Acute hemodynamic changes after correction of severe mitral regurgitation using MitraClip device

F. Bednář, V. Kočka, T. Buděšínský, H. Línková, P. Toušek, Z. Moťovská

Cardiocenter, 3rd Faculty of Medicine, Charles Univesity and University Hospital Kralovske VInohrady, Prague
The study objective

- Surgical correction of MR could increase LV afterload (elimination of low-impedance regurgitant flow into the LA)

- Increased afterload could impair LV function and may result in post-operative low CO state (12-19%) especially pts. with pre-op EF<60% (25-30%)

- Is low CO state result of elimination MR or result of other factors (CPB, cardioplegia, annular-chordal interruption...)?

References:
- Appelbaum A. Am J Cardiol 1976
- Detaint D. Circulation 2006
- Tribouilloy CM. Circulation 1999
- Detaint D. Circulation 2006
MitraClip procedure provides a unique model to assess the acute hemodynamic changes solely attributable to elimination of mitral regurgitation (no open chest surgery, no CPB, no cardioplegia...).
Invasive hemodynamic measurements after MitraClip (literature review)

- **Siegel RJ et al. JACC 2011**
  patients: n=79, 79% degenerative MR, EF 60 ± 8%
  measurements: immediately before and after clipping under GA !!!

- **Gaemperli et al. Heart 2012**
  patients: n=50, 56% functional MR, EF 47±18%
  measurements: immediately before and after clipping under GA !!!
The aim of the study

To assess the acute hemodynamic effect after MitraClip therapy in „real-world“ situation

before procedure
conscious pts,
before anesthesia

after procedure
extubated, conscious pts.
on day 1 after procedure
Methods

Patients:

severe symptomatic functional MR

The percutaneous mitral clip procedure may be considered in patients with 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 team of cardiologists and cardiac surgeons, and who have a life expectancy greater than 1 year (recommendation class IIb, level of evidence C).

Procedure:

TOE- and fluoroscopy guided

Time points:

T1... before induction to GA
T2... 15 min after GA
T3... after clipping (end of procedure)
T4... day 1 after procedure

Invasive hemodynamic measurements:

right heart catheterisation thermodilution method (VIGILANCE II)
## Results

### Baseline characteristics (n=23)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Age (years)</td>
<td>70±6</td>
</tr>
<tr>
<td>Male (%)</td>
<td>70</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>78</td>
</tr>
<tr>
<td>Ischemic HD (%)</td>
<td>78</td>
</tr>
<tr>
<td>Atrial fibrillation (%)</td>
<td>74</td>
</tr>
<tr>
<td>History of HF (%)</td>
<td>48</td>
</tr>
<tr>
<td>Ejection fraction (%)</td>
<td>35±13</td>
</tr>
<tr>
<td>NYHA III (%)</td>
<td>87</td>
</tr>
<tr>
<td>NYHA IV (%)</td>
<td>13</td>
</tr>
<tr>
<td>MR etiology – functional (%)</td>
<td>100</td>
</tr>
</tbody>
</table>

### Procedure-related data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>APS (%)</td>
<td>91</td>
</tr>
<tr>
<td>Number of clips (%)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>78</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Inotropic support day 1 (%)</td>
<td>0</td>
</tr>
<tr>
<td>In hospital heart failure (%)</td>
<td>0</td>
</tr>
<tr>
<td>Early mitral valve surgery (%)</td>
<td>0</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>13±9</td>
</tr>
<tr>
<td>In-hospital death (%)</td>
<td>0</td>
</tr>
</tbody>
</table>

APS, acute procedural acces (MR reduction 2+ or less)
Results – hemodynamic data I.

- **CI was increased**
  - T1: 2.0 ± 0.5
  - T2: 2.0 ± 0.5
  - T3: 2.4 ± 0.5
  - T4: 3.3 ± 0.5

- **Mean PCWP was reduced**
  - T1: 18.6 ± 5.6
  - T2: 16.2 ± 5.0
  - T3: 13.1 ± 4.3
  - T4: 10.5 ± 3.7

- **SVRI was reduced**
  - T1: 3427 ± 932
  - T2: 3100 ± 909
  - T3: 2440 ± 558
  - T4: 1686 ± 315

- **PVRI was reduced**
  - T1: 535 ± 344
  - T2: 480 ± 251
  - T3: 536 ± 272
  - T4: 365 ± 189
Results – hemodynamic data II.

MPAP was reduced

MAP was reduced

LVSWI was increased
left ventricular stroke work index:
SVI = (MAP-PCWP) x 0.0135

RVSWI was increased
right ventricular stroke work index:
SVI = (MPAP-CVP) x 0.0135
Results

Summary of the hemodynamic changes after MitraClip

Changes in hemodynamical parameters baseline (T1) vs. day 1 (T4)

* p<0.001
Subgroup results

**severe hemodynamic decompensated group (n=13)**

( baseline CI<2.5 and PCWP>15 mmHg)

Changes in hemodynamical parameters at baseline (T1) vs. day 1 (T4)

**no severe decomp group vs. severe decomp group**

![Graph showing changes in hemodynamic parameters](image)
Conclusions

• Percutaneous MV repair (MitraClip) for functional MR leads to favourable hemodynamic effect: increased CI and decreased PCWP, MPAP

• Similar effect on cardiac output state was observed even in severe decompensated group

• None of the patients developed post-procedural low CO state

• 1st presented data eliminating the effects of anaesthesia

• MitraClip therapy may be a promising strategy for patients with the high risk of post-operative low CO state.