal restored adjusted survival to levels equivalent to standard coronary bypass patients with similar risk profiles. Mitral valve replacement achieved an average 14% lower risk-adjusted survival over 15 years, as compared to valve repair. (From Milano et al. Ann Thorac Surg 2008; 86: 735-44).
Two-Year Outcomes of Surgical Treatment of Moderate Ischemic Mitral Regurgitation (II)

In patients with moderate ischemic mitral regurgitation undergoing CABG, the addition of mitral-valve repair:
1. did not lead to significant differences in left ventricular reverse remodeling at 2 years.
2. Mitral-valve repair provided a more durable correction of mitral regurgitation,
3. but did not significantly improve survival or reduce overall adverse events or readmissions and
4. was associated with an early hazard of increased neurologic and supraventricular arrhythmias.

Indications for mitral valve intervention in secondary mitral regurgitation

| IIA C | 2012 | 2017 |
|-------|------|------|
| Surgery should be considered in patients with moderate secondary mitral regurgitation undergoing CABG | Taken out | RE Michler et al NEJM 2106 |
2017 AHA/ACC Valve Guidelines

[Surgical] mitral valve repair or replacement may be considered for severely symptomatic patients (NYHA class III to IV) with chronic severe secondary MR (stage D) who have persistent symptoms despite optimal GDMT for heart failure.

No recommendation for transcatheter MV repair

Class IIb = weak recommendation; benefit ≥ risk; may be reasonable; effectiveness is uncertain

Nishimura RA et al. J Am Coll Cardiol 2017;70:252–89
Mitral valve – percutaneous approach

- Edge to edge approach
- Indirect annuloplasty
- Direct annuloplasty
- Chordae implantations
- LV reshaping
- MV replacement
Edge-to Edge repair with the MitraClip (Abbott Vascular)
Surgical Edge-to-Edge, Double-orifice technique, “Alfieri Stitch”

Double-orifice technique first performed in 1991

The “vision” of the percutaneous approach in 1998

The E-to-E repair is applicable to lesions of any etiology and it is effective not only when MR is due to leaflet prolapse, but also with other types of valve dysfunction. Due to its intrinsic simplicity, the E-to-E repair could be the technique of choice when exposure is difficult or when the repair is carried out through a port access. Eventually, the concept introduced by this type of repair can open the perspective of percutaneous correction of MR. Longer follow-up period is needed to confirm long term expectations with this promising alternative technique of valve repair.
Catheter-Based Edge-to-Edge Repair: Development Challenges

How to stabilize the leaflets?

How to grasp the leaflets?
“Final” Clip Prototype Design - Early 2002
Catheter-Based Approach to Mitral Regurgitation

JOSÉ ANTONIO CONDADO, M.D. and MANUEL VÉLEZ-GIMÓN, M.D.

From the Cardiology Unit, Hospital “Miguel Pérez Carreño,” Caracas, Venezuela

Mitral Regurgitation (MR) is a common medical problem. MR is also a prognostic factor; patients with severe symptomatic MR have a poor prognosis with an annual mortality rate of 5% without surgical intervention. An anatomic understanding of the normal and regurgitant mitral valve is essential in order to evaluate appropriately the severity and impact of MR. We briefly discuss mitral complex anatomy, MR evaluation, and treatment options (surgical and catheter-based alternatives) according to the type of lesion found. In particular, our group has shown temporal percutaneous annuloplasty and definitive percutaneous edge-to-edge mitral valve repair to be a feasible technique. Recently a study evaluating endovascular mitral valve edge-to-edge repair was successfully initiated by our group. Acute and chronic ischemic mitral regurgitation and special situations, such as paravalvular leaks, hypertrophic obstructive cardiomyopathy, and mixed lesions are also discussed. Future directions may include the percutaneous transcatheter implantation of a bioprosthetic valve in mitral position. (J Interven Cardiol 2003;16:523–534)
Session Objectives

1991
Clinical Trials

2003
>1000 publications

>1000 centers, 50 countries

Device Iteration

>1000 publications

MitraClip NTR

MitraClip XTR +5mm
CONCLUSIONS

Although percutaneous repair was less effective at reducing mitral regurgitation than conventional surgery, the procedure was associated with superior safety and similar improvements in clinical outcomes.
Mitral Regurgitation Severity to 5 Years
Echo Core Lab Assessed

All Non-HR (N=271)
- Baseline
  - 2+: 12%
  - 3+: 6%
  - 4+: 2%
- 5 Years
  - 2+: 8%
  - 3+: 3%
  - 4+: 1%

FMR (N=86)
- Baseline
  - 2+: 19%
  - 3+: 25%
  - 4+: 22%
- 5 Years
  - 2+: 7%
  - 3+: 14%
  - 4+: 12%

DMR (N=185)
- Baseline
  - 2+: 10%
  - 3+: 32%
  - 4+: 47%
- 5 Years
  - 2+: 3%
  - 3+: 12%
  - 4+: 23%

Paired Data (N=108)
- Baseline
  - 2+: 12%
  - 3+: 6%
  - 4+: 2%
- 5 Years
  - 2+: 8%
  - 3+: 3%
  - 4+: 1%

Paired Data (N=26)
- Baseline
  - 2+: 19%
  - 3+: 25%
  - 4+: 22%
- 5 Years
  - 2+: 7%
  - 3+: 14%
  - 4+: 12%

Paired Data (N=82)
- Baseline
  - 2+: 10%
  - 3+: 32%
  - 4+: 47%
- 5 Years
  - 2+: 3%
  - 3+: 12%
  - 4+: 23%

p < 0.0001
p = 0.026
p < 0.0001

Feldman T: The EVEREST II REALISM Continued Access Non-High Risk Study: Mid- and Long-Term Follow-up in Surgical Candidates
ESC 2017
Kaplan-Meier Freedom from MV Surgery in MitraClip group or Re-operation in Surgery group
All Treated Patients (N = 258) – Landmark Analysis

|                | 1 year | 2 years | 3 years |
|----------------|--------|---------|---------|
| MitraClip (N = 178) | 98.7%  | 97.2%   | 95.6%   |
| Surgery (N = 80)    | 97.1%  | 96.3%   | 95.5%   |
Acute Procedure Success Rate

Mitra Clip(s) implanted & MR ≤2+

| Study     | Year | n    |
|-----------|------|------|
| EVEREST I | 2004 | 55   |
| EVEREST I | 2015 | 107  |
| EVEREST II|      | 178  |
| ACCESS EU |      | 567  |
| TRAMI     |      | 861  |
| GRASP-It  |      | 171  |
Randomized Clinical Trials in FMR: The Long Wait

Capodanno Eurointervention 2017
Percutaneous Repair or Medical Treatment for Secondary Mitral Regurgitation

J.-F. Obadia, D. Messika-Zeitoun, G. Leurent, B. Iung, G. Bonnet, N. Piriou, T. Lefèvre, C. Piot, F. Rouleau, D. Carrié, M. Nejjar, P. Ohlmann, F. Leclercq, C. Saint Etienne, E. Teiger, L. Leroux, N. Karam, N. Michel, M. Gilard, E. Donal, J.-N. Trochu, B. Cormier, X. Armoiry, F. Boutitie, D. Maucort-Boulch, C. Barnel, G. Samson, P. Guerin, A. Vahanian, and N. Mewton, for the MITRA-FR Investigators.
Inclusion Criteria

- Symptomatic despite Optimal Treatment (NYHA ≥II).
- At least one hospitalization for HF within 12 months preceding randomization.
- Severe Secondary MR ➔ ERO > 20 mm² or R.vol > 30 mL/beat.
- 15% < EF < 40%.
- Not eligible for surgery “Heart Team”.
- Centralized echocardiographic Corelab.
452 Patients

307 Randomized

145 not eligible

3 consent Issues

152 Patients

307 Randomized

Mitraclip

control

152 Patients

Intention To Treat

152 Patients

Follow-up > 99%

43 Exclusions

15 Exclusions

109 Patients

Per-protocol Analysis

137 Patients
MITRA-FR

Trial design: Patients with severe secondary mitral regurgitation were randomized to percutaneous mitral valve repair (n = 152) vs. medical therapy (n = 152).

RESULTS
- Death or hospitalization for heart failure (HF): 54.6% of the percutaneous mitral valve repair group vs. 51.3% of the medical therapy group (p = 0.53)
- Death: 24.3% of the percutaneous mitral valve repair group vs. 22.4% of the medical therapy group (p = NS)
- Hospitalization for HF: 48.7% of the percutaneous mitral valve repair group vs. 47.4% of the medical therapy group (p = NS)

CONCLUSIONS
- Among patients with severe secondary mitral regurgitation, percutaneous mitral regurgitation repair (MitraClip) was not beneficial
- MitraClip was not associated with a reduction in the composite (or individual components) of death or hospitalization for HF

Obadia JF, et al. N Engl J Med 2018:Aug 27:[Epub]
All-cause Mortality

HR [95% CI] = 0.62 [0.46-0.82]

P<0.001

NNT (24 mo) = 5.9 [95% CI 3.9, 11.7]

No. at Risk:
MitraClip + GDMT 302 286 289 253 236 191 178 161 124
GDMT alone 312 294 271 245 219 176 145 121 88
Primary Effectiveness Endpoint
All Hospitalizations for HF within 24 months

- **MitraClip + GDMT**
  - 283 in 151 pts
  - HR (95% CI) = 0.53 [0.40-0.70]
  - P<0.001

- **GDMT alone**
  - 160 in 92 pts

No. at Risk:
- MitraClip: 302, 286, 269, 253, 236, 191, 178, 161, 124
- GDMT: 312, 294, 271, 245, 219, 176, 145, 121, 88

Time After Randomization (Months)

Median [25%, 75%] FU = 19.1 [11.8, 24.0] mos
Death or HF Hospitalization

NNT (24 mo) = 4.5 [95% CI 3.3, 7.2]

HR [95% CI] = 0.57 [0.45-0.71]

P<0.001

67.9%

45.7%

1-year
33.9% vs. 46.5%
HR [95% CI] = 0.63 [0.49, 0.82]

P<0.001

Time After Randomization (Months)

All-cause Mortality or HF Hospitalization (%)

No. at Risk:
MitraClip + GDMT 302 264 238 215 194 154 145 126 97
GDMT alone 312 244 205 174 153 117 90 75 55
The Timing of Drugs, Device and Interventions in Heart Failure

- Acute HF
- Advanced HF
- Mitral Interventions
- Onset of CHF
- Sudden Death
- Decompensations
- Pump Failure

Quality of Life

Time

Ruschitzka HFA 2018
mod. after Allen Circulation 2012
RESHAPE-HF2 trial – the 3rd population

Device group (MitraClip, within 14 days)
plus optimal standard of care

30 days  M6  M12  M24

Screening

R

1:1
n=420

Control group
plus optimal standard of care

End of study:
At least 2 years follow-up for all pats

Statistics:
• Prospective, randomized, parallel-controlled, multi-center
• 1. EP: Recurrent events of CV death & HHF

Organization:
• Legal sponsor: University Medicine Göttingen / Germany (IIT grant from AV)
• Academic leadership / co-ordination: P Ponikowski & SD Anker
We need ca. 10-12 patients per month to end recruitment in 2018

| Year | Total 2015 | JAR | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Total |
|------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| 2015 | 0          | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 3     |
| 2016 | 0          | 8   | 12  | 16  | 8   | 25  | 9   | 14  | 10  | 15  | 16  | 14  | 13  | 163   |
| 2017 | 10         | 13  | 13  | 12  | 15  | 11  | 7   | 5   | 15  | 8   | 16  | 14  | 139  |
| 2018 | 1          |     |     |     |     |     |     |     |     |     |     |     |     | 1     |

Recruited: 379 by July 2018
Dear RESHAPE-HF2 study teams,

Hopefully all of you returned refreshed from the summer holiday break and you are eager for RESHAPE HF2.

We would like to give you an update on the current status and activities in RESHAPE HF2.

1. Recruitment Overview:

| Site-ID | Activated sites                  | Country | Randomized patients as of 30-Aug-2018 |
|---------|----------------------------------|---------|---------------------------------------|
| RS01    | Göttingen                        | D       | 4                                     |
| RS02    | Heidelberg                       | D       | 2                                     |
| RS03    | Mainz                            | D       | 2                                     |
| RS04    | Athens                           | GR      | 88                                    |
| RS05    | Thessaloniki                     | GR      | 105                                   |
| RS06    | Wroclaw                          | PL      | 37                                    |
| RS07    | Zabrze                           | PL      | 46                                    |
| RS12    | Krakow                           | PL      | 10                                    |
| RS08    | Katowice                         | PL      | 60                                    |
| RS09    | Brescia                          | IT      | 7                                     |
| RS11    | Lisbon St. Maria                 | PT      | 8                                     |
| RS17    | Lisbon St. Marta                 | PT      | 0                                     |
| RS13    | Vila Nova de Gaia                | PT      | 1                                     |
| RS14    | Copenhagen                       | DK      | 3                                     |
| RS15    | Odense                           | DK      | 3                                     |
| RS10    | Leon                             | ES      | 6                                     |
| RS19    | Edinburgh                        | UK      | 0                                     |
| RS20    | Manchester                       | UK      | 0                                     |
| RS22    | Royal Brompton and Harefield     | UK      | 1                                     |
| RS24    | Glasgow                          | UK      | just activated                       |
| RS23    | Stoke-on-Trent                   | UK      | just activated                       |
| RS21    | Prague IKEM                      | CZ      | 0                                     |
| Total   |                                  |         | 383                                   |
ISCHEMIC CARDIOMYOPATHY FMR
EXTREME FMR- NO COAPTATION
Compassionate use of the PASCAL transcatheter mitral valve repair system for patients with severe mitral regurgitation: a multicentre, prospective, observational, first-in-man study

Fabien Praz*, Konstantinos Spaglia*, Michael Chrissoheris, Lutz Büßensfeld, Georg Nicknig, Florian Deussch, Robert Schueller, Neil P. Fam, Robert Moss, Moody Maker, Robert Boone, Jeremy Edwards, Aulis Moschosvitis, Sabai Ka, John Webb, Ulrich Schöfer, Ted Feldman, Stephan Wünderer

Summary

Background Severe mitral regurgitation is associated with impaired prognosis if left untreated. Currently available transcatheter mitral valve repair (TMVR) remains challenging in complex patients. We report the procedural and 30-day results of the first-in-man study of the Edwards PASCAL TMVR system.

Methods In this multicentre, prospective, observational, first-in-man study, we collected data from five hospitals in five countries that had a compassionate use programme in which patients underwent mitral valve repair using the Edwards PASCAL TMVR system. Eligible patients were those with severe organic, functional, degenerative, or mixed mitral regurgitation deemed at high risk or inoperable and with planned bioprosthetic valve replacement. The procedure was prospectively assessed at device implantation, discharge, and 30 days after implantation. The key study endpoints were technical success assessed at the end of the procedure and device and patient survival at 30 days after implantation using the Mitral Valve Academic Research Consortium definitions.

Findings Between Sept 1, 2016, and March 31, 2017, 23 patients (median age 75 years [IQR 69–83]) with moderate-to-severe (grade 3+) or severe (grade 4+) mitral regurgitation using the Edwards PASCAL TMVR system were included. At baseline, the median EuroScore II score was 7.1% (IQR 3.6–12.8) and the median Society of Thoracic Surgeons predicted risk of mortality for mitral valve repair was 4.8% (2.1–9.0) and 6.8% (2.9–10.1) for NYHA class III or IV at baseline. Of 23 patients, 22 (96%) were New York Heart Association (NYHA) class III or IV at baseline. Least one device was successful in all patients, resulting in procedural residual mitral regurgitation grade 1 or 2 in 22 (96%) patients. 55% (26%) of 23 patients had two implants. Periprocedural complications included 2 patients (one minor bleeding event and one transient ischaemic attack). Despite the compassionate use cohort, technical success was achieved in all patients, and device success at 30 days was achieved in 18 (78%) patients. Three patients (13%) had 30 day follow-up. 19 (95%) of 20 patients alive 30 days after implantation were NYHA class I or II.

Interpretation This study establishes feasibility of the Edwards PASCAL TMVR system with success and reduction of mitral regurgitation severity. Further research is needed on clinical outcomes.

Presented at EuroPCR, May 2017
PASCAL transcatheater mitral valve repair system for patients with severe mitral regurgitation

Multicentre, prospective, observational, first-in-man study. Symptomatic, severe F/DMR. 23 patients (75 y) using the Edwards PASCAL TMVr system.
Mitral valve – percutaneous approach

- Indirect annuloplasty
- Direct annuloplasty
- Edge to edge approach
- Chordae implantations
- LV reshaping
- MV replacement

Otto N Engl J Med 2001;345:740-746
The Carillon Mitral Contour System – an Indirect Annuloplasty Device

Distal Anchor
(in great cardiac vein)

Proximal Anchor
(in coronary sinus)

Anchor sizes are individually selected for each patient

Trans-jugular Delivery System

Caution: Investigational device. Limited by Federal (U.S) law to investigational use.
Cardioband Mitral System Procedure

1. Access via transseptal puncture & system insertion
2. Deploy implant via steerable catheter
3. Adjust and confirm real-time reduction of MR
REDUCE-FMR : A Sham-Controlled Randomized Controlled Trial of Transcatheter Indirect Mitral Annuloplasty in Heart Failure Patients with Functional Mitral Regurgitation

Horst Sievert, MD
CardioVascular Center Frankfurt - CVC
Frankfurt, Germany

On behalf of the REDUCE-FMR Investigators
Cardioband Mitral System CE Mark Trial

Clinically Significant Improvements at 2 Years (Paired Analysis)

- McNemar test; T-test

6MWT – Six Minute Walk Test; KCCQ – Kansas City Cardiomyopathy Questionnaire; NYHA – New York Heart Association
Mitral valve – percutaneous approach

- Direct annuloplasty
- Indirect annuloplasty
- Edge to edge approach
- Chordae implantations
- LV reshaping
- MV replacement

Otto N Engl J Med 2001;345:740-746
2-8 apically tethered chordae
Interventional annuloplasty and edge-to-edge repair for DMR

Robert Schueler, Nikos Werner, Georg Nickenig, and Christoph Hammerstingl, University Hospital Bonn, doi:10.1093/eurheartj/ehv765
Mitral repair with direct ring annuloplasty and neochord leaflet implantation for DMR

Ralph Stephan von Bardeleben, University Medicine Mainz. 
https://academic.oup.com/eurheartj/advance-article-abstract/doi/10.1093/eurheartj/ehx595/4569003
Conclusions

Percutaneous MV repair/Replacement techniques are constantly evolving with mature technologies (Mitraclip) merging with start-ups.

Clear good quality evidence from well-conducted multi-center RCTs of prognostic benefit in various settings especially in the field of FMR and Heart Failure.

Combination therapies appear to be an attractive solution for the future.
Surgical Evidence Base

- I would...
- We would...
- Intra-op video
- Single center retrospective...

Reference centers... *good surgeons*

Percutaneous Technique

- Reproducible
- Multi-center
- Based on prospective RCT
- Easy to teach
- Standardized
- Safer
- Less invasive
- More physiological