NEWS FROM VALVES GUIDELINES ESC 2012: What's new and Why?

Secondary Mitral Regurgitation

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Case (1)

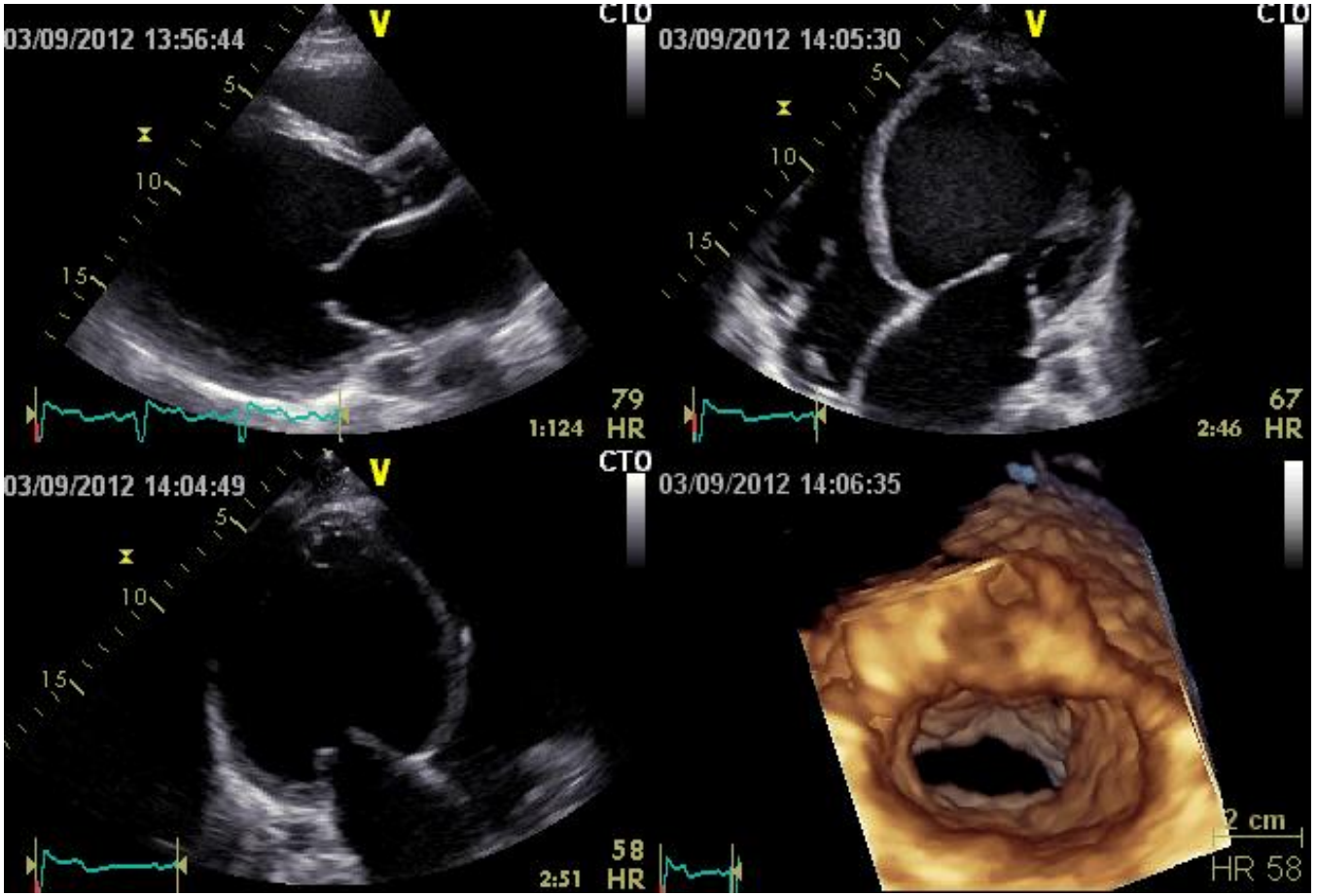
78 years old addressed for mitral surgery

- **History of dilated cardiomyopathy, no CAD**
- **Increasing SOB, the patient is in NYHA class III**
- **Treatment ACE inhibitors, BB, Aspirin, Loop diuretics, spironolactone**

- **The cardiologist of the patient performed an echocardiography showing a secondary MR and measured an EROA 25 mm2 and RV 30 ml**

- **He send the patient for an operation. Euroscore is 28**

Case (2)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Case (3)

- **The surgeon is absent and due to the borderline euroscore, the patient is addressed to the interventional cardiologist for a mitral clip**
- **The patient denied any intervention because of a pulmonary surinfection of his COPD**
- **A Chest X-ray revealed pulmonary neoplasia**
- **He died one month later due to fulminant generalisation and multiple metastasis**

Guidelines 2007 Definition

European Heart Journal (2007) 28, 230–268
doi:10.1093/eurheartj/ehl428

ESC Guidelines

Guidelines on the management of valvular heart disease

The Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology

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Ischaemic mitral regurgitation

Ischaemic MR is a frequent entity, which is, however, frequently overlooked in the setting of acute or chronic coronary disease.[110,111] Chronic ischaemic MR is the consequence of a restriction in leaflet motion, which is due to tethering by the subvalvular apparatus in patients who have LV enlargement and/or dysfunction, in particular of the posterolateral wall.

Evaluation

Acute MR due to papillary muscle rupture should be envisaged in a patient presenting with shock during acute myocardial infarction. The murmur may even be inaudible, which stresses the importance of performing echocardiography urgently in this setting. In chronic ischaemic MR, the murmur is of low intensity, which should not lead to the conclusion that MR is trivial.

It should be remembered that ischaemic MR is a dynamic condition and its severity may vary from time to time in relation to arrhythmias, ischaemia, hypertension, or exercise. Acute pulmonary oedema may result from a large exercise-induced increase in ischaemic MR.[112]

Echocardiographic examination is useful for establishing the diagnosis and differentiating true ischaemic MR, where valves are normal, from organic MR in patients with coronary disease.

After myocardial infarction, ischaemic MR should be routinely looked for and Doppler assessment of MR should be done. Colour flow mapping of the regurgitant jet overestimates the severity of ischaemic MR. The use of quantitative methods adds important information. In ischaemic MR, lower thresholds of severity, using quantitative methods, have been proposed (20 mm^2 for ERO and 30 mL for regurgitant volume).[24,110]

Ischaemic MR is a dynamic disease, which makes it logical to think that stress testing is likely to play an important role in the evaluation. Preliminary studies have shown that quantitation of MR during exercise is feasible, provides a good appreciation of dynamic characteristics, and has prognostic importance.[24,110–114] The prognostic value of exercise tests to predict the results of surgery has, however, to be evaluated.

TEE in the operating room should not be used to decide upon treatment of MR because in some patients, the afterload reduction during surgery decreases the degree of MR.

Limited studies using low-dose dobutamine or positron emission tomography have explored preoperative myocardial viability as a predictor of outcome.[115]

The assessment of coronary status is of particular importance since it completes the diagnosis and allows evaluation of the revascularization options.

Natural history

Acute MR, secondary to papillary muscle rupture, has a dismal short-term prognosis and requires urgent treatment.

Patients with chronic ischaemic MR have a poor prognosis.[110] Although coronary artery disease and LV dysfunction have prognostic importance, the presence and severity of MR are independently associated with increased mortality.

Results of surgery

The data are far more limited and heterogeneous in ischaemic MR than in organic MR. Overall, surgery of ischaemic MR remains a challenge. Operative mortality is higher than in organic MR, and long-term prognosis is less satisfactory with a higher recurrence rate of MR after valve repair.[116] These less favourable results are partly due to the more severe comorbidities in ischaemic MR patients.[116–119] If intervention is indicated, the preferred surgical procedure remains controversial. There is a trend favouring valve repair even if it carries a higher risk of mortality and of recurrence of MR than in the other aetiologies. Most patients with ischaemic MR seem to benefit from valve repair, using undersized rigid ring annuloplasty,[120,121] except in the most complex high-risk settings where residual after repair or replacement is similar.[122] Finally, the presence of significant myocardial viability is a predictor of good outcome after repair combined with bypass surgery.

Most studies show that severe ischaemic MR is not usually improved by revascularization alone.[123,124] There are studies that suggest that there is improved survival with valve surgery in patients with moderate ischaemic MR; however, this is still debated since these studies are not controlled and are of limited size.[125]

Indications for surgery

Rupture of a papillary muscle necessitates urgent surgical treatment after stabilization of the haemodynamic status, using an intra-aortic balloon pump and vasodilators. In addition to CABG, surgery consists of valve replacement in most cases.[126]

The limited data in the field of ischaemic MR result in less evidence-based management (*Table 9*).

Severe MR should be corrected at the time of bypass surgery. However, there is a continuing debate on the management of moderate ischaemic MR. In such cases, valve repair is preferable and the decision must be made preoperatively, since intraoperative echocardiographic assessment underestimates the severity of ischaemic MR. In patients with low EF, surgery is more likely to be considered if myocardial viability is present and if comorbidity is low.

There are no data to support surgically correcting mild MR due to ischaemia when the patient is asymptomatic from the point of view of MR and particularly when coronary revascularization can be carried out by percutaneous coronary intervention. However, these patients should be carefully followed up to detect any later change in the degree and the consequences of ischaemic MR.

Table 9 Indications for surgery in chronic ischaemic mitral regurgitation

	Class
Patients with severe MR, LVEF > 30% undergoing CABG	IC
Patients with moderate MR undergoing CABG if repair is feasible	IIaC
Symptomatic patients with severe MR, LVEF < 30% and option for revascularization	IIaC
Patients with severe MR, LVEF > 30%, no option for revascularization, refractory to medical therapy, and low comorbidity	IIbC

CABG = coronary artery bypass grafting, MR = mitral regurgitation, LV = left ventricular, EF = ejection fraction.

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ESC Guidelines

Functional mitral regurgitation

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Functional mitral regurgitation

In this group, mitral valves are also structurally normal and MR is secondary to the changes in LV geometry resulting from impaired LV function. It includes MR observed in cardiomyopathy and in ischaemic disease with severe LV dysfunction. Evaluation is the same as in ischaemic MR.

The data on the natural history and results of surgery are even more limited than in ischaemic MR. A precise analysis is difficult because of the limited number of series including small numbers of patients and mixing patients with or without revascularization.

Several observational studies have shown the high prevalence of significant MR in chronic heart failure, as well as its independent association with a poor prognosis.[127] However, its true prevalence and its pathogenic contribution to prognosis remain uncertain.

The main surgical technique is restrictive annuloplasty.[120,121,128,129] Other techniques can be combined aiming at LV remodelling and are currently being evaluated.

Surgical treatment of MR in these patients was previously avoided owing to concerns about the high operative risk and the potential deleterious effect of increasing afterload. Opinions have changed as a result of case series from highly experienced centres reporting good results.[120,121,128,129] Depending on the degree of urgency, operative mortality has been reported between 5 and 18%. In patients with EF < 30%, a 2 year survival rate of 70% and a 5 year survival rate of 61% have been reported with good functional results.[130,131] These data suggest that valve surgery using stringent restrictive annuloplasty combined with surgery of the LV may improve symptoms at an acceptable risk. However, it is not clear if surgery improves prognosis since more recent studies have shown that valve surgery does not improve survival.[130,131] This may be due to the fact that it may not influence LV remodelling, in particular, in patients with severe LV dilatation. In addition, little information is available on the durability of valve repair in this setting.

The limited data available suggest that isolated mitral valve surgery in combination with LV reconstruction techniques may be considered in selected patients with severe functional MR and severely depressed LV function, including those with coronary disease, where bypass surgery is not indicated, who remain symptomatic despite optimal medical therapy, and if comorbidity is low, the aim being to avoid or postpone transplantation.[132,133] Ongoing trials are expected to better define appropriate strategies. In the other patients, medical therapy followed by transplantation when this fails is probably the best option. However, surgery on the regurgitant mitral valve should not be considered in 'in extremis patients' with low output, severe right ventricular failure, and high comorbidity.

Medical therapy is the preferred treatment which should be used before considering surgical correction of the functionally regurgitant valve. ACE-inhibitors and beta-blockers, which may reduce MR by progressive inverse LV remodelling, are indicated. Nitrates and diuretics are useful for treating acute dyspnoea, secondary to any dynamic component.

LV dilatation, distortion, and dyssynchrony are linked to functional MR in patients with heart failure and LV dysfunction. Thus, in patients with increased QRS duration and intra-ventricular asynchrony, cardiac resynchronization therapy may reduce MR severity and improve LV function.[134] Defibrillators should be used according to the appropriate recommendations.

Mitral stenosis

Introduction

Although the prevalence of rheumatic fever has greatly decreased in industrialized countries, MS still results in significant morbidity and mortality worldwide.[2,3] Since its development 20 years ago, percutaneous mitral commissurotomy (PMC) has impacted significantly upon the management of MS.[135]

Evaluation

It may be difficult to evaluate precisely the functional disability in these patients who often present with a gradual decrease in activity and may feel asymptomatic for years. Physical examination, chest X-ray, and ECG establish the diagnosis in most cases and allow for initial evaluation of consequences such as atrial fibrillation and pulmonary hypertension.[15]

The general principles for the use of invasive and non-invasive investigations follow the recommendations made in the General comments section.

Specific issues in MS are as follows:

Echocardiography is the main method to assess the severity and consequences of MS, as well as the extent of anatomic lesions. Severity of MS should be quantified using two-dimensional planimetry and the pressure half-time method, which are complementary approaches for measuring valve area. Planimetry, when it is feasible, is the method of choice, in particular, immediately after PMC. Measurements of mean transvalvular gradient calculated using Doppler velocities are highly rate- and flow-dependent; however, they are useful to check consistency of the assessment of severity, in particular, in patients in sinus rhythm.[136] MS usually does not have clinical consequences at rest when valve area is >1.5 cm^2, except in patients with particularly large body size.

The assessment of valve morphology is important for the selection of candidates for PMC. Scoring systems have been developed to assess suitability, taking into account valve thickening, mobility, calcification, subvalvular deformity, and commissural areas[135,137,138] (*Tables 10,11*).

Echocardiography also evaluates pulmonary artery pressures, the presence of associated MR, concomitant valve disease, and the size of the left atrium.

The transthoracic approach usually provides sufficient information for routine management. However, transoesophageal examination should also be performed to exclude left atrial thrombosis before PMC or after an embolic episode or if transthoracic echocardiography provides suboptimal information on anatomy or associated MR.

In patients with no or doubtful symptoms, stress testing aids decision-making by unmasking symptoms. Exercise echocardiography provides other information by assessing the evolution of mitral gradient and pulmonary pressures.[139] Its additional value for decision-making has to be further defined.

Guidelines 2012 Definition

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doi:10.1093/eurheartj/ehs109

ESC/EACTS GUIDELINES

Guidelines on the management of valvular heart disease (version 2012)

The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Authors/Task Force Members: Alec Vahanian (Chairperson) (France)*, Ottavio Alfieri (Chairperson)* (Italy), Felicita Andreotti (Italy), Manuel J. Antunes (Portugal), Gonzalo Barón-Esquivias (Spain), Helmut Baumgartner (Germany), Michael Andrew Borger (Germany), Thierry P. Carrel (Switzerland), Michele De Bonis (Italy), Arturo Evangelista (Spain), Volkmar Falk (Switzerland), Bernard Iung (France), Patrizio Lancellotti (Belgium), Luc Pierard (Belgium), Susanna Price (UK), Hans-Joachim Schäfers (Germany), Gerhard Schuler (Germany), Janina Stepinska (Poland), Karl Swedberg (Sweden), Johanna Takkenberg (The Netherlands), Ulrich Otto Von Oppell (UK), Stephan Windecker (Switzerland), Jose Luis Zamorano (Spain), Marian Zembala (Poland)

6.2 Secondary mitral regurgitation

In secondary MR or, as it is also termed, 'functional MR', leaflets and chordae are structurally normal and MR results geometrical distortion of the subvalvular apparatus, second LV enlargement and remodelling due to idiopathic cardiomyo

remains uncertain. However, increasing severity is associated with worse outcome.[142]

In patients with secondary MR due to non-ischaemic aetiology, the data regarding the natural history are more limited than in ischaemic MR.[145] A precise analysis is difficult because of the limited number of series made up of small patient numbers with many confounding factors. Some studies have shown an independent association between significant MR and a poor prognosis.

6.2.3 Results of surgery

Surgery for secondary MR remains a challenge. Operative mortality is higher than in primary MR and the long-term prognosis is worse due—at least in part—to the more severe comorbidities (*Table 7*). In ischaemic MR patients, indications and the preferred surgical procedure remain controversial, mainly because of the persistence and high recurrence rate of MR after valve repair and the absence of evidence that surgery prolongs life.[146] Most studies show that severe ischaemic MR is not usually improved by revascularization alone, and that persistence of residual MR carries an increased mortality risk. The impact of valve surgery on survival remains unclear, since there are no randomized trials and the few observational studies addressing this issue have too many limitations to draw definite conclusions.[147] Regarding prognosis, most studies failed to demonstrate improved long-term clinical outcome following surgical correction of secondary MR.[148,149] The sole randomized trial, comparing CABG vs. CABG + valve repair in patients with moderate MR, was not designed to analyse the effect on survival of the addition of repair to CABG. It showed that the performance of valve repair improved functional class, EF, and LV diameter in the short-term.[150]

When surgery is indicated, there is a trend favouring valve repair using only an undersized, rigid ring annuloplasty, which confers a low operative risk although it carries a high risk of MR recurrence.[151,152] This surgical technique is also applicable in MR secondary to cardiomyopathy.[153]

Numerous preoperative predictors of recurrent secondary MR after undersized annuloplasty have been identified and are indicative of severe tethering, and associated with a worse prognosis [LVEDD >65 mm, posterior mitral leaflet angle >45°, distal anterior mitral leaflet angle >25°, systolic tenting area >2.5 cm^2, coaptation distance (distance between the annular plane and the coaptation point) >10 mm, end-systolic interpapillary muscle distance >20 mm, and systolic sphericity index >0.7].[152] The prognostic value of these parameters should, however, be further validated. After surgery, localized alteration of geometry and function in the vicinity of papillary muscles is associated with recurrent MR.

The presence of significant myocardial viability should be taken into consideration when deciding whether to operate, as it is a predictor of good outcome after repair combined with bypass surgery.[154]

Whether a restrictive annuloplasty might create clinically relevant mitral stenosis (MS) remains unclear.

No randomized study has been performed, comparing repair against replacement. In the most complex high-risk settings, survival after repair and replacement is similar. A recent meta-analysis of retrospective studies suggests better short-term and long-term survival after repair than after replacement.[155] In patients with preoperative predictors of increased MR recurrence, as detailed above, several techniques have been proposed to address subvalvular tethering and may be considered in addition to annuloplasty.[156] A recent randomized trial reports improved survival and a significant decrease in major adverse outcomes in patients requiring revascularization treated with ventricular reshaping.[157] In secondary non-ischaemic MR, surgical modalities aimed at LV reverse remodelling, such as LV reconstruction techniques, have been disappointing and cannot be recommended.

6.2.4 Percutaneous intervention

Experience from a limited number of patients in the EVEREST trials and from observational studies suggests that percutaneous edge-to-edge mitral valve repair is feasible—at low procedural risk—in patients with secondary MR in the absence of severe tethering and may provide short-term improvement in functional condition and LV function.[134,137] These findings have to be confirmed in larger series with longer follow-up and with a randomized design. Data on coronary sinus annuloplasty are limited and most initial devices have been withdrawn.[158]

6.2.5 Indications for intervention

The heterogeneous data regarding secondary MR result in less evidence-based management than in primary MR (*Table 13*).

Severe MR should be corrected at the time of bypass surgery.

The indications for isolated mitral valve surgery in symptomatic patients with severe secondary MR and severely depressed systolic

Table 13 Indications for mitral valve surgery in chronic secondary mitral regurgitation

	Class[a]	Level[b]
Surgery is indicated in patients with severe MR[c] undergoing CABG, and LVEF >30%.	I	C
Surgery should be considered in patients with moderate MR undergoing CABG.[d]	IIa	C
Surgery should be considered in symptomatic patients with severe MR, LVEF <30%, option for revascularization, and evidence of viability.	IIa	C
Surgery may be considered in patients with severe MR, LVEF >30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have low comorbidity, when revascularization is not indicated.	IIb	C

CABG = coronary artery bypass grafting; CRT = cardiac resynchronization therapy; LVEF = left ventricular ejection fraction; MR = mitral regurgitation; SPAP = systolic pulmonary artery pressure.
[a]Class of recommendation.
[b]Level of evidence.
[c]The thresholds for severity (EROA ≥ 20 mm^2; R Vol >30 ml) differ from that of primary MR and are based on the prognostic value of these thresholds to predict poor outcome: see *Table 5*.[17]
[d]When exercise echocardiography is feasible, the development of dyspnoea and increased severity of MR associated with pulmonary hypertension are further incentives to surgery.

Heart Valve Clinics

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ESC REPORT

ESC Working Group on Valvular Heart Disease Position Paper—heart valve clinics: organization, structure, and experiences

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The “Heart Team”: Fantastic 4

The seven questions of the 4F

- 1. Is the valvular heart disease severe?
- 2. Does the patient have symptoms?
- 3. Are the symptoms related to valvular heart disease?
- 4. What are patient life expectancy and likely quality of life in the future?
- 5. Do the benefits of the intervention outweigh its likely risks (compared to the natural evolution of the disease)?
- 6. What are the patients wishes and expectations?
- 7. Are local resources adequate for the intervention?

Euroscore oudated

European Heart Journal (2009) **30**, 74–80
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CLINICAL RESEARCH
Valvular and congenital heart disease

Overestimation of aortic valve replacement risk by EuroSCORE: implications for percutaneous valve replacement

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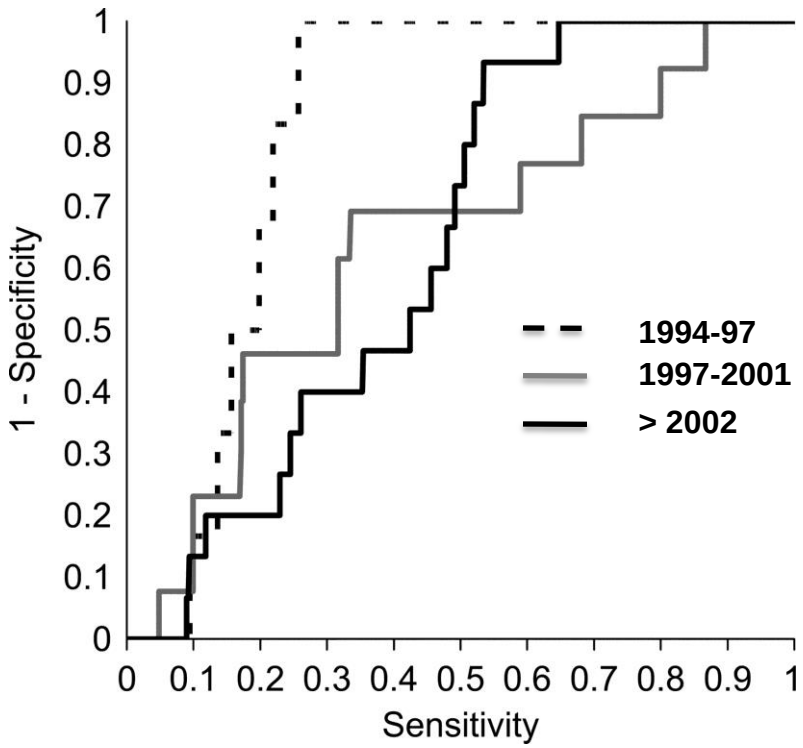


Universitair Ziekenhuis Brussel

Centrum voor Hart- en Vaatziekten

Comorbidities / Life expectancy/ Wish

- The surgeon is absent and due to the borderline euroscore, the patient is addressed to the interventional cardiologist for a mitral clip
- The patient denied any intervention because of a pulmonary surinfection of his COPD
- A Chest X-ray revealed pulmonary neoplasia
- He died one month later due to fulminant generalisation and multiple metastasis

Consensus decision-making

- **Cardiologists, imaging experts, interventional cardiac surgeons, and anesthesiologists: the “heart team”**
- **Less importance to surgical risk scores (EuroSCORE or STS [Society of Thoracic Surgeons]), which are increasingly challenged because of their tendency to overestimate risk, especially in severe cases.**
- **Problem with intermediate scores but a lot of co-morbidities**

Echocardiography : quantification

78 years old addressed for mitral surgery

- **History of dilated cardiomyopathy, no CAD**
- **Increasing SOB, the patient is in class III**
- **Treatment ACE inhibitors, BB, Aspirin, Loop diuretics, spironolacone**

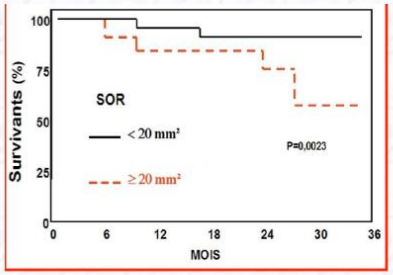
- **The cardiologist of the patient performed an echocardiography and measured an ERO 25 mm2 and RV 30 ml**

- **He send the patient for an operation. Euroscore is 28**

Echocardiography not a single measure

Echocardiographic criteria for the definition of severe MR: an integrative approach

Parameters	Severe
Qualitative	
Mitral valve morphology	Flail leaflet/ ruptured PMs
Colour flow MR jet	Very large central jet or eccentric jet adhering, swirling and reaching the posterior LA wall
Flow convergence zone	Large
CW signal of MR jet	Dense/Triangular
Semi-quantitative	
VC width (mm)	≥ 7 (>8 for biplane)
Pulmonary vein flow	Systolic flow reversal
Mitral inflow	E wave dominant (>1.5 m/s)
TVI mit/TVI Ao	≥1.4
Quantitative	
EROA (mm²)	≥ 40 for primary **(20 for secondary)**
R Vol (ml)	≥ 60 for primary **(30 for secondary)**



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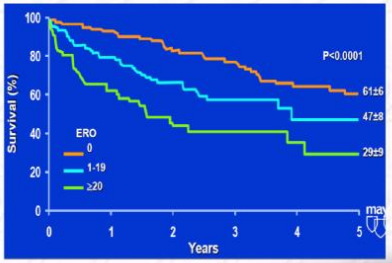

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www.escardio.org/guidelines

Lancellotti et al , EACVI J 2013

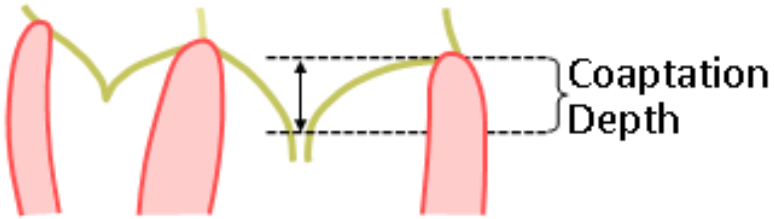
Specific questions in secondary MR

In secondary MR, a special attention should be given to LV remodelling (LV end-systolic diameter) and the severity of altered geometry of the mitral valve apparatus (tenting area and coaptation distance).

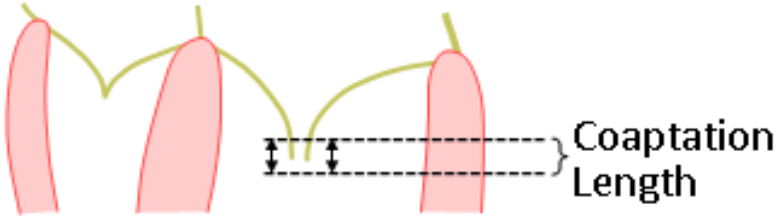
- Coaptation distance > 1 cm
- Systolic tenting area > 2.5 cm²
- LV end-systolic diameter > 51 mm
- Extensive basal LV necrosis

} Risk of persistent/ recurrent MR after mitral valve repair

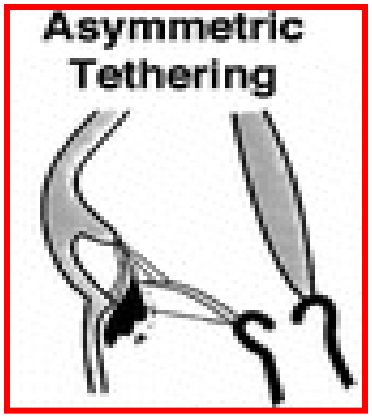
Coaptation Depth
The measurement should be taken in the 4Ch view where the coaptation depth is greatest.

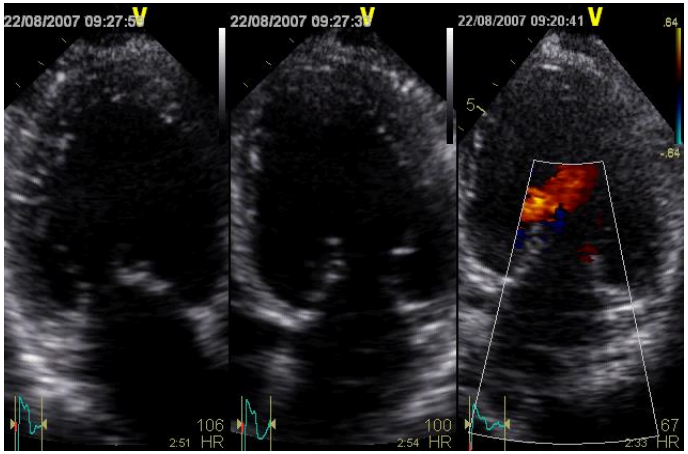


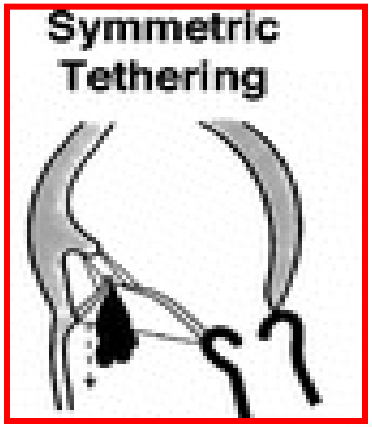
Coaptation Length
The measurement should be taken in the 4Ch view where the coaptation length is shortest.



Symmetric vs Asymmetric Tethering







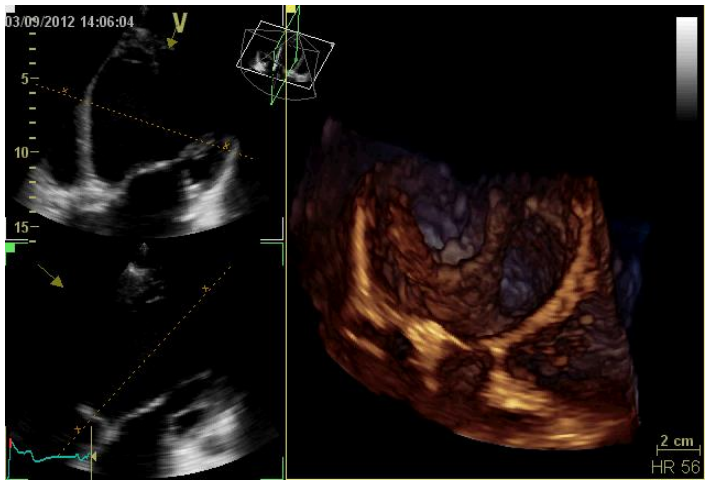
Secondary MR: New Technologies – 3D

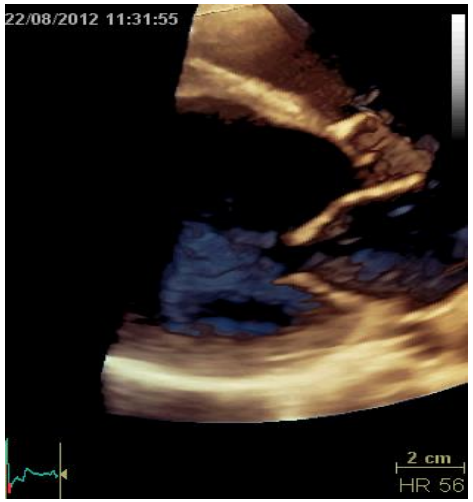
- **Accuracy**
  - **Fewer assumptions, post-processing capability**
- **Reproducibility**
  - **Fewer measurements, automation**

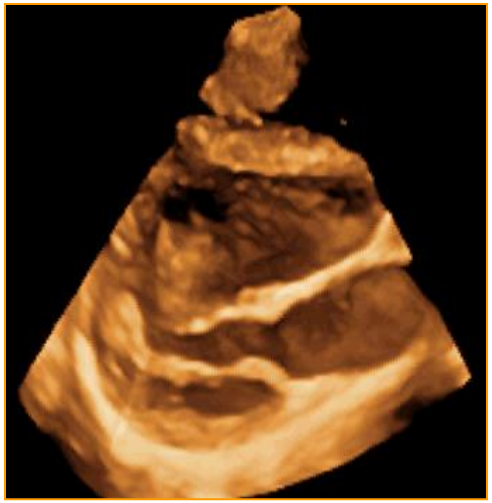
- **Quantitative 3D methods**
  - **Proximal isovelocity surface area**
  - **Vena contracta area**
  - **Anatomical regurgitant orifice area**
  - **Volumetric method/Stroke volume**

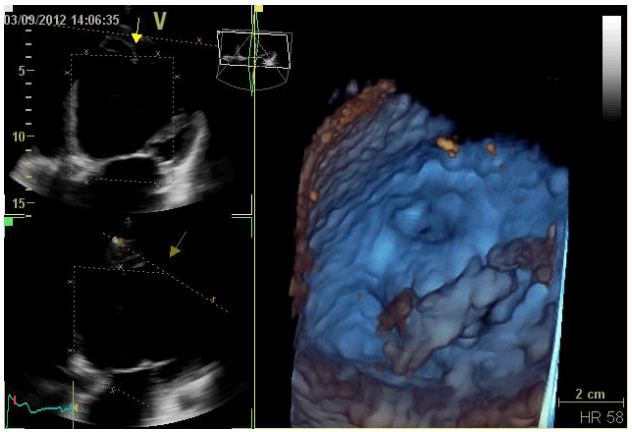
Secondary MR: New Technologies

Normal leaflets, Annular dilation, LV dilation + spherical + Altered geometry + PMs displacement + WM abnormalities

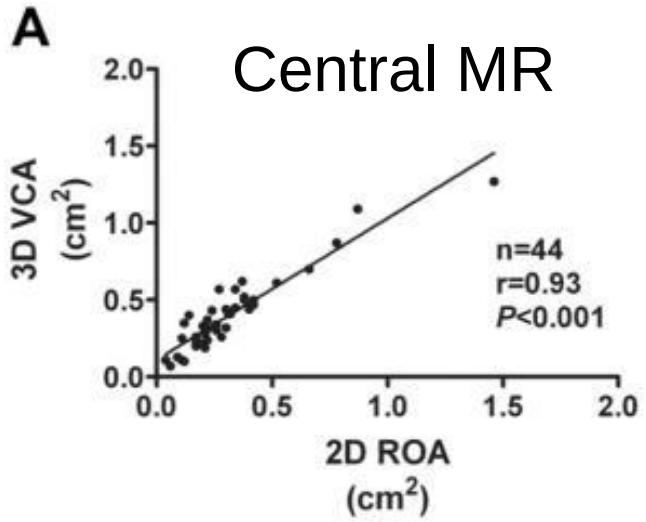


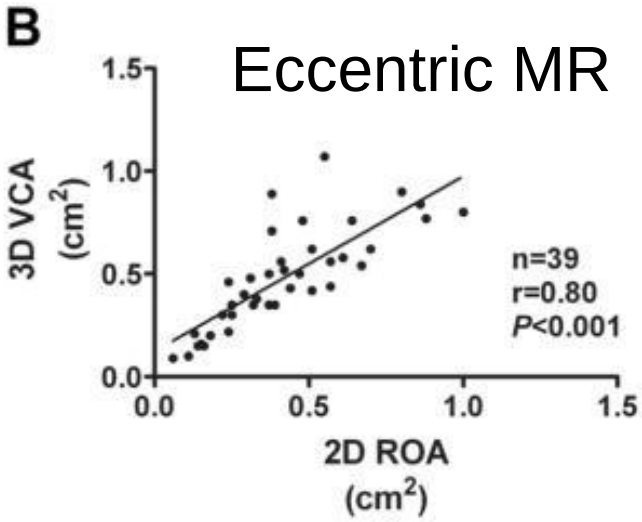


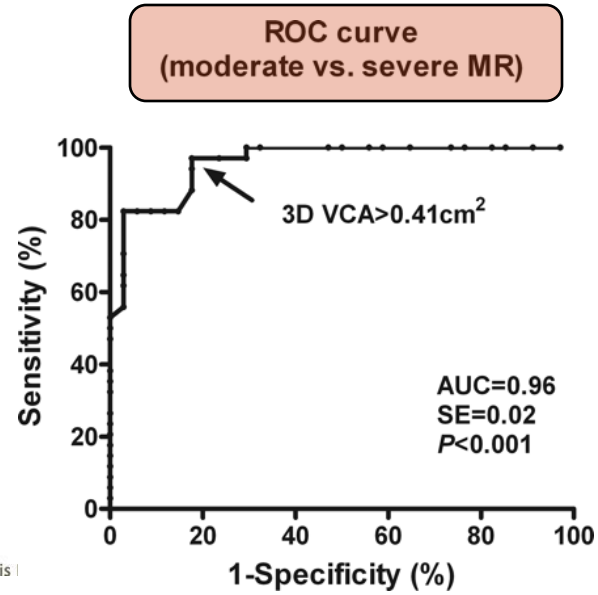




Underestimation of ROA by the 2D PISA







L/S > 1.5 (Asymmetric ERO)

Elliptical orifice geometry underestimates 2D EROA by 0.1 cm^2 relative to 3D VCA

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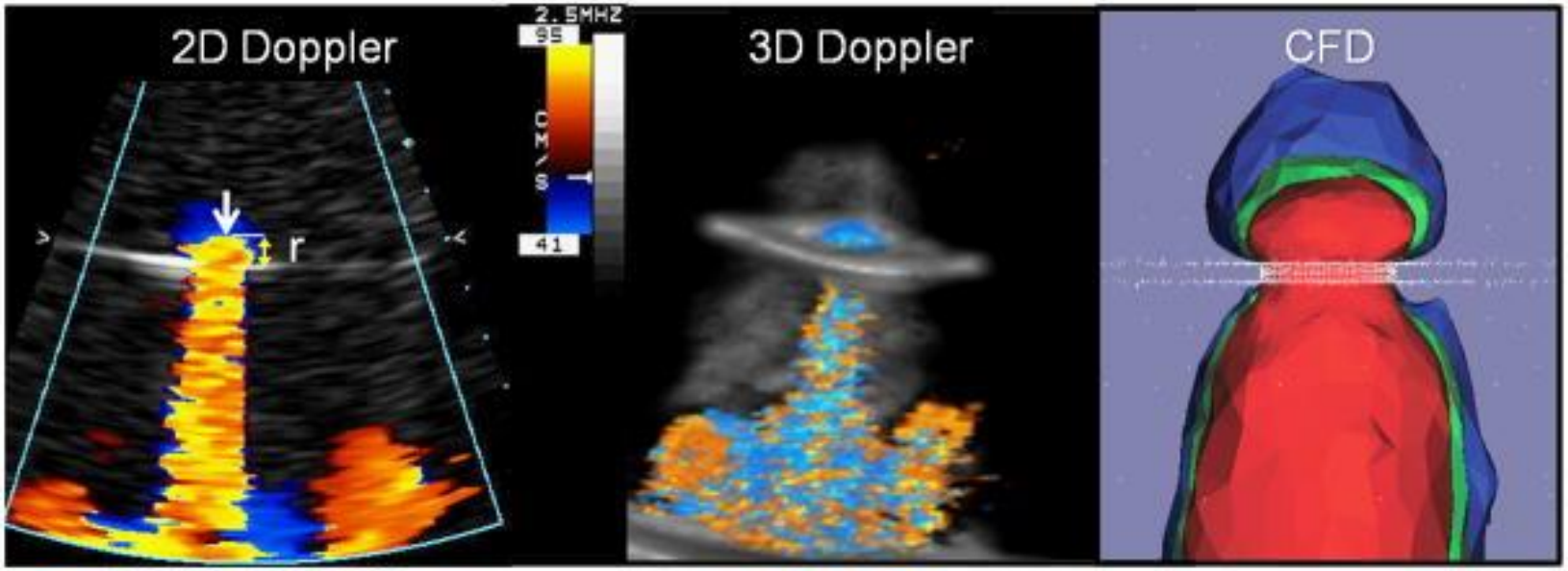
Zeng et al Circ Imag Imag 2011

Radius measure : RV= 2 π r^2 x V



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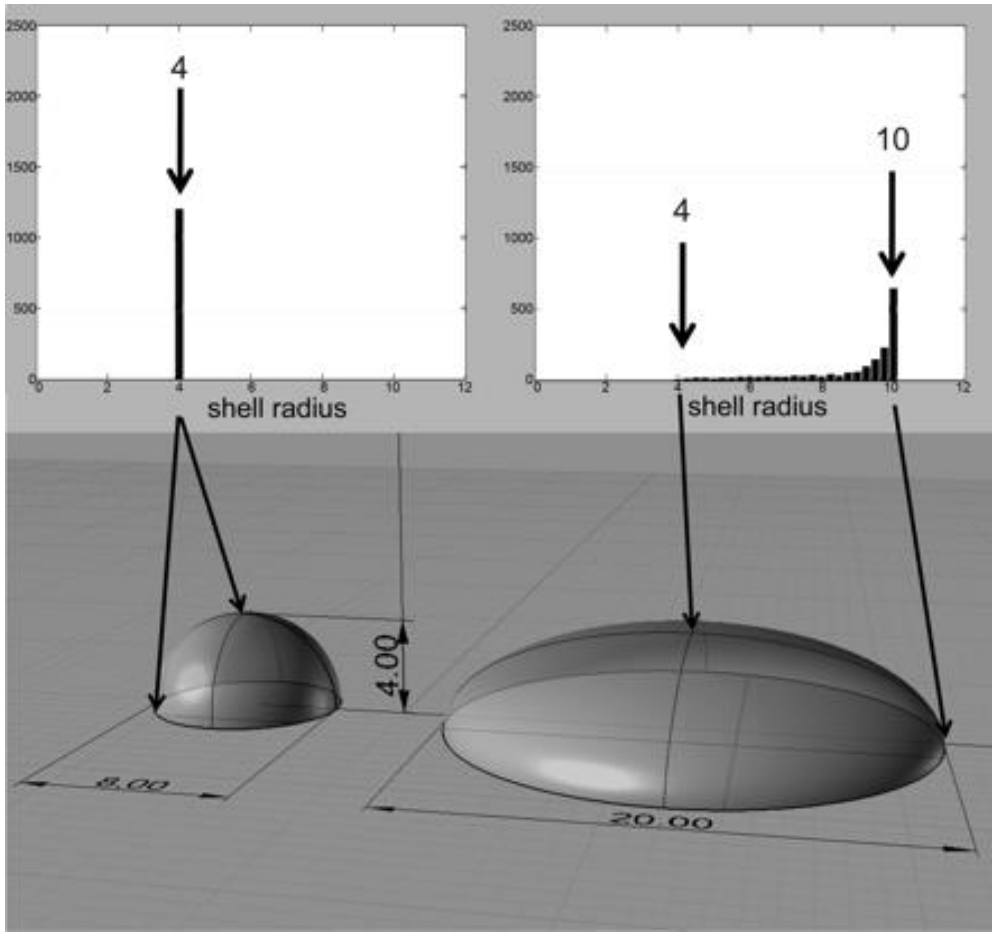
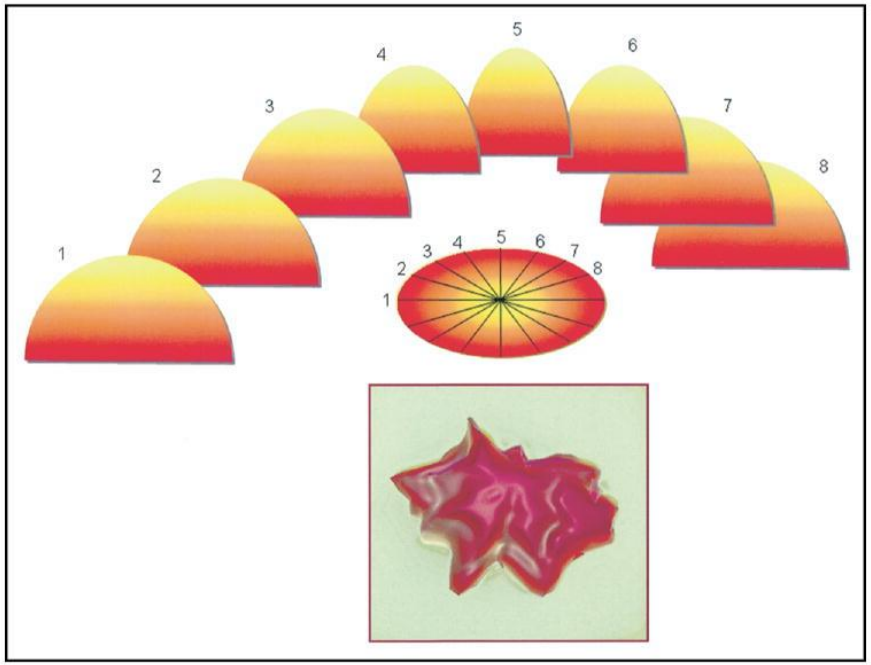
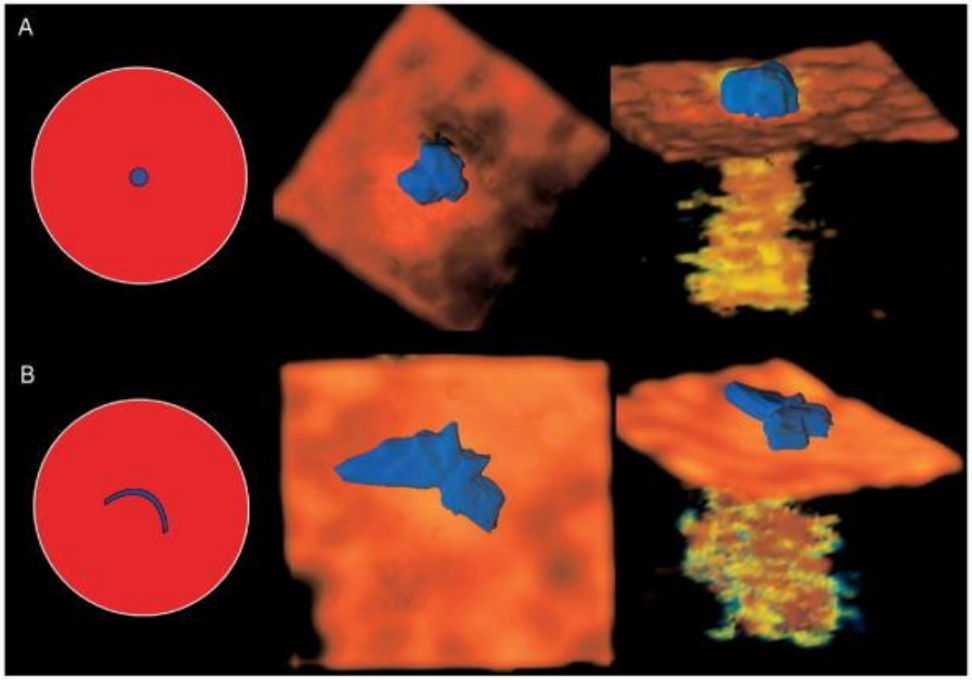
Quaini A Cardiovasc Eng Technol. 2011 Jun;2(2):77-89

Shape and Radius distribution



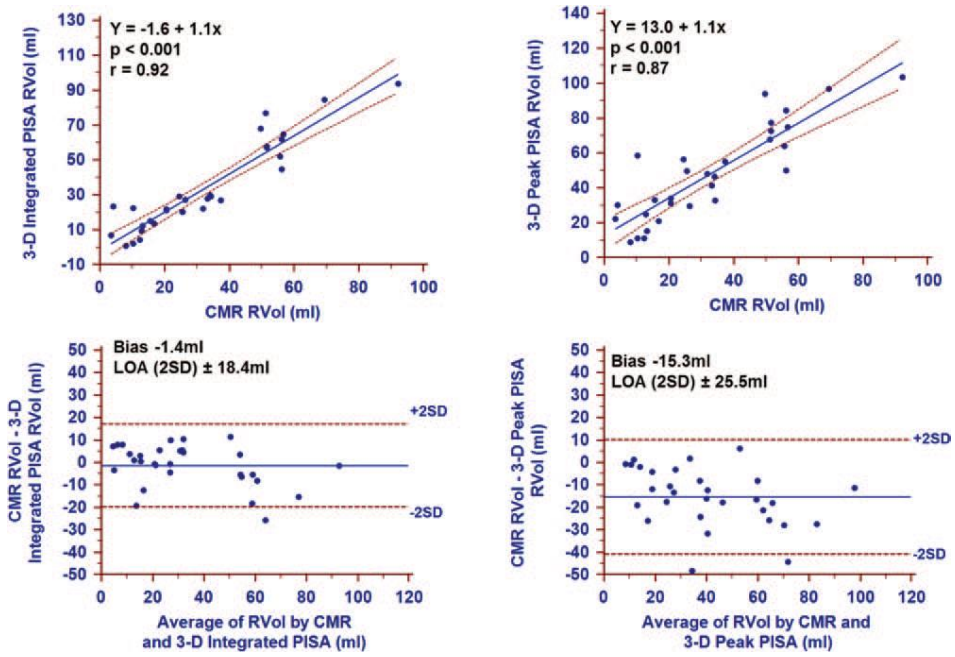
Principles of 3D – Easy PISA

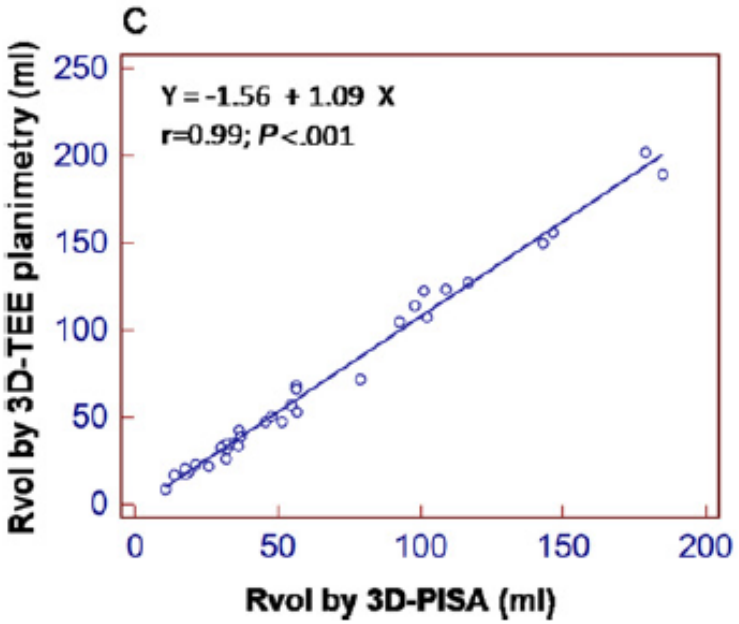




2D and 3D-PISA vs CMR

Automation = Workflow Advantage





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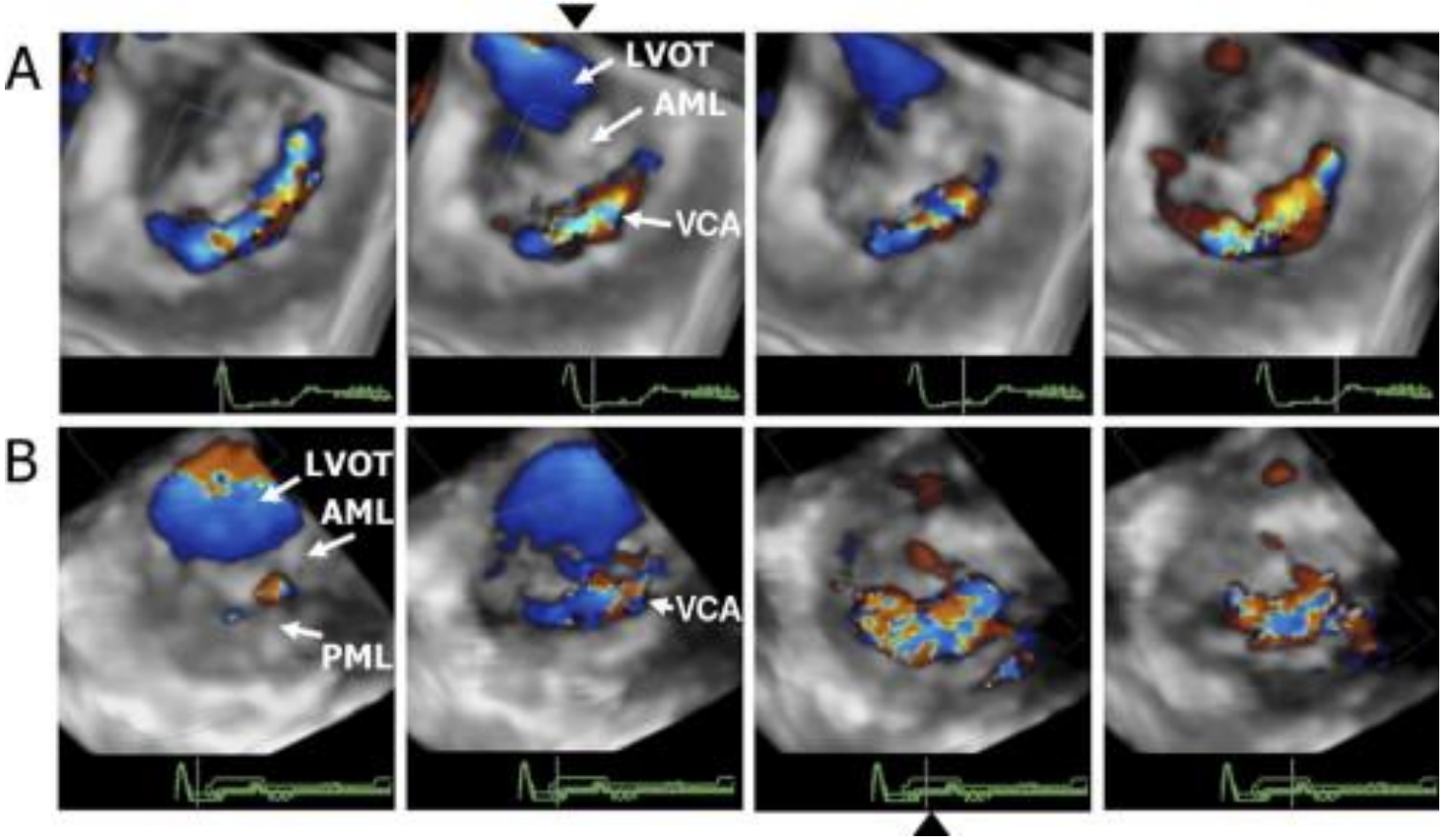
Thavendiranathan et al. Circulation cardiovascular imaging 2013, 6(1): 125-33

De Augustin JA et al, J Am Soc Echocardiogr. 2012 Aug;25(8):815-23

3D VC in functional and organic MR



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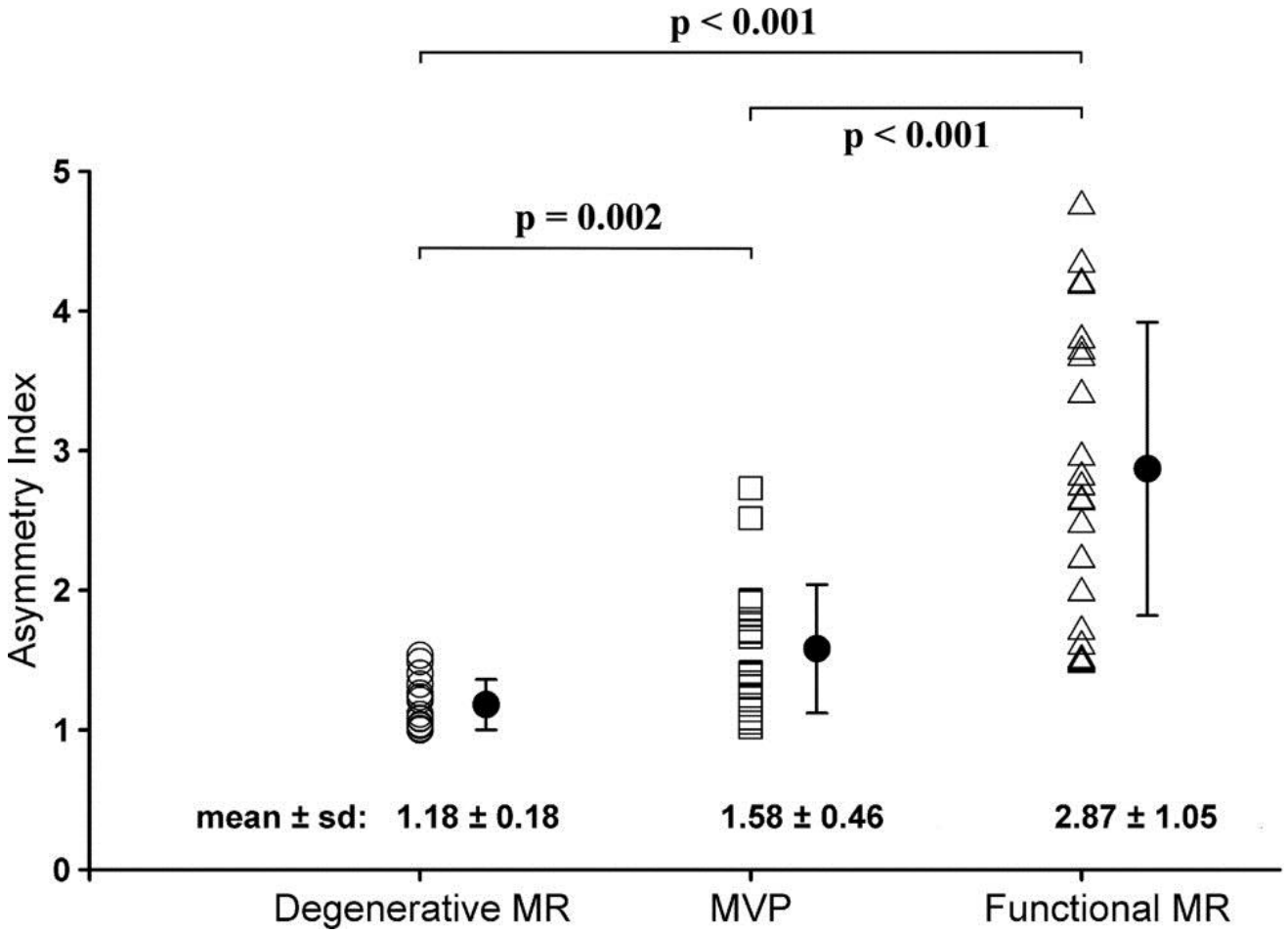
Kahlert et al JASE 2012; 21:8, 912–921

VC Asymmetry and Etiology of MR



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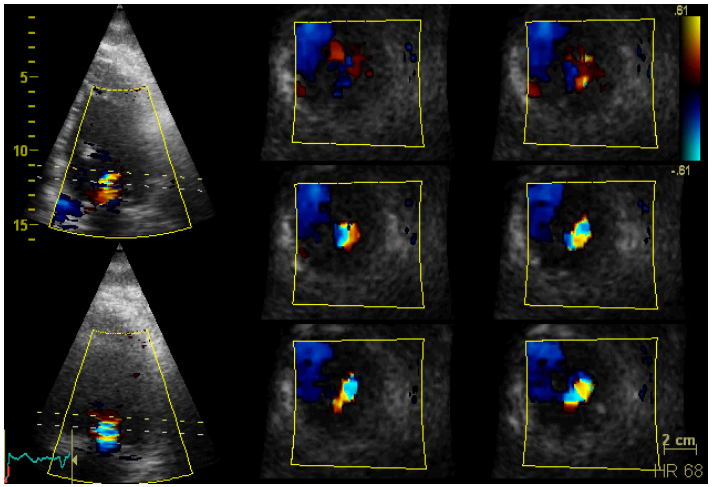
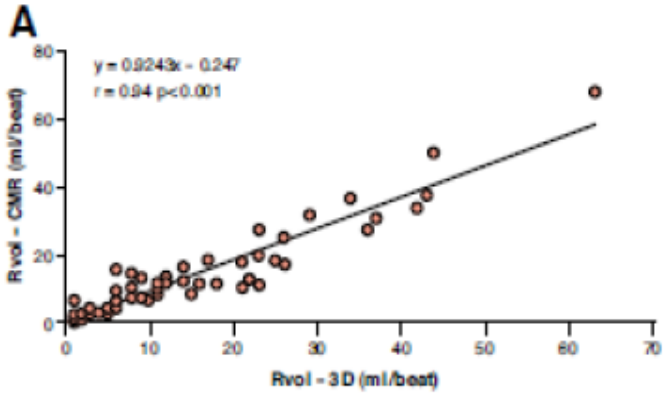
Kahlert et al JASE 2012; 21:8, 912–921

VC 2D and VC 3D versus CMR

TTE





Velocity-encoded cardiac magnetic resonance

TEE

MPR = Multi-planar Reformat /“Cropping”

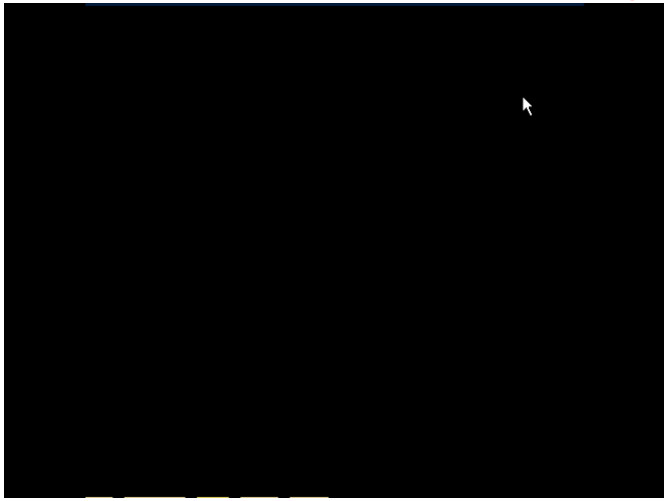


Table 1. Mean Values and Range of EROA

	Total Population (n = 64)	L/S >1.5 (n = 18)	L/S ≤1.5 (n = 46)
2D: EROA-4CH, cm²			
Mean ± SD	0.11 ± 0.12*	0.06 ± 0.06†	0.14 ± 0.13
Range, min–max	0.008–0.64	0.008–0.27	0.008–0.64
2D: EROA-elliptical, cm²			
Mean ± SD	0.14 ± 0.15†	0.15 ± 0.14	0.14 ± 0.16
Range, max–min	0.008–0.75	0.02–0.55	0.008–0.75
RT3DE: EROA-3D, cm²			
Mean ± SD	0.22 ± 0.14	0.23 ± 0.14	0.20 ± 0.16
Range, max–min	0.04–0.78	0.07–0.41	0.04–0.78

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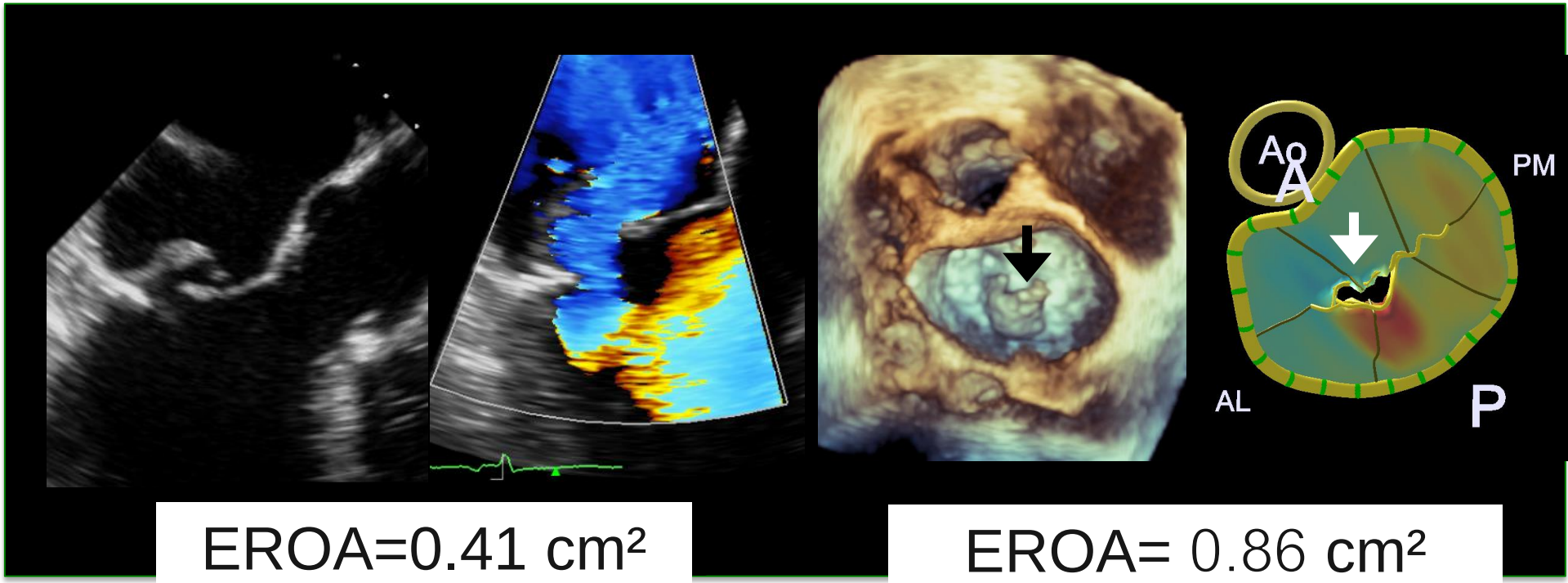
Marsan et al JACC Imag 2009

Anatomic EROA

Poor Agreement: AROA and PISA



EROA=0.41 cm²

EROA= 0.86 cm²

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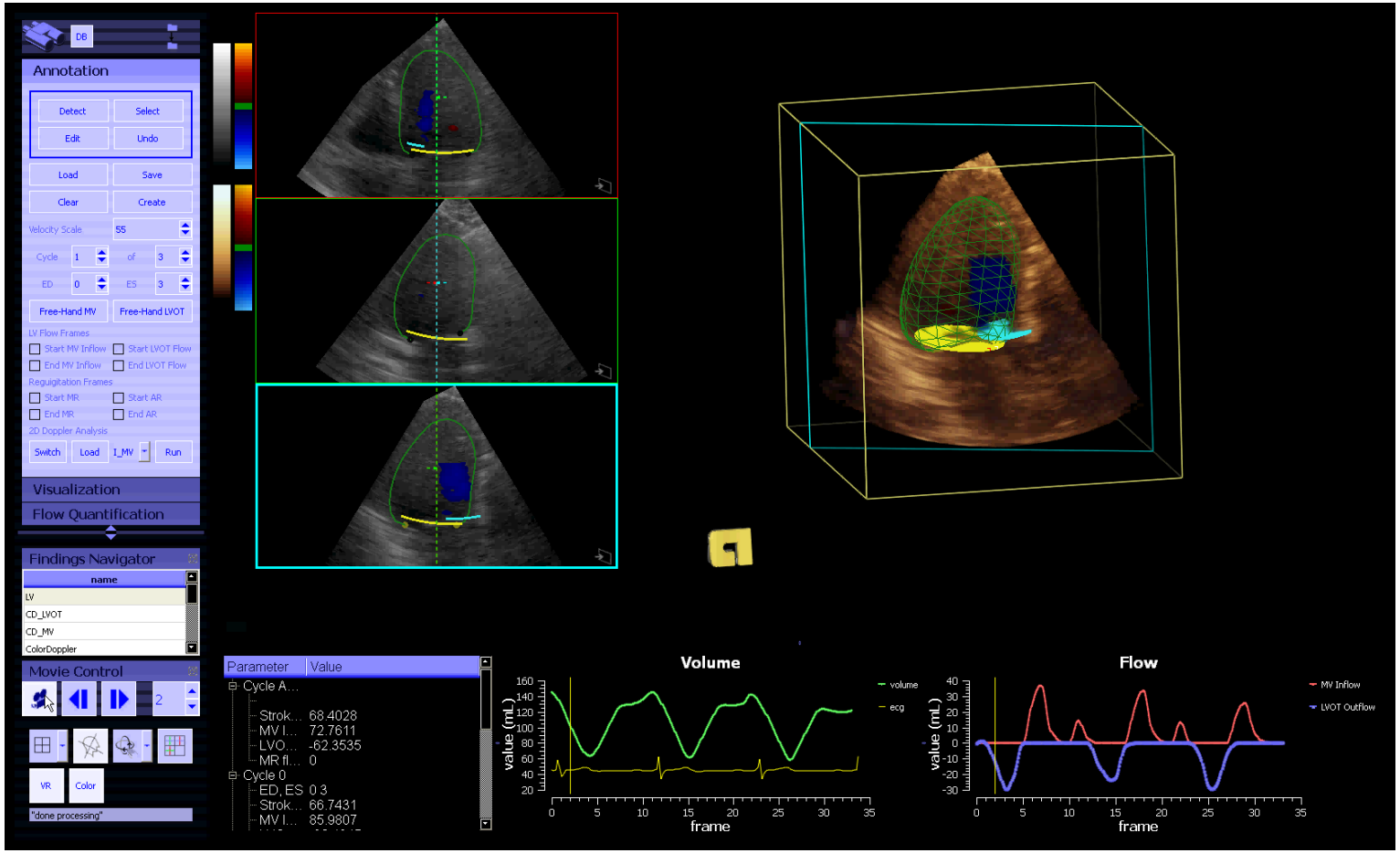
Thavendiranathan et al, JACC Cardiovascular Imaging, 2012, 5(11):1161-75.

Thavendiranathan et al, JACC 2012, 60(16): 1470-83

3D color Doppler Stroke volume



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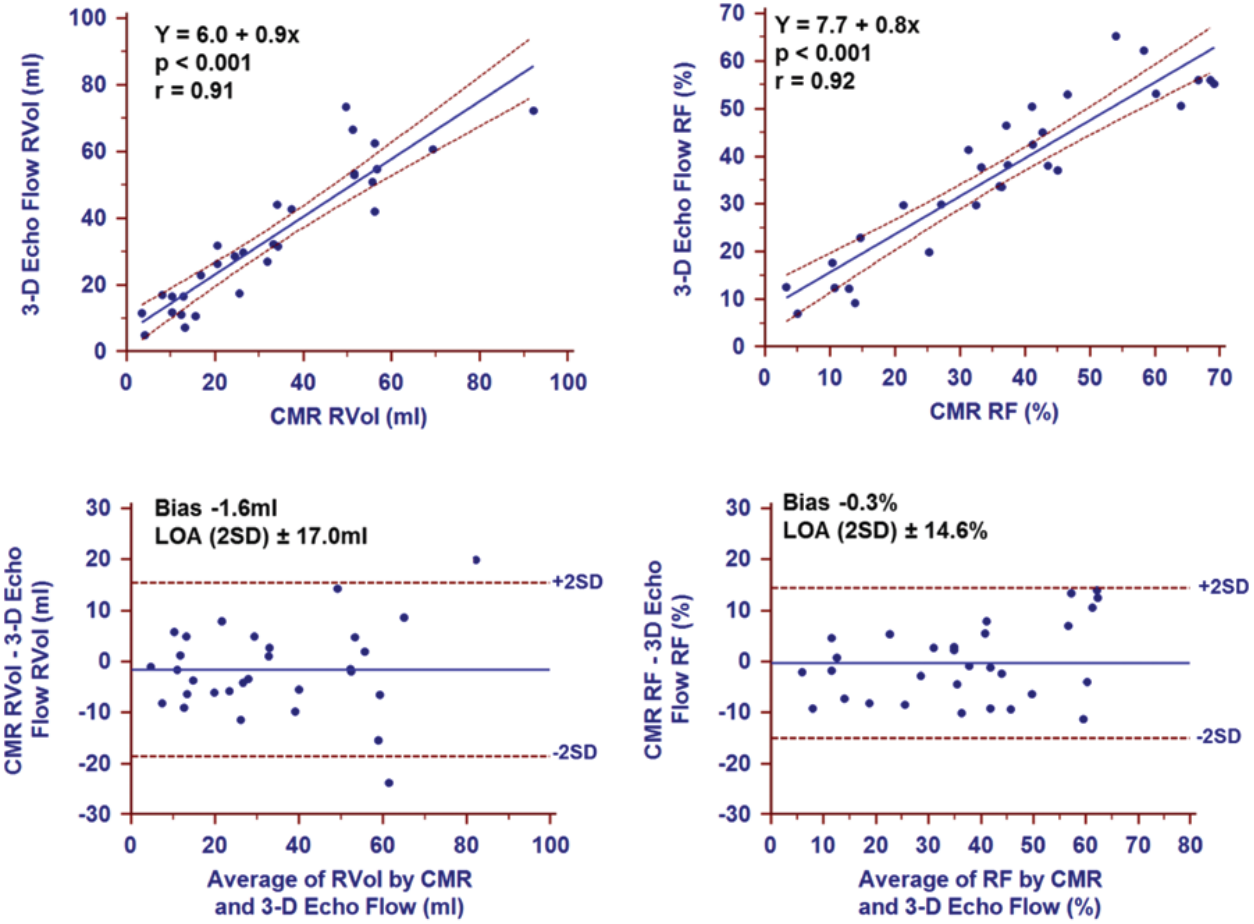
Thavendiranathan et al. J Am Soc Echocardiogr. 2012 Jan;25(1):56-65

Matthews et al, Eur J Echo, 11: 432-37, 2010

3D color Doppler Stroke volume



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Thavendiranathan et al. Circulation cardiovascular imaging 2013, 6: 125-33

Treatment optimal ? What else ?

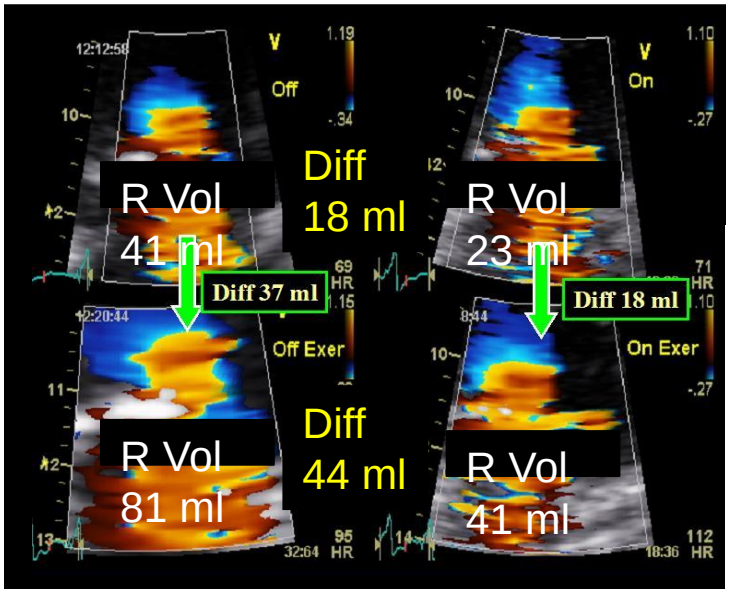
78 years old addressed for mitral surgery

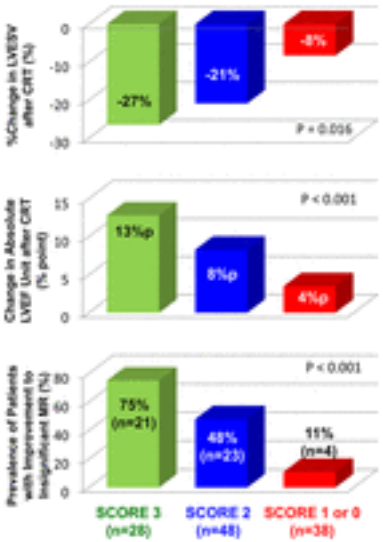
- History of dilated cardiomyopathy, no CAD
- Increasing SOB, the patient is in class III
- Treatment ACE inhibitors, BB, Aspirin, Loop diuretics, spironolacone
- The cardiologist of the patient performed an echocardiography and measured an ERO 25 mm2 and RV 30 ml
- He send the patient for an operation. Euroscore is 28

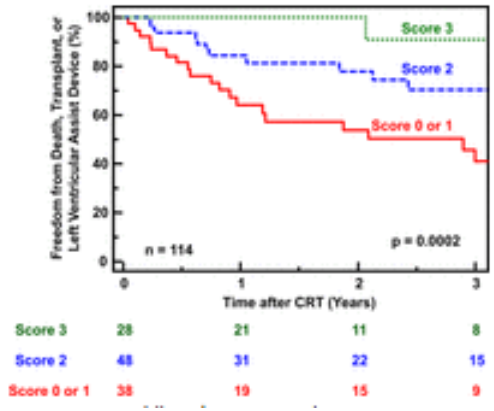
CRT and MR reduction

Score 1-3

1. Radial dyssynchrony >200 ms
2. LV end-systolic diameter index <29 mm/m^2
3. Lack of wall motion consistent with scar at papillary muscle insertion sites assessed by wall motion score index ≤2.5







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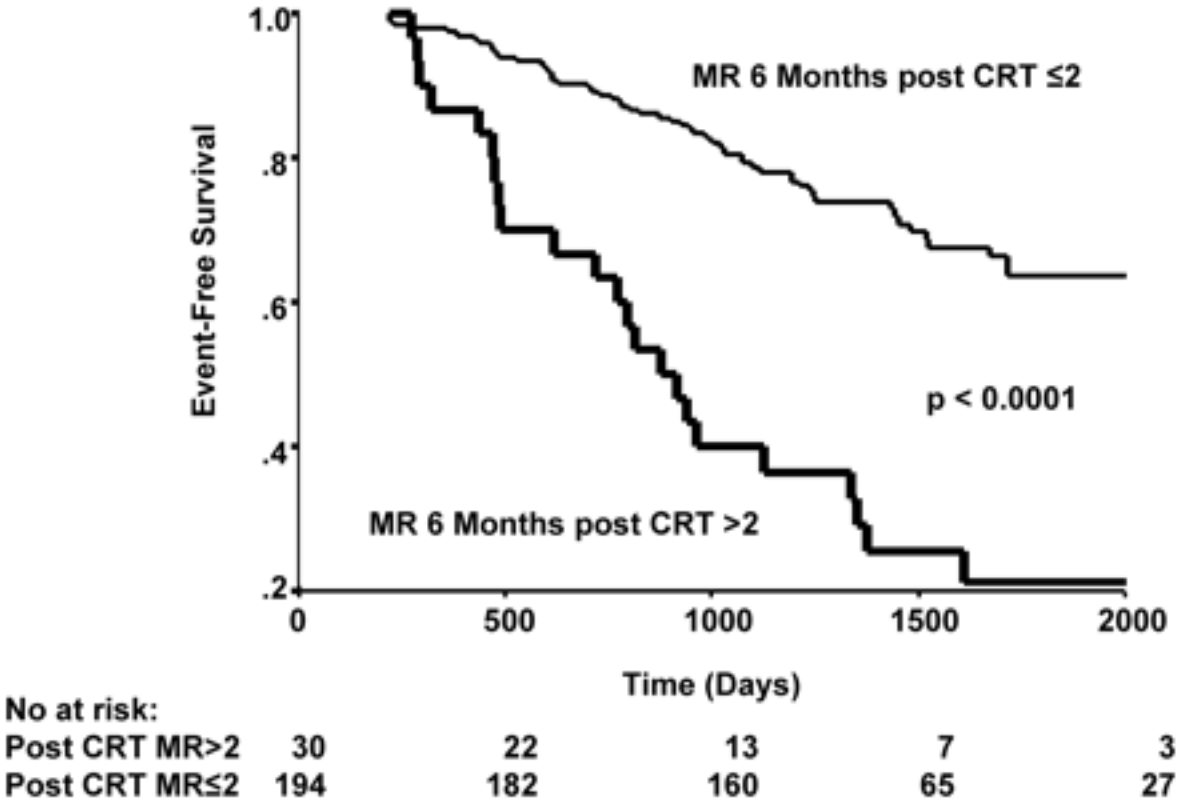
Onishi T et al Circulation Heart Failure 2013; 6: 685-693

Outcome of patients non responding to CRT



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Verhaert et al Circulation: Cardiovascular Imaging.2012; 5: 21-26

Indications for surgery

Indications for mitral valve surgery in secondary mitral regurgitation

	Class	Level
Surgery is indicated in patients with severe MR undergoing CABG, and LVEF > 30%.	I	C
Surgery should be considered in patients with moderate MR undergoing CABG (Exercise echo is recommended to identify dyspnea, increase in severity of MR and in SPAP).	IIa	C
Surgery should be considered in symptomatic patients with severe MR, LVEF < 30%, option for revascularization, and evidence of viability.	IIa	C
Surgery may be considered in patients with severe MR, LVEF > 30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have low comorbidity, when revascularization is not indicated.	IIb	C

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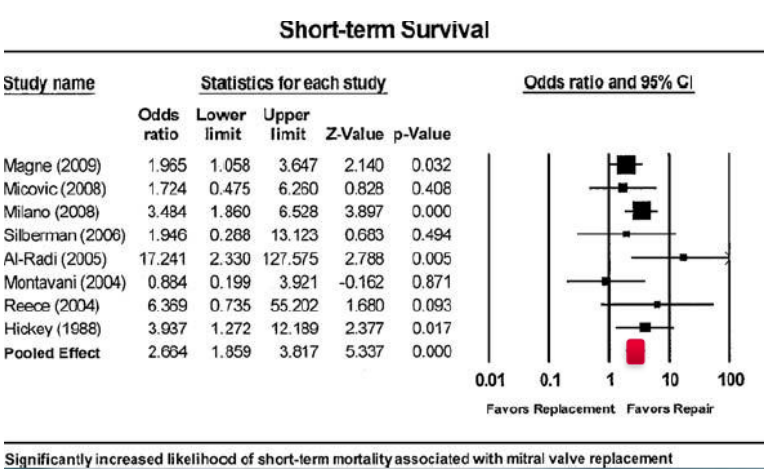
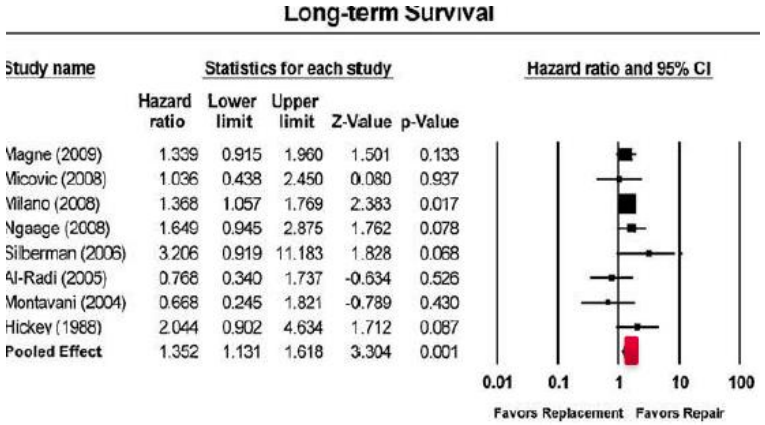
Indications for surgery in secondary MR

When surgery is indicated there is a trend favouring valve repair using an undersized rigid ring annuloplasty Which confers a low operative risk, although it carries a high risk of MR recurrence (up to 30-50% at 3 years)



Significantly increased likelihood of short-term mortality associated with mitral valve replacement



Significantly increased likelihood of long-term mortality associated with mitral valve replacement

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Vassileva Eur J Cardio Surg 2011

Background in the Management (Moderate-Severe) Secondary MR

- **Operative mortality is higher than in primary MR**
- **Long term prognosis is worse (co-morbidities)**
- **No evidence that surgery prolongs life (5-yrs death 50 %)**
  - CABG alone does not correct MR in most patients
  - Untreated MR is associated with recurrent HF and death
  - Functional improvement uniformly reported after MVS
- **Persistence and high recurrence rate of MR after MVR**
- **Most trials are not randomized observational or retrospective trials**
- **One randomized study (not powered to evaluate the outcome) comparing CABG with CABG/ MVR in moderate ischemic functional MR: improvement in NYHA class and LV function**

Fattouch JTCVS 2009

Indications for surgery

Indications for mitral valve surgery in secondary mitral regurgitation

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Surgery should be considered in patients with moderate MR undergoing CABG (Exercise echo is recommended to identify dyspnea, increase in severity of MR and in SPAP).	IIa	C
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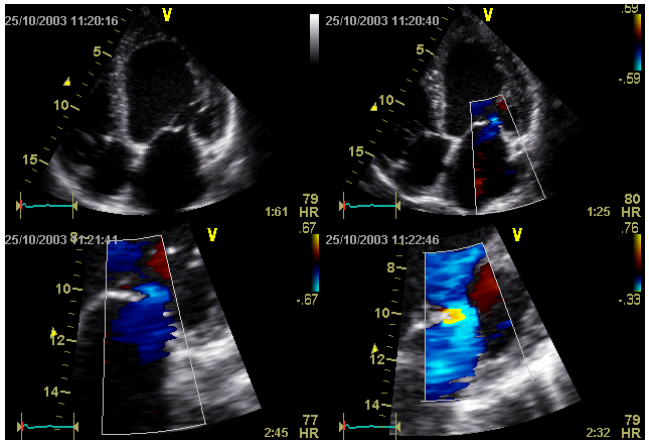
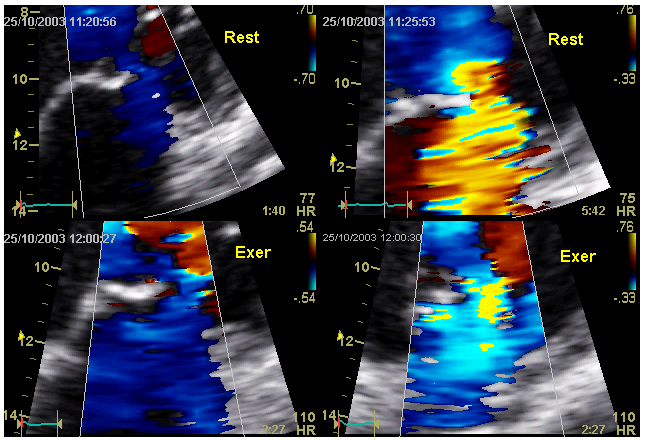
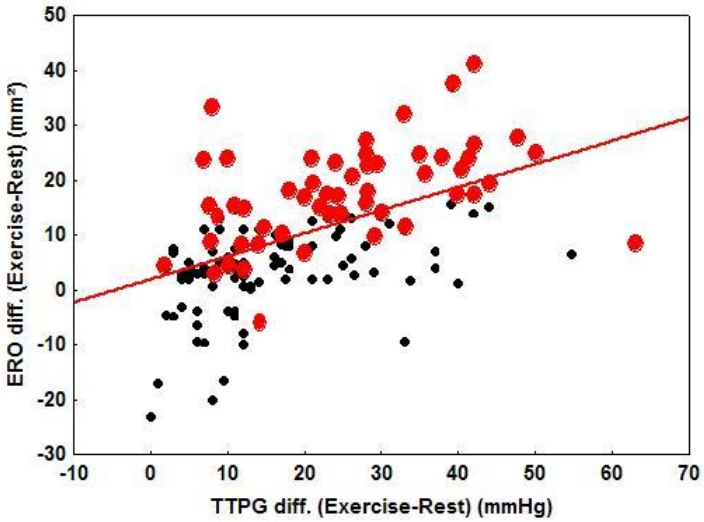
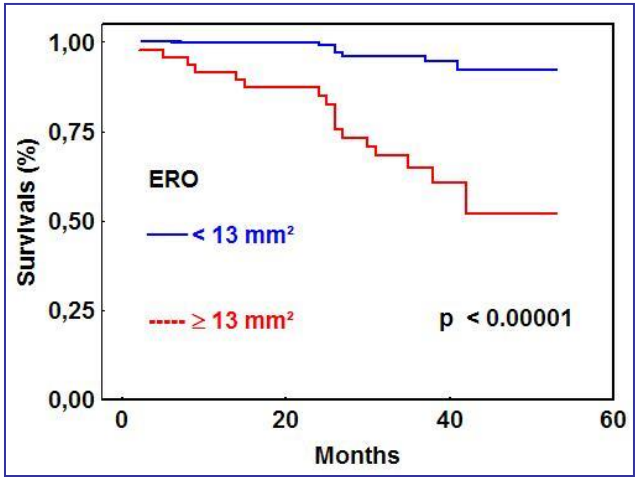
Dynamic MR on exercise









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Lancellotti et al Circulation 2003; Eur Heart J 2005 *Pierard , Lancellotti N Engl J Med 2006*

Indications for surgery

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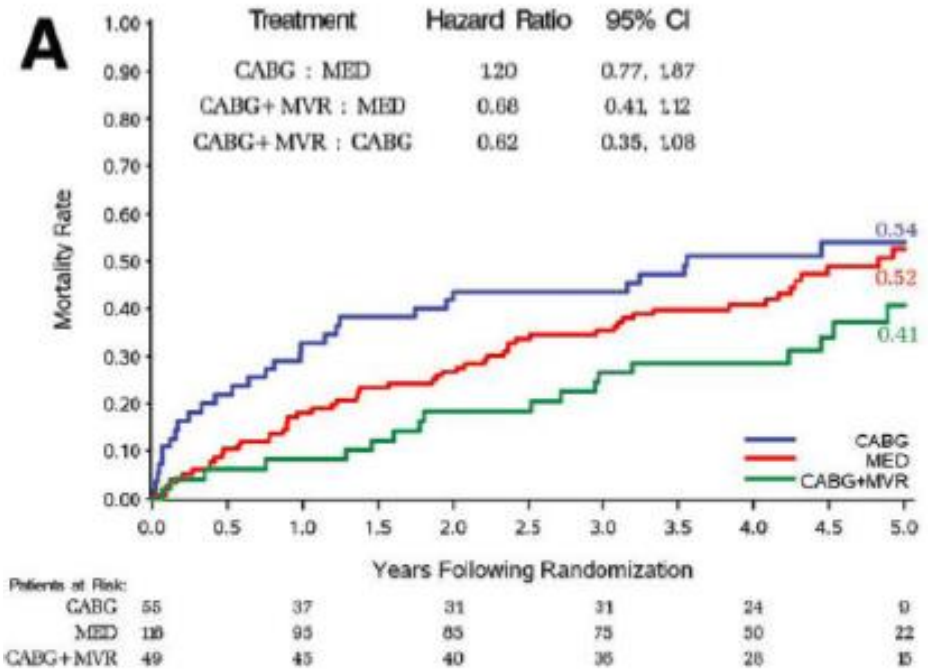
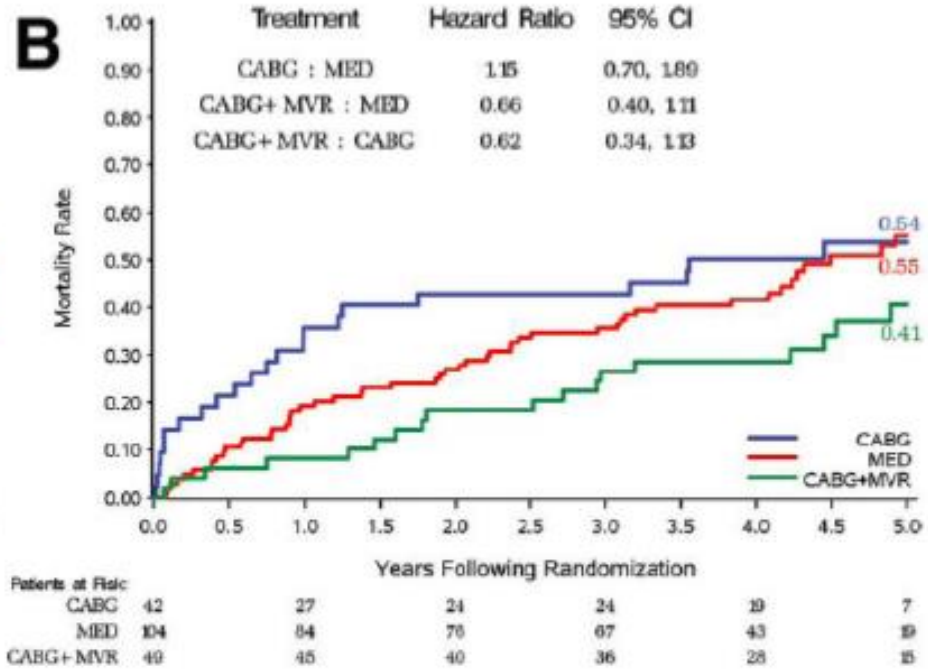
Combined surgery in secondary MR

1212 randomized patients in the STICH trial (Ventricular Reconstruction) with LV EF < 35%, 435 (36%) had none/trace MR, 554 (46%) had mild MR, 181 (15%) had moderate MR, and 39 (3%) had severe MR (observational data). The decision to treat the mitral valve during CABG was left to the surgeon.





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Deja et al Circulation 2012, 125: 2639

Indications for Mitral clipping

LV function, who cannot be revascularized or who present with cardiomyopathy, are questionable. Repair may be considered in selected patients if comorbidity is low, in order to avoid or postpone transplantation. In the other patients, optimal medical treatment is currently the best option, followed, in the event of failure, by extended HF treatment [cardiac resynchronization therapy (CRT); ventricular assist devices; cardiac restraint devices; heart transplantation].

The percutaneous mitral clip procedure may be considered in patients with symptomatic severe secondary MR despite optimal medical therapy (including CRT if indicated), who fulfil the echo criteria of eligibility, are judged inoperable or at high surgical risk by a team of cardiologists and cardiac surgeons, and who have a life expectancy greater than 1 year (recommendation class IIb, level of evidence C).

There is continuing debate regarding the management of moderate ischaemic MR in patients undergoing CABG. In such cases, valve repair is preferable. In patients with low EF, mitral valve surgery is more likely to be considered if myocardial viability is present and if comorbidity is low. In patients capable of exercising, exercise echocardiography should be considered whenever possible. Exercise-induced dyspnoea and a large increase in MR severity and systolic pulmonary artery pressure favour combined surgery.

There are no data to support surgical correction of mild MR.

6.2.6 Medical treatment

Optimal medical therapy is mandatory: it should be the first step in the management of all patients with secondary MR and should be given in line with the guidelines on the management of HF.[13] This includes ACE inhibitors and beta-blockers, with the addition of an aldosterone antagonist in the presence of HF. A diuretic is required in the presence of fluid overload. Nitrates may be useful for treating acute dyspnoea, secondary to a large dynamic component.

The indications for resynchronization therapy should be in accordance with related guidelines.[13] In responders, CRT may immediately reduce MR severity through increased closing force and resynchronisation of papillary muscles.[159] A further reduction in MR and its dynamic component can occur through a reduction in tethering force in relation to LV reverse remodelling.

7. Mitral stenosis

Rheumatic fever, which is the predominant aetiology of MS, has greatly decreased in industrialized countries; nevertheless, MS still results in significant morbidity and mortality worldwide.[1,3] Percutaneous mitral commissurotomy (PMC) has had a significant impact upon the management of rheumatic MS.

7.1 Evaluation

The patient with MS may feel asymptomatic for years and then present with a gradual decrease in activity. The diagnosis is usually established by physical examination, chest X-ray, ECG, and echocardiography.

The general principles for the use of invasive and non-invasive investigations follow the recommendations made in the *General comments* (Section 3).[12]

Specific issues in MS are as follows:

- Echocardiography is the main method used to assess the severity and consequences of MS, as well as the extent of anatomic lesions.

  Valve area should be measured using planimetry and the pressure half-time method, which are complementary. Planimetry, when it is feasible, is the method of choice, in particular immediately after PMC. Continuity equation and proximal isovelocity could be used when additional assessment is needed. Measurements of mean transvalvular gradient, calculated using Doppler velocities, are highly rate- and flow-dependent, but are useful to check consistency in the assessment of severity, particularly in patients in sinus rhythm. MS does not usually have clinical consequences at rest when valve area is $>1.5\ cm^2$ (*Table 4*).[15]

  A comprehensive assessment of valve morphology is important for the treatment strategy. Scoring systems have been developed to help assess suitability, taking into account valve thickening, mobility, calcification, subvalvular deformity, and commissural areas.[15,160,161]

  Echocardiography also evaluates pulmonary artery pressures, associated MR, concomitant valve disease, and LA size. Due to the frequent association of MS with other valve diseases, a comprehensive evaluation of the tricuspid and aortic valves is mandatory. TTE usually provides sufficient information for routine management.

  TOE should be performed to exclude LA thrombus before PMC or after an embolic episode, if TTE provides suboptimal information on anatomy or, in selected cases, to guide the procedure.

  3DE improves the evaluation of valve morphology (especially visualization of commissures),[162] optimizes accuracy and reproducibility of planimetry, and could be useful for guiding (TOE) and monitoring (TTE) PMC in difficult cases.

  Echocardiography also plays an important role in monitoring the results of PMC during the procedure.
- Stress testing is indicated in patients with no symptoms or symptoms equivocal or discordant with the severity of MS. Dobutamine or, preferably, exercise echocardiography may provide additional information by assessing changes in mitral gradient and pulmonary pressures.[21]

7.2 Natural history

Survival in asymptomatic patients is usually good up to 10 years, progression being highly variable with sudden deterioration, which is usually precipitated by pregnancy or complications such as AF or embolism.[163] Symptomatic patients have a poor prognosis without intervention.[12]

7.3 Results of intervention

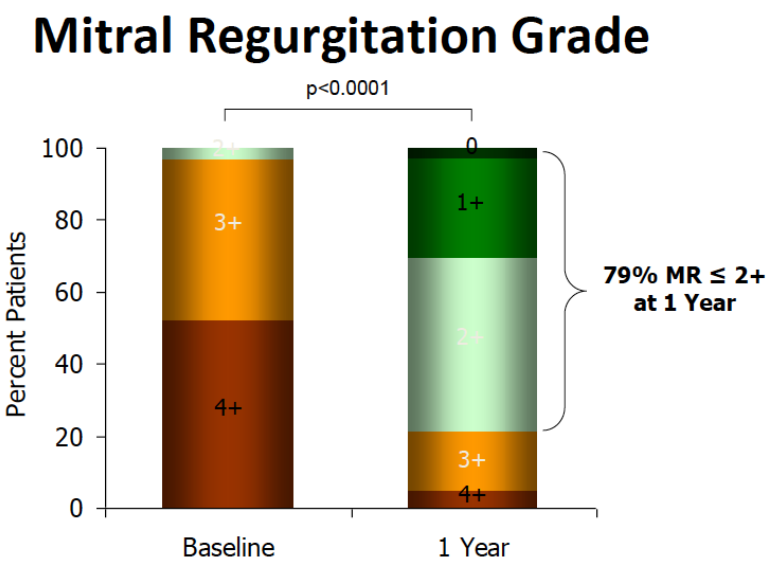
7.3.1 Percutaneous mitral commissurotomy

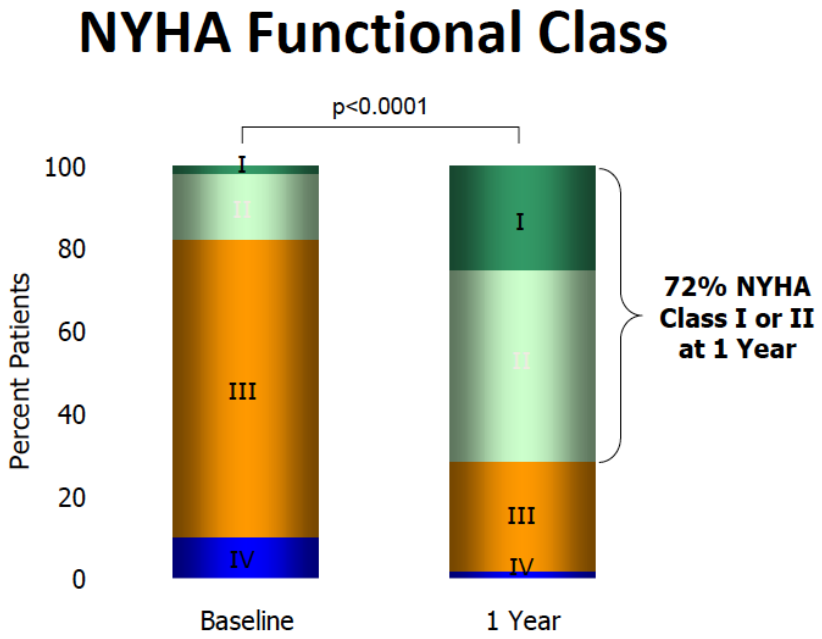
Technical success and complications are related to patient selection and the operator's experience.[164] Good initial results, defined as valve area $>1.5\ cm^2$ with no MR >2/4, are achieved in over 80% of cases. Major complications include procedural mortality 0.5–4%, haemopericardium 0.5–10%, embolism 0.5–5%, and

The percutaneous mitral clip procedure may be considered in patients with symptomatic severe secondary MR despite optimal medical therapy (including CRT if indicated), who fulfil the echo criteria of eligibility, are judged inoperable or at high surgical risk by a team of cardiologists and cardiac surgeons, and who have a life expectancy greater than 1 year (recommendation class IIb, level of evidence C).

ACCESS- EUROPE study

Demographics and Co-morbidities	EVEREST II RCT Device Patients N=178	EVEREST II High Surgical Risk Cohort N=211	ACCESS EU – MitraClip Patients N=567
Mitral Regurgitation Grade ≥ 3+, (%)	96	86	98
Ejection Fraction < 40%, (%)	6	28	53
Functional MR, (%)	27	71	77
Ischemic	NA	NA	42
Non-ischemic	NA	NA	58
Degenerative MR, (%)	73	29	23





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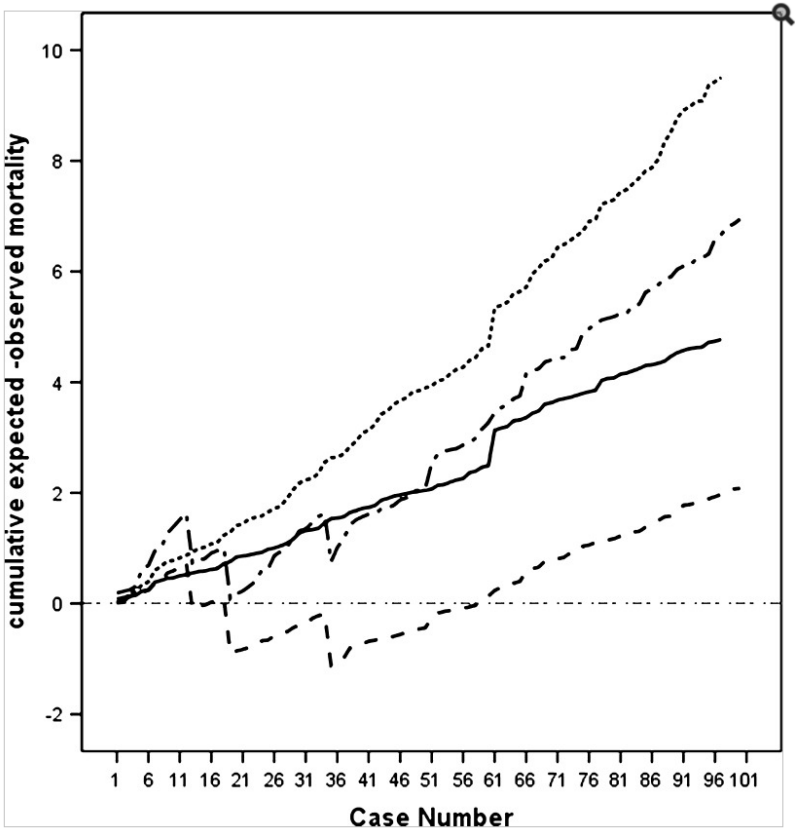
Centrum voor Hart- en Vaatziekten

What is still needed ?

- **Dedicated RCT; more levels B and A**
- **Improvement of pre-operative evaluation**
- **Evaluation of techniques for treatment**
- **Improve outcome and avoid recurring or persisting secondary MR**

Euroscore vs Euroscore II



Mitral Clip in CRT non responders

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FOCUS ISSUE: STRUCTURAL HEART DISEASE

Clinical Research

Correction of Mitral Regurgitation in Nonresponders to Cardiac Resynchronization Therapy by MitraClip Improves Symptoms and Promotes Reverse Remodeling

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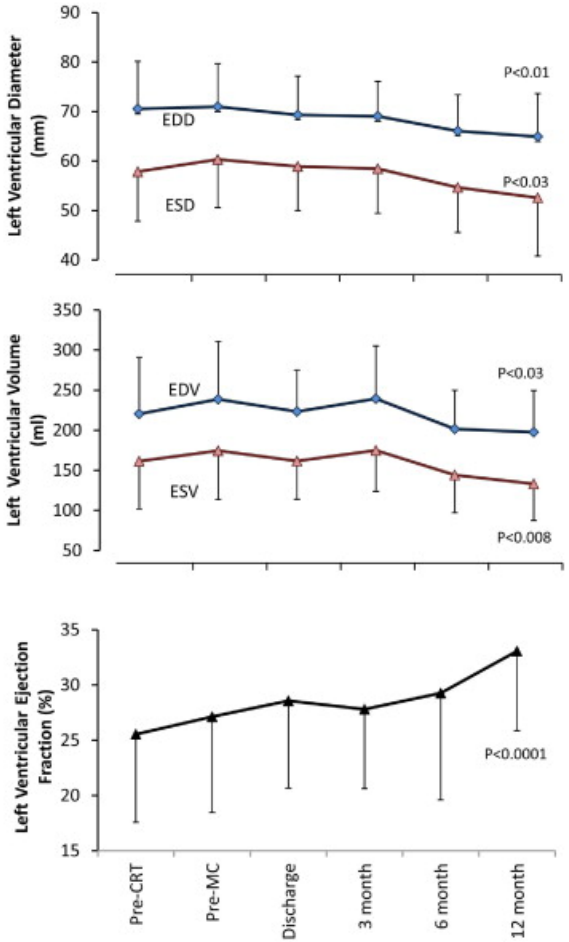
on behalf of the PERMIT-CARE Investigators

Mitral clip in non CRTR: LV / Outcome



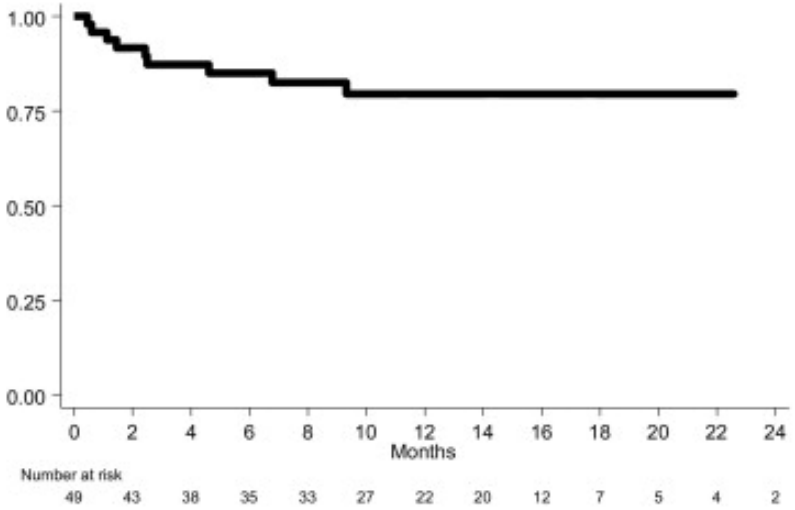
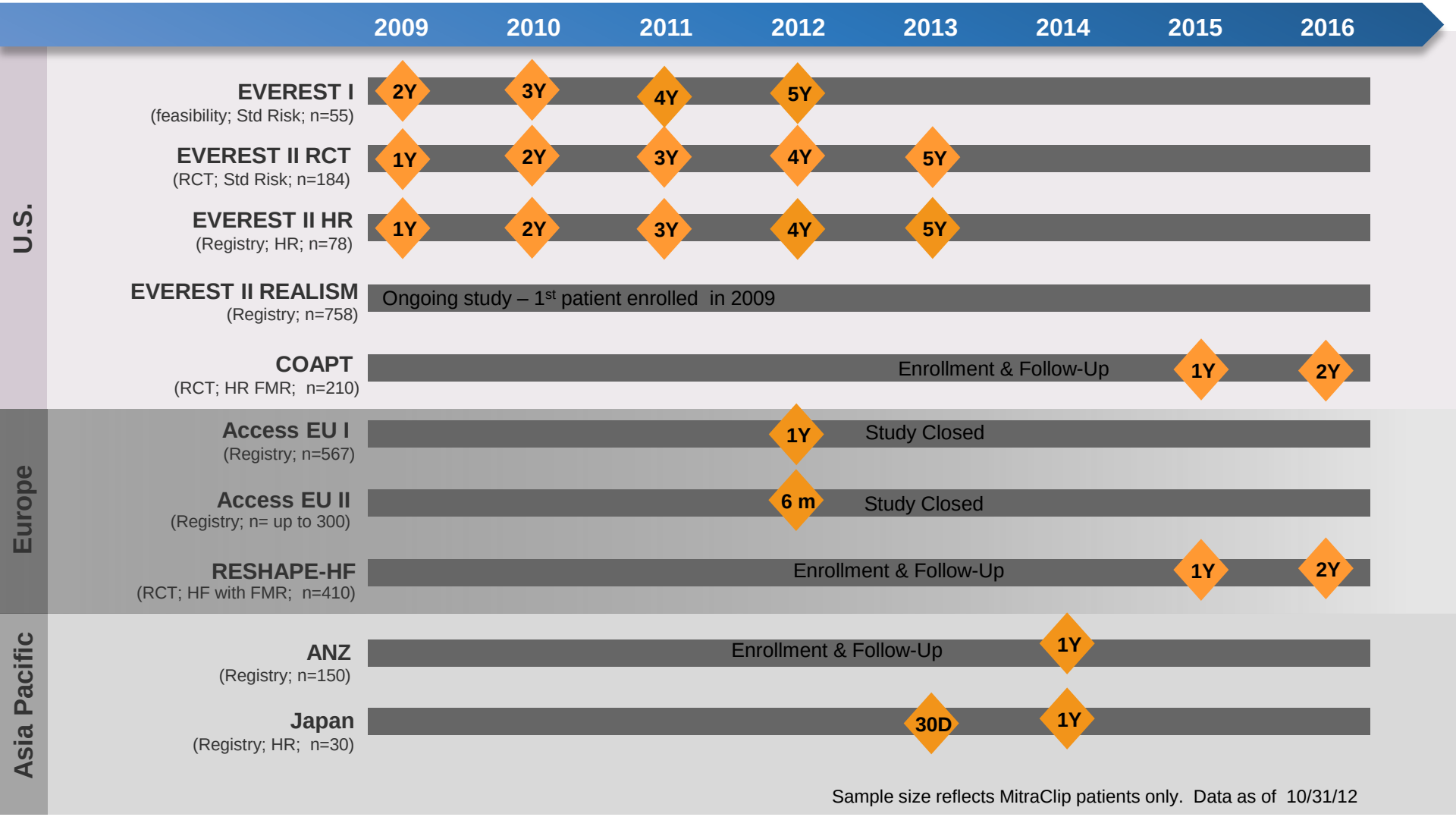


Figure 3.

Kaplan-Meier Survival Estimate

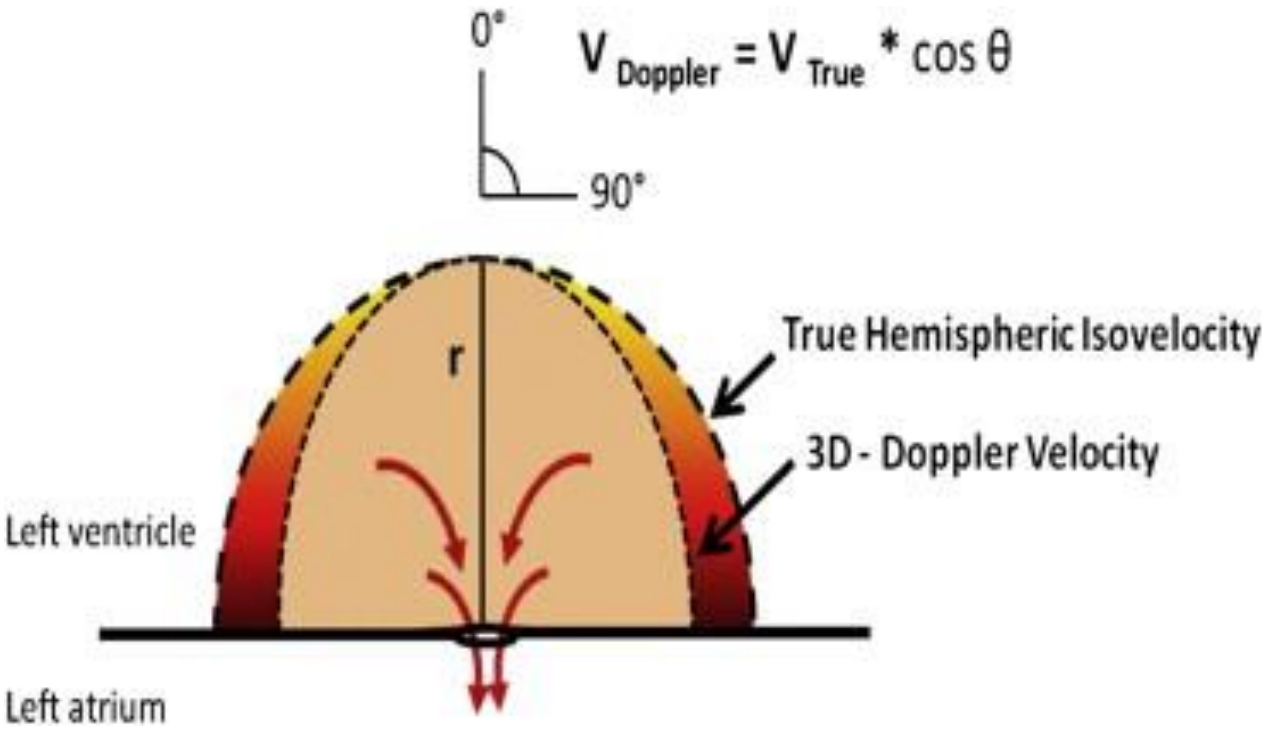
Cumulative event-free survival rate in successfully treated patients.

Clinical Trial Program



Sample size reflects MitraClip patients only. Data as of 10/31/12

3D PISA limitation: Angle dependency



PISA limitation : Phasic changes