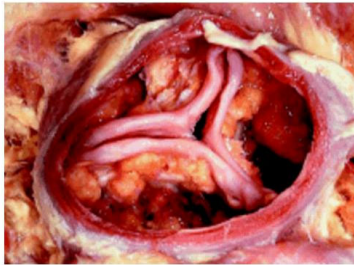


Lecture: Best Measure Response to Aortic Valve Disease: Gradients, areas and others

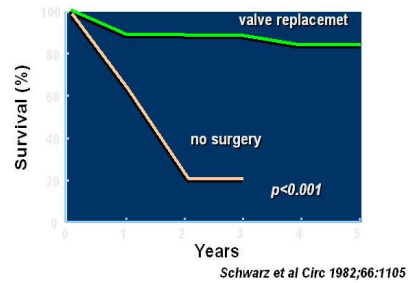
Fausto Pinto, MD (Yun Zhang, MD PhD in Asia Broadcast)

Aortic Valve Disease



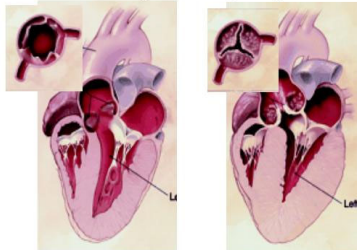
34.00 Pinto 2 of 33

Effect of AoV Surgery



34.00 Pinto 2 of 33

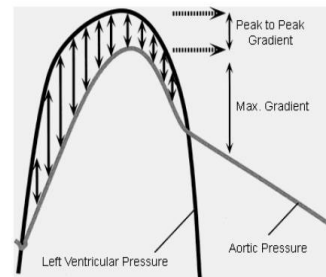
Aortic Valve Stenosis LV compensatory response



Nishimura RA Circ 2002;106

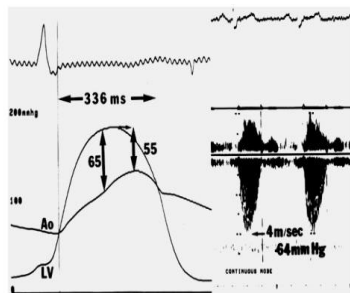
34.00 Pinto 3 of 33

Pressure Gradient in Ao Stenosis



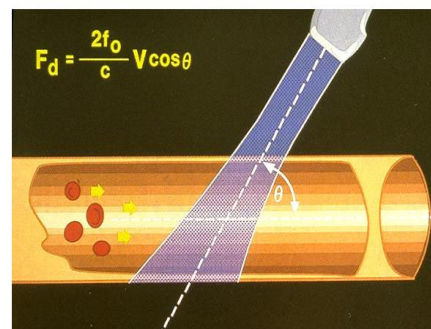
34.00 Pinto 4 of 33

Peak Instantaneous Gradient



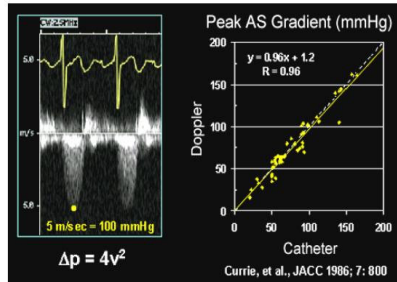
Pepine CJ et al 1994

34.00 Pinto 5 of 33



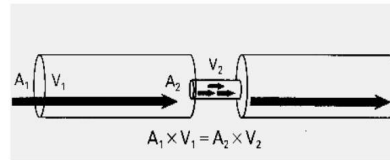
34.00 Pinto 6 of 33

Quantification of Valvular Gradients



34.00 Pinto 7 of 33

Continuity Equation to Assess Valve Area



Ross, Braunwald Circulation 1968;38:V61

34.00 Pinto 8 of 33

Bernoulli Equation

convective acceleration flow acceleration viscous friction

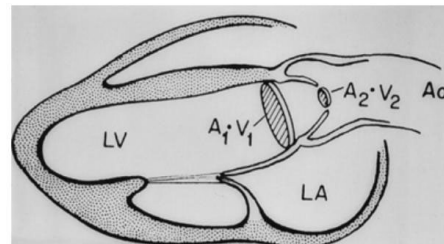
$$p_2 - p_1 = \frac{1}{2} \rho (V_2^2 - V_1^2) + \rho_1 \frac{dV}{dt} ds + R(V)$$

↓

$$p_2 - p_1 = 4V^2$$

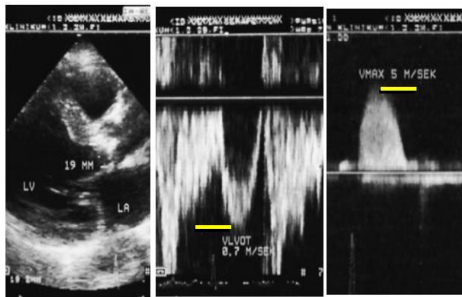
34.00 Pinto 9 of 33

Continuity Principle



34.00 Pinto 10 of 33

Assessment of Aortic Valve Area



34.00 Pinto 11 of 33

AoV Area Continuity Equation

$$A_{AV} \cdot \bar{V}_{AV} = A_{LVOT} \cdot \bar{V}_{LVOT}$$

$$A_{AV} = 0.785 \times (D)^2 \cdot \frac{\bar{V}_{LVOT}}{\bar{V}_{AV}}$$

34.00 Pinto 12 of 33

Figure 1 shows two echocardiographic images of the aortic valve. The top image is a parasternal short-axis view, and the bottom image is a parasternal long-axis view. Both images show the aortic valve with yellow outlines for the non-coronary (N), left coronary (L), and right coronary (R) cusps. The AVA is calculated as 1.4 cm².

Aortic valve area (cm²)

3.0
2.0
1.0
0

Baseline Final Baseline Final

AVR/Died Asymptomatic

Clinical Outcome

Figure 2 consists of two panels. The left panel is a scatter plot showing the Rate of Progression (m/sec/yr) for patients without and with cardiac events. The y-axis ranges from -0.2 to 1.6. The x-axis has two categories: 'Without Cardiac Events' and 'With Cardiac Events'. The 'Without Cardiac Events' group has a mean rate of progression of approximately 0.15 m/sec/yr, while the 'With Cardiac Events' group has a mean rate of progression of approximately 0.45 m/sec/yr. The difference is statistically significant (P<0.001). The right panel is a PET scan image showing the distribution of ¹⁸F-FDG in the heart. The image is a cross-section of the heart, with the apex of the heart indicated by a white arrow. The PET scan shows a high concentration of ¹⁸F-FDG in the apex of the heart, indicating a high rate of progression.

The Kaplan-Meier plot shows event-free survival (%) on the y-axis (0 to 100) against time on the x-axis (0 to 100 days). The survival curve starts at 100% at day 0, remains high until approximately day 20, then drops sharply to about 20% by day 100, where it plateaus.

Survival

Survival (%)

Years

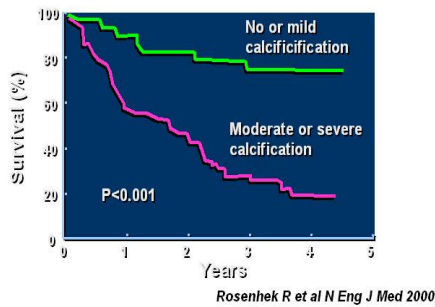
— general population
— aortic stenosis

Years	General Population Survival (%)	Aortic Stenosis Survival (%)
0	100	100
1	98	95
2	95	90
3	92	88
4	90	87
5	88	86

The Kaplan-Meier plot displays event-free survival percentages over a four-year period. The y-axis, labeled 'Event free survival (%)', ranges from 0 to 100. The x-axis, labeled 'Years', ranges from 0 to 4. Two curves are shown: a blue line for the '<50 yrs old' group and a red line for the '>50 yrs old' group. The blue curve starts at 100% and remains high, ending at approximately 60% at 4 years. The red curve starts at 100% and shows a rapid decline, reaching approximately 20% at 4 years. A horizontal dashed line at approximately 60% indicates the survival level of the younger group at the end of the study.

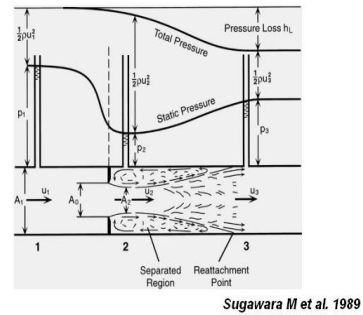
Years	<50 yrs old (%)	>50 yrs old (%)
0	100	100
1	90	60
2	75	45
3	65	30
4	60	20

Calcification and Prognosis in AS



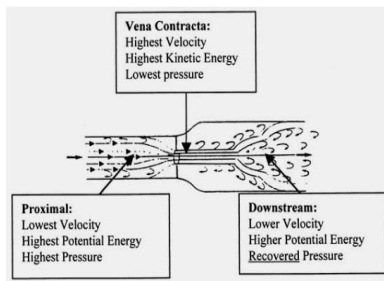
34.00 Pinto 20 of 33

Pressure Recovery



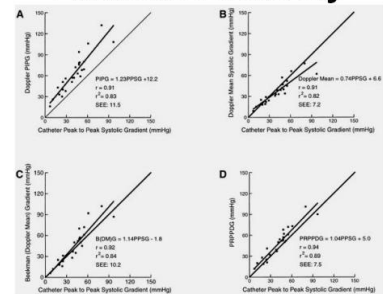
34.00 Pinto 21 of 33

Pressure Recovery



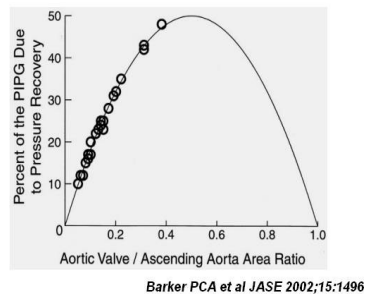
34.00 Pinto 22 of 33

Pressure Recovery



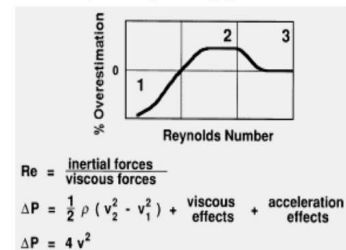
34.00 Pinto 23 of 33

Pressure Recovery

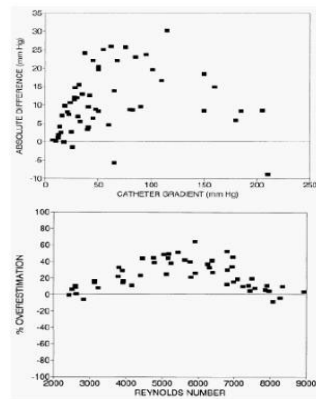


34.00 Pinto 24 of 33

Discrepancy Doppler-Cath

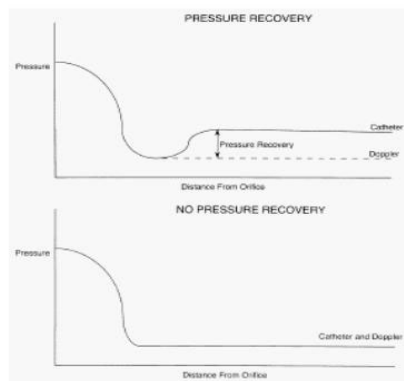


34.00 Pinto 25 of 33



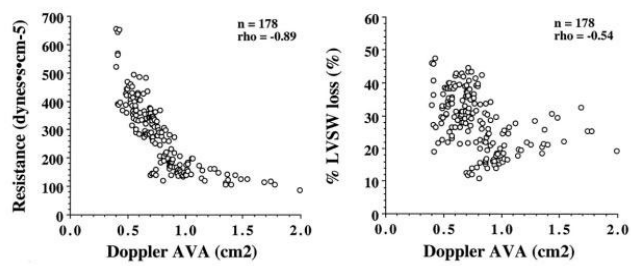
Cape et al.
Circulation 1996;94

34.00 Pinto 26 of 33



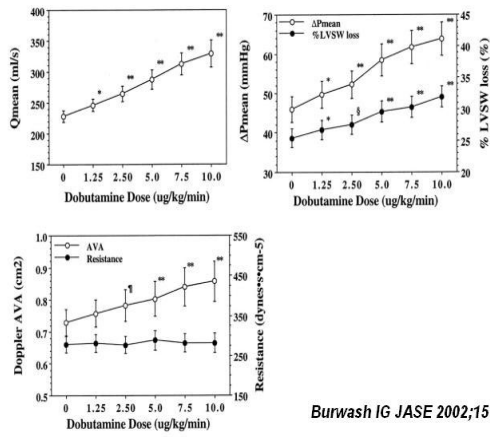
Cape et al. Circulation 1996;94

34.00 Pinto 27 of 33



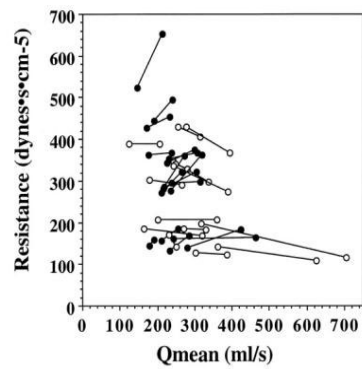
Burwash IG JASE 2002;15

34.00 Pinto 28 of 33



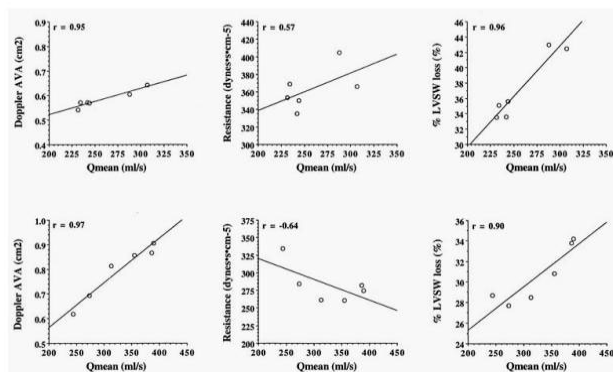
Burwash IG JASE 2002;15

34.00 Pinto 29 of 33



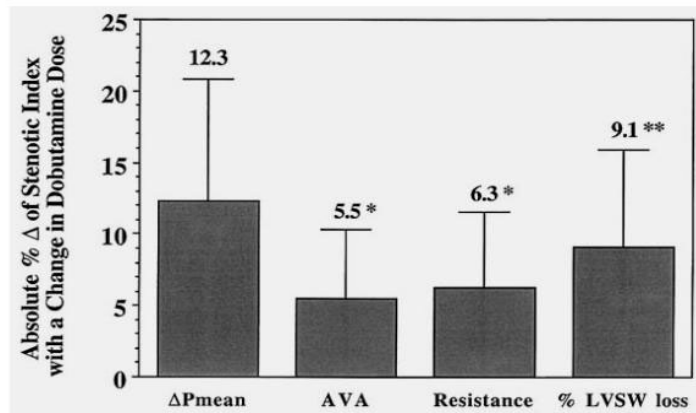
Burwash IG JASE 2002;15

34.00 Pinto 31 of 33



Burwash IG JASE 2002;15

34.00 Pinto 30 of 33



Burwash IG JASE 2002;15

34.00 Pinto 32 of 33

Doppler Quantification

Stenosis

- Use clinical judgement
- Take your time ... and your best pictures
- Use TEE if bad window
- If still in doubt: Use other methods (cath)

34.00 Pinto 33 of 33