Functional mitral regurgitation: medical therapy, surgical or percutaneous repair?

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Valvular heart disease: clinical imaging pathways in challenging scenarios:

a clinical case-guided discussion
Clinical Case

- 46 years old, male
- Past medical history
  - Hyperuricemia
- Cardiac history
  - Increasing SOB in the last 3 years
  - Permanent AF since 2010 (refractory to MT/DC Shock)
  - 3 hospital admissions for CHF in the previous 6 months
  - NYHA IIIB-IV
  - ECG: AF + RBB block
  - Coronary angiography: no CAD
  - TEE: severe functional MR, EF 15-20%, LVEDD 83 mm
Medical therapy

- Warfarin
- Carvedilol 6,25 mg bd
- Frusemide 125 mg bd
- Zofenopril 15 mg od
- Amiodarone 200 mg od
- Spironolactone 25 mg od
- Digoxin 0.125 mg od
Clinical Case

In the referring hospital

Only option → HTX
Severe LV remodeling and dysfunction (EF 20%)

Severe FMR (4+/4+), symmetric leaflet tethering + annular dilatation

TR 2+/4+, tricuspid annulus > 40 mm

SPAP 35 mmHg

Mild RV dysfunction

LV dyssynchrony (no indication to CRT due to RBB block)
TEE during high rate AF
Severe LV dysfunction + FMR
LVEDD/LVESD
LVESV

Lunghezza LV 9.03 cm
Area LV 50.1 cm²
Vol LV 235 ml
EF (A2C) 20 %
LVEF

EF (A2C) 20 %
LV function and dimension improvement after AF rate control

- EF 30%
- LVEDD 75 mm
- LVESD 68 mm
Still severe MR after AF rate control
Possible scenarios: medical therapy and HTX listing

- MV surgery + surgical AF ablation non indicated
- Screening for HTx waiting list
Possible scenarios: treating Functional MR

- Mitraclip?

- MV surgery + surgical ablation of permanent AF + tricuspid annuloplasty?
Mitraclip feasibility in Functional MR

- Coaptation length ≥ 2mm
- Coaptation depth < 11mm
Coaptation length > 2 mm
Coaptation depth 1 cm
Regurgitant jet

- Central origin
- Eccentric direction
- Extension <30% (intercommissural distance)
MitraClip® therapy in patients with end-stage systolic heart failure

Olaf Franzen¹, Jan van der Heyden², Stephan Baldus¹, Michael Schlüter¹, Wolfgang Schillinger³, Christian Butter⁴, Rainer Hoffmann⁵, Roberto Corti⁶, Giovanni Pedrazzini⁷, Martin J. Swaans², Michael Neuss⁴, Volker Rudolph¹, Daniel Sürder⁷, Jürg Grünenfelder⁶, Christine Eulenburg⁸, Hermann Reichenspurner⁹, Thomas Meinertz¹, and Angelo Auricchio⁷

- Mean age 70 years
- Euroscore 34
- LVEDD 70 mm
- LVEDV 252 mL
- LVEF 19%
- Hospital mortality 17%

MR post-Mitraclip
Mortality in the follow-up is strictly related to residual/recurrent MR
Possible scenarios: Mitraclip

....... Let’s try with the Mitraclip .....  
It would be less risky for the patient.... If it fails we will still have the surgical option.................
Is repair still feasible after Mitraclip implantation in FMR?
Is repair or replacement the same?
Mitral Valve Repair or Replacement for Ischemic Mitral Regurgitation?
The Italian Study on the Treatment of Ischemic Mitral Regurgitation (ISTIMIR)

The ISTIMIR Investigators

Cardiac Surgery Units
Brescia, Florence, Udine, Brescia 2, Milan, Terni, Catanzaro, Bologna, Bergamo, Parma, Massa, Novara and Catania
Italy
Repair might be better than replacement in FMR

J Thorac Cardiovasc Surg 2001;122:1107-24

Possible scenarios: MitraClip

PROS:
- Lower procedural risk compared to surgery?

CONS:
- AF and TR not addressed
- Higher likelihood of residual/recurrent MR
  - Negative effect on reverse LV remodeling
- If residual/recurrent MR → surgical MV repair unlikely
Possible scenarios: MV surgery

- Replacement
- Good repair
- Bad repair
Possible scenarios: MV surgery

- Replacement
- Good repair
- Bad repair
Can we avoid bad repair?
Can we avoid bad repair?

Complete rigid ring
Patient selection
Can we avoid bad repair?

Complete rigid ring

Patient selection
Is a good repair feasible in this patient?

YES
MV parameters predicting residual/recurrent MR after undersized annuloplasty

- Absence of annular dilatation
- Complex regurgitant jet
- Coaptation depth > 10 mm
- Distal anterior leaflet angle > 25°
- Posterior leaflet angle > 45°
Annular dilatation

Important annular dilatation in this patient

IC dimension 43 mm

AP dimension 47 mm
Regurgitant jet

- Central origin
- Eccentric direction
- Extension <30% (intercommissural distance)
And what about tethering?
Augmented PL tethering after undersized annuloplasty
Augmented PL tethering after undersized annuloplasty
Augmented PL tethering after undersized annuloplasty
Distal anterior leaflet angle

Lee et al.  
Circulation 2009;119:2606
Distal anterior leaflet angle

Lee et al.
Circulation 2009;119:2606
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Distal anterior leaflet angle

Lee et al.
Circulation 2009;119:2606
Symmetric MV tethring
MV leaflet tethering
Posterior leaflet angle < 45°
Distal anterior leaflet angle < 20°
Possible scenarios: surgery (“good” MV repair)

PROS:
- Possibility to address all the pathophysiology components of the disease
  - Functional MR
  - Tricuspid regurgitation
  - Permanent AF
Possible scenarios: surgery ("good" MV repair)

CONS:

- Surgical risk
- Reverse LV remodeling unpredictable
Undersized annuloplasty

Clinical outcomes for different strata of LV dimensions

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Preoperative LVEDD</th>
<th></th>
<th>Preoperative LVESD</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤65 mm</td>
<td>&gt;65 mm</td>
<td>p Value</td>
<td>≤50 mm</td>
</tr>
<tr>
<td>Early mortality</td>
<td>3/72 (4.2%)</td>
<td>5/28 (17.9%)</td>
<td>0.037</td>
<td>2/58 (3.4%)</td>
</tr>
<tr>
<td>Late mortality</td>
<td>8/69 (11.6%)</td>
<td>9/23 (39.1%)</td>
<td>0.016</td>
<td>7/56 (12.5%)</td>
</tr>
<tr>
<td>All mortality</td>
<td>11/72 (15.3%)</td>
<td>14/28 (50.0%)</td>
<td>&lt;0.0001</td>
<td>9/58 (15.5%)</td>
</tr>
<tr>
<td>Readmission CHF</td>
<td>6/69 (8.7%)</td>
<td>5/23 (21.7%)</td>
<td>NS</td>
<td>2/56 (3.6%)</td>
</tr>
<tr>
<td>Biventricular ICD</td>
<td>0/69</td>
<td>4/23 (17.4%)</td>
<td>&lt;0.0001</td>
<td>0/56</td>
</tr>
</tbody>
</table>

….but what about the risk of no reverse LV remodeling?

According to baseline LV dimensions →
- LV reverse remodeling unlikely
- However the real contribution of permanent AF to the severity of LV remodeling and dysfunction remains difficult to quantify
Restoring sinus rhythm may significantly improve LV function and promote reverse LV remodeling.
Long-term results of mitral repair for functional mitral regurgitation in idiopathic dilated cardiomyopathy

Michele De Bonis*, Maurizio Taramasso, Alessandro Verzini, David Ferrara, Elisabetta Lapenna, Maria Chiara Calabrese, Antonio Grimaldi and Ottavio Alfieri

Cardiac Surgery Department, San Raffaele University Hospital, Milan, Italy
# Predictors of reverse LV remodeling

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Univariate</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>HR</td>
<td>95% CI</td>
<td>p</td>
<td>HR</td>
<td>95% CI</td>
<td>p</td>
</tr>
<tr>
<td>NYHA &gt;3</td>
<td>0.6</td>
<td>0.2-1.8</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EF</td>
<td>0.9</td>
<td>0.8-1</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SPAP</td>
<td>0.9</td>
<td>0.9-1.0</td>
<td>0.05</td>
<td>0.9</td>
<td>0.9-1</td>
<td>0.04</td>
</tr>
<tr>
<td>LVEDVI</td>
<td>0.9</td>
<td>0.9-1</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LVESVI</td>
<td>0.9</td>
<td>0.9-1</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MR at discharge</td>
<td>0.6</td>
<td>0.2-1.2</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edge-to-edge repair</td>
<td>2.3</td>
<td>0.9-6.1</td>
<td>0.07</td>
<td>1.8</td>
<td>0.6-4.8</td>
<td>0.2</td>
</tr>
<tr>
<td>AF ablation and/or CRT</td>
<td>2.7</td>
<td>1-7.6</td>
<td>0.04</td>
<td>3.4</td>
<td>1.2-9.7</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Is surgical ablation of AF going to be effective in this patient?

- Young pt ! (46 years)
- Short AF duration (about 1 year)

but....
Is surgical ablation of AF going to be effective in this patient?

........ Large left atrium ....
## Indications for MV surgery in chronic secondary MR (ESC/EACTS Guidelines)

<table>
<thead>
<tr>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery is indicated in patients with severe MR* undergoing CABG, and LVEF &gt;30%</td>
<td>I</td>
</tr>
<tr>
<td>Surgery should be considered in patients with moderate MR undergoing CABG**</td>
<td>IIa</td>
</tr>
<tr>
<td>Surgery should be considered in symptomatic patients with severe MR, LVEF &lt;30%, option for revascularization</td>
<td>IIa</td>
</tr>
<tr>
<td>Surgery may be considered in patients with severe MR, LVEF &gt;30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have low comorbidity, when revascularization is not indicated</td>
<td>IIb</td>
</tr>
</tbody>
</table>
Isolated undersized annuloplasty

Saddle St. Jude Ring. N. 28
Remodeling tricuspid annuloplasty

Edwards MC³ tricuspid annuloplasty system n. 30
Left pulmonary veins

Right pulmonary veins

Left appendage

cryoablation

MV
Postoperative TEE
No residual MR
Good postoperative MV coaptation length
MV coaptation length 9 mm
Postoperative TEE
No residual tricuspid regurgitation
Postoperative sinus rhythm
Hospital discharge
6 months follow-up

- NYHA I-IIA
- Major improvement in QoL
- No CHF episodes
- ECG: SR+RBB block
- TTE: No MR, No TR, EF 40-45%
Same patient but...

multiple comorbidities
(renal, hepatic, pulmonary ...)

MITRACLIP
Complementary role of Mitraclip and Surgery
Thank you!

debonis.michele@hsr.it
Freedom from MR\(>2+\) in FMR (HSR experience)

Undersized annuloplasty
88±3.7% at 1 year

Mitraclip  58±9.3% at 1 year