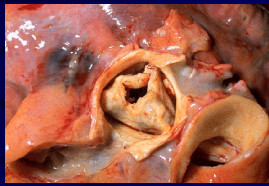


## Aortic Stenosis Difficult Issues



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Cesaria 2004



## Epidemiology

- AS is the **most common cardiac-valve lesion** in the United States.
- The prevalence of AS is **2% to 7%** in the population above 65 years of age.
- AS caused by degenerative calcification has become the **most common valvular disease requiring cardiac surgery**.
  - Two factors account for its common occurrence:
    - Approximately 1 to 2 percent of the population is born with a bicuspid aortic valve
    - The population is aging.

## AS severity

- AVA
  - $>1.5 \text{ cm}^2$  ( $>0.9 \text{ cm}^2/\text{m}^2$ ) - mild
  - $1-1.5 \text{ cm}^2$  ( $0.6-0.9 \text{ cm}^2/\text{m}^2$ ) - moderate
  - $<1 \text{ cm}^2$  ( $<0.6 \text{ cm}^2/\text{m}^2$ ) - severe \*
- Forward velocity across the valve
  - moderate AS - 3.0-4.0 m/s
  - Severe -  $>4 \text{ m/s}$

**Branwald:  $<0.8-0.9 \text{ cm}^2$  ( $<0.5-0.6 \text{ cm}^2/\text{m}^2$ )**

\* Cutoff levels 0.8, 0.9 or  $1.0 \text{ cm}^2$  (various authors)

## AS severity

Peak gradient	Mean gradient	Severe AS
$\geq 80$	$\geq 70$	Highly likely
60-79	50-69	Probable
$< 60$	$< 50$	Uncertain

Rahimtoola, JACC 1989; 14: 1-23

## Pitfalls in aortic valve gradient estimation

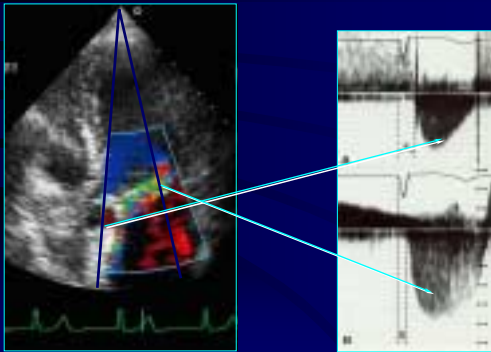
- Underestimation:
  - failure to record true peak velocities
    - inadequate signal
    - inappropriate recording angle
    - lack of technical expertise
- Overestimation:
  - comparison of peak gradient with peak-to-peak gradient
  - MR - recording of the wrong jet
  - High CO
  - Dynamic subaortic gradient
  - Post-extrasystolic beat - non representative selection of velocity data
  - Pressure recovery (prostheses)- recording of the wrong jet

## Aortic stenosis from apical view

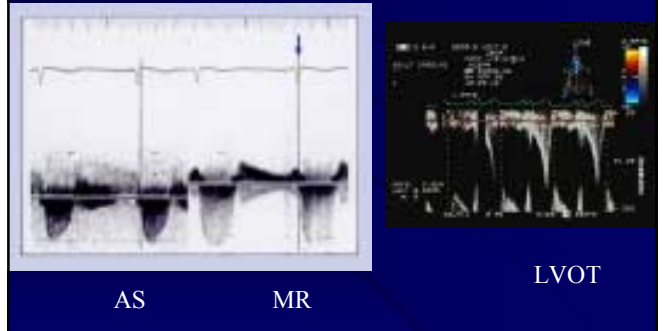
Bad tracing    Good tracing



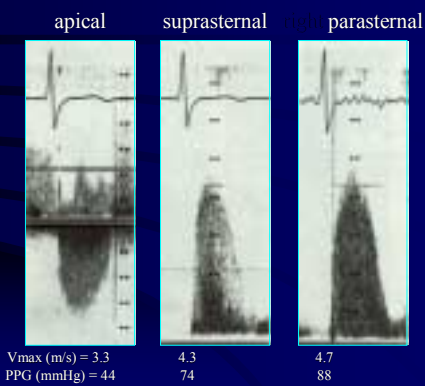
## Confusion among aortic stenosis and mitral regurgitation jets



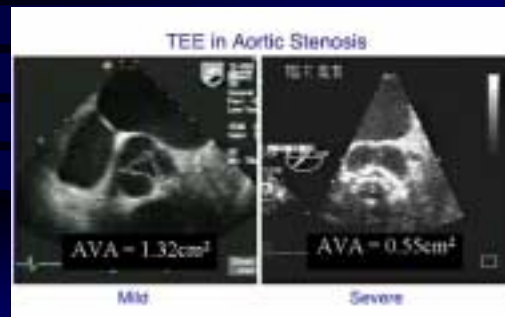
## CW Doppler – AS vs. MR vs. LVOT Obstruction



## Importance of multiple windows assessment



## TEE in AS

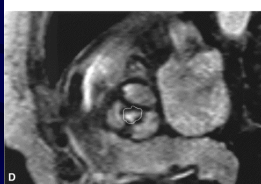


## MRI in AS

• Moderate AS



• Severe AS



• John AS et al  
JACC 2003

• Magnetic resonance planimetry of the AVA correlates well with TEE and less well with the catheter-derived AVA

## Complications in cardiac catheterization

Mortality	0.14 – 0.75%
Myocardial infarction	0.07 – 0.6%
<b>Cerebrovascular events</b>	<b>0.03 – 0.3%</b>
Major vascular	0.4%
Renal failure	1.4 – 2.3%
Minor	4%

## Silent and apparent cerebral embolism after retrograde catheterisation of the aortic valve in valvular stenosis: a prospective, randomised study

Omran Heyderetal

[The Lancet](#)

361; 1235-1310 (April 2003)

## Findings

- Acute cerebral embolic events after the procedure occurred in 22 (22%) patients
- Clinically apparent neurological deficits occurred in 3 (3%) patients
- None of the patients without passage of the valve, or any of the controls, had evidence of cerebral embolism as assessed by MRI.

## Interpretation

- Patients with valvular aortic stenosis who undergo retrograde catheterisation of the aortic valve have a substantial risk of clinically apparent cerebral embolism, and frequently have silent ischaemic brain lesions.
- Patients should be informed about these risks, and this procedure should be used only in patients with unclear echocardiographical findings when additional information is necessary for clinical management.

## ACC/AHA guidelines: Class I indications for cardiac catheterization

1. Coronary angiography before surgery in patients at risk of CAD
2. Assessment of the severity of VHD when
  - Noninvasive tests are inconclusive
  - Discrepancy between clinical findings and noninvasive tests
3. To perform percutaneous mitral balloon valvotomy

## Should we cross the valve: the risk of retrograde catheterization of the left ventricle in patients with aortic stenosis.

Meine TJ, Harrison JK.

- 22 of 101 patients (22%) assigned to retrograde catheterization developed new focal MRI abnormalities consistent with acute cerebral embolic events.
- 3 of these patients (3%) demonstrated clinically apparent neurologic deficits.
- None of the patients who did not undergo retrograde catheterization--and none of the control patients--had MRI or clinical evidence of cerebral embolism.

Am Heart J. 2004

## AS progression

- Yearly rate of AS progression
  - 0.1 cm<sup>2</sup>/s
  - 0.3 m/s
  - 6-8 mmHg
- Considerable individual variability
- Methodological flaws
  - Selected population
  - Many with short F-U period
  - Technical difficulties, esp. in critical stenosis

## Potential determinants of AS progression

### Echo factors

- Leaflet calcifications
- Leaflet thickening
- Baseline AVA

### Clinical factors

- Men
- Older age
- Smoking
- Cholesterol
- CRF/dialysis
- Ca/Phos product
- Hypertension
- Etiology

## Pathophysiology and Concepts in AS Progression

- Lipid process - ("cholesterol hypothesis")
- Inflammatory process
- Renin angiotensin system
- Calcification and ossification
- Genetic factors

All these processes are involved in atherosclerosis

## New Insights Into the Progression of Aortic Stenosis

### Implications for Secondary Prevention

Sanjeev Palta, MD; Anita M. Pai, MD;  
Kanwaljit S. Gill, MD; Ramdas G. Pai, MD  
(*Circulation*. 2000;101:2497.)

## The impact of cholesterol level on AS progression

- In patients with a serum cholesterol level  $>200$  mg/dL, the annual reduction in AVA was  $0.14 \pm 0.35$  cm<sup>2</sup>, compared with  $0.07 \pm 0.19$  cm<sup>2</sup> in those with a level  $<200$  mg/dL ( $P=0.04$ ).

## Conclusions

- Absolute and percentage reduction in AVA per year in those with AS is greater in those with milder degrees of stenosis.
- Factors associated with rapid AS progression:
  - smoking
  - hypercholesterolemia,
  - elevated serum creatinine
  - calcium levels.

## Effect of Hydroxymethylglutaryl Coenzyme A Reductase Inhibitors on the Progression of Calcific Aortic Stenosis

Gian M. Novaro, MD; Irving Y. Tiong, MD;  
Gregory L. Pearce, MS; Michael S. Lauer, MD;  
Dennis L. Sprecher, MD; Brian P. Griffin, MD  
(*Circulation*. 2001;104:2205.)

## Main Results

- The decrease in aortic valve area for the **nonstatin** group was **0.11±0.18 cm<sup>2</sup>** compared with **0.06±0.16 cm<sup>2</sup>** for those treated with a statin ( $P=0.030$ )

(Gian M et al, *Circulation*. 2001;104:2205.)

## Multivariate analysis

- Statin usage was a significant independent predictor** of a smaller decrease in valve area ( $P=0.01$ ) and a lesser increase in peak gradient ( $P=0.02$ ).

(Gian M et al, *Circulation*. 2001;104:2205.)

## Conclusions

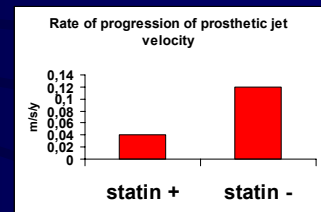
- Statin-treated patients had reduced aortic stenosis progression compared with those not treated with a statin.**

Gian M et al, *Circulation*. 2001;104:2205.)

## Statins for aortic biological prosthesis

- Statin-treated pts showed a lower rate of progression of prosthetic gradients and a **reduction in worsening of AR**
- Thus, statins **slow bioprosthesis degeneration.**

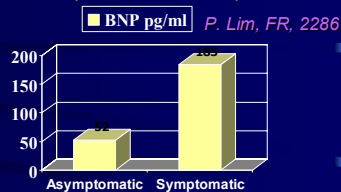
141 pts with aortic bioprosthesis- FU 4±3 yrs



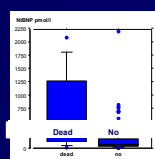
F. Antonini Canterin, IT, 2885

## Predictors of outcome in AS Natriuretic Peptides (BNP, NtBNP)

- Natriuretic peptides, are significantly **higher in symptomatic AS pts**
- Non-survivors** had significantly **higher** natriuretic peptides.
- Thus, natriuretic peptides are **predictors of outcome in AS** and can optimise timing of surgery in asymptomatic pts.



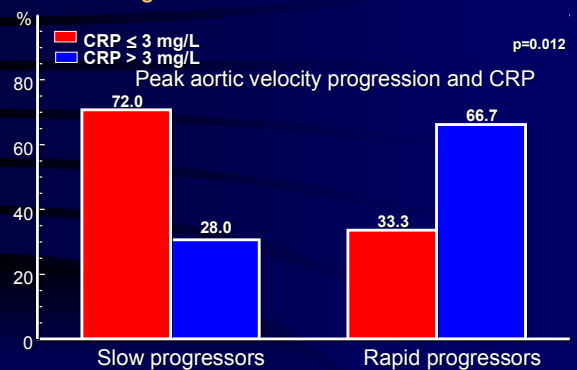
**NtBNP**  
299 vs 66 pmol/l  
 $p<0.0001$



Mc Cann, UK, 2287

J. Bergler-Klein, AT, 3536  
(*Circulation*. 2004 May)

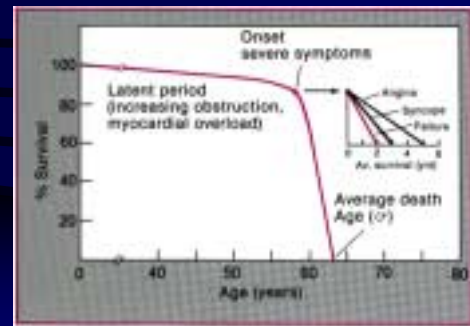
## C-reactive protein- predicts progression of degenerative aortic valve stenosis



## AS - natural history

- Yearly mortality in asymptomatic AS - <1%
- Crude adjusted operative mortality in AVR
  - 4% for isolated AVR
  - 7% for AVR + CABG
- No data to support prevention LVH & diastolic dysfunction by early AVR
- Symptoms → 2 year survival < 50%.

## AS - natural history



## Systematic review of the outcome of aortic valve replacement in patients with aortic stenosis.

- Meta- analyzes of the change in LVM and EF after AVR in adult patients
- 27 articles published between 1980 and 2003 in 1546 AS patients
- Increase in EF after surgery is more pronounced in the pts that have low preoperative EF (28% vs 40%)
- However, regression of LV mass ; predominantly within the first 6 months after surgery - 181 vs. 124 g/msq.) uniformly achieved regardless of age, sex, time of operation, or types of valve substitute.

• Sharma UC Ann Thorac Surg. 2004

## Asymptomatic severe AS

- Goals of early intervention:
  - Prevent SD ?
  - Prevent LV dysfunction ?
  - Prevent LVH ?

## Sudden death in AS

- SD in AS - mostly arrhythmic (Holter)
- An extreme case of syncope?
- SD usually occurs in symptomatic patients\*
- SD is rare in asymptomatic severe AS\*.
  - 5 out of 229 (2%) in one study

E BranWALD (jacc 1990)

## F-U of 123 initially asymptomatic patients With AS

- F-U - 32±12 months
- 8 (7%) died, 48 (39%) AVR
- In all 4 patients with cardiac death - CHF requiring hospitalization preceded death
- Multivariate analysis of adverse outcome:
  - High initial Vmax
  - Low initial FC
  - Rapid rate of progression

Otto et al. Circ 1997; 95: 2262-70

## Conclusions

- In adults with asymptomatic AS, the rate of hemodynamic progression and clinical outcome are predicted by jet velocity, the rate of change in velocity, and functional status

Otto et al. Circ 1997; 95: 2262-70

## Predictors of outcome in severe, asymptomatic aortic stenosis.

Rosenhek R, Binder T, Porenta G, Lang I, Christ G, Schemper M, Maurer G, Baumgartner H.

N Engl J Med 2000;343:611-7

## Asymptomatic severe AS

- 128 consecutive patients with asymptomatic, severe aortic stenosis
- 59 women and 69 men
- Age  $60 \pm 18$  years
- Aortic-jet velocity,  $5.0 \pm 0.6$  m/s.
- Prospectively F-U 1994-8.

Rosenhek et al, Mayo Clinic, N Engl J Med 2000;343:611-7

## Asymptomatic severe AS

- Follow-up -  $22 \pm 18$  months (98%)
- Percent event-free survival
  - 1y -  $67 \pm 5$
  - 2y -  $56 \pm 5$ ,
  - 4y -  $33 \pm 5$
- End points: death (n=8), AVR for symptoms (n=59)
- Among cardiac deaths, 5/6 were preceded by symptoms

Rosenhek et al, Mayo Clinic, N Engl J Med 2000;343:611-7

## Asymptomatic severe AS multivariate analysis of endpoints

- Extent of *aortic-valve calcification* - the only independent predictor of outcome
- Parameters that **did not predict** adverse outcome:
  - age
  - sex
  - Coronary artery disease
  - hypertension
  - diabetes
  - hypercholesterolemia

Rosenhek et al, Mayo Clinic, N Engl J Med 2000;343:611-7

## Influence of rate of progression of stenosis

- Patients who had cardiac events:
  - $0.45 \pm 0.38$  m/s/y
- Patients who did not have cardiac events:
  - $0.14 \pm 0.18$  m/s/y ( $P < 0.001$ )
- Moderately or severely calcified aortic valves + velocity increase by  $\pm 0.3$  m/s/y - 79% underwent surgery or died within two years of the observed increase.

Rosenhek et al, Mayo Clinic, N Engl J Med 2000;343:611-7

## Conclusions

- In asymptomatic patients with aortic stenosis, it appears to be relatively safe to delay surgery until symptoms develop.
- The presence of **moderate or severe valvular calcification, together with a rapid increase in aortic-jet velocity**, identifies patients with a very poor prognosis. These patients should be considered for early valve replacement rather than have surgery delayed until symptoms develop

Rosenhek et al, Mayo Clinic, N Engl J Med 2000;343:611-7

## Aortic stenosis *Indications for surgery*

- Class I
  - Severe, symptomatic AS
  - Severe AS when CABG other valvular / aortic surgery is indicated
- Class IIA
  - Moderate AS when CABG / other valvular / aortic surgery is indicated
  - Severe AS + LV dysfunction
  - Severe AS + abnormal exercise response (BP ↓)

Bonow et al. JACC 1998; 32: 1486-588

## Aortic stenosis *Indications for surgery (Cont'd)*

- Class IIB
  - Asymptomatic severe AS + VT
  - Asymptomatic severe AS + severe LVH ( $\geq 15$  mm)
  - Critical AS ( $< 0.6$  cm<sup>2</sup>)
- Class III
  - None of the above

Bonow et al. JACC 1998; 32: 1486-588

## Exercise test in AS

- Goal:
  - To elucidate symptoms / signs in sedentary / dissimulant patients
- Target population:
  - Patients with moderate or severe AS, who claim to be asymptomatic, and are not excluded from surgery
- Contraindicated if
  - Unequivocal heart failure
  - Angina
  - Presyncope/syncope

## Exercise test in AS

- Safety:
  - Safe if conducted properly
- Endpoints:
  - BP fall by  $> 10$  mmHg
  - Symptoms
  - Significant arrhythmia
  - Significant ST depression NOT an indication to stop study if unaccompanied by symptoms / hemodynamic / arrhythmic complications

"It is usually better to have a complication under observation during a treadmill test than walking up a hill in the country"

## AS with low gradients

- AVR in AS + LV dysfunction:
  - 20% operative mortality
  - Worse if additional CABG
  - Highest risk period: from induction to pump
- AVR is never late when associated with LV dysfunction *if AVG is high*



## AS with low gradients Subgroups

- 1a - contractile reserve present but no increase of the aortic valve area\*
- 1b - contractile reserve present and increase of the aortic valve area
- 2 - no contractile reserve present

\* Likely to benefit from AVR

## AS with severe LV dysfunction and low transvalvular pressure gradients

### Risk stratification by low-dose dobutamine echocardiography

Jean-Luc Monin MD<sup>1,2,3</sup>, Mehran Monchi MD, Virginie Gest MD<sup>2</sup>, Anne-Marie Duval-Moulin MD<sup>2</sup>, Jean-Luc Dubois-Rande MD, PhD<sup>2</sup> and Pascal Gueret MD, FACC<sup>2</sup>

[JACC 2001; 37: 2101-2107](#)

## Patients and Methods

- Low-dose DSE was performed in **45 patients**
- Mean age 75 [69 to 79]
- Mean LV ejection fraction: **29%**
- Aortic valve area [cm<sup>2</sup>]: 0.7 [0.5 to 0.8]
- **Mean** transaortic gradient **26 [mm Hg]**

[JACC 2001; 37: 2101-2107](#)

## AS with severe LV dysfunction and low transvalvular pressure gradients

- Patients were classified into two groups:
  - **group I** (n = 32) - LV contractile reserve on DSE
  - **group II** (n = 13) no contractile reserve.
- Valve replacement was performed in 24 and 6 patients in groups I and II, respectively.

[JACC 2001; 37: 2101-2107](#)

## Low Gradient severe AS Perioperative Mortality

- Group I (LV contractile reserve) - 8%
- Group II (No LV contractile reserve) - 50%

[Jean-Luc Monin et al JACC 2001; 37: 2101-2107](#)

## CONCLUSIONS

- In patients with AS, LV dysfunction and low transvalvular gradients, **contractile reserve on DSE is associated with a low operative risk and good long-term prognosis after valve surgery.**
- In contrast, operative mortality remains high in the absence of contractile reserve.

[Jean-Luc Monin et al JACC 2001; 37: 2101-2107](#)

## Low-output, low-gradient aortic stenosis in patients with depressed left ventricular systolic function:

### The clinical utility of the dobutamine challenge in the catheterization laboratory.

Nishimura RA, Grantham JA, Connolly HM, Schaff HV, Higano ST, Holmes DR Jr.  
*Circulation* 2002;106:809

## Results

- Patients will have true fixed aortic stenosis if they have
  - a mean aortic valve gradient >30 mm Hg at rest or dobutamine infusion
  - an aortic valve area that remains <1.2 cm<sup>2</sup> during dobutamine infusion

Nishimura et al, *Circulation* 2002;106:809

## Results

- In the 15 patients in whom **contractile reserve was identified** during dobutamine challenge (increase in stroke volume >20%) **mortality rate was 7%.**
- 12 patients were alive in New York Heart Association **class I or II status at follow-up.**

Nishimura et al, *Circulation* 2002;106:809

## Low-Gradient Aortic Stenosis Operative Risk Stratification and Predictors for Long-Term Outcome: A Multicenter Study Using Dobutamine Stress Hemodynamics

Jean-Luc Monin et al  
*Circulation*. 2003;108:319

## Patients

- **136** patients with aortic stenosis –6 centers
- Median age, 72 years [range, 65 to 77 years]
- Median aortic valve area, 0.7 cm<sup>2</sup> (**≤1.0 cm<sup>2</sup>**)
- Mean transaortic gradient 29 mm Hg [range, 23 to 34 mm Hg] **MPG < 40 mm Hg**
- Follow-up were obtained in all patients at a median interval of 14 months (range, 7 to 29 months)

## Dobutamin stress echo

- Presence of **LV contractile reserve** on the dobutamine stress Doppler study was present in **92 patients (group I)**
- **Absent contractile reserve** in **44 patients (group II)**

## Results

- **Operative mortality:**
  - **5% in group I with contractile reserve**
  - **32% (10 of 31 patients) in group II without contractile reserve**  
( $P=0.0002$ )

## Nitroprusside in Critically Ill Patients with Left Ventricular Dysfunction and Aortic Stenosis

Umesh N. Khot, M.D., Gian M. Novaro, M.D., Zoran B. Popović, M.D., Roger M. Mills, M.D., James D. Thomas, M.D., E. Murat Tuzcu, M.D., Donald Hammer, M.D., Steven E. Nissen, M.D., and Gary S. Francis, M.D.

N Engl J Med 2003;348:1756

## Background

- Vasodilators are considered to be contraindicated in patients with severe aortic stenosis because of concern that they may precipitate life-threatening hypotension. However, vasodilators such as nitroprusside may improve myocardial performance if peripheral vasoconstriction is contributing to afterload.

## AIM

- To determine the response to intravenous nitroprusside in 25 patients with severe aortic stenosis and left ventricular systolic dysfunction

## RESULTS

- After six hours of therapy with nitroprusside
  - the cardiac index had increased to 2.22
- After 24 hours of nitroprusside infusion
  - the cardiac index had increased further, to 2.52

## Conclusions

- Nitroprusside rapidly and markedly improves cardiac function in patients with decompensated heart failure due to severe left ventricular systolic dysfunction and severe aortic stenosis.
- It provides a safe and effective bridge to aortic-valve replacement or oral vasodilator therapy in these critically ill patients.

### Hemodynamic effects of the ACEI, ramipril, in patients with mild to moderate AS and preserved LV function.

- 13 elderly patients with mild to moderate AS
- 7.5 mg of ramipril twice daily.
- There were no significant changes from baseline to week 8 in any echocardiographic parameters
- Short-term treatment with ramipril was well tolerated in pts with mild to moderate AS and preserved LV function. A surprisingly high proportion of patients (30%) with documented AS were already receiving ACE inhibitors.

• O'Brien KD, Otto CM. J Investig Med. 2004

### החלפת מסתם אאורטלי בקשיש

#### תוצאות:

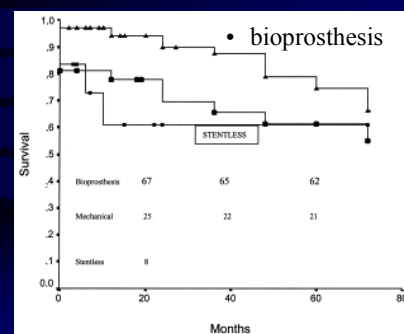
- הישרדות אחרי ניתוח מוצלח - כמו אוכלוסיה רגילה:
- שנה - 95% (לעומת 57% בחולים שסירבו ניתוח)
- 3 שנים - 80% (לעומת 37% בחולים שסירבו ניתוח)
- 5 שנים - 70% (לעומת 25% בחולים שסירבו ניתוח)
- שיפור סימפטומטי - עד 90%
- הרוב חוזרים לתפקוד עצמאי ולכושר בינוני (+)
- עד 10% תסחיפים מוחיים עקב סיד באאורטה העולה

### Outcome after aortic valve replacement in octogenarians.

- Surgical outcome in 115 octogenarians after aortic valve replacement between January 1992 and April 2003
- Age 82.3 years (mean, 80 to 92 years)
- The in-hospital mortality rate was 8.5%
- Actuarial survival at 1 and 5 years was 86.4% and 69.4%, respectively
- **STROKE - 1 (0.8%)**
- Predictors of late mortality were EF, preop heart failure and the type of prosthesis

• Chiappini B et al; Ann Thorac Surg. 2004

The actuarial survival rates according to the type of prosthesis, bioprosthesis vs. mechanical.



### AVR in mild to moderate AS scheduled for CABG operation

#### Consider:

- Natural history of AS (including progression rate)
- Additional operative risk by adding AVR to CABG
- Additional risk at F-U from AVR
- Operative risk of delayed AVR
- Hemodynamic benefit from AVR for mild/mod. AS

Hilton TC, Clin Cardiol 2000;23:141-7

### AVR in mild to moderate AS scheduled for CABG operation

- CABG alone - 1-3% mortality
- CABG + AVR - 4-6% mortality
  - Additional operative risk 1-3%
- Additional yearly mortality from AVR - 1-2%
- Additional yearly morbidity from AVR - 1-2%
- Mortality from Re-AVR late after CABG:
  - 14-24%

Hilton TC, Clin Cardiol 2000;23:141-7

## AVR in mild to moderate AS scheduled for CABG operation

- If aortic gradient is >20-25 mmHg, symptomatic AS may develop prior to reaching the end of expected benefit from CABG → consider AVR
- If aortic gradient is <25 mmHg - AVR generally unnecessary

Hilton TC, Clin Cardiol 2000;23:141-7

## AVR in mild to moderate AS scheduled for CABG operation

- Late AVR after CABG with initial “mild to moderate AS” - 14-19% mortality
  - Collins et al, J Cardiovasc Surg 1994; 9 (Suppl) 145-7
  - Odell et al, Ann Thorac Surg 1996; 62: 1424-30
  - Fighali et al, Circ 1995 92 (Suppl II): II 163-8
- Conclusion: AVR in mild to moderate AS in adjunct to CABG !?

## Management of patients undergoing coronary artery bypass graft surgery with mild to moderate aortic stenosis.

- To examine the outcome in patients with mild to moderate AS undergoing CABG.
- 200 patients requiring CABG and with a peak AS gradient < 40 mmHg by Doppler echo between 1990 and 2000.
- 154 underwent isolated CABG (group A) and 46 CABG + AVR (group B).

• Karagounis A et al; J Heart Valve Dis. 2004

## Management of patients undergoing coronary artery bypass graft surgery with mild to moderate aortic stenosis.

- Mortality was 2.6% (n = 4) in group A and 6.5% (n = 3) in group B (p = NS)
- There was no significant difference in postoperative complications
- median postoperative stay was 6 and 8 days, respectively (p = 0.02)
- During the median follow up period of 4.2 years no patient in group A required AVR

## Management of patients undergoing coronary artery bypass graft surgery with mild to moderate aortic stenosis.

- Morbidity and mortality in patients who underwent combined surgery was comparable with that in patients who had isolated CABG. However, none of the patients who underwent only CABG required AVR during the follow up period.
- It is concluded that patients with mild AS at the time of CABG should not undergo AVR. It is possible that a cut-off AS gradient > 40 mmHg should be considered for combined surgery.

## AVR in mild to moderate AS scheduled for MVR

- N=131, Age 61±12
- MVR for rheumatic disease in 1975-1992
- F-U 13 ±7 years (1-33)
- Aortic valve disease:
  - 42% at baseline (all mild)
  - 73% at end of follow-up
- Severe AS/AR at end of follow-up - only 3

Vaturi ; Sagie et al, JACC 1999; 33: 2003-8

## Severe AS in a patient scheduled for non-cardiac surgery

- Hemodynamically significant AS - 13% risk of perioperative death
- In severe symptomatic AS - AVR is preferred before an elective non-cardiac surgery
  - JACC 1996; 27: 910-48
- In severe symptomatic AS who need emergent non-cardiac surgery - consider PBAV
  - Hayes et al, Mayo Clin Proc 1989; 64: 737-57
  - Rahimtoola, Circ 1987; 75: 895-901

## Severe AS in a patient scheduled for non-cardiac surgery

- 19 pts., AVAI < 0.5 cm<sup>2</sup>/m<sup>2</sup>, mean AVG > 50 mmHg
- 28 procedures - 12 orthopedic, 6 intraabdominal, 4 vascular and more.
- 16/19 (84%) - at least 1 symptom of AS.
- Arterial line in 20/28
- Hypotension - treated with phenylephrine
- 2 deaths (postoperative)

Torcher et al, Am J Cardiol 1998; 81: 448-452

## AS and pregnancy

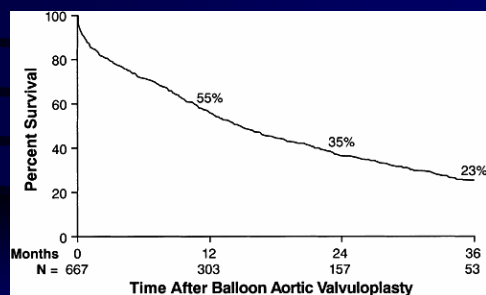
- Commonest cause - BAV
- Normal LV, Mild to moderate AS - normal pregnancy
- Severe (>50 mmHg) or symptomatic - relief AS before conception
- Severe AS in a pregnant woman - consider intervention (PBAV / AVR) before labor
- Severe symptomatic AS in a pregnant woman - deliver

Bonow et al. JACC 1998; 32: 1486-588

## Aortic stenosis Balloon valvotomy

- 1<sup>st</sup> experience - Cribier, 1985
- Post-procedural AVA 0.7-1.1 cm<sup>2</sup>
- Hospital mortality 3.5-13.5%
- 20-25% - ≥1 complication within 24h
- If not operated - few months of alleviation of symptoms. Benefit disappears within 2 years
- Later AVR - improves survival

## Survival after balloon aortic valvuloplasty (n=674)



Otto et al, Circ 1994; 89: 642-50

## Balloon valvuloplasty in critical AS with shock

	N	AVA pre	AVA post	In hospital death	Death <30 days	AVR	1Y survival
NHLBI	39	*	*	*	51%	*	*
Cribier	10	0.47±0.1	0.95±0.3	10%	20%	60%	*
Moreno	21	0.48±0.04	0.84±0.06	43%	*	5%	33%
Buchwald	14	0.38±0.09	0.81±0.12	71%	67%	21%	29%

## Balloon valvuloplasty in critical AS with shock

- The only independent predictor of mortality is duration of shock
  - 0/10 (0%) survival if shock >48h
  - 4/4 (100%) survival if shock <48h

Buchwald et al, Clin Cardiol 2001; 24: 214-218

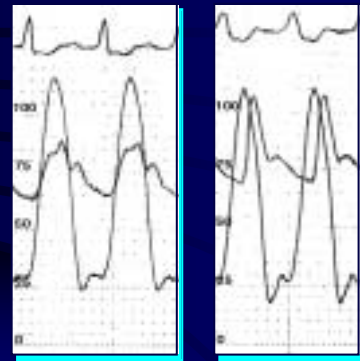
## Aortic stenosis Indications for balloon valvotomy

- Class IIA
  - Hemodynamically unstable patients, as a bridge to AVR
- Class IIB
  - Palliation in serious comorbidities
  - Palliation when urgent non-cardiac surgery indicated
- Class III
  - Alternative to AVR

## Percutaneous aortic valve replacement

- Around 1/3 of elderly patients with severe AS are declined by cardiac surgeons for AVR and therefore, there is a real need for non surgical AVR.
- This concept might become a feasible option for treating patients with relevant aortic valve disease but a high operative risk

## Post- PHV Implantation



AVA: 0.6 cm<sup>2</sup>

AVA: 1.9 cm<sup>2</sup>

## Early experience with percutaneous transcatheter implantation of heart valve prosthesis for the treatment of end-stage inoperable patients with calcific AS.

Cribier A et al

• J Am Coll Cardiol. 2004

## Percutaneous implantation of aortic valve

- Six PHV implantations
- PHV was successfully delivered in 5 patients
- No residual gradient
- AVA was increased from 0.5 to 1.70 cmsq.
- Aortic regurgitation (paravalvular) was mild (3 pts) or severe (2 pts)
- Patent coronary arteries

## Percutaneous implantation of aortic valve

- The first 3 patients died of a non-cardiac cause at 18, 4, and 2 weeks
- The other patients are alive at 8 weeks with no signs of heart failure
- CONCLUSION: Implantation of the PHV can be achieved in patients with end-stage calcific aortic stenosis and might become an important therapeutic option for patients not amenable to surgical valve replacement.

## Acute Improvement in Global and Regional LV Systolic Function After Percutaneous Heart Valve Implantation in Patients With Symptomatic AS.

Bauer F, Eltchaninoff H, Tron C, Lesault PF, Agatiello C, Nercolini D, Derumeaux G, Cribier A.

Department of Cardiology, Hopital Charles Nicolle, Rouen, France.

- Circulation. 2004 Jun 28

## Acute Improvement in LV Systolic Function After Percutaneous Heart Valve Implantation in Symptomatic AS.

- 8 pts with severe AS had 2D echo at baseline and 24 hours after PHV implantation to evaluate changes in LV volume and LVEF
- AVA increased from 0.59 to 1.69 cmsq.
- LV EF increased from 48% to 57%; (P<0.01)
- Immediately after PHV replacement, improvement of LV global and regional systolic function was evidenced by tissue Doppler imaging.

מה מהבאים אינו מהווה הוריה להפסקת מבחן מאמץ בחולה עם היצרות אאורטלית קשה?

- א. כאבים בחזה.
- ב. צניחת ST אופקית של 3 מ"מ.
- ג. ירידת ל"ד ל-15 מ"מ.
- ד. Non-sustained VT בן 10 פעימות.

התאם המצבים הבאים לניתוח או המסתם המועדף (הנח) - כל החולים בסינוס. תיתכנה מספר אופציות קבילות לאותה שאלה, נסה למצוא את הטובה ביותר):

- א. בן 10, AS קשה מלידה
- ב. בת 40, חולת דיאליזה, AS קשה
- ג. Homeless בן 58, AR קשה על רקע אנדוקרדיטיס
- ד. בת 73, AS קשה, טבעת 19 מ"מ
- ה. בן 77, AS קשה, טבעת 23 מ"מ.
- א. תותב מיכאני
- ב. תותב ביולוגי עם Stents
- C ניתוח ע"ש Ross
- D. הומוגרפט
- E. תותב ביולוגי Stentless

לפי האיגודים הקרדיולוגיים האמריקאיים (Bonow et al, 1998), ניתוח המסתם האורטלי מומלץ (דרגת המלצה I) בכל המצבים הבאים המלווים AR קשה למעט:

- א. אי ספיקת לב NYHA III, LVEF=54%.
- ב. LVEF=40%, דרגה תפקודית 1.
- ג. NYHA I, קוטר חדר שמאל: סוף-דיאסטולי - 63 מ"מ, סוף-סיסטולי - 39 מ"מ.
- ד. תעוקת חזה CCS III



בחולה עם הפרעה ניכרת בתפקוד חדר שמאל (LVEF=25%)  
נמצאה היצרות אאורטלית משמעותית, כאשר השטח המחושב לפי  
נוסחת Continuity הוא 0.8 סמ"ר. מפל השיא על המסתם - 30  
ממ"כ. מה מהאמירות הבאות לגבי מבחן אקו עם הזלפת דובוטאמין  
אינה נכונה?

- א. עלית שטח המסתם ל-1.1 סמ"ר ללא שינוי במפל מלמדת על Pseudostenosis של המסתם.
- ב. עליית המפל ל 50 ממ"כ ללא שינוי שטח המסתם מצביעה על סיכוי טוב לשיפור תפקוד החדר והמצב התפקודי של החולה אם יעבור בשלום את ניתוח החלפת המסתם.
- ג. אם אין שינוי במפל - יש להמשיך המבחן במינונים של 20-40  $\mu\text{g/kg/min}$  כדי לברר את הרזרבה של המיוקארד.
- ד. כאשר שטח המסתם 0.5 סמ"ר קרוב לוודאי החסימה אורגנית והתועלת ממבחן הזלפת דובוטאמין מעטה.