

HERZ IM FOCUS: Mitralklappentherapie mit Carillon

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Potential conflicts of interest

Grant / Research support; receipt of honoraria or consultation fees:

- Cardiac Dimensions
- Abbott Medical, Edwards Lifesciences, Medtronic, Penumbra, Zoll
- AstraZeneca, Bayer, BMS



- **Vorstellung der Methode**
- **Datenlage**
- **Persönliche Erfahrungen**

The Carillon Mitral Contour System

Dynamic Indirect Annuloplasty Device

Distal Anchor
(in great cardiac vein)

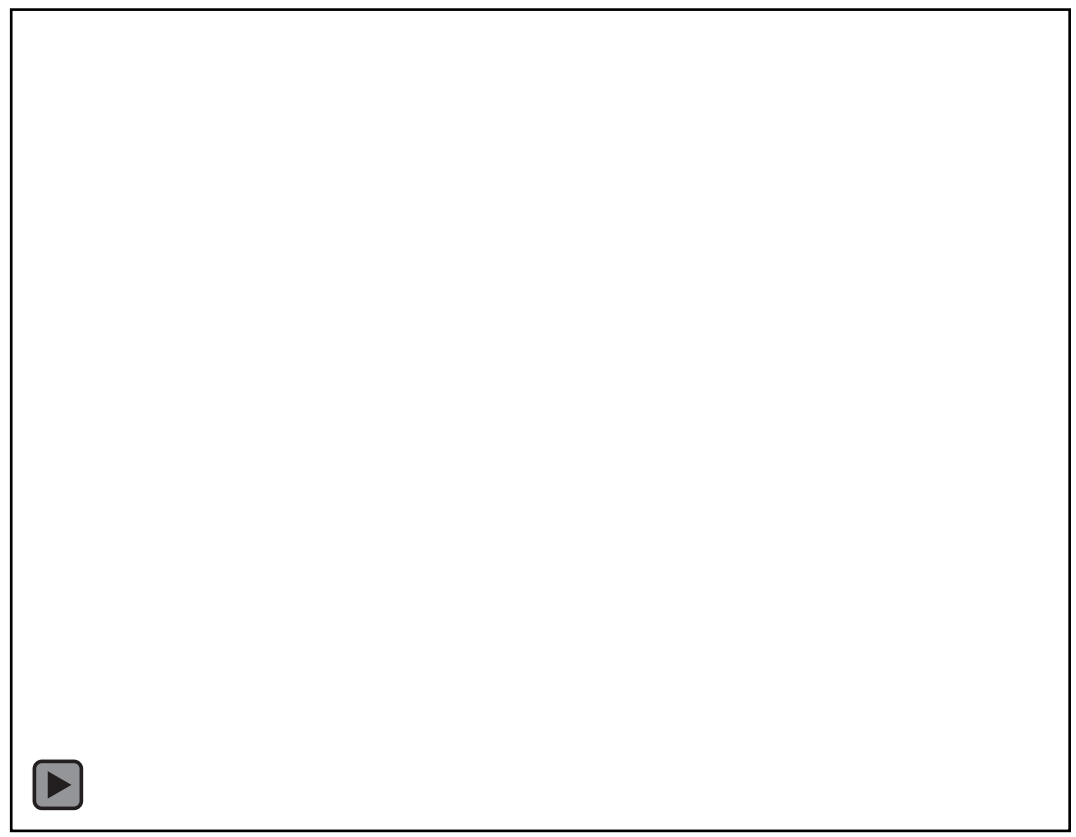


Proximal Anchor
(in coronary sinus)

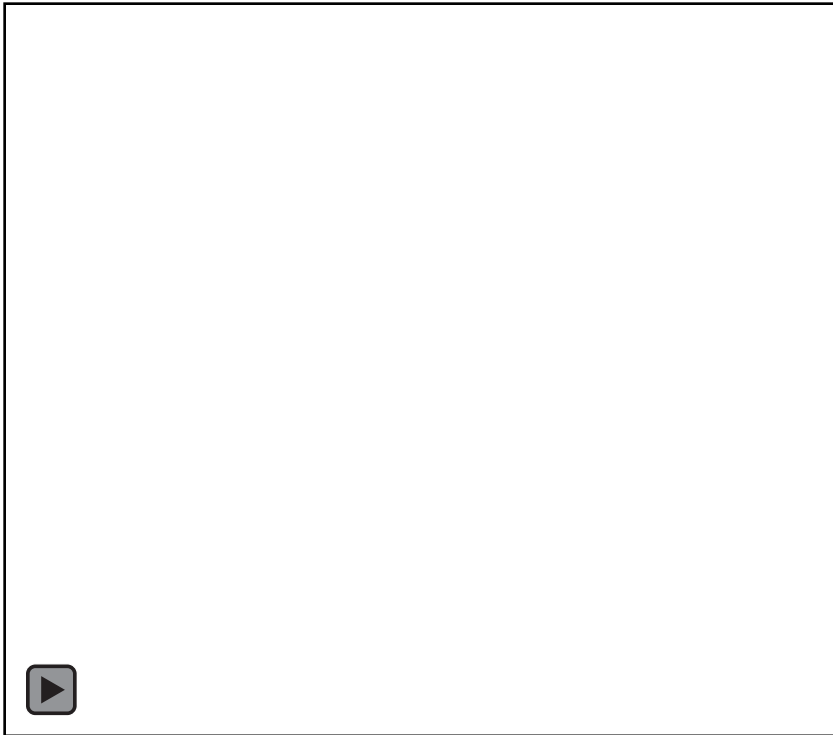
Trans-jugular Delivery System



Implant Animation

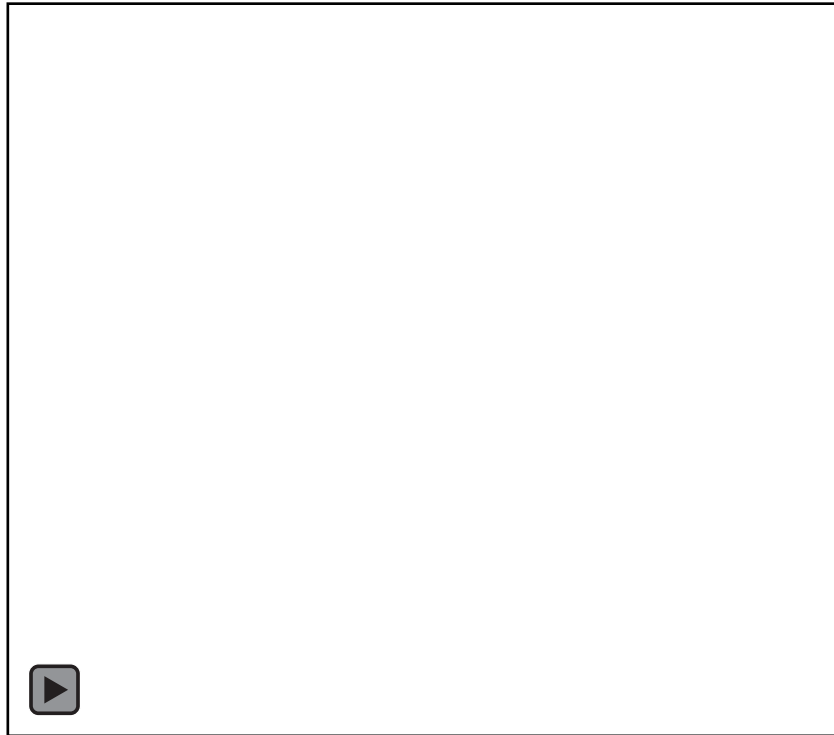


Cinching with the Carillon device



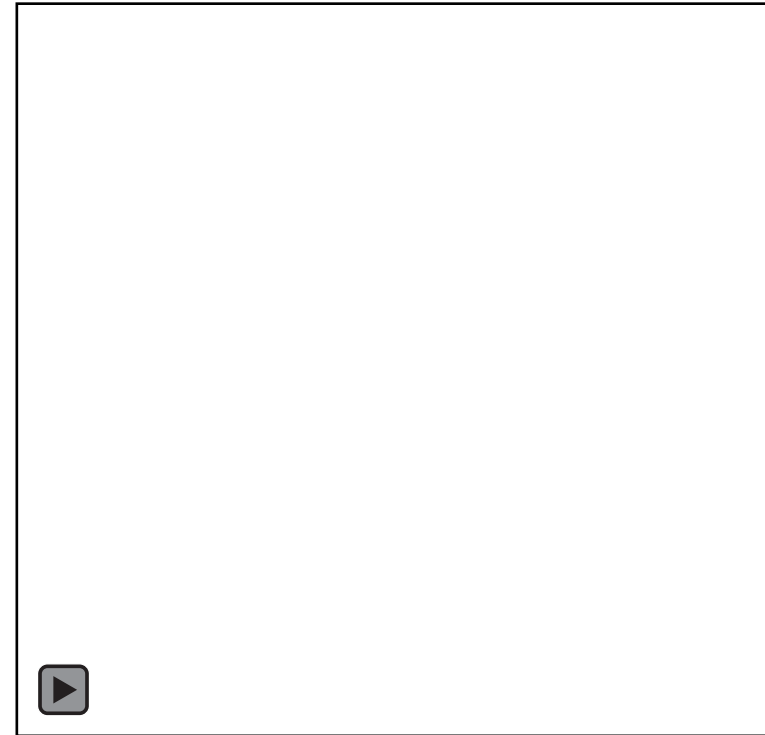
Animation

Animated cinching of the mitral annulus



Visible heart

Cinching of the mitral annulus of a deer heart

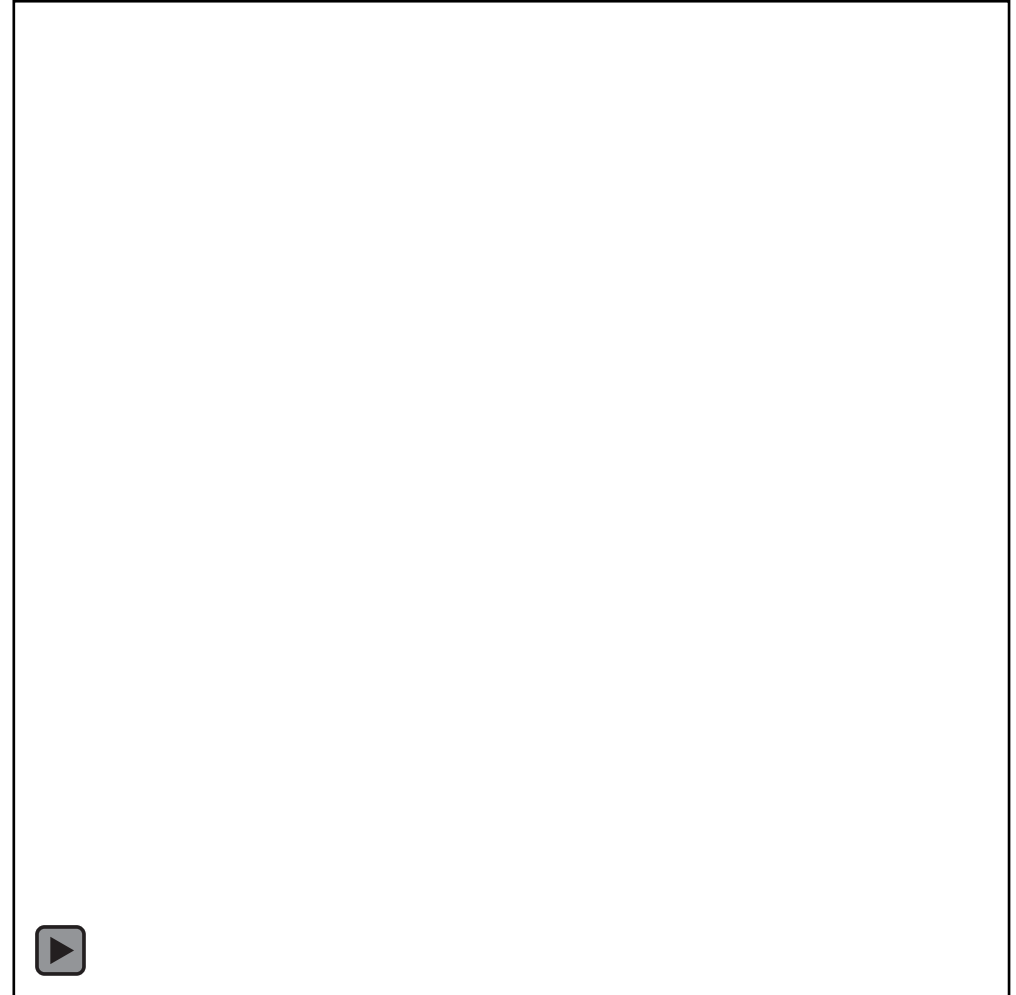
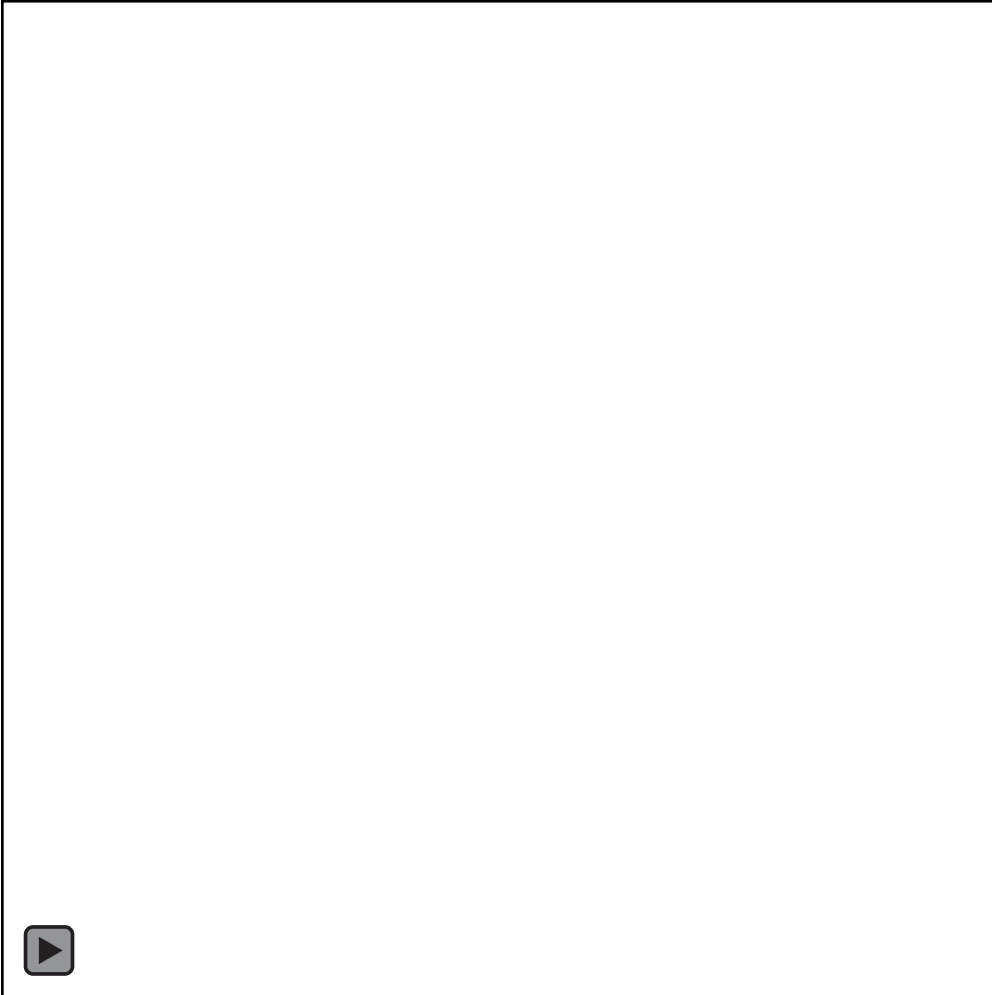


Human heart

Cinching of the mitral annulus, patient case
Courtesy of Dr. Lutz, Lübeck, Germany

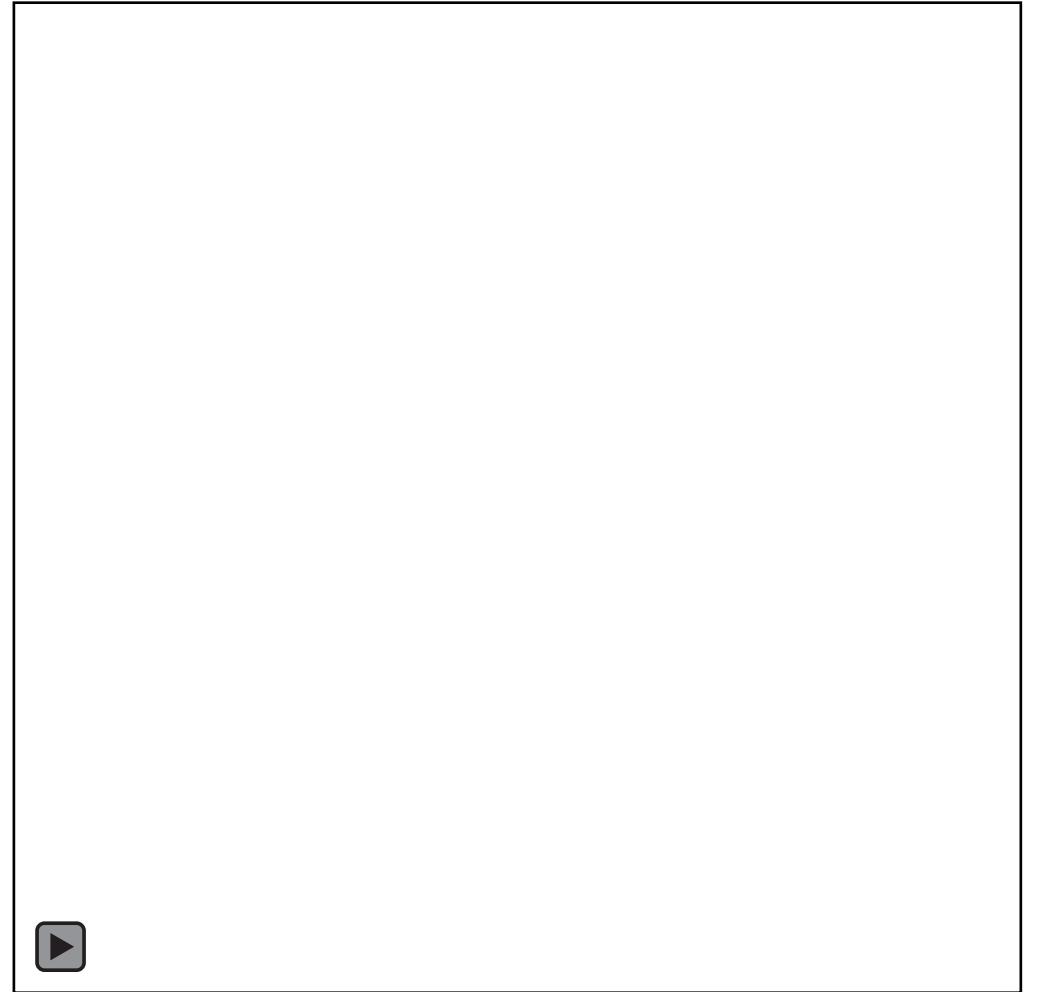
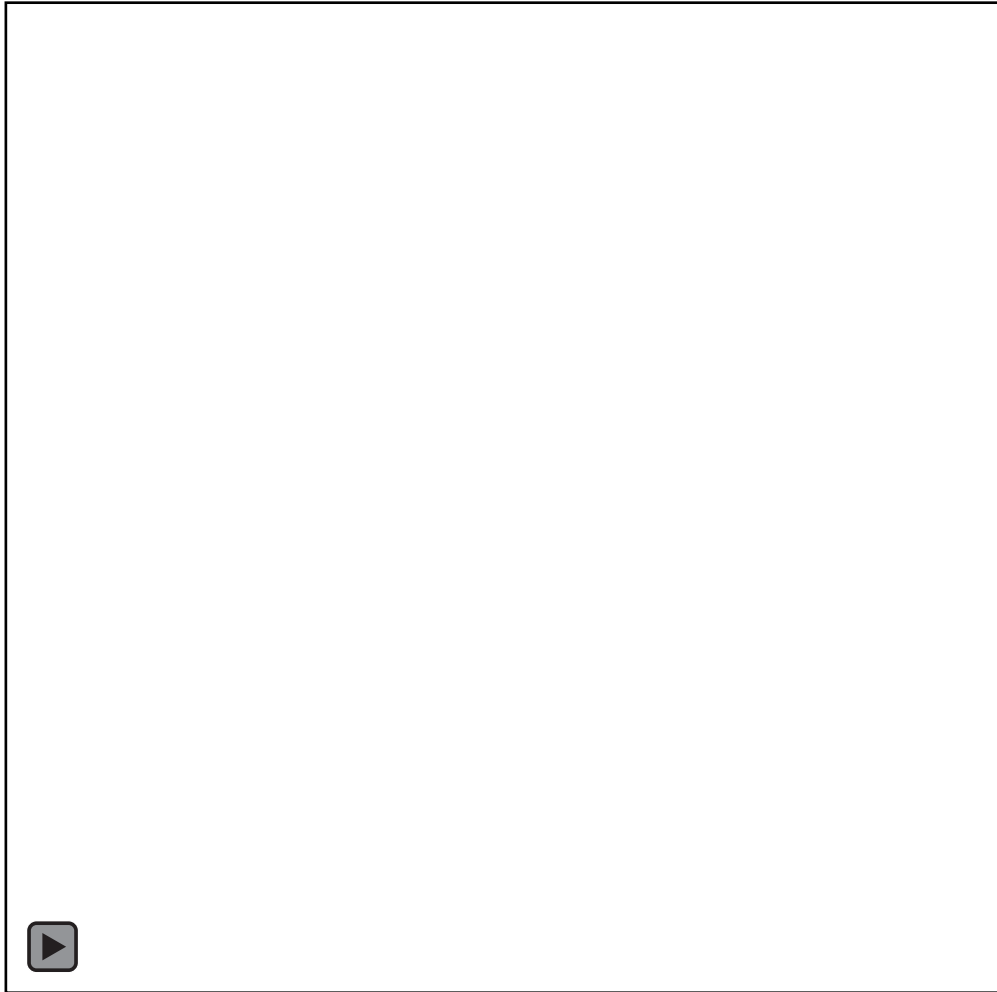
Interventionelle Mitralklappenanuloplastie

Die Implantation der Carillon-Spange



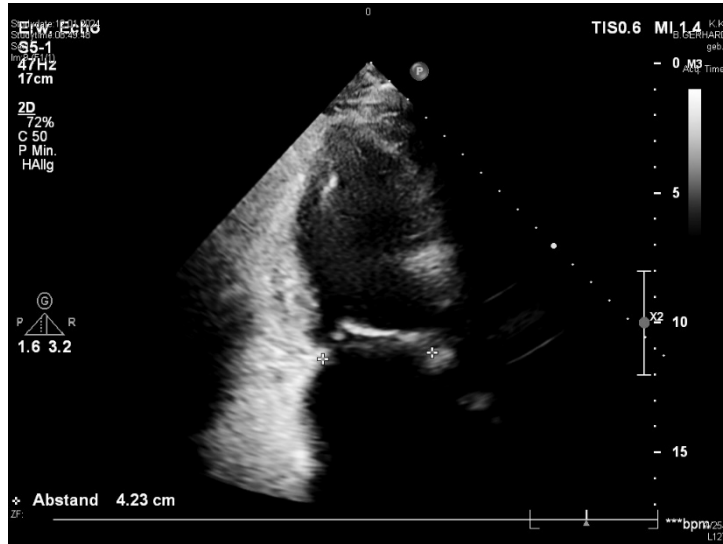
Interventionelle Mitralklappenanuloplastie

Die Implantation der Carillon-Spange

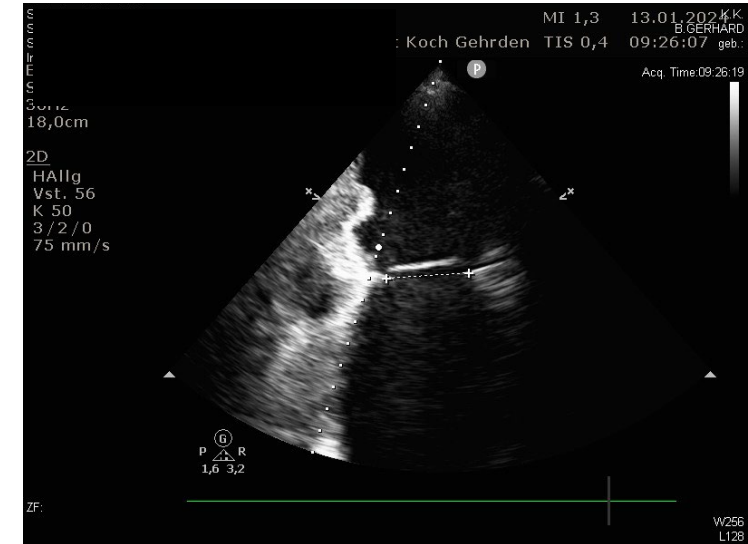


Interventionelle Mitralklappenanuloplastie

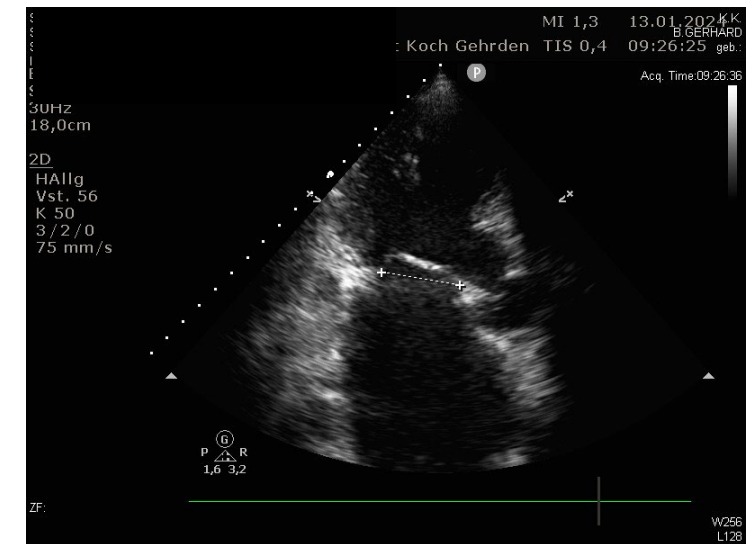
direkter Effekt auf Mitralklappenring postprozedural



medial-lateral
- 6mm



anterior-posterior
- 10mm



- Vorstellung der Methode
- **Datenlage**
- Persönliche Erfahrungen

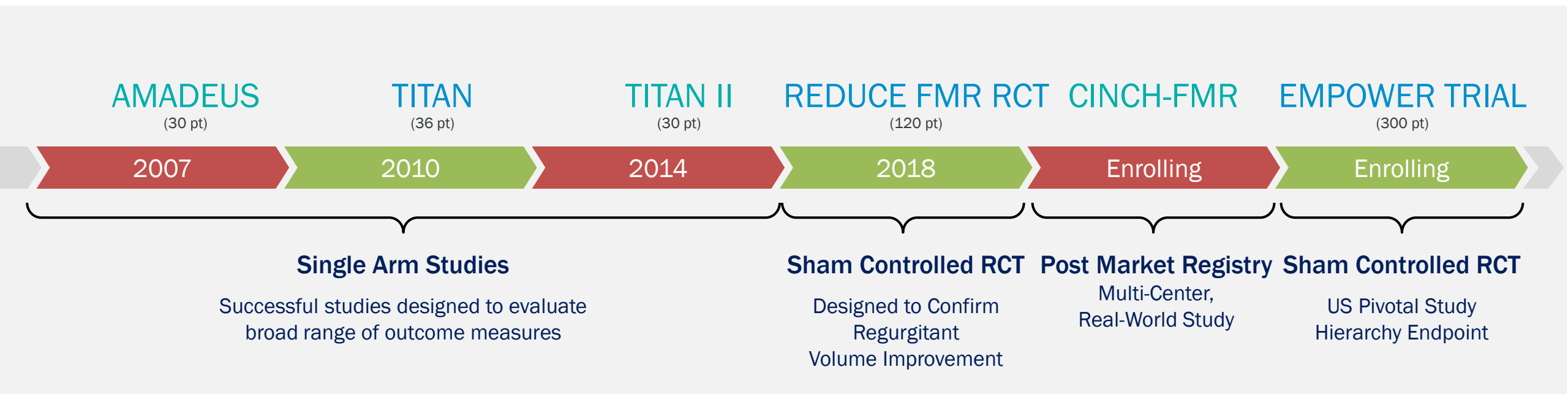


Carillon Mitral Contour System — Clinical Experience

450+ patients studied over 4 studies and a post-market registry

Consistent Inclusion/Exclusion Criteria Across Studies

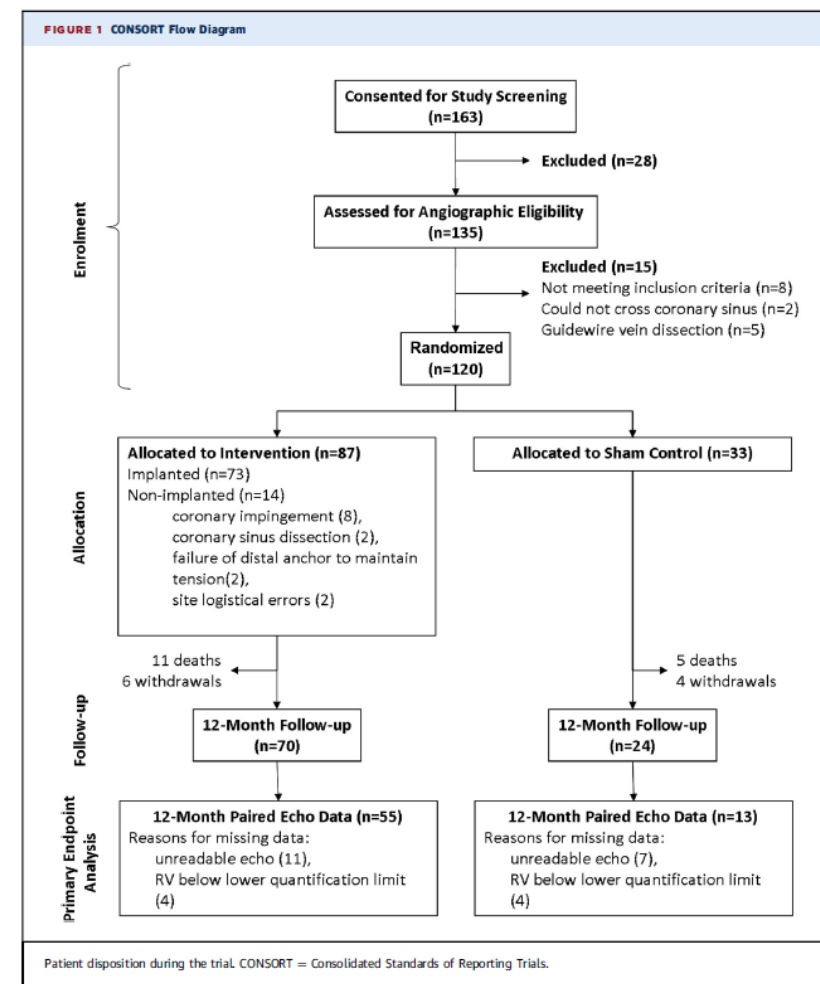
Independent Core Lab Assessment of Key Outcome Measures



The Reduce-FMR Trial

Overview

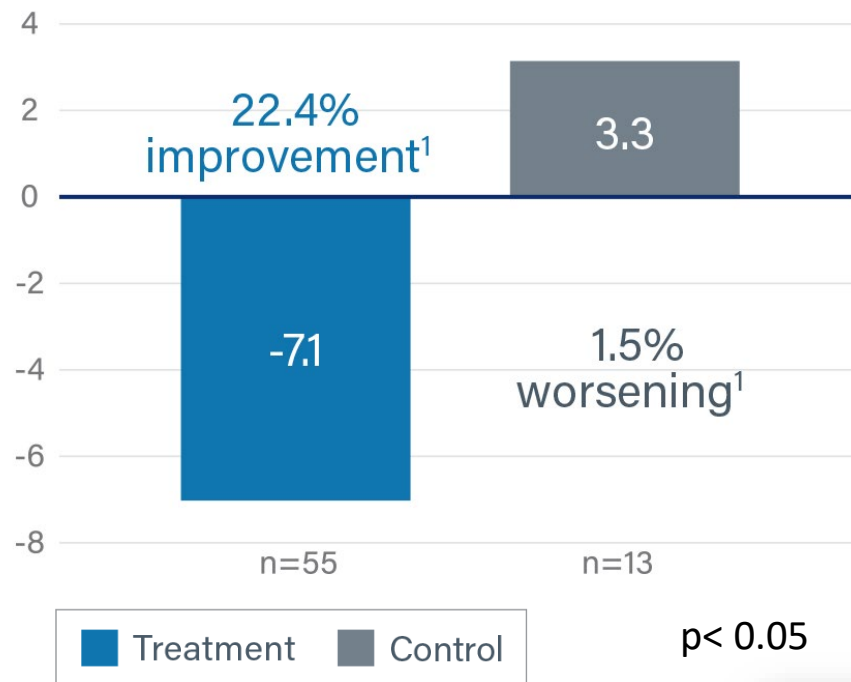
- Goal: Comparison of functional outcomes through 1 year in pts with moderate to severe FMR (HF_rEF) treated with Carillon or control group
- Multicenter, randomized, double-blinded, proof-of-concept, sham-controlled trial
- 120 patients randomized, 87 in treatment, 33 in control group
- All pts received optimal medical therapy



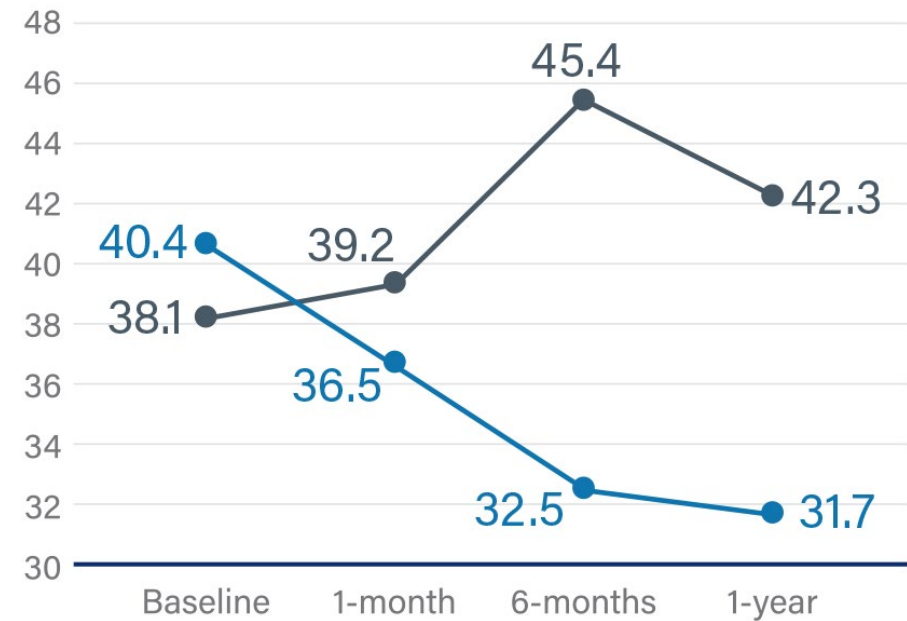
The Reduce-FMR Trial

Outcomes: Reduced MR

Change in regurgitant volume (mL), ITT



Mean regurgitant volume (mL), ITT

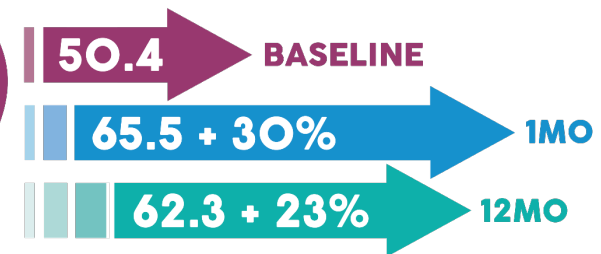
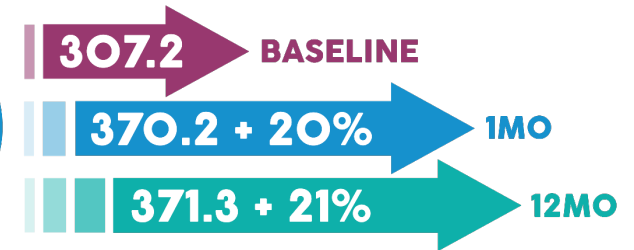
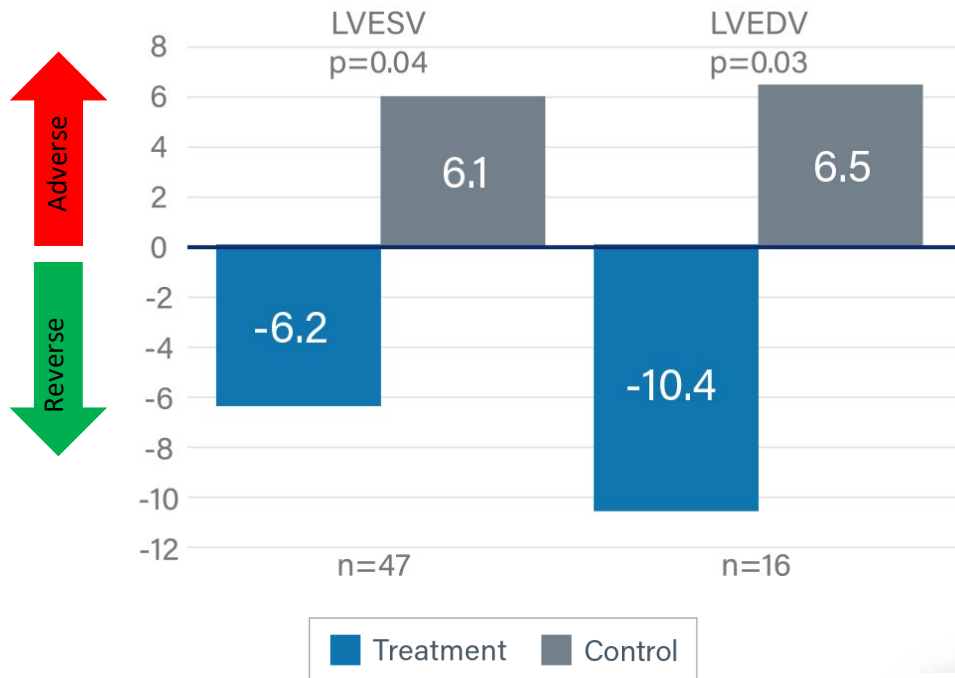


The Reduce-FMR Trial

Outcomes: Reduced LV Volumes

Improved walking distance & QoL

Mean LVESV and LVEDV change from baseline at 12 months (mL)



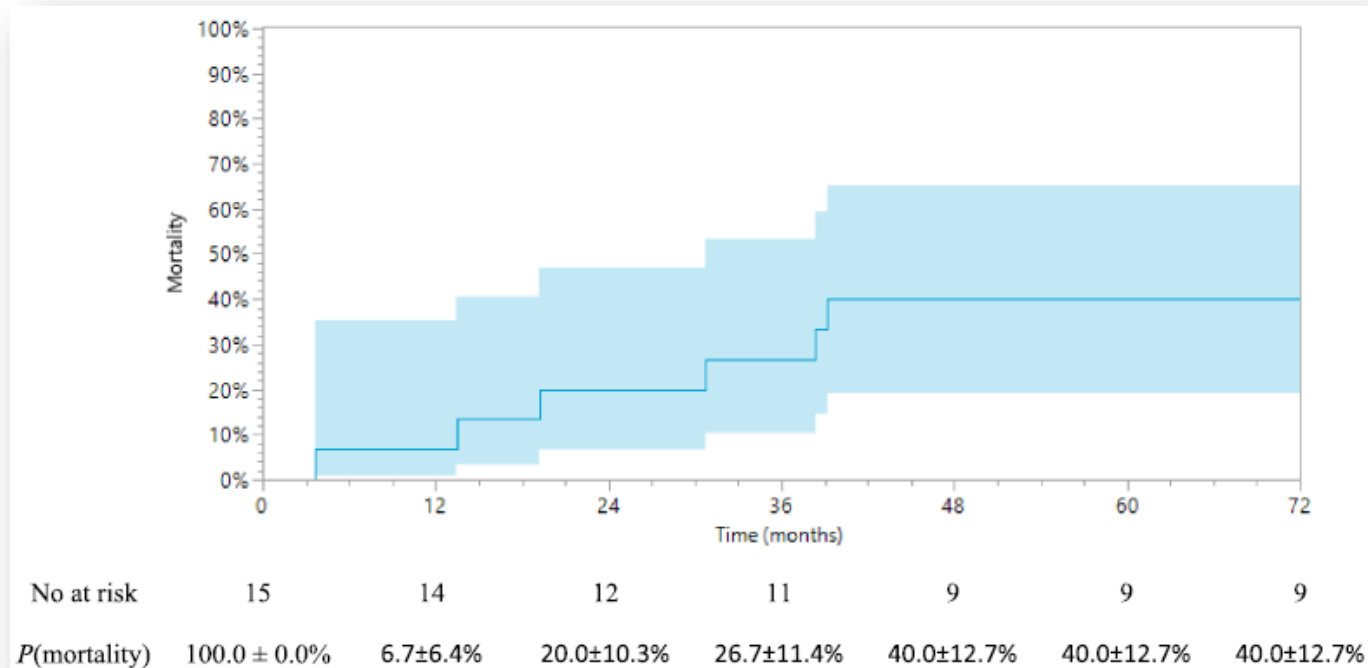
ESCAPE HEART FAILURE ORIGINAL RESEARCH ARTICLE
 ESC Heart Failure 2021; 8: 872-878
 Published online 22 February 2021 in Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/ehf2.13273

Functional outcomes with Carillon device over 1 year in patients with functional mitral regurgitation of Grades 2+ to 4+: results from the REDUCE-FMR trial

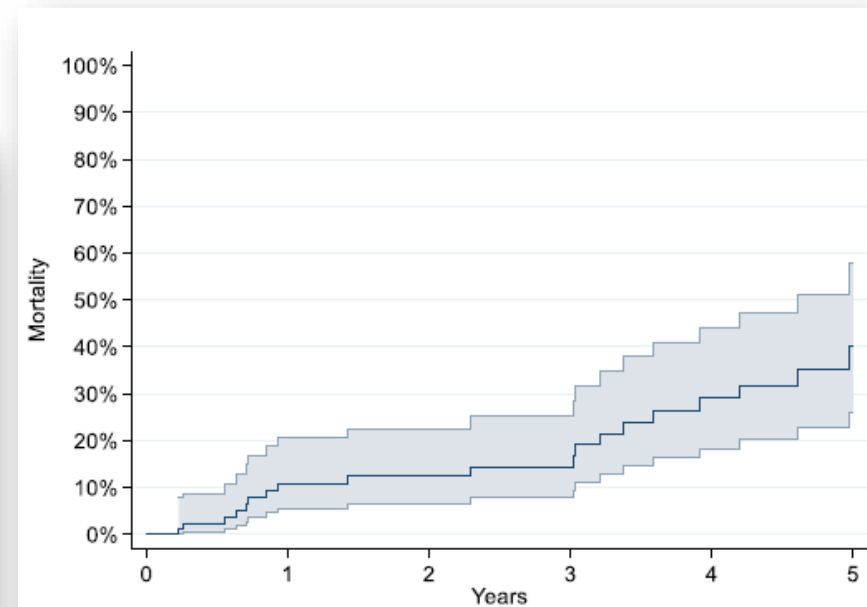
Muhammad Shahzeb Khan¹, Tariq Jamal Siddiqi², Javed Butler¹, Tim Friede^{3,4}, Wayne C. Levy⁵, Klaus K. Witte⁶, Janusz Lipiecki⁷, Horst Sievert^{8,9} and Andrew J. Stewart Coats^{10*}

Survival data

Lipiecki et al. (2020) and Yildiz (2024) show encouraging survival outcomes



Lipiecki, Janusz et al. "Long-term prognosis of patients treated by coronary sinus-based percutaneous annuloplasty: single centre experience." *ESC heart failure* vol. 7,6 (2020): 3329-3335. doi:10.1002/ehf2.12955



Years	Beginning Total	Events	Lost	Mortality	95% CI
0	101	—	—	—	—
1	59	8	34	10.8%	5.5% - 20.6%
2	47	1	11	12.4%	6.6% - 22.5%
3	38	1	8	14.4%	7.9% - 25.3%
4	27	6	5	29.0%	18.3% - 43.9%
5	11	3	13	40.1%	26.1% - 58.0%

Yildiz M et al. The CINCH-FMR postmarket registry: Real-world long-term outcomes with percutaneous mitral valve repair with the Carillon Mitral Contour System®. *Cardiovasc Revasc Med.* 2024;60:35-40. doi:10.1016/j.carrev.2023.09.007

Treating Mild and Moderate FMR

Evaluation of 68 Carillon patients with baseline MR grade 1+ or 2+ at 12 months:

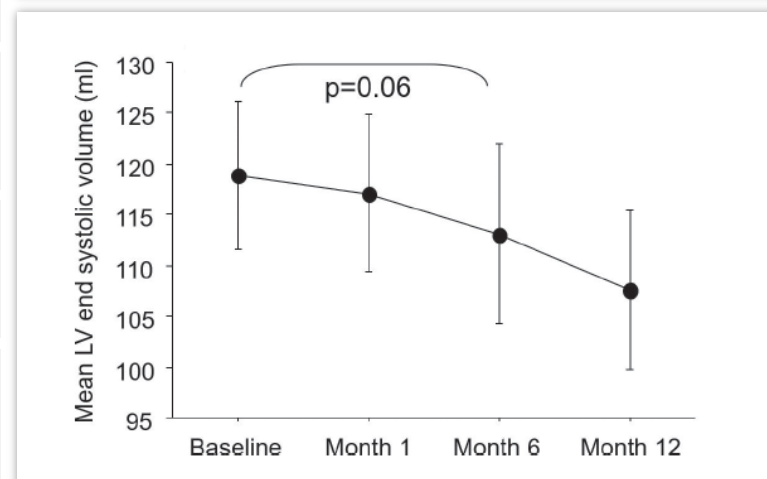
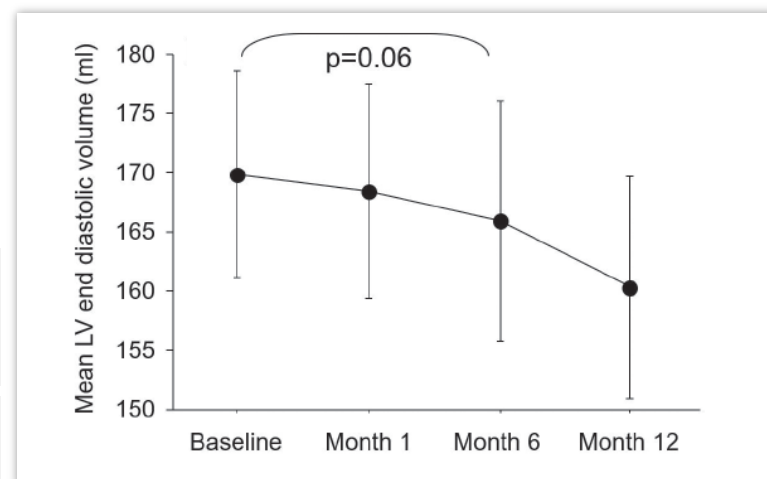
6MWT increased by 34 m (95% CI 12 to 57; $P < 0.01$)

KCCQ scores increased from baseline by 10 units
[95% confidence interval (CI) 3 to 17; $P < 0.01$]

FMR improved by an average of 26% from baseline with a mean regurgitant volume reduction of -7 mL (95% CI -11 to -3; $P < 0.001$)

New York Heart Association class status was maintained (48%)
or improved (46%) in the vast majority of patients

Survival over one year was 89% and freedom
from HF hospitalization was 73%





Percutaneous Mitral Valve Annuloplasty in Patients With Secondary Mitral Regurgitation and Severe Left Ventricular Enlargement

Stefan D. Anker, MD, PhD,^{1,2} Randall C. Starling, MD, MPH,^{1,2} Muhammad Shahzeb Khan, MD, MSc,¹ Tim Friede, PhD,^{1,2} Gerasimos Filippatos, MD,¹ JoAnn Lindenfeld, MD,¹ Ralph Stephan von Bardeleben, MD,¹ Andrew J.S. Coats, MD,^{1,2} Javed Butler, MD, MPH, MBA¹

Treating Severe Left Ventricular Dysfunction

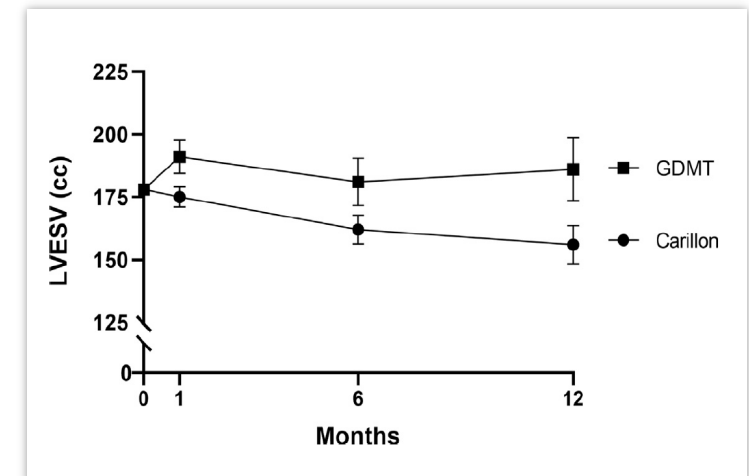
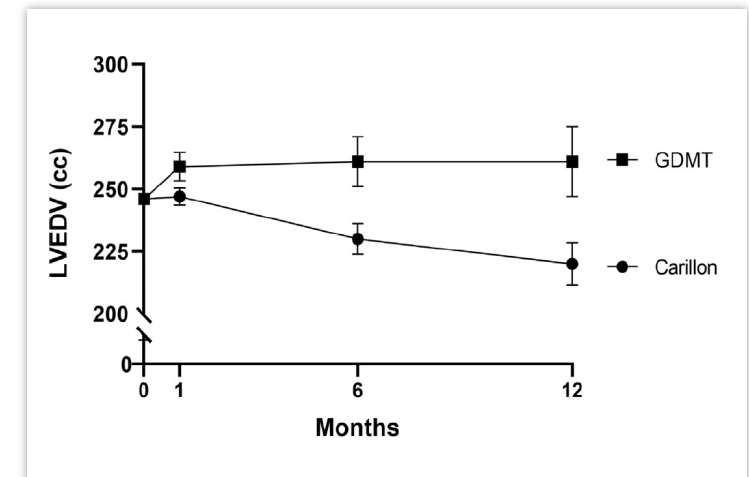
95 patients (67 Carillon; 28 GDMT only) with severe LV enlargement (LV end-diastolic diameter > 65 mm) with 12 month follow up

In the Carillon group, all mitral valve and LV morphology parameters were significantly improved at 12 months.

- Regurgitant volume decreased by 12 ml ($p < 0.001$)
- LV end-diastolic volume decreased by 25 cc ($p = 0.005$)
- LV end-systolic volume decreased by 21 cc ($p = 0.01$)

Significant functional improvement differences were also noted between the Carillon group vs. GDMT group:

- Improvement of KCCQ score (15 ± 4 vs 6 ± 6 ; $p = 0.03$)
- Incidence of HF hospitalization was 29.9% vs. 50.0% and the cumulative rate of HF hospitalization was 0.43 vs. 0.75 ($p < 0.001$)



Study Recruitment Empower Trial

Main clinical
criteria for
patient
evaluation

Imaging Core
Lab and Central
Review Committee
determines
eligibility

- NYHA II-IVa
- HF Medications (1-month stable dose; no requirement for titration to max dose)
- No CRT Lead in Coronary Sinus
- No other Mitral Valve repair devices in place
- LVEF < 50%
- LVEDD ≥ 57 mm LVESD ≤ 70 mm
- Functional MR grade at least 1+ (mild to severe included)

EMPOWER
TRIAL

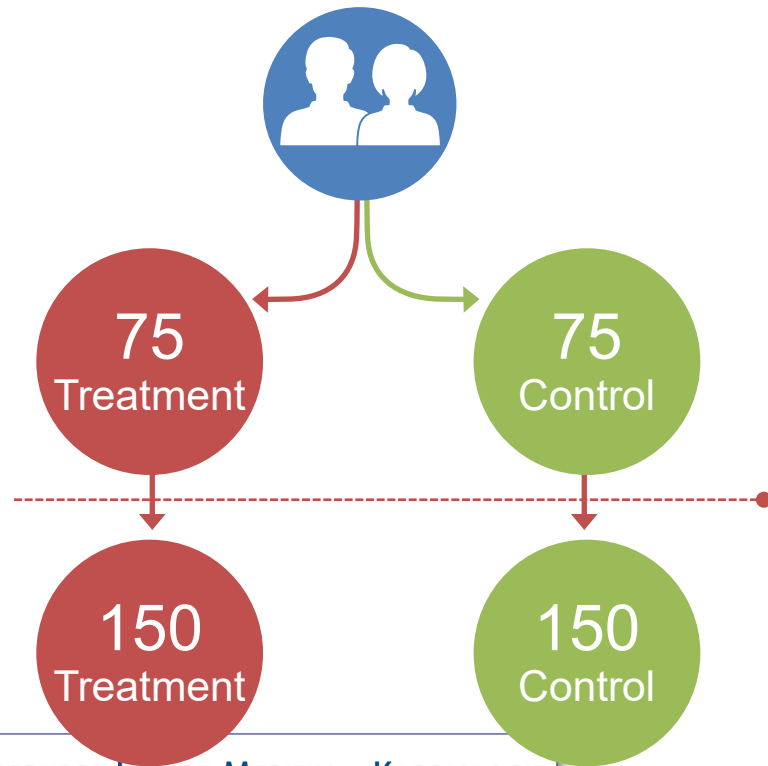
Objective:

Position the Carillon therapy as the first interventional treatment for heart failure patients with functional mitral regurgitation

The Empower Trial Design

Study Size
(300 Total Patients; 75 Sites)

Stratify by MR grade and other baseline characteristics
(minimization algorithm)



Interim analysis at 150 patients with 12 Month Data (sample size adjustment)

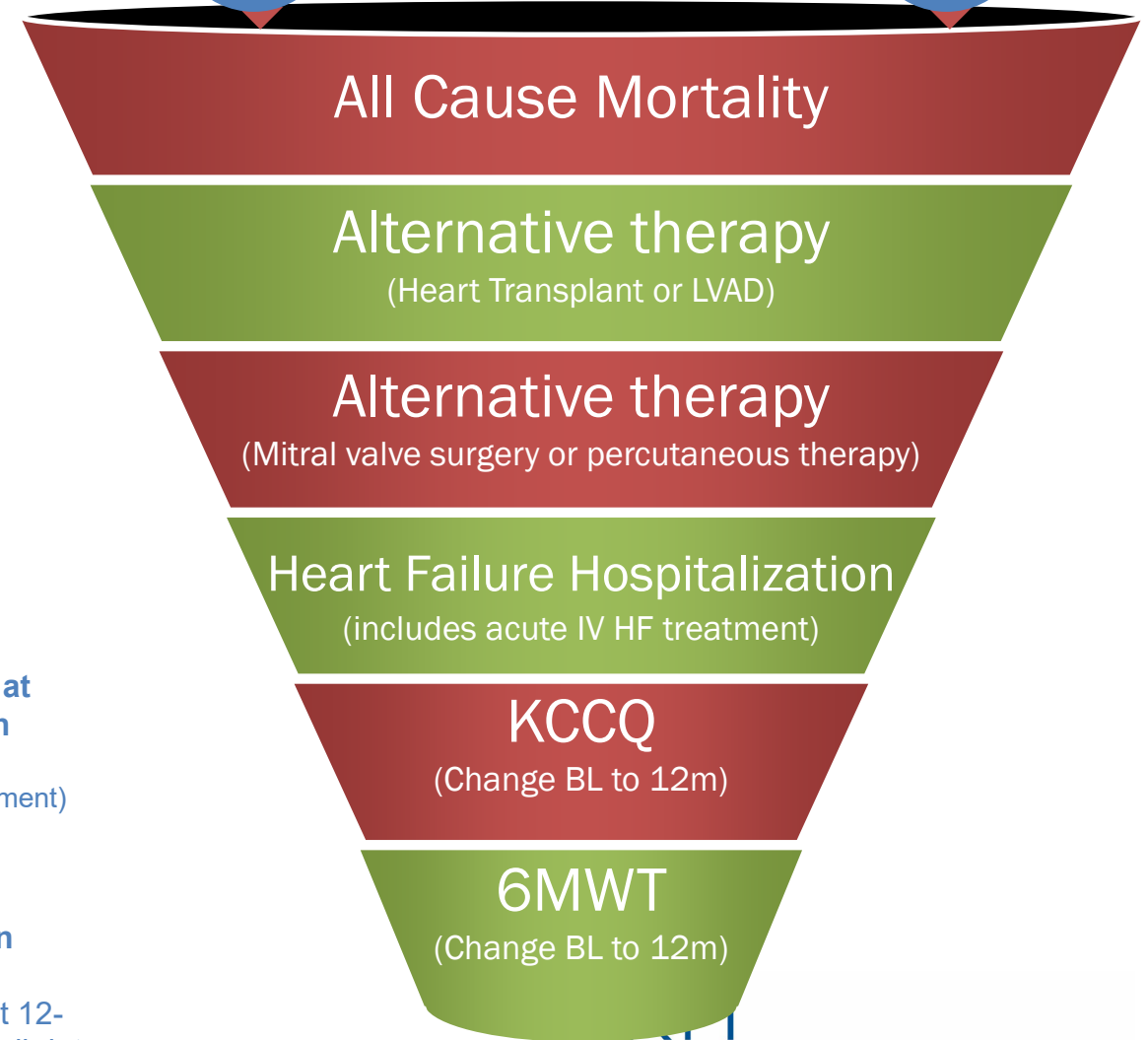
PMA Submission at 300 patients with last patient at 12-month follow-up (all data through 24-months)

Treatment

Control



Primary Endpoint (Win Ratio)

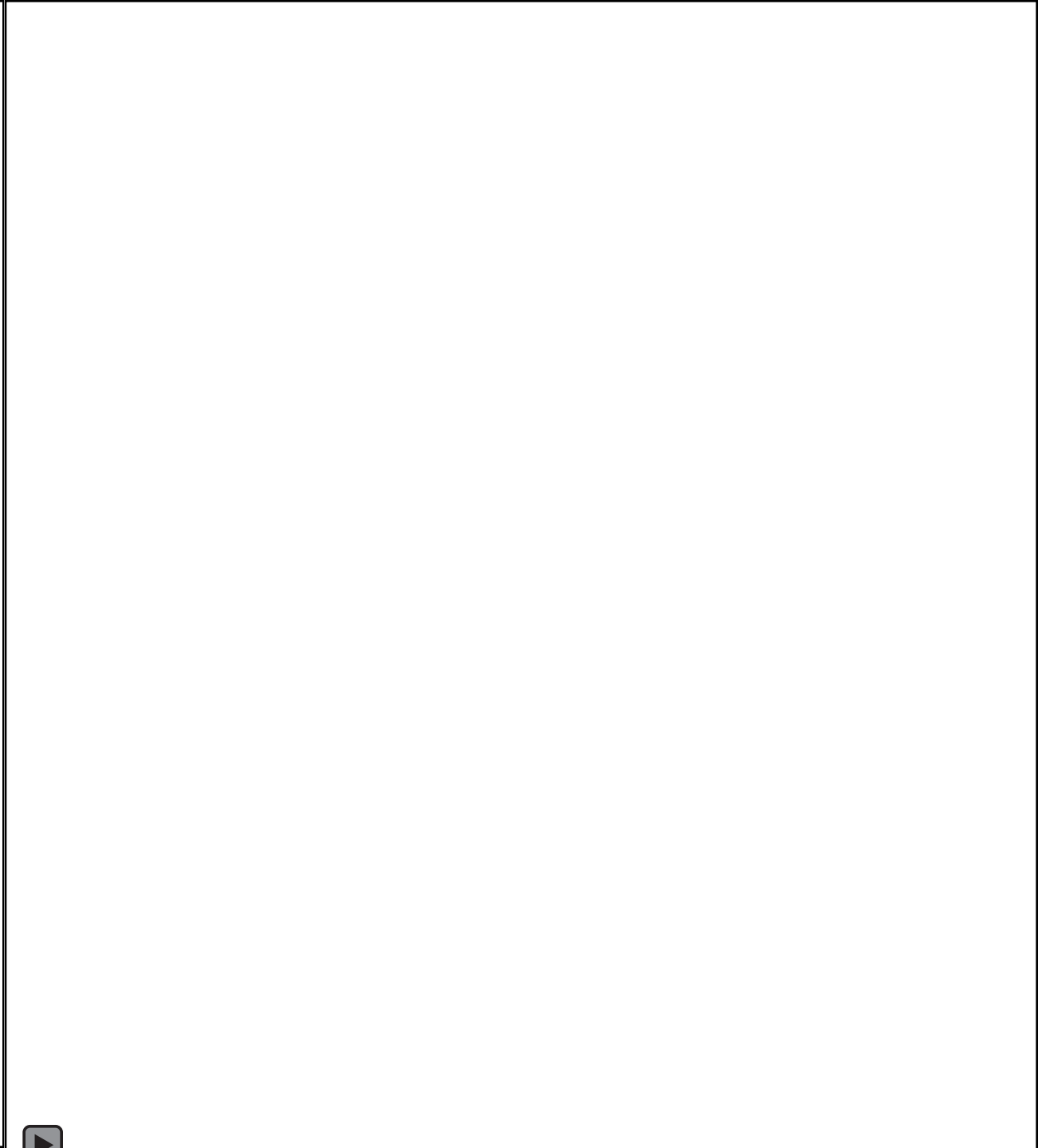
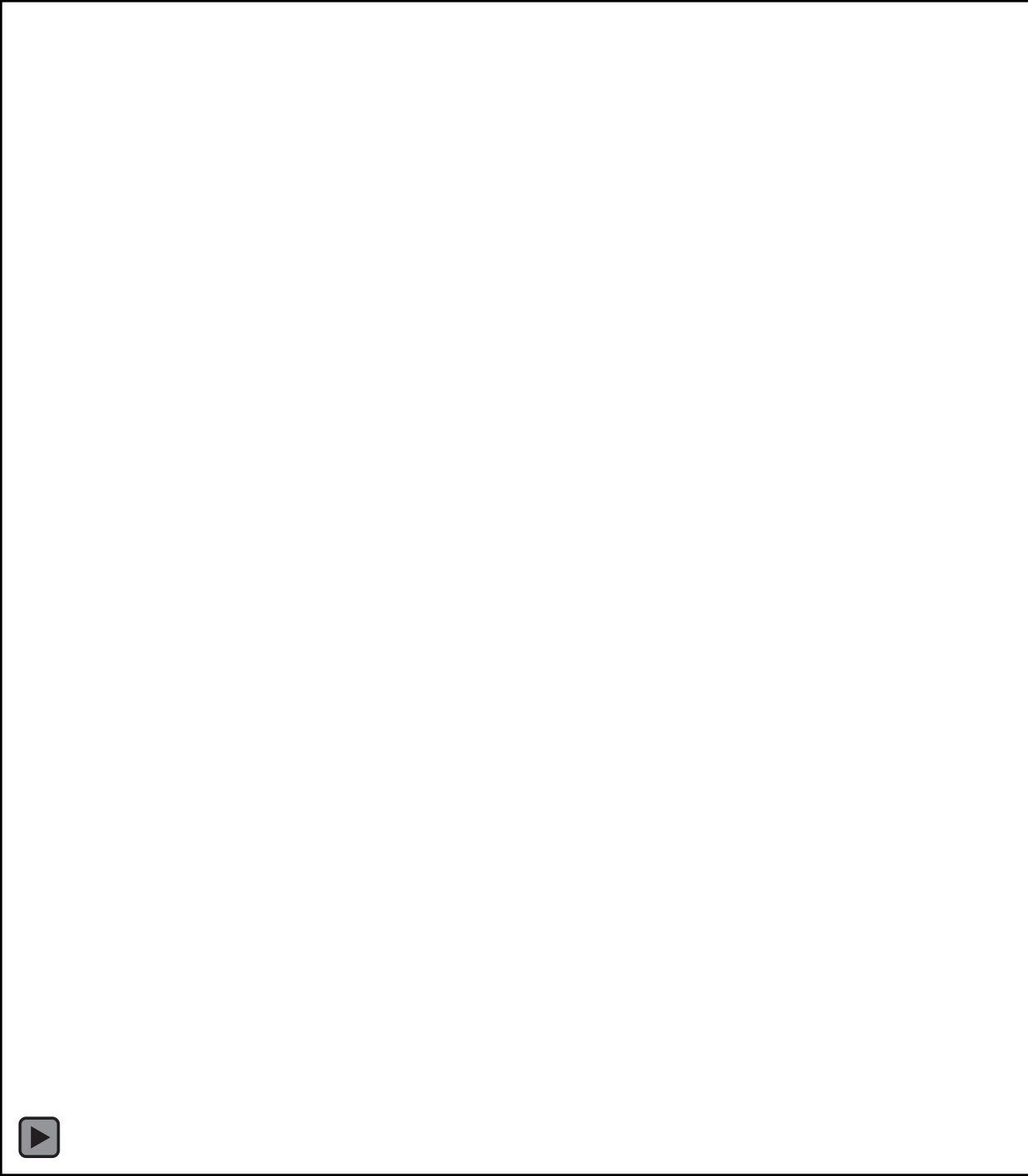


- Vorstellung der Methode
- Datenlage
- **Persönliche Erfahrungen**











take home messages

- **Differenziertes, personalisiertes Vorgehen zur AV Klappen Therapie:**
 - **Operativ ↔ Interventionell**
 - **Maßgeschneiderte interventionelle Rekonstruktion: Verschiedene Clips, indirekte Annuloplastie, Kombination der Verfahren**
 - **Falls Rekonstruktion nicht möglich: interventioneller Ersatz**
- **Studien zur früheren (rechtzeitigen?) Therapie werden mit Spannung erwartet**
- **!!! Immer Herz Team Entscheidung !!!**

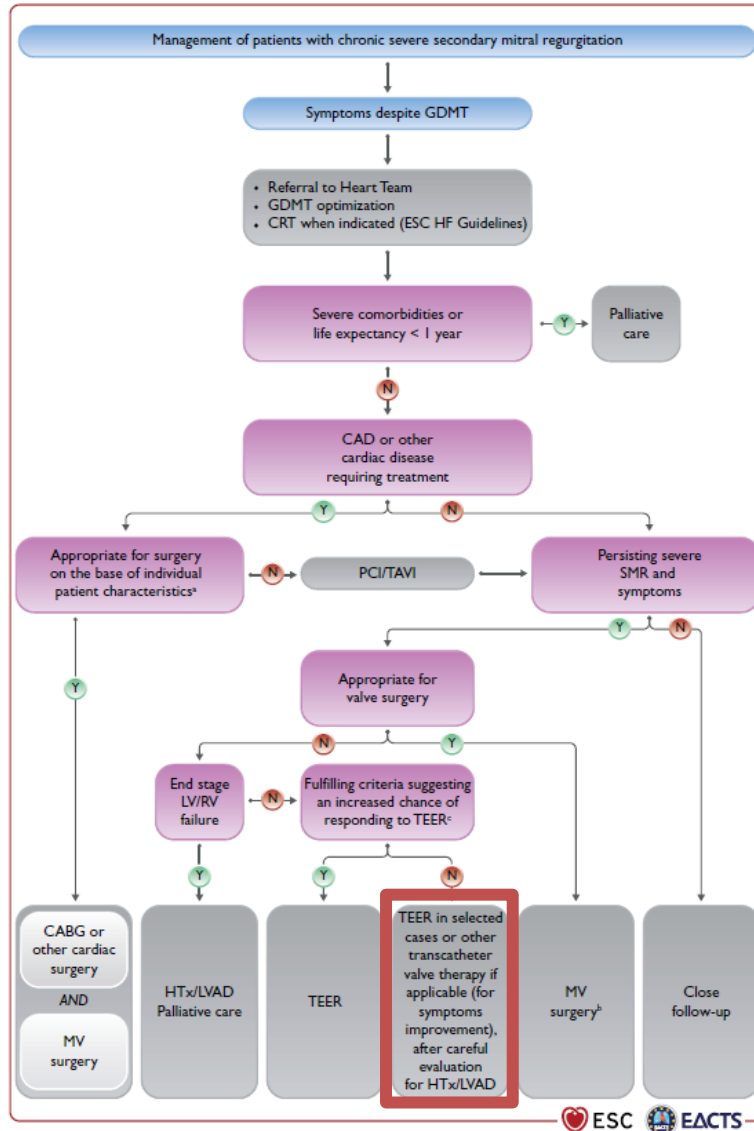


Herzlichen Dank!
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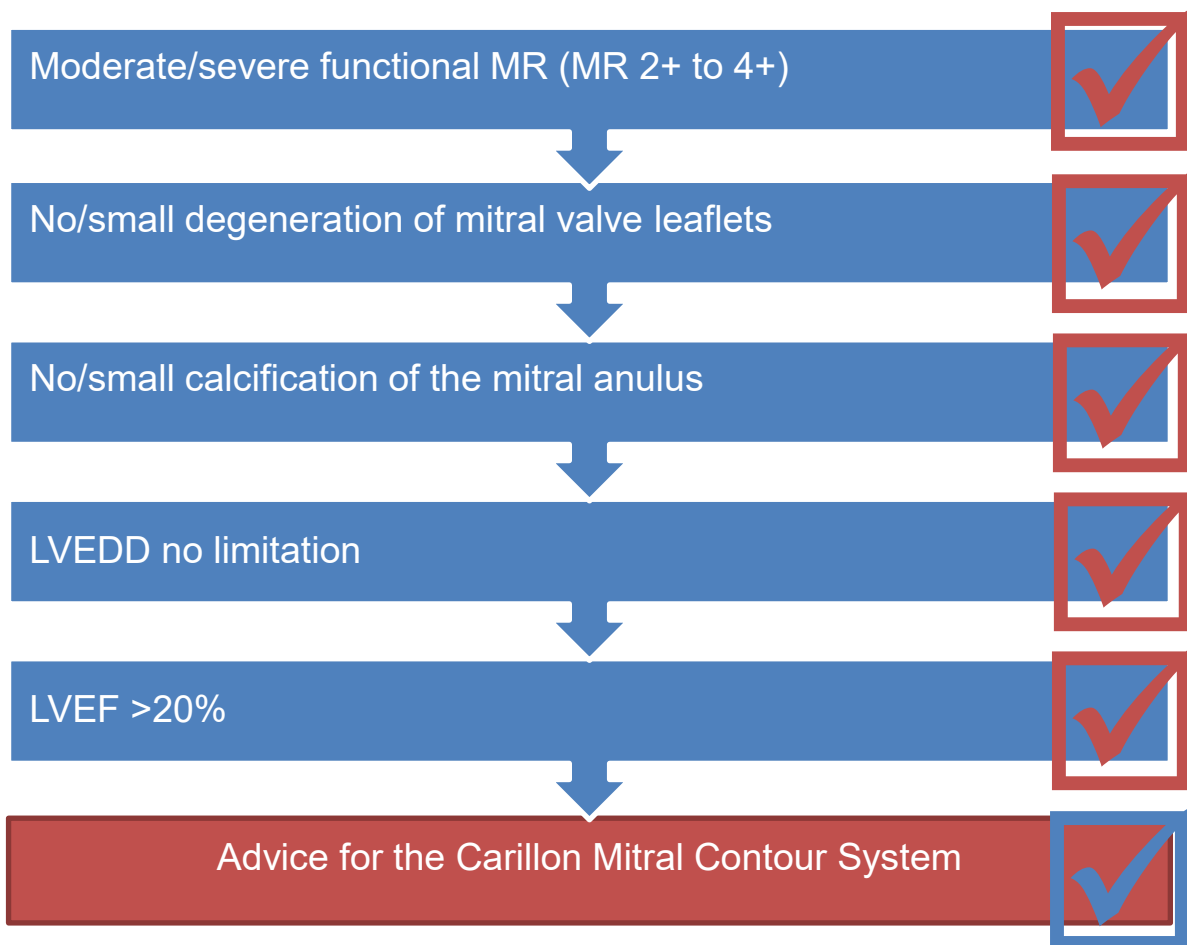


Carillon in the ESC 2021 Guidelines



„Other percutaneous mitral valve repair systems, such as indirect annuloplasty, are available for treatment of SMR. This approach has a shorter learning curve and lesser technical requirements than percutaneous edge-to-to edge mitral valve repair and does not preclude different procedures once it is performed. A sham-controlled randomized trial testing a transcatheter indirect mitral annuloplasty device met its primary endpoint of mitral regurgitant volume reduction with reverse LV and LA remodeling at 12 months. Further studies confirmed favorable results on LA volumes and LV remodeling with trends towards improvement in mean 6MWT distance and symptoms and a reduction in HF hospitalizations in an IPD meta-analysis.“ (ESC HF guidelines)

Patient Selection Overview



Carillon Mitral Contour System®

Patient Selection Considerations

New York Heart Association¹⁻²



Mitral Regurgitation Grade¹⁻²



Ventricular Dilatation (LVEDD [mm]³)



Atrial Dilatation (LAVI [ml/m²])



Ejection Fraction (LVEF [%])

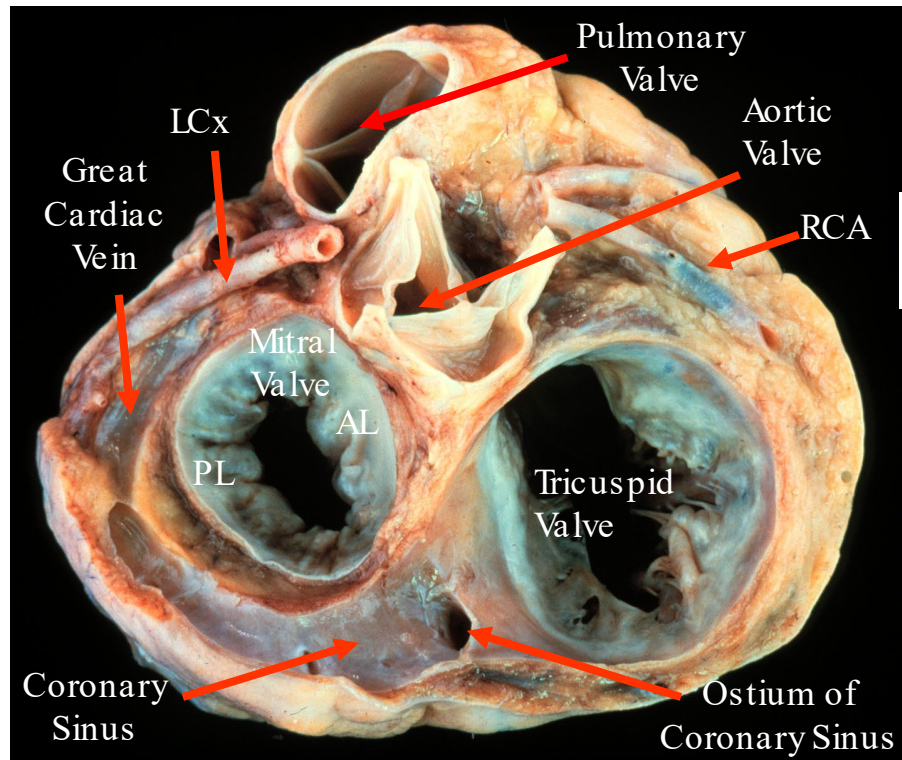


Mitral Annulus Calcification¹⁻²

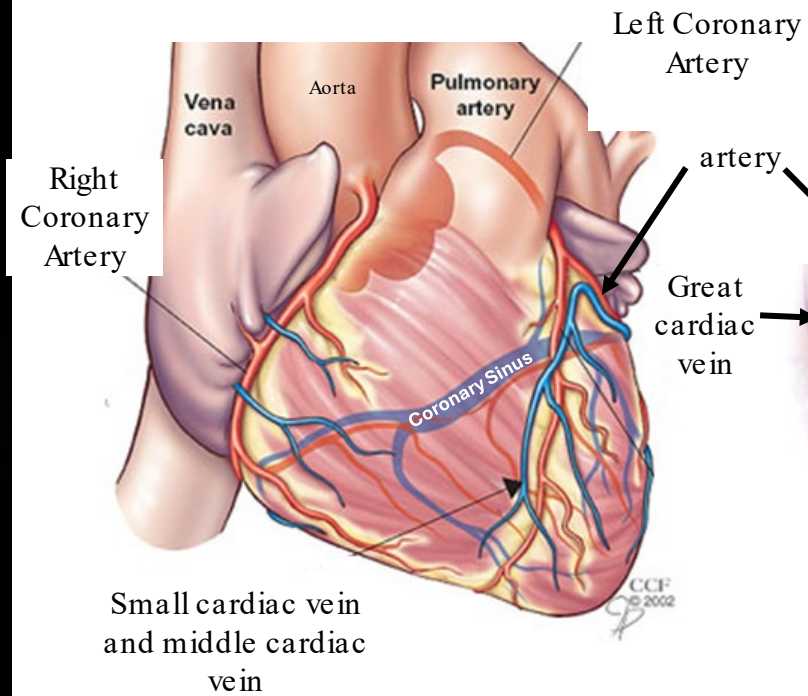


Anatomical Background

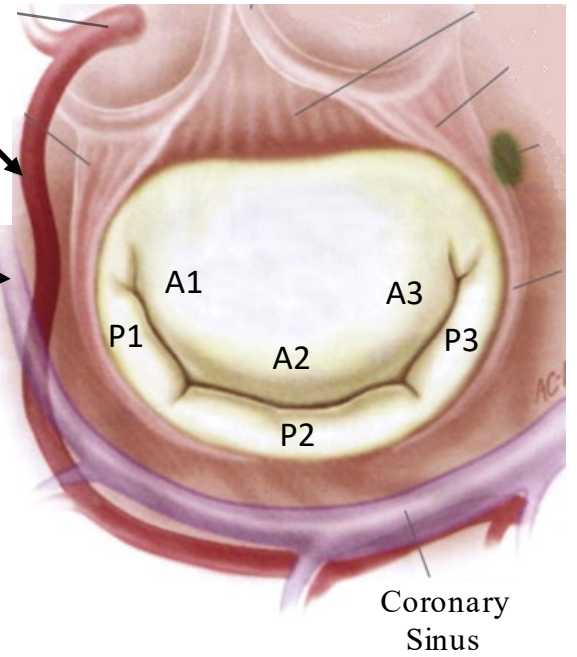
Surgical View



Anterior View

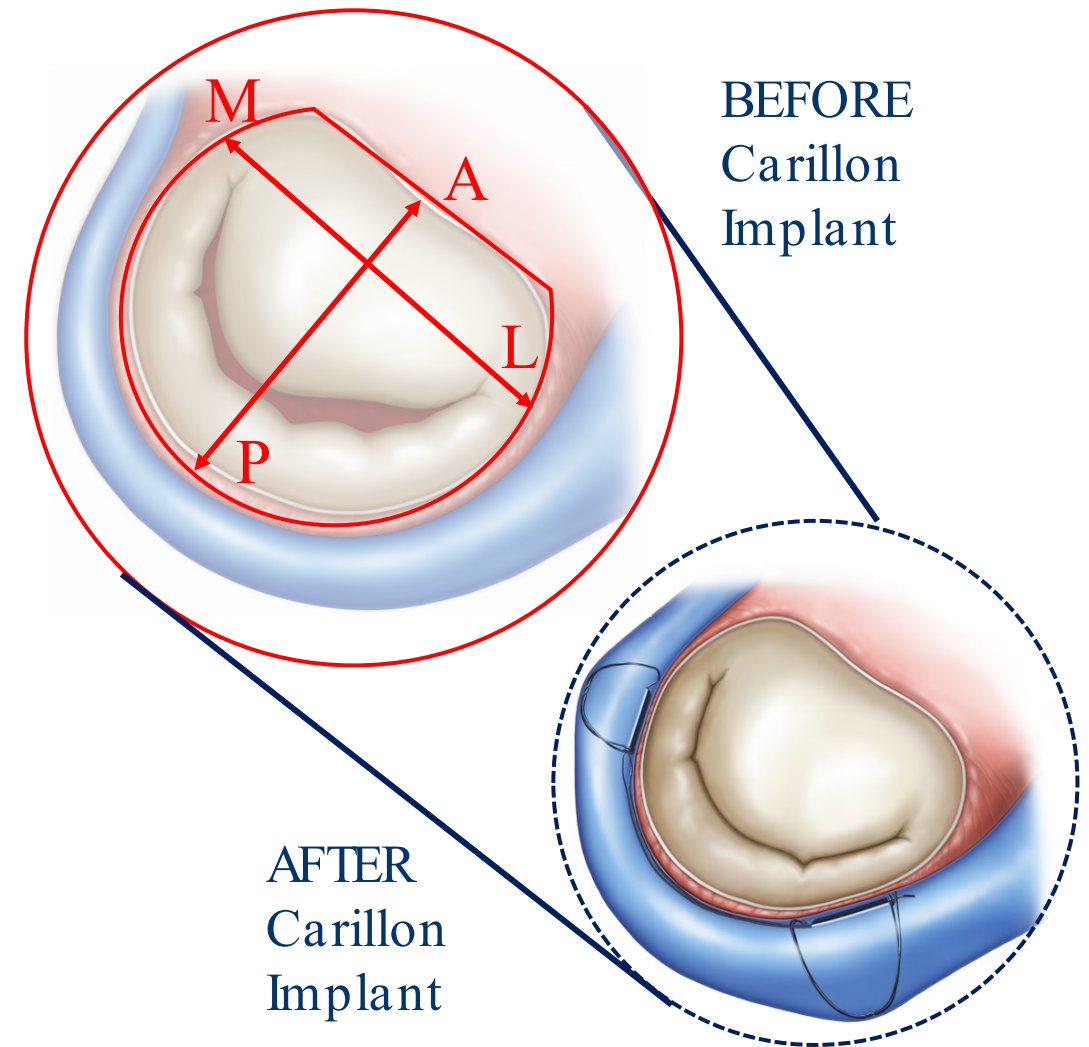


Atrial View



Mechanism of Action (II/II)

- Reductions can be seen in responders¹:
 - MV perimeter,
 - A-P diameter,
 - intercommissural diameter (M-L diameter)
 - MV area
- Less regurgitant volume
- Leading to reverse remodeling over time



1. Rottländer et al.: Percutaneous Coronary Sinus-Based Mitral Valve Repair Differentially Modulates Coronary Sinus to Mitral Valve Annulus Geometry and Topography