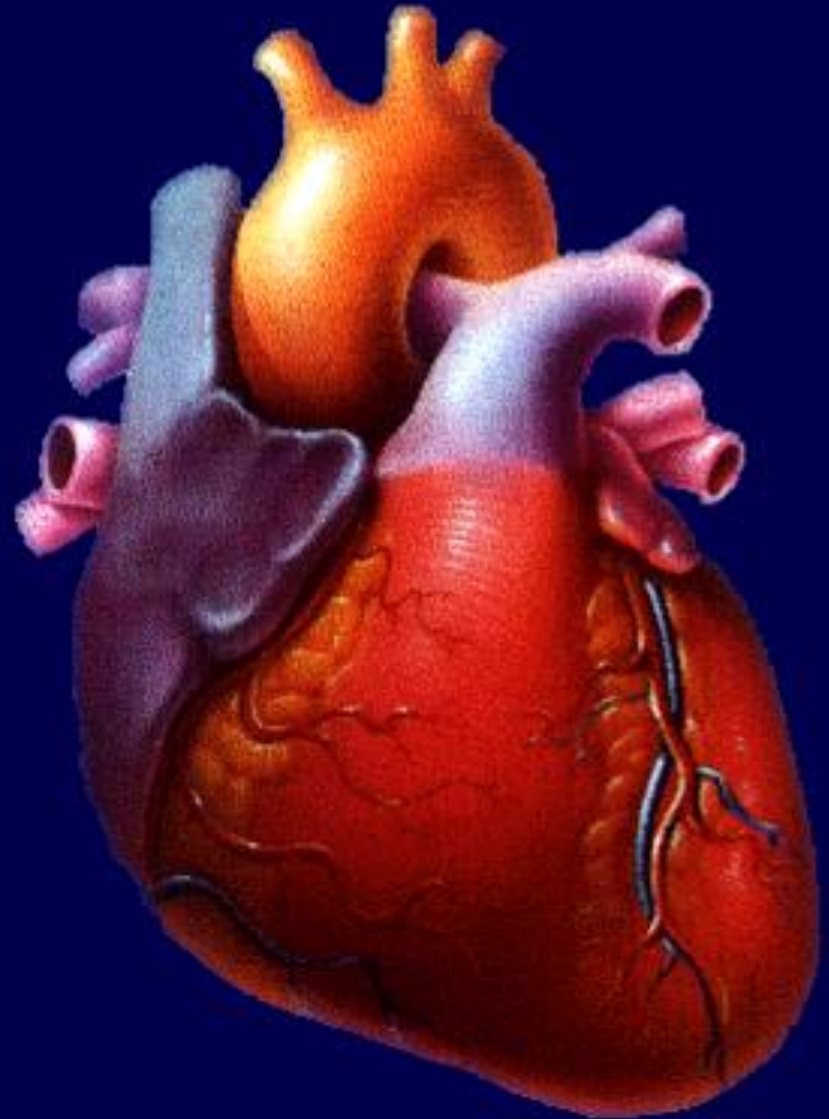


# *Ecocardiografia e Estenose Aórtica*

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**Dr. Manuel Paredes Horna**

**São Paulo - Brasil**



## Epidemiologia

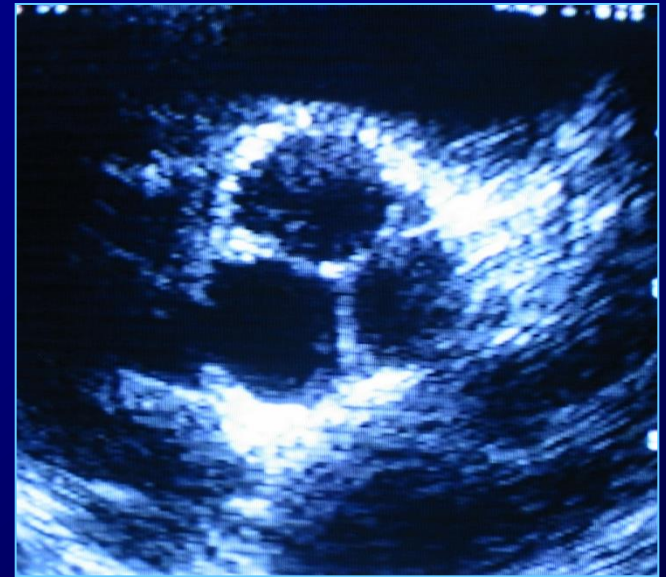
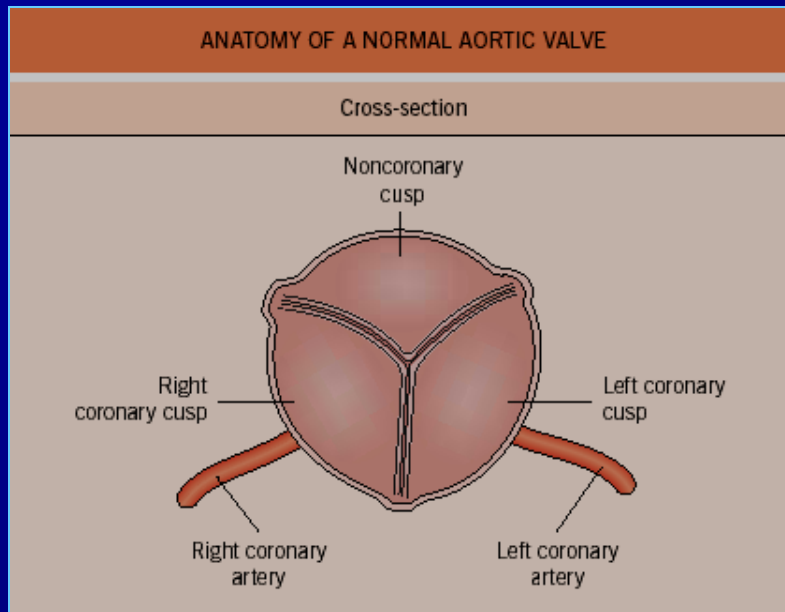
- 61% dos casos de troca valvar > 65 anos
- esclerose aórtica:
  - 20% faixa 65-74 anos
  - 80% > 84 anos
- aorta bicúspide:
  - 2% população
  - masculino > feminino (4:1)
  - coarctação, dissecação

## Epidemiologia

- estenose aórtica:
  - 1,3% 65-74 anos
  - 4% > 84 anos
- fatores associados:
  - sexo masculino, Lp(a), altura, HAS, tabagismo, LDL, DM

# *Ecocardiografia e Estenose Aórtica*

## *Anatomia Normal*



# *Ecocardiografia e Estenose Aórtica*

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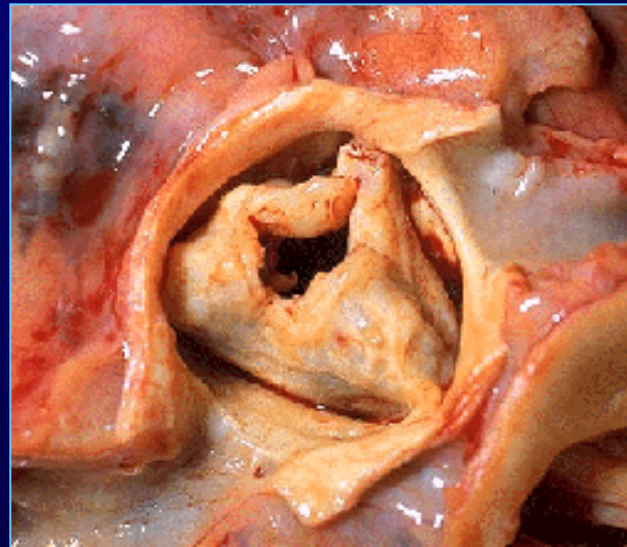
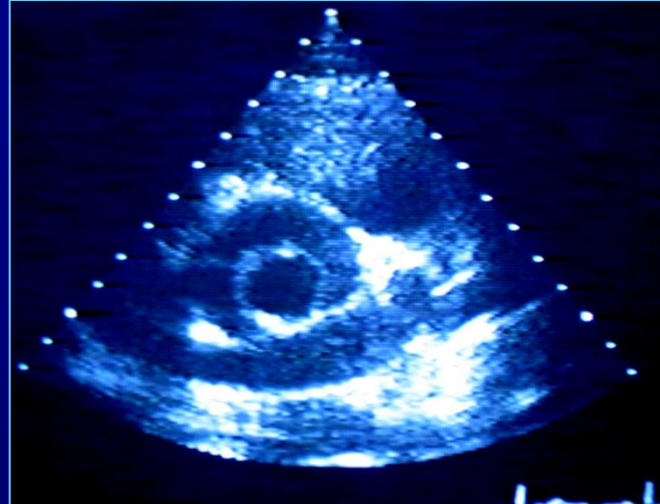
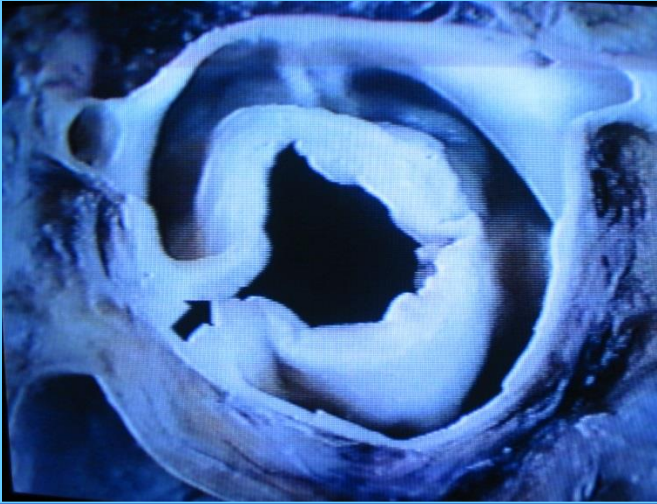
## *Etiologia*

- **Congênita**
  - Valva Unicúspide
  - Valva Bicúspide
  - Valva Quadricúspide
- **Reumática**
- **Degenerativa**
  - Doença degenerativa da valva tricúspide

# *Ecocardiografia e Estenose Aórtica*

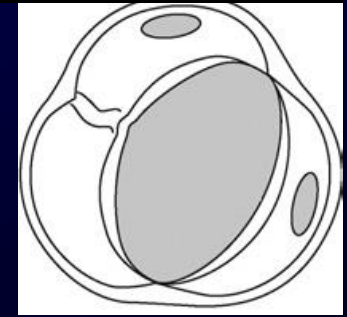
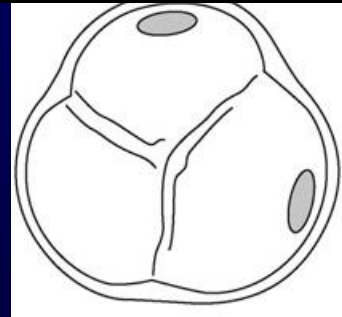
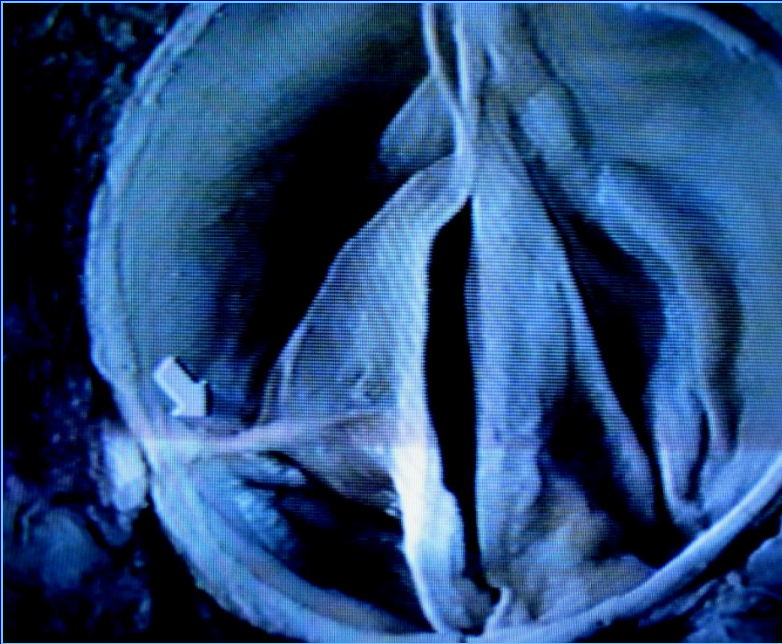
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## *Valva Unicúspide*



# *Ecocardiografia e Estenose Aórtica*

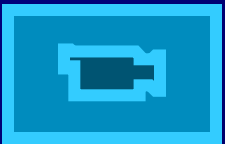
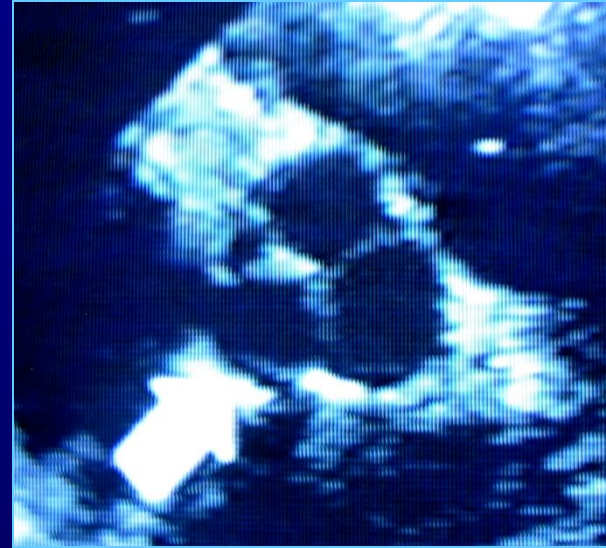
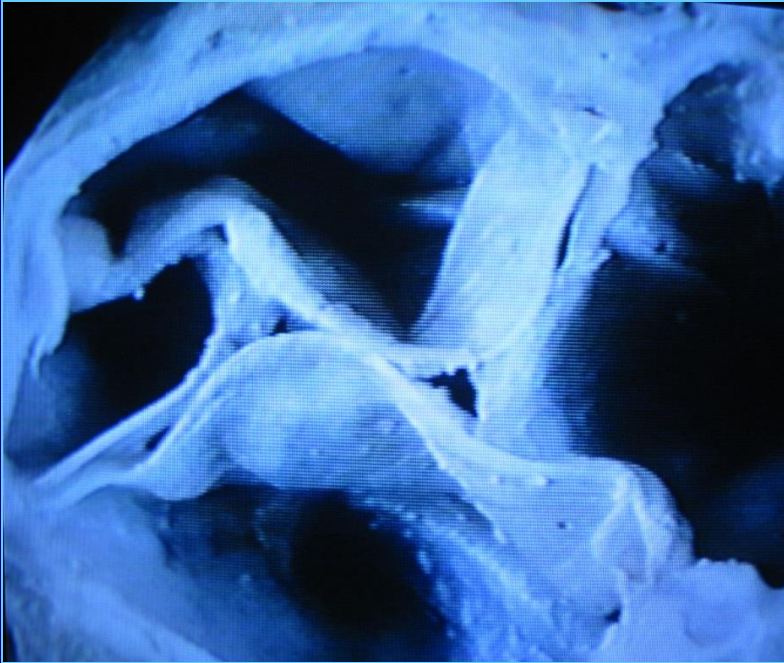
## *Valva Bicúspide*



# *Ecocardiografia e Estenose Aórtica*

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## *Valva Quadricúspide*

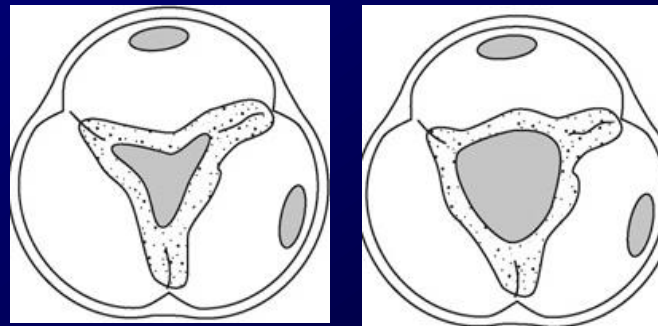
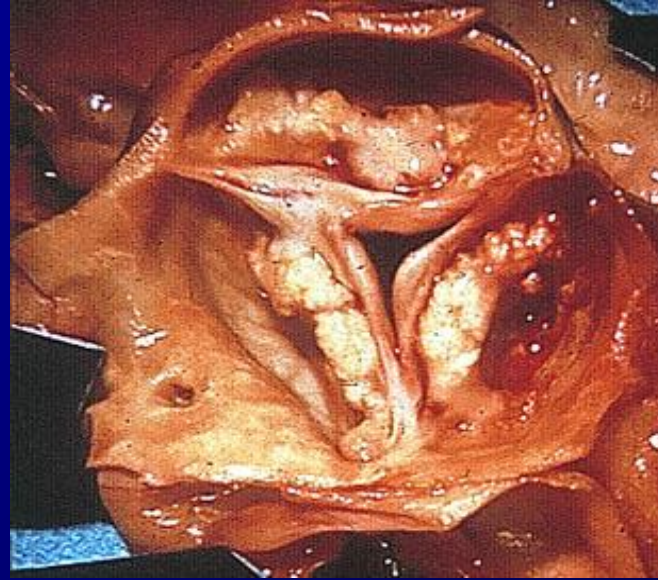




# *Ecocardiografia e Estenose Aórtica*

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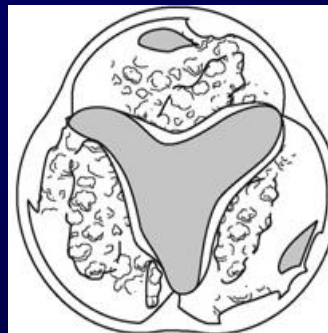
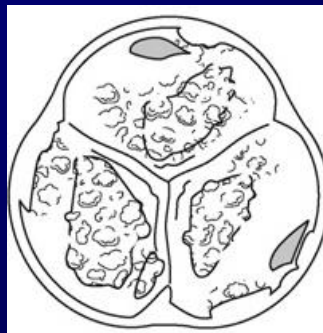
## *Etiologia Reumática*



# *Ecocardiografia e Estenose Aórtica*

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## *Etiologia Degenerativa*



# *Ecocardiografia e Estenose Aórtica*

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## *Etiologia*

- **Causas Raras**
  - Hipercolesterolemia Tipo II
  - Doença de Paget (óssea)
  - Insuficiência Renal
  - Exposição a Radiação

# *Fisiopatologia Estenose Aórtica*

---

## *Manutenção Estresse Parede VE (Laplace)*



$$\text{Estresse Parede VE} = \frac{\text{Pressão} \times \text{Raio}}{2 \times \text{espessura VE}}$$

Minimizar  
Estresse Parede VE

Minimizar  
Trabalho VE

# *Fisiopatologia Estenose Aórtica*

---

## *CUSTO Manutenção Estresse Parede VE*

- Diminuição Complacência VE
- Aumento demanda MVO<sub>2</sub>
- Diminuição fluxo coronário
- Disfunção Sistólica VE

# *Fisiopatologia Estenose Aórtica*

---

## *Padrão HVE segundo Sexo*

### **SEXO FEMININO**

- VE pequeno
- HVE concêntrica
- VE hiperdinâmico

### **SEXO MASCULINO**

- VE dilatado
- espessura normal
- VE hipocinético

# *Quadro Clínico Estenose Aórtica*

---

## *Sintomas*

- Assintomático durante anos
- Início Sintomas:
  - Pior Px sem conduta cirúrgica
  - Angina
  - Síncope / Pre-síncope
    - Esforço: hipotensão / bradicardia
    - Repouso: arritmia ventricular
  - Dispnéia por ICC

# *Quadro Clínico Estenose Aórtica*

---

## *Exame Clínico*

- Impulso apical +++
- Pulso *tardus e parvus*
- B4
- Click protossistólico (EAo cong)
- B2 única ou A2 tardia
- B3
- SS holo ejetivo *crescendo-decrescendo*



# *Quadro Clínico Estenose Aórtica Severa*

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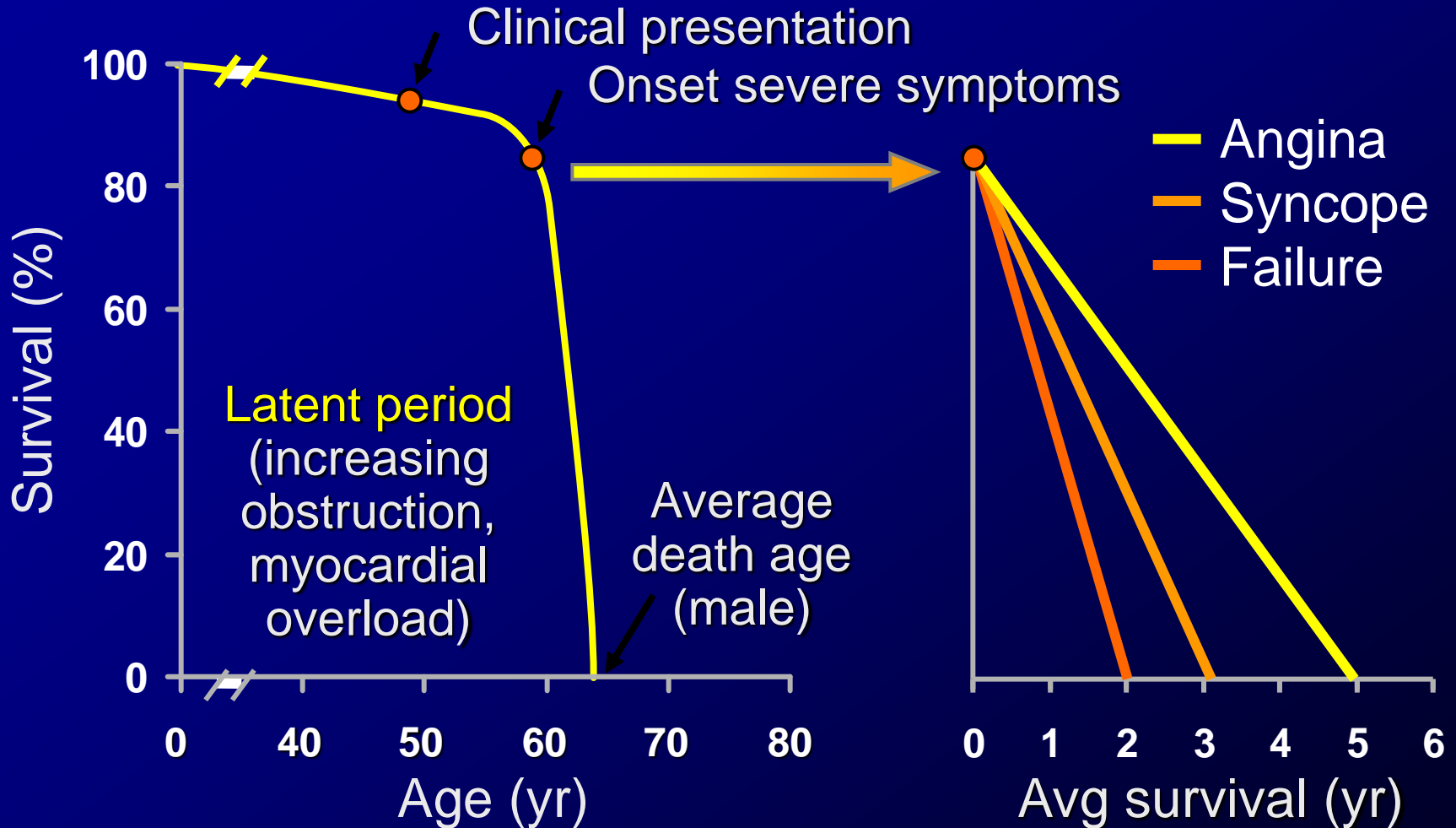
## *Prognóstico*

### *Início Sintomas segundo Etiologia*

- Bicúspide calcificada: 50-60 anos
- Degenerativa : 70-80 anos
- Reumática : 20-50 anos

# Valvular Aortic Stenosis in Adults

## Average Course (Post Mortem Data)



Ross and Braunwald: Circ, 1968

# *Ecocardiografia e Estenose Aórtica Severa*

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## *Prognóstico EAo Sintomática*

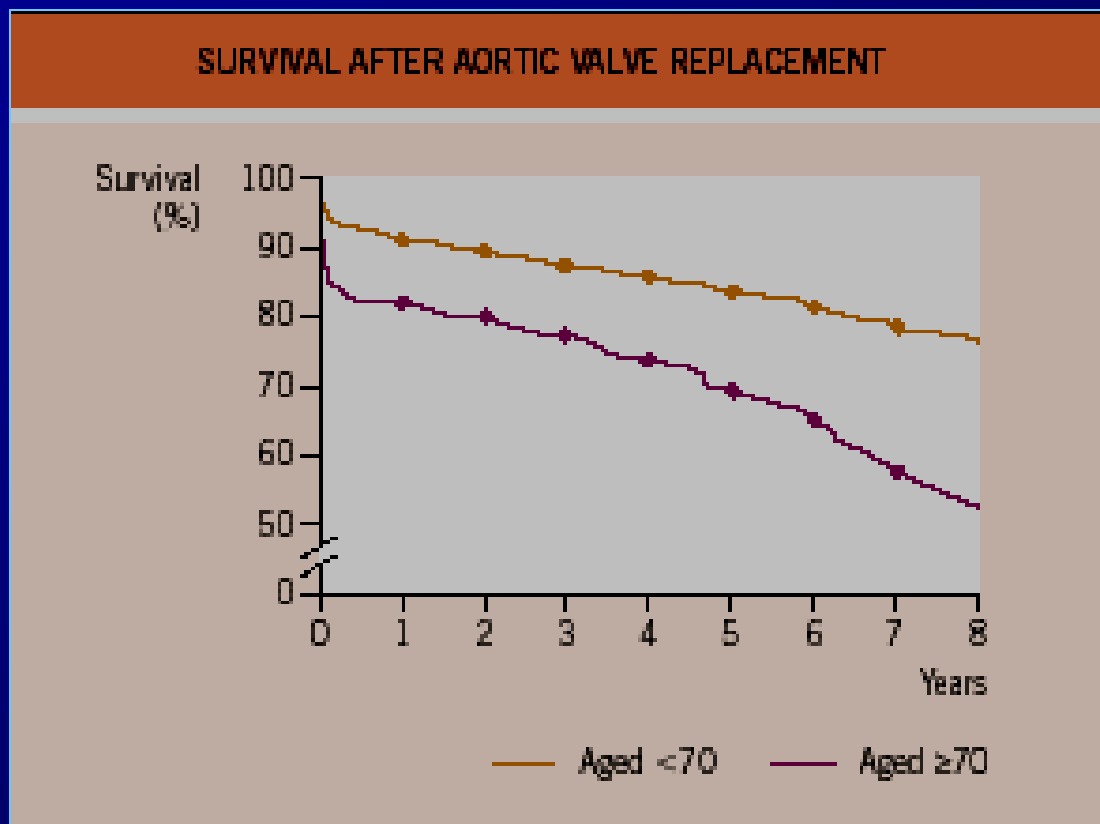
### *Tratamento Conservador*

- Sobrevida em 5 anos : 15 – 50%
- JACC/AHA: sobrevida < 2 a 3 anos

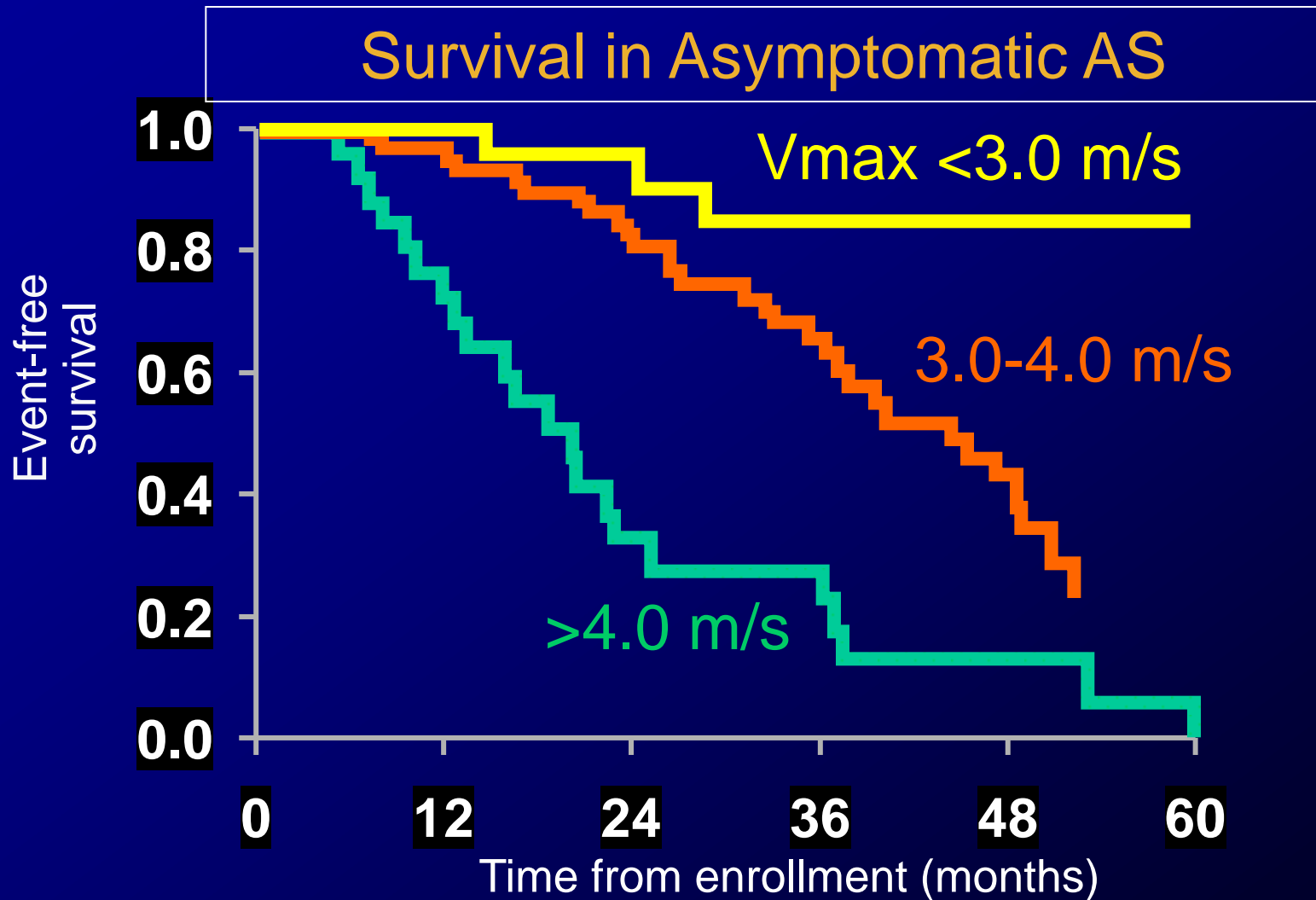
# *Ecocardiografia e Estenose Aórtica Severa*

## *Prognóstico EAo Sintomática*

### *Tratamento Cirúrgico*



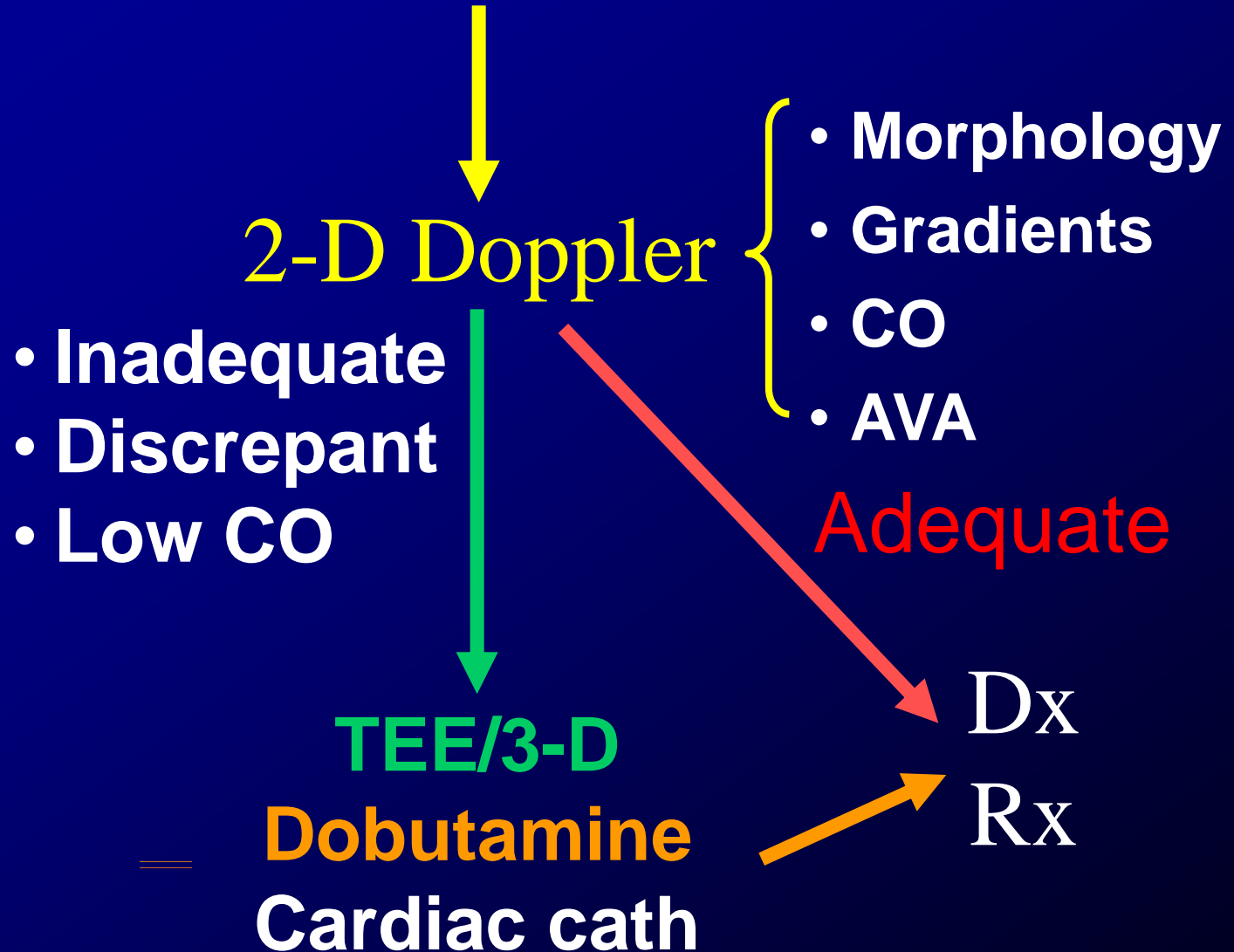
# Natural Progression in Asymptomatic All Degrees Aortic Stenosis (5y. follow-up)



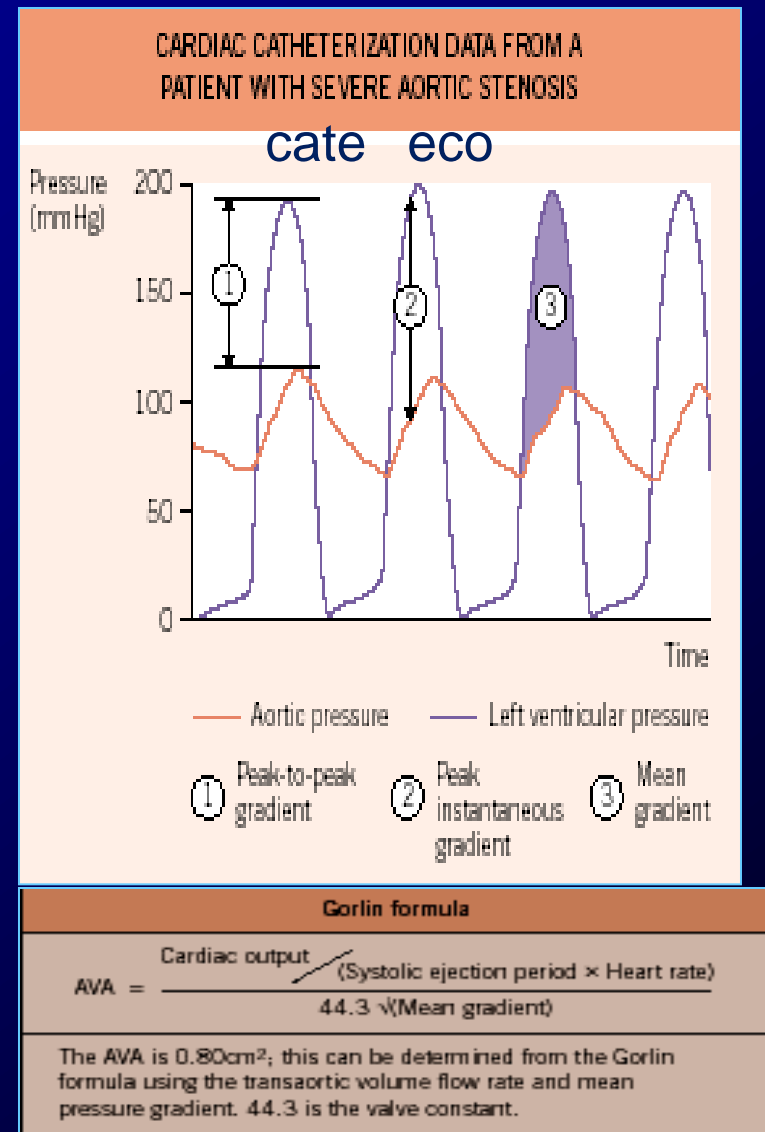
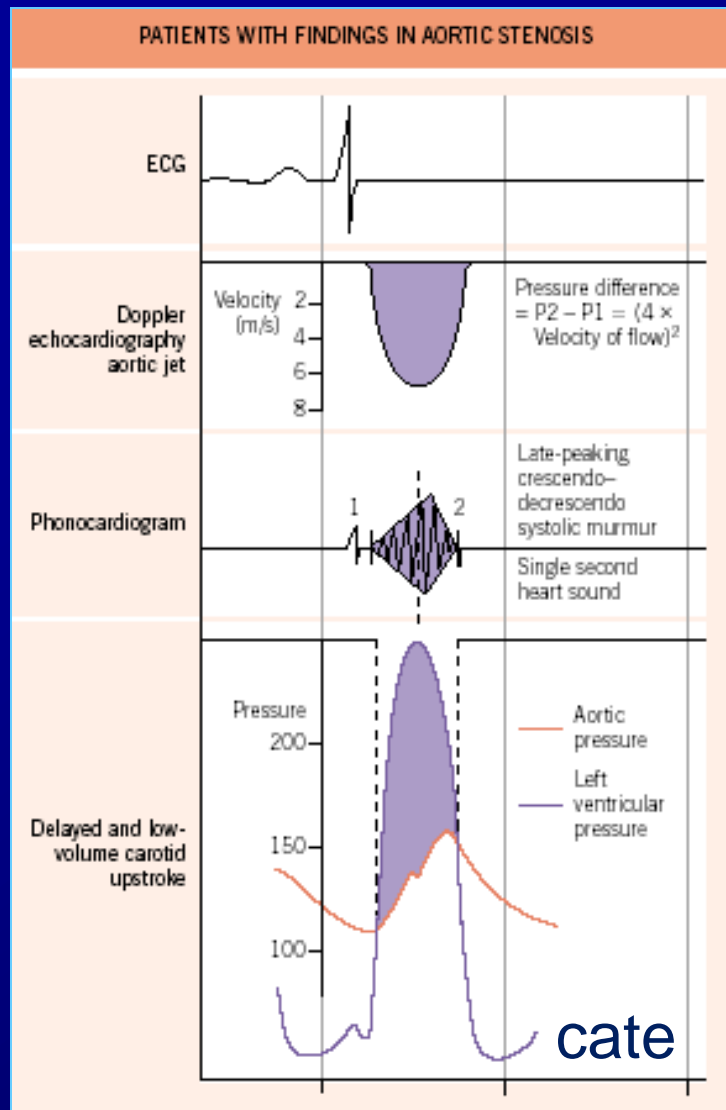
# Natural Progression in Asymptomatic All Degrees Aortic Stenosis (5y. follow-up)

- ↑ aortic jet velocity by  $0.32 \pm 0.34$  m/s per year
- ↑ mean gradient by  $7 \pm 7$  mmHg per year
- ↓ aortic valve area by  $0.12 \pm 0.19$  cm<sup>2</sup> per year
- ↓ 21±18% survival in 2 years without valve replacement with peak velocity  $\geq 4.0$  m/s

# Diagnosis 2002 and Beyond Aortic Stenosis?



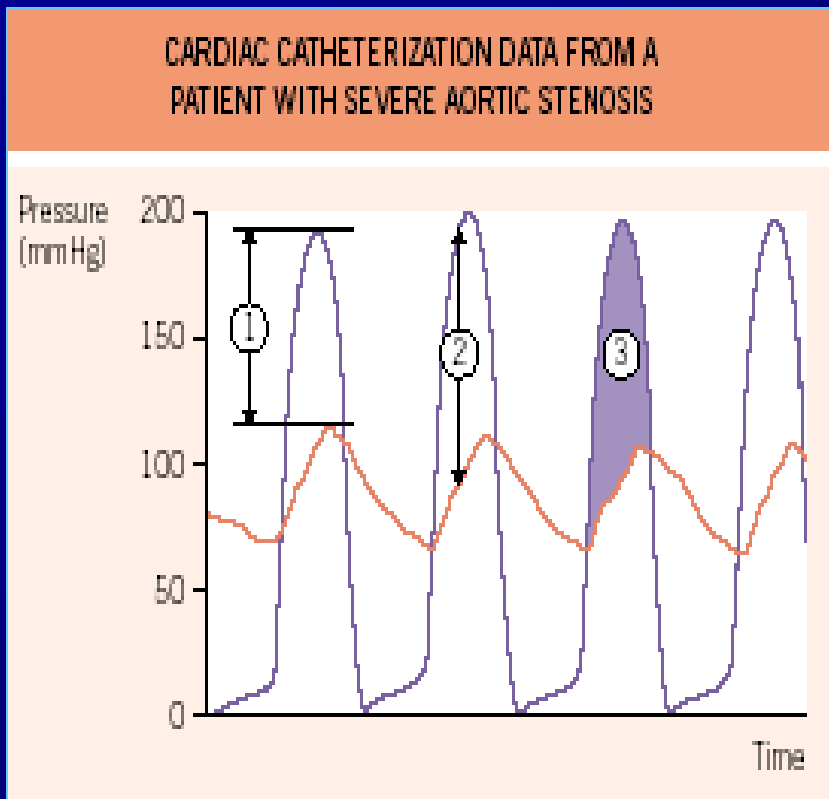
# Exames Complementares Estenose Aórtica





# Ecocardiografia e Estenose Aórtica

## Severidade Hemodinâmica



ECO

vs

CATE

Gd Mx

>

Gd Mx

Gd Md

=

Gd Md

# *Ecocardiografia e Estenose Aórtica*

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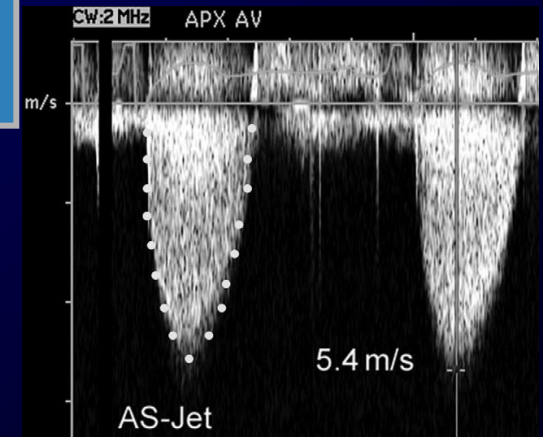
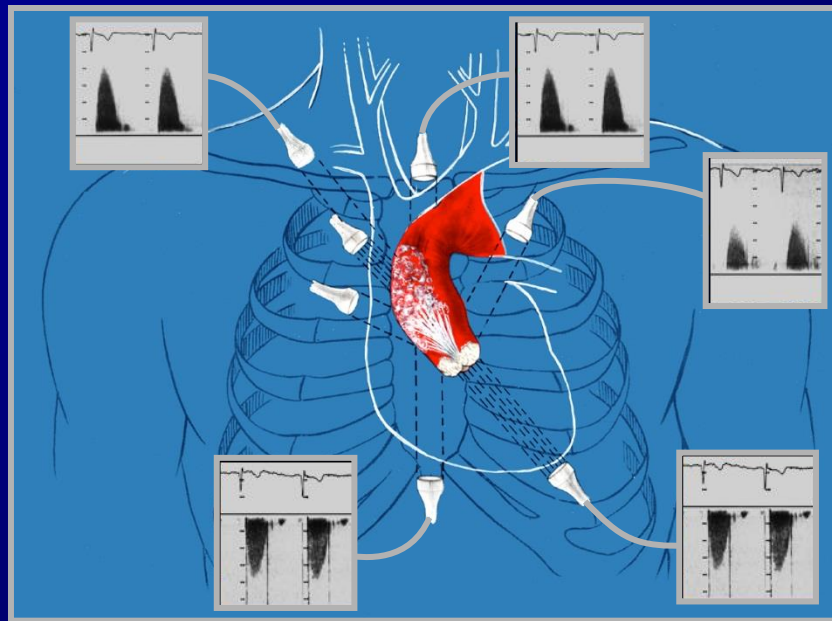
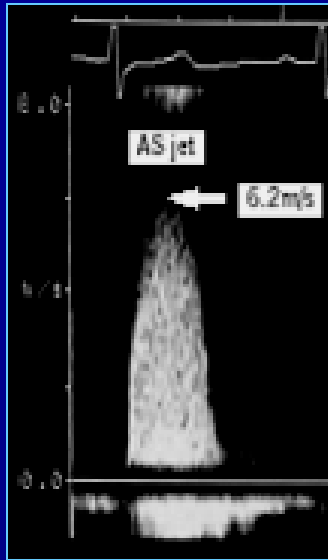
## Severidade Hemodinâmica e Área Valvar

|   | <u>NORMAL</u> | <u>DISCRETA</u>        | <u>MODERADA</u>            | <u>SEVERA</u>          |
|---|---------------|------------------------|----------------------------|------------------------|
| Vel. Máx (m/seg)                                | <2,5          | 2,6-2,9                | 3,0-4,0                    | > 4,0                  |
| Gd.Máx (mmHg)                                   | < 20          | 20-40                  | 40-64                      | > 64                   |
| Gd.Médio (mmHg)                                 |               | <20 (<30) <sup>a</sup> | 20-40 (30-50) <sup>a</sup> | >40 (>50) <sup>a</sup> |
| Área (cm <sup>2</sup> )                         | 2,5-4,5       | > 1,5                  | 1,0-1,5                    | < 1,0                  |
| AVA indexada (cm <sup>2</sup> /m <sup>2</sup> ) |               | > 0,85                 | 0,60-0,85                  | < 0,6                  |
| Índice Velocidade                               |               | > 0,50                 | 0,25-0,50                  | < 0,25                 |

<sup>a</sup> ESC Guidelines

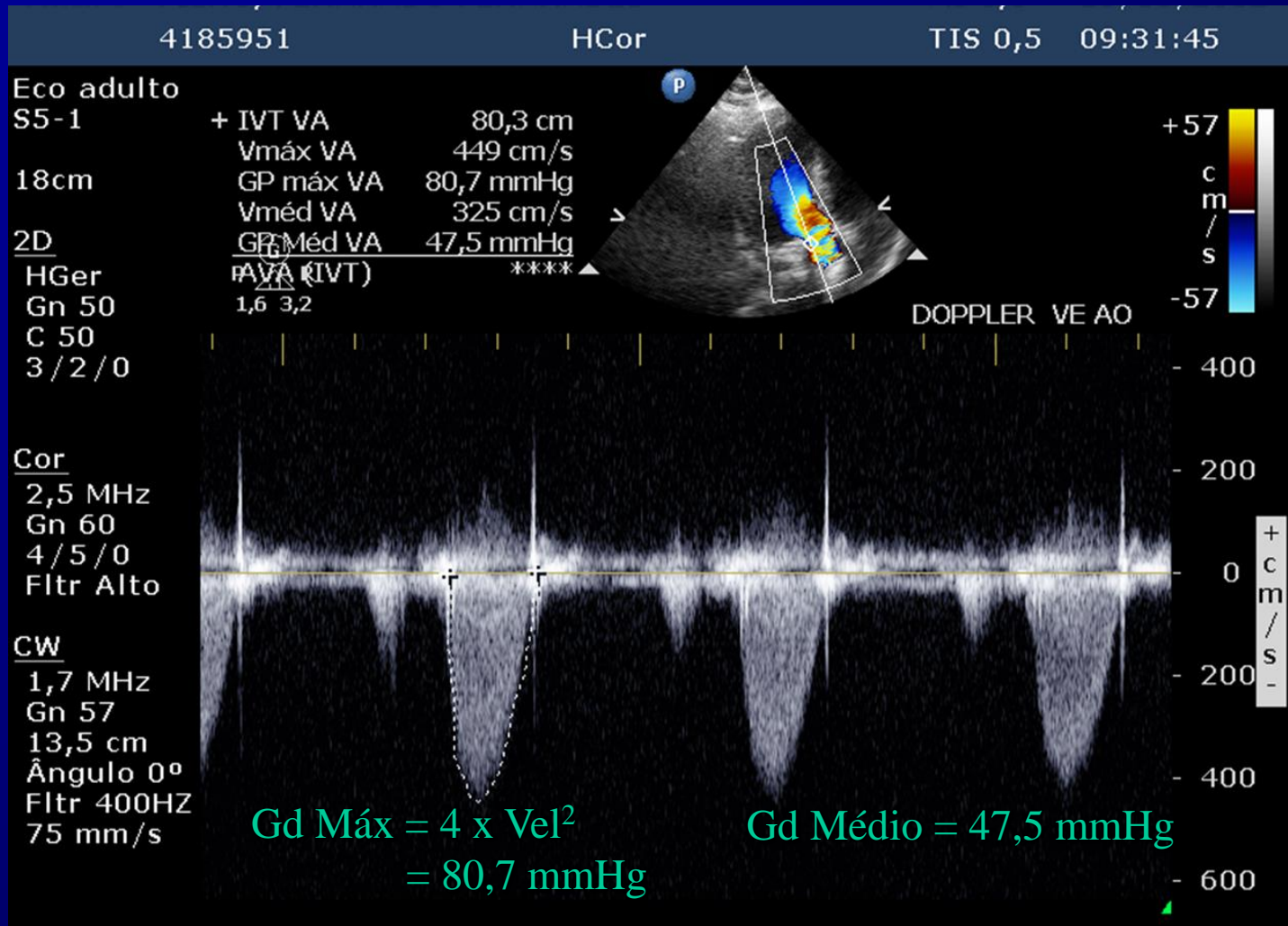
# *Ecocardiografia e Estenose Aórtica*

## Cálculo da Severidade Hemodinâmica



# Ecocardiografia e Estenose Aórtica

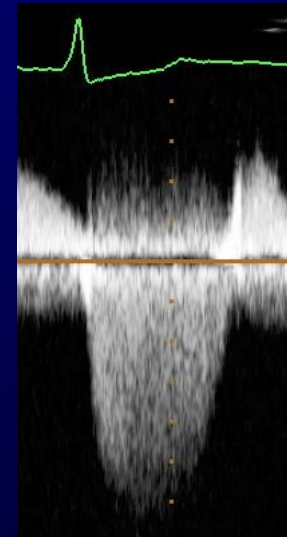
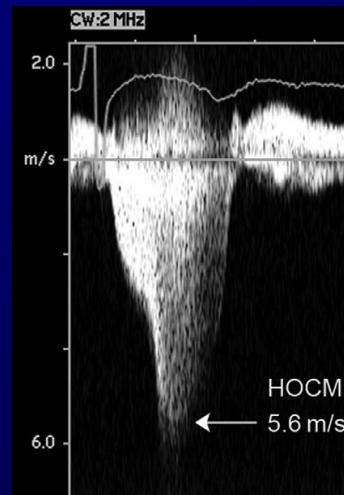
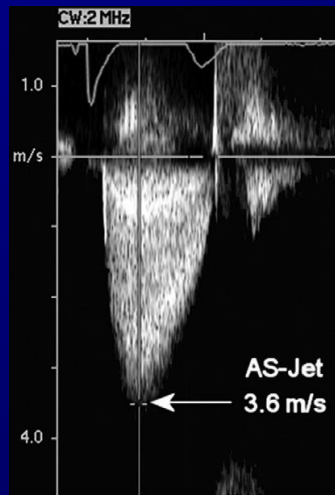
## Cálculo da Severidade Hemodinâmica



# Quadro Clínico Estenose Aórtica

## Diagnóstico Diferencial Doppler Contínuo

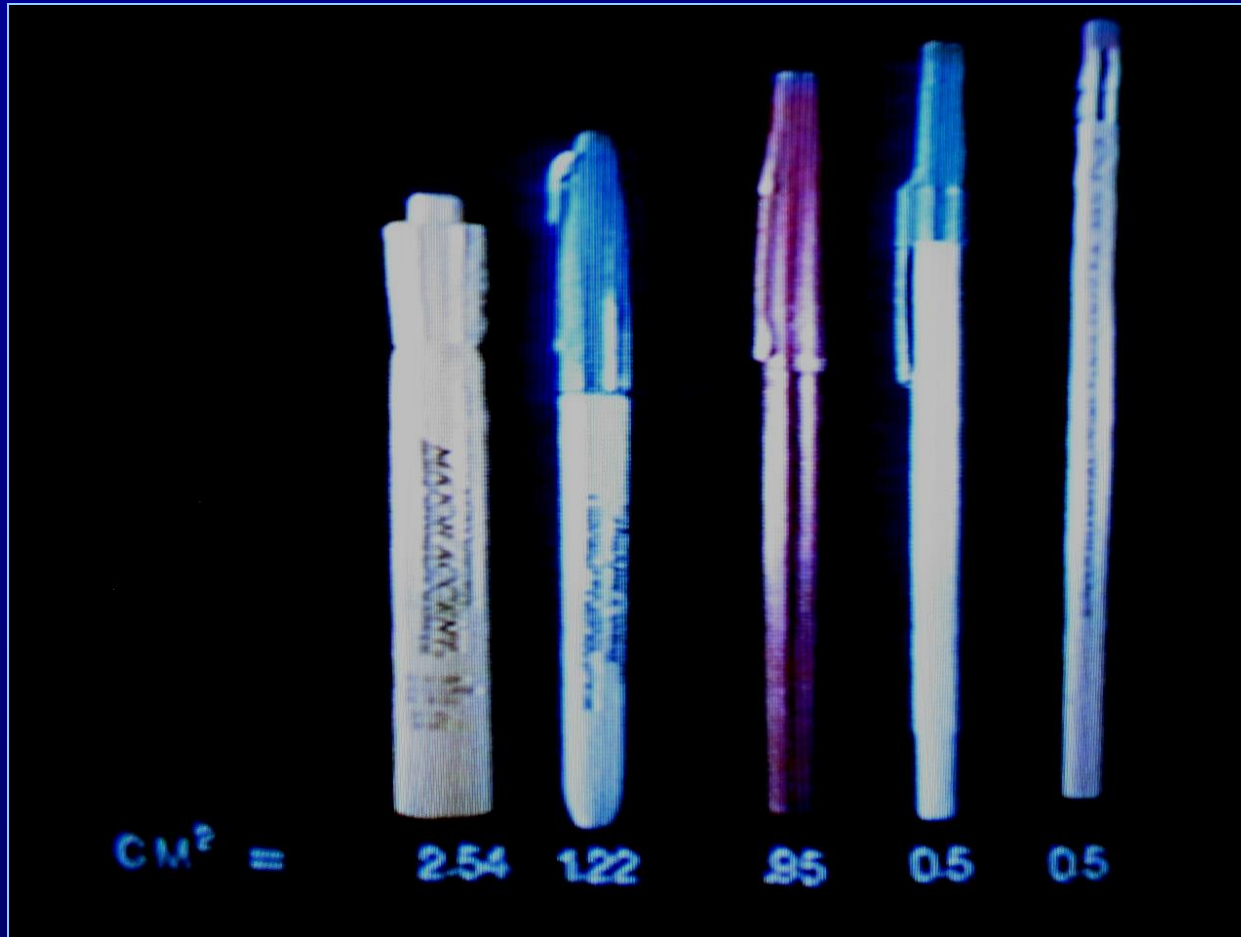
- Miocardiopatia Hipertrófica
- Insuficiência Mitral



# *Ecocardiografia e Estenose Aórtica*

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## Cálculo da Área Valvar Aórtica



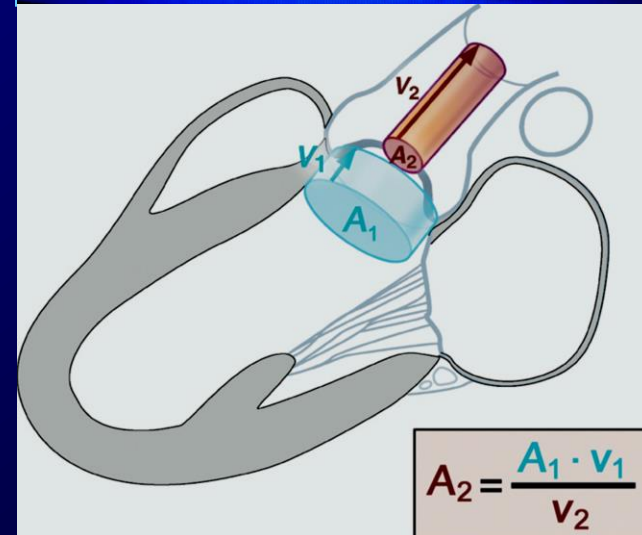
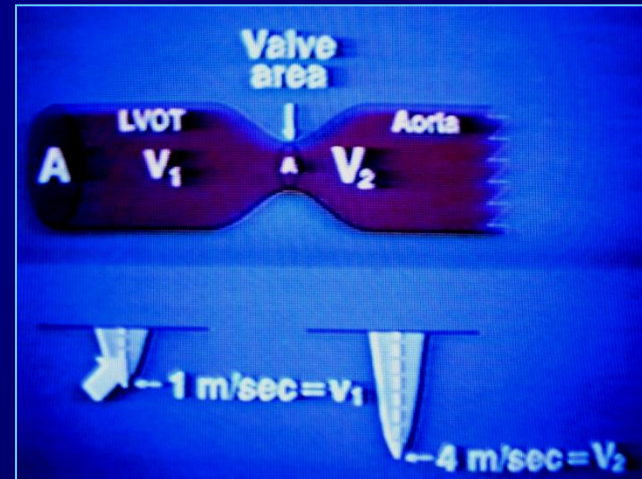
# Ecocardiografia e Estenose Aórtica

## Cálculo da Área Valvar Aórtica

### CONTINUITY EQUATION

Simplified approach

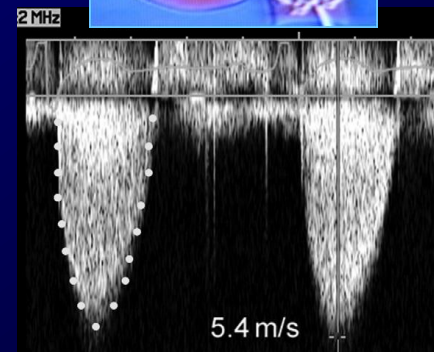
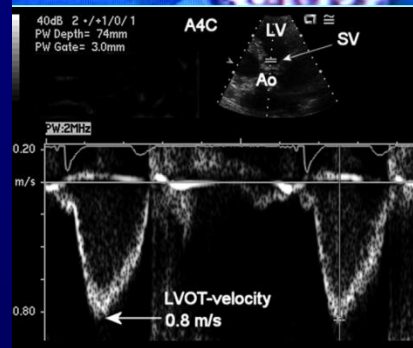
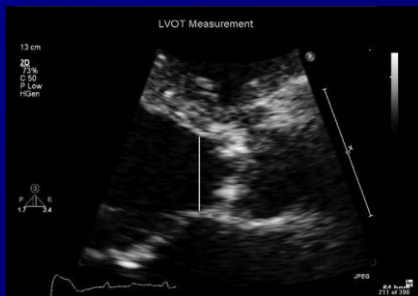
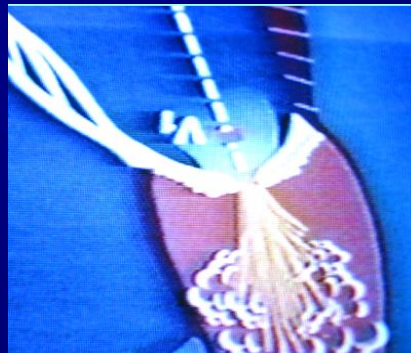
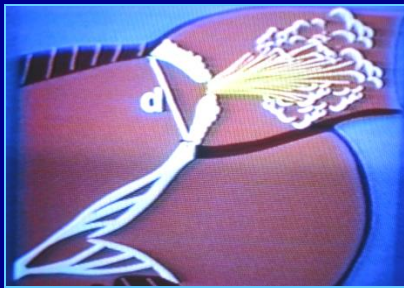
$$AVA = \text{Area}_{LVOT} \left( \frac{V_1}{V_2} \right)$$



# Ecocardiografia e Estenose Aórtica

## Cálculo da Área Valvar Aórtica

$$AVA = (d)^2 \times 0.785 \times V_1 / V_2$$



$$A_{VALVAR} = 2.2^2 \times 0.785 \times 0,8/5,4 = 0,56 \text{ cm}^2$$

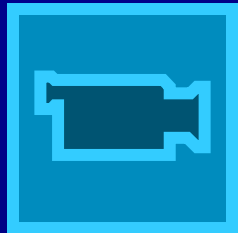


## Área Valvar Aórtica

### Quando Calcular?

- Aspecto 2-D VAo ( Ca++, abertura)
- Baixo Débito Cardíaco (F.E.)
- Baixo Gradiente Pressão

## Área Valvar Aórtica



Fração Ejeção = 40%

Gd Sist. Máx. = 31mmHg

Gd Médio = 20mmHg

$V_1$  <sub>VSVE</sub> = 0,6 m/seg

$V_2$  <sub>TRANSVALVAR</sub> = 2,8 m/seg

Diâmetro <sub>VSVE</sub> = 2,2 cm

Area Valvar = 0,8 cm<sup>2</sup>

# Dobutamine Echocardiography in Severe Aortic Stenosis with Low Aortic Pressure Gradient

**Low cardiac output**  
**Low pressure gradient**

**Baseline Doppler hemodynamics:**  
AVA= $\leq 0.75\text{cm}^2$   
LVOT: Ao TVI  $\leq 0.25$

**True Anatomically Severe AS**

**Functionally severe AS**

**Dobutamine stress**  
up to 20  $\mu\text{g}/\text{kg}/\text{min}$

**↑↑ Gradient**  
**←↓ AV area**

**↑ Gradient**  
**↑ AV area**

# Dobutamine Echocardiography in Severe Aortic Stenosis with Low Aortic Pressure Gradient

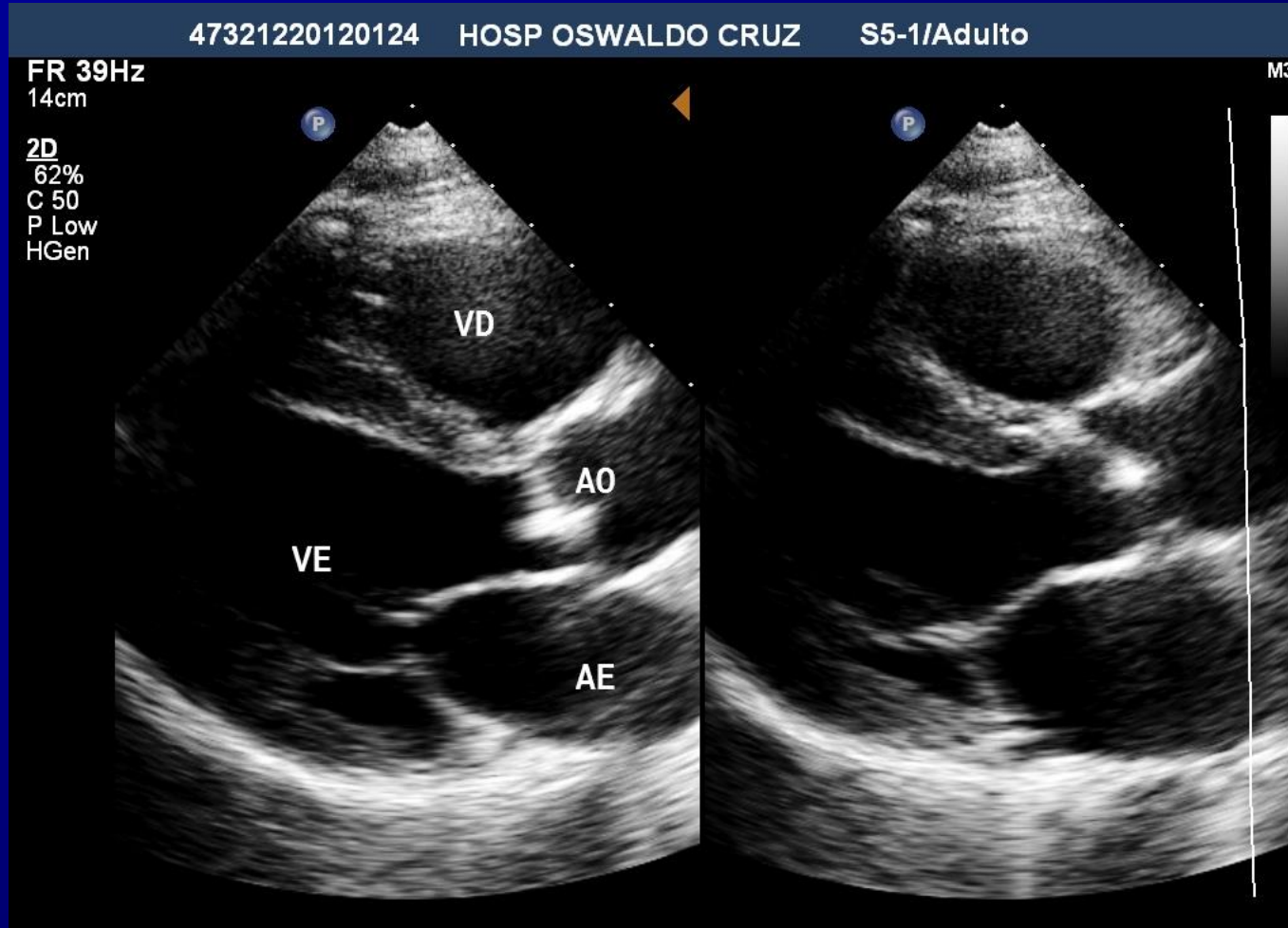
- The most important role of Dobutamine is to assess inotropic reserve:  $>20\%$  in stroke volume
- Lack of inotropic reserve with dobutamine portends poor perioperative mortality (50% vs 7%) if aortic valve replacement is attempted
- If no inotropic reserve is demonstrated, aortic valve replacement is still better than no treatment, but the mortality rate is very high

# *Ecocardiografia e Estenose Aórtica*

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- **Bi-Dimensional**
  - Morfologia, Mobilidade, Ca++
  - Grau de HVE
  - Função VE
  - Comprometimento outras valvas
- **Doppler**
  - Severidade hemodinâmica

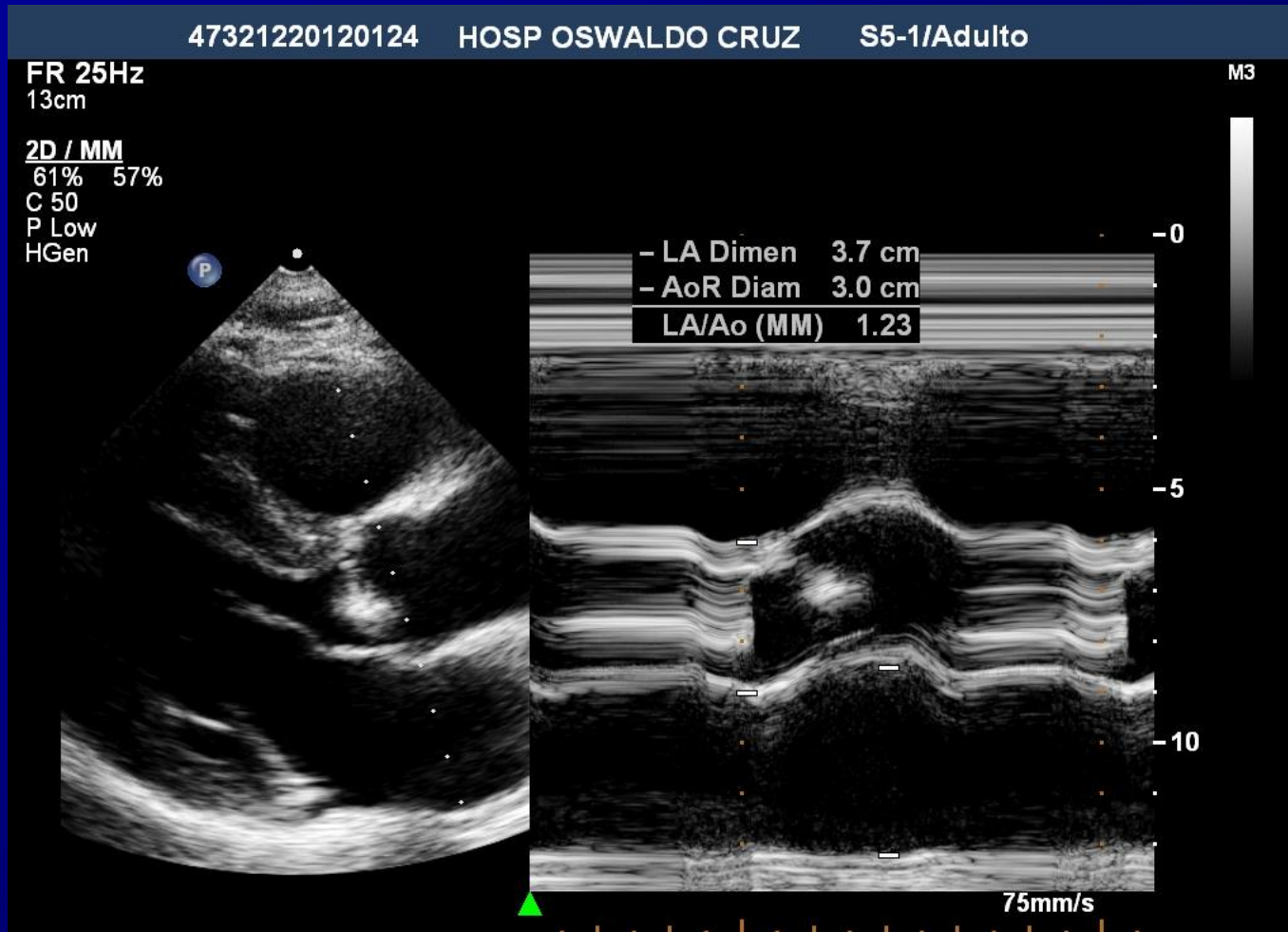
# Ecocardiografia e Estenose Aórtica



# Ecocardiografia e Estenose Aórtica

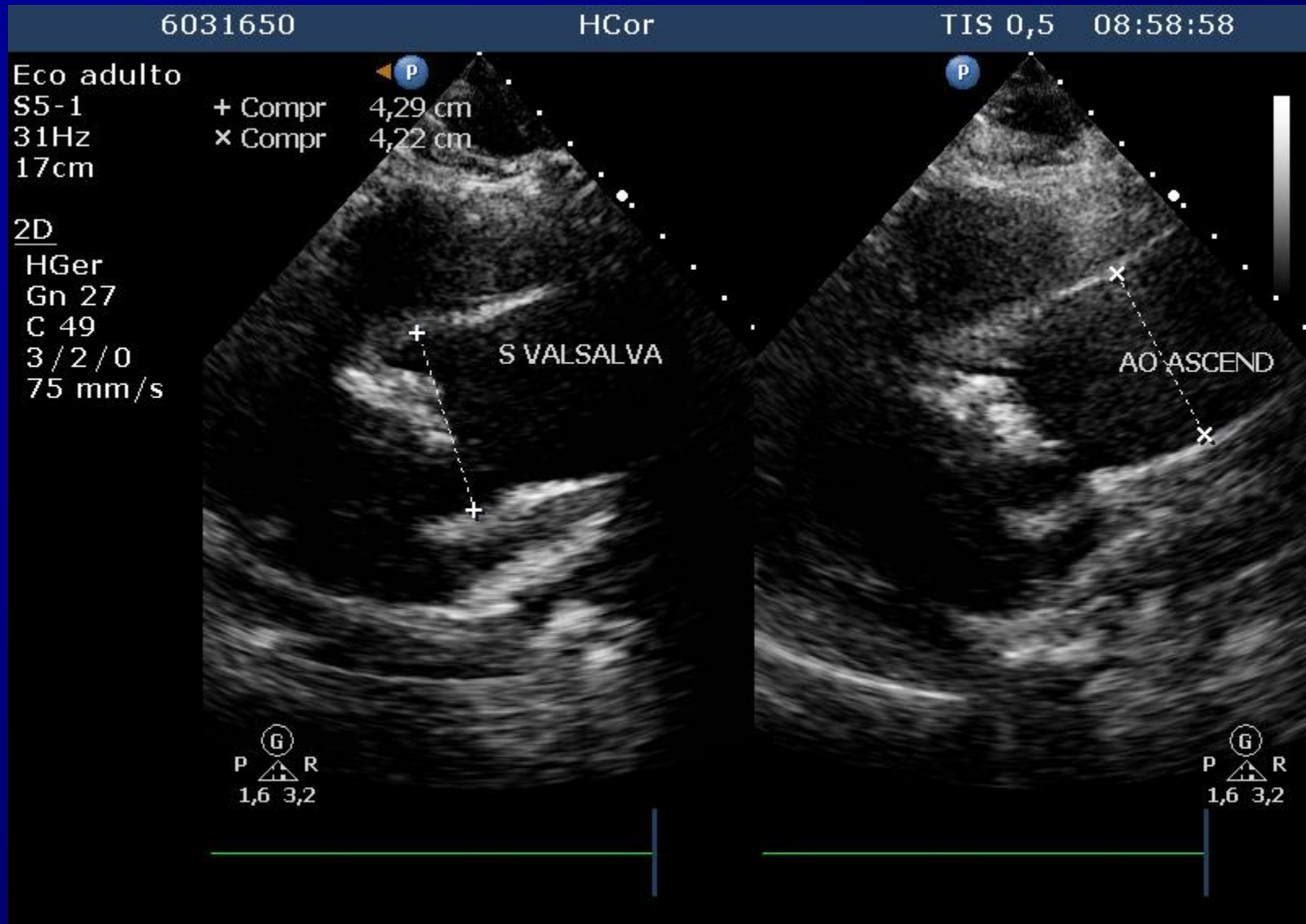


# Ecocardiografia e Estenose Aórtica

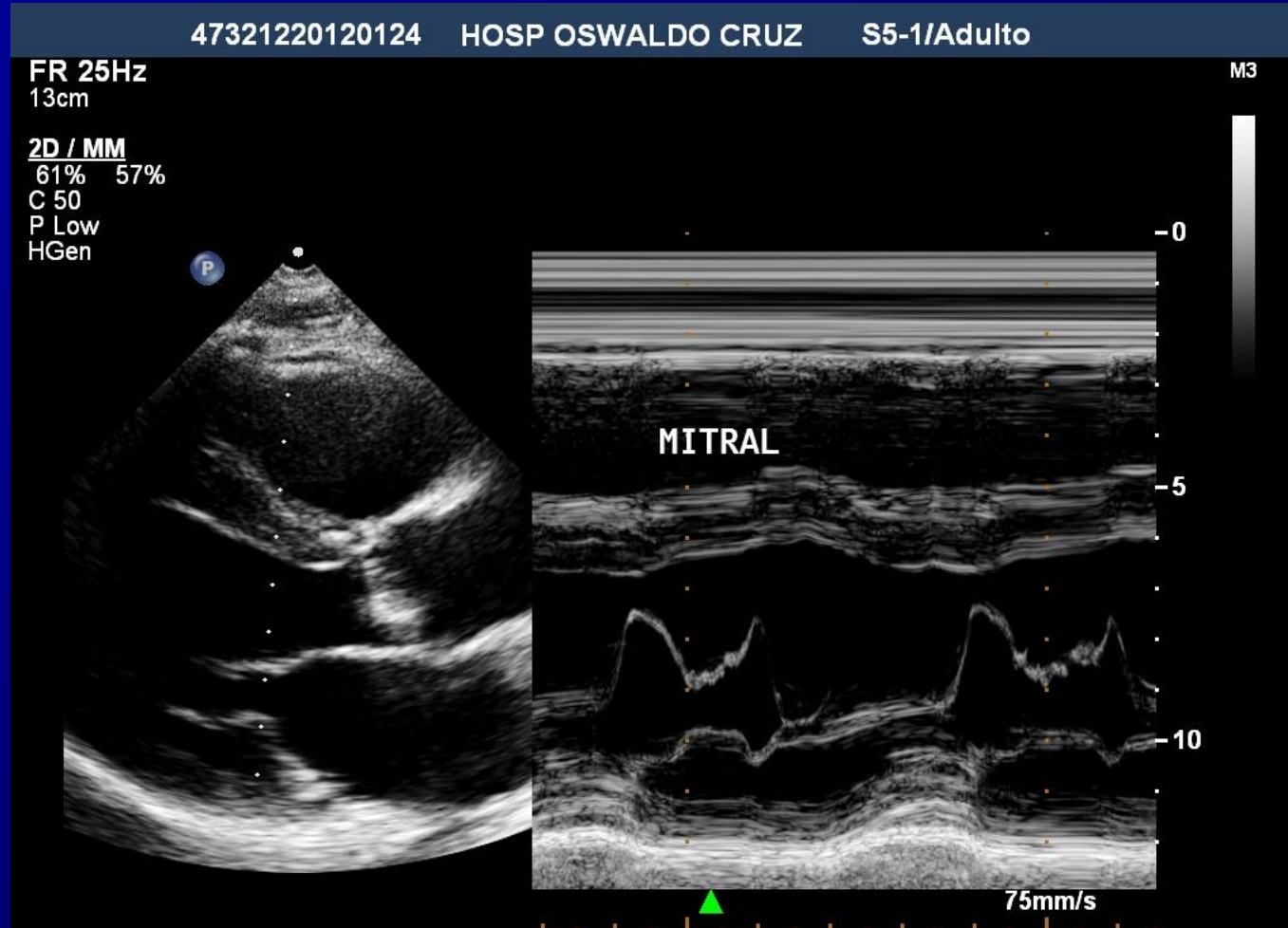




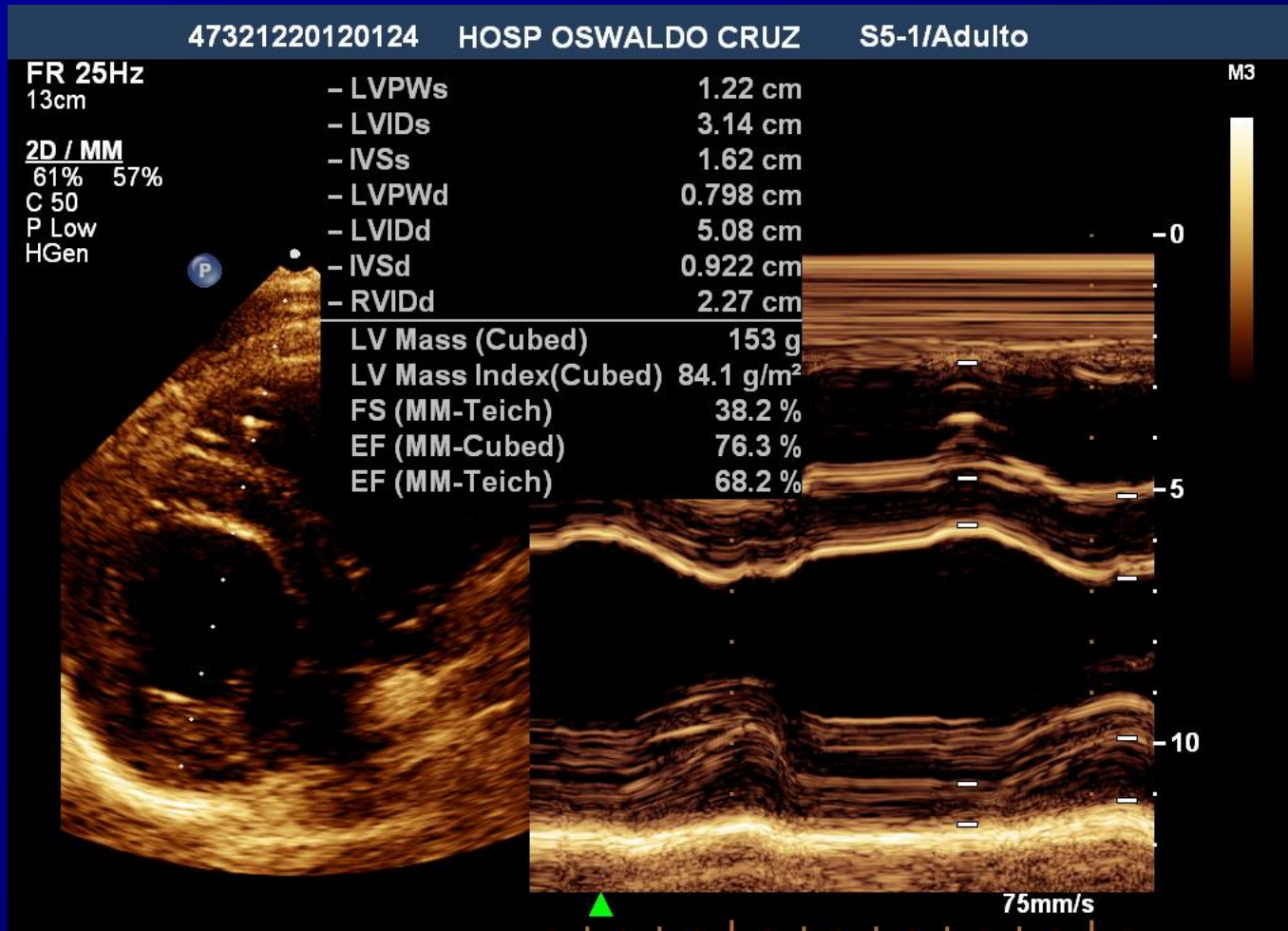
# Ecocardiografia e Estenose Aórtica



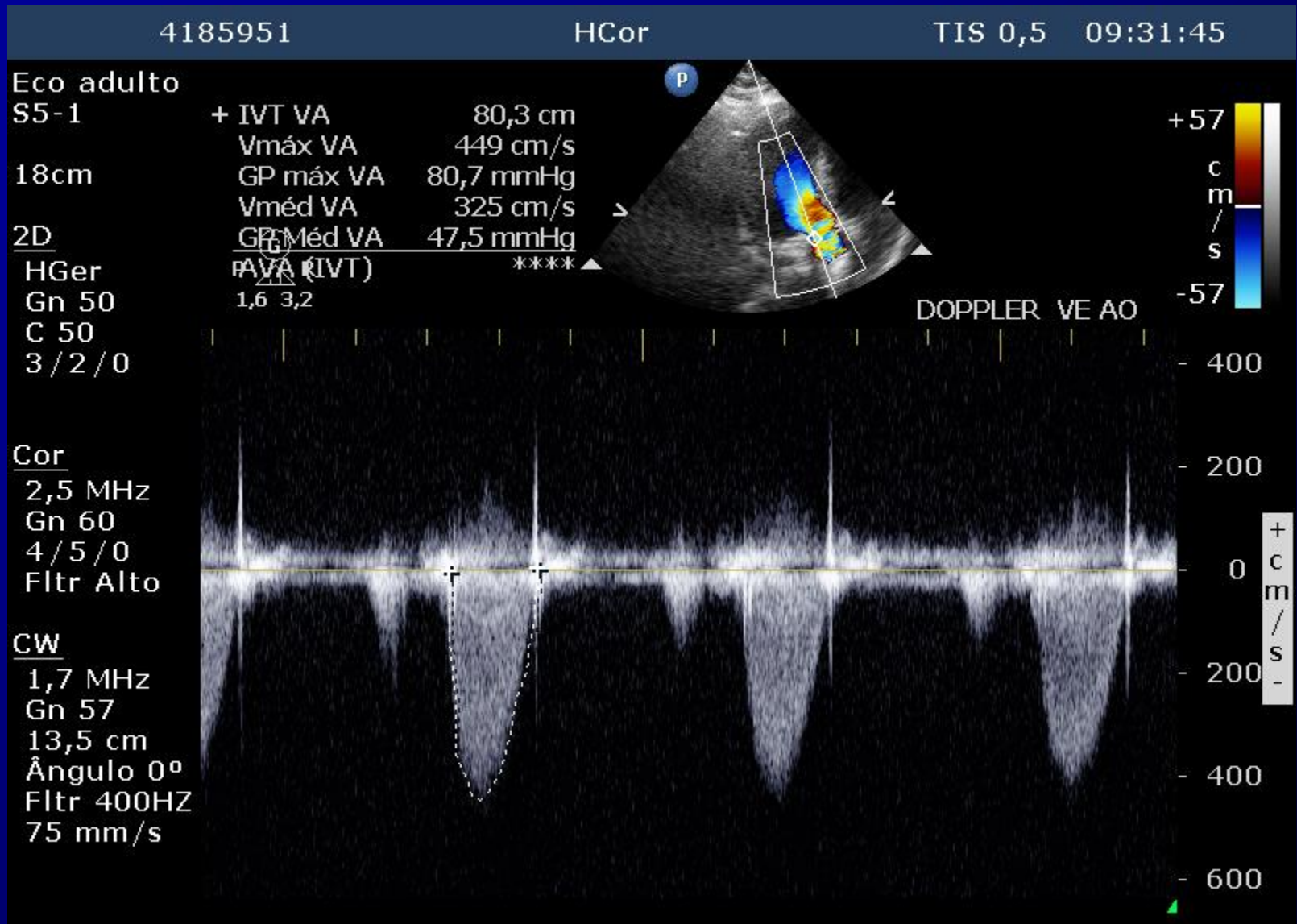
# Ecocardiografia e Estenose Aórtica



# Ecocardiografia e Estenose Aórtica



# Ecocardiografia e Estenose Aórtica



# Ecocardiografia e Estenose Aórtica

