

Valvular Regurgitation

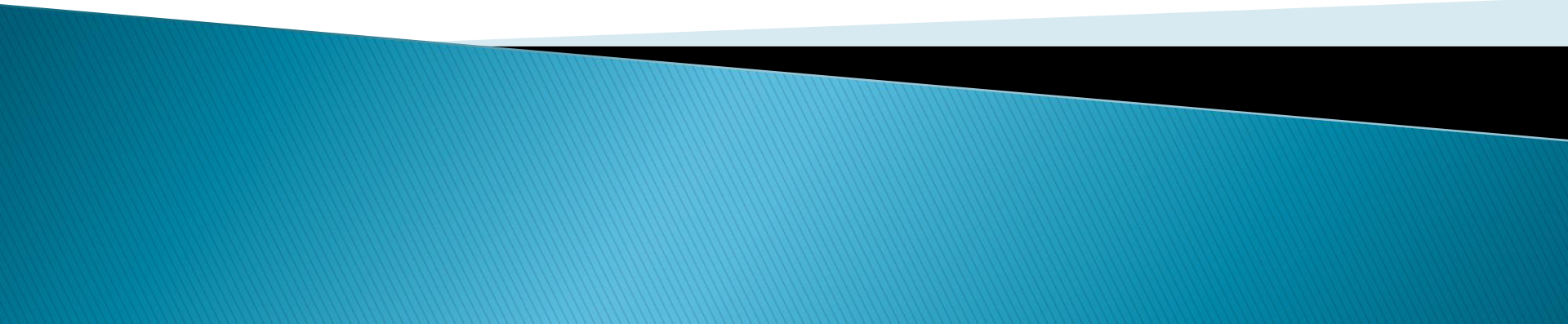


Table 6 Management of coronary artery disease in patients with valvular heart disease

	Class ^a	Level ^b
Diagnosis of coronary artery disease		
Coronary angiography ^c is recommended before valve surgery in patients with severe valvular heart disease and any of the following: <ul style="list-style-type: none">• history of coronary artery disease• suspected myocardial ischaemia^d• left ventricular systolic dysfunction• in men aged over 40 years and postmenopausal women• ≥1 cardiovascular risk factor.	I	C
Coronary angiography is recommended in the evaluation of secondary mitral regurgitation.	I	C
Indications for myocardial revascularization		
CABG is recommended in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥70%. ^e	I	C
CABG should be considered in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥50–70%.	IIa	C

CABG = coronary artery bypass grafting.
^aClass of recommendation.
^bLevel of evidence.
^cMulti-slice computed tomography may be used to exclude coronary artery disease in patients who are at low risk of atherosclerosis.
^dChest pain, abnormal non-invasive testing.
^e≥50% can be considered for left main stenosis.
Adapted from Wijns et al.²⁰

Table 8 Indications for surgery in (A) severe aortic regurgitation and (B) aortic root disease (whatever the severity of aortic regurgitation)

	Class ^a	Level ^b	Ref ^c
A. Indications for surgery in severe aortic regurgitation			
Surgery is Indicated in symptomatic patients.	I	B	59
Surgery is Indicated in asymptomatic patients with resting LVEF ≤50%.	I	B	71
Surgery is Indicated in patients undergoing CABG or surgery of ascending aorta, or on another valve.	I	C	
Surgery should be considered in asymptomatic patients with resting EF >50% with severe LV dilatation: LVEDD >70 mm, or LVESD >50 mm or LVESD >25 mm/m ² BSA. ^d	IIa	C	
B. Indications for surgery in aortic root disease (whatever the severity of AR)			
Surgery is Indicated in patients who have aortic root disease with maximal ascending aortic diameter ^e ≥50 mm for patients with Marfan syndrome.	I	C	
Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter: ≥45 mm for patients with Marfan syndrome with risk factors ^f ≥50 mm for patients with bicuspid valve with risk factors ^g ≥55 mm for other patients	IIa	C	

AR = aortic regurgitation; BSA = body surface area; CABG = coronary artery bypass grafting; EF = ejection fraction; LV = left ventricular; LVEDD = left ventricular end-diastolic diameter; LVESD = left ventricular end-systolic diameter.

^aClass of recommendation.

^bLevel of evidence.

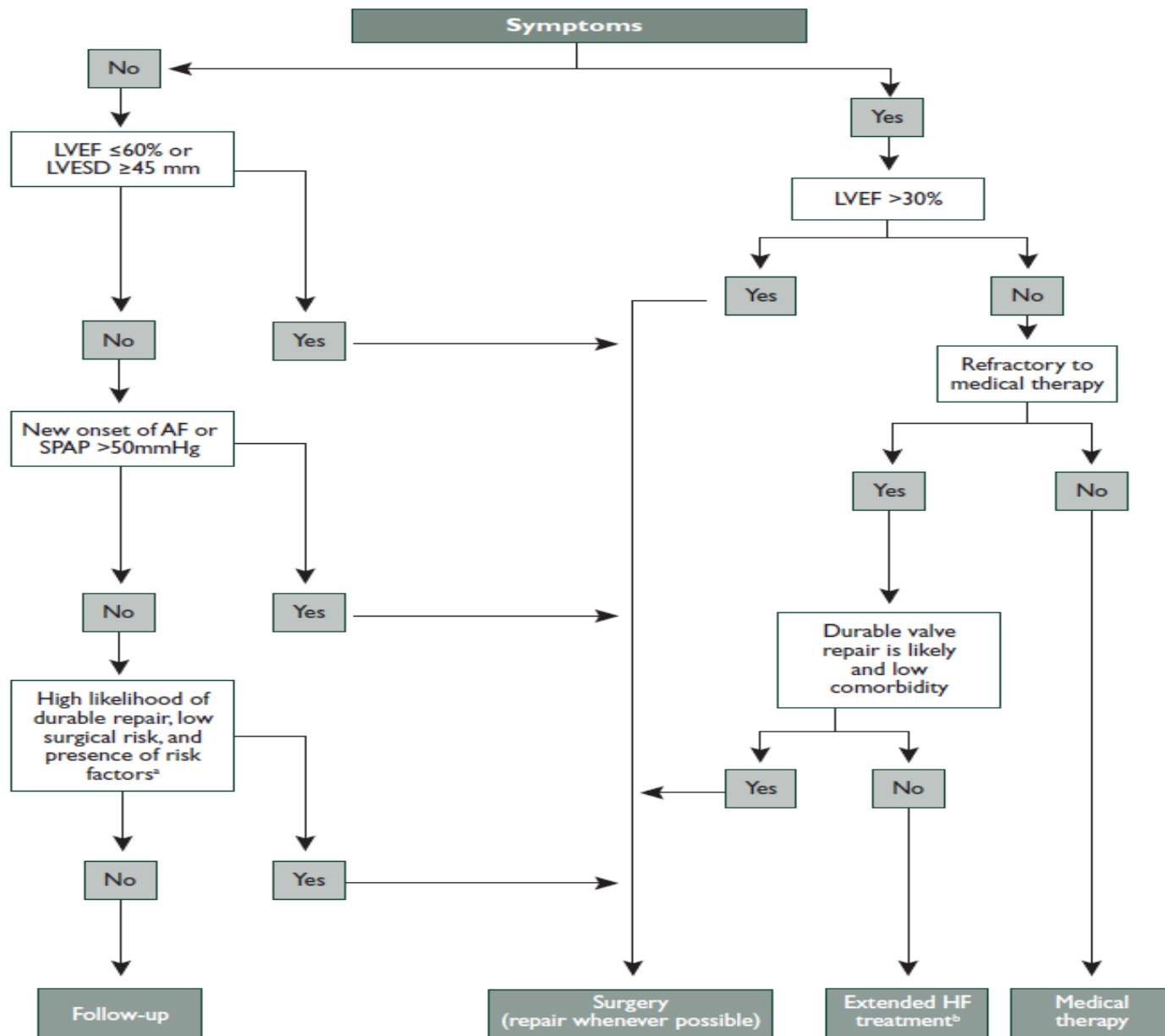
^cReference(s) supporting class I (A + B) and IIa + IIb (A + B) recommendations.

^dChanges in sequential measurements should be taken into account.

^eDecision should also take into account the shape of the different parts of the aorta. Lower thresholds can be used for combining surgery on the ascending aorta for patients who have an indication for surgery on the aortic valve.

^fFamily history of aortic dissection and/or aortic size increase >2 mm/year (on repeated measurements using the same imaging technique, measured at the same aorta level with side-by-side comparison and confirmed by another technique), severe AR or mitral regurgitation, desire of pregnancy.

^gCoarctation of the aorta, systemic hypertension, family history of dissection or increase in aortic diameter >2 mm/year (on repeated measurements using the same imaging technique, measured at the same aorta level with side-by-side comparison and confirmed by another technique).



AF = atrial fibrillation; BSA = body surface area; HF = heart failure; FU = follow-up; LA = left atrium; LV = left ventricle; LVEF = left ventricular ejection fraction; LVESD = left ventricular end-systolic diameter; SPAP = systolic pulmonary arterial pressure.

^aWhen there is a high likelihood of durable valve repair at a low risk, valve repair should be considered (IIaC) in patients with flail leaflet and LVESD ≥40 mm; valve repair may be considered (IIbC) if one of the following is present: LA volume ≥60 mL/m² BSA and sinus rhythm or pulmonary hypertension on exercise (SPAP ≥60 mmHg).

^bExtended HF management includes the following: cardiac resynchronization therapy; ventricular assist devices; cardiac restraint devices; heart transplantation.

Figure 3 Management of severe chronic primary mitral regurgitation.

Table 13 Indications for mitral valve surgery in chronic secondary mitral regurgitation

	Class ^a	Level ^b
Surgery is indicated in patients with severe MR ^c undergoing CABG, and LVEF >30%.	I	C
Surgery should be considered in patients with moderate MR undergoing CABG. ^d	IIa	C
Surgery should be considered in symptomatic patients with severe MR, LVEF <30%, option for revascularization, and evidence of viability.	IIa	C
Surgery may be considered in patients with severe MR, LVEF >30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have low comorbidity, when revascularization is not indicated.	IIb	C

CABG = coronary artery bypass grafting; CRT = cardiac resynchronization therapy; LVEF = left ventricular ejection fraction; MR = mitral regurgitation; SPAP = systolic pulmonary artery pressure.

^aClass of recommendation.

^bLevel of evidence.

^cThe thresholds for severity (EROA ≥ 20 mm²; R Vol >30 ml) differ from that of primary MR and are based on the prognostic value of these thresholds to predict poor outcome: see Table 5.¹⁷

^dWhen exercise echocardiography is feasible, the development of dyspnoea and increased severity of MR associated with pulmonary hypertension are further incentives to surgery.

	Class ^a	Level ^b
Surgery is indicated in symptomatic patients with severe TS. ^c	I	C
Surgery is indicated in patients with severe TS undergoing left-sided valve intervention. ^d	I	C
Surgery is indicated in patients with severe primary or secondary TR undergoing left-sided valve surgery.	I	C
Surgery is indicated in symptomatic patients with severe isolated primary TR without severe right ventricular dysfunction.	I	C
Surgery should be considered in patients with moderate primary TR undergoing left-sided valve surgery.	IIa	C
Surgery should be considered in patients with mild or moderate secondary TR with dilated annulus (≥ 40 mm or >21 mm/m ²) undergoing left-sided valve surgery.	IIa	C
Surgery should be considered in asymptomatic or mildly symptomatic patients with severe isolated primary TR and progressive right ventricular dilatation or deterioration of right ventricular function.	IIa	C
After left-sided valve surgery, surgery should be considered in patients with severe TR who are symptomatic or have progressive right ventricular dilatation/dysfunction, <i>in the absence of left-sided valve dysfunction, severe right or left ventricular dysfunction, and severe pulmonary vascular disease.</i>	IIa	C

PMC = percutaneous mitral commissurotomy; TR = tricuspid regurgitation;
TS = tricuspid stenosis

^aClass of recommendation.

^bLevel of evidence.

^cPercutaneous balloon valvuloplasty can be attempted as a first approach if TS is isolated.

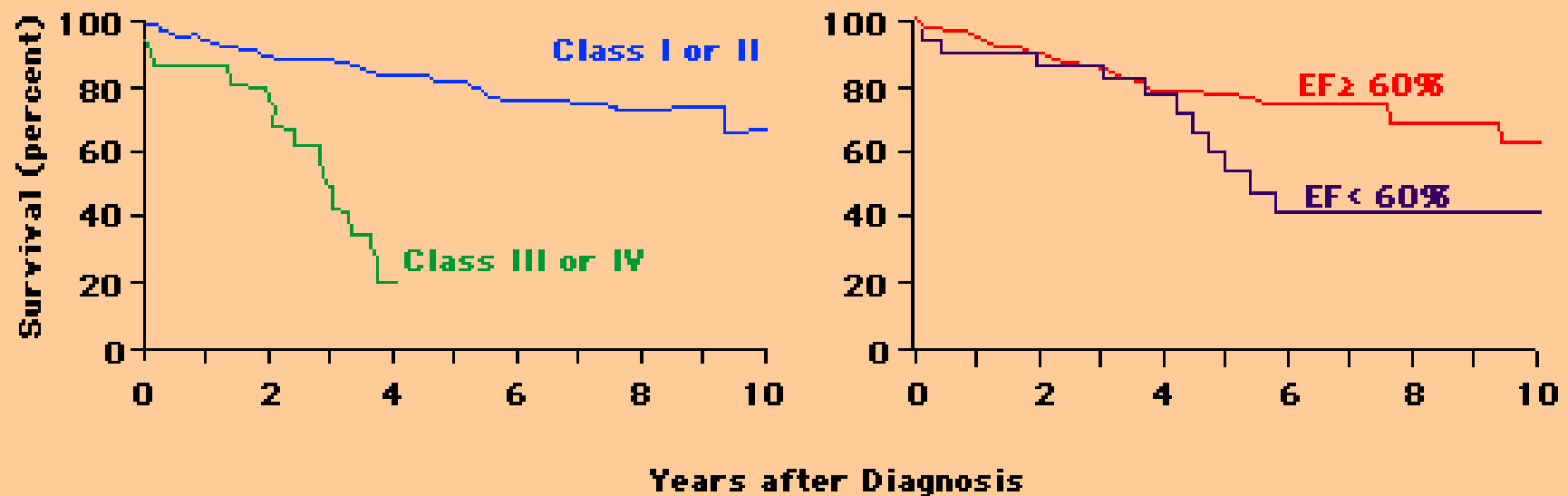
^dPercutaneous balloon valvuloplasty can be attempted if PMC can be performed

Incidence of complications of MR

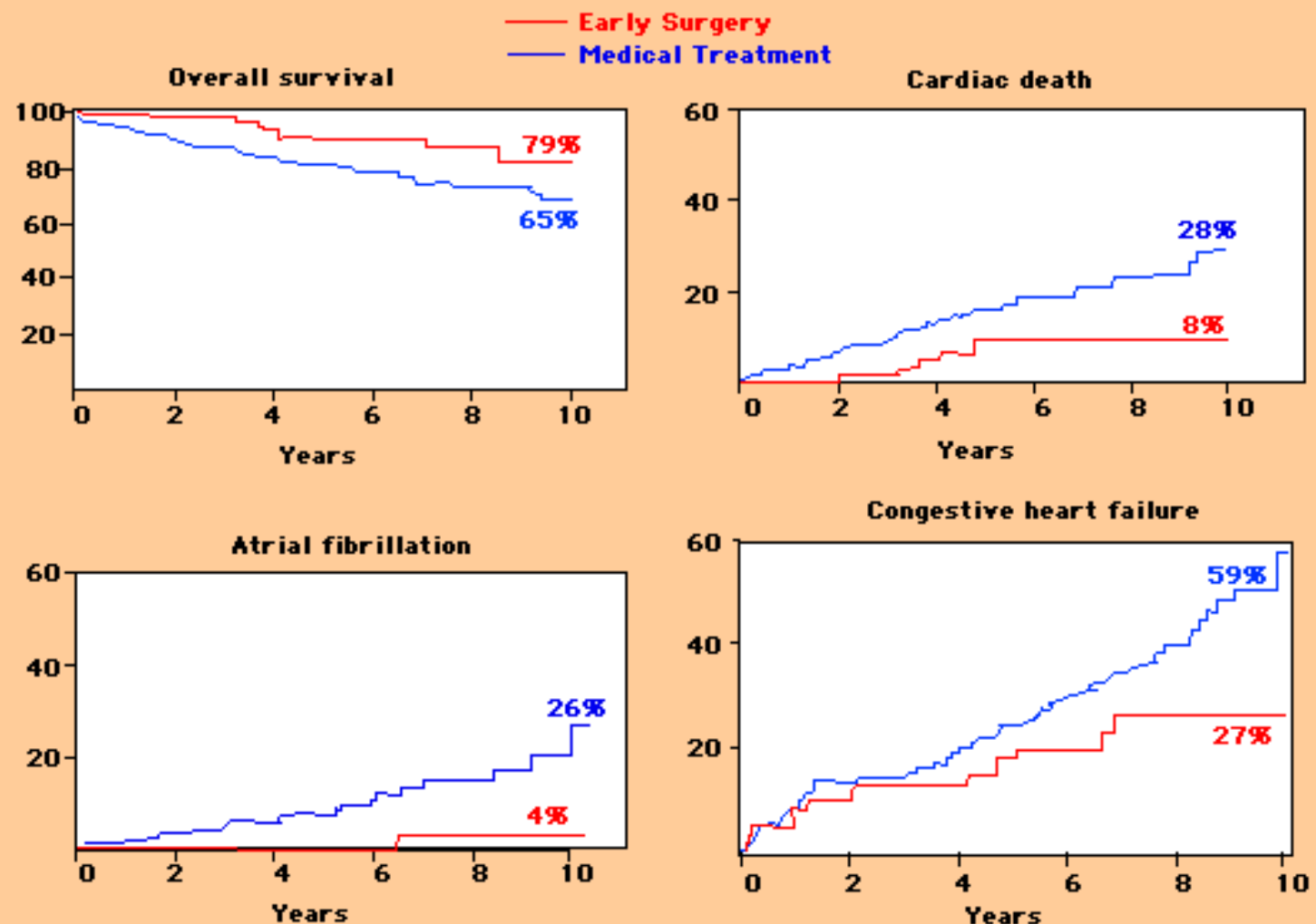


Complications resulting from mitral regurgitation The incidence of complications, including atrial fibrillation, congestive heart failure, chordal rupture, infective endocarditis, the need for mitral valve replacement, cerebral embolism, and cardiac death is directly related to the severity of mitral regurgitation in 229 patients with mitral valve prolapse. (Data from Kim, S, Kuroda, T, Nishinaga, M, et al, Am Heart J 1996; 132:348.)

Long term follow up after severe MR



Long-term survival in flail mitral leaflet Among 229 patients with isolated mitral regurgitation due to a flail mitral leaflet, long term survival was related to NYHA class (left panel) and left ventricular ejection fraction (EF) (right panel). Mortality was higher in patients with poor left ventricular function as indicated by more significant clinical heart failure (class III or IV) and lower EF (< 60 percent). (Redrawn from Ling, LH, Enriquez-Sarano, M, Steward, JB, et al. N Engl J Med 1996; 335:1417).



Early surgery for flail mitral leaflets improves outcome Early surgery for flail mitral leaflets may improve outcomes as compared to conservative therapy. Among 221 with mitral regurgitation due to a flail leaflet who were eligible for surgery, 63 underwent early mitral valve surgery while 158 were treated medically. Compared to medical therapy, early surgery was associated with a higher overall survival ($p=0.028$), lower cardiac mortality ($p=0.025$), lower incidence of atrial fibrillation ($p=0.032$), and a lower incidence of congestive heart failure ($p=0.046$).

Table 8 Indications for surgery in severe chronic organic mitral regurgitation

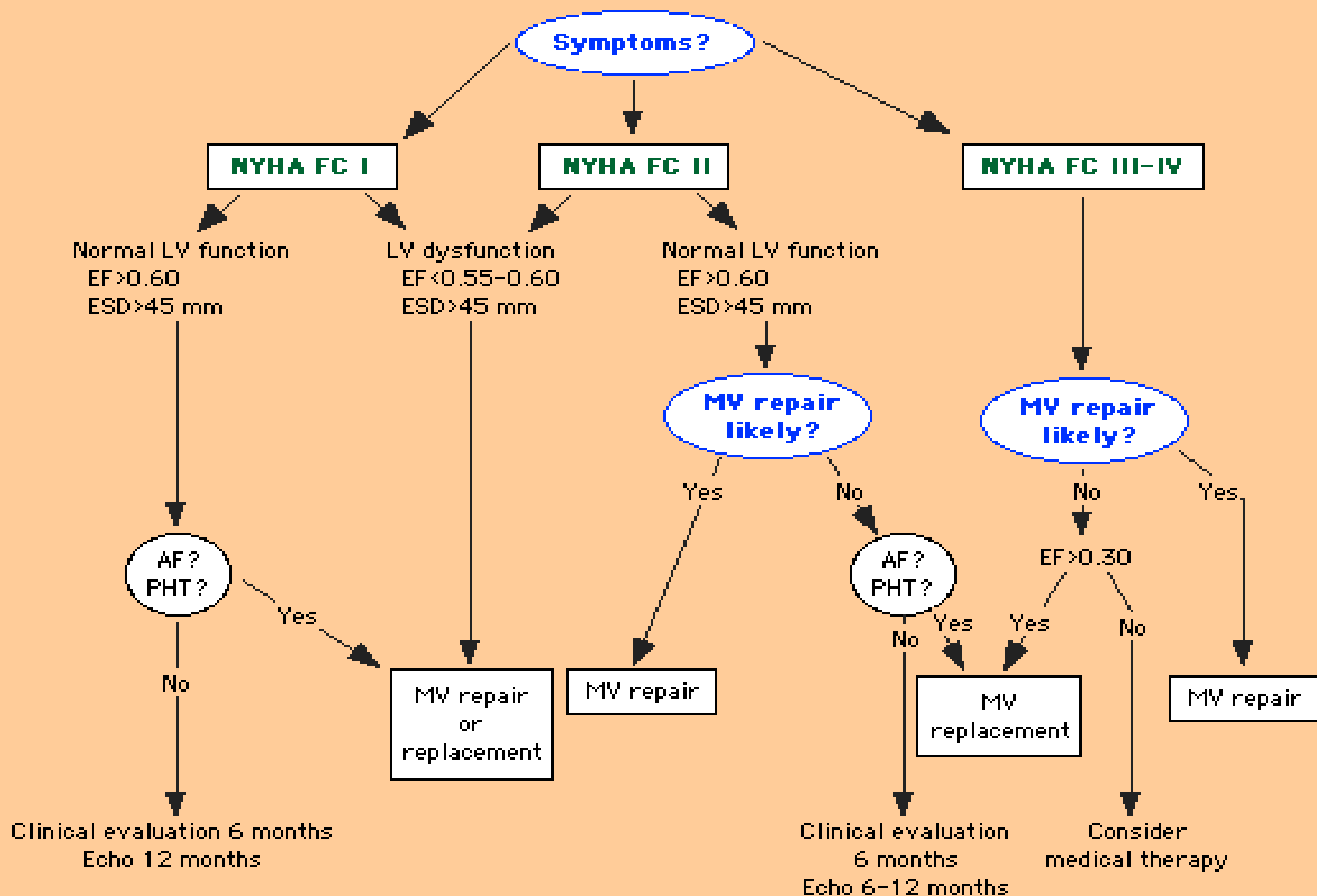
	Class
Symptomatic patients with LVEF $> 30\%$ and ESD < 55 mm	IB
Asymptomatic patients with LV dysfunction (ESD > 45 mm ^a and/or LVEF $\leq 60\%$)	IC
Asymptomatic patients with preserved LV function and atrial fibrillation or pulmonary hypertension (systolic pulmonary artery pressure > 50 mmHg at rest)	IIaC
Patients with severe LV dysfunction (LVEF $< 30\%$ and/or ESD > 55 mm) ^a refractory to medical therapy with high likelihood of durable repair, and low comorbidity	IIaC
Asymptomatic patients with preserved LV function, high likelihood of durable repair, and low risk for surgery	IIbB
Patients with severe LV dysfunction (LVEF $< 30\%$ and/or ESD > 55 mm) ^a refractory to medical therapy with low likelihood of repair and low comorbidity	IIbC

Severity is based on clinical and echocardiographic assessment.

ESD = end-systolic dimension, EF = ejection fraction, LV = left ventricular, MR = mitral regurgitation.

^aLower values can be considered for patients of small stature.

Schema for the Management of Chronic Severe Mitral Regurgitation[†]



LV=left ventricle; EF=ejection fraction; ESD=end-systolic diameter; MV=mitral valve; AF=atrial fibrillation; PHT=pulmonary hypertension; NYHA FC=New York Heart Association functional class



**Annuloplasty ring
used in valve repair**

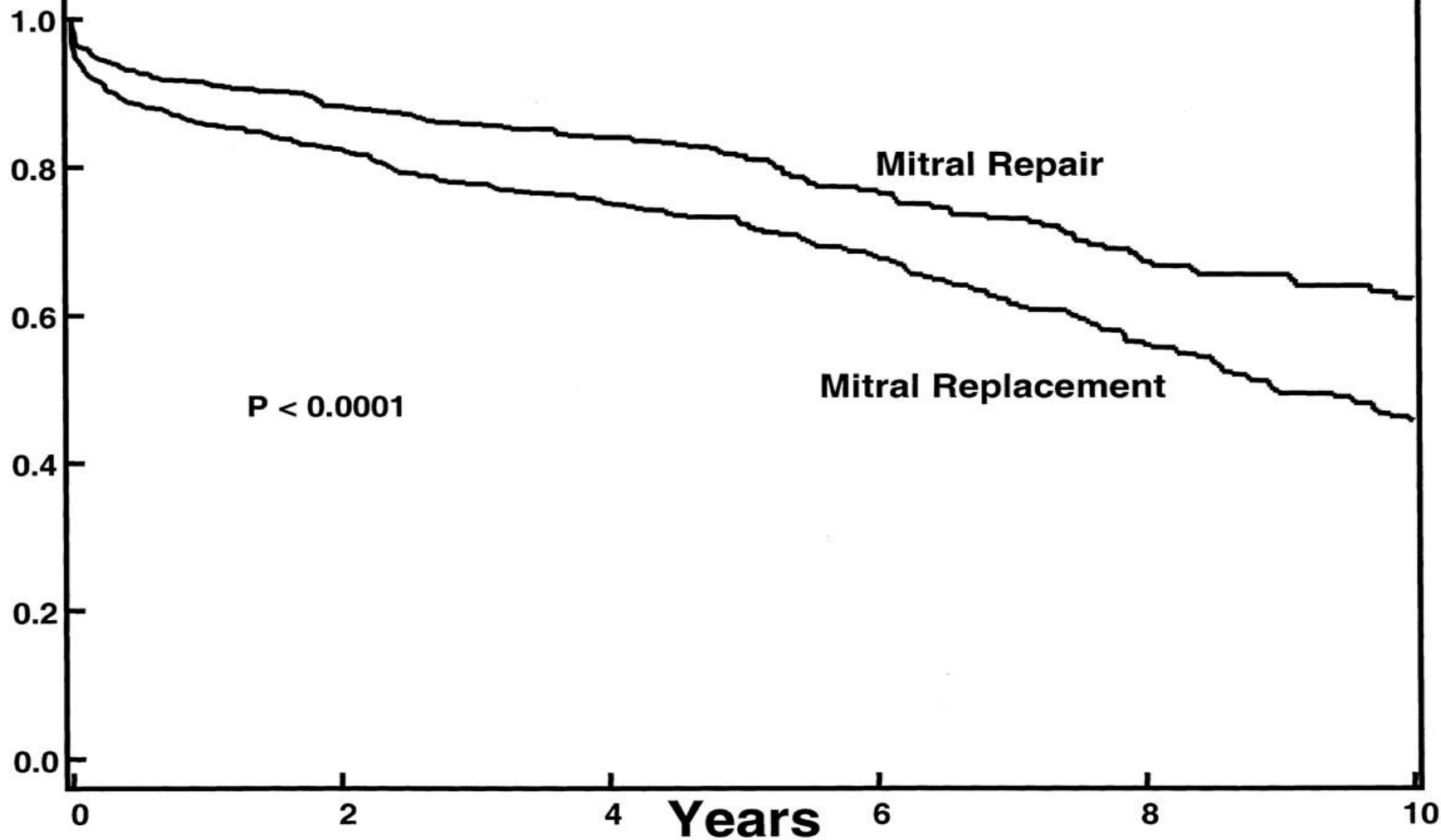
Bioprosthesis



Bileaflet mechanical prosthesis



Survival



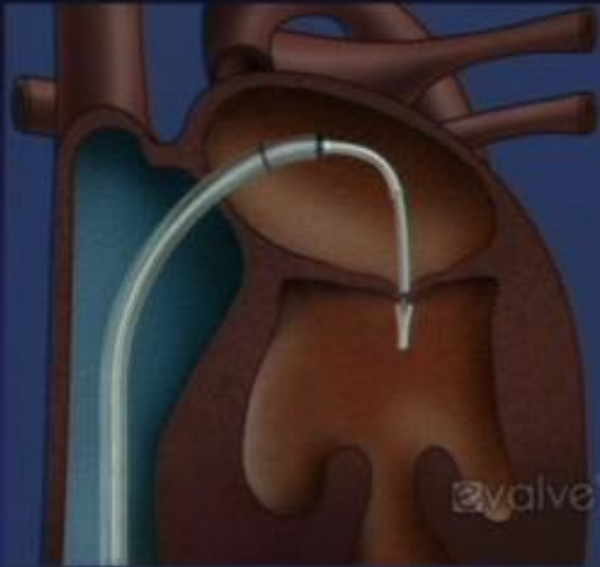
Repair (Survival)	1	0.91	0.88	0.86	0.84	0.82	0.76	0.73	0.67	0.65	0.62
At Risk	581	507	401	379	357	321	166	147	117	89	69
Replace (Survival)	1	0.86	0.82	0.78	0.75	0.72	0.68	0.61	0.56	0.49	0.46
At Risk	600	510	413	369	331	295	198	163	142	114	101

Thourani V H et al. Circulation 2003;108:298-304



Mitral clip for functional MR

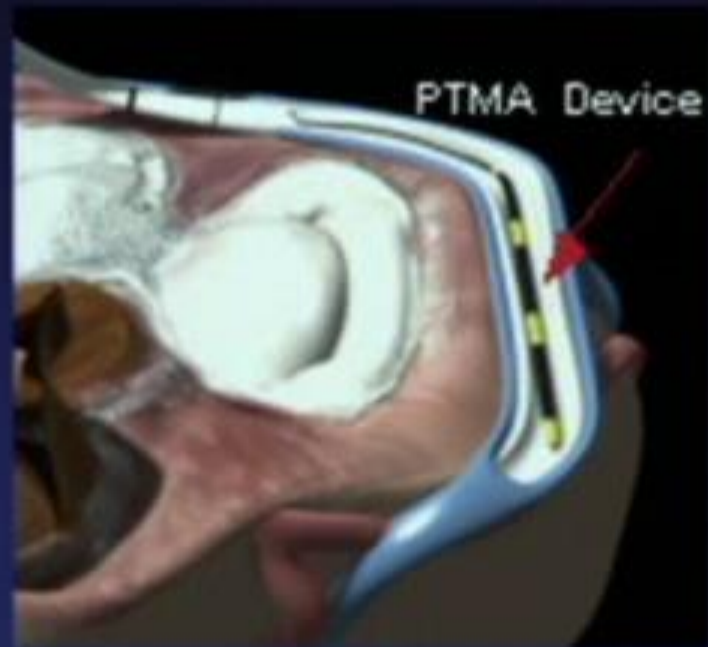
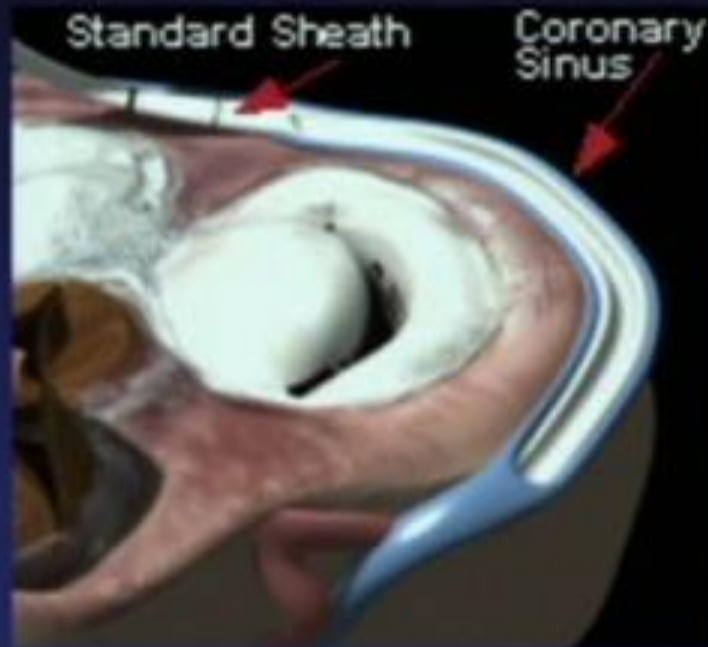
Evalve® System



Caution: Investigational Device. Restricted by Federal (US) Law to
Investigational Use only

Coronary Sinus Anatomy For the Venture Capitalist

Coronary sinus allows percutaneous mitral repair







AR due to Abnormalities of the Leaflets

Rheumatic HD

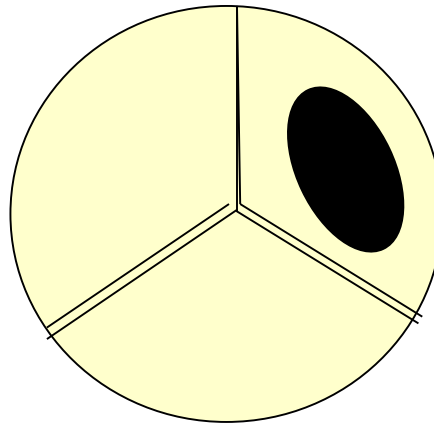
Infective endocarditis



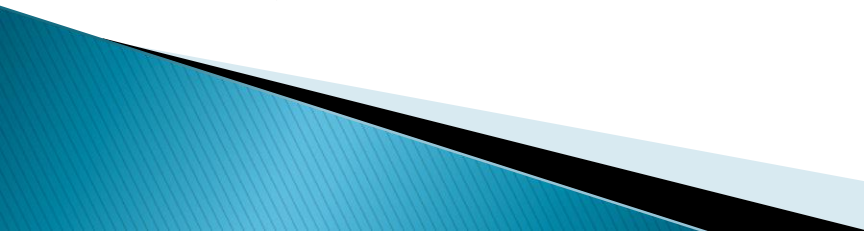
Cusp perforation

Trauma

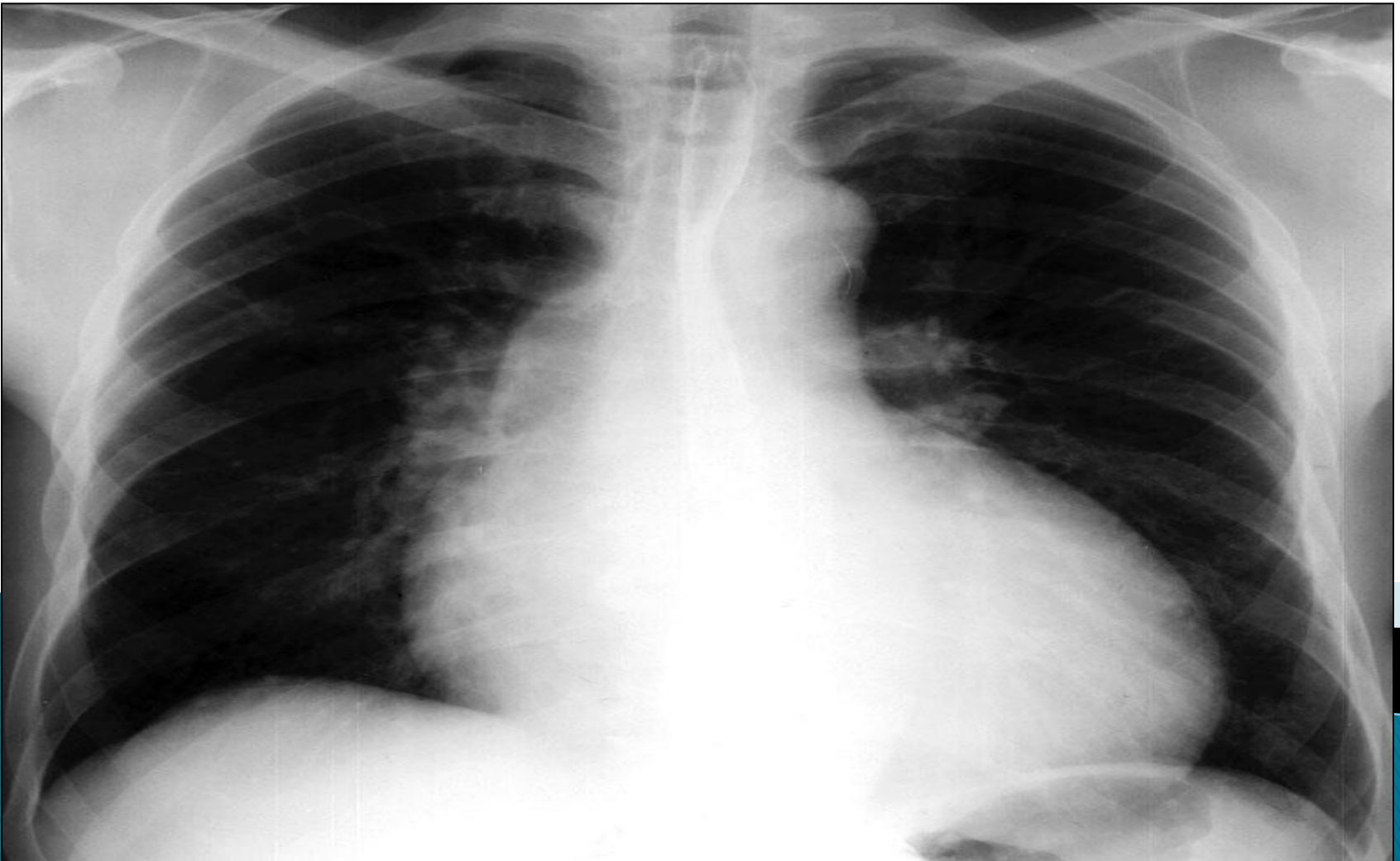
Iatrogenic cause



Clinical features of AR

- ▶ Symptoms of palpitations
 - ▶ Shortness of breath
 - ▶ LV failure symptoms
 - ▶ Peripheral sings of AR
 - ▶ Early diastolic murmur at A1 and A2
 - ▶ S3,loud P MR
- 

AORTIC REGURGITATION



Regurgitation – Medical therapy

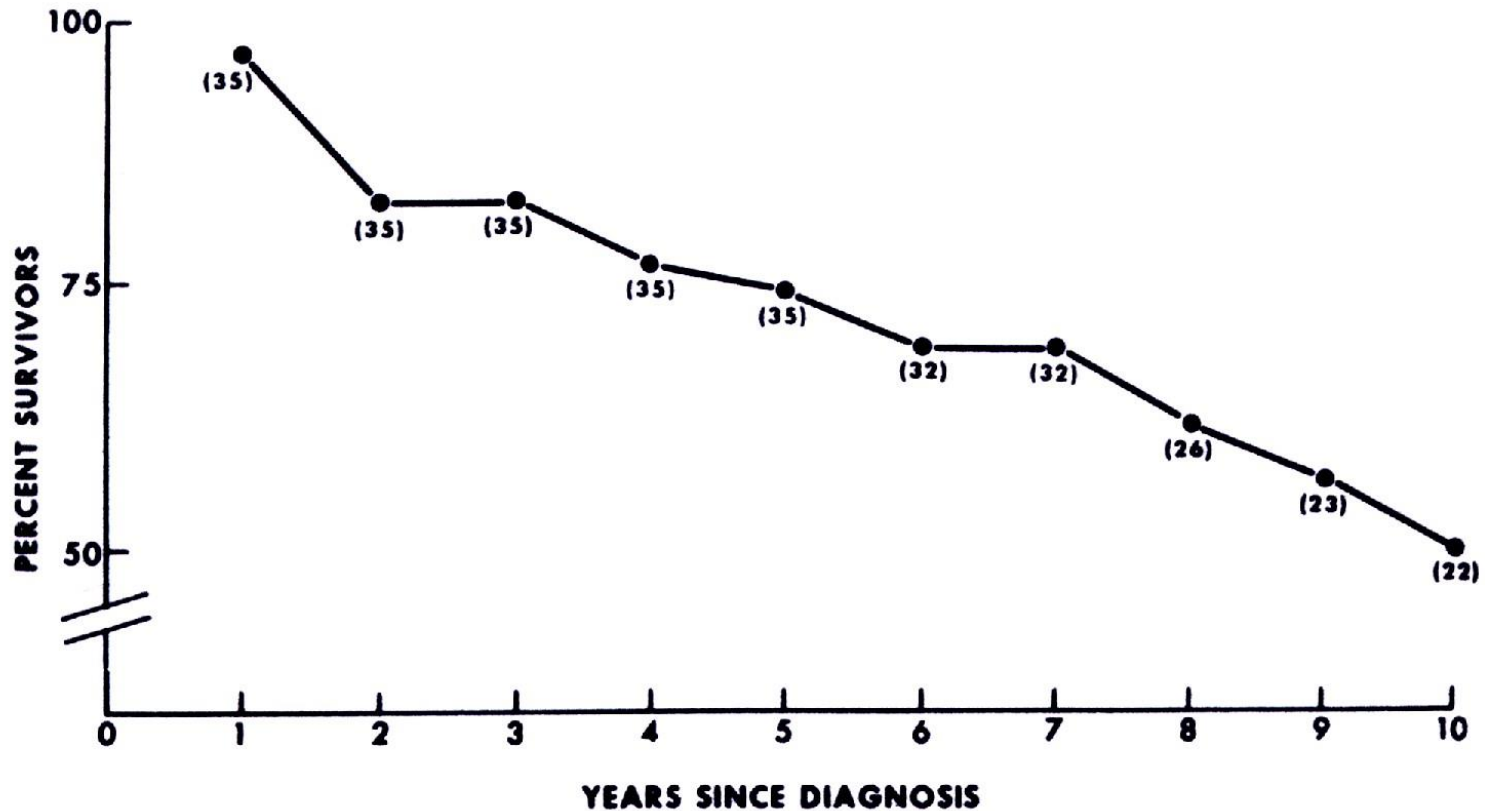


Figure 120-2. Percent survival of patients with aortic insufficiency treated medically. (From Rapaport E: *Natural history of aortic and mitral valve disease*. *Am J Cardiol* 35:221, 1975.)

MANAGEMENT – AR

MEDICAL

- ▶ Calcium channel blocker
- ▶ Regular ECHO
- ▶ Avoid isometric exercise
- ▶ Endocarditis prophylaxis
- ▶ Monitor for symptoms
- ▶ Protracted course

SYMPTOMATIC

AVR

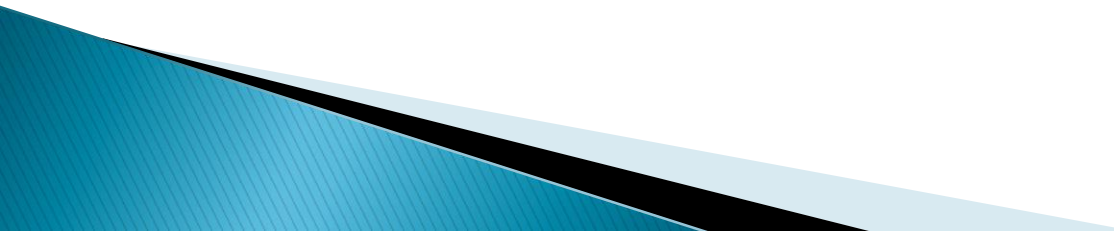
- ▶ Symptom onset
- ▶ Asymptomatic if:
 - LVESD > 50–55mm
 - LVEDD > 70–75mm
 - LVEF < 55%

Indications of surgery in AR

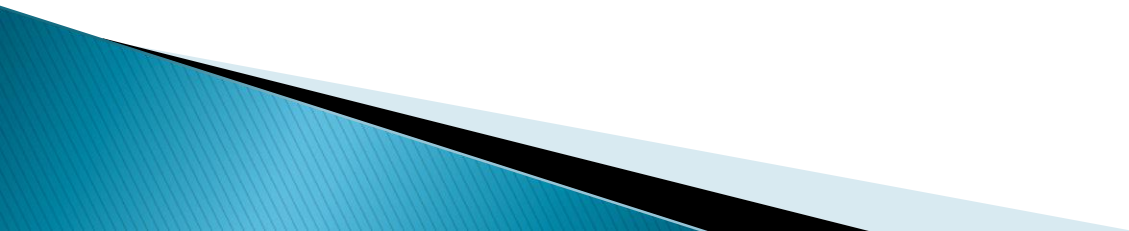
Symptomatic severe AR

Marked LV dilatation ($EDD > 7.5 \text{ cm}$)

LV dysfunction ($EF < 50\%$, $ESD > 55 \text{ mm}$)



Tricuspid valve disease



Pulmonic valve

Anterior cusp

Right cusp

Left cusp

Moderator
band

Tricuspid valve

Anterior cusp

Medial cusp

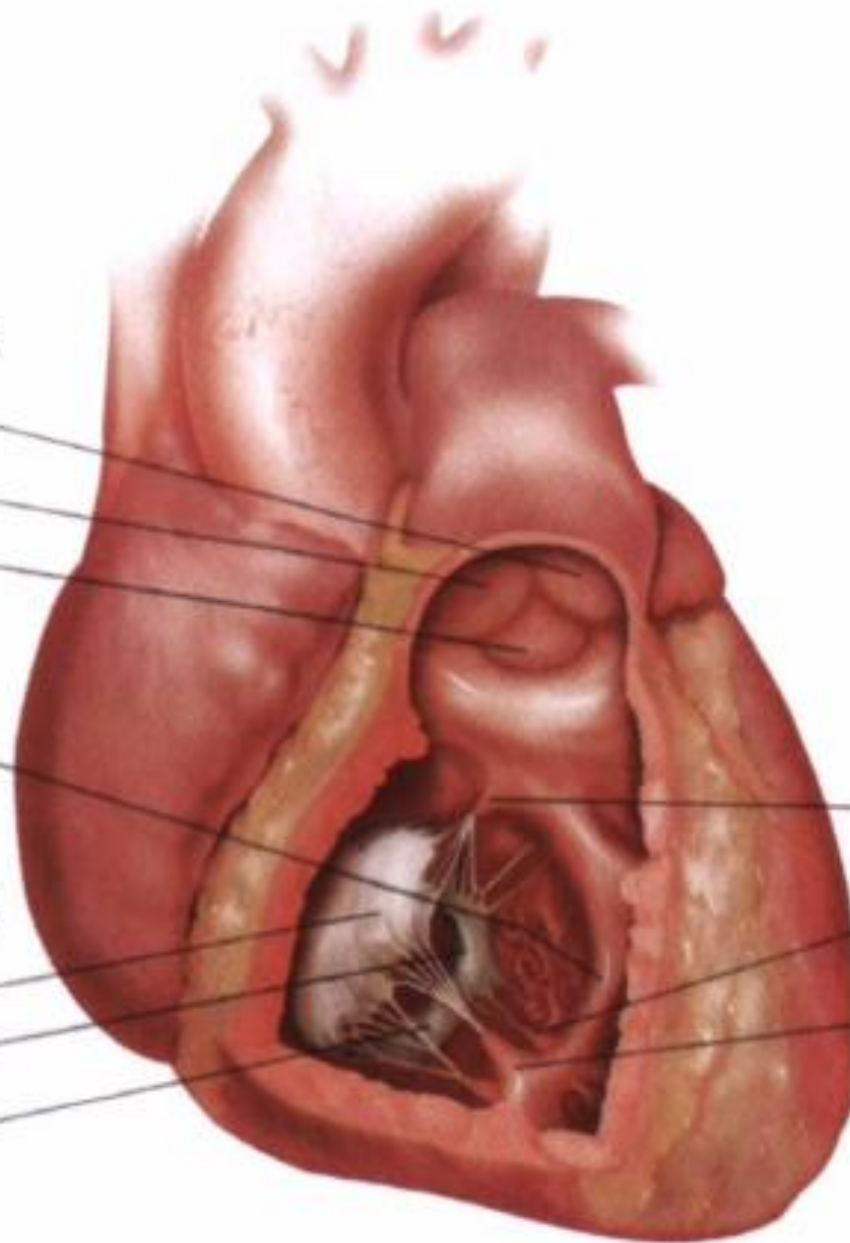
Posterior cusp

Papillary muscles

Medial (conal)

Posterior

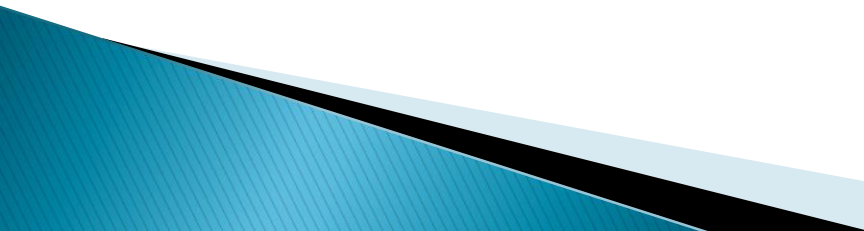
Anterior



► **TABLE 27.3.** Tricuspid Valve Disease: Etiology and Pathologic Changes

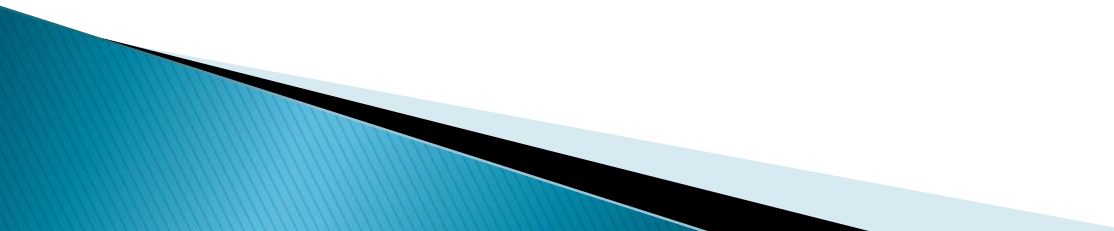
<i>Etiology</i>	<i>Pathologic Changes</i>
Functional regurgitation	1. Asymmetric annular dilatation universally involving the anterior and posterior leaflets
Rheumatic	1. Leaflet thickening and fibrosis 2. Commissural fusion (commonly the anteroseptal commissural) 3. Chordal fusion and shortening
Endocarditis	1. Vegetations usually on the atrial side of the valves
Carcinoid	1. Endocardial fibrous thickening on the ventricular surface of the valve

Symptoms of TVD

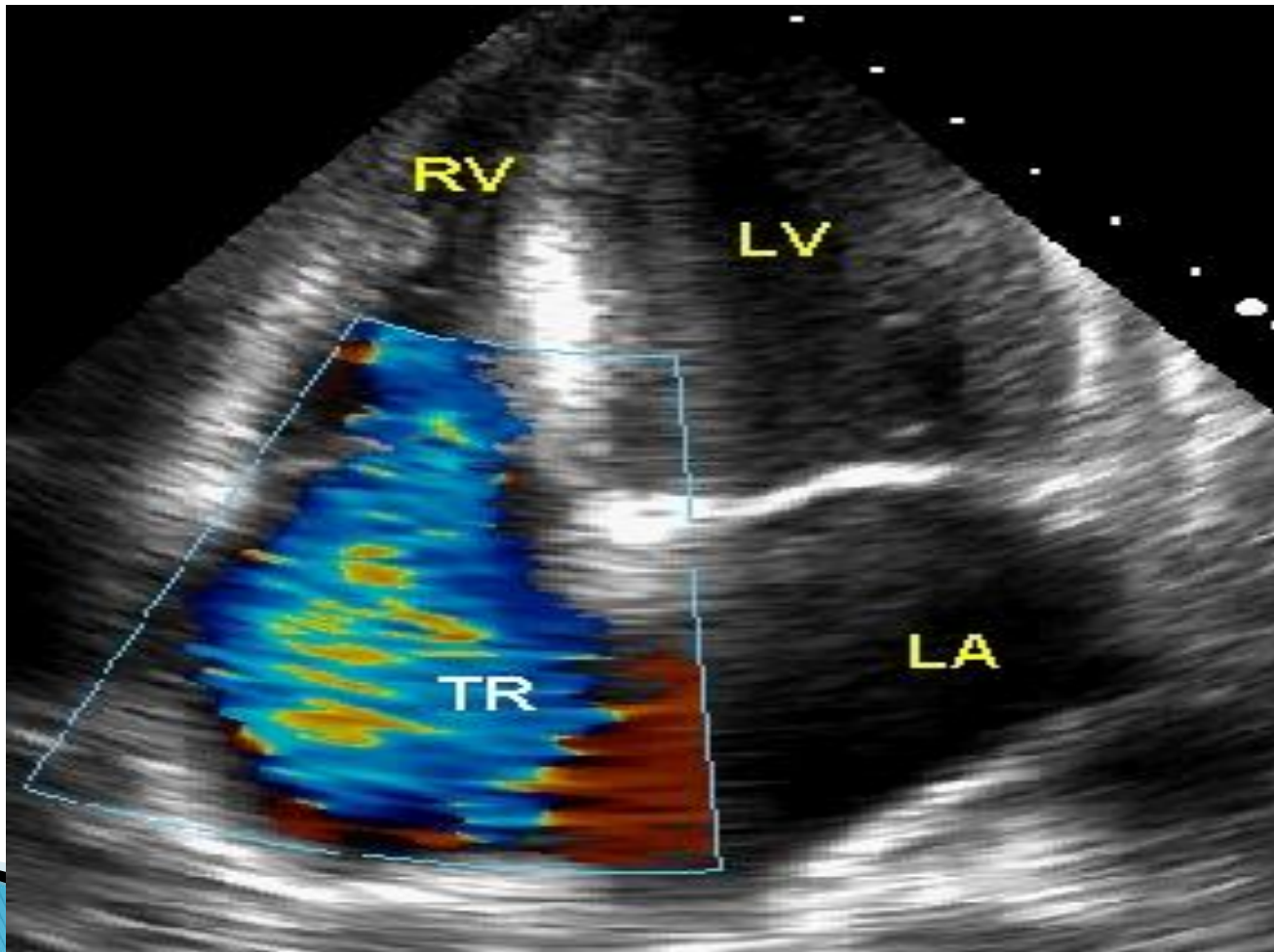
- Fatigue
 - Liver/gut congestion
 - Right upper quadrant discomfort
 - Dyspepsia
 - Indigestion
 - Fluid retention with leg edema
 - Ascites
- 

Tricuspid valve disease

auscultatory findings

- ▶ Stenosis : Low-to medium-pitch diastolic rumble with inspiratory accentuation
 - ▶ Regurgitation : Soft, early, or holosystolic murmur Augmented with inspiratory effort (Caravallo's sign)
 - ▶ Prolapse : Systolic click
- 

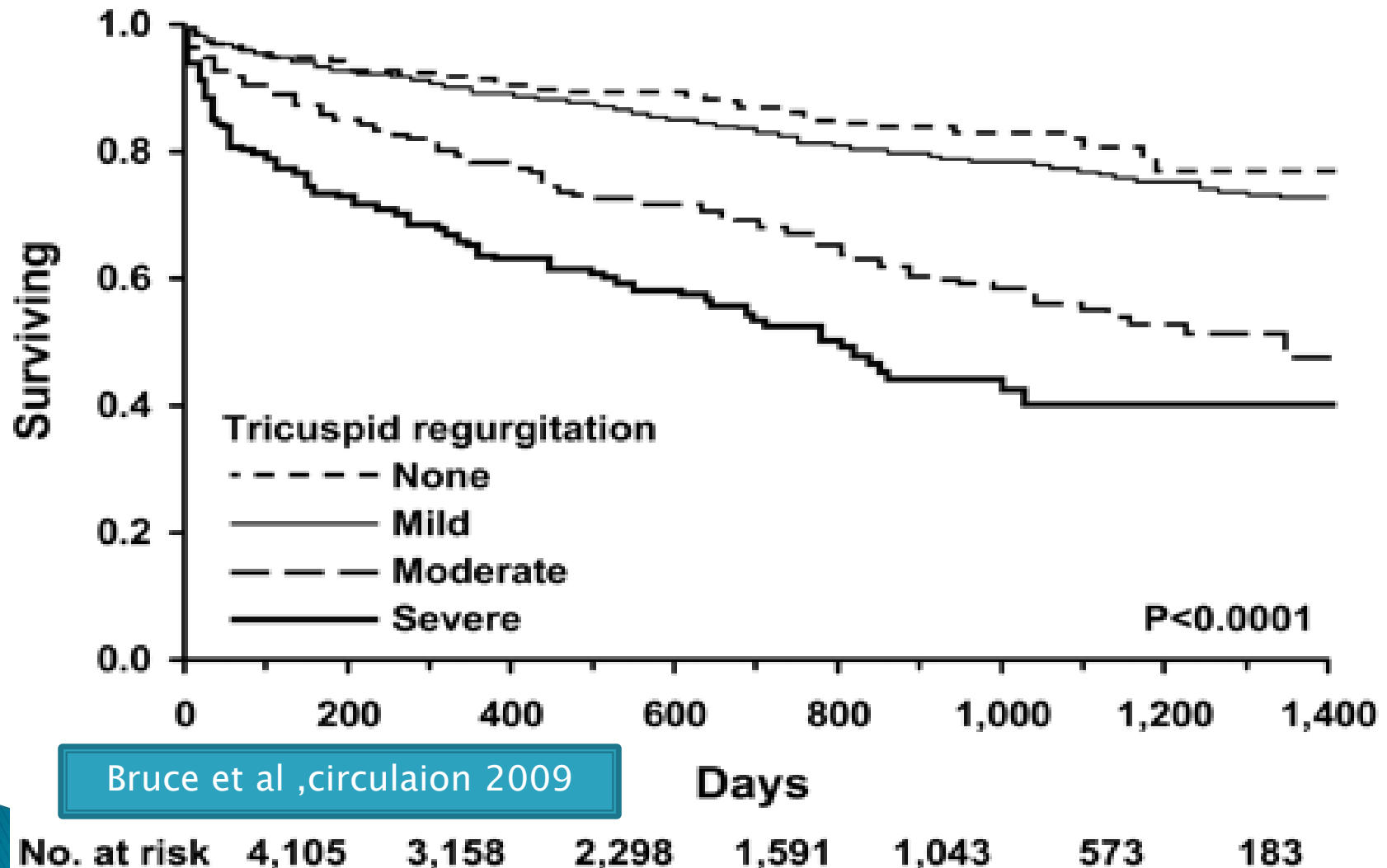
Echo in severe TR



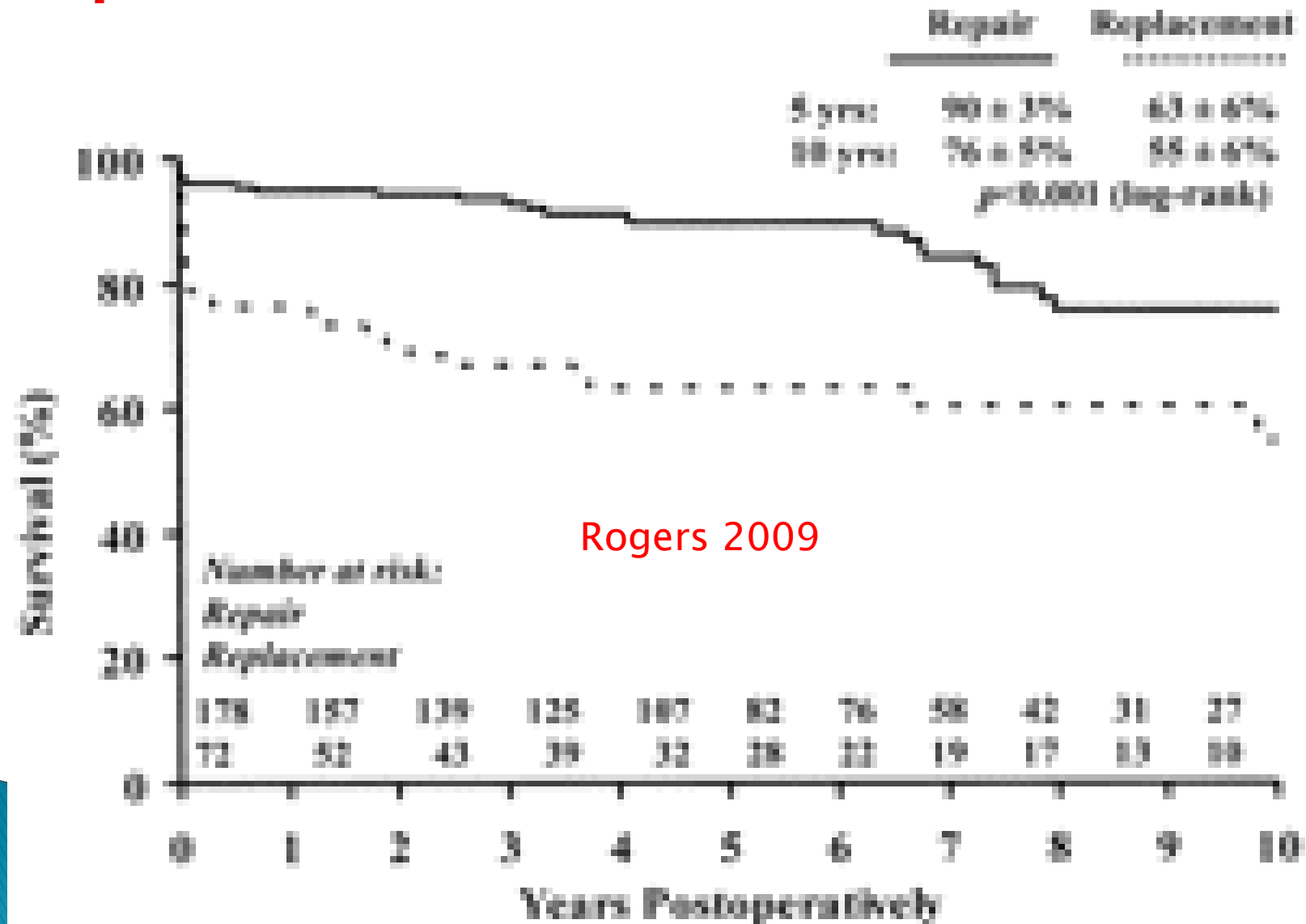
TR & TS Severity

Parameter	Mild	Moderate	Severe
	Tricuspid valve regurgitation		
Valve morphology	Normal	Normal/abnormal	Abnormal
RV, RA, IVC size	Normal	Normal or dilated	Dilated unless acute TR; TV annulus ≥ 4 cm
CW jet	Less intense than inflow	Almost as dense as inflow	As dense as inflow with late delay
Jet area	$<5 \text{ cm}^{2a}$	$5\text{--}10 \text{ cm}^2$	$>10 \text{ cm}^2$
Jet/RA area	$<20\%$	$20\text{--}40\%$	$>40\%$
Vena contracta width	Small ^a	Probably <7 mm	≥ 7 mm
Proximal isovelocity surface area radius	≤ 5 mm	$0.6\text{--}0.9$ mm	>10 mm for a Nyquist limit of 30 cm/sec ; ≥ 7 mm for a Nyquist limit of 40 cm/sec Other feature: jet length $>5.3 \text{ cm}^a$
Hepatic vein flow	Systolic dominance	Systolic blunting	Systolic reversal
Tricuspid valve stenosis			
Mean gradient	<2 mm Hg	$2\text{--}5$ mm Hg	$>5\text{--}7$ mm Hg

Survival for TR patients



Survival after TV repair vs replacement



Management of tricuspid valve regurgitation: key points

- ▶ Tricuspid regurgitation (TR) is common in patients with left-sided heart (especially mitral) valve disease
- ▶ There is now some evidence that, in these cases, TR is not always “functional”; it may be due to pathological involvement of the annulus
- ▶ Therefore, correction of left-sided heart valve disease does not automatically correct TR
- ▶ Dilatation of the tricuspid annulus is progressive and may not be accompanied by TR initially, but eventually leads to it; “prophylactic intervention may be justified
- ▶ Tricuspid annuloplasty achieves excellent results; tricuspid valve replacement is seldom necessary
- ▶ Suture annuloplasty is usually adequate but ring annuloplasty is essential in organic TR