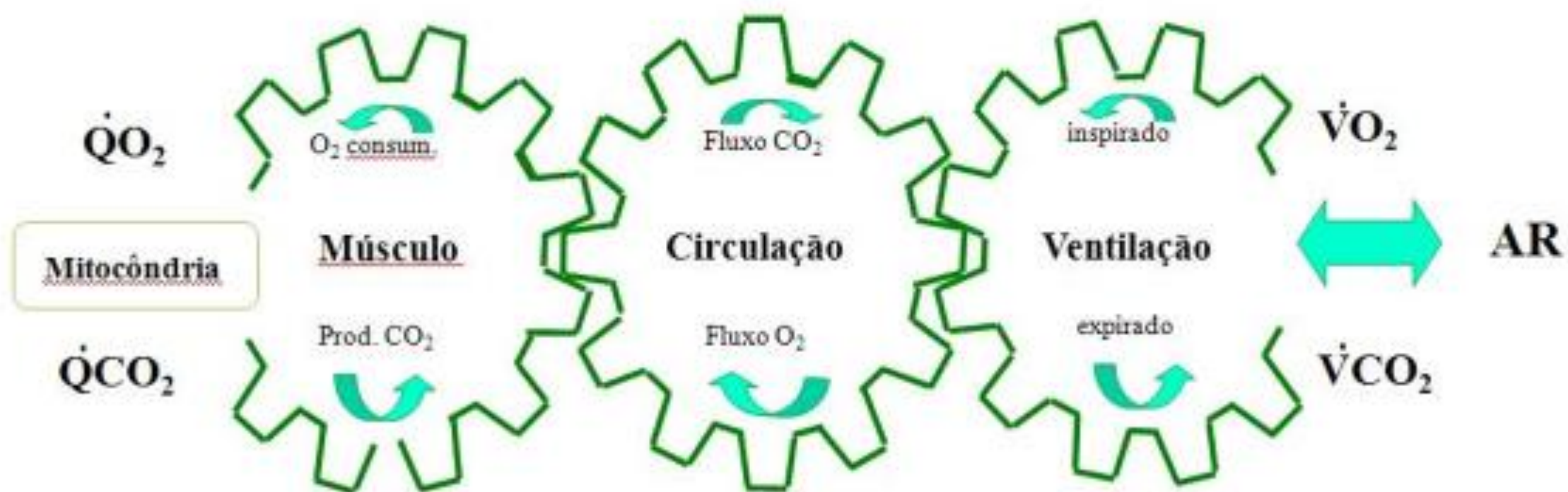


# “Indicações e interpretação do teste cardiopulmonar”

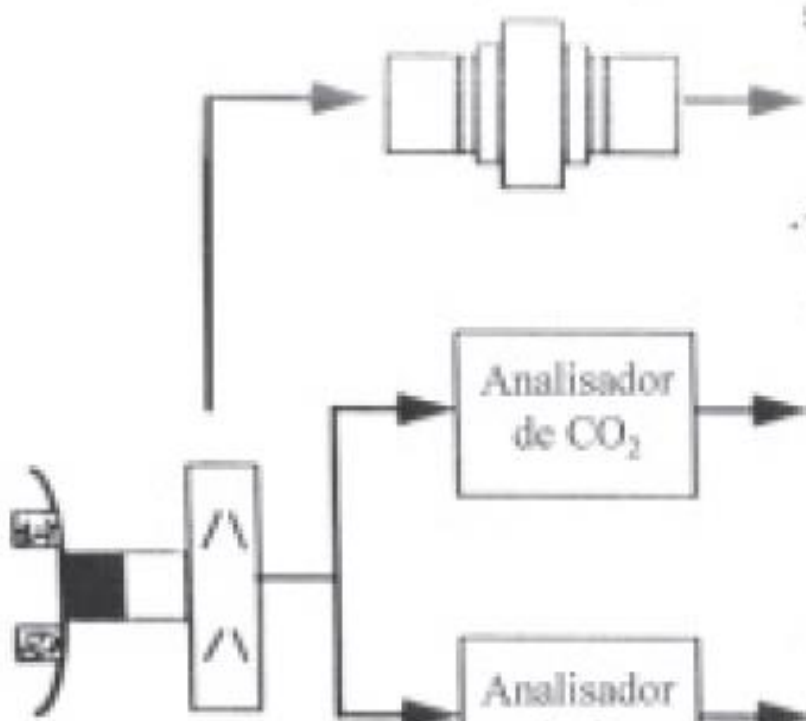
Dr. Ednei Pereira Guimarães

Hosp. Vera Cruz

TECP:



Pneumotacógrafo



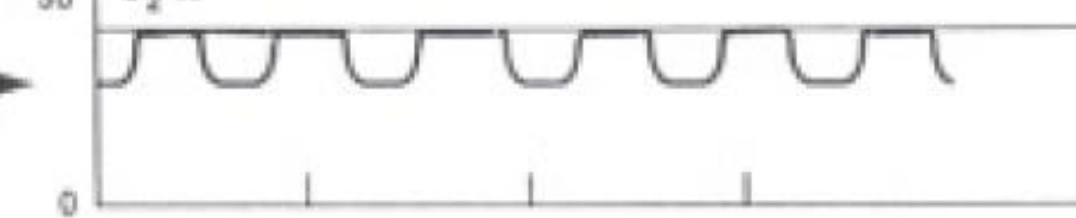
Fluxo



CO<sub>2</sub> %



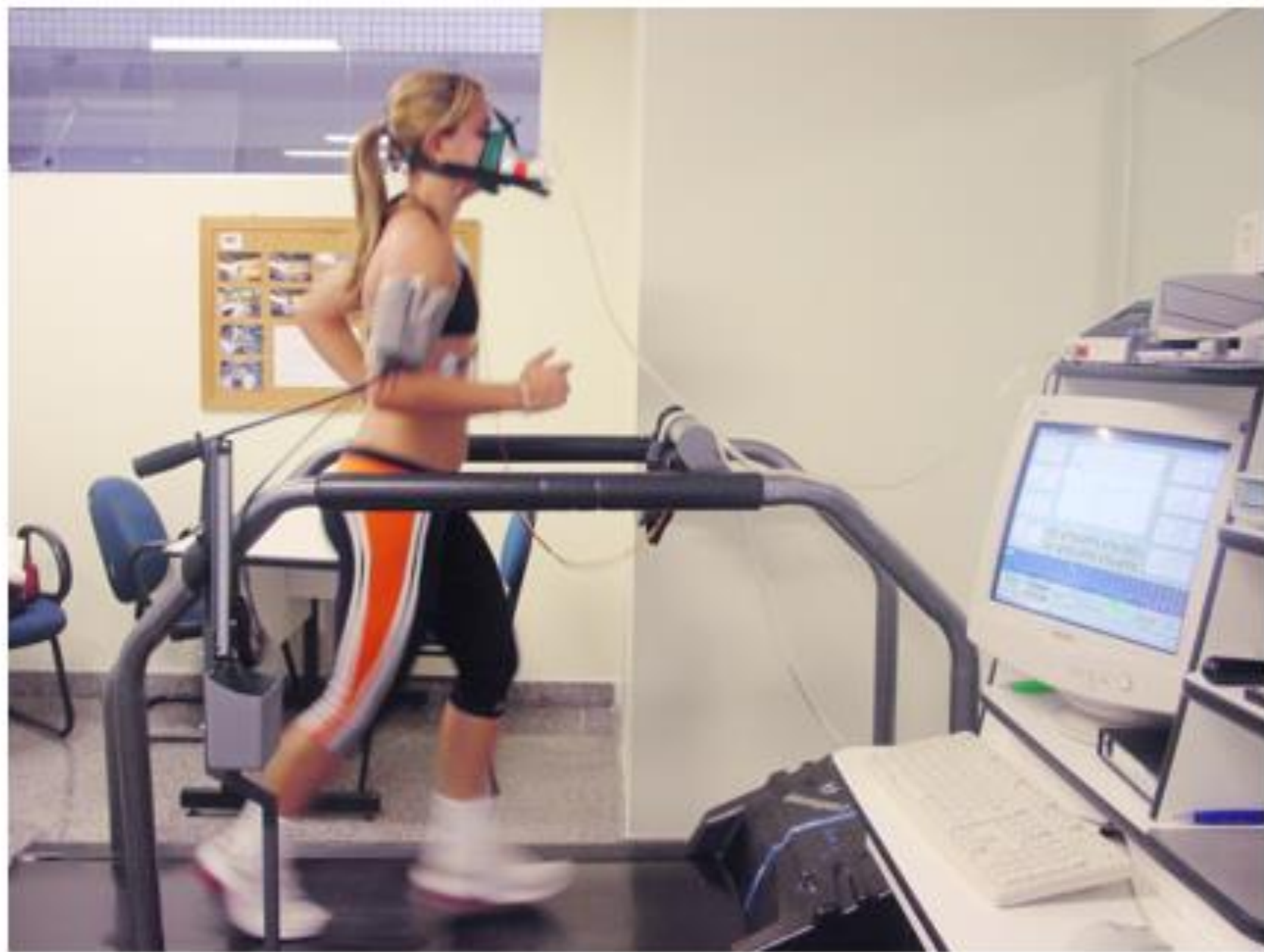
O<sub>2</sub> %



ECG



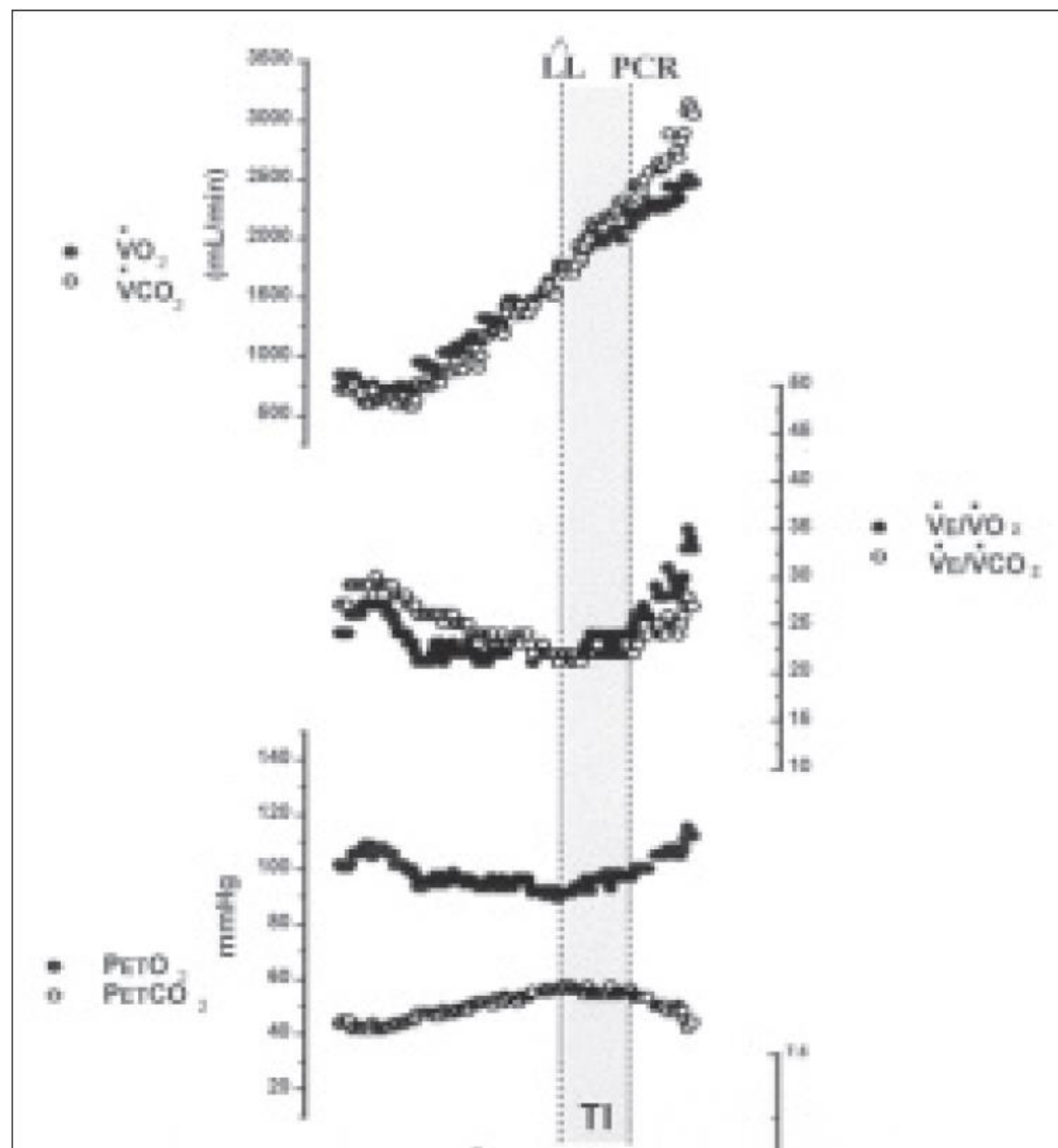
Resultados





**QUADRO III**  
**Características de interesse clínico dos dois principais tipos de ergômetros utilizados para o TECP\***

Característica	Bicicleta ergométrica	Esteira ergométrica
Maior $\dot{V}O_2$ máx		+
Maior estresse ventilatório e cardiovascular		++
Familiariedade com o tipo de exercício		++
Quantificação exata da potência	++	
Segurança	++	
Menos artefatos e melhor qualidade dos sinais	++	
Facilidade na obtenção de amostras sanguíneas	+	
Mais compacto e silencioso	+	
Menos caro	+	



**Tabela 1 – Comportamento das principais variáveis do TCPE nas diversas causas de dispneia**

Origem dispneia	Cardiovascular	Pulmonar	Vascular-pulmonar	Hiperventilação	Simulação
VO <sub>2</sub>	reduzido	reduzido	reduzido	normal	reduzido
LA	precoce	normal	precoce	normal	normal
R	normal	reduzido	normal/reduzido	normal/reduzido	reduzido
VE/VCO <sub>2</sub> slope	elevado	elevado	elevado	elevado	normal
PET CO <sub>2</sub>	Baixo	baixo	baixo no LA	baixo no LA	normal
VE/VVM	normal	reduzida	normal	normal	normal
PuO <sub>2</sub>	reduzido/platô	normal/platô	reduzido/platô	normal	normal
Sat O <sub>2</sub>	normal	queda	queda	normal	normal
ΔVO <sub>2</sub> /ΔWR	reduzido/platô	normal/platô	reduzido/platô	normal	normal



## TABLE 1. INDICATIONS FOR CARDIOPULMONARY EXERCISE TESTING

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### Evaluation of exercise tolerance

- Determination of functional impairment or capacity (peak  $\dot{V}O_2$ )
- Determination of exercise-limiting factors and pathophysiologic mechanisms

### Evaluation of undiagnosed exercise intolerance

- Assessing contribution of cardiac and pulmonary etiology in coexisting disease
- Symptoms disproportionate to resting pulmonary and cardiac tests
- Unexplained dyspnea when initial cardiopulmonary testing is nondiagnostic

### Evaluation of patients with cardiovascular disease

- Functional evaluation and prognosis in patients with heart failure
- Selection for cardiac transplantation
- Exercise prescription and monitoring response to exercise training for cardiac rehabilitation (special circumstances; i.e., pacemakers)

## Evaluation of patients with respiratory disease

- Functional impairment assessment (see specific clinical applications)
- Chronic obstructive pulmonary disease
  - Establishing exercise limitation(s) and assessing other potential contributing factors, especially occult heart disease (ischemia)
  - Determination of magnitude of hypoxemia and for O<sub>2</sub> prescription
  - When objective determination of therapeutic intervention is necessary and not adequately addressed by standard pulmonary function testing
- Interstitial lung diseases
  - Detection of early (occult) gas exchange abnormalities
  - Overall assessment/monitoring of pulmonary gas exchange
  - Determination of magnitude of hypoxemia and for O<sub>2</sub> prescription
  - Determination of potential exercise-limiting factors
  - Documentation of therapeutic response to potentially toxic therapy
- Pulmonary vascular disease (careful risk–benefit analysis required)
- Cystic fibrosis
- Exercise-induced bronchospasm

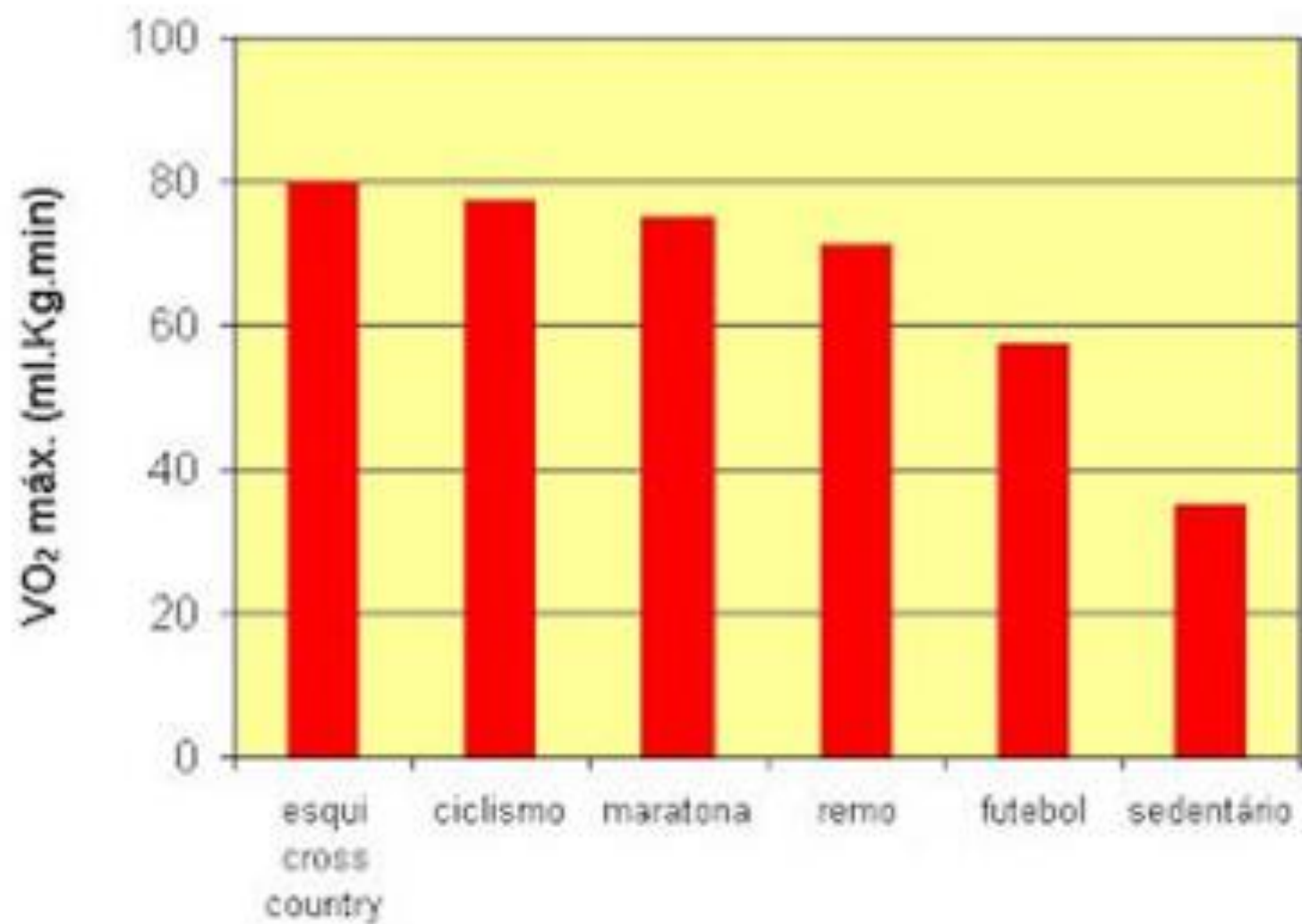
## Specific clinical applications

- Preoperative evaluation
    - Lung resectional surgery
    - Elderly patients undergoing major abdominal surgery
    - Lung volume resectional surgery for emphysema (currently investigational)
  - Exercise evaluation and prescription for pulmonary rehabilitation
  - Evaluation for impairment–disability
  - Evaluation for lung, heart–lung transplantation
-

VO2 max (Pico) Classificação funcional



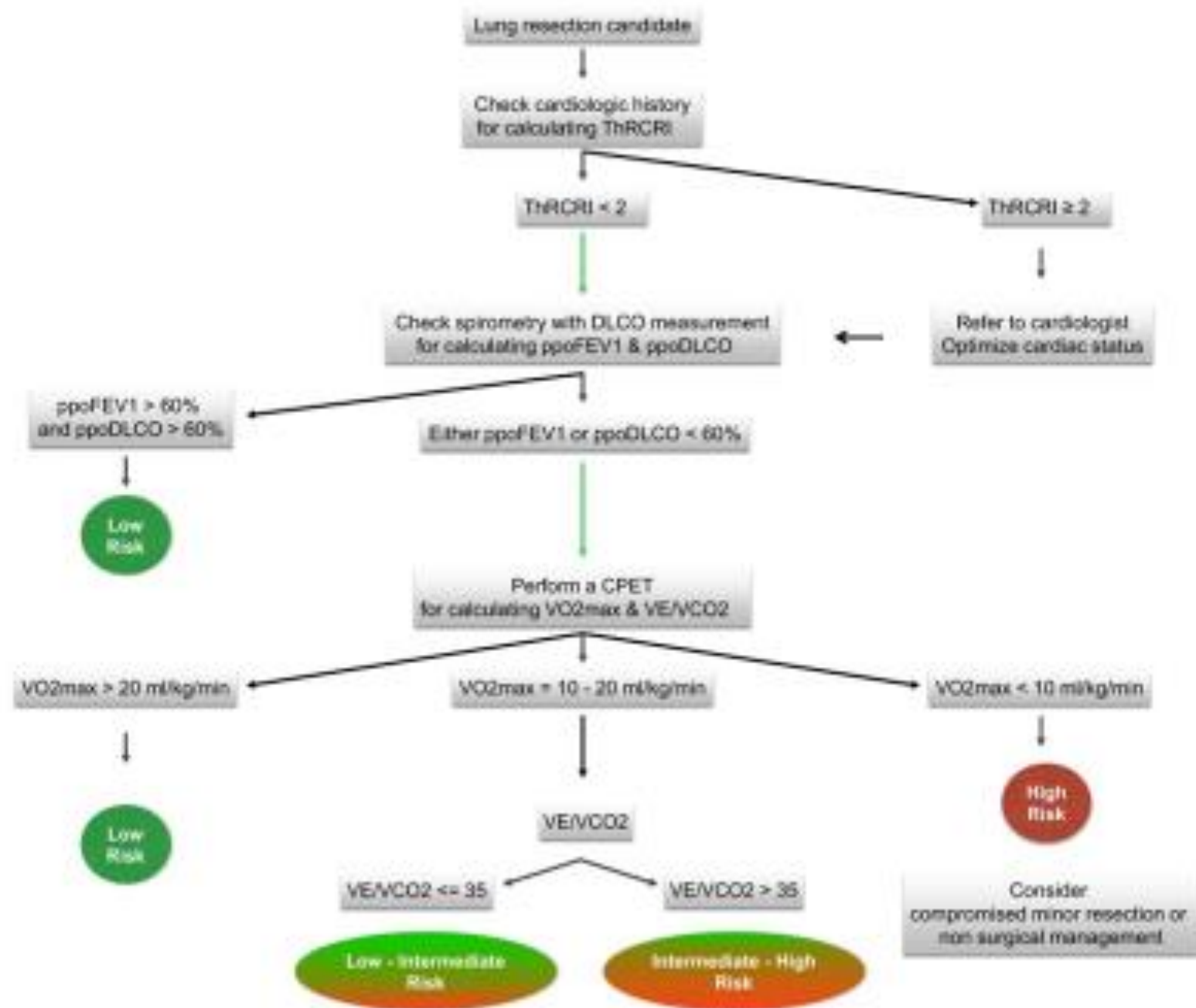
### VO<sub>2</sub> máx. x modalidades esportivas



- Avaliação de causas de dispneia
- Avaliação prognóstica em:
  - Cardiopatas
  - Pneumopatas
  - Pré-operatório
- Prescrição de exercícios em:
  - Normais
  - Atletas
  - Cardiopatas
  - Pneumopatas

**QUADRO II**  
**Principais padrões fisiopatológicos de limitação ao esforço em resposta ao TECP incremental\***

	Distúrbio circulatório	Destreinamento (dist. periférico)	Distúrbio ventilatório	Distúrbio na troca gasosa pulmonar	Ansiedade/hiperventilação	Subesforço
$\dot{V}O_2$ máx	↓ ou ↔	↓ ou ↔	↓ ou ↔	↓ ou ↔	↓ ou ↔	↓ ou ↔
$\theta_L$	↓↓	↓	↔ ou ↓	↔ ou ↓	↔	↔
$\Delta\dot{V}O_2/\Delta\dot{W}$	↓↓	↓	↔ ou ↓	↔ ou ↓	↔	↔
$PuO_2$ máx	↓↓, com platô precoce	↓	↓	↓	↔	↔
$\Delta FC/\Delta\dot{V}O_2$	↑↑	↑ ou ↔ (mas desviado para cima)	↔ (mas desviado para cima)	↑ ou ↔ (mas desviado para cima)	↔	↔
RFC	Variável, habitualmente ↓ ou $\phi$	Variável	↑↑	Variável, habitualmente ↓	↔	↑
R $\dot{V}E$	↔ ocasionalmente ↑	↔	↓↓ ou $\phi$	↔ ou ↓	↔ ou ↓	↑
Máx <i>f</i>	↔	↔	↔ ou ↑	↑↑	↑	↔ ou ↓
$\Delta VC/\Delta \ln\dot{V}E$	↔ ou ↓	↔	↓	↓↓	↓	↔
VC/CI	↔	↔	↔ ou ↑	↑ (distúrbio restritivo)	↔	↔ ou ↓
$\Delta\dot{V}E/\Delta\dot{V}CO_2$	↔ ou ↑	↔	↑↑	↑↑	↑	↔
$SaO_2/PaO_2$	↔	↔	Variável	↓↓	↔	↔
Sintoma limitante	Variável	Dor muscular	Dispnéia	Dispnéia	Dispnéia	Variável

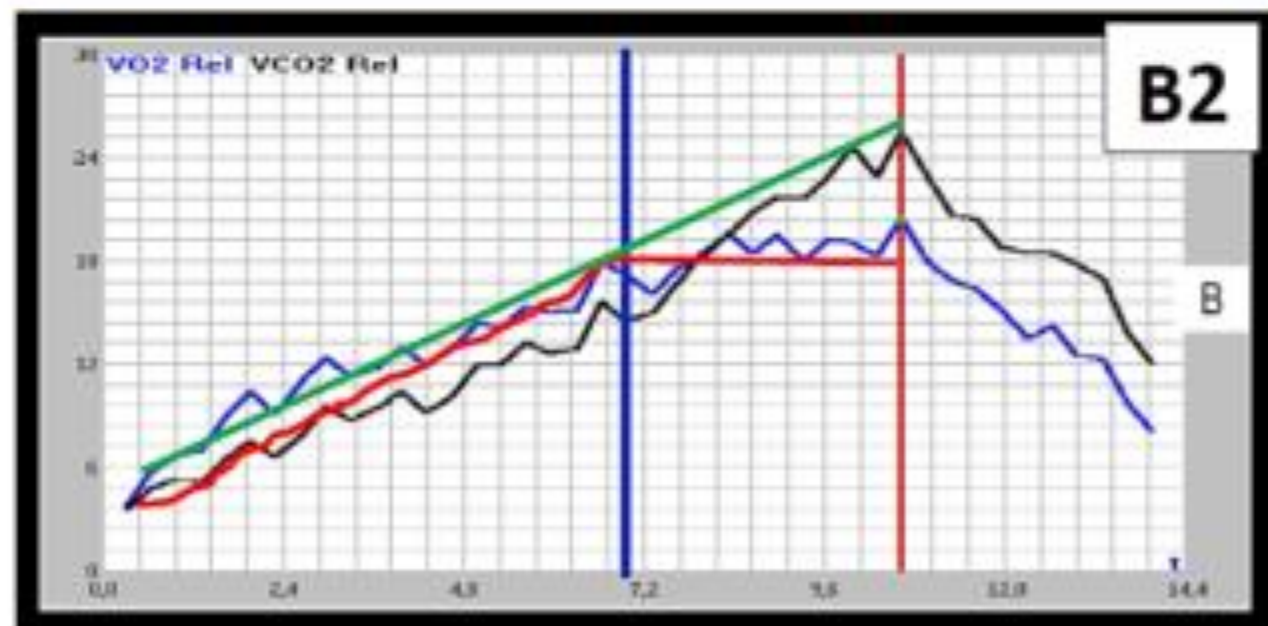
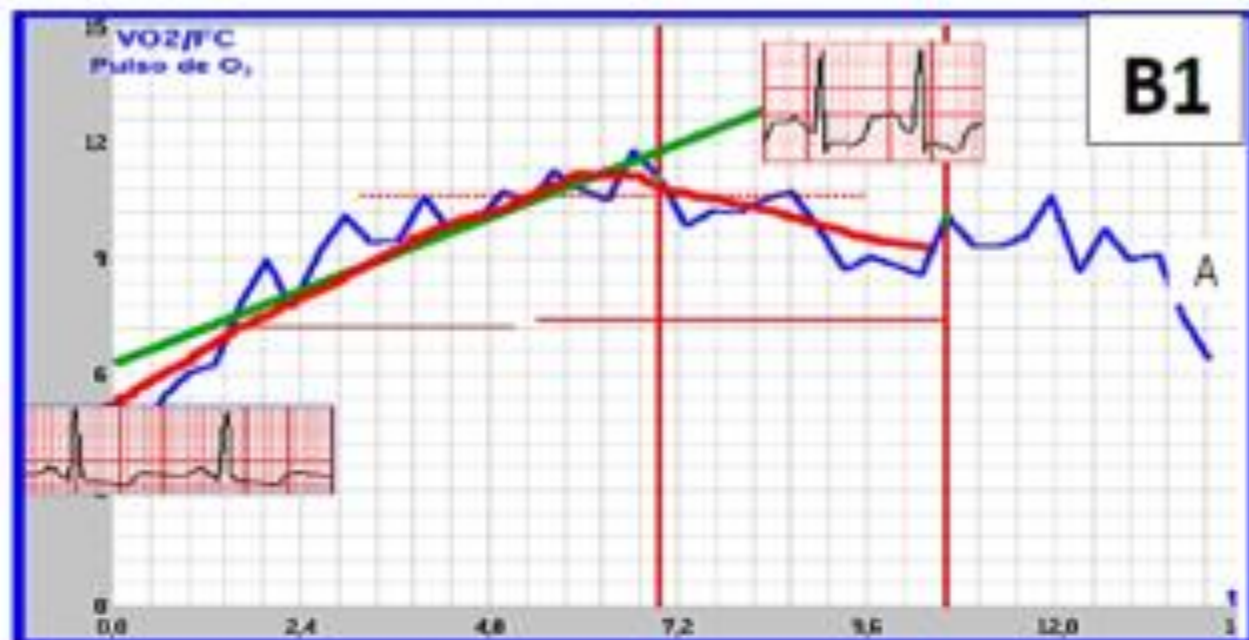


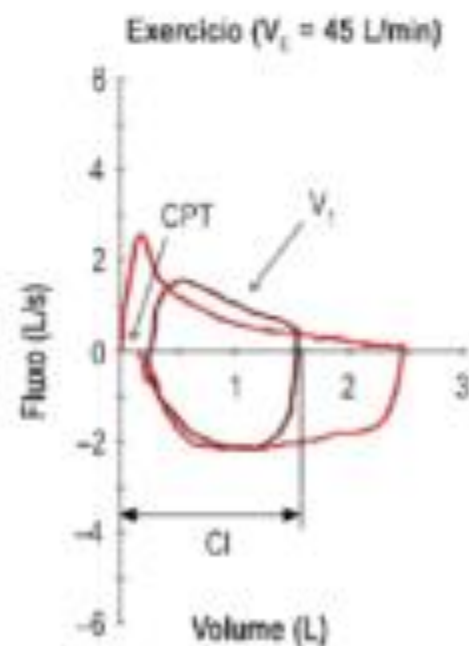
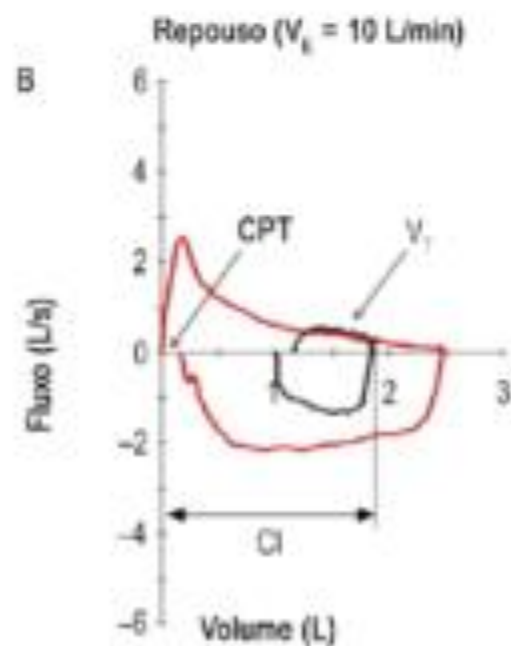
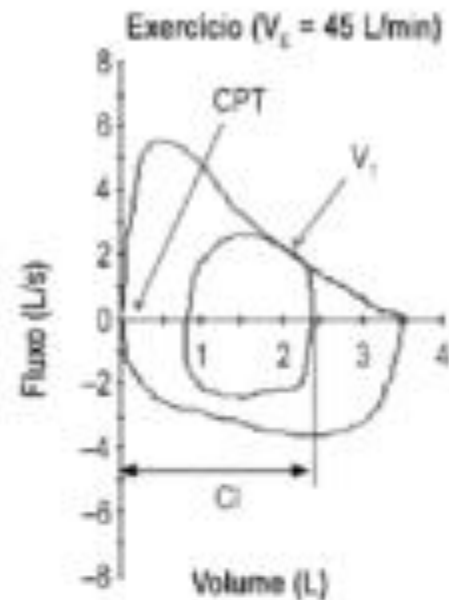
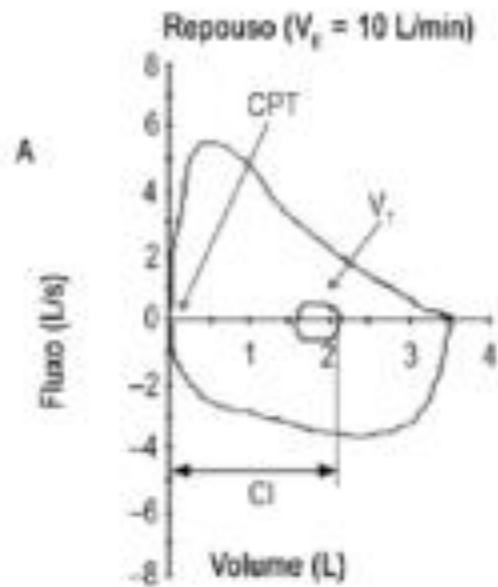
Disease Severity	Weber Class		Ventilatory Class	
		Peak $\dot{V}O_2$ (mL $O_2 \cdot kg^{-1} \cdot min^{-1}$ )		$\dot{V}_E/\dot{V}CO_2$ Slope
Mild to none	A	>20	I	$\leq 29.9$
Mild to moderate	B	16–20	II	30.0–35.9
Moderate to severe	C	10–16	III	36.0–44.9
Severe	D	<10	IV	$\geq 45.0$

$\dot{V}O_2$  indicates oxygen consumption;  $\dot{V}_E/\dot{V}CO_2$  minute ventilation/carbon dioxide production relationship.

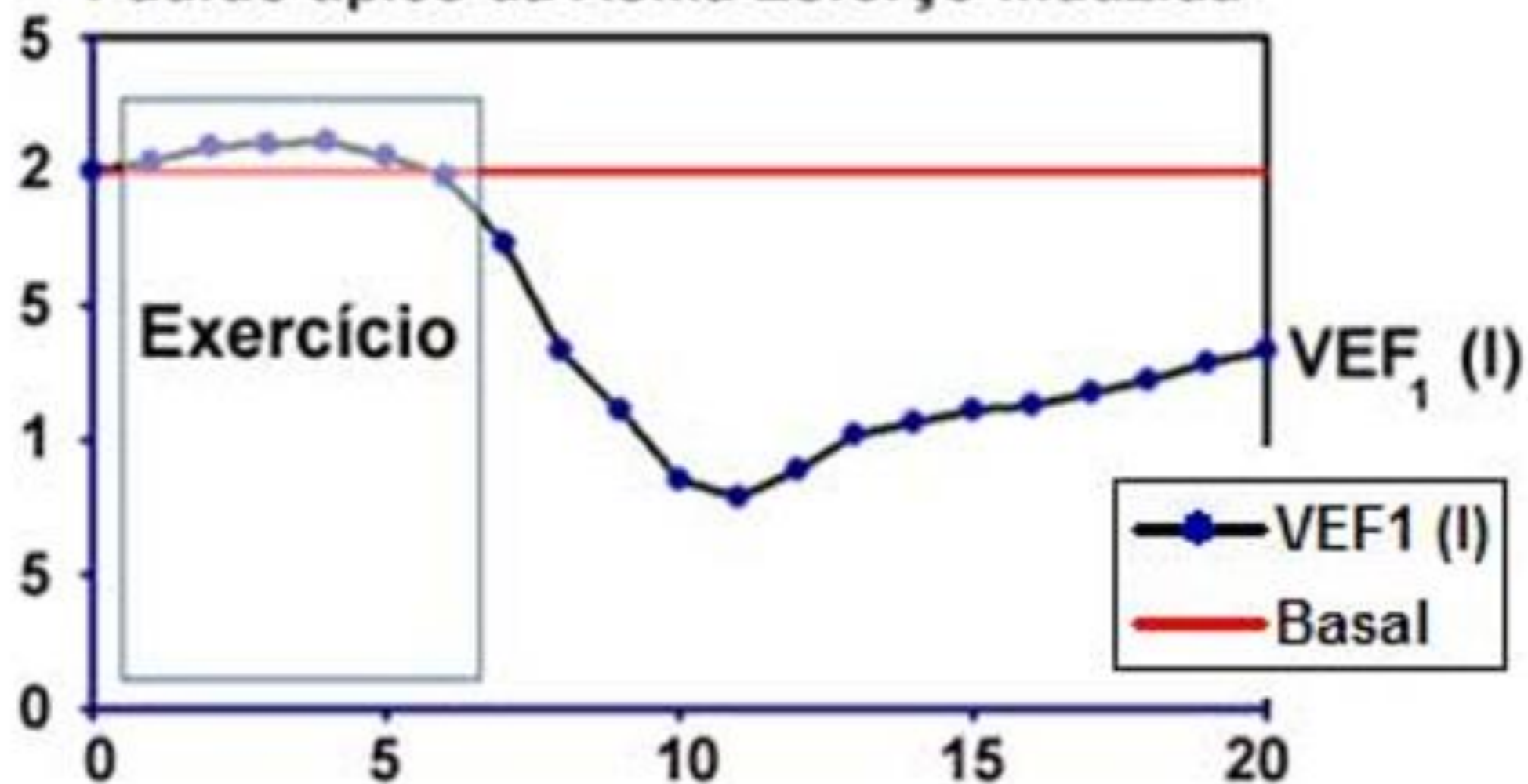








## Padrão típico da Asma Esforço-Induzida



- Obrigado!