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Carmel Medical Center



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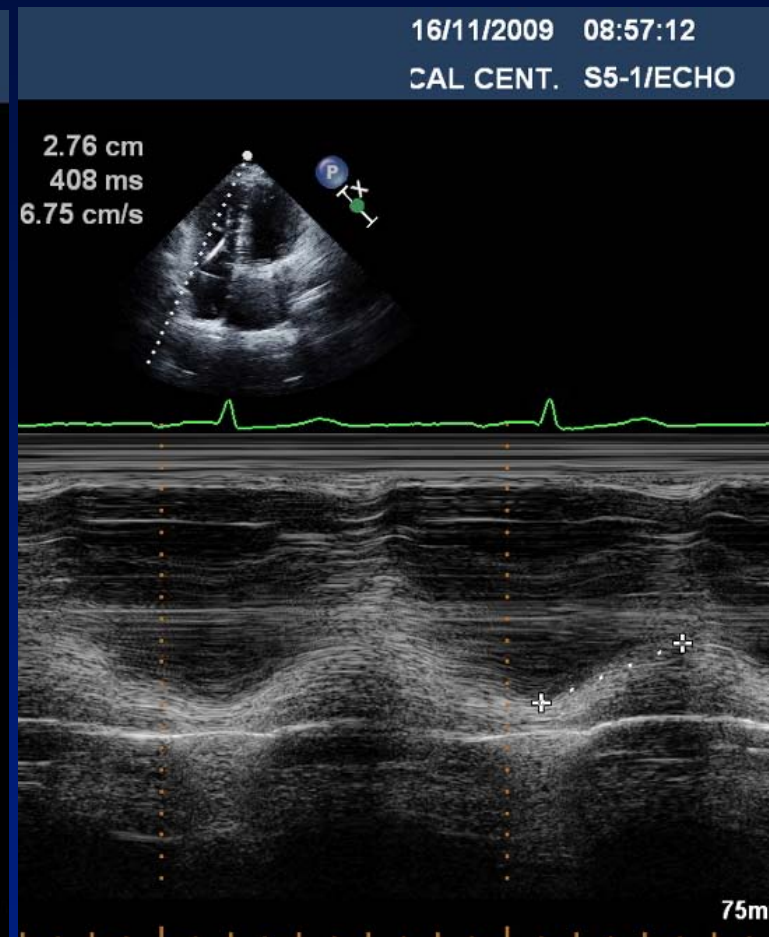
# ***The Tricuspid Valve: Not Forgotten Any More***

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‣ Director, Echocardiography  
‣ Lady Davis Carmel Medical Center, Technion IIT

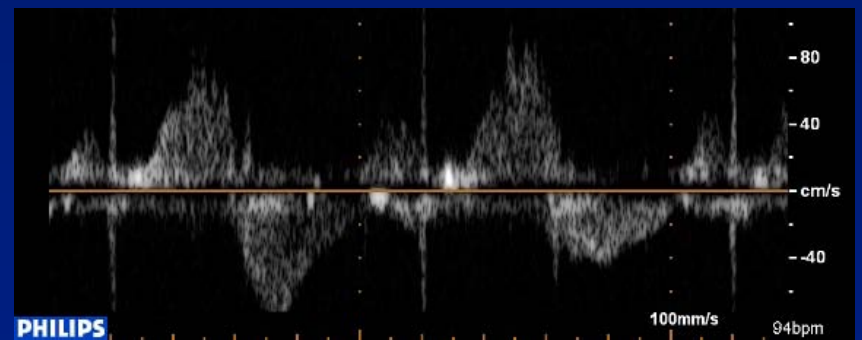
Israeli WG on Echo & Cardiac Surgery 10/2011

# Case Presentation

- ◆ 48y woman
- ◆ RHD & MS, s/p closed valvotomy @ 16y
- ◆ MVR + DDDR PM @ 45y
- ◆ Pre-op mild TR
- ◆ 5m Post-op moderate TR
- ◆ 3y post-op severe TR, no PHT
- ◆ FC 3 – effort dyspnea



TAPSE=2.8 cm

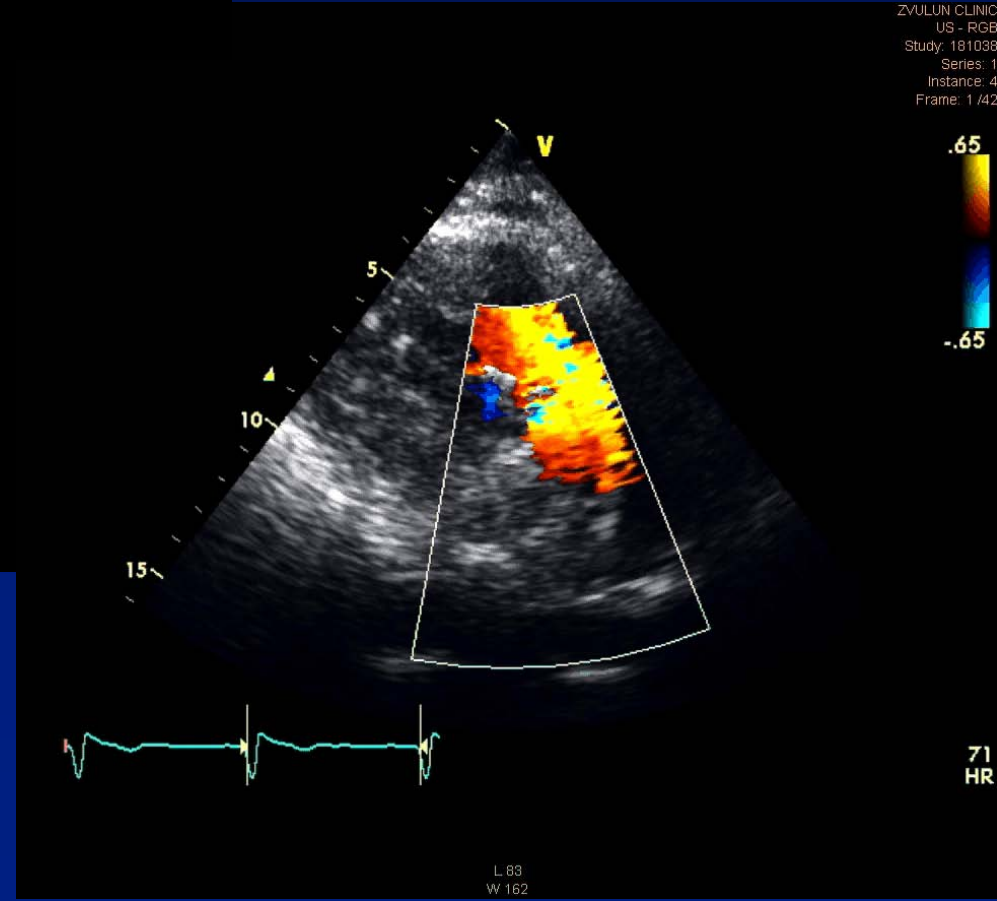


HV flow

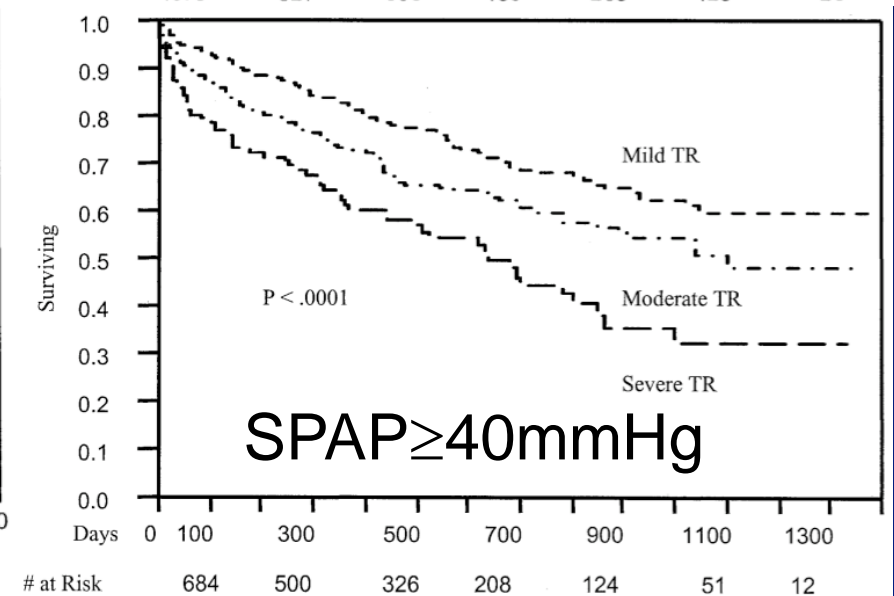
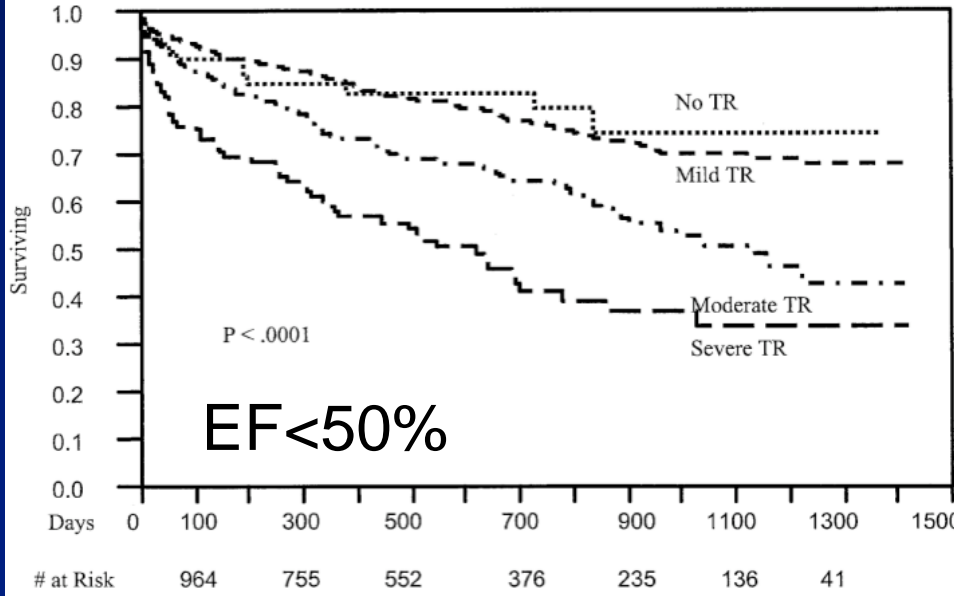
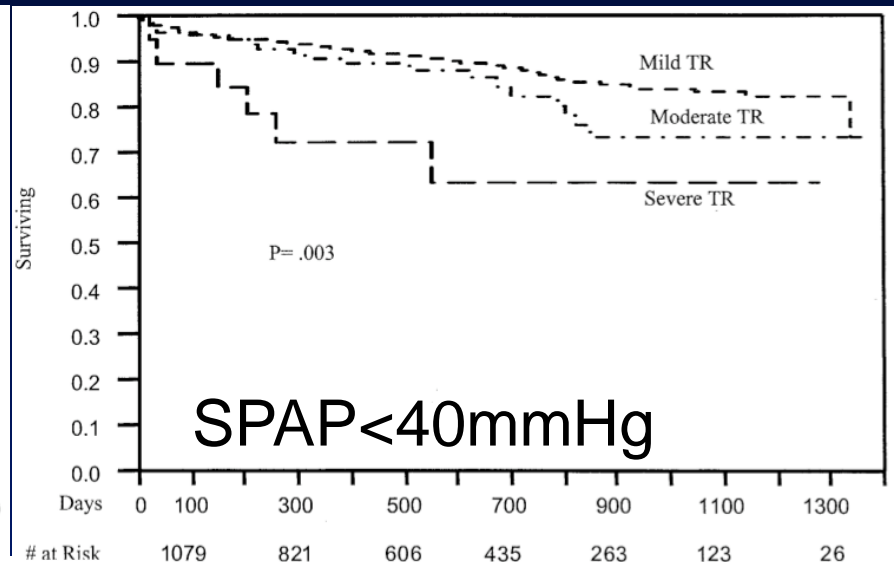
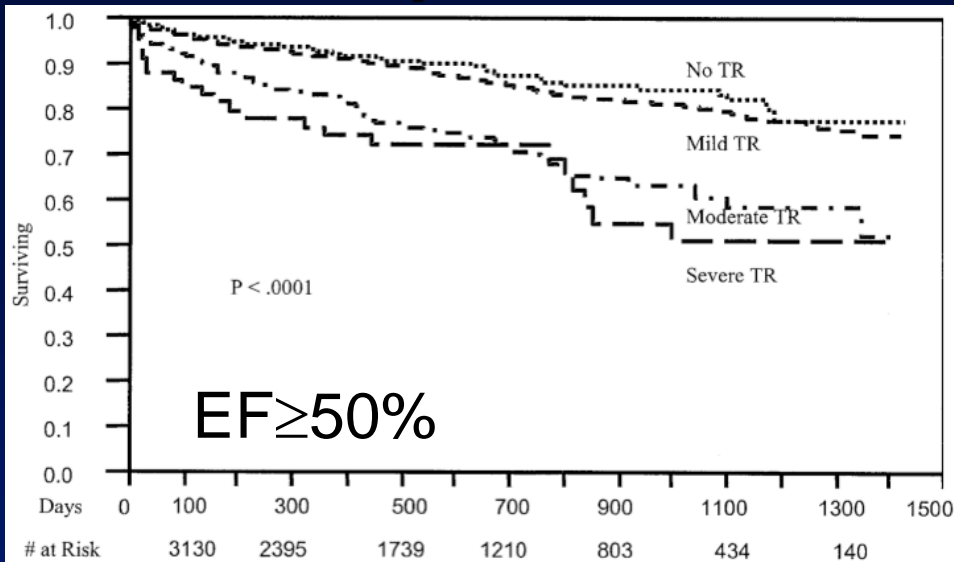
# Intra-op TEE: PM lead repositioning + TV annuloplasty (Cosgrove ring 30mm)

TTE 1.5y postop

Intraop TEE



# TR predicts survival (n=5,223)



# Late TR after MVR predicts survival & CHF

(n=708, 61% females)

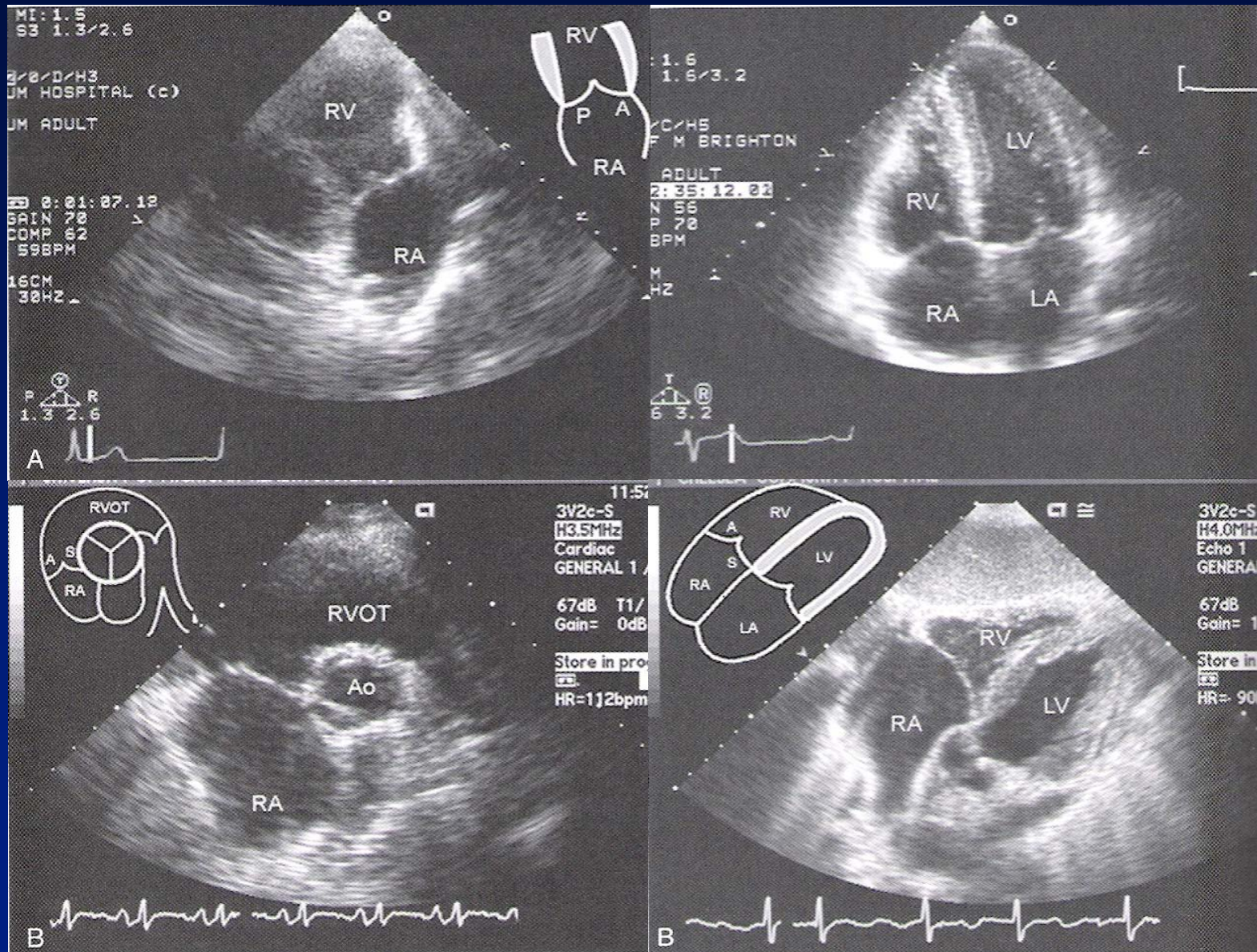
- ◆ Mod-severe TR was an independent predictor of poor outcome:
  - ◆ CHF: HR=2.5 (1.1-5.4), p=0.027
  - ◆ Death: HR=2.2 (1.3-3.6), p=0.003

# Incidence of TR

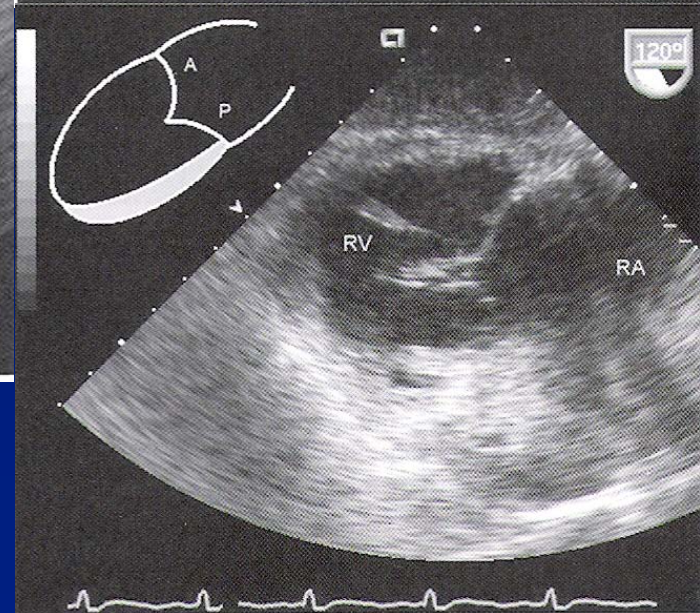
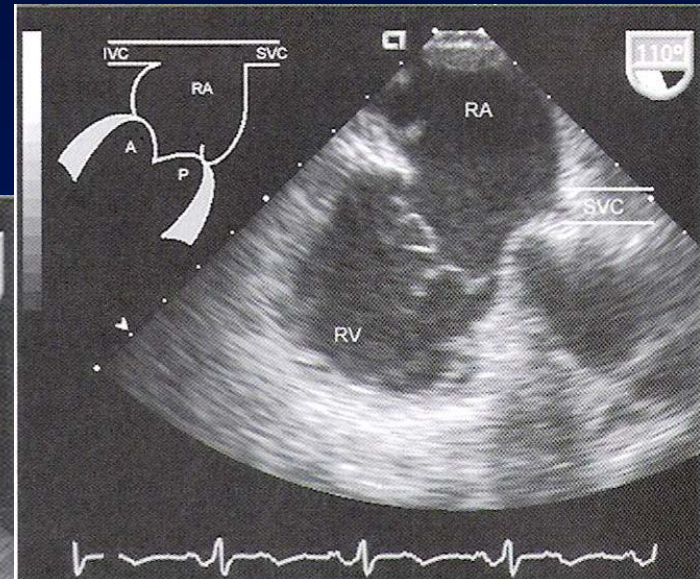
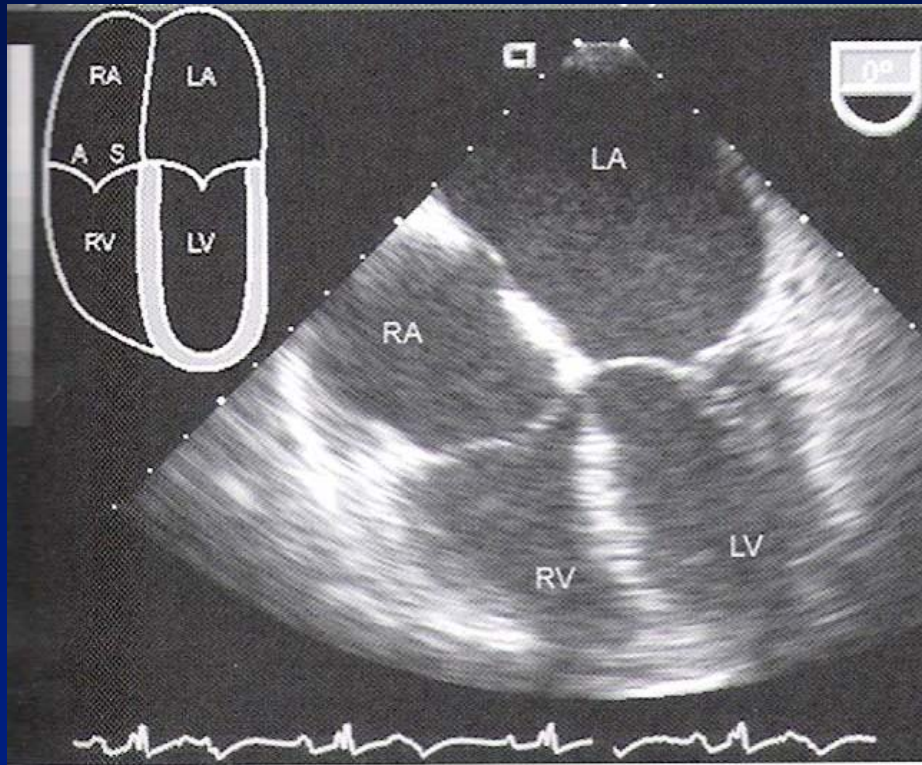
- ◆ RHD: 25%-40% severe TR post MVR  
(~10y range 1-30y)
- ◆ Ischemic MR: 75% • moderate TR  
3y post MV repair
- ◆ Degenerative MR: 15% • moderate TR



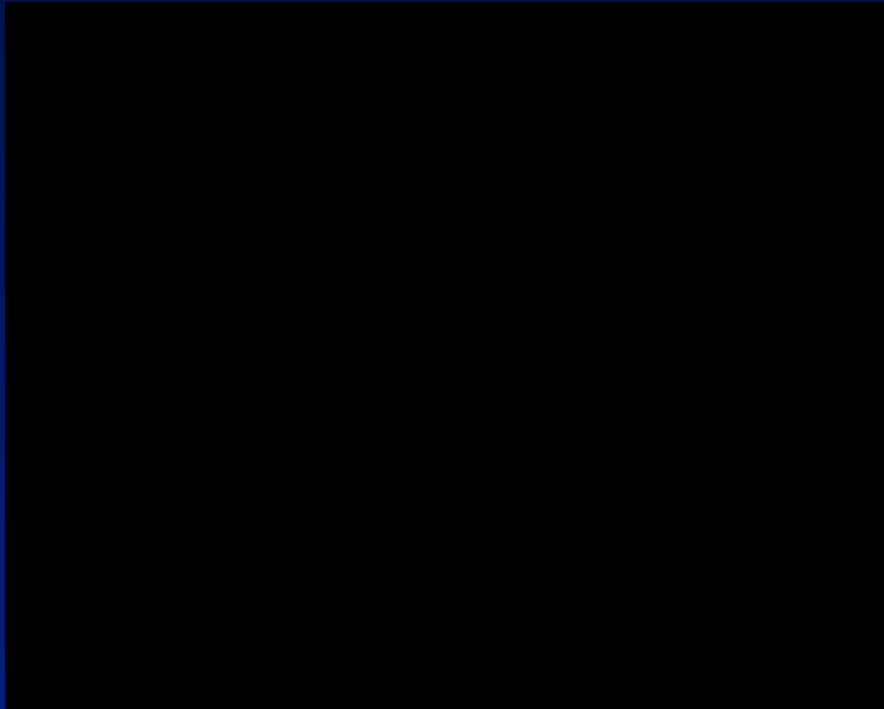
# Tricuspid Valve Anatomy - TTE



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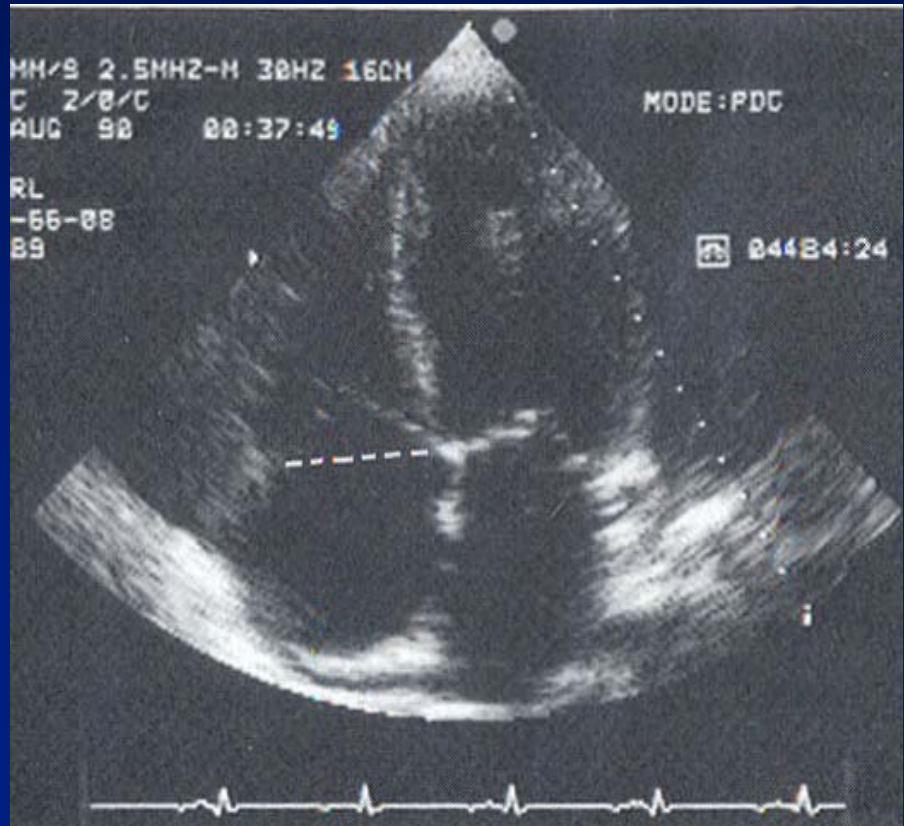
2D



Live 3D

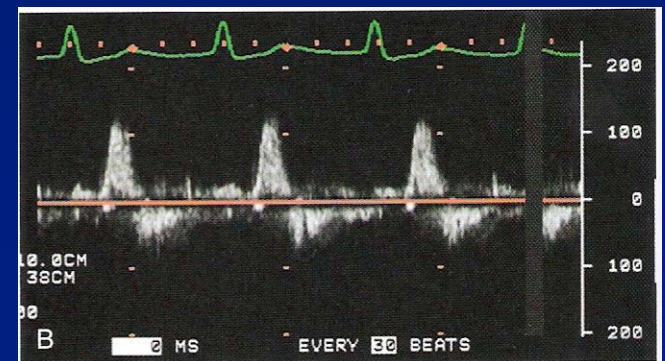
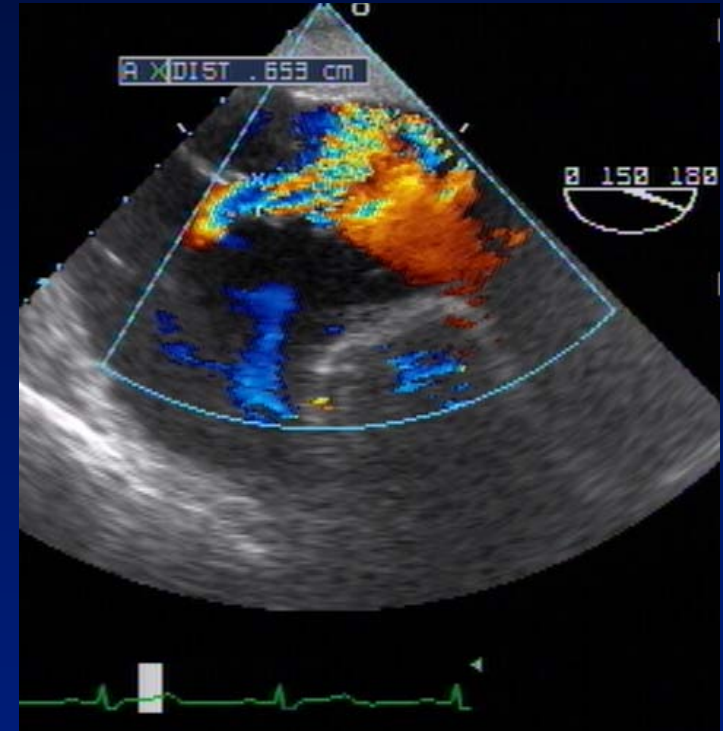
# Tricuspid Valve assessment

- ◆ Leaflets
  - ◆ Thickening, doming, restriction
  - ◆ Coaptation
  - ◆ Flail
- ◆ Annulus diameter
- ◆ Mean gradient
- ◆ RA + RV dilatation, septal flattening
- ◆ TR severity

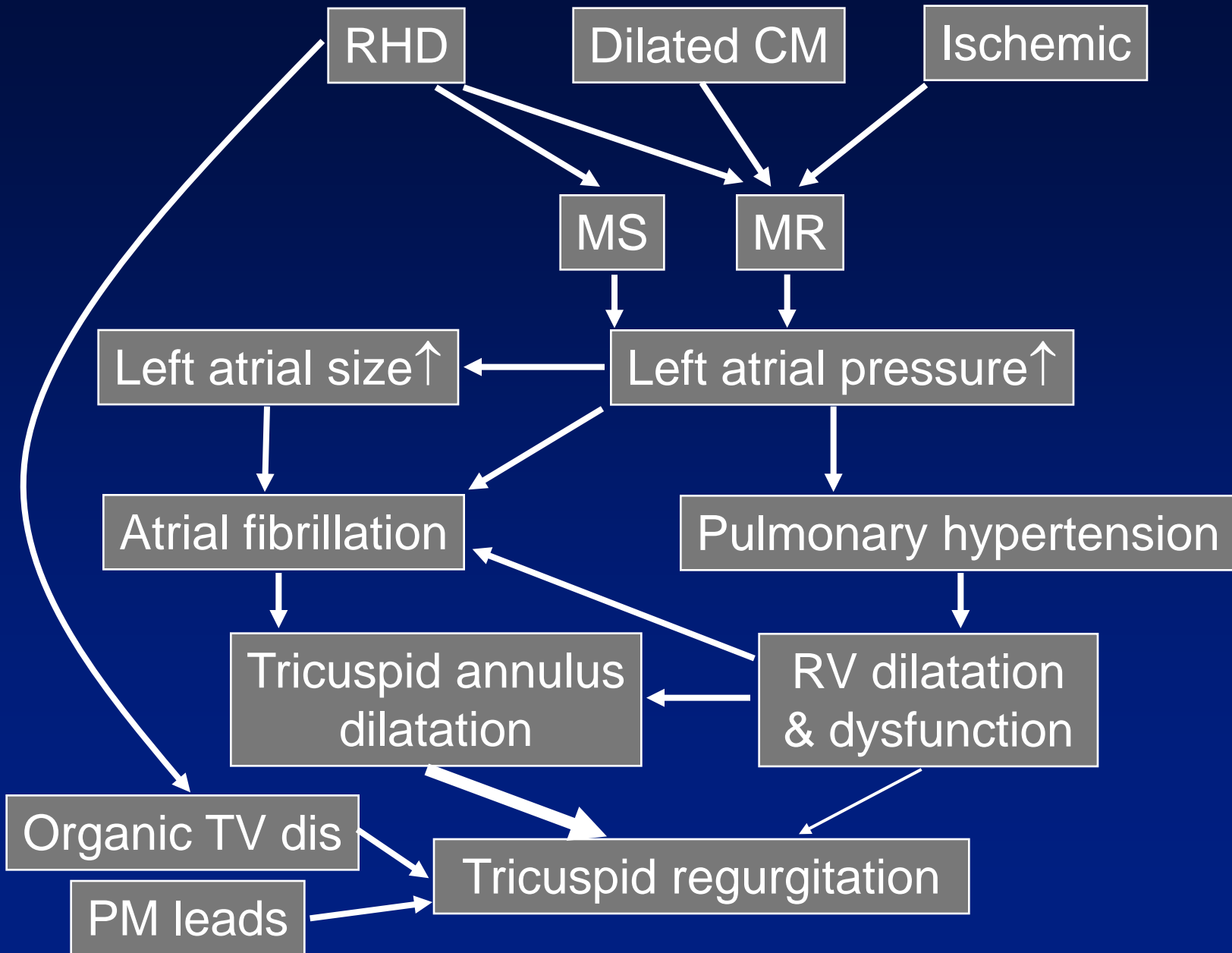


# Severe TR

- ◆ Clinical assessment
- ◆ Malcoaptation
- ◆ RV/RA/IVC – dilated
- ◆ Jet area  $> 10 \text{ cm}^2$
- ◆ Vena contracta  $> 0.7 \text{ cm}$
- ◆ PISA @  $28 \text{ cm/sec}$   
 $> 0.9 \text{ cm}$
- ◆ CW – dense, triangular
- ◆ Systolic hepatic venous flow reversal



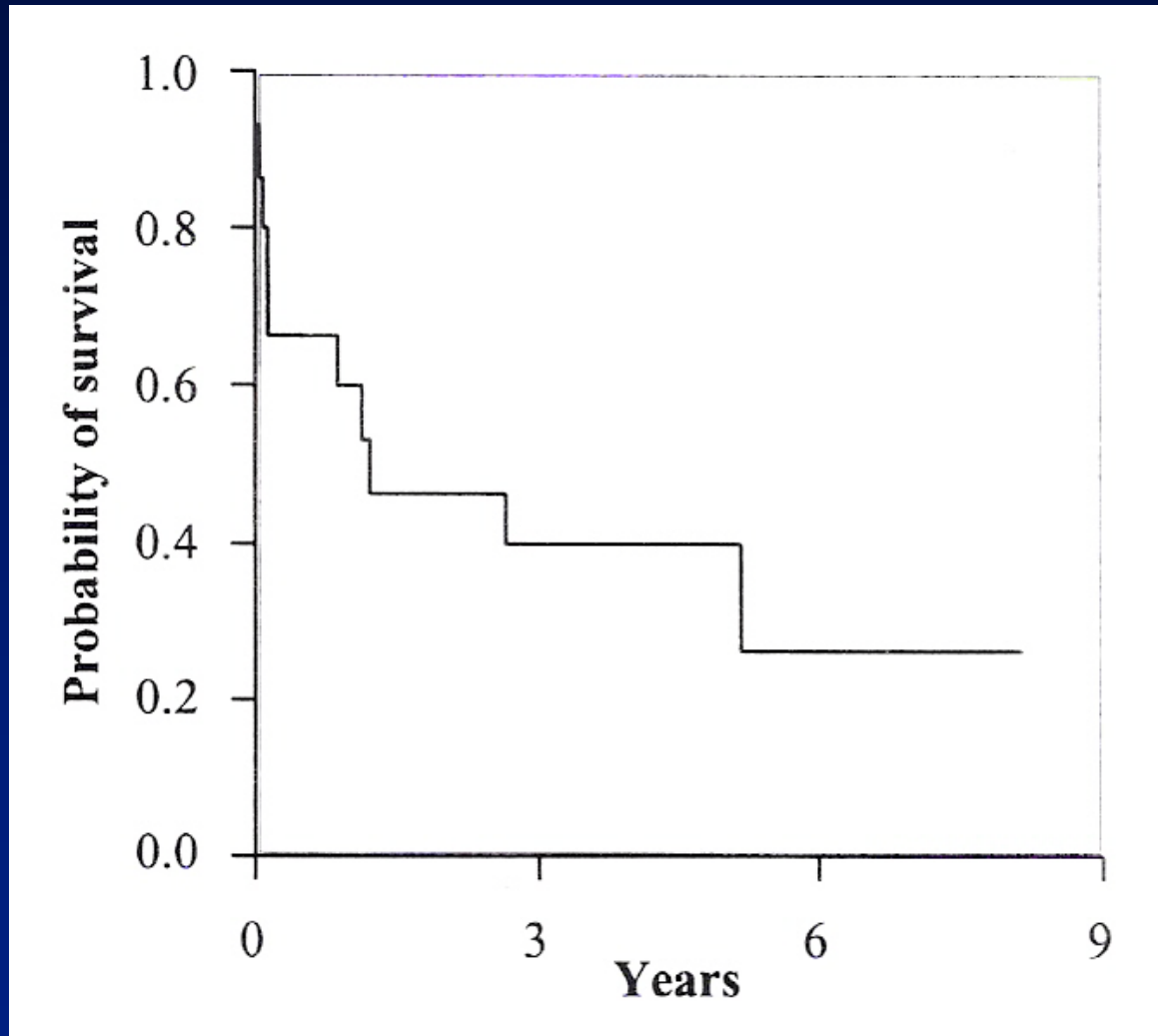
# Pathogenesis of TR in MV disease



# Outcome following isolated TVR

Survival (n=15)

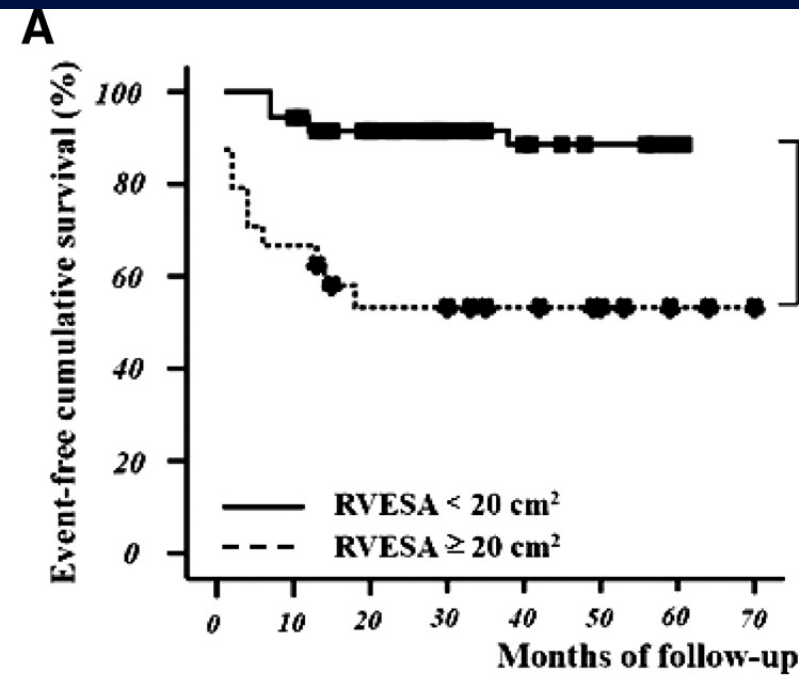
- ◆ Early death - 3p (20%)
- ◆ Median survival 1.2y



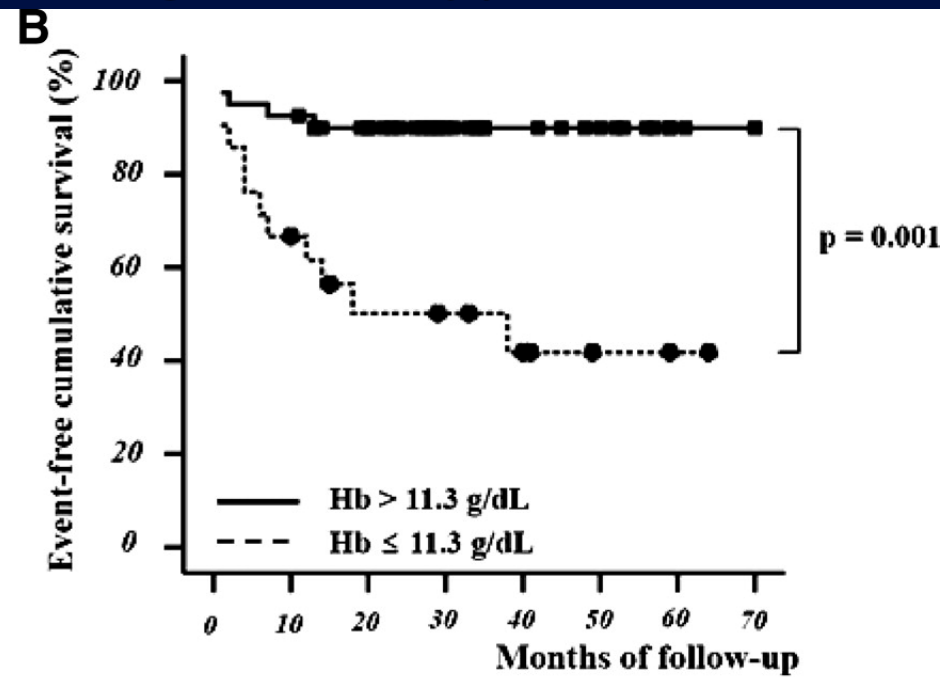
Mangoni et al (Boston), Eur J Card Thorac Sur 2000

# Isolated TR

(n=61, 54 females, age 57±9 y)



RVESA < 20 cm <sup>2</sup>	37	35	34	34	33	33	33	33
RVESA ≥ 20 cm <sup>2</sup>	24	16	13	13	13	13	13	13



Hb > 11.3 g/dL	40	37	36	36	36	36	36	36
Hb ≤ 11.3 g/dL	21	14	11	11	10	10	10	10

- ◆ Early death - 6p (10%), late death - 3p (5%)
- ◆ No control group, 87% PV, long term outcome?



# Does TR resolve after correcting the MV lesion?



TR did not improve in 49% (26/53)\* to 80% (16/20)\*\* pts with moderate or severe TR after successful mitral balloon valvulotomy

\*Hannoush et al (Riyadh), AHJ 2004

\*\*Sagie et al (Boston), J Thorac Cardiovasc Surg 1994

# Resolution of TR after PBMV

1. Younger patients
2. Non-chronic disease
3. No atrial fibrillation
4. Functional, non-organic TR
5. Severe pulmonary hypertension without RV dysfunction

# Predictors of late TR after MVR

- ◆ RHD
- ◆ Pre-op TR  $\geq 2+$
- ◆ Atrial fibrillation
- ◆ Large LA ( $>6\text{cm}$ )
- ◆ Pre-op PAP did not predict TR!

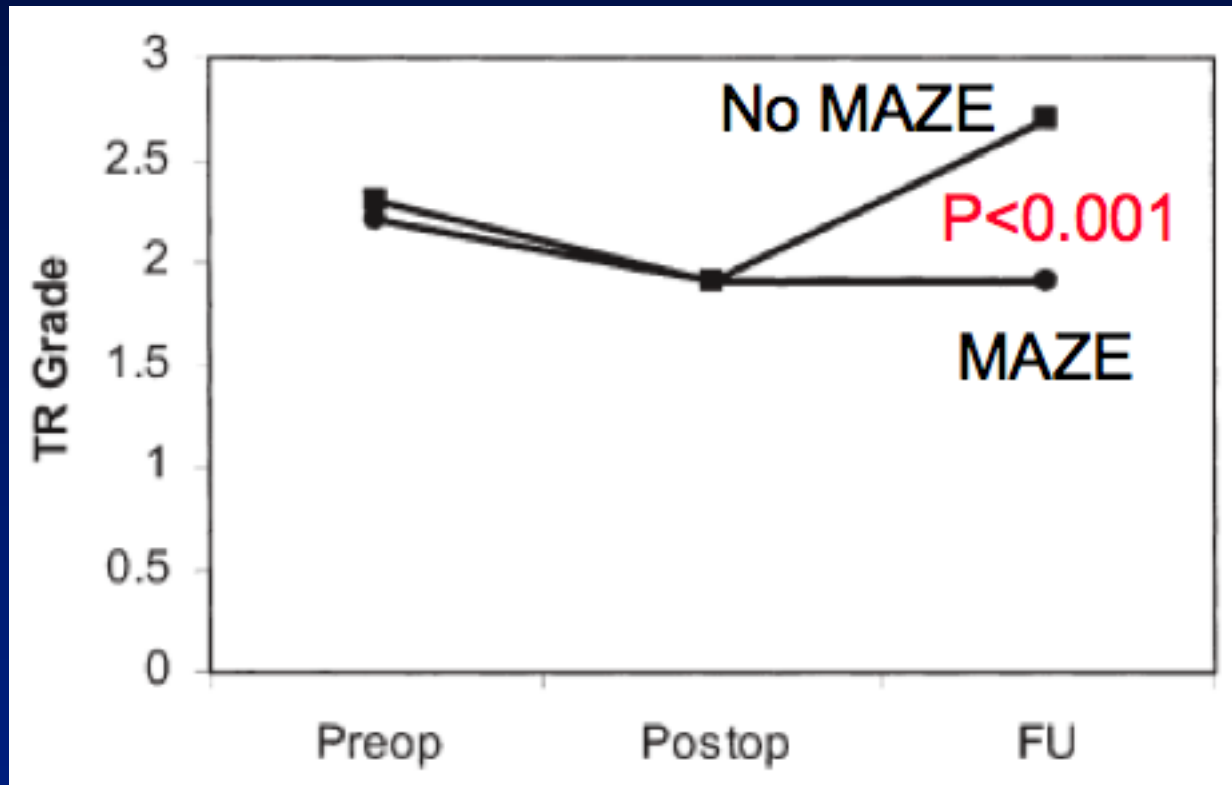
Matsuyama et al (Japan), Ann Thorac Surg 2003

Wang et al (Wuhan, China) Surg Today 2008

Kwak et al (Seoul, S.Korea), Am Heart J 2008

Song et al, (Korea), Heart 2010

# Impact of successful MAZE on TR progression after MV surgery (n=66)

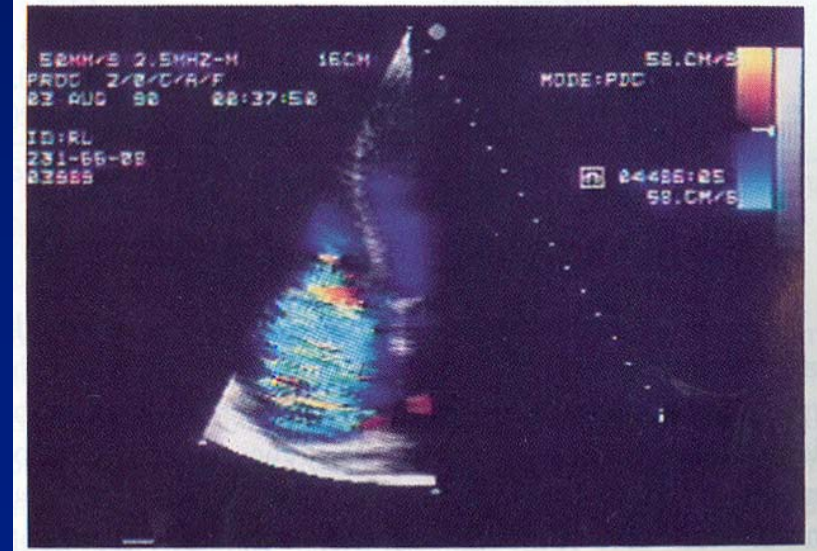
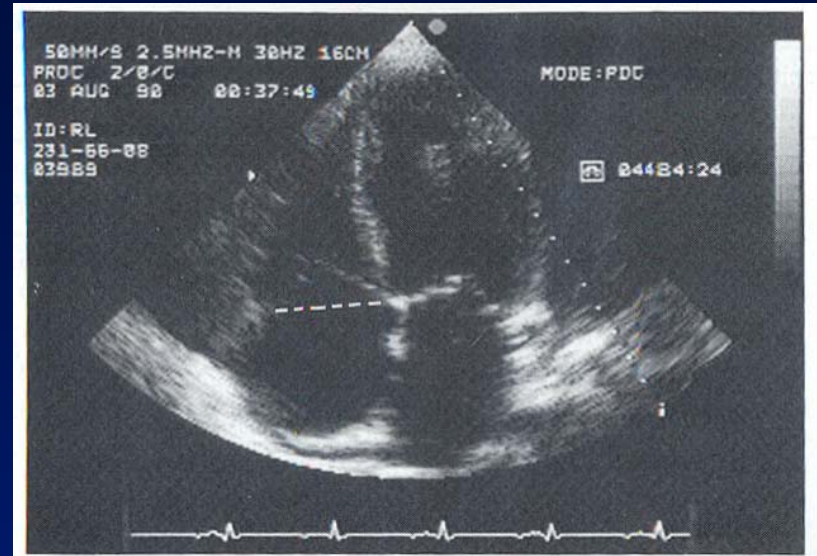


Multivariate analysis: MAZE protected against TR progression

# Tricuspid annulus diameter (TAD) and TR

## 4CV, end diastole

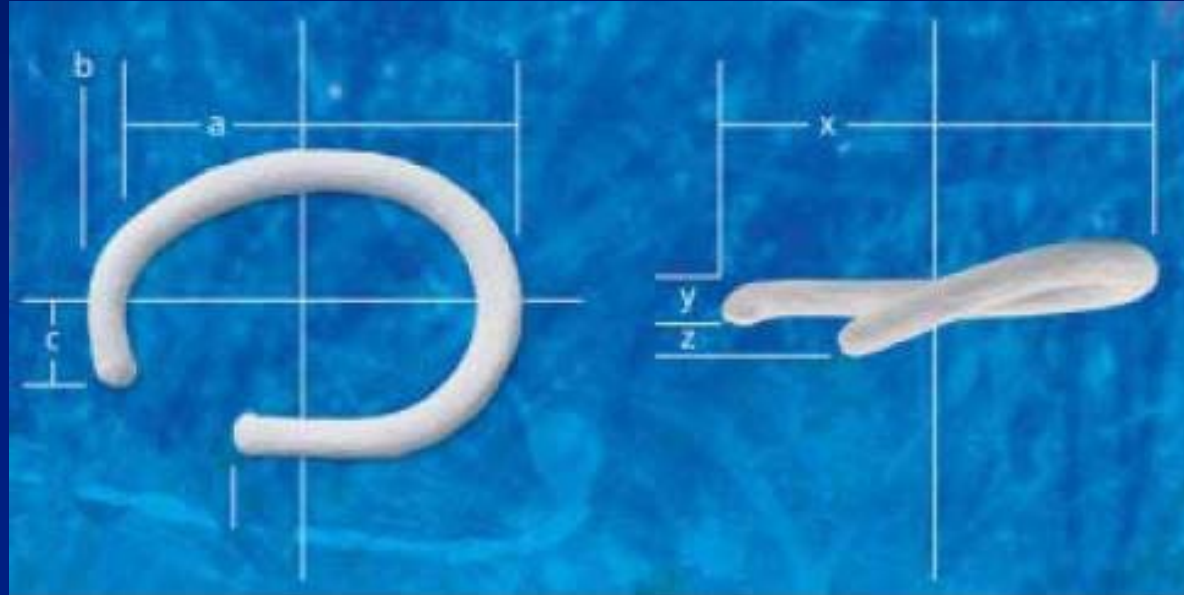
- ◆ TAD (cm)
  - ◆ Normal= 2.8, 0.5
  - ◆ TR=4.4±0.7
- ◆ TAD was the best determinant of TR (not PAP or RVD)



# Tricuspid annuloplasty

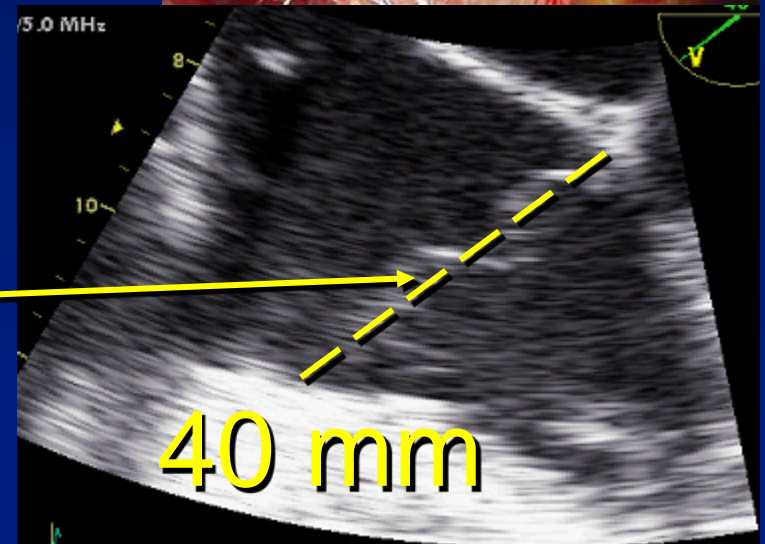
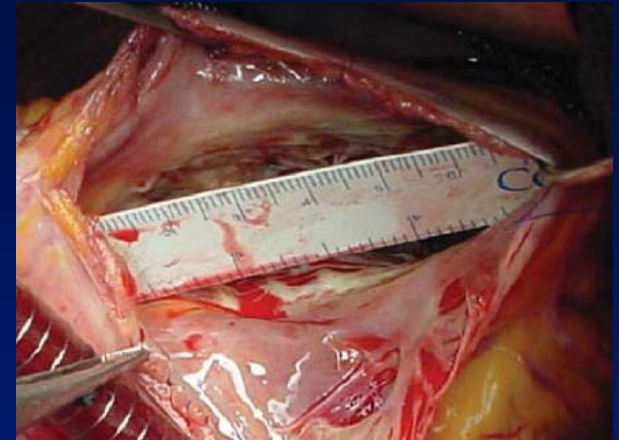
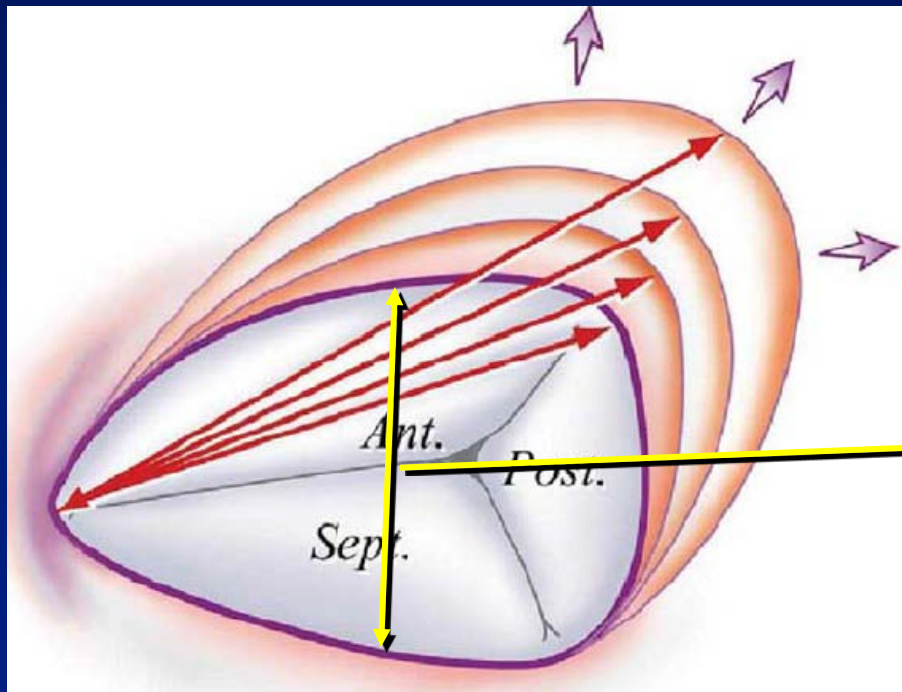
1. De Vega annuloplasty
2. Ring annuloplasty

Carpentier-Edwards semirigid tricuspid ring



# Tricuspid annuloplasty during MV repair

- ◆ 311p with MR undergoing MV repair & TV repair if intra-op TAD•7cm
- ◆  $TR \leq 1+$  in 88% of TVR group



Dreyfus et al (UK), Ann Thorac Surg 2005

# Outcome by tricuspid annuloplasty

	<b>Operative mortality</b> p=NS	<b>10y survival</b> p=NS	<b>FC 3-4*</b> p<0.001	<b>TR* +3 +4</b> P<0.01
<b>MVR+TVR</b> <b>TAD≥7cm</b> (n=148, 48%)	0.7%	90.3%	0	1 (0.7%)
<b>MVR only</b> <b>TAD&lt;7cm</b> (n=163, 52%)	1.8%	85.5%	23 (14%)	55 (34%)

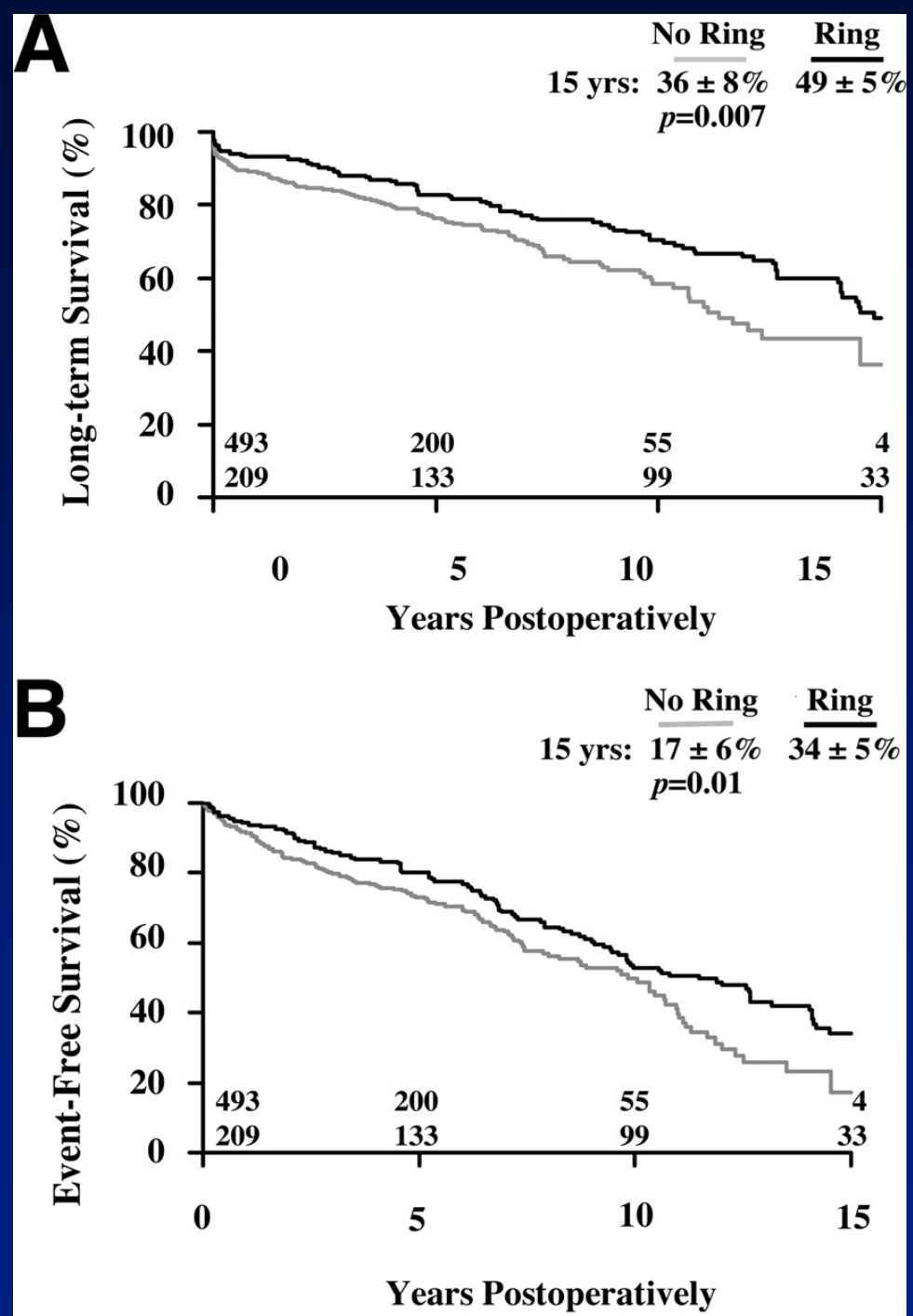
\*F/U 5, 3y

Dreyfus et al (UK), Ann Thorac Surg 2005

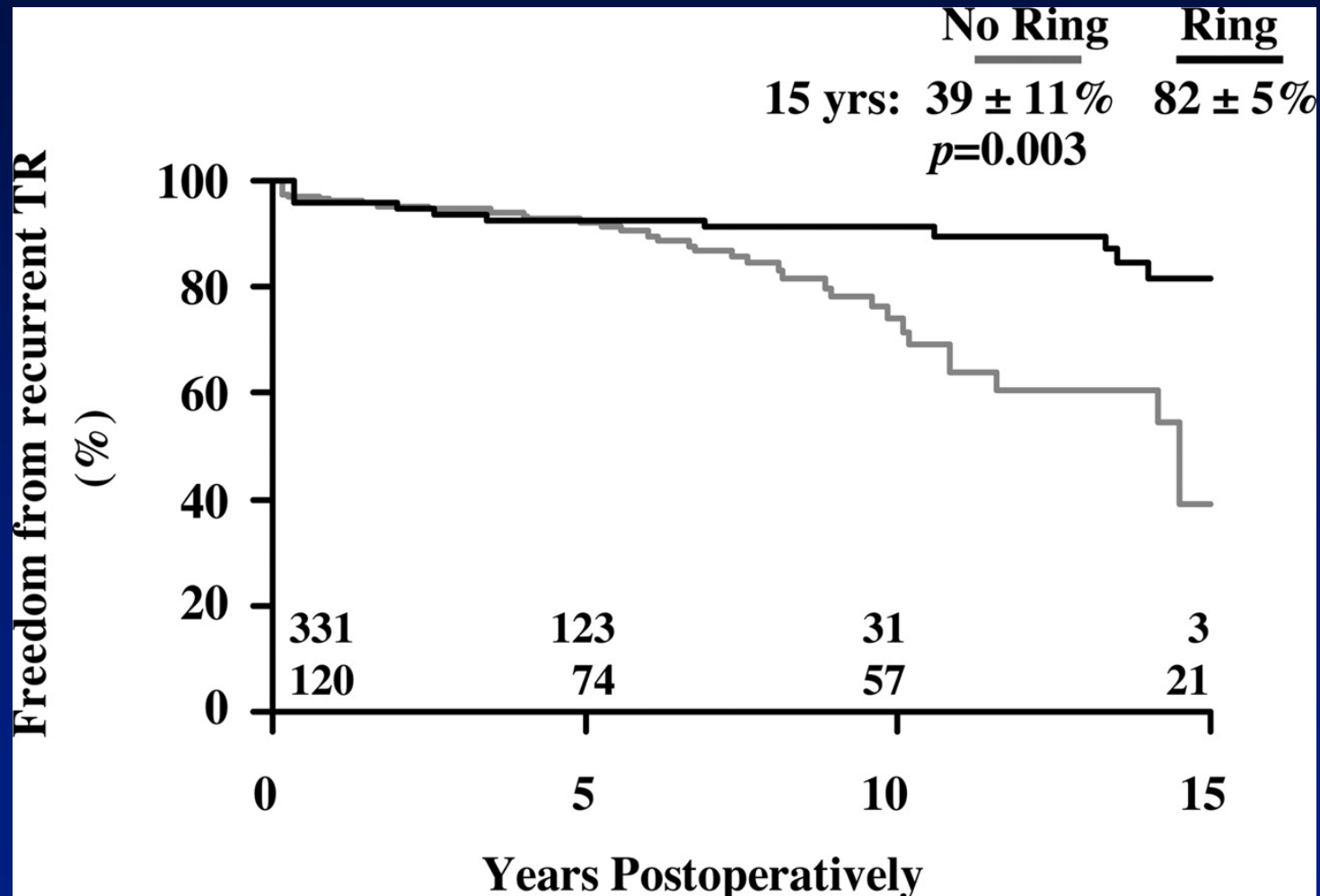


# TV annuloplasty with a ring improves survival compared to De Vega annuloplasty (n=702)

Tang et al (Toronto), Circ 2006



# Recurrent TR after ring annuloplasty (n=451)



# ACC/AHA 2008 guidelines for TV surgery

## Class I

Tricuspid valve repair is beneficial for severe TR in patients with MV disease requiring MV surgery. (*Level of Evidence: B*)

## Class IIa

1. Tricuspid valve replacement or annuloplasty is reasonable for severe primary TR when symptomatic. (*Level of Evidence: C*)
2. Tricuspid valve replacement is reasonable for severe TR secondary to diseased/abnormal tricuspid valve leaflets not amenable to annuloplasty or repair. (*Level of Evidence: C*)

## Class IIb

Tricuspid annuloplasty may be considered for less than severe TR in patients undergoing MV surgery when there is pulmonary hypertension or tricuspid annular dilatation. (*Level of Evidence: C*)

# ESC 2007 Guidelines for TV surgery

**Table 14** Indications for intervention in tricuspid valve disease

	Class
Severe TR in a patient undergoing left-sided valve surgery	IC
Severe primary TR and symptoms despite medical therapy without severe right ventricular dysfunction	IC
Severe TS ( $\pm$ TR), with symptoms despite medical therapy <sup>a</sup>	IC
Severe TS ( $\pm$ TR) in a patient undergoing left-sided valve intervention <sup>a</sup>	IC
Moderate organic TR in a patient undergoing left-sided valve surgery	IIaC
Moderate secondary TR with dilated annulus ( $>40$ mm) in a patient undergoing left-sided valve surgery	IIaC
Severe TR and symptoms, after left-sided valve surgery, in the absence of left-sided myocardial, valve, or right ventricular dysfunction and without severe pulmonary hypertension (systolic pulmonary artery pressure $> 60$ mmHg)	IIaC
Severe isolated TR with mild or no symptoms and progressive dilation or deterioration of right ventricular function	IIbC

# Summary

1. Moderate or severe TR predicts CHF & death, especially after MVR
2. Late TR after MV surgery without TVR is common in RHD (~40%) and may appear years (~10y) after MV surgery
3. Late TR is also common in ischemic MR but less common in degenerative MR
4. Preoperative TR predicts poor prognosis and may not resolve after MV surgery

# Summary

4. Most commonly, late TR is functional and isolated, secondary to tricuspid annulus dilatation ( $\pm$ rheumatic)
5. TV ring annuloplasty should be performed at the time of the initial MV surgery. **Avoid late surgery!**
6. Select patients for TV repair based on etiology, presence of AF, >mild pre-op TR, tricuspid annulus diameter  $\geq 3.5$  cm\* and LA $\uparrow\uparrow$ . Consider concomitant MAZE in AF