What echo measurements are key prior to MitraClip?

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Conflict of interest

• No disclosure
69 y.o man with severe ischemic cardiomyopathy

2007: severe CHF
- History of previous inferior MI
- RCA desobstruction + LAD stenting
- LV dysfunction EF 0.30 LV dyssynchrony
- ICD + CRT implantation
- NYHA II under medical Rx until 2011

2011: new episode of CHF
- 2/6 holosystolic murmur. S3
- Clinical signs of left and right CHF
TTE

LVEDD 75 mm
LVESD 63 mm

EDVi : 160 ml/m²
EF: 0.28
LAVol 50 ml/m²
MR quantification

ERO: 0.42 cm²
R Vol: 55 ml/bt

Estimated SPAP 65 mmHg
Annulus diameter 36 mm
Tenting depth: 11 mm
Tenting area: 3.2 cm²
Posterolateral angle: 45°
What should we do?

• Coronary angio: no significant restenosis
• Rest TI SPECT: no viability in inferior territory
• Multidisciplinary team discussion
  – Severe symptomatic FMR
  – Optimal medical therapy
  – Already CRT
  – No indication for revascularization
  – High operative risk STS 9% Euroscore I 16%

Candidate for Mitraclip implantation?
Mitraclip therapy

Maisano et al, J Am Coll Cardiol 2011;58: 2174–82
Mitraclip therapy

**EVEREST II**
More than 6000 implantations worldwide

**ACCESS EU**

Mitral Regurgitation Grade
Baseline, 1 and 2 Years (matched)
Intention to Treat

+ Within group difference (p<0.05)
† Between group difference at 1 year (p<0.05)
‡ Between group difference at 2 year (p<0.05)

Mitral Regurgitation Grade*

80% MR ≤ 2+ at 6 Months

N = 392 Matched Cases
Mitraclip therapy

- Experience with Mitraclip
  - Safe procedure. Low mortality
  - High implant rate (99.6 % ACCESS EU)
  - Reduction of MR but less than surgery (20 % of grade 3-4 with clip vs 3-4% with surgery at 1 year)
  - Similar functional improvement and LV remodelling between clip and surgery
  - Shift to functional MR (80 % in Europe)
Percutaneous edge-to-edge procedure may be considered in patients with symptomatic severe primary MR or symptomatic severe secondary MR despite optimal medical therapy (including CRT if indicated)

who fulfill the echo criteria of eligibility

are judged inoperable or at high surgical risk by a ‘heart team’ and have a life expectancy greater than 1 year

(recommendation class IIb, level of evidence C)
Mitraclip therapy
Selection of patients

- Patient selection is strongly influenced by clinical and anatomical factors

- Essential role of echocardiography
  - Grade 3 to 4 degenerative or functional MR
  - MR originating from the A2P2 area
  - Sufficient tissue for mechanical caption of the valve
Mitraclip therapy
Selection of patients

- Multiple echo modalities
- Comprehensive and systematic assessment of MR
  - Key echocardiographic views in each echo modality
  - Optimal visualization of MR origin and valve pathology
Mitraclip therapy
Selection of patients

- Type and mechanisms of MR
- Severity of MR
- Location of MR
- Morphology of the MV apparatus
- Specific measurements
- Additional feasibility parameters
Type of MR

Organic or primary MR

Functional or secondary MR
Type and mechanisms of MR

Carpentier’s Classification
### Echocardiographic criteria for the definition of severe valve regurgitation: *an integrative approach*

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PISA 3D geometry with 3DTTE

Functional MR

Organic MR

Matsumura et al, Am Heart J 2008; 155: 231-8
Quantification of Functional MR by RT3D Echocardiography

Ajmone Marsan et al J Am Coll Cardiol Img 2009;2:1245–52
Secondary MR

- Ischaemic or functional MR
  - Local remodelling ± wall motion abnormalities
    - Displacement of papillary muscles
    - Traction on mitral leaflets (tethering)
    - Tenting and incomplete closure
  - Imbalance between ↑ tethering and closure forces

(Levine et al. Curr Cardiol Rep 2002;4:125-9)
Secondary MR

Secondary MR

FUNCTIONAL MITRAL REGURGITATION

Coaptation length ≥ 2 mm

Coaptation depth < 11 mm


EVEREST trial
Secondary MR

Good candidate
Secondary MR

Less favorable candidate

Lack of coaptation of the leaflets
Secondary MR
Role of 3D TEE

Type IIIb MR

Symmetric closure

Asymmetric closure
Secondary MR
Role of 3D TEE

• Others parameters to assess
  – Morphology of the valve
  – LV dimensions and function
  – Dyssynchrony
  – other exclusion criteria
Morphology of the valve

- Calcifications of the leaflets
- Annular calcifications
- MV stenosis (MV area > 4 cm²)
Morphology of the valve

- Annulus shape and dimensions
LV dimensions and function

- LV dimensions
- LV volumes
- EF
- Sphericity index
- Asynchronism
- Thrombus ?

Courtesy of E Donal
Secundary MR

Good candidates

• Central MR jet
• Tenting height < 11 mm
• Coaptation length >2 mm
• Pliable valves
• Sufficient tissue for coaptation

Poor candidates

• Severe valve deformation
• Mitral valve area < 4 cm²
• Morphologic valve abnormalities
• Too severe LV dilatation or dysfunction (?)
Annulus diameter : 36 mm
Tenting depth : 11 mm
Coaptation length : 2 mm
MVA > 4 cm²
What we did

Mitraclip procedure
Mitraclip procedure

Leaflet grasp
Mitraclip procedure

Residual MR
Mitraclip procedure

Final result
Follow up

NYHA class II
No recurrence of CHF
LV EDV: 235 ml
LV ESV: 150 ml
EF: 0.35
SPAP: 45 mmHg
MR grade 1-2/4
Primary MR

- Mitral valve prolapse
- Précise assessment
  - Uni or bivalvular
  - Topography (segmental analysis)
  - Extension (« flail »)
  - Chordal rupture
  - Specific measurements
Location of prolapse
Role of 2D TTE
Primary MR

MR jet should be central (A2P2)

SAX view of the MV
Localisation of MV prolapse

Good candidates

Type II
Organic (degenerative)
Ruptured chordae
P2 prolapse
Localisation of MV prolapse

Not candidate to Mitraclip

Type II
Severe bileaflet flail
Multiple chordal rupture

Type I+ II
Perforation
Commissural prolapse
Localisation of MV prolapse
Role of 3D TEE

Biner S et al J Am Soc Echocardiogr 2011;24:611-7
Localisation of MV prolapse

Not candidate to Mitraclip

Commissural prolapse

Barlow’s disease
Specific measurements

- Flail gap < 10 mm
- Flail width < 15 mm

3D measurements of MV prolapse

RMP reconstruction
Primary MR

- Exclusion criteria
  - Calcifications (annulus, leaflets)
  - Restrictive posterior leaflet (short PVM)
  - Rheumatic MR
  - Endocarditis
  - MV perforation
  - MVA < 4cm²
  - Extensive flail
  - Leaflet cleft
Morphology of the MV

Rheumatic MR

MVA : 1.8 cm²
Primary MR

**Good candidates**

- A2 or P2 prolapse
- Central MR jet
- Flail gap < 10 mm
- Flail width < 15 mm
- Sufficient tissue for coaptation
- Mitral valve area > 4 cm²

**Contra indications**

- Endocarditis, Rheumatic origin
- Calcifications of leaflets/annulus
- Extensive bileaflet prolapse
- Commissural prolapse
- Insufficient leaflet length for coaptation
- Mitral valve area < 4 cm²
Additional parameters

• Interatrial septum
Additional parameters

- Left atrial appendage

LAA thrombus
Spectrum of pathologies treatable with the MitraClip

Type I

Type II

Type IIIb

A

B

C

Rogers J H, Franzen O Eur Heart J 2011;eurheartj.ehr101
In 35 patients (69%), adverse mitral valve morphology and/or severe LV dysfunction were present.
Summary

• Growing use of Mitraclip (> 6000 procedures worldwide)
• Patient selection
  • Multidisciplinary clinical decision (Heart team)
  • Importance of anatomy and function assessment
• Major role of echo, including all echo modalities, 2D TTE, TEE and RT 3D TEE
  – Particular attention to valve morphology, location and severity of MR jet and mechanisms of MR
  – Specific measurements for feasibility assessment
Summary

• What we need to improve selection
  – Refinements of anatomic criteria proposed at the beginning of experience
  – Large series, registries and randomized studies especially in functional MR
Thank you