Surgery for Functional Tricuspid Regurgitation
Why, How and When?

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I have no disclosures
Definition of Functional Tricuspid Regurgitation

• Not related to primary TV leaflet pathological lesions
• Due to another disease process
  – Right ventricular dilatation
  – Tricuspid annular dilatation
  – Distortion of the subvalvular apparatus
• 73 YO WF with 3-month h/o CHF, AF
• Echo / Cath
  – LVEF=30%
  – Severe MR – annular dilatation, tethering leaflets
  – Dilated RV
  – Moderate TR
  – Normal coronaries
  – PAP=58/24/35, PCW= 26, V=40

Non-ischemic dilated cardiomyopathy
Annular diameter 2.8 cm
Tethering height 0.67 cm
Tethering area 0.96 cm²
Sphericity index 0.48
Eccentricity index 2.28
Functional Tricuspid Regurgitation
One Possible Solution

- MV Repair
- TV Repair – Non-flexible 3-D Incomplete Ring
- Maze
Conservative Management of Tricuspid Regurgitation in Patients Undergoing Mitral Valve Replacement

By Nina S. Braunwald, M.D., John Ross, Jr., M.D., and Andrew G. Morrow, M.D.
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In many patients with advanced mitral valve disease, associated tricuspid regurgitation is of a functional nature and secondary to right ventricular hypertension and dilatation of the tricuspid annulus. The present results indicate that in such patients tricuspid regurgitation will improve or disappear after mitral replacement and that tricuspid valve replacement is seldom necessary.
Functional TR is Progressive and Adversely Affects Patient Outcomes

Secondary Tricuspid Regurgitation or Dilatation: Which Should Be the Criteria for Surgical Repair?

Gilles D. Dreyfus, MD, Pierre J. Corbi, MD, K. M. John Chan, AFRCS, and Toufan Bahrami, MD

Department of Cardiothoracic Surgery, Royal Brompton and Harefield NHS Trust, Harefield Hospital, Harefield, Middlesex, United Kingdom
Progressive Tricuspid Valve Annular Dilatation
# Functional TR - A Frequent Problem after Left-Sided Valve Surgery

## Table 1. Impact of Tricuspid Valve Repair at the Time of Mitral Valve Repair on Progression of Tricuspid Regurgitation

<table>
<thead>
<tr>
<th>Grade</th>
<th>Before Surgery</th>
<th>After Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group 1 (MVR)</td>
<td>Group 1 (MVR)</td>
</tr>
<tr>
<td>Grade 0</td>
<td>54</td>
<td>38</td>
</tr>
<tr>
<td>Grade 1</td>
<td>102</td>
<td>92</td>
</tr>
<tr>
<td>Grade 2</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Grade 3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Grade 4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Mean TR grade: 0.7 ± 0.5† (Group 1) vs. 0.9 ± 0.6† (Group 2) vs. 2.1 ± 1.0‡ (Group 1) vs. 0.4 ± 0.6‡ (Group 2)

MVR, mitral valve repair; TVR, tricuspid regurgitation.
Reprinted with permission from Dreyfus et al., 2005 Society of Thoracic Surgeons.

*Measurements by transthoracic echocardiography.
†P = 0.027, Mann–Whitney.
‡P < 0.001, Mann–Whitney.
Progressive RV Dilatation – Tethering of PM and Chordae

A

B

Displacement of the papillary muscles

Mascherbauer J, Eur Heart J 2010;31:2841-2843
Echo Assessment of RV Remodeling and TV Tethering

Annular Diameter
Tethering Height
Tethering Area
RV Sphericity Index
RV Eccentricity Index

Determinants of Severity of Functional TR

- TV Annular Diameter > 3.9 cm
- TV Tethering Area > 1.0 cm²
- RV Eccentricity Index > 2.0

Kim HK et al, Am J Cardiol 2006;98:236-242
Functional TR - A Frequent Problem after Left-Sided Valve Surgery

638 Patients
Follow-up 64 months

• Preop No-Trace TR (n=548) → Severe TR 7.3%

• Preop Mild TR (n=90) → Severe TR 20%

Song H, et al Heart 2009;95:931-6
Clinical Predictors of Functional TR after Left-Sided Valve Surgery

- Age
- Female Gender
- Rheumatic Etiology
- Atrial Fibrillation
- Postoperative pulmonary hypertension

Song H, et al Heart 2009;95:931-6
Impact of Late TR after Left-Sided Valve Surgery

- Mortality of patients without late TR: 4.9%
- Mortality of patients with late TR: 16.3%

P = 0.004

Song H, et al Heart 2009;95:931-6
Impact of Late TR after Left-Sided Valve Surgery

Song H, et al Heart 2009;95:931-6
TV Repair vs. Replacement

30–Day Mortality

TV Repair – 13.9%

TV Replacement - 33%

Guenther T et al, EJCTS 2008;34:402-9
TV Repair vs. Replacement
Long-term Survival

Guenther T et al, EJCTS 2008;34:402-9
DeVega Suture Annuloplasty
Bicuspidization of the Tricuspid Valve
Kay Annuloplasty
Alfieri Clover-Leaf Edge-to-Edge Repair
Tricuspid 3-D Annuloplasty Band
Mid-Term Follow Up after TV Annuloplasty

Mid-Term Follow-Up after TV Annuloplasty

Navia JL, et al. JTVCS 2010;139:1473-82
Predictors of Recurrent or Residual TR After Tricuspid Annuloplasty

- Preoperative TV tethering height > 0.51 cm
- Preoperative TV tethering area > 0.80 cm²
- Postoperative LV Ejection Fraction < 36.6%
- Postoperative TR Severity > 13%
- Postoperative Increasing RV Pressure

Fukuda S et al, Circulation 2006;114:(Suppl I):I582-I587
Functional Tricuspid Regurgitation
A Severe and Progressive Disease

• 68 YO WF Class IV CHF (Rt>Lt)
• RHD - 1971 - MV Commiss, 1984 - MVR St Jude
• Echo / Cath
  – LVEF=35%
  – Well-functioning prosthetic MV
  – Severe AS / AI
  – Dilated RV mod.-reduced function
  – Severe TR
  – Normal coronaries
  – PAP=41/24/35
Preoperative Echo

Annular diameter  4.6 cm
Tethering height   1.51 cm
Tethering area    3.32 cm²
Sphericity index  0.54
Eccentricity index 2.24
Functional Tricuspid Regurgitation
Another Possible Solution

- Redo Sternotomy
- AVR
- TV Replacement – 33mm Bovine Bioprosthesis
Postoperative Echo
Anterior Leaflet Augmentation – One More Surgical Option for TV Tethering

Detached AL from commissure to commissure

(a) RV Wall
AL
PL
SL

(b) AL Autologous Pericardial Patch
Native AL
PL
SL

(c) AL Patch

(d) Patch
Native AL
Coaptation Surface

Ring Annuloplasty

Raja SJ Expert Rev Cardiovasc Ther 2009;7:73-84
Anterior Leaflet Augmentation – One More Surgical Option for TV Tethering

(a) (b) (c) (d)
**Functional Tricuspid Regurgitation – Decision Tree**

- **TR Severity**
  - **Severe**
  - **Moderate**
  - **Mild**

  **Tethering Present**
  - TVR or TA + Leaflet Augmentation

  **Tethering Absent**
  - **MV Disease, PASP > 60mmHg**
    - **TAD > 40mm or 21 mm/m^2**
    - TV Repair Using Annuloplasty Ring
  - **Intraoperative TAD > 70mm**

Modified from Raja SG, Dreyfus GD Semin Thorac Surg 2010;22:79-83
• Functional TR is a progressive disease

• Functional TR develops in a significant number of patients after successful left-sided valve surgery

• Functional TR adversely affects survival
Summary - II

• TV Repair should be considered in patients with mild TR in the presence of defined clinical and echocardiographic criteria

• Ring annuloplasty is the preferred surgical technique

• Anterior leaflet augmentation with annuloplasty or TV replacement should be considered in the presence of severe tethering