

STS/EACTS Latin America Cardiovascular Surgery Conference

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Worldwide Results and Review of MitraClip®: What Is the Future?





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Disclosure Information

The following relationships exist:

Consultant: Medtronic, Abbott Vascular

*Off label use of products and investigational devices
will be discussed in this presentation*



Introduction

- The MV apparatus is anatomically complex

Primary/Degenerative MV regurgitation (DMR)

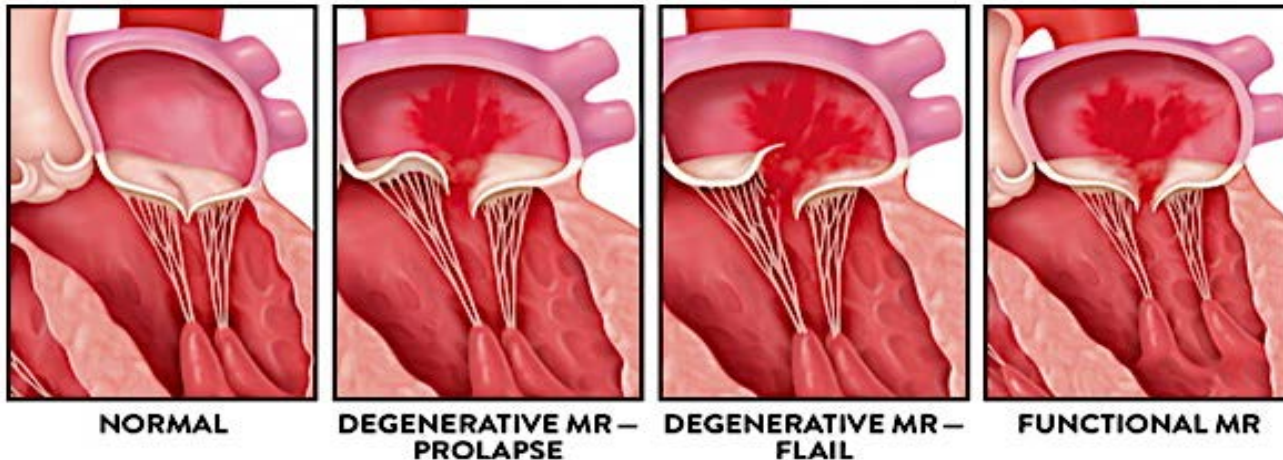
Structural changes to the mitral valve apparatus

(i.e., MV prolapse, chordal rupture, or myxomatous MV disease)

Secondary / Functional MV regurgitation (FMR)

Functional changes

(i.e., dilation of the left atrium, MV annulus, or left ventricle)



de Marchena E, et al. J Card Surg. 2011;26:385– 92.



Terminology

- **Transcatheter Mitral Valve Repair (TMVR)**

MitraClip®

Transcatheter repair technologies

valve-in-valve therapy for failing MV bioprostheses,

failing mitral valve rings

valve-in-MAC

- **Specific abbreviation:**

TMVR: transcatheter mitral valve repair

TMVr: transcatheter mitral valve replacement

TMVI: transcatheter mitral valve implantation



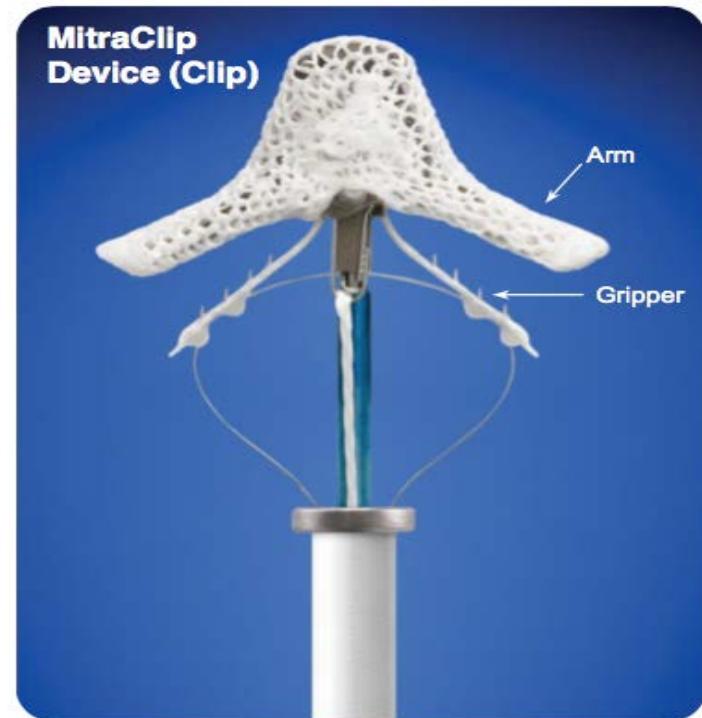
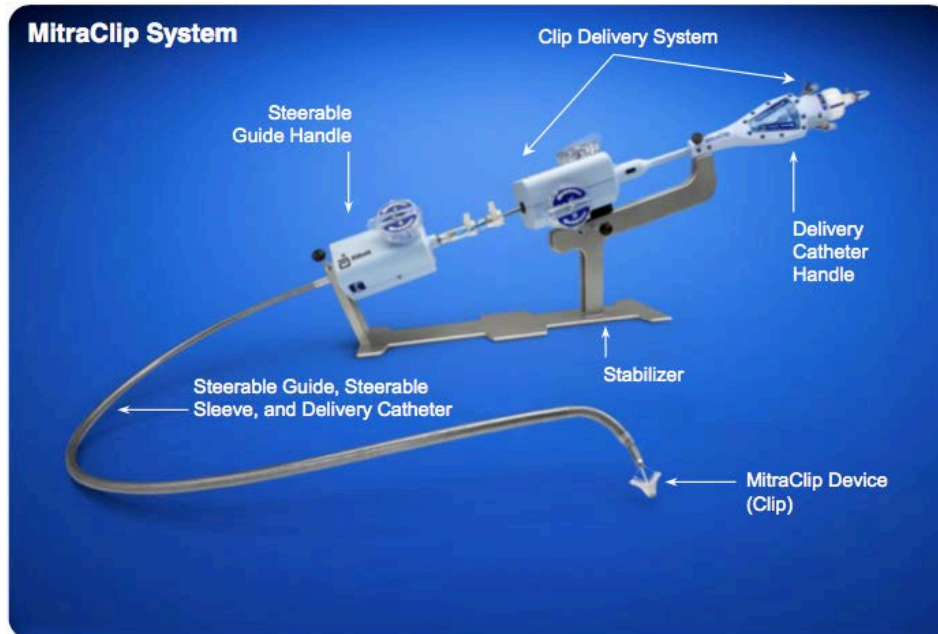
Gössl M, et al. Current status of catheter-based treatment of mitral valve regurgitation.

Curr Cardiol Rep 2017;19:38



MitraClip® Device

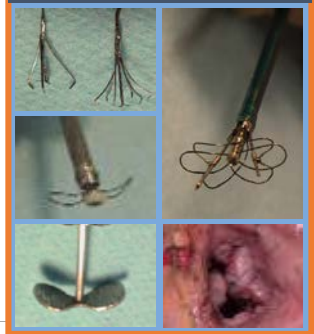
- The clip is a polyester-covered cobalt chromium device
- 2 arms that are opened and closed by control mechanisms
- Has an arm span of approximately 2 cm when opened
- The width of the clip is 4 mm



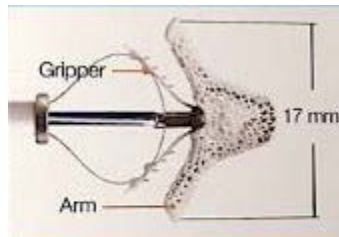
St Goar FG, et al. Endovascular edge-to-edge mitral valve repair: short-term results in a porcine model. *Circulation* 2003;108: 1990–3.

History of MitraClip® and Future

Suture-Based Designs



Percutaneous
Edge-to-Edge
prototype



First MitraClip
Implantation

2003

Minor Changes
for Safety

2011



MitraClip XT
MitraClip
Momentum

2017

1999

Evalve
Company

Clip-Based Designs



2008

MitraClip CE
Mark Approval



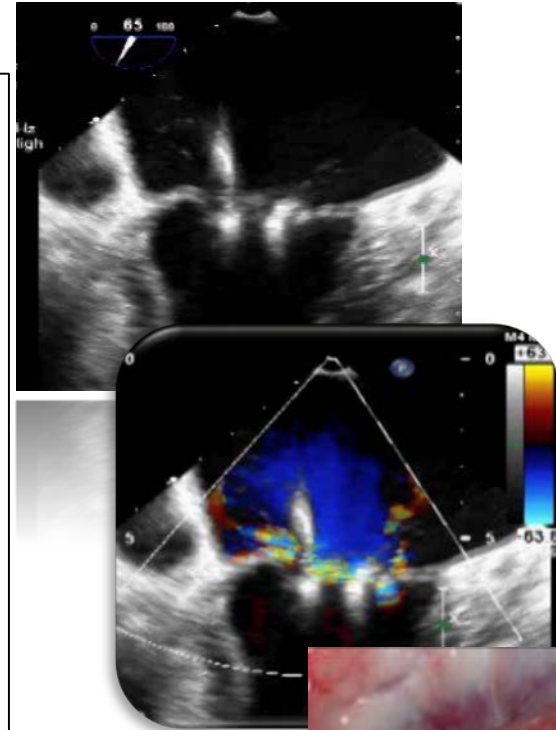
2016

MitraClip NT

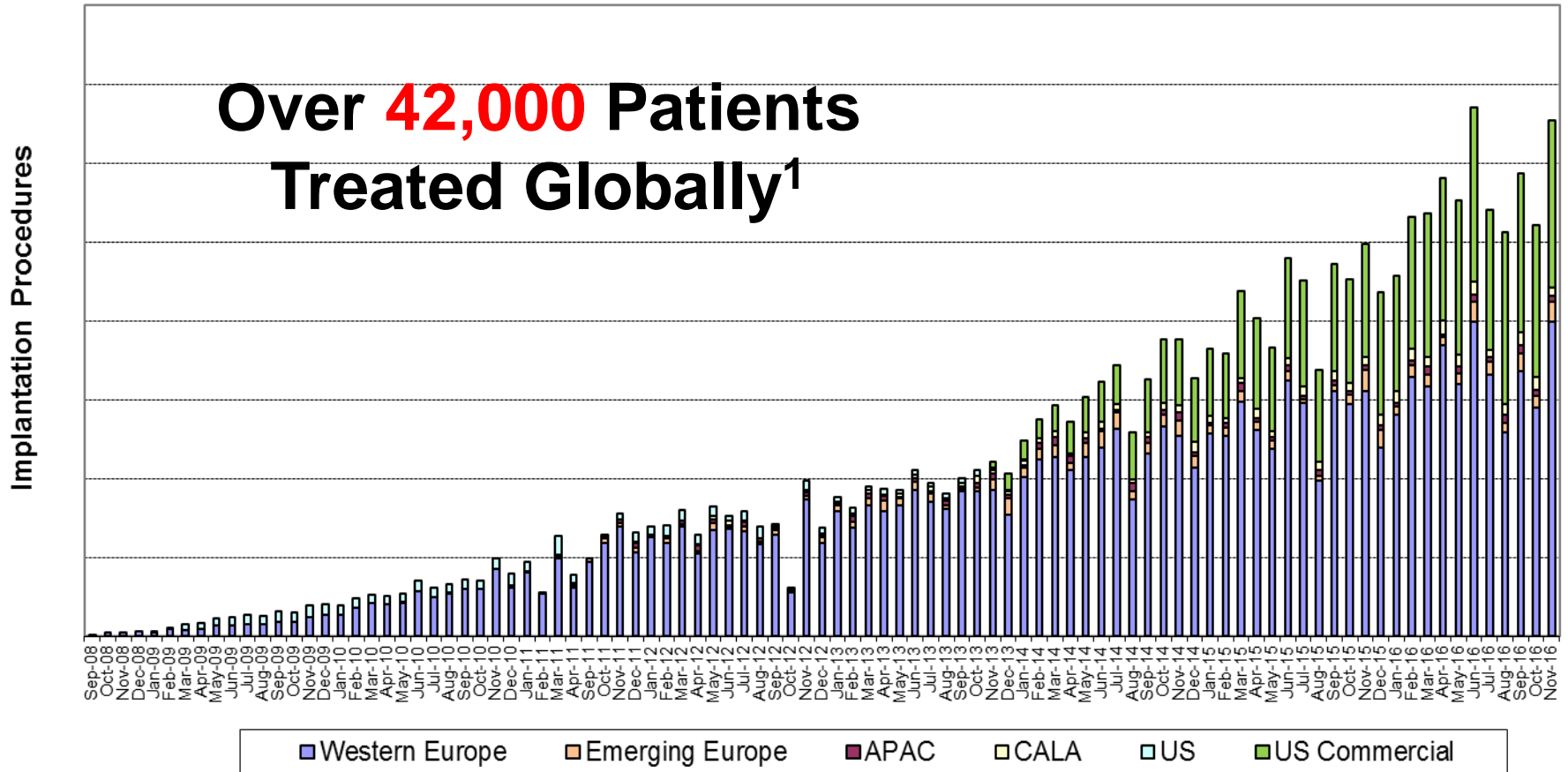


Rationale for use MitraClip®

- **Coaptation of Leaflets**
 - Reduces MR
- **Creates tissue bridge**
 - Limits dilatation of annulus
 - Septal-lateral (A-P) dimension
 - Supports durability of repair
- **Restrains LV wall**
 - Limits LV dilatation



Global MitraClip Experience



1. Includes clinical and commercial procedures as of 30/11/2016. Source: Data on file at Abbott Vascular



Randomized Comparison of Percutaneous Repair and Surgery for Mitral Regurgitation



5-Year Results of EVEREST II

Ted Feldman, MD,* Saibal Kar, MD,† Sammy Elmariah, MD, MPH,‡§ Steven C. Smart, MD,* Alfredo Trento, MD,|| Robert J. Siegel, MD,† Patricia Apruzzese, MS,§ Peter Fail, MD,¶ Michael J. Rinaldi, MD,# Richard W. Smalling, MD, PhD,** James B. Hermiller, MD,†† David Heimansohn, MD,†† William A. Gray, MD,§§ Paul A. Grayburn, MD,||| Michael J. Mack, MD,¶¶ D. Scott Lim, MD,## Gorav Ailawadi, MD,*** Howard C. Herrmann, MD,††† Michael A. Acker, MD,††† Frank E. Silvestry, MD,††† Elyse Foster, MD,§§§ Andrew Wang, MD,||| Donald D. Glower, MD,¶¶¶ Laura Mauri, MD,§§§ for the EVEREST II Investigators

Treatment of MR with MitraClip® showed superior safety compared with surgery, but **less effective reduction in MR at 1 year**

OBJECTIVES: To evaluate the final 5-year clinical outcomes and durability of percutaneous MV repair with the MitraClip® device compared with conventional MV surgery

METHODS: Patients with grade 3 or 4 MR were randomly assigned to MitraClip® or conventional MV surgery in a 2:1 ratio (178:80). Patients prospectively consented to 5 years of follow-up

Feldman T, et al. Randomized comparison of percutaneous repair and surgery for mitral regurgitation: 5-year results of EVEREST II. J Am Coll Cardiol. 2015;66:2844–54.



TABLE 1 Baseline Characteristics: All-Treated Cohort

	Percutaneous Repair	Surgery
Age, yrs	67.0 ± 12.7 (178)	64.7 ± 12.6 (80)
Female	36.5 (65/178)	33.8 (27/80)
LVEF, %	59.9 ± 10.1 (176)	61.3 ± 10.7 (80)
NYHA functional class		
I	9.6 (17/178)	17.5 (14/80)
II	40.4 (72/178)	32.5 (26/80)
III	43.8 (78/178)	45.0 (36/80)
IV	6.2 (11/178)	5.0 (4/80)
MR etiology		
Functional	27.0 (48/178)	22.5 (18/80)
Degenerative	73.0 (130/178)	77.5 (62/80)
Degenerative with anterior/bileaflet flail/prolapse	32.6 (58/178)	27.5 (22/80)
Degenerative with posterior flail/prolapse	37.6 (67/178)	47.5 (38/80)
Degenerative with neither flail nor prolapse	2.8 (5/178)	2.5 (2/80)

Feldman T, et al. Randomized comparison of percutaneous repair and surgery for mitral regurgitation: 5-year results of EVEREST II. J Am Coll Cardiol. 2015;66:2844–54.



All-Treated Cohort: Efficacy Endpoint and Components at 5 years

	5 Years			5 Years if Event-Free at 1 Year		
	Percutaneous Repair (n = 154)	Surgery (n = 56)	p Value	Percutaneous Repair (n = 87)	Surgery (n = 48)	p Value
Freedom from death, MV surgery, or reoperation, and 3+ or 4+ MR	44.2 (68)	64.3 (36)	0.01	69.0 (60)	75.0 (36)	0.55
Death	20.8 (32)	26.8 (15)	0.36	16.1 (14)	16.7 (8)	>0.99
MV surgery or reoperation	27.9 (43)	8.9 (5)	0.003	5.7 (5)	6.3 (3)	>0.99
3+ or 4+ MR	12.3 (19)	1.8 (1)	0.02	11.5 (10)	2.1 (1)	0.10

Values are % (n). *Includes patients that completed the 5-year visit and had MR grade available or died or had MV surgery before withdrawal from the study.

MR = mitral regurgitation; MV = mitral valve.

Feldman T, et al. Randomized comparison of percutaneous repair and surgery for mitral regurgitation: 5-year results of EVEREST II. J Am Coll Cardiol. 2015;66:2844–54.



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,¶¶

Prospective registries of patients who received the MitraClip®
Patients with MR in the United States

OBJECTIVES:

To report 12-month outcomes in high-risk patients

METHODS:

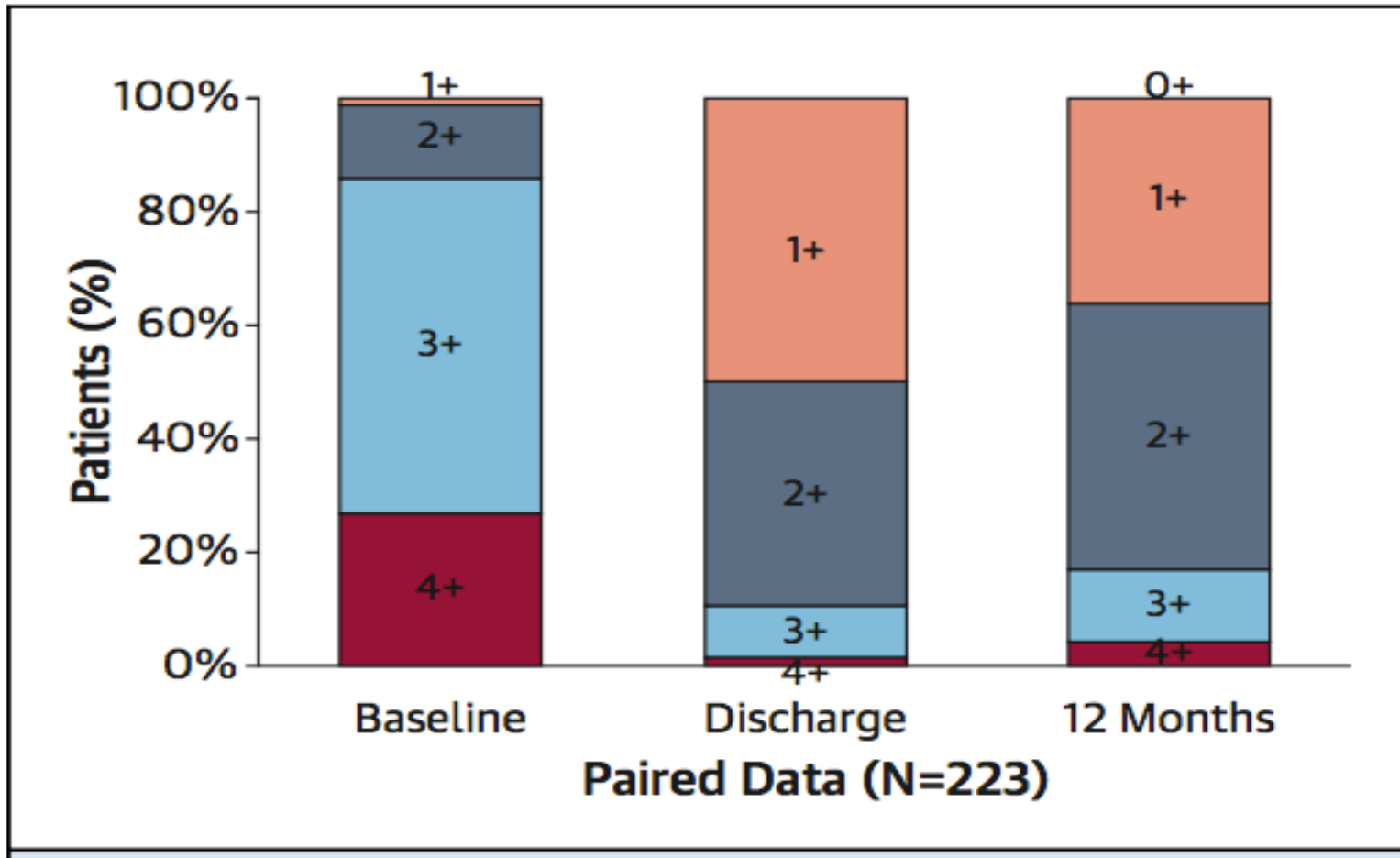
Grades 3 to 4 MR

Surgical mortality risk of >12% - STS Risk

Glower DD, et al. J Am Coll Cardiol 2014;64:172–81



Mitral Regurgitation Grade



Glomer DD, et al. J Am Coll Cardiol 2014;64:172–81



Improved Functional Status and Quality of Life in Prohibitive Surgical Risk Patients With Degenerative Mitral Regurgitation After Transcatheter Mitral Valve Repair

D. Scott Lim, MD,* Matthew R. Reynolds, MD, MSc,†† Ted Feldman, MD,§ Saibal Kar, MD,||
Howard C. Herrmann, MD,¶ Andrew Wang, MD,# Patrick L. Whitlow, MD,** William A. Gray, MD,††
Paul Grayburn, MD,†† Michael J. Mack, MD,†† Donald D. Glower, MD#

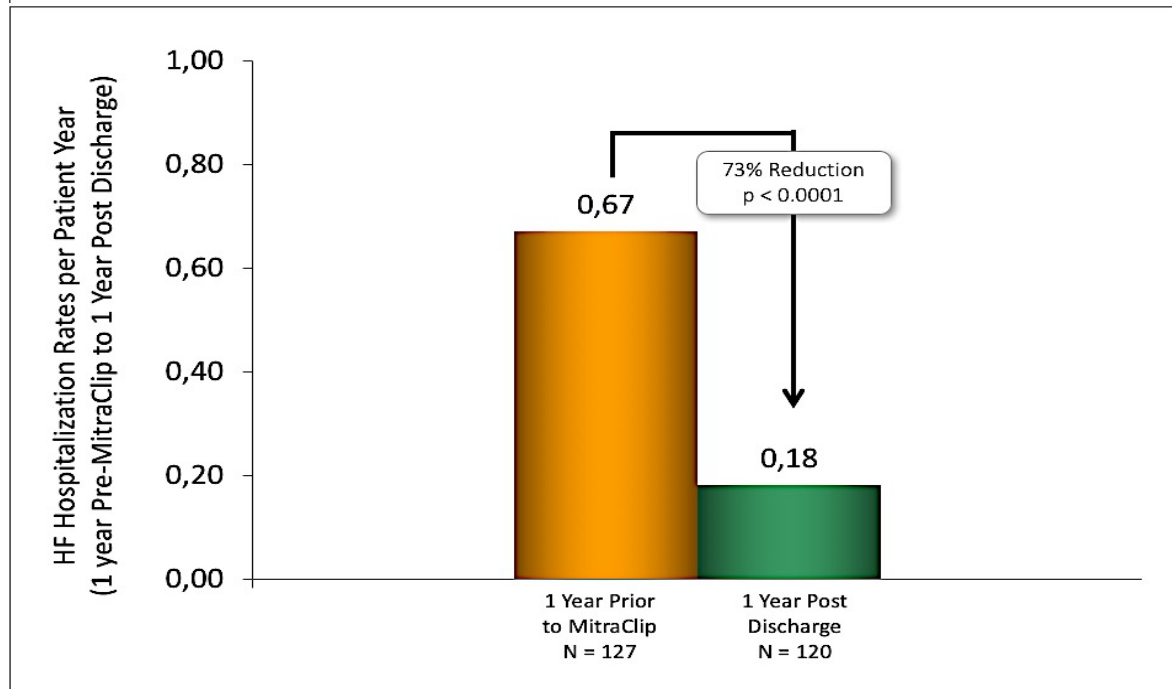
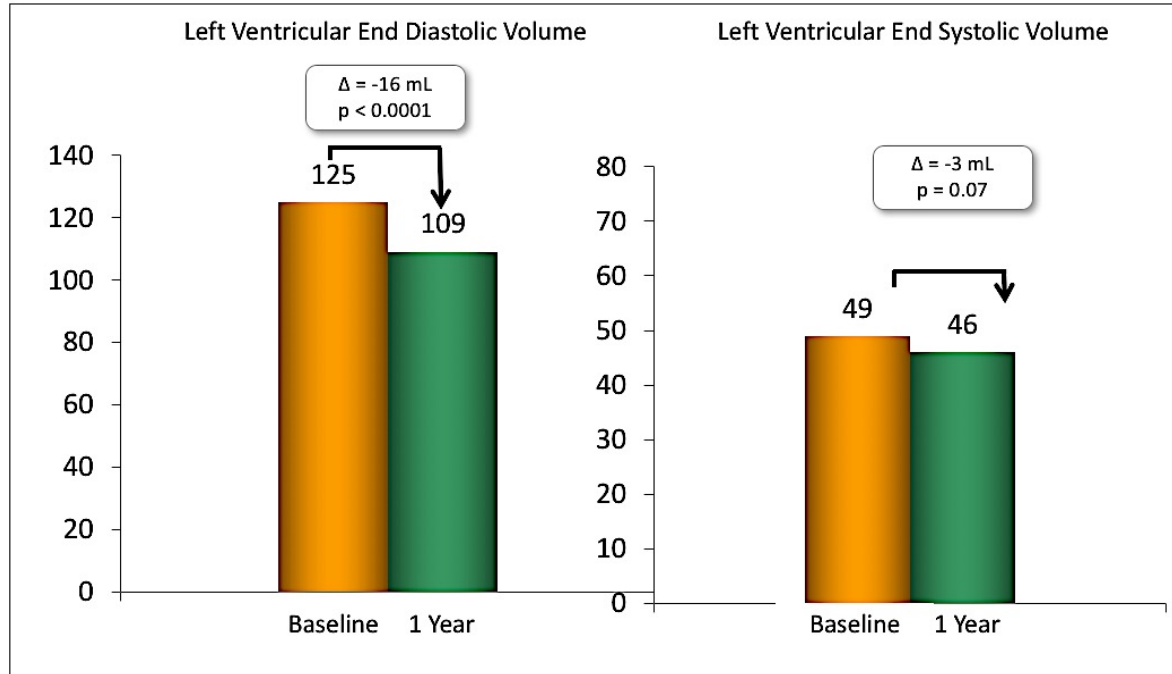
- SMVR remains the gold standard for severe DMR.
- Results with TMVR in prohibitive-risk DMR patients have not been previously reported.

OBJECTIVES:

- To evaluate treatment of MR in patients with severe DMR at prohibitive surgical risk undergoing TMVR.


Lim DS, et al. J Am Coll Cardiol 2014;64:182–92





Lim DS, et al. J Am Coll Cardiol 2014;64:182–92

Surgical & Interventional - Therapy for MR

	Degenerative	Functional
Low Surgical Risk	Surgical Mitral Repair	
High Surgical Risk	Commercial MitraClip	International Practice- 3 CE Devices



Percutaneous Mitral Valve Interventions in the Real World

Early and 1-Year Results From the ACCESS-EU,
A Prospective, Multicenter, Nonrandomized Post-Approval
Study of the MitraClip Therapy in Europe

Francesco Maisano, MD,* Olaf Franzen, MD,† Stephan Baldus, MD,‡ Ulrich Schäfer, MD,§
Jörg Hausleiter, MD,|| Christian Butter, MD,¶ Gian Paolo Ussia, MD,#** Horst Sievert, MD,††
Gert Richardt, MD,‡‡ Julian D. Widder, MD,§§ Tiziano Moccetti, MD,|||
Wolfgang Schillinger, MD¶¶

To report short and mid-term outcomes

ACCESS-EU study, a European prospective, multicenter,
nonrandomized post-approval study of MitraClip® therapy.

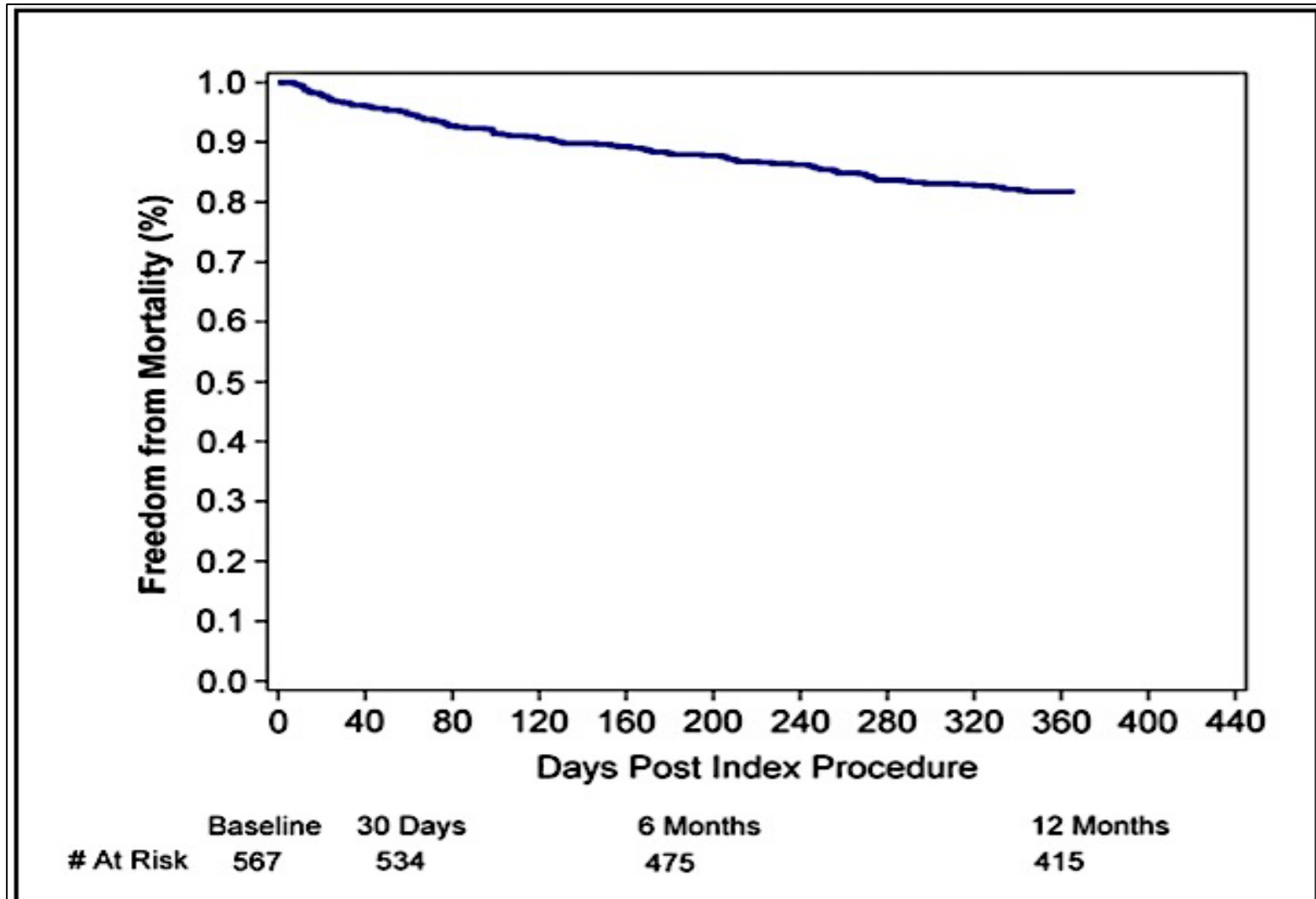
A total of 567 patients

14 European sites

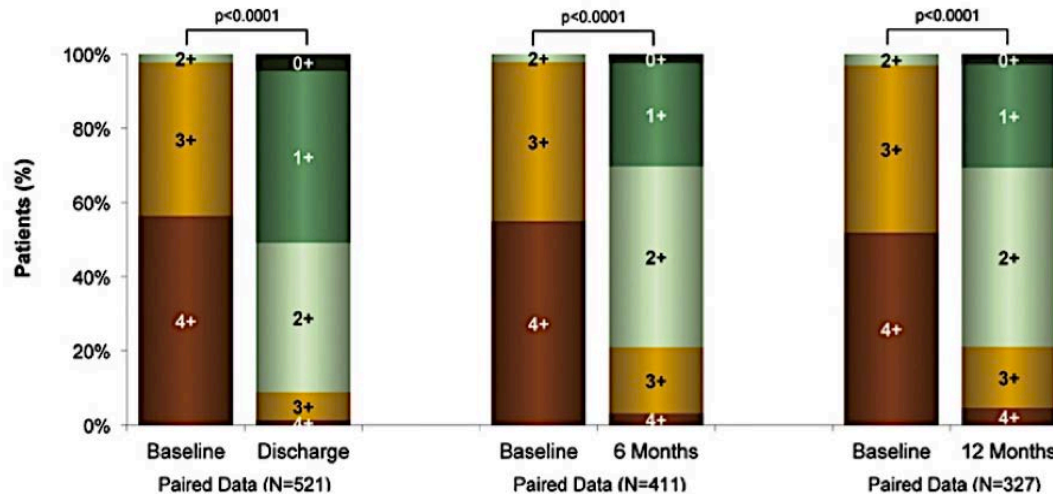
The first large database reporting outcomes of the MitraClip® in
a high-risk population of patients with prevalence of **FMR**.



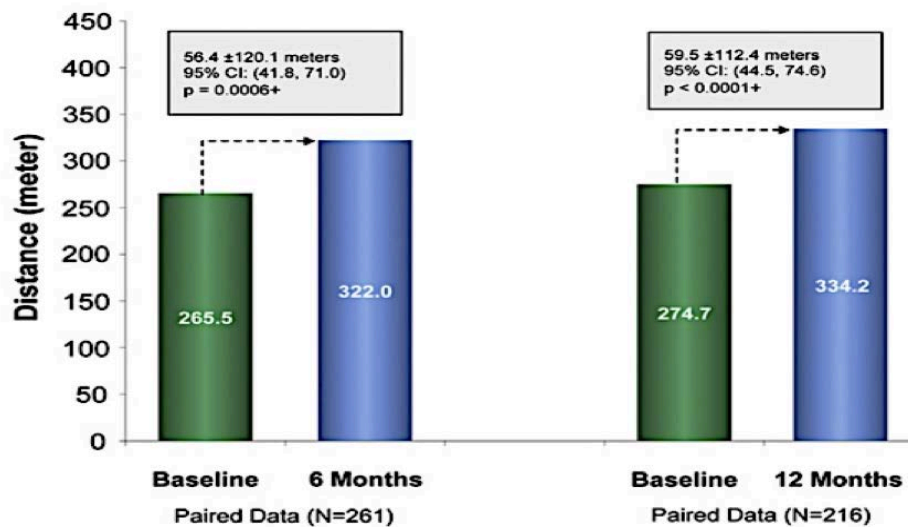
Freedom from Mortality (%) – MitraClip® in FMR



Severity of MR at Baseline, Discharge, 6 and 12 Months



Change in 6-Min Walk Distance From Baseline, to 6 and 12 Months



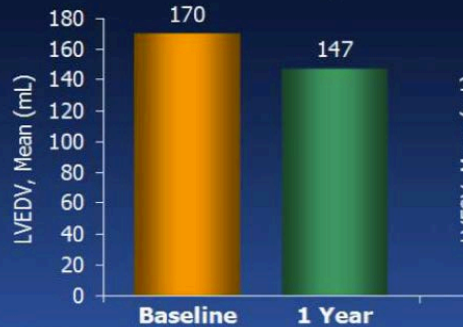
EVEREST II High Surgical Risk FMR Patients

Left Ventricular Volumes

N = 96 Matched Cases, Core-Lab Assessed

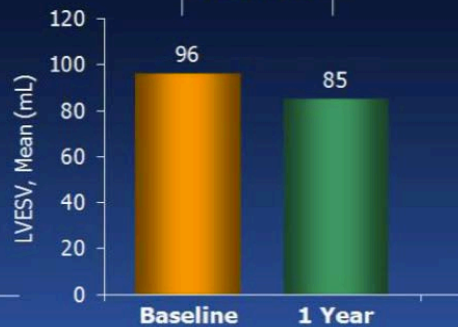
LVEDV

P < 0.0001



LVESV

P < 0.0001



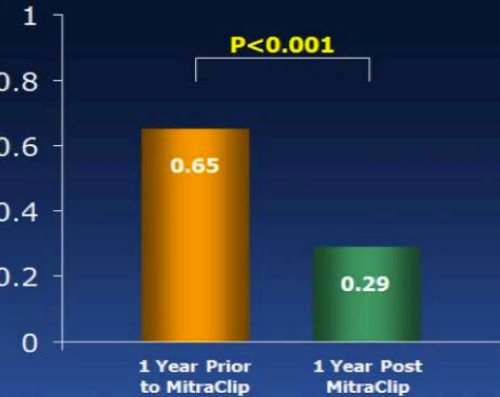
Argenziano M. TCT 2011.

COLUMBIA UNIVERSITY
Medical Center
NewYork-Presbyterian

Hospitalizations for CHF

N = 110 Matched Cases

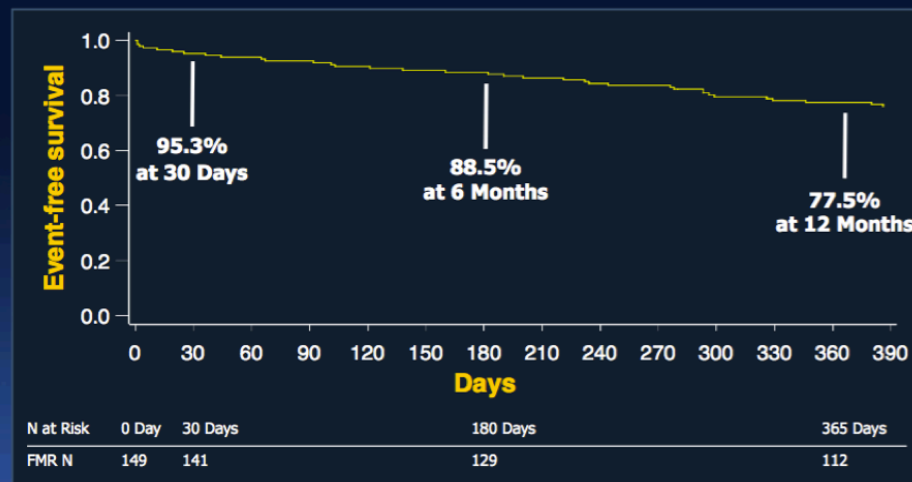
Annual Rate of CHF Hospitalizations
(# CHF Hospitalizations Per Patient-Year)



Argenziano M. TCT 2011.

COLUMBIA UNIVERSITY
Medical Center
NewYork-Presbyterian

Freedom from Death



Argenziano M. TCT 2011.

COLUMBIA UNIVERSITY
Medical Center
NewYork-Presbyterian



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



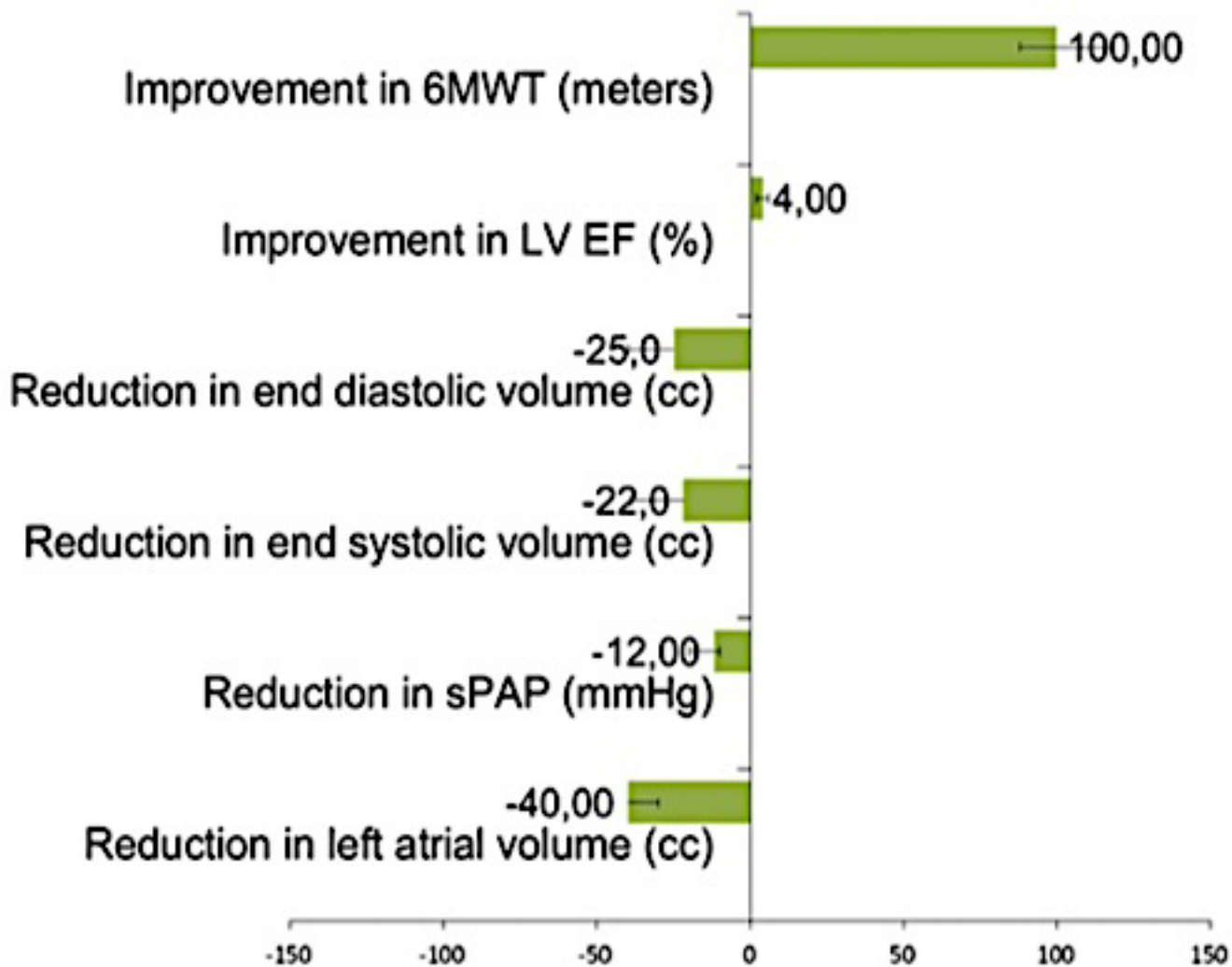
Fabrizio D'ascenzo, MD^a, Claudio Moretti, MD^a, Walter Grosso Marra, MD^a, Antonio Montefusco, MD^a, Pierluigi Omede, MD^a, Salma Taha, MD^{a,b,*}, Davide Castagno, MD^a, Oliver Gaemperli, MD^c, Maurizio Taramasso, MD^d, Simone Frea, MD^a, Stefano Pidello, MD^e, Volker Rudolph, MD^f, Olaf Franzen, MD^g, Daniel Braun, MD^h, Cristina Giannini, MDⁱ, 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

- Meta-regression analysis
- 875 patients were included
- 9 studies
- 1.48 clips (1.3 to 1.7) for patients were implanted
- Median follow-up of 9 months (6 to 12)

Am J Cardiol 2015;116:325e331



Change of Functional and Echo data at FU



Am J Cardiol 2015;116:325e331



COAPT Trial: Design

~610 patients enrolled at up to 100 sites

Symptomatic HF treated with maximally tolerated guideline directed medical therapy

Significant FMR ($\geq 3+$ by echo core lab)

Not appropriate for MV surgery as determined by site's local heart team

Valve anatomy eligible for MitraClip treatment

Randomize 1:1

MitraClip

N~305

Control group
Standard of care

N~305

Clinical and TTE follow-up: Baseline, treatment, 1-week (phone),
1, 6, 12, 18, 24, 36, 48, 60 months

Primary efficacy endpoint: Hospitalization for heart failure within 2 years

Primary safety endpoint: Device-related complications at 1 year

Principal Investigators: Gregg Stone, Michael Mack

Heart Failure Co-Principal Investigators: William Abraham, JoAnn Lindenfeld

Sponsor: Abbott Vascular

COAPT: Enrollment

Between December 2012 and June 10th, 2017, 600 patients have been randomized at 84 active sites

~0.15 pts/site/month

COAPT results in 4th quarter 2018



2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

7.3. Chronic Primary MR

7.3.3. Intervention: Recommendations

Recommendations for Chronic Primary MR Intervention

IIb	B	Transcatheter mitral valve repair may be considered for severely symptomatic patients (NYHA class III to IV) with chronic severe primary MR (stage D) who have favorable anatomy for the repair procedure and a reasonable life expectancy but who have a prohibitive surgical risk because of severe comorbidities and remain severely symptomatic despite optimal GDMT for heart failure (HF). ¹²⁴	2014 recommendation remains current.
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Circulation. 2017;135:e1159–e1195.



6.1 Primary mitral regurgitation

Percutaneous edge-to-edge procedure may be considered in patients with symptomatic severe primary mitral regurgitation who fulfil the echocardiographic criteria of eligibility and are judged inoperable or at high surgical risk by the Heart Team, avoiding futility.

IIb

C

6.2 Secondary mitral regurgitation

In patients with severe secondary mitral regurgitation and LVEF <30% who remain symptomatic despite optimal medical management (including CRT if indicated) and who have no option for revascularization, the Heart Team may consider a percutaneous edge-to-edge procedure or valve surgery after careful evaluation for a ventricular assist device or heart transplant according to individual patient characteristics.

IIb

C



MitraClip® - Conclusion

- Transcatheter mitral valve treatment should be discussed by the **Heart Team** in symptomatic patients who are at high surgical risk or are inoperable.
- **More prospective**, randomized controlled **trials** are needed to determine patients, potential adverse events, device durability, and long-term follow-up.
- MitraClip® should be used only in **centers** with **high-quality** surgical and **interventional experience**, and training.



MitraClip® - Conclusion

- **For Selected patients:**

- Reduced MR severity to 2+ or less in 86%

- NYHA functional class

- 6-minute walk test improved

- Significant reduction in left ventricular volumes

- Significant reduction in systolic pulmonary pressure

- Atrial fibrillation reduced






- Quality-of-life measures improved

- Decrease in the annual hospitalization rate for HF

- Kaplan–Meier survival: 77.2%








Transcatheter Mitral Valve Repair (TMVR)- Technologies

Company	Abbott	NeoChord	Cardiac Dimensions	Valtech Cardio	Mitralign
Name	MitraClip	DS1000	Carillon*	Cardioband	Bident
					
Description	Edge-to-edge technique	Implantation through TA access	Coronary sinus cinching	Transcatheter surgical-like annuloplasty	Plication device
Strengths	Versatility (DMR and FMR)	Solid surgical background	Simplicity	Solid surgical background	Simpler than other direct annuloplasty
Weaknesses	Lack of annuloplasty	TA access	Limited efficacy, unpredictable results	Complexity, advanced imaging	Limited efficacy
MR aetiology	DMR and FMR	DMR	FMR	FMR	FMR
Status	About 40,000 patients worldwide	About 300 patients	About 500 patients	About 100 patients	About 100 patients

Gössl M, et al. Current status of catheter-based treatment of mitral valve regurgitation. Curr Cardiol Rep 2017;19:38



Transcatheter Mitral Valve Replacement (TMVr)- Technologies

Company	Abbott	Edwards	Edwards	Medtronic	Neovasc
Name	Tendyne	CardiaQ	Fortis	Twelve	Tiara
					
Patients treated	31	12	23	15	15
First implant	October 2014	June 2012	February 2014	September 2014	January 2014
Functional aetiology	86%	64%	100%	73%	54%
Successful deployment	21/23 (91%)	9/11 (82%)	10/13 (77%)	14/15 (93%)	9/11 (82%)
30-day mortality	1/23 (4%)	5/11 (45%)	5/13 (38%)	2/15 (13%)	3/11 (27%)
MR grade 0 at follow-up	19/19 (100%)	na	8/9 (89%)	13/14 (93%)	na

CE-marked Transcatheter Mitral Valve Replacement (TMVr)- Technologies

Gössl M, et al. Current status of catheter-based treatment of mitral valve regurgitation.
Curr Cardiol Rep 2017;19:38



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Thank You



The Society
of Thoracic
Surgeons



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